

# Evolution of Poor Food Access over the Course of the Conflict in the Republic of Yemen

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## Abstract

The Republic of Yemen has undergone a profound transformation following the escalation of conflict in March 2015. There has been an increase in violence, a disruption in supply chains due to a tightening of the ports, and a decline in the general economic climate that has left a large share of the population without the income to support their basic needs. These transformations have resulted in widespread food insecurity, where nearly half the population is under the threat of a potential famine. Although the violence has undeniably had a significant impact on the population and

local outcomes, the temporal and regional distribution of poor food access suggest that food insecurity of the mobile phone–using population has been primarily driven by factors aside from the localized effects of violence alone. The lack of a strong relationship between violence and poor welfare outcomes contrasts with evidence from other conflict settings, and further contrasts with the rationale underpinning much of the humanitarian and development assistance currently being delivered in the country.

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# Evolution of Poor Food Access over the Course of the Conflict in the Republic of Yemen<sup>1</sup>

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## Introduction

The conflict in the Republic of Yemen escalated in March of 2015 and has been continuing unabated for over three years. Although the actual implications of conflict significantly vary from context to context, the conflict in Yemen is composed of a number of different conflict-related shocks. Specifically, there has been an escalation in violence (e.g., Sundberg and Melander 2013), a tightening of the ports and a disruption of vital supply chains,<sup>4</sup> and a general worsening of the economic climate.<sup>5</sup>

These major shocks have all contributed to a humanitarian catastrophe. Estimates suggest that approximately 22 million Yemenis (over three-quarters of the total population) are in need of humanitarian assistance, of which over 11 million are in acute need of assistance to sustain their lives (OCHA 2018). One of the most pressing concerns is food security, which was an important issue even prior to the conflict due to the spike in international food prices in 2011 and the uncertainty in the country following the political transition in 2012 (e.g., WFP 2012; World Bank 2017). However, the addition of the conflict-related shocks has substantially caused income to decline and worsened food security, where nearly the entire population is under the threat of famine or would be threatened by famine in the absence of humanitarian aid (e.g., FEWS NET 2018).

Despite the identification of all three types of shocks- violence, disrupted supply chains, and a poor economic climate- as being important determinants of income declines and food insecurity, there is little concrete understanding of how each of these factors individually is contributing to the evolution of food security over time. This paper assesses the degree to which the worsening food security situation is related to the localized effects of violence, as opposed to other factors. Better understanding these correlations can help to better identify populations that could most be helped by food assistance and can better identify policies that have the potential to most improve food security.

Using a monthly mobile phone survey conducted by the World Food Programme (WFP) in Yemen since September of 2015, this paper demonstrates that the evolution of poor food access- as measured through standard food coping strategies- does not match the evolution of violence after the conflict began.<sup>6</sup> In the most complete empirical specification, one can reject the hypothesis that the effect of doubling the monthly fatalities in a governorate on average having a larger than 0.008 increase in the share of people reporting to have poor food access in the following month at standard significance levels.<sup>7</sup> This lack of a statistically significant or meaningful relationship survives numerous robustness checks, including incorporating the effects of lagged violence, separating the violence by either type of violence or by actors involved, separating the effect of violence separately for different years or for different locations in the country, accounting for food assistance being distributed in the country, and accounting for the possibility of internal displacement obscuring the true relationship.

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<sup>4</sup> For example, see (accessed September 2018): <https://reliefweb.int/report/yemen/escalating-humanitarian-crisis>.

<sup>5</sup> For example, see (accessed September 2018): <https://reliefweb.int/report/yemen/yemen-rapid-assessment-report-december-2016-measuring-impact-public-sector-wage>.

<sup>6</sup> Prior to the conflict, 85 percent of the population resided in a household that owned a mobile phone and would be able to be reached by the household-level survey conducted by the WFP. Furthermore, the Data section will discuss a wide range of evidence that suggests mobile phone access of households has remained high even among the population most affected by violence.

