

Mental Health and Life-Course Shocks Among the Global Poor: Evidence from Malawi

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November 14, 2021

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Abstract

Economic insecurity has been widely hypothesized to be an important determinant of mental health, but this relationship has not been well-documented in low-income countries. Using data from the Mature Adults Cohort of the Malawi Longitudinal Study of Families and Health (MLSFH-MLSFH), we investigate the association of negative economic shocks with mental health outcomes such as depression and anxiety among mature adults in a low-income country. Using fixed effects estimates that control for time-invariant unobserved individual heterogeneity, we find that increased economic instability caused by events such as death of a family member, yield loss, or income loss is positively associated with worse mental health outcomes as measured by the PHQ-9 and GAD-7 indexes. Our results suggest that costly economic events are a key component to worsening mental health in settings characterized by pervasive poverty and underscore the importance of mental health as a public health and development target.

Keywords: mental health, depression, anxiety, economic shocks, poverty, Malawi, sub-Saharan Africa

Introduction

Depression and anxiety are two important dimensions of mental health that have a significant and growing contribution to the global burden of disease (Collins et al., 2013; Susser and Patel, 2014; Vigo et al., 2016). In resource-poor contexts, depression and anxiety have been widely recognized as having important implications for individual productivity, individual and family-level well-being, and overall economic development (Canavan et al., 2013; Kohler et al., 2017; Lund et al., 2018). While there has been a more concerted effort in recent years by researchers and international organizations such as the World Health Organization (WHO) to understand the determinants of mental illnesses such as depression and anxiety, these mental health issues still are poorly understood and under documented especially in Sub-Saharan Africa (SSA).

One potentially important determinant of depression and anxiety is economic insecurity. This relationship has been explored in high income countries especially after the Great Recession. For example, in Austria job loss due to plant closures were correlated with higher subsequent antidepressant use and more mental health related hospitalizations (Kuhn et al., 2009). Similarly, in Greece a cross-sectional study found that the rate of major depressive episodes significantly increased from the beginning of 2008 to 2009 after the meltdown of the Greek economy (Madianos et al., 2011). Individuals in the United States who reported falling behind on their mortgage payments were found more likely to develop depressive symptoms (Alley et al., 2011). More recently, economic insecurity due to the COVID-19 pandemic have been linked to worsening mental health in the United States and European countries (Kämpfen et al., 2020; Witteveen and Velthorst, 2020).

While the relationship between negative economic shocks and mental health outcomes has not been explored extensively in low- and middle-income countries (LMIC) there are a number of studies in this setting evaluating the impact of positive economic shocks on mental health via anti-poverty programs (Kilburn et al., 2016; Angeles et al., 2019; Ohrnberger et al., 2020a,b). Randomized-control trials for cash transfer programs have been carried out in a

number of SSA countries. For example, Kenyan households given cash transfers of 400 to 1500 USD reported increased consumption and happiness and a reduction in depression and stress (Haushofer and Shapiro, 2016, 2018). These studies provide a compelling causal relationship between positive economic shocks and mental health. However, these experiments do not provide evidence for how negative economic shocks impact mental health in SSA leading to two questions. First, at very low levels of income will additional negative shocks have a further negative effect on depression and anxiety? Second, will differing economic events compared to those in high-income countries such as drought or death also cause worsening mental health?

A study conducted in rural Indonesia is the closest to getting at these questions in a LMIC context. Christian et al. (2019) used longitudinal data from the Indonesia Family Life Survey and found that lack of rain fall was correlated with higher depression scores (Christian et al., 2019). However, they only looked at the impacts of rain fall on depression and the country as a whole was recently recategorized as upper-middle income vastly different to the Malawi economic setting. In order to improve our understanding of the relationship between economic instability and mental health in LMICs specifically in SSA, this paper models the impact of negative economic shocks on the mental health of Malawian adults from 2012 through 2018.

There are three primary goals of this paper. First, to investigate the impact of negative economic shocks in a SSA resource limited population. Secondly, this paper addresses a methodological limitation present in cross-sectional research looking at economic shocks and mental health. Exposure to economic shocks and mental health are likely to be determined by time-invariant individual specific factors such as personality disposition and demographic characteristics. We address this issue by utilizing a fixed-effects panel data model that controls for these unobservables. Lastly, we quantify the effect that changes in the number of experienced economic shocks has on the mental health of Malawian adults. We focus on the relationship linking negative economic shocks with depressive and anxiety disorders,

the most common mental illnesses, which we refer to using the more general term ‘mental health’. While other more serious mental illnesses, such as schizophrenia, are also correlated with income loss, unemployment, and other negative economic outcomes we do not discuss them here (Lund, 2014).

Data and Methods

The data used in this study come from The Mature Adults Cohort of the Malawi Longitudinal Study of Families and Health (MLSFH-MAC). The MLSFH-MAC is a population-based cohort study of mature adults aged 45+ years old living in rural communities in three districts in Malawi: Balaka in the south, Mchinji in the central region and Rumphi in the north (Kohler et al., 2020). MLSFH-MAC was derived from the Malawi Longitudinal Study of Families and Health (MLSFH), an ongoing longitudinal panel study established in 1998 that examines how families and individuals cope with the social, economic, demographic and health consequences of the HIV/AIDS epidemic. It is one of very few long-standing publicly available longitudinal cohort studies in sub-Saharan Africa (SSA) (Kohler et al., 2020). MLSFH cohorts (and as a result MLSFH-MAC) are broadly representative of Malawi’s substantial rural population. We use the MLSFH-MAC because the MLSFH-MAC has collected extensive information on mental health wellbeing and provides detailed descriptions of individual exposure to economic shocks. The age of our sample means that our results should be interpreted as applying to mature, rural adults.¹ Our analyses include respondents in the 2012, 2013, 2017 and 2018 MLSFH-MAC (Kohler et al., 2020).

