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# **FAMINE AND THE AID RESPONSE**

EVIDENCE FROM THE ANNOUNCEMENT OF FAMINE-LIKE CONDITIONS IN THE REPUBLIC OF YEMEN

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## ABSTRACT

This study analyzes the impacts of the recent rural road development in Ethiopia on welfare and economic outcomes. The identification of the impacts relies on a difference-in-differences matching approach, taking advantage of the nationally representative household survey and the original road database, both of which are panel data spanning between 2012 and 2016. The results of the econometric analysis overall suggest that Ethiopia's recent rural road development has substantially increased household welfare and supported households in coping with the recent severe droughts. This study estimates that rural roads increased, on average, household consumption by 16.1 percent between 2012 and 2016 (or 3.8 percent per year). The effects of rural road development were largest in the most remote communities, as it increased household consumption by 27.9 percent. Furthermore, in the communities most affected by the El Niño drought, the likelihood of falling into poverty was 14.4 percent lower between 2012 and 2016 if the community was connected by a rural road. Taken together, the results suggest that, by connecting remote communities to markets, rural roads have substantially increased the welfare and resilience of rural households in shock-prone environments.

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– Poverty & Equity Global Practice Knowledge Management & Learning Team

# **Famine and the Aid Response: Evidence from the Announcement of Famine-Like Conditions in the Republic of Yemen**

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## 1. Introduction

The Republic of Yemen is in the midst of a humanitarian disaster. The conflict has resulted in extraordinary violence (e.g., Sundberg and Melander 2013), significantly restricted access to food and vital medical supplies due to a tightening of the ports,<sup>1</sup> and has resulted in a substantial decline of the economic climate.<sup>2</sup> Resilience is at a breaking point as of 2018 - estimates suggest 22 million people are in need of humanitarian assistance, of which 11 million people are in acute need to sustain their lives (OCHA 2018).

Access to food has been one of the most important issues throughout the conflict. Evidence from early in the conflict demonstrated a significant decline in food access (e.g., Tandon forthcoming), and the United Nations and humanitarian partners announced in March 2017 that 17 million people were food insecure and nearly 7 million were classified as being at risk of falling into famine (IPC 2017). This announcement included a classification of each governorate based on the Integrated Food Security Phase Classification (IPC) scale, which denotes the likelihood of experiencing a famine.<sup>3</sup>

Previous research on famines has addressed the general causes (e.g., Sen 1981), the household and individual coping strategies (e.g., Dreze and Sen 1991), and their effects on the population (e.g., Dando 1981; Boyle and Grado 1986; Dreze 1990; etc.).<sup>4</sup> Based on the devastating effects famines have had, substantial investments have been made in the past three decades to try and create early warning systems for famines to help mobilize aid resources before food emergencies happen (e.g., FEWS NET, etc.). However, due to a lack of reliable data, there is little understanding of how current famine prediction and announcement mechanisms are performing during food emergencies.<sup>5</sup>

This paper utilizes a novel mobile phone survey that provides estimates of food security that are regionally disaggregated and that are reported at a high frequency over the entire course of the food emergency in Yemen for the mobile phone-using population. In addition to collecting 16 commonly used indicators of food access, the survey also collects information on whether the household is receiving any food assistance. The geographic coverage along with the high frequency of the survey helps to identify a number of issues that have not been able to be addressed in the midst of food emergencies. In particular, the data can assess the short and medium-term consequences of the announcement on the distribution of food assistance among households with access to a mobile phone, and the degree to which food access was stabilized following the announcement in these households. Although the survey misses households without access to mobile phones who potentially are at more risk of famine, the relatively high penetration of mobile phones allows an analysis of food needs and food assistance for a large share of the population.

Among the mobile phone-using population, the announcement of famine-like conditions in Yemen led to an almost immediate and dramatic increase in food assistance in the coun-

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<sup>1</sup>For example, see (accessed September 2018): <https://reliefweb.int/report/yemen/escalating-humanitarian-crisis>.

<sup>2</sup>For example, see (accessed September 2018): <https://reliefweb.int/report/yemen/yemen-rapid-assessment-report-december-2016-measuring-impact-public-sector-wage>.

<sup>3</sup>See Appendix 1 for a map of the official IPC classification that accompanied the announcement of famine-like conditions.

<sup>4</sup>Although not in the context of famine, a more recent literature investigates the advantages and disadvantages of locally-procured emergency food assistance versus transoceanic shipments (e.g., Barrett et al. 2013; Harou et al. 2014; etc.). An additional literature investigates the characteristics of food aid recipients in non-emergency settings (e.g., Clay et al. 1999, etc.).

<sup>5</sup>Although there is little evidence of how famine early warning systems affect the distribution of aid in a food emergency, some have argued that it is still difficult to harness aid resources prior to the onset of a food emergency based on the devastating effect many food emergencies have had on populations despite the existence of an early warning system (e.g., Buchanan-Smith and Davies 1995).

try that remained stable for the year-and-a-half since the announcement. Food assistance increased across the entire country, but regions identified as being more at risk of falling into famine received larger increases in assistance. However, the assistance was not evenly distributed across the at-risk regions- three of the seven at-risk governorates (Hajjah, Lahj, and Sa'ada) received an increase in food assistance that was twice as large as the increase received by the rest of the country, while the rest of the at-risk regions received an increase that was 40 percent larger. Furthermore, the increase in food assistance in the high-aid regions even magnified in the year following the announcement relative to the rest of the country.

Additionally, we find that the evolution of access to food since the announcement has changed. We find that each of the five food coping strategies collected decreased in at-risk regions. There were declines between 1.5 and 4.4 percentage points in coping strategies in at-risk regions relative to the rest of the country. These declines were observed in both regions that were targeted for larger increases in food assistance and regions that received smaller increases, which suggests that a variety of factors could be leading to the improvement in food coping strategies besides only food assistance, such as targeting other types of assistance based on the IPC classification. Alternatively, there was roughly no change in food coping strategies in regions that were not identified as being at the most risk of famine.

Furthermore, the data demonstrate that although the IPC classification identifies some regions that are more at risk of famine than others, the potential difference in access to food between those regions is likely not large among the mobile phone-using population. We find that there was little difference in measures of food access among mobile phone-using households between the at-risk regions and the rest of the country at the time of the announcement. All 16 measures of food access collected in the survey- food coping strategies, measures of diet choice, and food access indexes- all demonstrate nearly identically poor food access in both types of regions.

Lastly, the data also demonstrate that targeting strategies did not respond to updates of the IPC classification. Following the official IPC classification, there were a number of unofficial updates provided by famine early warning systems (e.g., FEWS NET 2018). The subsequent updates were consistent with the findings in this paper- most regions in the country were similarly food insecure. Despite the significant changes made to the projection of regional food needs, the resulting flow of food assistance did not appear to be affected by these updates and continued to provide more assistance to regions initially identified in the official announcement as being closer to famine.

However, there is an important caveat to emphasize. This analysis only addresses food assistance and the food access of the mobile phone-using population. Although 85 percent of the population resided in a household with access to a mobile phone prior to the conflict,<sup>6</sup> and access to mobile phones appears to have remained high following the start of the conflict, there are potentially rural and extremely poor households that are underrepresented in the surveys. Thus, one is unable to make an inference about the validity of the entire IPC classification without better understanding of this out-of-sample population.

We draw two conclusions based on these results. First, the humanitarian community was able to dramatically increase food assistance in a matter of months following the announcement of famine-like conditions. Furthermore, the increase in assistance was nimble enough to target specific regions as opposed to only using the IPC classification to identify needs, and the assistance contributed to a significant improvement in food coping strategies in the regions most at risk of falling into famine. This response stands in stark contrast to some of the worst examples of famine in history (e.g., Sen 1981). But despite this achievement, the evidence suggests that much larger amounts of food assistance are still needed across the

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entire

<sup>6</sup>This statistic is from the authors' calculations using the 2014 Household Budget Survey.

country and that the assistance could have begun before the country was declared at risk of famine.

And second, these findings suggest a number of potential improvements to famine early warning systems. First, a more continuous measure of food emergencies that is officially updated regularly could help to better distribute food assistance during food emergencies. The large differences in assistance based on IPC classifications might not be supported by a more continuous measure of food access given the similarly poor food access of the mobile phone using population across nearly the entire country. Additionally, although there were unofficial updates, the humanitarian and development community appeared to target assistance based only on the official announcement that did not change despite significant changes in both the nature of the conflict and access to food (e.g., Tandon and Vishwanath 2019). These results suggest that there is a need to better link targeting to changes in forecasts.

## **2. Background- the International Phase Classification System**

The Integrated Food Security Phase Classification (IPC) scale is a system that has been adopted by the United Nations and their humanitarian partners to identify food emergencies. The classification differentiates between five progressively worse food insecurity phases- generally food secure, borderline food insecure, acute food and livelihood crisis, humanitarian emergency, and famine/humanitarian crisis. The classifications respectively correspond to more than 80 percent of households cannot meet their food needs in absence of coping strategies, at least 20 percent of households have consumption that is lessened but still adequate, at least 20 percent of households have significant intake shortfalls that cannot be met without irreversible coping strategies, at least 20 percent of households have significant intake shortfalls that cannot be met and result in high levels of acute malnutrition, and at least 20 percent of households face a complete lack of food that results in starvation.

For a famine to be declared, the U.N. and partner agencies have to agree on the classification using a variety of data on food coping strategies, acute malnutrition, and hunger-related deaths (e.g., IPC 2017). Although the official announcement of IPC classifications happens infrequently, individual agencies, such as FEWS NET, can update the classification over time without the agreement of all partner agencies and the U.N. For example, in Yemen, FEWS NET has published seven updates to the IPC classification that was announced in March 2017 (e.g., FEWS NET 2018).

However, in practice, identifying regions on the IPC scale can be complicated. For example, how does one identify the difference between reduced consumption versus inadequate consumption when minimum daily energy requirements are unobservable? Is the acute malnutrition being caused by inadequate food consumption, or is it caused by poor water and sanitation indicators that also tend to be prevalent in countries at risk of famine? Lastly, how does one easily attribute a death to hunger versus a myriad of other causes?

On top of all these difficulties, there are often additional structural issues that make collecting the necessary statistics extremely difficult. In the case of Yemen, the war has made it extremely difficult for agencies to acquire data necessary to at least make good faith estimates to answer the questions listed above. The last household survey representative of the entire population was conducted before the war began. There was an Emergency Food Security and Nutrition Assessment (EFSNA) conducted in December 2016, but this survey avoided the two most conflict-affected governorates, and was likely plagued by a host of difficulties given the security situation in the country and the structural break that has occurred since the last census. Thus, it is difficult to know how representative the survey is of the entire population (FAO 2017).

In Yemen, the official UN announcement of the IPC scale in March 2017 included a number of statistics that were used in identifying the classification of each region. One statistic

that was prominently mentioned in the classification was displacement, where the internally displaced tended to have worse food security than the non-displaced population (IPC 2017). Although this fact has been verified in the 2016 EFSNA, the Gallup World Poll (GWP) conducted in 2015 and 2016 (e.g., World Bank 2017), and in the monthly WFP survey used in this analysis,<sup>7</sup> it is very difficult to accurately identify the size of the displaced population in the country. For example, the monthly mobile phone survey conducted by the WFP and the GWP both find that the size of the displaced population is up to three times as large as is being identified by the Task Force for Population Movement (TFPM), which is the official source used in the IPC 2017 classification (e.g., WFP 2018; World Bank 2017).

There was an update to the IPC classification in December 2018 based on further data collection that tried to better identify conditions at the district level (IPC 2018). The process relied on a number of different types of data collection, but the details of the data collection were not widely publicized. Furthermore, as was the case in 2017, there was a technical committee that determined the IPC classification of each district. As stated in the official announcement, the IPC update involved numerous instances where data sources conflicted either with each other or with impressions on the ground, and the technical committee made their own determination as to the status of districts in which there were such discrepancies. However, it is unclear how many districts were involved these discrepancies, or which districts they might have been (IPC 2018).

Overall, the identification of IPC categories involves aggregating a number of very disparate indicators into one index, many of which are poorly monitored in such difficult circumstances. Furthermore, the weighting scheme used to arrive at the classification is not readily apparent. Thus, it is possible that the differences in food access between some of the IPC classifications might not be large.

### **3. Data**

Given the difficult environments in which many food emergencies occur, it is very difficult to find data that can assess how food assistance responds to the early warning systems. Yemen is no exception, where the security situation (e.g., Sundberg and Melander 2013), the budgetary problems of the government and the Central Statistical Organization (e.g., World Bank 2017), and the significant upheaval in population and population movement since the last census conducted in 2004 all make it very difficult to conduct traditional household surveys (e.g., TFPM 2018). Furthermore, given the large and frequent shocks that potentially necessitate changes in the targeting of food assistance in this setting (e.g., Tandon and Vishwanath 2019), high frequency data collection would help in determining the persistence of the potentially transitory changes in food assistance.

Given the substantial constraints on traditional data collection and the need for data at a higher frequency than is traditionally collected, we are forced to turn to non-traditional survey data. This paper utilizes the most geographically complete survey covering both the pre and post-announcement periods- the mobile Vulnerability and Assessment Mapping Survey (mVAM) conducted by the WFP in Yemen each month beginning in August 2015.<sup>8</sup> The survey is conducted via mobile phone, and respondents are reached via random digit dialing (RDD). The survey is stratified by governorate, where potential respondents continue to be contacted until a sufficient number of completed responses have been met in each governorate aside from the island of Socatra. The number of minimum responses per governorate is

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<sup>7</sup>Based on authors' calculations in the November 2017 mobile phone survey (the only unit-level survey reporting food security data to which the authors had access), food coping strategies were worse among households that reported to be displaced.

<sup>8</sup>In the 2016 IPC classification, the mVAM was actually the key component of determining food access across the country.

determined by the governorate's share of the total population. The number of respondents surveyed each month is approximately 2,400.<sup>9</sup>

The survey is a rolling panel, where the call center initially acquires a list of 2,400 phone numbers that answered the survey in the initial month. In the second month, the same 2,400 phone numbers are contacted for an identical survey. Of these 2,400, approximately 400 on average will not be able to be reached and will have to be replaced for the second survey via random digit dialing, and approximately 200 will not respond for two months in a row. However, those that are not reached will continue to be listed in the bank of possible phone numbers to be tried each month and will only be dropped from the survey completely if they have been tried to be contacted and not completed a survey for two straight rounds; and individuals that have completed 10 total surveys will also be taken out of the potential pool of phone numbers.<sup>10</sup>

The survey collects information on a variety of standard food coping strategies, measures necessary to construct diet diversity, location (governorate and district), and a number of characteristics including displacement status, type of housing, and whether the household received any food assistance.<sup>11</sup> The survey takes approximately 10 minutes for respondents to complete on average, and aggregate averages and confidence intervals are reported for each variable at the national and governorate level each month. Summary statistics that are weighted by the governorates share of the total population are reported in appendix 4.