<sup>7</sup> The average number of monthly fatalities in a governorate over the time period under analysis is approximately 70.

Alternatively, the empirical specifications demonstrate that food access was significantly worse in the northern parts of the country that are largely controlled by Houthi forces. The fact that food access tended to be worse in the north could be indicative of both the tightening of the ports and the lack of government salaries adversely affecting food security. The ports that supply the north have been subjected to more pressure than ports in regions controlled by the internationally-recognized government, and reports suggest that government salaries have been paid less often in those same regions (e.g., WFP 2017). However, the worse food security outcomes could also be due to other conflict-related factors, such as poor governance and oversight given the lack of control by the internationally-recognized government.<sup>8</sup>

However, there is further evidence that the tightening of the ports in particular had a large and immediate impact on the population. During November 2017, there was an unexpected air and sea blockade of the entire country, which dramatically worsened the disruption to the supply chains. One of the monthly WFP mobile phone surveys was being fielded as this blockade was implemented, and one can observe an immediate and significant decline in food access overnight. Given the speed with which households were affected, these results suggest that food supplies in the country are very tight and have been substantially stressed by the difficulty in importing goods over the course of the conflict.

There are two primary contributions of these results. First, the finding that violence is less correlated with levels of welfare than other conflict-related shocks contrasts with findings in other settings where aggregate economic outcomes, firm outcomes, and individual employment outcomes are adversely affected by violence (e.g., Abadie and Gardeazaba 2003; Singh and Pedersen 2003; Guidolin and La Ferrara 2007; Collier and Duponchel 2013; Klapper et al. 2013; Ksoll et al. 2015; Amodio and Di Maio 2018; Tandon forthcoming; etc.).<sup>9</sup> Thus, these previous results might not generalize to this unique setting among the mobile phone-using population.

Second, these results have important implications for the targeting of food assistance across Yemen. The most recent official IPC classification of food emergencies in Yemen, which is the basis for much of the food aid distributed in the country, has identified more violent regions as being closer to famine. The announcement explained the classification stating that “armed conflict remains the main driver of food security (IPC 2018).” The previous official IPC classification in 2017 also explicitly included indicators that correlated with violence, which resulted in governorates being more affected by violence receiving much more food assistance than the rest of the country (e.g., Tandon and Vishwanath 2019). However, the results here contrast with this narrative, and suggest that reducing the emphasis on violence in the identification of regions with poor food security could lead to better targeting of assistance.

### **Background: The Current Conflict in Yemen and Available Data**

The conflict in Yemen has been ongoing since the mid-2000s. The Houthis' movement began as a theological movement that protested the national government. However, following this protest, the government used the military to try to arrest their leader, which led to a number of wars during which the group made few gains, and was repeatedly beaten back by the military.<sup>10</sup>

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<sup>8</sup> This pattern was not present just prior to the conflict in the 2014 Household Budget Survey (World Bank 2017).

<sup>9</sup> See also Blattman and Miguel (2010) for a thorough review of the literature.

<sup>10</sup> See (accessed July 2017): <http://www.aljazeera.com/news/middleeast/2014/08/yemen-houthis-hadi-protests-201482132719818986.html>.

However, following the Arab Spring in 2011, the government led by Ali Abdullah Saleh was forced to hand over power to his vice president and a transitional unity government. Using this political vacuum and the unpopularity of the transition government, the Houthis began making military gains against the internationally-recognized government after its formation in 2012 in the hopes of having more representation in the transitional government. These military gains eventually led to the quick capture of the capital Sana`a in September 2014, and then eventually an attempt to capture the southern part of the country.<sup>11</sup>

Beginning in March 2015, following the attempted capture of the southern part of the country, a coalition of nine Gulf and North African countries started to target Houthi positions with air strikes in an attempt to stop the Houthi aggression and support the internationally recognized government. It is important to note that the current conflict is actually composed of a number of different conflict-related shocks. First, there has been a significant amount of violence, that is steadily increasing in intensity. The violence has resulted in a loss of human and physical capital, and in other contexts, has led to a nearly universal drop in aggregate, firm-level, and individual economic outcomes where the conflict intensity has been the worst (e.g., Abadie and Gardeazaba 2003; Singh and Pedersen 2003; Guidolin and La Ferrara 2007; Collier and Duponchel 2013; Klapper et al. 2013; Ksoll et al. 2015; Amodio and Di Maio 2018; Tandon 2019; etc.).