We employed two measures of mental health outcomes in this study. Our first dependent variable, the PHQ-9 depression test questionnaire ranges from 0 to 27 (from best to worst mental health). PHQ-9 includes nine questions that ask the respondent to categorize if or how often they have been bothered in the past two weeks by indicators such as: (1) little

¹See Kohler et al. (2015) and Kohler et al. (2020) for detailed discussion of sampling procedures, survey methods, survey instruments, and analyses of attrition in the MLSFH-MAC and MLSFH

interest or pleasure in doing things; (2) feeling down, depressed, or hopeless...; (6) feeling bad about yourself—or that you are a failure or have let yourself or your family down...; (9) thoughts that you would be better off dead or of hurting yourself in some way. Response categories for all questions in the PHQ-9 range from 0 (not at all) to 3 (nearly every day). We computed an overall depression score, PHQ-9 score, equal to the sum of scores from the PHQ-9 instrument. Based on the PHQ-9 guidelines, the clinical significance of depression is classified as follows: 0–4 indicates none/minimal depression; 5–9 indicates mild depression; 10–14 indicates moderate depression; 15–19 indicates moderately severe depression; and 20–27 indicates severe depression (Kroenke et al., 2010).

The second dependent variable, the GAD-7 anxiety test questionnaire, ranges from 0 to 21 (from least to worst anxiety). GAD-7 includes 7 questions that ask the respondent to categorize if or how often they have been bothered in the past two weeks by indicators such as the following: (1) feeling nervous, anxious, or on edge; (2) not being able to stop or control worrying...; (6) becoming easily annoyed or irritable; (7) feeling afraid as if something awful might happen. Similarly, to PHQ-9 response categories for all questions in the GAD-7 range from 0 (not at all) to 3 (nearly every day) and an overall anxiety score, GAD-7 score, was computed as the sum of scores from the GAD-7 instrument. The guidelines for the measure specify scores of 5, 10, and 15 as cut points for mild, moderate, and severe anxiety (Kroenke et al., 2010).

PHQ-9 and GAD-7 have been shown to be reliable and valid instruments to measure depression and anxiety especially in high-income settings. However, in the low-income context of sub-Saharan Africa, there may be reduced sensitivity (Kessler and Bromet, 2013; Sweetland et al., 2014; Brinkmann et al., 2020). Our analyses of mental health do not involve qualitatively distinguishing between depressed, mildly depressed, and nondepressed statuses. Instead, we use a linear specification of the PHQ-9 depression and GAD-7 anxiety scores. Individuals recording higher scores experience a higher number of depressive or anxiety symptoms. Therefore, we can evaluate a range of depressive and anxiety states without

relying on a classification scheme that may not be fully applicable to the low-income country context being studied in this paper.

The central independent variable in our study, Total Negative Economic Shocks, is a measure of total negative economic shocks experienced. Respondents were asked if negative events had affected their household in the past two years (2012, 2017, and 2018) or in the past year (2013). The negative shocks included: death or serious illness of an adult member or someone who provides support for yourself or your family; poor crop yields, loss of crops due to disease or pests, or loss of livestock due to theft or disease, or loss of fertilizer coupon; loss of source of income such as loss of employment or business failure; breakup of household such as divorce; and damage to house due to fire, flood, etc. Subsequently, the number of negative economic shocks was added together for each respondent to produce a total.²

In our cross-sectional specifications, we control for individual demographic characteristics. Female is equal to 1 if the respondent identifies as a female and is equal to 0 if the respondent identifies as male. Married is equal to 1 if the respondent is married and is equal to 0 if the respondent is divorced, separated or widowed. Age group was another control broken down into four categories: Age4054, Age5564, Age6574, and Age75+ with Age4054 being omitted from the regression.³ Lastly, we controlled for respondent's region Rumphu, Balaka, and Mchinji with Mchinji being omitted from the regression. Descriptive statistics for all dependent and independent variables used in this study are reported in the Table 1 below.

²A second version of the Total Economic Shock, Death of Family Member Shock, Income Loss Shock, Yield Shock, and Positive Fertilizer Shock variables was also calculated that only included shocks within one year of the survey. These OLS fixed effects regression results are in the appendix.

³We included respondents who reported an age of 40-44 even though they do not meet the age requirement of 45 for the mature cohort because of the unreliability of self-reported age. For example, there are respondents who report an age of 43 in 2012 but then report 61 in 2017. There were 205 respondents that for at least one year were in the 40-44 age range.

Table 1: Summary Statistics from the Sample Population

| | 2012 | | 2013 | | 2017 | | 2018 | |
|------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| | Female | Male | Female | Male | Female | Male | Female | Male |
| Number of Observations | 760 | 536 | 706 | 527 | 1,024 | 726 | 976 | 667 |
| Age Group | | | | | | | | |
| 40-54 | 0.52 | 0.43 | 0.52 | 0.44 | 0.45 | 0.38 | 0.42 | 0.36 |
| 55-64 | 0.25 | 0.31 | 0.25 | 0.31 | 0.26 | 0.29 | 0.28 | 0.28 |
| 65-74 | 0.14 | 0.18 | 0.15 | 0.18 | 0.16 | 0.19 | 0.18 | 0.21 |
| 75+ | 0.08 | 0.08 | 0.08 | 0.08 | 0.13 | 0.14 | 0.13 | 0.15 |
| Married | 0.63 | 0.95 | 0.61 | 0.95 | 0.59 | 0.93 | 0.59 | 0.94 |
| Region | | | | | | | | |
| Mchinji | 0.29 | 0.32 | 0.28 | 0.32 | 0.30 | 0.36 | 0.29 | 0.37 |
| Balaka | 0.39 | 0.33 | 0.38 | 0.33 | 0.37 | 0.32 | 0.37 | 0.31 |
| Rumphi | 0.33 | 0.35 | 0.34 | 0.35 | 0.33 | 0.33 | 0.33 | 0.33 |
| PHQ-9 Score | 3.53 (3.86) | 2.53 (3.58) | 3.28 (4.01) | 2.17 (3.34) | 4.67 (4.41) | 3.66 (4.04) | 4.27 (4.25) | 3.00 (3.69) |
| GAD-7 Score | 2.84 (2.62) | 2.16 (2.43) | 3.01 (3.24) | 2.09 (2.81) | 3.97 (3.59) | 2.98 (3.20) | 3.48 (3.34) | 2.46 (2.89) |
| Total Economic Shocks | 1.39 (0.92) | 1.26 (0.93) | 1.19 (0.93) | 1.03 (0.93) | 1.79 (0.98) | 1.66 (0.97) | 1.55 (0.97) | 1.41 (0.91) |

In Table 1 we report the summary statistics for the sample. The sample sizes for 2012, 2013, 2017, and 2018 were 1,226, 1,233, 1,750, and 1,643 respectively. Females on average had higher depression and anxiety scores across all years. Furthermore, females reported experiencing more negative economic shocks. Generally, PHQ-9 scores, GAD-7 scores, and number of negative economic shocks were higher in 2017 and 2018 than in 2012 and 2013.