The survey illustrates a dire food security situation in Yemen over the course of the conflict. The average prevalence of the food coping strategies collected are between 52 and 68 percent of the mobile phone-using population; households consumed fruit, vegetables, and protein less than half the days of the previous week and primarily relied on staples; and the share of individuals receiving food assistance (since it was reported at the governorate level beginning in January 2017) and the share of individuals reporting to be displaced both average approximately one-third of the mobile phone-using population. The majority of food assistance takes the form of in-kind assistance, and the vast majority of food assistance is being provided by the WFP.<sup>12</sup>

Appendix 4 further demonstrates how food access has changed over time. The estimates demonstrate that food coping strategies were already poor in 2015, where the prevalence varied between 38.3 and 64.4 percent of the mobile phone-using population. However, the prevalence of food coping strategies continued to increase in 2016 and peaked in 2017, when food coping strategies varied in prevalence between 51.6 and 72.3 percent. Food coping strategies remained stable in 2018 with a nearly identical prevalence to that reported in 2017.

Throughout the paper, the averages that we present are averages among governorates in a particular type of IPC category- Stressed, Crisis, Crisis but would be Emergency in absence of humanitarian aid (Crisis-Plus), and Emergency. Throughout we weight governorates by their share in the population in each type of IPC category, where population by governorate was obtained from estimates of the Central Statistical Office of Yemen (based on the 2004 Census). However, all results are qualitatively identical when unweighted averages are reported.

However, there are important caveats to note about the data. First, the survey can only

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<sup>9</sup>See Appendix 2 for the number of responses by governorate.

<sup>10</sup>The WFP is unable to observe whether a phone number exists or not in the random digit dialing procedure, and thus we are unable to identify the share of active phone numbers that do not respond to the survey.

<sup>11</sup>See Appendix 3 for the questionnaire of each survey.

<sup>12</sup>The share of the mobile phone-using population reporting receiving aid from the WFP is higher than the share reporting receiving food assistance because the averages are reported over different time periods. The average share of food assistance is reported between January 2017 and July 2018, whereas the breakdown of assistance by form and whether it was from the WFP was only added to the survey in April 2018.

be representative of the mobile phone-using population following the beginning of the conflict. Although it is difficult to identify exactly how access to mobile phones has changed since the start of the conflict, all evidence suggests that access has remained high. The share of the population that lived in a household that owned at least one mobile phone was high prior to the conflict across the entire country and among vulnerable groups,<sup>13</sup> there is anecdotal evidence that the share with access to mobile phones remained high following the start of the conflict,<sup>14</sup> the geographic coverage of the survey reaches the vast majority of the country that is the primary focus of this analysis,<sup>15</sup> and the WFP survey itself demonstrates that the number of mobile phones owned by households has mostly not changed at the national and governorate level.<sup>16</sup>

In addition to the issue of how mobile phone access has changed since the beginning of the conflict, there is the possibility that sample selection (i.e., non-random non-response) could be affecting the generalizability of the estimates. For example, in random digit dialing phone surveys in the United States of political preferences, the surveys are generally good at predicting party affiliation and many other political attributes relative to traditional household surveys, but over-predict the amount of civic engagement due to differences in who is most likely to respond to a phone survey (e.g., Abraham et al. 2009).

To the degree that we are able to assess in such a data and evidence-scarce environment, we validate the WFP survey's representativeness of the broader mobile phone-using population by demonstrating that the survey is capturing trends that are independently corroborated by other sources. First, we demonstrate that the survey does in fact detect large declines in many welfare outcomes and access to basic services that are consistent with the reports of humanitarian and news agencies on the ground.<sup>17</sup> Additionally, the regions that the WFP

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<sup>13</sup>Prior to the escalation of the conflict, 85 percent of the total population lived in a household that owned at least one mobile phone and would be represented by the household-level survey conducted by the WFP. Furthermore, this figure remained high for the rural population (81 percent), the population living below the poverty line (77 percent), and the population of all governorates (over 60 percent for each). Authors' calculations using the 2014 Household Budget Survey.

<sup>14</sup>Registration for the World Bank's cash transfers program being implemented by UNICEF, which covers approximately one-quarter of the total population and is aimed at relatively poorer households, demonstrates the vast majority of households can be reached via phone (see (accessed September 2018): <http://www.worldbank.org/en/news/press-release/2017/05/19/new-world-bank-support-to-address-food-insecurity-in-yemen-aims-to-reach-9-million-yemenis>); evidence from different WFP surveys of food aid beneficiaries suggests that the share of food aid recipients that can be reached via mobile phone has remained very high (see (accessed September 2018): <http://documents.wfp.org/stellent/groups/internal/documents/projects/wfp278006.pdf>); and evidence from the WFP mobile phone survey itself suggests that particularly struggling households are well represented in the sample with approximately one-third of the sample being IDPs and over one-third receiving food assistance.

<sup>15</sup>See Appendix 5 for a map presenting the regions in which there were no respondents in the November 2017 survey, the only survey to which we have access to the unit-level data that report the district of the respondent. The survey reached respondents in 264 of the 333 districts in the country- nearly 80 percent of the total. It is important to note that the districts for which there are zero respondents tend to be less populated and in the east of the country. Only 9.2 percent of the country's 2017 population resided in the 69 districts for which there are zero respondents; and the districts overwhelmingly came from the governorates of Hadramaut and Al Mahrah, where only 39 and 33 percent of districts in each respective governorate had at least one respondent. Importantly, these governorates are the most food secure in the country over the time period under analysis, and are not the primary focus of the analysis.

<sup>16</sup>See Appendix 6.

<sup>17</sup>Appendix 7 compares the 2017 WFP survey to population estimates in the 2014 HBS. The comparison demonstrates that every single indicator of food security collected that is replicable in the 2014 HBS dramatically declined, consistent with the reports of widespread food insecurity (e.g., IPC 2017; FEWNET 2018; etc.); home ownership declined, the prevalence of renting increased, and the size of households all increased, which is consistent with the widespread issue of internal displacement in the country (e.g., TFPM 2018); and access to services dramatically declined, where essentially no households had access to an electricity network

survey identifies as receiving the most assistance roughly align with the population-level estimates of the prevalence of food assistance.<sup>18</sup>

#### 4. The Evolution of Food Assistance over the Course of the Food Emergency

Figure 1 reports the monthly prevalence of food assistance in Yemen over the entire course of the WFP mobile phone survey. The prevalence of food assistance among the mobile phone-using population was stable in the year-and-a-half leading up to the announcement of famine-like conditions, and was approximately between 10 and 15 percent. However, within months of the announcement, the share receiving assistance more than doubled from approximately 15 to above 35 percent by July of 2017. The increase in assistance further remained stable for the year-and-a-half since the announcement.

We further investigate the degree to which the increase in food assistance that is evident at the national level is targeted at specific regions. Figure 2 maps the prevalence of food assistance before the announcement in the first month for which estimates by governorate are reported (January 2017), the month after which food assistance doubles (July 2017), and maps food assistance in the country one year after assistance doubled (July 2018).<sup>19</sup>

There are three significant patterns apparent in figure 2. First, assistance increased in nearly all regions of the country after the famine announcement. The prevalence at least doubled in the majority of governorates between January and July 2017.<sup>20</sup>

Second, the increase in Emergency areas is not uniform. There is a larger initial increase in two governorates in the Emergency region that continues to remain as the survey continues—Lahj and Sa’ada. Furthermore, there is a large increase in Hajjah, that further increases as the survey continues. Combined, these three governorates have a significantly larger increase in food assistance than the rest of the Emergency regions and the rest of the country.

And third, the increase in food assistance persists for the year after the increase in food assistance. The geographic distribution of that assistance remains roughly the same, where Emergency regions still receive significantly more aid than the rest of the country. However, the difference between Emergency regions targeted with the largest increase in assistance (Hajjah, Lahj, and Sa’ada) magnified even further over time.

Formalizing this difference, table 1 estimates the size of the difference in aid targeted at the different classifications with the following specification:

$$(1) \quad Assistance_{rt} = \tau_t + \varphi_r + \sum_{j=2}^4 [\gamma_j IPC Phase^j_{rt} + \beta_j IPC Phase^j_{rt} \cdot Post_{rt}] + c_{rt}$$

where  $r$  denotes governorate,  $t$  denotes time,  $\tau_t$  denotes time fixed effects,  $\varphi_r$  denotes governorate fixed effects,  $Post$  denotes an indicator for whether the observation was after the announcement (July 2017–July 2018), and  $IPC.Phase^j$  denotes indicators equal to one if the governorate was respectively categorized to the IPC classifications Stressed, Crisis but would have been in Emergency if not for humanitarian aid, and Emergency (Crisis is the omitted category). The specification includes the entire country aside from the Stressed regions (Al Maharah governorate), and all time periods for which food assistance is reported by region

and only 25 percent had access to a water network, which is consistent with the reporting of humanitarian agencies (e.g., OCHA 2018).

<sup>18</sup>See Appendix 8. Importantly, the WFP survey was not used as an input to the population-level estimates (IPC 2018).

<sup>19</sup>Although the WFP makes the prevalence of food assistance available at the national level for the entire survey, the estimates by governorate are only reported beginning in January 2017.

<sup>20</sup>Al Jawf reports an anomalously high prevalence of food assistance that reverts back to a level in line with the rest of the country in the next month.

(January 2017-July 2018).<sup>21</sup>

The coefficients  $\beta_j$  represent how much more food assistance increased in regions classified worse than Crisis relative to Crisis regions. Table 1 first reports specifications that compare Crisis regions to each classification that is worse one at a time by restricting the sample (columns 1-4). Table 1 then reports the full specification in column (5).

Table 1 demonstrates that assistance increased more so in Emergency regions than in Crisis and Crisis-Plus regions. Column (1) demonstrates that one cannot reject the hypothesis that there is no difference in the increase in Crisis and Crisis-Plus regions, and that the estimate of the difference is small in magnitude (2.8 percentage points). Alternatively, column (2) demonstrates that assistance in all Emergency regions increased relative to Crisis regions by 11.7 percentage points, which represents an increase of 56 percent larger than in Crisis regions.

However, as evident in the maps presented in figure 2, the increase was not evenly distributed between the Emergency regions. Columns (3) and (4) re-estimate specification (1) separately for the high and low-aid Emergency areas identified in the maps.<sup>22</sup> Column (3) demonstrates that there was a 7.7 percentage point increase in low-aid Emergency regions relative to Crisis regions, and column (4) demonstrates that there was a 19 percentage point increase in high-aid Emergency regions. Furthermore, the patterns in columns (1)-(4) all survive estimating the entire specification, and one can reject the hypothesis that the relative increase in high-aid Emergency regions is equal to the increase in low-aid Emergency regions at conventional significance levels (p-value of 0.013).

We further investigate the timing of these changes in food assistance by estimating specifications of the form:

(2)

$$\begin{aligned} Assistance_{rt} = & \tau_t + \varphi_r + \theta Emergency_{rt} + [\sum_{j=2}^4 \gamma_j^{2017} Ind_{Q^{2017}}^{j,rt} + \beta^{2017} Ind_{Q^{2017}}^{j,rt} Emergency_{rt}] \\ & + [\sum_{j=1}^3 \gamma_j^{2018} Ind_{Q^{2018}}^{j,rt} + c_{rt}] \end{aligned}$$

where all variables are the same as described above,  $Ind_{Q^{jk}}$  denotes an indicator if the observation was taken during the quarter number  $j$  in year  $k$ , and  $Emergency$  denotes an indicator for whether the governorate belonged to any Emergency region. We estimate a number of variants of specification (2) to analyze by how much more food assistance was increasing in regions based on the IPC classification. In each specification  $\beta_{jk}$  represents by how much more food assistance increased in quarter  $j$  and year  $k$  in either Emergency or high-aid Emergency regions relative to the comparison region.

Figure 3 presents coefficient estimates and 95 percent confidence intervals for  $\beta_{jk}$  from each specification. The top panel compares the change in all Emergency regions to Crisis/Crisis-Plus regions; the middle panel compares the change in Emergency regions receiving a higher amount of assistance to Crisis/Crisis-Plus regions; and the bottom panel compares the change in Emergency regions receiving a higher amount of assistance to Emergency regions receiving a lower increase in assistance. Consistent with the estimates in table 1, one is able to reject the hypothesis that all post-announcement coefficients are jointly equal to zero in each panel (p-values of 0.046, 0.000, and 0.000 respectively). But in addition, one can further reject the hypothesis that all post-announcement coefficients are jointly equal to each other either at or near conventional significance levels in each panel (p-values of 0.133, 0.009, and 0.000

<sup>21</sup>In all estimates in the paper, standard errors are clustered at the governorate level, with a total of 21 governorates with the exclusion of Socotra. Additionally, for all coefficients of interest in each table, we also report p-values estimated using the wild bootstrap percentile-t method described by Cameron et al. (2008). All estimates emphasized in the text are robust to either method to estimate the standard errors.

<sup>22</sup>High-aid Emergency regions are Hajjah, Lahj, and Sa'ada.

respectively).

The top panel demonstrates that there was little change in the quarter prior to the famine announcement in Emergency regions relative to Crisis/Crisis-Plus regions. However, immediately after the announcement in the third quarter of 2017, Emergency regions received a larger increase in assistance (consistent with figure 2 and table 1). This initial change in assistance was further magnified in 2018, where there was a statistically significant increase in the second quarter of 2018. Importantly, the magnitude of the coefficients demonstrates that the increases in aid, both initially and in 2018, were large.

The second panel demonstrates that the changes in the first panel were actually even more pronounced in the high-aid Emergency regions. And the third panel demonstrates that there was initially a higher amount of assistance targeted at high-aid Emergency regions, but the coefficients were not precisely estimated. However, the size of the relative increases in high-aid regions continued to grow over the course of 2018, and by the second and third quarter of 2018, the differences were statistically significant at conventional significance levels and were large in magnitude (close to 20 percentage points).

Overall, the increase in food assistance did reach all categories of regions over the course of the survey and was not only targeted at the regions at highest risk of famine in the announcement of famine-like conditions. However, there was a higher increase targeted at Emergency regions, and this larger increase was targeted at three governorates more so than the rest of the region. Combined with the fact that the governorates that received the largest increase in food assistance already were receiving more food assistance than the rest of the country, there were significant disparities between the rest of the country and these three governorates. For example, the bottom panel of figure 2 demonstrates that the prevalence of food assistance in the high-aid Emergency governorates was approximately four times as large as the prevalence of food assistance in the capital Sana'a.