Second, there has been a significant tightening of the ports due to the presence of coalition navy forces restricting imports in ports that supply regions in the north where Houthi forces have a strong presence. Importantly, this restricts the imports of food to a country that imported approximately 90 percent of its food prior to the conflict (e.g., WFP 2012), and it restricts the ability of health providers to acquire vital equipment and medicines that are badly needed in a setting where communicable diseases have been raging out of control (e.g., OCHA 2018). Although it is difficult to precisely gauge the intensity of this disruption to supply chains, reports have suggested that immediately following the escalation of the conflict, imports in Al Hudaydah- the port that supplies nearly the entirety of the north- immediately reduced to 40 percent of pre-conflict levels (e.g., WFP 2017).

Third, the government began paying public salaries infrequently, if at all, beginning in November 2016. Nearly 30 percent of households relied at least in part on government salaries, and in the capital, this figure was nearly one of every two households (e.g., World Bank 2017). Thus, many households lost income that was helping to support them at precisely the time supply chains were disrupted and prices of basic commodities and food items began to rise (e.g., WFP 2017). In addition to the decline in incomes, anecdotal evidence suggests that the lack of payment of employees has led to an exodus of public sector employees.<sup>12</sup> This in turn has significantly reduced the amount of public services provided to the Yemeni people and likely has hampered institutional capacity.

Each of these conflict-related shocks has likely contributed to the dramatic worsening of humanitarian conditions in the country. However, little thorough analysis has investigated the relative role played by each of these major factors. This paper investigates the relationship between temporal and geographic variation in food security and variation in each of the potential drivers described above. Conflict data were obtained from the Armed Conflict Location & Event Data Project (ACLED), which provides information on the date, location, event type, actors involved, and the number of people killed in each

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<sup>11</sup> See (accessed July 2017): <http://www.bbc.com/news/world-middle-east-29319423>.

<sup>12</sup> For example, the Central Statistical Organization has stated in informal discussions that much of their staff has departed following the inability to pay their salaries regularly.

recorded instance of conflict; and information on port blockages and non-payment of government salaries was obtained from reports of humanitarian and news agencies on the ground in Yemen.

The food security data were obtained from a mobile phone survey of approximately 2,400 households conducted each month by the WFP. The survey, conducted via random digit dialing, continues to survey households in a governorate until a sufficient number of respondents complete the survey, where the governorate targets are based on the governorate's share of the total population. The survey is representative of the mobile phone-using population and provides governorate-level estimates of five commonly-collected food coping strategies used by households with poor access to food- restricting consumption, reducing the number of meals, relying on less expensive foods, borrowing to purchase food, and limiting portion sizes. Thus, the data allow for a regionally-disaggregated analysis of food access each month over nearly the entire course of the conflict.

However, there are two issues to note with these data. First, the survey can only be representative of the mobile phone-using population following the beginning of the conflict. However, mobile phone ownership was very high prior to the conflict (even among relatively disadvantaged groups),<sup>13</sup> anecdotal evidence suggests that even struggling households have found innovative ways to maintain mobile phone access despite the lack of access to network electricity and the dramatic decline in overall welfare,<sup>14,15</sup> and a comparison of the number of mobile phones owned in the WFP surveys and the population-level estimates before the conflict are actually very similar (Tandon and Vishwanath 2019).