In our central analysis, we estimate ordinary least squares panel regressions with fixed effects for individual respondents and year of survey and report robust standard errors clustered on individuals. The estimating equation is

$$Y_{it} = \beta_0 + \beta_1 \text{Total Economic Shocks}_{it} + \delta \mathbf{X}_{it} + \alpha_i + \gamma_t + \epsilon_{it} \quad (1)$$

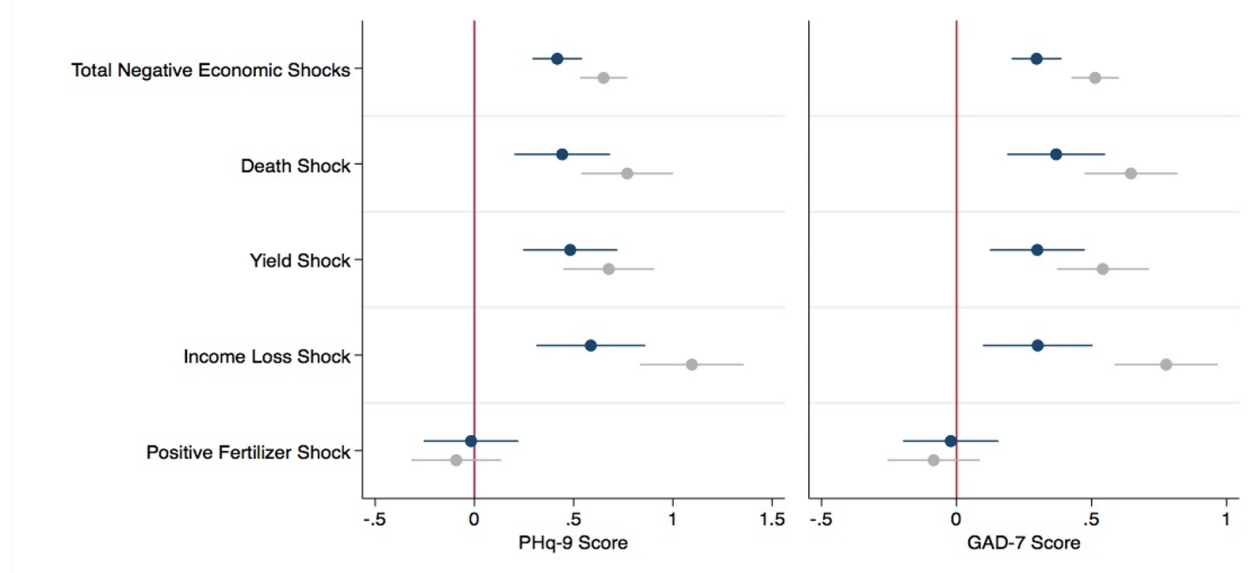
where Y_{it} is the outcome (depression or anxiety score) for an individual i at time t , *Total Economic Shock* $_{it}$ is the number of shocks experienced by i in the one to two year period prior to t , \mathbf{X}_{it} are other time-varying characteristics of i at time t , α_i is individual fixed effect, γ_t is a wave fixed effect, and ϵ_{it} is the residual for individual i at time t .

A common concern for cross-sectional analyses is that the α_i 's are also correlated with *Total Economic Shock* $_{it}$ leading conventional cross-sectional estimates to be biased. However, these individual fixed-effects regressions control for time-invariant unobserved heterogeneity. Suppose, for example, there are time-constant unobserved factors that jointly influence mental health and economic shock exposure (such as fixed personality characteristics or fixed local socioeconomic status). The individual fixed effects in the panel analysis control for these unobservables. We conduct a Hausman test to evaluate if the fixed effects specification is preferred to a random effects alternative. It should be clear, though, that time-variant unobservables could still be a source of bias in our panel analyses. We also estimate individual level pooled cross-sectional ordinary least squares regressions, regressing PHQ-9 score or GAD-7 score on Total Negative Economic Shocks and the demographic control variables with year fixed effects. In these regressions we report heteroskedastic robust standard errors clustered on individuals.

Results

Figure 1 reports the fixed effect panel estimates for PHQ-9 Score and GAD-7 Score, reported in navy, and the coefficient estimates for the pooled cross-sectional analysis with demographic controls, reported in grey. Total Negative Economic Shocks, Death of Family Member Shock, Income Loss Shocks and Yield Shocks all have positive and statistically sig-

Figure 1: Economic Shocks and Mental Health (PHQ-9 Score) and Anxiety (GAD-7) Fixed Effect Panel Estimates and Pooled Cross-Sectional Estimates



Note: This figure reports OLS fixed effects regression and pooled cross-sectional estimates of PHQ-9 Score and GAD-7 Score on Total Economic Shocks, Death of Family Member Shock, Income Shocks, Yield Shocks, and Positive Fertilizer Shocks.

nificant coefficient estimates for each mental health outcome across both specifications.⁴ This indicates a positive relationship between economic insecurity and higher levels of depression and/or anxiety.

For the fixed effects analysis, an increase of one for Total Negative Economic Shocks is associated with a 0.417 increase in the PHQ-9 score ($p < 0.001$). Similarly, an increase of one for Total Negative Economic Shocks is associated with a 0.296 increase in the GAD-7 score ($p < 0.001$). This relationship was also observed in the the pooled cross-sectional analysis with demographic controls. An increase of one for Total Negative Economic Shocks, a little greater than one standard deviation, was associated with a 0.633 increase in the PHQ-9 score and 0.543 increase in the GAD-7 score. Moreover, this positive association is observed for important components of the Total Economic Shock index including Death of Family

⁴We conducted a Hausman test to evaluate whether a fixed effects or random effects specification was preferred for the results reported in Figure 1. For each, we could reject the null hypothesis that coefficients in the fixed effects and random effects models were equal, which suggests that the fixed effects models are preferred.