## **5. Did Food Assistance Respond to Updates to the IPC Classification?**

Although there was not an official update to the IPC classifications agreed to by the United Nations and the associated humanitarian agencies before the last time period under analysis here, there have been unofficial updates to the announcement produced by FEWS NET. The organization updated the classifications in June and October in 2017; and updated the classification in February, April, June, and August of 2018.

Overall the official IPC announcement made in March in 2017 mirrors the July 2015 FEWS NET projection of IPC classifications. The Emergency regions were primarily regions that were affected by conflict and had a high prevalence of IDPs, and these issues were explicitly discussed in the rationale for the projection. However, despite the similarity in the projections in 2015 and nearly two years later in 2017, it is important to note that the food security situation changed substantially over that time period (e.g., Tandon and Vishwanath 2019).

However, the next FEWS NET update in June 2017 substantially changed the projected IPC classifications just three months after the official announcement. Only one governorate remained in Emergency status (Lahj), while the rest of the Emergency regions and some Crisis regions were changed to the Crisis-Plus classification. Later FEWS NET updates in 2017 and 2018 largely mirrored the update in June 2017, but beginning in October 2017, there were no governorates that were classified as being in the Emergency classification.

Figure 4 presents the share of governorates that were in each IPC classification by time. At the time of the announcement, approximately 35 percent of governorates were in the Emergency classification, and only 15 percent of governorates were in the Crisis-Plus classification. However, in the next update, the emphasis between the two regions completely changed. Approximately 5 percent of governorates had the Emergency classification, while 45

percent of governorates were classified as Crisis-Plus. The new emphasis beginning in June 2017 continued throughout the rest of the updates.

We further investigate whether these updated IPC classifications over time better explain the observed patterns of food assistance by re-estimating specification (1), but instead of using indicators for the official IPC classifications, we use the time-varying indicators of the IPC classifications that are updated over time. Estimates of the specification are reported in table 2. Column (1) estimates how much larger the increase in food assistance was in updated Crisis-Plus regions than in updated Crisis regions; column (2) estimates how much larger the increase in food assistance was in the updated Emergency regions than in the updated Crisis regions; column (3) estimates the two changes together in the same specification; and columns (4) and (5) break up the post-period by quarter to investigate if there were differences in the targeting over time.

Column (1) of table 2 demonstrates that there was little difference in the increase in food assistance in updated Crisis-Plus regions and updated Crisis regions. The estimate is low in magnitude, and one cannot reject the hypothesis that there was no difference in the increase in food assistance between the two regions at conventional significance levels. However, column (2) demonstrates that there was a larger amount of food assistance targeted at updated Emergency regions than updated Crisis regions. Column (3) demonstrates that the pattern is identical when estimating the two differences in the same specification, and columns (4) and (5) demonstrate that there is little difference in the food aid increases over the course of the post-announcement period.

However, it is important to note that the increase in Emergency regions is not very robust. There was only one governorate that was identified as being in Emergency in June 2017, and zero governorates that were identified as being in Emergency in any period after that. The governorate was one of the three in the country that was targeted for a larger increase in assistance than the rest of the country (Lahj), but the updates failed to identify any of the three high-aid Emergency regions in the official announcement as being in Emergency thereafter. Furthermore, the estimate does not survive the wild bootstrap (p-values ranging between 0.406 and 0.553).

Interestingly, all three high-aid regions identified in the last section were updated as Crisis-Plus beginning in the second update in October 2017, and this change did not actually cause there to be a much larger increase in updated Crisis-Plus regions relative to all others. There are a couple of reasons for this lack of change. First, there were other regions that were originally identified as Emergency and Crisis regions in the official announcement that were also changed to Crisis-Plus. This change decreased the average in the resulting updated Crisis-Plus regions. Additionally, the Crisis regions that became Crisis-Plus actually were the regions that received the smallest increases in food assistance among the Crisis regions, which further increased the average increase in food assistance in Crisis regions. These two changes depressed the difference between updated Crisis-Plus regions and updated Crisis regions. This change also depressed the difference between updated Emergency regions and updated Crisis regions, where the estimate in column (3) of table 2 is smaller than the estimate on high-aid Emergency regions in column (5) of table 1 (9.2 percentage points versus 19.0 percentage points).

Overall, it does not appear that the distribution of assistance matched the updates to the IPC classification produced by FEWS NET. In addition to the lack of a robust difference between regions with different updated classifications, the previous section demonstrated that the uneven distribution of assistance is inconsistent with the convergence of the entire country towards the same IPC classification. This is especially apparent in figure 2, where as noted before, the difference between the high-aid regions that were initially identified as Emergency regions had four times the prevalence of food assistance relative to the capital. However, in

the updated IPC classifications, the capital and these high-aid governorates have the same updated IPC classification despite the large difference in food assistance.

## 6. Food Coping Strategies in Yemen at the time of the Famine Announcement

Despite the large increase in food assistance between Crisis and Emergency regions in the original announcement, there appeared to be little difference in access to food among the mobile phone-using population at the time of the announcement in the regions that were classified as being in Crisis or worse. Figure 5 presents the average share of respondents who relied on each of the five food coping strategies captured in the survey, the average days that households consumed each of six different food groups in the past 7 days, and the average of a number of indices that capture access to food.

In each case, figure 5 demonstrates that individuals residing in regions classified as being in Crisis exhibited extremely similar access to food as individuals that resided in regions classified as being in Crisis-Plus, low-aid Emergency regions, and high-aid Emergency regions. The first panel of figure 5 demonstrates there is a nearly identical prevalence in each food coping strategy collected in the survey- reducing the number of meals consumed, restricting food consumption, borrowing to purchase food, relying on less expensive foods, and limiting portion size. Additionally, the second and third panel further demonstrate that both the average reported diet is nearly identical and that common indices measuring access to food were also nearly identical. The similarity in the figures is particularly striking, as there is substantial heterogeneity across these regions in the specific types of conflict shocks that are more prevalent (e.g., Tandon and Vishwanath 2019), and there are substantial differences in initial conditions prior to the onset of conflict (e.g., World Bank 2017).

Alternatively, figure 5 demonstrates that the one governorate classified as Stressed appeared to be better off in all indicators of food access collected by the survey. Panel 1 of figure 3 demonstrates that the prevalence of each coping strategy was roughly two-thirds that of the rest of the country; panel 2 demonstrates that staple consumption was similar to the rest of the country, but the Stressed region consumed all other food groups collected more often in the past week; and the third panel demonstrates that the Stressed region was better off in all indices measuring food access.

We more formally assess the differences in food access between regions by estimating the following specification:

$$(3) \quad Food\_Access_{rt} = \tau_t + \varphi_r + \sum_{j=2}^4 \gamma_j IPC\ Phase^j + c_{rt}$$

where *FoodAccess* denotes each of the 16 indicators of food access presented in figure 5, and all other variables are as described before. The specification includes all time periods either during the projection of the official famine announcement (March - June 2017), or prior to the announcement. Estimates of  $\gamma_j$  denote differences in food access between Crisis regions and each of the other types IPC classifications in the original announcement.

Estimates of specification (3) are reported in table 3. The patterns are identical to what is presented in figure 5. The one governorate identified as Stressed has better food access in each of the 16 indicators of food access, and most of the coefficients were statistically significant at the 1 percent level. However, there was very little difference between Crisis regions and either of the types of Emergency regions. Of the 32 coefficients across the 16 different measures of food access, only one was statistically significant at the 5 percent level and only one statistically significant at the 10 percent level, which is what one might expect by chance. Furthermore, of these two coefficients that were statistically significant at conventional levels, they actually corresponded to slightly better food access in Emergency regions than in Crisis

regions.

Lastly, table 3 further reports p-values of a test of all coefficients of regions rated as being worse than Crisis being equal (Crisis-Plus, and all Emergency regions). Of the 16 specifications, only 2 are statistically significant at the 10 percent level. And in those specifications, the result is being driven by either worse food access in Crisis-Plus regions relative to Crisis regions, or better access to food in Emergency regions than in Crisis regions.

However, it is important to better understand how food access was trending in each of these regions prior to the famine announcement to better understand the evolution of these needs over the course of the conflict. It is possible that the IPC classifications might also capture some of these historical trends as opposed to the average characteristics at the time of the announcement.

Investigating this concern, we estimate the following specification to better understand how food access was trending in Emergency- Low Aid and Emergency-High Aid regions relative to those in Crisis or Crisis-Plus:

$$(4) \quad Coping_{rt} = \tau_t + \varphi_r + \theta Emergency_{rt} + \left[ \sum_{j=1}^4 \sum_{k=2016}^{2017} \gamma_{jk} Ind_{Q_{jk}} + \beta_{jk} Ind_{Q_{jk}} \right] Emergency_{rt} + c_{rt}$$

where  $r$  denotes governorate,  $t$  denotes the month-year time period,  $Coping$  denotes the share of the respondents that rely on the food coping strategy at least one day in the past week,  $Emergency$  is an indicator equaling one if the governorate is classified as being in any Emergency region, and  $Ind_{Q_{jk}}$  denote indicators equaling one if the observation was from the  $j$ th quarter and  $k$ th year. The sample is restricted to governorates that were classified as being in Crisis or worse (i.e., omits Al Maharah), and includes observations between September 2015 and June 2017. Estimates of  $\beta_{jk}$  represent how much larger this change was in Emergency regions than the change in Crisis/Crisis-Plus regions.<sup>23</sup>

The estimates of each of the  $\beta_{jk}$  along with their 95 percent confidence intervals are presented in figure 6. The estimates presented in figure 6 demonstrate that the increase in food coping strategies was very similar in both Emergency and Crisis/Crisis-Plus regions leading up to the announcement of famine-like conditions. Of 30 estimated coefficients, 29 are not statistically significant at the 95 percent significance level, all estimated coefficients are small in magnitude (approximately 4 percent or below), and the estimates vary in sign.

In addition to the similarity in the mobile phone-using population across most of Yemen, it is important to note that, as discussed in the Background section, some of the indicators used in the official IPC announcement are either difficult to precisely measure (e.g., displacement), or difficult to attribute to poor food consumption alone (e.g., malnutrition). Given the likely large confidence intervals on the classifications, and the observed similarity in food access of the mobile phone-using population across most of Yemen, it is difficult to argue that there are large differences in food access across the discontinuous classifications in the official IPC announcement. This finding is further corroborated by the updates to the IPC classifications produced by FEWS NET described in the last section. The updates suggest that all regions across the country aside from the one region originally identified as Stressed (Al Maharah) mostly converged to the same updated IPC classification.

## 7. Evolution of Food Coping Strategies Following the Increase in Food Assistance

<sup>23</sup>For simplicity, the main text focuses on the difference between Emergency and Crisis/Crisis-Plus regions. However, estimates of a more complete specification that shows similar differences between Crisis regions and all other IPC categories in Yemen- Stressed, Crisis-Plus, and Emergency- separately are qualitatively identical, and demonstrate that food coping strategies were not trending differently in any of the three regions (or separately in Emergency- High Aid regions).

One natural question following the increase in aid is whether it might have helped in increasing people's access to food. We investigate this question by re-estimating specification (1), but using food coping strategies as the dependent variable. The specification includes the entire country aside from the Stressed region (Al Maharah governorate), and all time periods for which food coping strategies are reported by region (September 2015 - July 2018).

The estimates are presented in table 4. Columns (1)-(5) report estimates from specifications using a different food coping strategy as the dependent variable, and the estimates represent how much more each of the five food coping strategies increased in each of the regions classified as worse than Crisis relative to Crisis regions following the official announcement.

The estimates in table 4 demonstrate that there has been little change in food coping strategies in either Crisis or Crisis-Plus regions since the announcement of famine-like conditions. The signs of the coefficients estimated in the first row are all low in magnitude relative to the changes in food assistance, they vary in sign, and none are statistically significant at conventional significance levels.

However, table 4 further demonstrates that there has been a reduction in food coping strategies in Emergency regions- both regions receiving high and low increases in food assistance. All estimates of the coefficient on the interaction of Emergency indicators with a post indicator are negative, and six of 10 are statistically significant at least at the 10 percent significance level. As one might expect, the reduction in food coping strategies was more robustly estimated in regions that received a higher amount of food assistance.

We further investigate the timing of these changes over time by re-estimating specification (2), but using prevalence of households that reduced their meals consumed in the past week for at least one day as the dependent variable. Again, the specification includes the entire country aside from the Stressed regions (Al Maharah governorate), and all time periods for which food coping strategies are reported by region (September 2015 - July 2018). In each specification  $\beta_{jk}$  represents by how much more food coping strategies increased in quarter  $j$  and year  $k$  in Emergency regions included in the specification than in Crisis/Crisis-Plus regions following the official announcement.

Figure 7 presents coefficient estimates and 95 percent confidence intervals for  $\beta_{jk}$  from each specification. The top panel compares the change in all Emergency regions to Crisis/Crisis-Plus regions; the middle panel compares the change in Emergency regions receiving a higher amount of assistance to Crisis/Crisis-Plus regions; and the bottom panel compares the change in Emergency regions receiving a lower amount of assistance to Crisis/Crisis-Plus regions.

The estimates demonstrate that food coping strategies did not start trending differently in Emergency regions in the second quarter of 2017 prior to the increase in assistance in any of the panels. However, the point estimates for the third quarter of 2017 in all three panels began increasing in magnitude and were still negative, and by the first and second quarter of 2018 the estimate became statistically significant at the 95 percent level in all three specifications. However, it is important to note that the magnitudes of the estimates are smaller than the estimates using food assistance as the dependent variable in figure 3.

It is possible that the increased food assistance helped to improve food access in governorates that received larger increases in food assistance. However, it is difficult to attribute this improvement in food coping strategies to the increase in food assistance alone. One cannot reject the hypothesis that the improvement in food coping strategies was identical in high and low-aid Emergency regions at conventional significance levels in any of the specifications reported in table 4. This is despite high-aid Emergency regions receiving a significantly larger amount of food assistance than even low-aid Emergency regions, as reported in table 1.

Other potential reasons for why food assistance might trend differently in each of the Emergency regions relative to Crisis and Crisis-Plus regions include the possibility that conditions on the ground had changed over the course of the year and a half that has passed

since the initial IPC classifications were announced. In fact, given the large changes in the prevalence of conflict, changes to the regional distribution of the conflict, and a worsening of port access necessary to import vital food supplies and medicine, it is likely that the regional distribution of poor food access has changed (e.g., Tandon and Vishwanath 2019).