Second, there could be sample selection (i.e., non-random non-response) of who responds to the survey methodology and the averages analyzed here can only speak to the actual sample as opposed to populations in which we might have more interest.<sup>16</sup> Although this is a difficult issue to directly address, there is evidence that the WFP surveys detected many of the significant changes in welfare relative to the pre-conflict population estimates that large segments of the population have been reported to have experienced during the conflict, and the survey is able to roughly identify the areas that are receiving the largest amount of food assistance as identified by 2018 population-level estimates by the UN and the humanitarian community (IPC 2018; Tandon and Vishwanath 2019). Thus, there is some corroboration

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<sup>13</sup> Approximately 85 percent of the population resided in a household that owned a mobile phone and would be represented in the household-level survey conducted by the WFP. In no governorate was this share lower than 60 percent, and the share was 77 and 81 percent respectively for poor households and rural households.

<sup>14</sup> The survey reaches a large share of struggling households, where approximately one-third of the respondents report being internally displaced and upwards of 40 percent of the population reports receiving food assistance. Additionally, surveys of food aid recipients performed by the WFP and the registration procedure for the World Bank's cash transfers program being implemented by UNICEF (which covers nearly one-quarter of the entire population and is aimed at relatively poorer households) both find that very large shares of beneficiaries have access to mobile phones. For example, see (accessed January 2019): <http://documents.wfp.org/stellent/groups/internal/documents/projects/wfp278006.pdf> and <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>).

<sup>15</sup> Authors' calculations from the unit-level WFP mobile phone survey conducted in November 2017 demonstrate that the vast majority of the population relies on either solar power or generators for their primary energy source.

<sup>16</sup> Approximately 8 percent of phone numbers do not respond to two straight surveys, which results in their removal from the sample. However, 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.

that the data are able to accurately characterize the large welfare changes and a significant share of the population.

### **Correlation between Poor Food Access and Localized Violence**

Using this approach, we find little correlation between poor food access and either the incidence or severity of violence. First, figure 1 compares the aggregate trends in food access and violence over the course of the conflict. There is little alignment between food access and either the number of violent incidents or the severity of those incidents measured in fatalities.

Over the course of the conflict, the number of violent incidents has remained relatively constant between 2016 and 2018, but the severity of those incidents has more than doubled from the approximately 2,500 fatalities per quarter towards the beginning of the conflict to the 5,000-7,500 fatalities per quarter in 2018. Furthermore, there is little volatility in the number of incidents over the course of the conflict, but there is a great degree of variability in the severity of violence, where there were surges in severity in the second half of 2016 and the first half of 2018.