Member Shock, Yield Shocks, and Income Loss Shocks.

In contrast to the cross-sectional estimates, these fixed-estimates control for all time constant unobserved characteristics of individuals as well as common shocks across individuals. This means that the estimates identify off of within-individual changes over time. Therefore, although the pooled cross-sectional estimates are useful to confirm the relationships discovered in the fixed effects analysis they are less helpful for inferring a causal relationship. Under a strong but not unreasonable assumption that the economic shocks are uncorrelated with other changes that might influence mental health outcomes, the fixed effects estimates have a causal interpretation. Negative economic shocks induce depression and anxiety even in settings characterized by very low levels of economic welfare.

We also evaluate whether the association between economic events relies exclusively on negative events by examining the correlation between a positive economic shock—receiving fertilizer subsidy—and the PHQ-9 and GAD-7 scores. Figure 1 reports the fixed effect estimates and pooled cross-sectional estimates for the impact of positive fertilizer shock on GAD-7 score and PhQ-9 score. While for both GAD-7 and PHQ-9 there is a negative association none of the estimates for either analysis are significant. This suggests that only negative economic shocks have a substantial effect on the PHQ-9 and GAD-7 assessments. However, it should be noted that this is only one example of a positive economic shock.

Table 2 and 3 report in further detail the coefficient estimates for the fixed effects analysis. In addition, all cross-sectional estimates by year are reported in the appendix. The cross-sectional estimates by year simply substantiate our discussed findings in greater detail.

Table 2: Economic Shocks and Depression (PHQ-9 Score) Fixed Effect Panel Estimates

| | (1) | (2) | (3) | (4) | (5) |
|--------------------------------|----------------------|---------------------|---------------------|---------------------|--------------------|
| Total Negative Economic Shocks | 0.417*** (0.0636) | | | | |
| Death of Family Member Shock | | 0.442*** (0.123) | | | |
| Yield Shock | | | 0.483*** (0.121) | | |
| Income Loss Shock | | | | 0.586*** (0.140) | |
| Positive Fertilizer Shock | | | | | -0.0170 (0.122) |
| Individual Fixed Effects | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes | Yes | Yes |
| Observations | 5333 | 5349 | 5350 | 5346 | 5343 |
| R^2 | 0.080 | 0.072 | 0.072 | 0.074 | 0.068 |
| Hausman Test (p-values) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: This table reports OLS fixed effects regression estimates of PHQ-9 Score on Total Economic Shocks, Death of Family Member Shock, Income Shocks, Yield Shocks, and Positive Fertilizer Shocks. The table reports the coefficient estimates, heteroskedastic robust standard errors clustered on individuals in parentheses, and p-values.

Table 3: Economic Shocks and Anxiety (GAD-7 Score) Fixed Effect Panel Estimates

| | (1) | (2) | (3) | (4) | (5) |
|--------------------------------|----------------------|----------------------|----------------------|--------------------|---------------------|
| Total Negative Economic Shocks | 0.296*** (0.0471) | | | | |
| Death of Family Member Shock | | 0.369*** (0.0924) | | | |
| Yield Shock | | | 0.299*** (0.0895) | | |
| Income Loss Shock | | | | 0.301** (0.104) | |
| Positive Fertilizer Shock | | | | | -0.0215 (0.0901) |
| Individual Fixed Effects | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes | Yes | Yes |
| Observations | 5557 | 5573 | 5574 | 5571 | 5567 |
| R^2 | 0.066 | 0.060 | 0.059 | 0.058 | 0.056 |
| Hausman Test (p-values) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: This table reports OLS fixed effects regression estimates of GAD-7 Score on Total Economic Shocks, Death of Family Member Shock, Income Shocks, Yield Shocks, and Positive Fertilizer Shocks. The table reports the coefficient estimates, heteroskedastic robust standard errors clustered on individuals in parentheses, and p-values.

Discussion

Depression and anxiety are important aspects of mental health and have contributed to the global burden of disease. Economic shocks have been documented as determinants of depression and mental health. Previous research in high-income countries has shown negative economic events like job loss, income loss, and unemployment have substantial negative consequences for mental health (Alley et al., 2011; Kuhn et al., 2009; Madianos et al., 2011; Frasquilho et al., 2016; Kämpfen et al., 2020; Witteveen and Velthorst, 2020). In SSA positive economic shocks have been established to causally improve mental health via cash-transfer and other anti-poverty experiments (Haushofer and Shapiro, 2016, 2018; Kilburn et al., 2016;

Angeles et al., 2019; Ohrnberger et al., 2020a,b) . Considering the negative impact depression and anxiety can have on individual productivity, individual and family-level well-being, and overall economic development (Canavan et al., 2013; Kohler et al., 2017; Lund et al., 2018) and the prevalence of depression and anxiety in SSA, understanding how negative shocks effect individual’s mental health is important.

We find a strong positive relationship between more exposure to negative economic events and increased depression and/or anxiety. The fixed effects results and pooled cross-sectional analysis with demographic controls support the conclusion that negative events lead to higher depression and anxiety evaluations even in very low-income settings. In particular death of a family member, loss of agriculture yield, and income loss were particularly traumatic. Within our limited exploration of positive shocks, we found fertilizer subsidies do not hold the same pattern as negative shocks and were not significantly associated with improved depression or anxiety within a fixed effects analysis. While our fixed effect results do not agree with previous cash transfer experiments in SSA, fertilizer subsidies are not equivalent positive shocks to cash transfers which may explain the contradicting outcomes.

We believe our findings are important for three reasons. First, our analyses suggest that negative economic shocks do have an impact in resource limited settings similar to those documented in high income countries. Despite living at low levels of poverty and experiencing shocks unsimilar to those in high income countries individuals still suffer mental health consequences. Second, although preliminary assessment of the relationship between economic shocks and mental health in low-income settings has been done it has mainly relied on cross-sectional data. Cross-sectional analyses maybe biases if there are unobserved characteristics of individual or the places they live in that make experiencing negative economic shocks and depression and/or anxiety more likely. Fixed effects analysis controls for time invariant unobservables and therefore, provide more credible estimates of the causal link between economic shocks and worsening mental health. Lastly, this paper contributes to the limited amount of literature covering mental health in SSA. By starting to understand

what factors effect mental health in SSA global aide organizations and governments can be better informed on how to approach the increasing levels of mental health problems. Hence, policy leaders interested in addressing mental health in low-income countries such as Malawi should consider economic safety nets as a means to prevent declines in mental health.