Another potential reason for the slight difference in the evolution of food coping strategies in Emergency regions relative to the rest of the country is the possibility that other types of aid were either targeted based on the IPC classification, or based on indicators used in the construction of those classifications. A number of the indicators- malnutrition, displacement, and inability to afford basic goods and services- have likely been used as targeting mechanisms for the ongoing emergency health projects, humanitarian aid targeted at victims of the conflict, and by the social safety net programs that are currently being run in the country.

## **8. The State of Food Assistance and Food Access One Year after the Announcement**

Each of these trends over time- the magnifying of the uneven distribution of food assistance and the slight bettering of food access in Emergency regions relative to the rest of the country- have culminated in an uneven distribution of food assistance across the original IPC classifications despite similar reported measures of food access among the mobile phone-using population. The distribution of food assistance and food coping strategies from the latest survey used in this analysis are presented in figure 8. The top panel presents a map of food assistance by governorate in July 2018; the middle panel presents a map of the share of households that reduced the meals consumed in the week before the survey by governorate; and the bottom panel presents the aggregated prevalence of food assistance and the share of households that relied on food coping strategies by the original IPC classifications, and breaks up the Emergency regions into high and low aid-receiving regions.

There are substantial differences in food assistance across the country in the first panel. Households in Emergency regions receive significantly more assistance than the rest of the country, and this is especially true for the Emergency governorates of Hajjah, Lahj, and Saada. But the share that reduced the number of meals they consumed in the week before the survey is similarly poor in all the northern governorates in the second panel. Other coping strategies collected in the survey all demonstrate a qualitatively identical pattern.

The third panel demonstrates this distinction more directly. The panel presents the prevalence of food assistance and the share of households that resort to each of the five coping strategies collected in the survey. Relative to Crisis regions in the original IPC announcement, Crisis-Plus regions have a prevalence of food assistance that is 90 percent higher (24 percentage points), Emergency- Low Aid regions have a prevalence that is 73 percent higher (19 percentage points), and Emergency- High Aid regions have a prevalence that is 147 percent higher (39 percentage points). Despite these large differences in the prevalence of food assistance, the share of the same population that resorts to any of the food coping strategies is identical across each of these types of regions.

In total, the initial higher prevalence of food assistance in Emergency regions relative to the rest of the country, the higher increases in assistance in Emergency regions immediately after the announcement, and additional higher increases in food assistance in Emergency regions in the first quarter of 2018 have resulted in a highly uneven distribution of food assistance across the country. However, the very small improvement in food access in Emergency regions relative to Crisis regions over the same time period has resulted in little change in measures of food access over this time from the initial levels that were indistinguishable across IPC classifications. The results demonstrate that even neighboring governorates can have large disparities in food assistance but a nearly identical share that reports poor food access among the mobile phone-using population.

However, there are two important issues to note. First, it is possible that the empirical patterns could be due to the possibility of humanitarian agencies having more difficulty operating in some parts of the country. However, it is unlikely that difficulty in operating in individual districts is driving the larger increases in Emergency regions relative to Crisis regions. There are humanitarian partners working in all Emergency and Crisis regions. Furthermore, there are actually more humanitarian partners working in Crisis regions (OCHA 2018), which suggests that assistance is likely easier to deliver in Crisis regions and is not a barrier to distributing more food assistance in those regions relative to Emergency regions.

Second, it is important to note that this survey is representative of the mobile phone-using population, and the population that resides in households without access to a mobile phone might have significantly different food access. However, whatever the food assistance needs of the out-of-sample population might be, as discussed in the Data section, the evidence suggests that the share of the population with access to mobile phones is the majority of the population.

## **9. Conclusion**

We found that there was a more than doubling in the prevalence of food assistance among the mobile phone-using population following the announcement of famine-like conditions in Yemen. However, much larger increases in food assistance were targeted at particular regions that were identified in the initial announcement as being at higher risk of famine. Furthermore, this regional distribution of food assistance has persisted for even a year and a half following the initial announcement.

However, it is important to note that there are many caveats to this analysis. First, the food assistance needs of the population without access to mobile phones need to be addressed with other survey methodologies. Although face-to-face interviews in the current context that are representative of the entire population are difficult in this setting, they could at least account for some of this difficult-to-reach population. And in cases where the security situation makes it difficult to reach these households, one can complement mobile phone surveys with key informant surveys of service providers and local government officials to at least paint as complete a picture as possible about the needs of the entire population in a region.

Second, it is unclear how Yemenis themselves would like to see assistance distributed. Preliminary evidence from phone and internet-based surveys designed to provide more anonymity to respondents suggests that some Yemenis believe it is fair to give more assistance to more conflict-affected regions, while others report that it is only fair for all regions to receive identical amounts of food assistance. Importantly, individuals' stated preferences appear to depend on where they live in the country, and the degree to which their region is affected by conflict.<sup>24</sup> A better understanding of how to deliver assistance in ways that encourage recovery and reconstruction could help current targeting strategies.

Another issue highlighted by this analysis is the potential need for improvements in the ways that humanitarian and development agencies use famine early warning systems. Specifically, understanding ways in which agencies can better agree on the classification of famine and better collectively target the populations with the poorest access to food could be particularly valuable. Two particular changes that might help that are highlighted by this analysis are the need for more constant official updating and the need to rely on less discontinuous measures of famine risk if the underlying access to food is potentially not large. However, ways to improve the coordination required for all agencies to work together to best

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<sup>24</sup>Results are from author's calculations of internet-based surveys that are randomly distributed to individuals who arrive at wrong or dated webpages and are representative of the internet-using population.

respond to famine risks still need to be better addressed.

Lastly, this analysis also highlights the need for better ways to best predict the onset of a food emergency. Predictions are likely best made when using data collected directly from the population at a very high frequency. The WFP mobile phone surveys are a very good contribution to the sorts of data necessary to better identify the needs of each region and to better identify when households are reaching crisis levels in real time. However, there are a variety of other types of data that can complement direct surveys, including data from telecommunications companies regarding the volume and places of calls, data from internet search engines, data from social media, and so on. Incorporating these sorts of high frequency data along with machine learning techniques could help complement existing early warning systems and could help improve accuracy, transparency, and timeliness in declaring food emergencies (e.g., Mullainathan and Spiess 2017; etc.).

## References

- Abraham, K.G., S. Helms, and S. Presser. 2009. "How Social Processes Distort Measurement: The Impact of Survey Nonresponse on Estimates of Volunteer Work in the United States." *American Journal of Sociology* 114, 1129-1165.
- Besley, T., and R. Kanbur. 1988. *The Principles of Targeting. Policy, Research, and External Affairs Working Paper 385*, World Bank, Washington, D.C.
- Boyle, P., and O. Grada. 1986. Fertility Trends, Excess Mortality, and the Great Irish Famine. *Demography* 23 (4), 543-562.
- Buchanan-Smith, M., and S. Davies. 1995. "Famine Early Warning and Response: The Missing Link." London: Intermediate Technology Publications, 1995.
- Cameron, C., J. Gelbach, and D. Miller. 2008. "Bootstrap-Based Improvements for Inference with Clustered Errors." *Review of Economics and Statistics* 90 (3), 414-427.
- Clay, D., D. Molla, and D. Habtewold. 1999. Food Aid Targeting in Ethiopia: A Study of Who Needs it and Who Gets it. *Food Policy* 24 (4), 391-409.
- Dando, W. Man-Made Famines: Some Geographical Insights from an Exploratory Study of a Millennium of Russian Famines, in *Famine: Its Causes, Effects and Management*. Ed.: J. Robson. New York: Gordon and Breach, 1981, 139-154.
- Dreze, J. 1990. Famine Prevention in India, in J. Dreze and A. Sen eds. *The Political Economy of Hunger: Vol 2*. 1990, 13-122. Dreze, J., and A. Sen. 1989. *Hunger and Public Action*. Oxford: Oxford University Press, 1990.
- FAO. 2017. *Emergency Food and Nutrition Security Assessment. Report*, Food and Agriculture Organization of the United Nations, Rome, Italy.
- FEWS NET. 2018. *Yemen Food Security Alert. Famine Early Warning System*, Sanaa, Yemen, June.
- Garg, T., C. Barrett, M. Gomez, E. Lentz, and W. Violette. 2013. Market Prices and Food Aid Local and Regional Procurement and Distribution: A Multi-Country Analysis. *World Development* 49, 19-29
- Harou, A., J. Upton, E. Lentz, C. Barrett, and M. Gomez. 2013. Tradeoffs of Synergies? Assessing Local and Regional Food Aid Procurement through Case Studies in Burkina Faso and Guatemala. *World Development* 49, 44-57.
- IPC. 2017. *IPC Map of Yemen: March July, 2017. Integrated Food Security Phase Classification. Report*, Food Security Cluster, Humanitarian Response, Yemen.
- IPC. 2018. "IPC Map of Yemen: December 2018 January 2019." *Integrated Food Security Phase Classification Report*, Food Security Cluster, Humanitarian Response, Yemen.
- Mahmud, I., and N. Mbuya. 2016. "Water, Sanitation, Hygiene, and Nutrition in Bangladesh: Can Building Toilets Affect Children's Growth?" Report, World Bank, Washington D.C..
- Nunn, N. and N. Qian. 2013. "US Food Aid And Civil Conflict." *American Economic Review* 104 (6), 1630-1666.
- OCHA. 2018. *Yemen: 2018 Humanitarian Needs Overview. Report*, United Nations Office for the Coordination of Humanitarian Affairs, Sanaa, Yemen.

- Mullainathan, S., and J. Spiess. 2017. Machine Learning: An Applied Econometric Approach. *Journal of Economic Perspectives* 31 (2), 87-106.
- Sen, A. 1981. *Poverty and famines: An Essay on Entitlement and Deprivation.* Oxford: Oxford University Press, 1981.
- Sundberg, R., and E. Melander. 2013. "Introducing the UCDP Georeferenced Event Dataset." *Journal of Peace Research* 50 (4), 523-532.
- TFPM. 2018. "Yemen- 17th Report." International Organization for Migration, Sana'a, Yemen.
- Tandon, S. Forthcoming. When Rebels Attack: Quantifying the Impacts of Capturing Territory from the Government of Yemen. *World Bank Economic Review*, forthcoming.
- Tandon, S. and T. Vishwanath. 2019. The Evolution of Food Coping Strategies Over the Course of the Conflict in Yemen. Working Paper, World Bank, Washington, D.C.
- TFPM. 2017. TFPM 13th Report. Task Force on Population Movement, Sanaa, Yemen.
- World Bank. 2017. Yemen Poverty Notes. Report, World Bank, Washington, D.C.
- WFP. 2018. mVAM Monitoring Bulletin 35. World Food Programme, Rome, Italy.

Table 1. Change in Food Assistance Following the Famine Announcement

VARIABLES	(1) food assistance	(2) food assistance	(3) food assistance	(4) food assistance	(5) food assistance
Post Ind. x Crisis-Plus Ind.	0.028 [0.032] {0.440}	-	-	-	0.028 [0.031] {0.440}
Post Ind. x Emergency Ind.	-	0.117*** [0.039] {0.018}**	-	-	-
Post Ind. x Emergency- Low Aid Ind.	-	-	0.077** [0.034] {0.108}	-	0.077** [0.033] {0.108}
Post Ind. x Emergency- High Aid Ind.	-	-	-	0.190*** [0.040] {0.008}***	0.190*** [0.039] {0.008}***
Crisis-Plus Ind.	0.179*** [0.023]	-	-	-	0.285*** [0.022]
Emergency Status Ind.	-	0.130*** [0.028]	-	-	-
Emergency-Low Aid Ind.	-	-	0.159*** [0.025]		0.159*** [0.024]
Emergency-High Aid Ind.				0.261*** [0.029]	0.274*** [0.028]
Post Ind.	0.201** [0.082]	0.212*** [0.047]	0.200*** [0.040]	0.234** [0.083]	0.196*** [0.062]
Observations	234	306	252	234	360

This table estimates the change in the prevalence of food assistance following the announcement of famine-like conditions separately for each of the famine classifications worse than "Stressed." Column (1) compares "Crisis-Plus" regions to "Crisis" regions; column (2) compares all "Emergency" regions to "Crisis" regions; column (3) compares "Emergency- Low Aid" regions to "Crisis" regions; column (4) compares "Emergency- High Aid" regions to "Crisis" regions; and column (5) includes all regions in the same specification and estimates how much more food assistance increased in regions classified worse than "Crisis." All specifications include month and governorate fixed effects. Standard errors clustered at the governorate level are presented in brackets immediately below the coefficient estimates; and p-values utilizing a wild cluster bootstrap are reported in the second brackets below the higher-order coefficients only. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 2. Lack of Response of Food Assistance to the Unofficial Updates of Famine Risk

VARIABLES	(1) Food Assistance	(2) Food Assistance	(3) Food Assistance	(4) Food Assistance	(5) Food Assistance
Crisis-Plus-FEWS Ind. x Post Ind.	0.007 [0.050] [.901]	-	0.019 [0.039] [.629]	-	-
Emergency-FEWS Ind. x Post Ind.	-	0.138*** [0.039] [.406]	0.092** [0.044] [.553]	-	-
Emergency-FEWS Ind. x Q2-2017 In	-	-	-	-	0.048 [0.058] [.464]
Emergency-FEWS Ind. x Q3-2017 In	-	-	-	-	0.114*** [0.031] [.474]
Crisis-Plus-FEWS Ind. x Q2-2017 Ind	-	-	-	-0.048 [0.053] [.464]	-
Crisis-Plus-FEWS Ind. x Q3-2017 Ind	-	-	-	-0.000 [0.041] [.965]	-
Crisis-Plus-FEWS Ind. x Q4-2017 Ind	-	-	-	-0.041 [0.046] [.342]	-
Crisis-Plus-FEWS Ind. x Q1-2018 Ind	-	-	-	-0.066 [0.053] [.226]	-
Crisis-Plus-FEWS Ind. x Q2-2018 Ind	-	-	-	-0.050 [0.056] [.360]	-
Crisis-Plus-FEWS Ind. x Q3-2018 Ind	-	-	-	0.021 [0.061] [.755]	-
Crisis-Plus FEWS Ind.	-0.044 [0.033]	-	-0.032 [0.031]	0.048 [0.036]	-
Emergency-FEWS Ind.	-	-0.071 [0.043]	-0.121*** [0.038]	-	-0.133*** [0.037]
Post Ind.	0.225*** [0.048]	0.158** [0.056]	0.209*** [0.045]	-	-
Observations	302	191	360	302	191

Notes: This table reports estimates of how food assistance changed in regions based on their updated IPC classification as estimated by FEWS NET. Column (1) estimates how much more food assistance went to "Crisis-Plus" regions than "Crisis" regions; column (2) estimates how much more went to "Emergency" regions than "Crisis" regions; column (3) estimates the same differences as columns (1) and (2) in the same specification; column (4) estimates how much more assistance went to Crisis-Plus regions by quarter; and column (5) estimates how much more went to Emergency regions by quarter. However, there were no "Emergency" regions in the FEWS NET updates following the third quarter of 2017. All specifications include time and governorate fixed effects. Standard errors clustered at the governorate level are reported in the first bracket, and p-values utilizing a Wild Cluster Bootstrap are reported in the second set of brackets for each higher-order term.