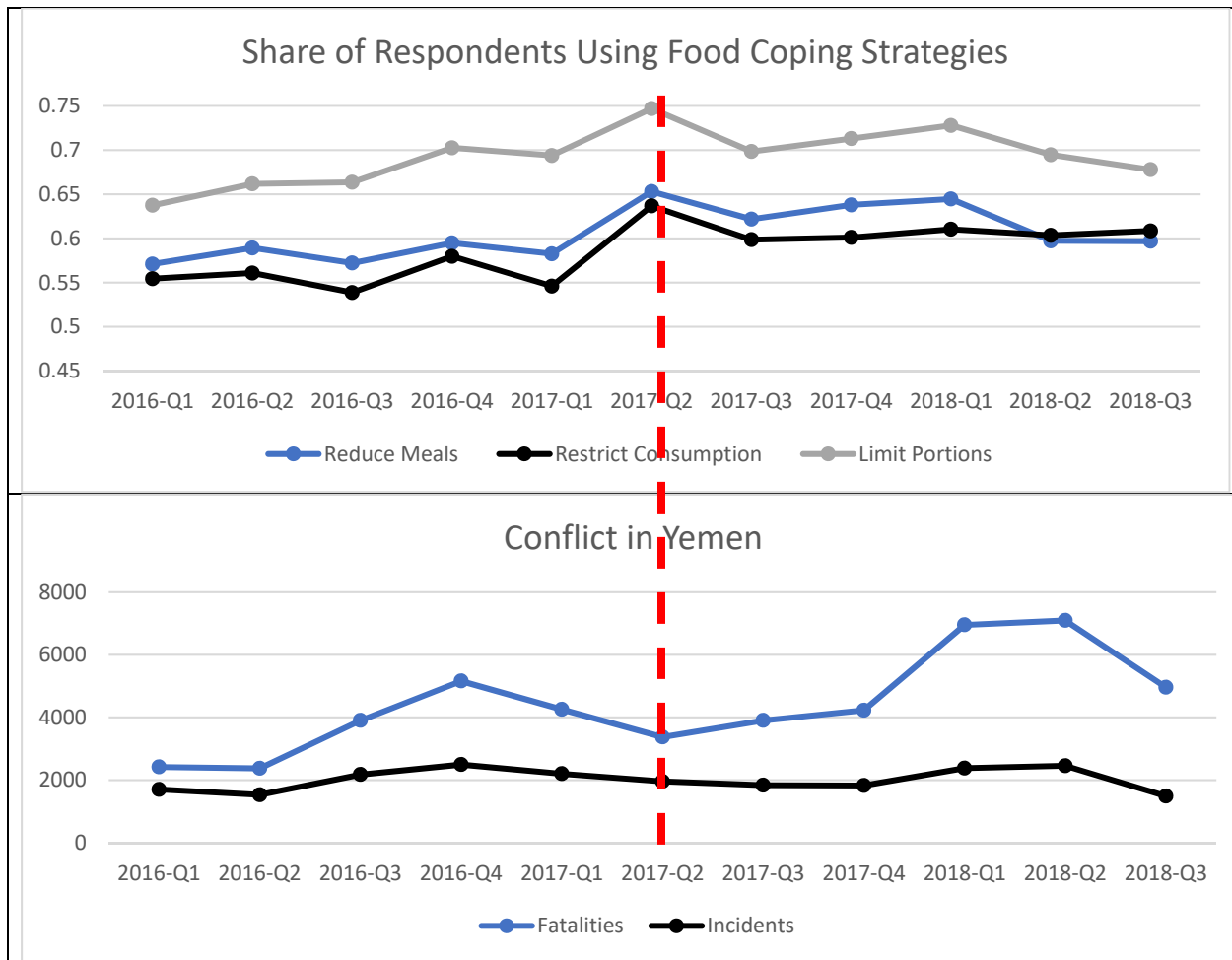
However, the evolution of both of these measures of violence is at odds with the evolution of food access over the course of the conflict. Food access is progressively getting worse over time, which is different from the little change in the number of violent incidents over time, and also different from the more than doubling of the severity of violence. Furthermore, there is significant variability in food access over time—with a spike in the second quarter of 2017. However, this spike does not correspond to any spike in the number of incidents, and further does not correspond to the time periods in which the severity of violence is spiking (second half of 2016 and first half of 2018).

In addition to a lack of alignment in the national trends, the current regional distribution of violence and food access do not align. Figure 2 demonstrates that the most violence occurs in governorates on the front lines—governorates that border regions fully controlled by the internationally-recognized government or the boundaries of the country. Alternatively, regions in both the north and the south of the country that are not on the front lines tend to have less violence. This is true in both the number of incidents and the severity of those incidents measured in fatalities.

However, figure 2 demonstrates that the regional distribution of food access does not follow this pattern. First, the governorates in the north that do not border the front lines tend to have just as poor food access as governorates on the front lines that have a much higher incidence of violence. Second, the governorates in the south that are exposed to significantly less violence have food access that is quite poor. And lastly, there was little change in access to food in Al Hudaydah following the surge in violence during the third quarter of 2018.