Finally, there are a few limitations to the study that should be noted. The PHQ-9 and GAD-7 were developed in high-income settings and as mentioned in the methods the validity and sensitivity of these tools in low-income context is less certain. Therefore, it is difficult to gauge the practical significance of the relationships we found because it is unclear how the PHQ-9 and GAD-7 tool work in resource limited settings. Also, when determining the relationship between positive shocks and mental health we relied on the variable Positive Fertilizer Shocks. Since this only includes one type of positive shock our conclusions covering the impact of positive shocks are limited.

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Appendix

Table 4: Economic Shocks and Depression (PHQ-9 Score) Pooled Cross-Sectional Estimates

| | (1) | (2) | (3) | (4) | (5) |
|--------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Total Negative Economic Shocks | 0.651*** (0.0608) | | | | |
| Death of Family Member Shock | | 0.770*** (0.118) | | | |
| Income Loss Shock | | | 1.096*** (0.133) | | |
| Yield Shock | | | | 0.677*** (0.117) | |
| Positive Fertilizer Shock | | | | | -0.0918 (0.115) |
| Female | 0.933*** (0.134) | 0.908*** (0.137) | 0.991*** (0.135) | 0.973*** (0.136) | 0.978*** (0.137) |
| Age 55-64 | 0.336** (0.123) | 0.311* (0.126) | 0.304* (0.124) | 0.304* (0.125) | 0.289* (0.126) |
| Age 65-74 | 1.332*** (0.180) | 1.273*** (0.184) | 1.283*** (0.182) | 1.275*** (0.184) | 1.254*** (0.185) |
| Age 75+ | 3.245*** (0.279) | 3.068*** (0.279) | 3.167*** (0.278) | 3.136*** (0.282) | 3.061*** (0.280) |
| Married | -0.572*** (0.172) | -0.661*** (0.173) | -0.680*** (0.172) | -0.685*** (0.173) | -0.671*** (0.175) |
| Balaka | -0.813*** (0.171) | -0.682*** (0.171) | -0.793*** (0.172) | -0.837*** (0.175) | -0.753*** (0.174) |
| Rumphi | -0.713*** (0.156) | -0.787*** (0.159) | -0.792*** (0.157) | -0.779*** (0.159) | -0.807*** (0.160) |
| Observations | 5329 | 5345 | 5342 | 5346 | 5339 |
| R^2 | 0.139 | 0.125 | 0.131 | 0.122 | 0.117 |
| Fixed Year Effects | Yes | Yes | Yes | Yes | Yes |

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: This table reports OLS pooled cross-sectional regression estimates of PHQ-9 Score on Total Economic Shocks, Death of Family Member Shock, Income Shocks, Yield Shocks, and Positive Fertilizer Shocks with demographic control variables. The table reports the coefficient estimates and heteroskedastic robust standard errors clustered on individuals in parentheses.

Table 5: Economic Shocks and Anxiety (GAD-7 Score) Pooled Cross-Sectional Estimates

| | (1) | (2) | (3) | (4) | (5) |
|--------------------------------|----------------------|----------------------|----------------------|----------------------|---------------------|
| Total Negative Economic Shocks | 0.513*** (0.0448) | | | | |
| Death of Family Member Shock | | 0.646*** (0.0878) | | | |
| Income Loss Shock | | | 0.776*** (0.0972) | | |
| Yield Shock | | | | 0.542*** (0.0869) | |
| Positive Fertilizer Shock | | | | | -0.0847 (0.0874) |
| Female | 0.793*** (0.102) | 0.772*** (0.103) | 0.837*** (0.103) | 0.827*** (0.103) | 0.831*** (0.104) |
| Age 55-64 | 0.372*** (0.0989) | 0.350*** (0.101) | 0.342*** (0.0997) | 0.345*** (0.101) | 0.330** (0.101) |
| Age 65-74 | 1.107*** (0.132) | 1.058*** (0.134) | 1.064*** (0.134) | 1.057*** (0.134) | 1.044*** (0.136) |
| Age 75+ | 2.716*** (0.216) | 2.582*** (0.215) | 2.650*** (0.214) | 2.637*** (0.218) | 2.579*** (0.216) |
| Married | -0.339** (0.127) | -0.405** (0.128) | -0.426*** (0.128) | -0.428*** (0.128) | -0.418** (0.129) |
| Balaka | -0.245* (0.124) | -0.140 (0.125) | -0.222 (0.125) | -0.274* (0.127) | -0.205 (0.127) |
| Rumphu | -0.195 (0.120) | -0.248* (0.122) | -0.254* (0.122) | -0.242* (0.123) | -0.265* (0.124) |
| Observations | 5553 | 5569 | 5567 | 5570 | 5563 |
| R^2 | 0.137 | 0.124 | 0.126 | 0.120 | 0.115 |
| Fixed Year Effects | Yes | Yes | Yes | Yes | Yes |

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: This table reports OLS pooled cross-sectional regression estimates of GAD-7 Score on Total Economic Shocks, Death of Family Member Shock, Income Shocks, Yield Shocks, and Positive Fertilizer Shocks with demographic control variables. The table reports the coefficient estimates and heteroskedastic robust standard errors clustered on individuals in parentheses.

Table 6: Total Economic Shocks and Depression (PHQ-9 Score) Cross-sectional Estimates

| | (1) | (2) | (3) | (4) |
|--------------------------------|----------------------|----------------------|----------------------|---------------------|
| | 2012 | 2013 | 2017 | 2018 |
| Total Negative Economic Shocks | 0.379** (0.128) | 0.672*** (0.116) | 0.844*** (0.108) | 0.548*** (0.110) |
| Female | 0.926*** (0.242) | 0.736*** (0.200) | 0.908*** (0.214) | 1.143*** (0.212) |
| Age 55-64 | 0.467 (0.238) | 0.239 (0.215) | 0.458 (0.242) | 0.123 (0.211) |
| Age 65-74 | 1.771*** (0.420) | 1.575*** (0.304) | 1.094*** (0.288) | 1.064*** (0.272) |
| Age 75+ | 2.804*** (0.627) | 3.394*** (0.595) | 3.309*** (0.386) | 3.210*** (0.438) |
| Married | -0.518 (0.336) | -1.037*** (0.288) | -0.370 (0.269) | -0.402 (0.272) |
| Balaka | -0.346 (0.327) | -1.360*** (0.250) | -0.847*** (0.252) | -0.551* (0.250) |
| Rumphi | -0.987*** (0.246) | -0.802** (0.254) | -0.459 (0.251) | -0.746** (0.239) |
| Observations | 993 | 1226 | 1566 | 1544 |
| R^2 | 0.110 | 0.171 | 0.122 | 0.113 |

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: This table reports OLS regression estimates by year of PHQ-9 Score on Total Economic Shocks with demographic controls variables. The table reports the coefficient estimates and heteroskedastic standard errors in parentheses.