Table 3. Differences in Food Access between IPC Classifications Prior to the Official Announcement

	Stressed		Crisis-Plus		Emergency-Low Aid		Emergency-High Aid		P-value from test of Crisis Regions Equaling all Worse Classifications
Reduce Meals	-0.196***	[0.020]	-0.009	[0.023]	0.010	[0.022]	0.055	[0.069]	0.502
		[0.006]***		[.667]		[.659]		[.613]	
Restrict Consumption	-0.262***	[0.025]	-0.000	[0.026]	-0.010	[0.037]	0.070	[0.079]	0.793
		[0.000]***		[.963]		[.775]		[.609]	
Borrow to Purchase Food	-0.176***	[0.020]	0.034	[0.027]	0.004	[0.030]	0.053	[0.064]	0.539
		[.004]***		[.262]		[.911]		[.641]	
Rely on Less Expensive	-0.224***	[0.020]	0.011	[0.027]	-0.000	[0.032]	0.040	[0.049]	0.849
		[.002]***		[.727]		[1.000]		[.605]	
Limit Portion Sizes	-0.256***	[0.022]	-0.010	[0.024]	0.002	[0.032]	0.049	[0.073]	0.802
		[.002]***		[.667]		[.983]		[.685]	
Food Consumption Score	0.165***	[0.016]	-0.043**	[0.017]	-0.001	[0.041]	-0.022	[0.029]	0.078
		[.002]***		[.022]		[1.000]		[.541]	
Share with Poor Coping Strategy Group	0.246***	[0.021]	-0.009	[0.024]	-0.008	[0.033]	-0.041	[0.062]	0.926
		[.002]***		[.719]		[.861]		[.701]	
Share with Poor Food Consumption Group	-0.144***	[0.020]	0.083***	[0.025]	0.014	[0.054]	0.039	[0.035]	0.025
		[.010]***		[.008]		[.771]		[.410]	
Reduced Coping Strategy Index	-0.108***	[0.010]	-0.009	[0.010]	-0.010	[0.013]	0.016	[0.030]	0.668
		[.002]***		[.384]		[.484]		[.663]	
Number of Days- Protein	2.265***	[0.227]	0.093	[0.255]	0.255	[0.500]	-0.045	[0.380]	0.928
		[.008]***		[.743]		[.577]		[.883]	
Number of Days- Pulses	0.465**	[0.184]	-0.479	[0.323]	0.035	[0.269]	0.007	[0.213]	0.397
		[.134]		[.216]		[.867]		[.951]	
Number of Days- Staples	0.254***	[0.035]	-0.030	[0.083]	-0.034	[0.119]	-0.016	[0.081]	0.977
		[0.000]***		[.763]		[.771]		[.839]	
Number of Days- Sugar	0.848***	[0.110]	0.076	[0.125]	0.285**	[0.135]	-0.348	[0.390]	0.084
		[.016]**		[.523]		[.042]		[.482]	
Number of Days- Veg.	0.393*	[0.191]	-0.275	[0.252]	0.231	[0.594]	-0.103	[0.401]	0.653
		[.172]		[.364]		[.615]		[.795]	
Number of Days- Fat	0.765***	[0.103]	0.057	[0.126]	0.304*	[0.168]	-0.137	[0.299]	0.277
		[.010]***		[.641]		[.130]		[.695]	
Number of Days- Fruit	1.177***	[0.101]	-0.200*	[0.114]	-0.066	[0.196]	-0.187	[0.189]	0.359
		[0.000]***		[.122]		[.815]		[.555]	

Notes: This table estimates the difference in food coping strategies between "Crisis" regions and the rest of Yemen prior to the announcement of famine-like conditions. Each row reports estimates from a separate specification, includes 433 observations, and includes month fixed effects. Standard errors clustered by governorate are reported in the first set of brackets, and p-values utilizing a wild cluster bootstrap are reported in the second set of brackets. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 4. Evolution of Food Coping Strategies Following the Announcement of Famine-Like Conditions

VARIABLES	(1) reduce meals	(2) restrict consumption	(3) borrow	(4) limit portion	(5) less expensive
Post Ind. x Crisis-Plus Ind.	0.023 [0.014] {0.172}	0.015 [0.015] {0.438}	-0.027 [0.026] {0.326}	0.015 [0.016] {0.372}	-0.017 [0.016] {0.346}
Post Ind. x Emergency- Low Aid Ind.	-0.018 [0.031] {0.635}	-0.019 [0.032] {0.623}	-0.015 [0.035] {0.733}	-0.021 [0.036] {0.613}	-0.034** [0.013] {0.014}*
Post Ind. x Emergency- High Aid Ind.	-0.030** [0.012] {0.060}*	-0.026* [0.014] {0.158}	-0.030 [0.024] {0.310}	-0.039*** [0.012] {0.032}**	-0.044*** [0.011] {0.014}**
Crisis-Plus Ind.	-0.028*** [0.005]	0.036*** [0.006]	0.061*** [0.010]	-0.034*** [0.006]	0.001 [0.006]
Emergency-Low Aid Ind.	-0.021* [0.012]	-0.042*** [0.012]	-0.082*** [0.014]	-0.066*** [0.014]	-0.071*** [0.005]
Emergency-High Aid Ind.	-0.035*** [0.006]	0.002 [0.006]	-0.040*** [0.010]	-0.069*** [0.005]	-0.028*** [0.005]
Post Ind.	-0.130*** [0.022]	-0.083*** [0.014]	-0.015 [0.029]	-0.107*** [0.017]	-0.104*** [0.023]
Observations	672	672	672	672	672

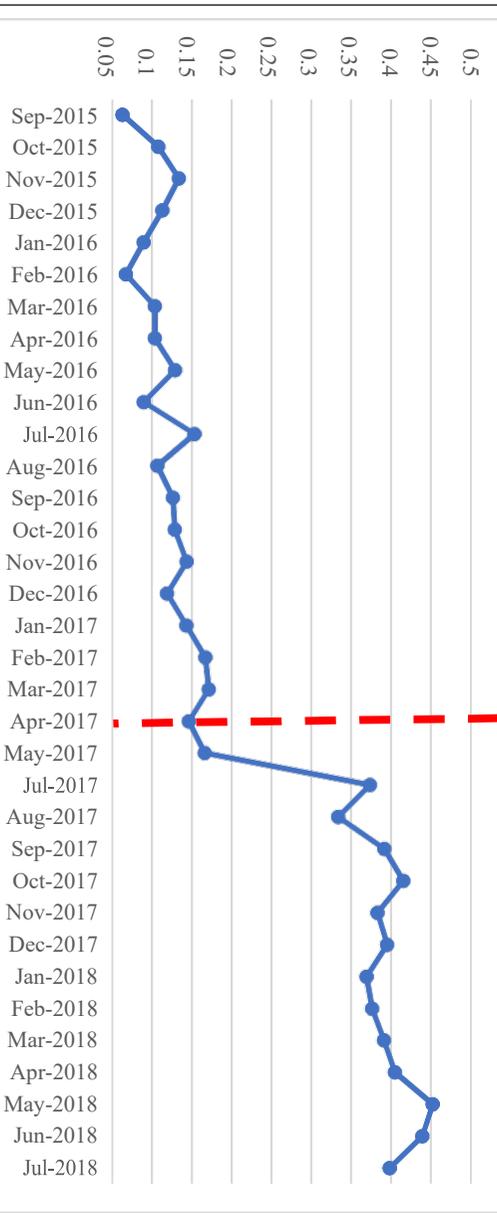
This table estimates the change in the prevalence of food coping strategies following the announcement of famine-like conditions separately for each of the famine classifications worse than "Stressed." Each column uses a different food coping strategy as the dependent variable. All specifications include month and governorate fixed effects. Standard errors clustered at the governorate level are presented in brackets immediately below the coefficient estimates; and p-values utilizing a wild cluster bootstrap are reported in the second brackets below the higher-order coefficients only. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 5. Differences in Food Assistance and Food Access in the Year After the Official Announcement

	Stressed		Crisis-Plus		Emergency-Low Aid		Emergency-High Aid		P-value from test of Crisis Regions Equaling all Worse Classifications
Food Assistance	-0.051	[0.043]	0.168**	[0.061]	0.153***	[0.043]	0.329***	[0.055]	[0.000]***
		[0.308]		[0.020]**		[0.026]**		[0.000]***	
Reduce Meals	-0.336***	[0.024]	0.001	[0.030]	-0.018	[0.034]	0.006	[0.067]	[0.929]
		[0.000]***		[1.000]		[0.597]		[0.889]	
Restrict Consumption	-0.312***	[0.027]	0.004	[0.028]	-0.029	[0.033]	0.033	[0.078]	[0.446]
		[0.000]***		[0.905]		[0.368]		[0.697]	
Borrow to Purchase Food	-0.246***	[0.034]	-0.018	[0.042]	-0.022	[0.038]	0.009	[0.067]	[0.904]
		[0.0140]**		[0.665]		[0.547]		[0.855]	
Rely on Less Expensive	-0.291***	[0.023]	-0.002	[0.039]	-0.038	[0.039]	-0.009	[0.057]	[0.789]
		[0.000]***		[0.981]		[0.346]		[0.945]	
Limit Portion Sizes	-0.309***	[0.022]	-0.009	[0.027]	-0.031	[0.031]	-0.005	[0.083]	[0.781]
		[0.000]***		[0.737]		[0.328]		[0.993]	
Food Consumption Score	0.190***	[0.020]	-0.039*	[0.022]	0.003	[0.041]	-0.006	[0.029]	[0.188]
		[0.002]***		[0.112]		[0.885]		[0.811]	
Share with Poor Coping Strategy Group	0.339***	[0.022]	0.011	[0.029]	0.034	[0.029]	0.020	[0.065]	[0.676]
		[0.000]***		[0.737]		[0.214]		[0.779]	
Share with Poor Food Consumption Group	-0.090***	[0.025]	0.036	[0.027]	0.002	[0.037]	-0.001	[0.030]	[0.185]
		[0.082]*		[0.238]		[0.987]		[1.000]	
Reduced Coping Strategy Index	-0.120***	[0.014]	-0.021	[0.015]	-0.023	[0.017]	-0.001	[0.032]	[0.491]
		[0.006]***		[0.222]		[0.216]		[1.000]	
Number of Days-Protein	2.929***	[0.356]	0.108	[0.366]	0.443	[0.614]	-0.080	[0.515]	[0.851]
		[0.180]**		[0.819]		[0.494]		[0.869]	
Number of Days-Pulses	0.337*	[0.180]	-0.269	[0.281]	0.006	[0.284]	0.650*	[0.332]	[0.107]
		[0.214]		[0.400]		[0.983]		[0.148]	
Number of Days-Staples	0.313***	[0.054]	0.042	[0.062]	0.025	[0.069]	0.047	[0.071]	[0.901]
		[0.000]***		[0.533]		[0.707]		[0.553]	
Number of Days- Sugar	0.594***	[0.152]	0.555***	[0.157]	0.342*	[0.169]	-0.473	[0.390]	[0.001]***
		[0.0440]**		[0.0120]**		[0.0520]*		[0.388]	
Number of Days- Veg.	0.483**	[0.230]	0.008	[0.278]	0.339	[0.550]	-0.116	[0.265]	[0.794]
		[0.148]		[0.961]		[0.559]		[0.701]	
Number of Days- Fat	1.149***	[0.195]	0.176	[0.262]	0.469	[0.300]	0.353	[0.238]	[0.371]
		[0.0220]**		[0.527]		[0.204]		[0.174]	
Number of Days- Fruit	1.679***	[0.170]	-0.081	[0.176]	0.055	[0.228]	-0.160	[0.229]	[0.742]
		[0.010]***		[0.689]		[0.777]		[0.537]	

Notes: This table estimates the difference in food coping strategies between "Crisis" regions and the rest of Yemen in 2018, which is the year after the announcement of famine-like conditions. Each row reports estimates from a separate specification, includes 126 observations, and includes month fixed effects. Standard errors clustered by governorate are reported in the first set of brackets, and p-values utilizing a wild cluster bootstrap are reported in the second set of brackets. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Figure 1. Share of Respondents Receiving Food Assistance- WFP Mobile Phone Survey



Source: Authors' calculations, WFP mobile Vulnerability Analysis and Mapping Survey September 2015-July 2018.