Table 7: Total Economic Shocks and Anxiety (GAD-7) Cross-sectional Estimates

| | (1) | (2) | (3) | (4) |
|--------------------------------|----------------------|----------------------|----------------------|----------------------|
| | 2012 | 2013 | 2017 | 2018 |
| Total Negative Economic Shocks | 0.274*** (0.0807) | 0.576*** (0.0962) | 0.686*** (0.0840) | 0.410*** (0.0825) |
| Female | 0.573*** (0.151) | 0.621*** (0.167) | 0.883*** (0.173) | 1.021*** (0.163) |
| Age 55-64 | 0.447** (0.160) | 0.329 (0.184) | 0.330 (0.193) | 0.330 (0.171) |
| Age 65-74 | 0.958*** (0.222) | 1.435*** (0.249) | 1.068*** (0.230) | 0.954*** (0.208) |
| Age 75+ | 1.919*** (0.358) | 3.085*** (0.464) | 2.871*** (0.315) | 2.728*** (0.330) |
| Married | -0.372 (0.199) | -0.781*** (0.231) | -0.274 (0.221) | -0.0231 (0.205) |
| Balaka | -0.452* (0.178) | -0.520** (0.198) | -0.139 (0.195) | 0.00345 (0.191) |
| Rumphi | -0.621*** (0.174) | -0.214 (0.200) | 0.178 (0.202) | -0.286 (0.186) |
| Observations | 1217 | 1225 | 1567 | 1544 |
| R^2 | 0.098 | 0.167 | 0.135 | 0.111 |

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: This table reports OLS regression estimates by year of GAD-7 Score on Total Economic Shocks with demographic controls variables. The table reports the coefficient estimates and heteroskedastic standard errors in parentheses.

Table 8: Death of Family Member Shock and Depression (PHQ-9 Score) Cross-sectional Estimates

| | (1) 2012 | (2) 2013 | (3) 2017 | (4) 2018 |
|------------------------------|-------------|-------------|-------------|-------------|
| Death of Family Member Shock | 0.650* | 0.815*** | 0.887*** | 0.689** |
| | (0.261) | (0.222) | (0.215) | (0.220) |
| Female | 0.938*** | 0.740*** | 0.805*** | 1.122*** |
| | (0.240) | (0.205) | (0.221) | (0.216) |
| Age 55-64 | 0.426 | 0.202 | 0.510* | 0.0855 |
| | (0.238) | (0.217) | (0.245) | (0.212) |
| Age 65-74 | 1.745*** | 1.517*** | 1.084*** | 0.975*** |
| | (0.420) | (0.306) | (0.293) | (0.275) |
| Age 75+ | 2.778*** | 3.281*** | 3.166*** | 2.953*** |
| | (0.625) | (0.598) | (0.390) | (0.430) |
| Married | -0.488 | -1.130*** | -0.566* | -0.475 |
| | (0.335) | (0.288) | (0.270) | (0.273) |
| Balaka | -0.279 | -1.428*** | -0.559* | -0.349 |
| | (0.322) | (0.254) | (0.254) | (0.249) |
| Rumphi | -1.134*** | -1.021*** | -0.396 | -0.703** |
| | (0.251) | (0.259) | (0.256) | (0.242) |
| Observations | 996 | 1229 | 1570 | 1550 |
| R^2 | 0.108 | 0.154 | 0.097 | 0.105 |

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: This table reports OLS regression estimates by year of PHQ-9 Score on Death of Family Member Shock with demographic controls variables. The table reports the coefficient estimates and heteroskedastic standard errors in parentheses.

Table 9: Death of Family Member Shock and Anxiety (GAD-7 Score) Cross-sectional Estimates

| | (1) 2012 | (2) 2013 | (3) 2017 | (4) 2018 |
|------------------------------|----------------------|----------------------|---------------------|---------------------|
| Death of Family Member Shock | 0.437** (0.161) | 0.655*** (0.180) | 0.835*** (0.174) | 0.592*** (0.168) |
| Female | 0.587*** (0.150) | 0.625*** (0.170) | 0.786*** (0.179) | 0.998*** (0.164) |
| Age 55-64 | 0.423** (0.160) | 0.289 (0.186) | 0.368 (0.194) | 0.293 (0.172) |
| Age 65-74 | 0.959*** (0.221) | 1.376*** (0.249) | 1.033*** (0.235) | 0.873*** (0.209) |
| Age 75+ | 1.892*** (0.358) | 2.986*** (0.467) | 2.736*** (0.318) | 2.563*** (0.326) |
| Married | -0.350 (0.200) | -0.862*** (0.232) | -0.428 (0.219) | -0.0740 (0.205) |
| Balaka | -0.423* (0.177) | -0.582** (0.202) | 0.121 (0.197) | 0.152 (0.189) |
| Rumphi | -0.728*** (0.173) | -0.394 (0.206) | 0.250 (0.205) | -0.249 (0.189) |
| Observations | 1220 | 1228 | 1571 | 1550 |
| R^2 | 0.095 | 0.148 | 0.113 | 0.106 |

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: This table reports OLS regression estimates by year of GAD-7 on Death of Family Member Shock with demographic controls variables. The table reports the coefficient estimates and heteroskedastic standard errors in parentheses.