Figure 2. Distribution of Food Assistance by Governorate over Time

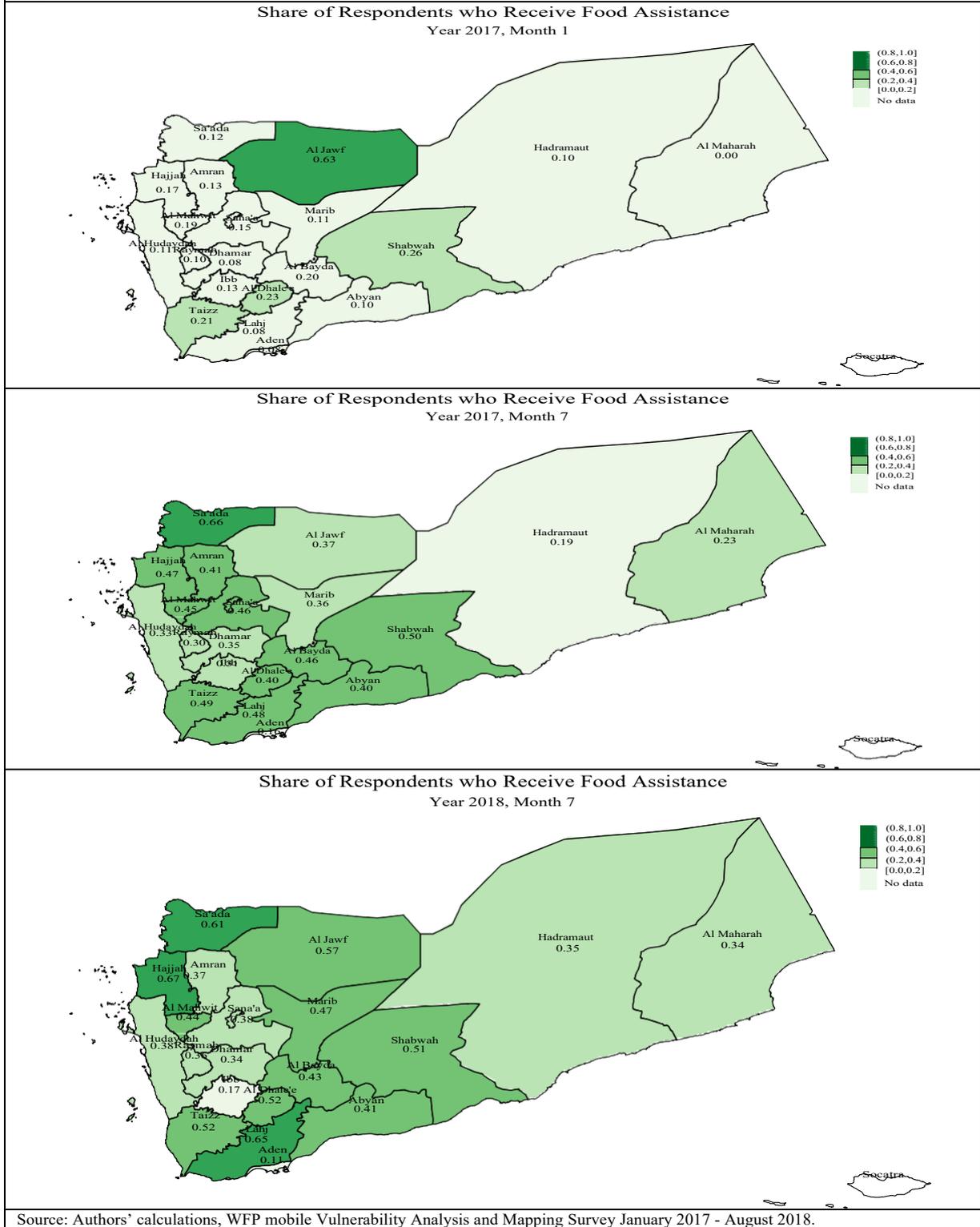
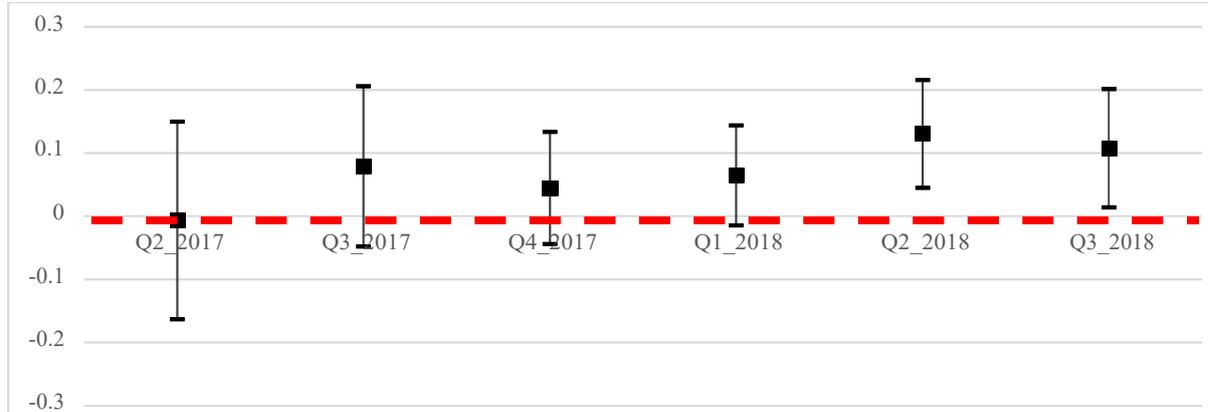
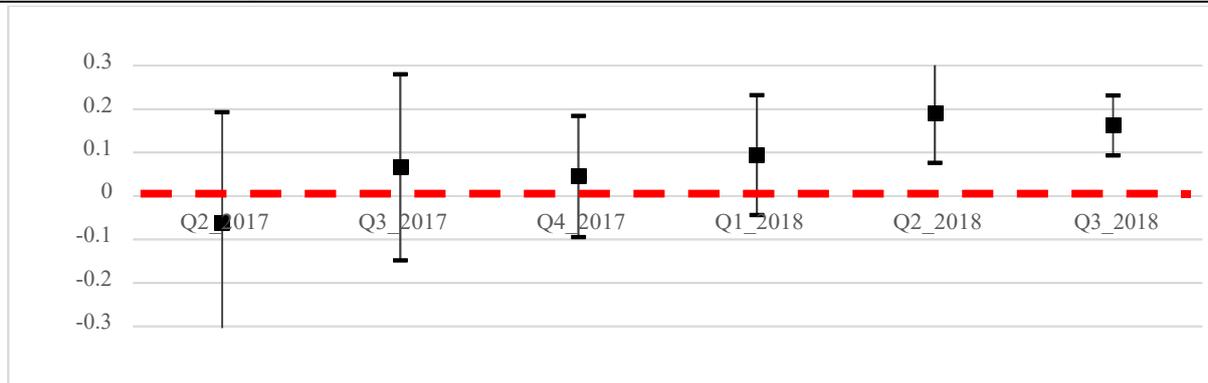


Figure 3. Evolution of Food Assistance Through July 2018

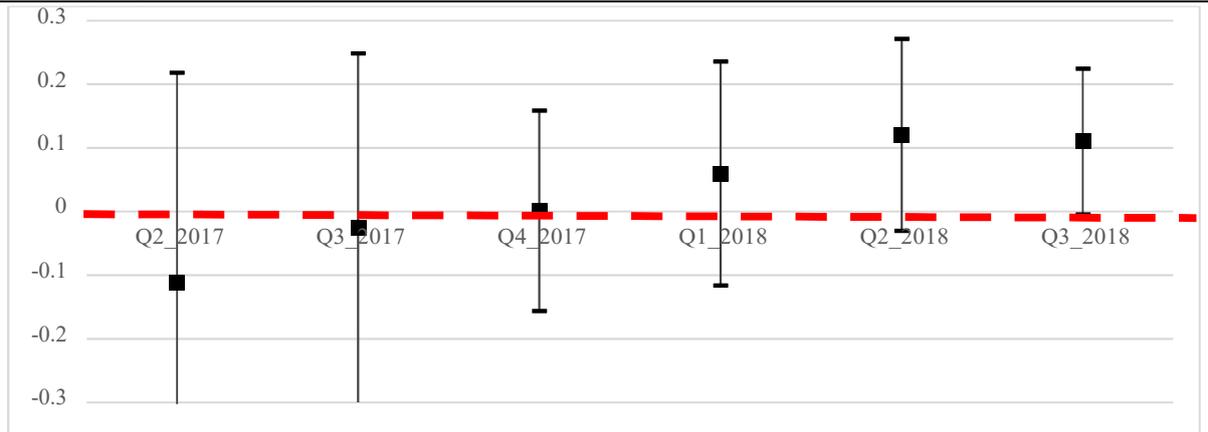
3a. How much more food assistance increased in all “Emergency” regions relative to “Crisis” and “Crisis-Plus” regions



3b. How much more food assistance increased in “Emergency- High Aid” regions relative to “Crisis” and “Crisis-Plus” regions



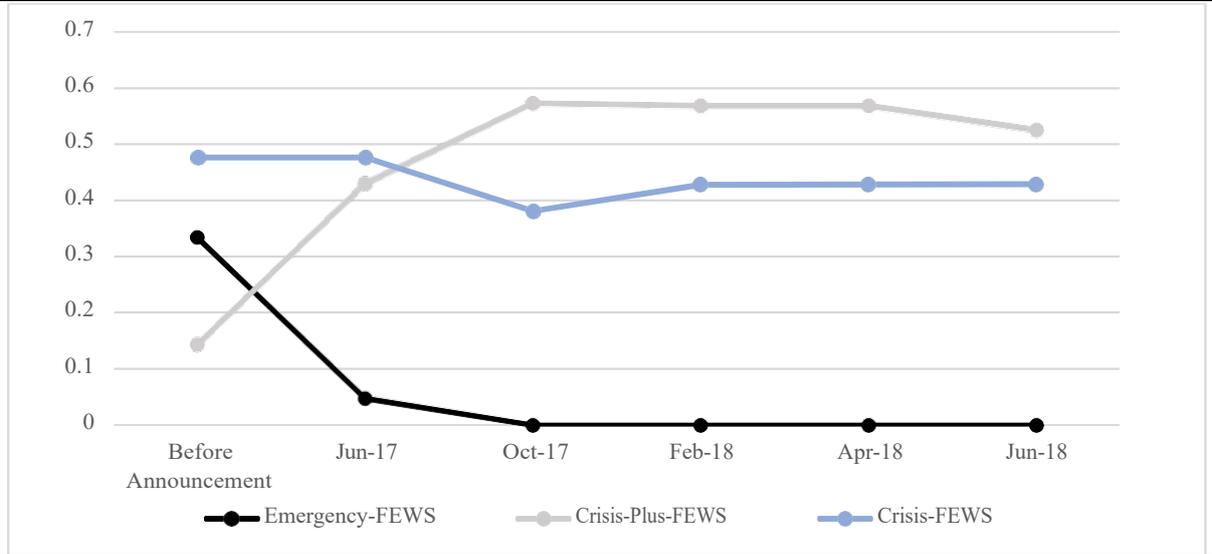
3c. How much more food assistance increased in “Emergency- High Aid” regions relative to “Emergency- Low Aid” regions



Source: Authors’ calculations, WFP mobile Vulnerability Analysis and Mapping Survey January 2017-July 2018.

Note: Figures report regression coefficients and associated 95 percent confidence intervals that report how much more food assistance increased in Emergency regions than in other types of regions. The figures demonstrate that the increase in assistance was much larger in Emergency regions than the rest of the country, and that certain governorates in the Emergency regions had especially large increases in assistance.

Figure 4. Share of Governorates by IPC Classifications

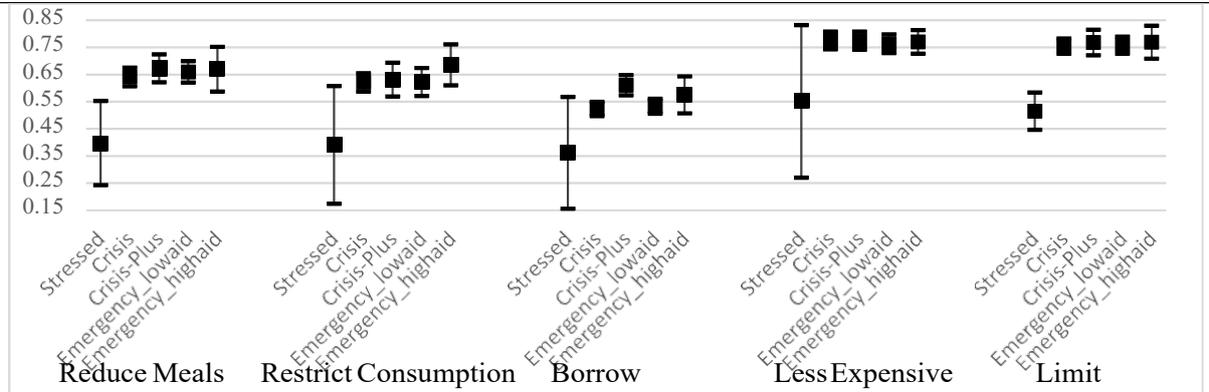


Source: Authors' calculations, FEWS NET Updates to IPC Classifications in Yemen, July 2015-June 2018.

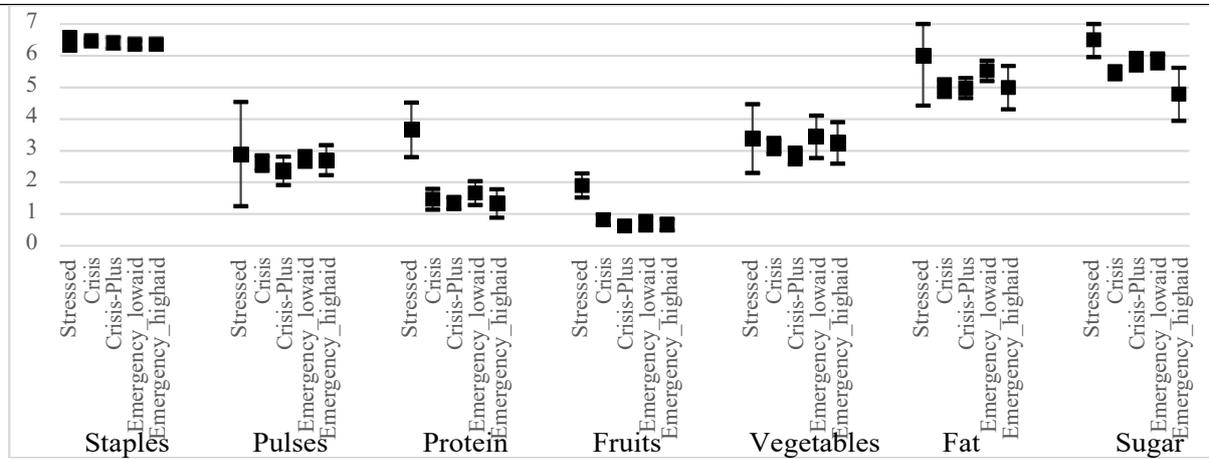
Note: This figure demonstrate that in the FEWS NET updates to the IPC classification that there was much less emphasis on emergency regions, and nearly the entire country was classified as Crisis and Crisis-Plus (would be Emergency if not for humanitarian assistance).

Figure 5. Measures of Access to Food Dividing Up “Emergency Regions,” March – June 2017

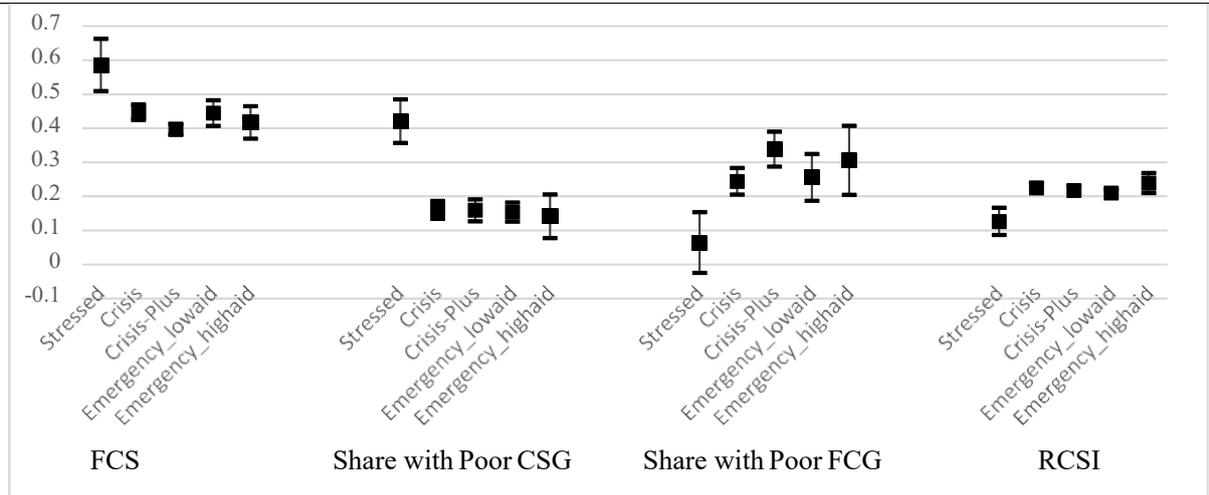
5a. Food Coping Strategies



5b. Number of Days Household Consumed from Each Food Group in Past Week



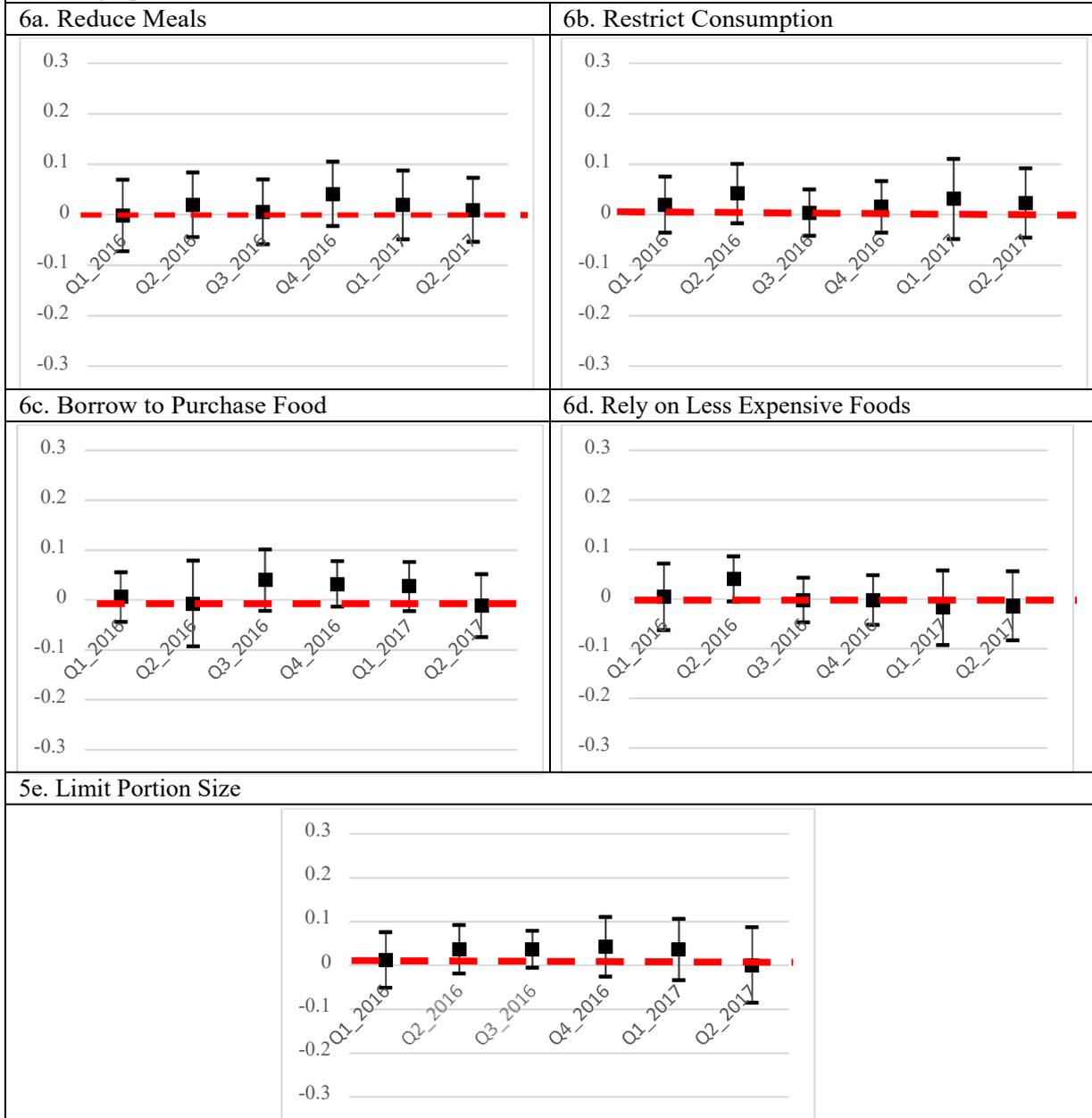
5c. Indices Measuring Access to Food



Source: authors’ calculations, WFP mobile Vulnerability Analysis and Mapping Survey March 2017-June 2017.

Note: this figure presents summary statistics along with 95 percent confidence intervals of all measures of food access captured by the WFP surveys, and breaks up the estimates by the IPC classification.

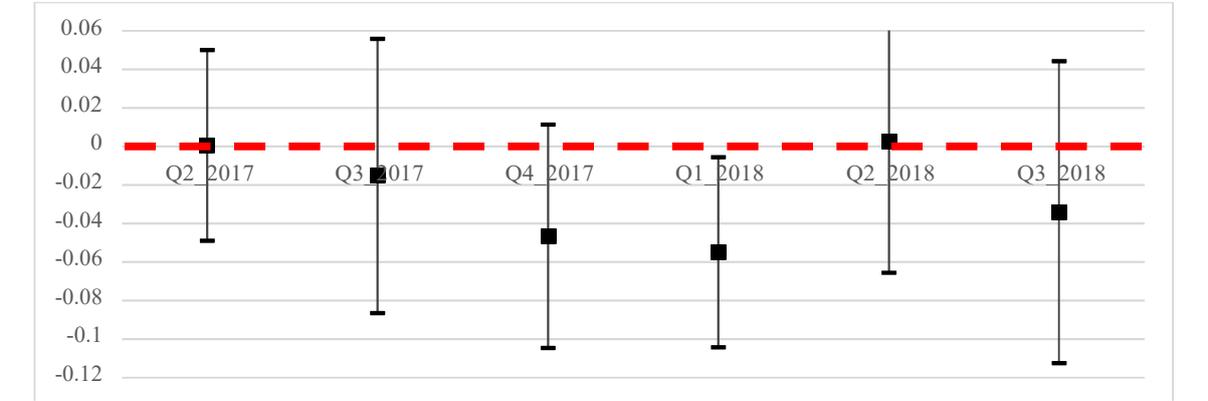
Figure 6. Evolution of Food Coping Strategies in Emergency Regions Relative to the Rest of Yemen Leading up to the Famine Announcement



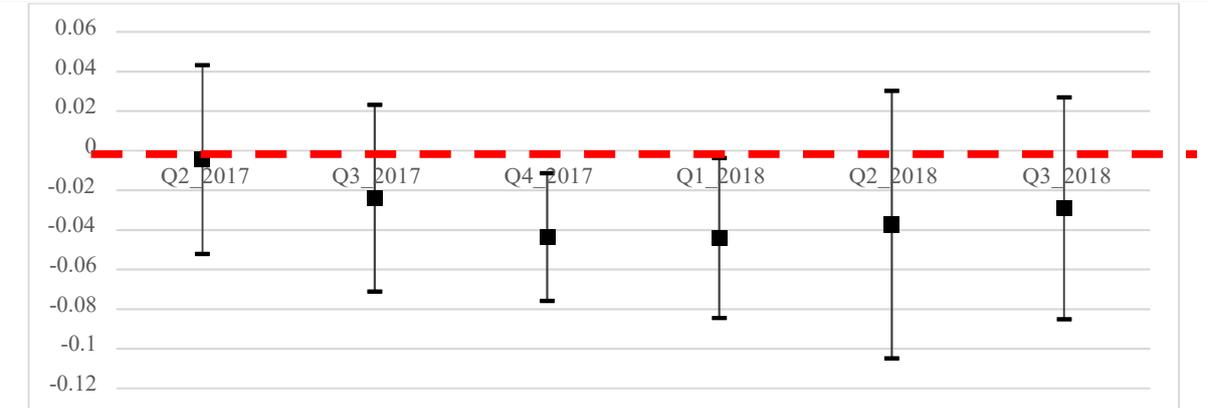
Source: Authors' calculations, WFP mobile Vulnerability Analysis and Mapping Survey September 2015 - June 2017.  
 Note: Figures report regression coefficients and associated 95 percent confidence intervals of coefficients that represent how much larger coping strategies were in Emergency regions relative to the rest of Yemen leading up to the announcement of famine-like conditions. The figures demonstrate that one cannot reject the hypothesis that no food coping strategy was trending differently in Emergency regions leading up to the announcement.

Figure 7. Evolution of Food Coping Strategies Through July 2018

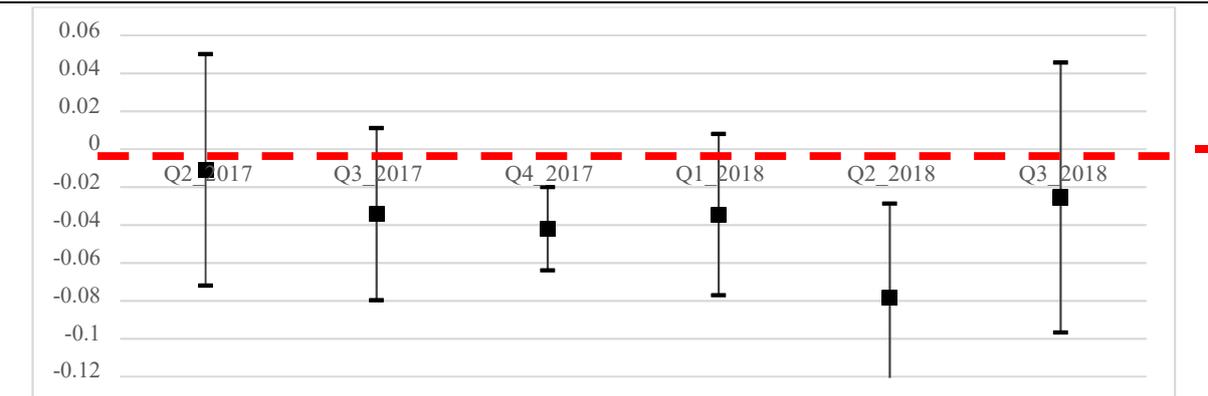
7a. How much more food coping strategies increased in all “Emergency” regions relative to “Crisis” and “Crisis-Plus” regions following the increase in aid



7b. How much more food coping strategies increased in “Emergency-High Aid” regions relative to “Crisis” and “Crisis-Plus” regions following the increase in aid



7c. How much more food coping strategies increased in “Emergency-Low Aid” regions relative to “Crisis” and “Crisis-Plus” regions following the increase in aid

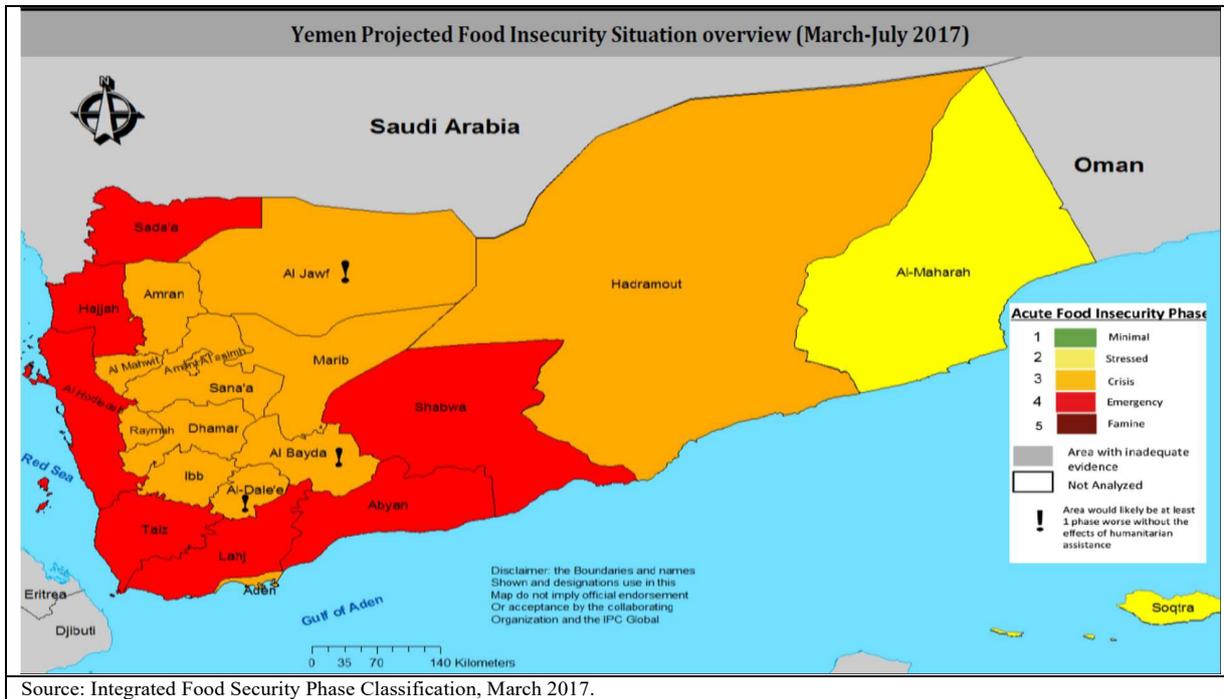


Source: Authors’ calculations, WFP mobile Vulnerability Analysis and Mapping Survey September 2015-July 2018.

Note: Figures report regression coefficients and associated 95 percent confidence intervals of coefficients that represent how much larger coping strategies were in Emergency regions relative to the rest of Yemen following the increase in food assistance. The figures demonstrate that the prevalence of food coping strategies were slightly decreasing in Emergency regions relative to the rest of the country.



Appendix 1. Official Announcement of Famine-Like Conditions in the Republic of Yemen



Appendix 2. Geographic Coverage of the Survey

Governorate	Number of Surveys Targeted
Abyan	87
Aden	65
Al Bayda	114
Al Hudaydah	147
Al Jawf	96
Al Mahrah	44
Al Mahweet	96
Amran	94
Dhale	116
Dhamar	140
Hadramout	70
Hajja	108
Ibb	155
Lahij	142
Mareb	94
Raymah	78
Saada	141
Sanaa	125
Sanaa City	180
Shabwah	125
Taiz	204
Total	2421

Notes: This table presents the number of completed surveys by governorate in the November 2017 survey. The geographic distribution of responses is qualitatively identical in each round of the survey.