Table 10: Income Loss Shocks and Depression (PHQ-9 Score) Cross-sectional Estimates

| | (1) | (2) | (3) | (4) |
|--------------------|----------------------|----------------------|---------------------|---------------------|
| | 2012 | 2013 | 2017 | 2018 |
| Income Loss Shocks | 0.887** (0.295) | 1.268*** (0.264) | 1.268*** (0.230) | 0.816*** (0.237) |
| Female | 0.958*** (0.241) | 0.780*** (0.199) | 1.002*** (0.218) | 1.184*** (0.213) |
| Age 55-64 | 0.470* (0.236) | 0.172 (0.216) | 0.487* (0.243) | 0.0767 (0.211) |
| Age 65-74 | 1.744*** (0.419) | 1.463*** (0.306) | 1.140*** (0.293) | 0.995*** (0.275) |
| Age 75+ | 2.762*** (0.624) | 3.334*** (0.597) | 3.277*** (0.387) | 3.085*** (0.431) |
| Married | -0.589 (0.333) | -1.096*** (0.290) | -0.552* (0.269) | -0.500 (0.272) |
| Balaka | -0.275 (0.320) | -1.469*** (0.252) | -0.766** (0.253) | -0.495* (0.251) |
| Rumphi | -1.021*** (0.248) | -0.920*** (0.256) | -0.508* (0.252) | -0.782** (0.240) |
| Observations | 995 | 1229 | 1569 | 1549 |
| R^2 | 0.112 | 0.163 | 0.106 | 0.105 |

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: This table reports OLS regression estimates by year of PHQ-9 Score on Income Loss Shocks with demographic controls variables. The table reports the coefficient estimates and heteroskedastic standard errors in parentheses.

Table 11: Income Loss Shocks and Anxiety (GAD-7 Score) Cross-sectional Estimates

| | (1) | (2) | (3) | (4) |
|--------------------|----------------------|----------------------|---------------------|---------------------|
| | 2012 | 2013 | 2017 | 2018 |
| Income Loss Shocks | 0.0607 (0.171) | 1.092*** (0.211) | 1.062*** (0.185) | 0.674*** (0.182) |
| Female | 0.606*** (0.151) | 0.656*** (0.166) | 0.964*** (0.175) | 1.050*** (0.163) |
| Age 55-64 | 0.418** (0.160) | 0.259 (0.184) | 0.349 (0.194) | 0.286 (0.171) |
| Age 65-74 | 0.942*** (0.223) | 1.337*** (0.248) | 1.086*** (0.236) | 0.908*** (0.209) |
| Age 75+ | 1.861*** (0.358) | 3.030*** (0.466) | 2.836*** (0.315) | 2.667*** (0.325) |
| Married | -0.386 (0.199) | -0.829*** (0.232) | -0.423 (0.218) | -0.106 (0.204) |
| Balaka | -0.442* (0.178) | -0.613** (0.201) | -0.0661 (0.196) | 0.0362 (0.190) |
| Rumphi | -0.739*** (0.174) | -0.310 (0.203) | 0.149 (0.203) | -0.313 (0.188) |
| Observations | 1220 | 1228 | 1570 | 1549 |
| R^2 | 0.089 | 0.159 | 0.120 | 0.107 |

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: This table reports OLS regression estimates by year of GAD-7 on Income Loss Shocks with demographic controls variables. The table reports the coefficient estimates and heteroskedastic standard errors in parentheses

Table 12: Yield Shocks and Depression (PHQ-9 Score) Cross-sectional Estimates

| | (1) | (2) | (3) | (4) |
|--------------|----------------------|----------------------|---------------------|---------------------|
| | 2012 | 2013 | 2017 | 2018 |
| Yield Shocks | 0.345 (0.242) | 0.694*** (0.203) | 0.780** (0.263) | 0.611** (0.235) |
| Female | 0.944*** (0.241) | 0.804*** (0.201) | 0.929*** (0.218) | 1.183*** (0.213) |
| Age 55-64 | 0.407 (0.238) | 0.201 (0.218) | 0.507* (0.246) | 0.0814 (0.212) |
| Age 65-74 | 1.729*** (0.420) | 1.463*** (0.307) | 1.130*** (0.295) | 0.988*** (0.275) |
| Age 75+ | 2.704*** (0.628) | 3.421*** (0.594) | 3.212*** (0.391) | 3.055*** (0.434) |
| Married | -0.540 (0.332) | -1.084*** (0.290) | -0.613* (0.271) | -0.513 (0.272) |
| Balaka | -0.364 (0.335) | -1.429*** (0.251) | -0.831** (0.264) | -0.537* (0.255) |
| Rumphi | -1.099*** (0.251) | -0.800** (0.260) | -0.567* (0.258) | -0.760** (0.241) |
| Observations | 997 | 1229 | 1570 | 1550 |
| R^2 | 0.103 | 0.152 | 0.092 | 0.102 |

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: This table reports OLS regression estimates by year of PHQ-9 Score on Yield Shocks with demographic controls variables. The table reports the coefficient estimates and heteroskedastic standard errors in parentheses.

Table 13: Yield Shocks and Anxiety (GAD-7 Score) Cross-sectional Estimates

| | (1) | (2) | (3) | (4) |
|--------------|----------------------|----------------------|---------------------|---------------------|
| | 2012 | 2013 | 2017 | 2018 |
| Yield Shocks | 0.282 (0.152) | 0.650*** (0.164) | 0.618** (0.198) | 0.451* (0.180) |
| Female | 0.600*** (0.151) | 0.673*** (0.167) | 0.903*** (0.176) | 1.049*** (0.164) |
| Age 55-64 | 0.420** (0.160) | 0.293 (0.186) | 0.368 (0.196) | 0.288 (0.172) |
| Age 65-74 | 0.946*** (0.222) | 1.342*** (0.250) | 1.078*** (0.238) | 0.884*** (0.209) |
| Age 75+ | 1.862*** (0.359) | 3.114*** (0.461) | 2.779*** (0.320) | 2.635*** (0.329) |
| Married | -0.394* (0.198) | -0.820*** (0.233) | -0.471* (0.219) | -0.104 (0.205) |
| Balaka | -0.507** (0.180) | -0.573** (0.200) | -0.107 (0.202) | 0.00682 (0.195) |
| Rumphi | -0.694*** (0.176) | -0.199 (0.205) | 0.105 (0.207) | -0.293 (0.188) |
| Observations | 1221 | 1228 | 1571 | 1550 |
| R^2 | 0.092 | 0.148 | 0.104 | 0.102 |

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: This table reports OLS regression estimates by year of GAD-7 on Yield Shocks with demographic controls variables. The table reports the coefficient estimates and heteroskedastic standard errors in parentheses.

Table 14: Positive Fertilizer Shocks and Depression (PHQ-9 Score) Cross-sectional Estimates

| | (1) | (2) | (3) | (4) |
|----------------------------|----------------------|----------------------|---------------------|----------------------|
| | 2012 | 2013 | 2017 | 2018 |
| Positive Fertilizer Shocks | -0.369 (0.255) | -0.406 (0.229) | 0.322 (0.211) | -0.406 (0.229) |
| Female | 0.963*** (0.240) | 0.820*** (0.203) | 0.924*** (0.220) | 0.820*** (0.203) |
| Age 55-64 | 0.365 (0.238) | 0.173 (0.220) | 0.540* (0.247) | 0.173 (0.220) |
| Age 65-74 | 1.685*** (0.418) | 1.440*** (0.308) | 1.125*** (0.296) | 1.440*** (0.308) |
| Age 75+ | 2.663*** (0.622) | 3.323*** (0.595) | 3.199*** (0.391) | 3.323*** (0.595) |
| Married | -0.524 (0.332) | -1.071*** (0.292) | -0.626* (0.272) | -1.071*** (0.292) |
| Balaka | -0.379 (0.322) | -1.542*** (0.255) | -0.634* (0.256) | -1.542*** (0.255) |
| Rumphi | -1.134*** (0.256) | -0.940*** (0.260) | -0.447 (0.258) | -0.940*** (0.260) |
| Observations | 996 | 1226 | 1570 | 1226 |
| R^2 | 0.104 | 0.146 | 0.088 | 0.146 |

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: This table reports OLS regression estimates by year of PHQ-9 Score on Positive Fertilizer Shocks with demographic controls variables. The table reports the coefficient estimates and heteroskedastic standard errors in parentheses.

Table 15: Positive Fertilizer Shocks and Anxiety (GAD-7 Score) Cross-sectional Estimates

| | (1) | (2) | (3) | (4) |
|----------------------------|----------------------|----------------------|---------------------|----------------------|
| | 2012 | 2013 | 2017 | 2018 |
| Positive Fertilizer Shocks | -0.220 (0.155) | -0.411* (0.192) | 0.211 (0.170) | -0.411* (0.192) |
| Female | 0.624*** (0.150) | 0.691*** (0.169) | 0.898*** (0.177) | 0.691*** (0.169) |
| Age 55-64 | 0.393* (0.159) | 0.262 (0.188) | 0.392* (0.196) | 0.262 (0.188) |
| Age 65-74 | 0.924*** (0.223) | 1.316*** (0.250) | 1.075*** (0.239) | 1.316*** (0.250) |
| Age 75+ | 1.840*** (0.355) | 3.020*** (0.463) | 2.768*** (0.320) | 3.020*** (0.463) |
| Married | -0.384 (0.198) | -0.803*** (0.234) | -0.478* (0.219) | -0.803*** (0.234) |
| Balaka | -0.489** (0.178) | -0.680*** (0.203) | 0.0462 (0.199) | -0.680*** (0.203) |
| Rumphi | -0.729*** (0.176) | -0.325 (0.207) | 0.197 (0.208) | -0.325 (0.207) |
| Observations | 1220 | 1225 | 1571 | 1225 |
| R^2 | 0.092 | 0.141 | 0.100 | 0.141 |

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: This table reports OLS regression estimates by year of GAD-7 on Positive Fertilizer Shocks with demographic controls variables. The table reports the coefficient estimates and heteroskedastic standard errors in parentheses.

Table 16: Economic Shocks and Depression (PHQ-9 Score) Fixed Effect Panel Estimates (Only shocks within one year of survey)

| | (1) | (2) | (3) | (4) | (5) |
|--------------------------------|----------------------|-------------------|---------------------|---------------------|-------------------|
| Total Negative Economic Shocks | 0.369*** (0.0621) | | | | |
| Death of Family Member Shock | | 0.317* (0.132) | | | |
| Yield Shock | | | 0.408*** (0.107) | | |
| Income Loss Shock | | | | 0.534*** (0.144) | |
| Positive Fertilizer Shock | | | | | 0.0641 (0.120) |
| Individual Fixed Effects | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes | Yes | Yes |
| Observations | 5334 | 5349 | 5350 | 5346 | 5343 |
| R^2 | 0.078 | 0.070 | 0.072 | 0.073 | 0.068 |
| Hausman Test (p-values) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: This table reports OLS fixed effects regression estimates of PHQ-9 Score on a second calculation of Total Economic Shocks, Death of Family Member Shock, Income Shocks, Yield Shocks, and Positive Fertilizer Shocks which only includes shocks within one year of the survey administration year. The table reports the coefficient estimates, heteroskedastic robust standard errors clustered on individuals in parentheses.

Table 17: Economic Shocks and Anxiety (GAD-7 Score) Fixed Effect Panel Estimates (Only shocks within one year of survey)

| | (1) | (2) | (3) | (4) | (5) |
|--------------------------------|----------------------|--------------------|---------------------|-------------------|--------------------|
| Total Negative Economic Shocks | 0.233*** (0.0484) | | | | |
| Death of Family Member Shock | | 0.263** (0.100) | | | |
| Yield Shock | | | 0.228** (0.0831) | | |
| Income Loss Shock | | | | 0.267* (0.106) | |
| Positive Fertilizer Shock | | | | | 0.0848 (0.0906) |
| Individual Fixed Effects | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes | Yes | Yes |
| Observations | 5558 | 5573 | 5574 | 5571 | 5567 |
| R^2 | 0.063 | 0.058 | 0.058 | 0.058 | 0.056 |
| Hausman Test (p-values) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: This table reports OLS fixed effects regression estimates of GAD-7 Score on a second calculation of Total Economic Shocks, Death of Family Member Shock, Income Shocks, Yield Shocks, and Positive Fertilizer Shocks which only includes shocks within one year of the survey administration year. The table reports the coefficient estimates, heteroskedastic robust standard errors clustered on individuals in parentheses.