### Appendix 3. Variables and Definitions in the WFP Mobile Phone Survey

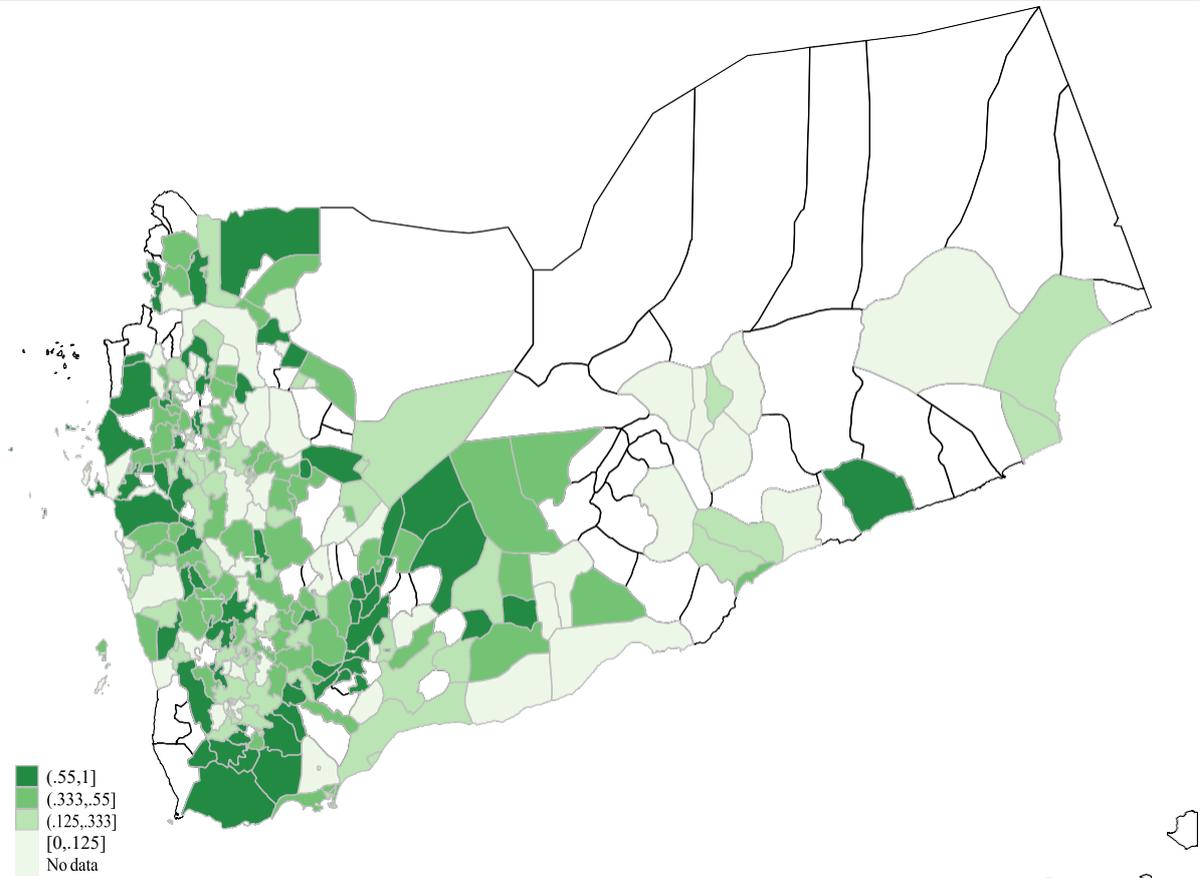
Variable	Definition
BorrowOrHelp	# of days household using this coping strategy per week
Cereals	# of days household eating this food item per week
CSG==1	coping strategy group==poor
CSG==2	coping strategy group==borderline
CSG==3	coping strategy group==acceptable
Dairy	# of days household eating this food item per week
Eggs	# of days household eating this food item per week
FCG	food consumption group
FCS	food consumption score
Fruits	# of days household eating this food item per week
HouseType==Camp	prevalence-->where Household is staying
HouseType==Other	prevalence-->where Household is staying
HouseType==Own_home	prevalence-->where Household is staying
HouseType==Public_building	prevalence-->where Household is staying
HouseType==Rental	prevalence-->where Household is staying
HouseType==Staying_with_someone_for_free	prevalence-->where Household is staying
HouseType==Unfinished_building	prevalence-->where Household is staying
HouseTypeGrp==Camp	prevalence-->where Household is staying
HouseTypeGrp==Guest	prevalence-->where Household is staying
HouseTypeGrp==Other	prevalence-->where Household is staying
HouseTypeGrp==Own_home	prevalence-->where Household is staying
HouseTypeGrp==Rental	prevalence-->where Household is staying
HouseTypeGrp==Unfinished_building	prevalence-->where Household is staying
IDP_YN==Y	prevalence-->household is IDP
LessExpensiveFood	# of days household using this coping strategy per week
LimitPortionSize	# of days household using this coping strategy per week
Meat	# of days household eating this food item per week
Pulses	# of days household eating this food item per week
rCSI	reduced coping strategy
ReduceNumMeals	# of days household using this coping strategy per week
RestrictConsumption	# of days household using this coping strategy per week
Veg	# of days household eating this food item per week

## Appendix 4. Summary Statistics

	Mean	St. Dev.	Mean-2015	St. Dev.	Mean-2016	St. Dev.	Mean-2017	St. Dev.	Mean-2018	St. Dev.
Food Consumption Score	0.477	[0.082]	0.488	[0.069]	0.468	[0.074]	0.451	[0.074]	0.514	[0.091]
Share with Poor Coping Strategy Group	0.221	[0.111]	0.255	[0.097]	0.223	[0.115]	0.206	[0.107]	0.211	[0.11]
Share with Poor Food Consumption Group	0.213	[0.11]	0.226	[0.088]	0.233	[0.097]	0.243	[0.108]	0.136	[0.099]
Reduced Coping Strategy Index	0.196	[0.045]	0.178	[0.037]	0.202	[0.045]	0.2	[0.044]	0.192	[0.045]
Share with Reduced Meals	0.591	[0.112]	0.51	[0.094]	0.581	[0.108]	0.62	[0.103]	0.619	[0.114]
Share with Restricted Consumption	0.573	[0.12]	0.522	[0.11]	0.557	[0.12]	0.59	[0.12]	0.606	[0.112]
Share that Borrowed for Food Purchases	0.523	[0.128]	0.383	[0.078]	0.566	[0.134]	0.516	[0.109]	0.537	[0.114]
Share Relied on Less Expensive Foods	0.658	[0.145]	0.629	[0.102]	0.577	[0.162]	0.723	[0.104]	0.722	[0.11]
Share with Reduced Portion Sizes	0.683	[0.115]	0.644	[0.099]	0.665	[0.12]	0.708	[0.108]	0.707	[0.109]
Days Consumed Protein in the Past Week	1.971	[1.005]	2.351	[0.869]	1.897	[0.869]	1.761	[0.996]	2.146	[1.194]
Days Consumed Pulses in the Past Week	2.811	[0.648]	2.921	[0.662]	2.746	[0.632]	2.684	[0.635]	3.088	[0.632]
Days Consumed Staples in the Past Week	6.188	[0.363]	5.751	[0.41]	6.108	[0.305]	6.241	[0.264]	6.457	[0.287]
Days Consumed Sugar in the Past Week	5.571	[0.674]	5.288	[0.583]	5.612	[0.632]	5.402	[0.672]	5.881	[0.656]
Days Consumed Vegetables in the Past Week	2.94	[0.84]	2.722	[0.725]	3.017	[0.802]	2.777	[0.83]	3.083	[0.883]
Days Consumed Fat in the Past Week	5.627	[0.679]	6.144	[0.377]	5.748	[0.597]	5.204	[0.653]	5.747	[0.624]
Days Consumed Fruit in the Past Week	1.147	[0.662]	1.215	[0.469]	1.145	[0.541]	0.897	[0.47]	1.273	[0.786]
Share Reside in a Camp	0.005	[0.011]	0.014	[0.018]	0.004	[0.01]	0.002	[0.005]	0.003	[0.007]
Share that Own House	0.613	[0.127]	0.655	[0.102]	0.594	[0.147]	0.619	[0.112]	0.614	[0.107]
Share Reside in Public Housing	0.004	[0.009]	0.004	[0.006]	0.003	[0.007]	0.005	[0.01]	0.007	[0.017]
Share that Rent House	0.278	[0.136]	0.247	[0.102]	0.32	[0.148]	0.255	[0.122]	0.214	[0.127]
Share that Host Others	0.053	[0.036]	0.052	[0.033]	0.047	[0.037]	0.059	[0.034]	0.065	[0.033]
Share Receiving Food Aid	0.333	[0.184]	-	-	-	-	0.284	[0.175]	0.403	[0.169]
Share Receiving In-Kind Aid	0.332	[0.142]	-	-	-	-	-	-	0.332	[0.142]
Share Receiving Cash Aid	0.007	[0.012]	-	-	-	-	-	-	0.007	[0.012]
Share Receiving Vouchers for Aid	0.089	[0.055]	-	-	-	-	-	-	0.089	[0.055]
Share Not Receiving WFP Aid	0.027	[0.071]	-	-	-	-	-	-	0.027	[0.071]
Share Receiving WFP Aid	0.371	[0.181]	-	-	-	-	-	-	0.371	[0.181]

This table reports summary statistics of variables collected in the WFP mobile phone survey. Governrate observations are weighted by the pre-conflict population so as to be representative of the population. All variables have 706 observations over the course of the entire survey (21 governorates, most of which were surveyed in each month), aside from the housing variables (601 observations), food assistance (378 observations), and the breakdown of aid into its form and whether it was from the WFP (63 observations). The lower number of observations is due to the variable being added to the survey over the course of the conflict.

Appendix 5. Share of Respondents Receiving Food Assistance by District- November 2017



Source: Authors' calculations, WFP mobile Vulnerability Analysis and Mapping Survey November 2017.

Appendix 6. Comparison of Mobile Phone Ownership in November 2017 WFP Survey to 2014 Household Budget Survey

Region	2014 Household Budget Survey			November 2017 WFP Survey			CI Overlap
	Lower Bound- 95%CI	Upper Bound- 95%CI	Mean	Lower Bound- 95% CI	Upper Bound- 95% CI	Mean	
National	2.17	2.72	2.45	2.08	2.44	2.26	Y
Abyan	1.43	2.02	1.72	2.03	2.73	2.38	N
Aden	2.58	3.03	2.81	2.14	2.91	2.52	Y
Al_Bayda	2.40	2.95	2.67	1.70	2.22	1.96	N
Al_Hudayda	1.73	2.15	1.94	1.60	2.10	1.85	Y
Al_Jawf	2.00	3.13	2.56	2.21	3.00	2.60	Y
Al_Mahrah	2.44	3.72	3.08	2.38	3.98	3.18	Y
Al_Mahweet	1.66	2.38	2.02	1.67	2.38	2.02	Y
Amran	1.86	2.43	2.15	1.77	2.45	2.11	Y
Dhale	1.83	2.67	2.25	1.99	2.48	2.23	Y
Dhamar	1.76	2.51	2.14	1.68	2.14	1.91	Y
Hadramout	2.98	3.85	3.41	2.38	3.16	2.77	Y
Hajja	1.65	2.18	1.91	1.58	2.05	1.81	Y
Ibb	1.91	2.48	2.20	1.99	2.53	2.26	Y
Lahij	1.56	2.03	1.80	1.72	2.15	1.94	Y
Mareb	2.78	3.60	3.19	2.27	3.30	2.79	Y
Raymah	1.74	3.04	2.39	1.53	1.95	1.74	Y
Saada	0.96	2.47	1.72	2.23	2.90	2.57	Y
Sanaa	1.86	3.23	2.54	1.70	2.20	1.95	Y
Sanaa_City	3.33	3.89	3.61	2.45	3.26	2.86	N
Shabwah	2.82	3.69	3.25	2.34	3.10	2.72	Y
Taiz	2.32	2.78	2.55	1.85	2.24	2.04	N

Notes: This table compares mobile phone ownership in the November 2017 WFP mobile phone survey and the 2014 Household Budget Survey (HBS), where the 2014 HBS summary statistics are restricted to the share of the population that resides in a household that owns at least one mobile phone. The 2014 HBS is the last known population estimates of these variables for Yemen.

Appendix 7. Comparison of the November 2017 WFP Survey to the 2014 Household Budget Survey

Variable	2014 Household Budget Survey			November 2017 WFP Survey		
	Lower Bound- 95%CI	Upper Bound- 95%CI	Mean	Lower Bound- 95% CI	Upper Bound- 95% CI	Mean
Own House	0.776	0.880	0.828	0.459	0.570	0.515
Rent House	0.070	0.165	0.118	0.224	0.373	0.299
HH Size	6.73	7.51	7.12	9.50	10.53	10.02
Share relying on Food Coping	0.040	0.123	0.082	0.851	0.901	0.876
Number of Days Eating Staples Last Week	6.99	7.00	7.00	5.92	6.11	6.01
Number of Days Eating Pulses Last Week	3.38	4.21	3.80	2.74	3.32	3.03
Number of Days Eating Vegetables Last Week	3.91	5.03	4.47	2.11	2.67	2.39
Number of Days Eating Fruits Last Week	1.20	1.71	1.45	0.74	1.08	0.91
Number of Days Eating Proteins Last Week	4.24	5.24	4.74	1.26	1.99	1.63
Number of Days Eating Dairy Last Week	4.00	5.04	4.52	1.99	2.53	2.26
Number of Days Eating Fats Last Week	6.76	6.97	6.87	5.05	5.46	5.25
Number of Days Eating Sugars Last Week	6.64	7.00	6.82	5.25	5.69	5.47
Share Living with Improved Water	0.347	0.561	0.454	0.177	0.332	0.254
Share with Access to Electricity Network	0.674	0.877	0.776	0.000	0.010	0.005
Share Relying on Solar Energy	0.000	0.044	0.022	0.444	0.657	0.550
Share Relying on Generator Energy	0.005	0.050	0.027	0.120	0.349	0.235

Notes: This table compares variables common to both the November 2017 WFP mobile phone survey and the 2014 Household Budget Survey (HBS), where the 2014 HBS summary statistics are restricted to the share of the population that resides in a household that owns at least one mobile phone. The 2014 HBS is the last known population estimates of these variables for Yemen. Consistent with reports of humanitarian and news agencies on the ground in Yemen, the WFP estimates report significantly worse welfare statistics and access to basic services relative to the 2014 HBS before the conflict.



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