**Figure 1. Trends in Food Access and Violence**

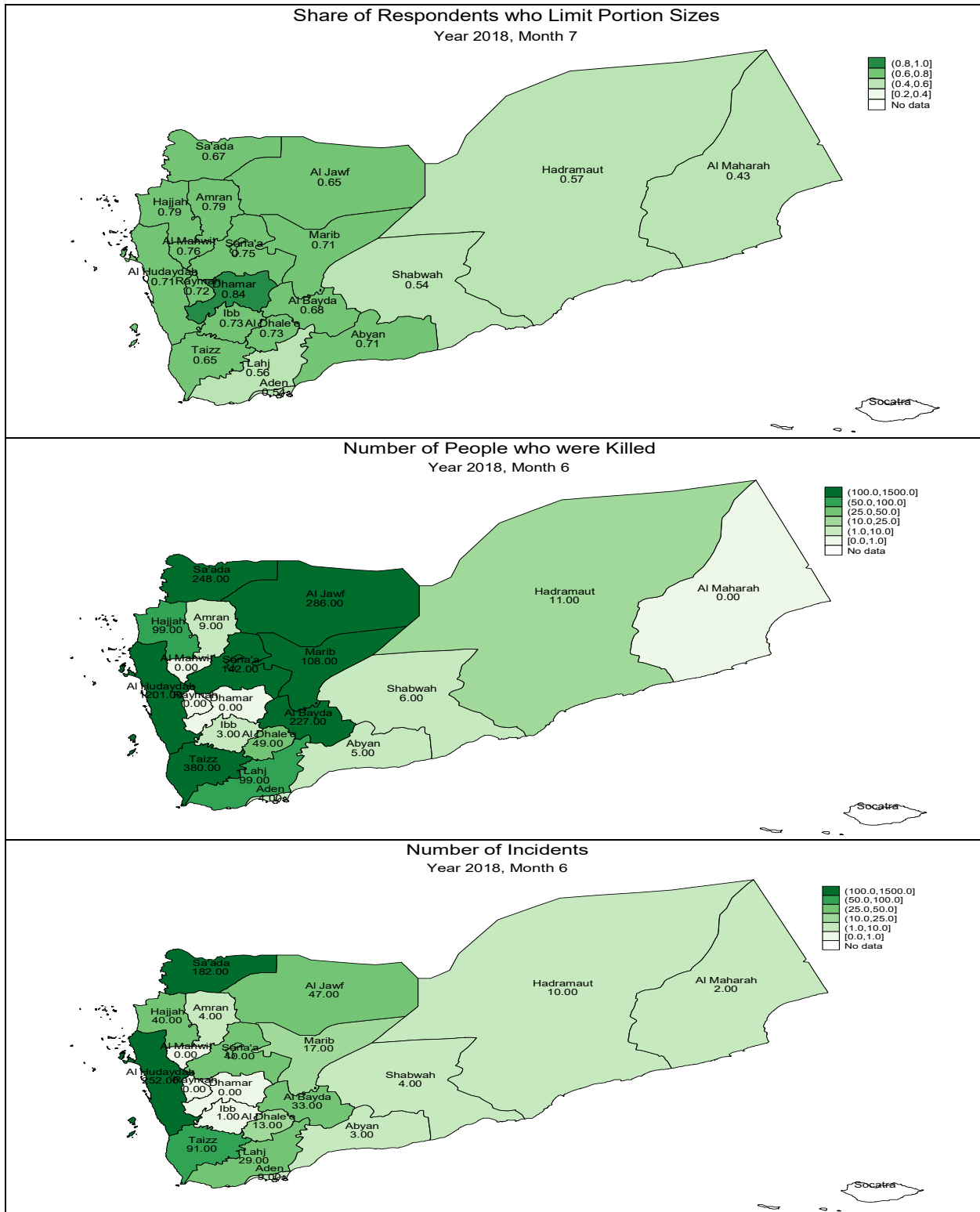


Sources: WFP mobile phone survey; ACLED conflict data base.

In addition to the lack of alignment between the geographic distribution of violence and food access in the June 2018, this lack of alignment persists throughout the entire conflict. Figure 3 presents the geographic distribution of violence over time. One can see that the regions experiencing the most violence has evolved over time. Initially, regions along the front lines in the eastern and southern parts of the country experienced the most violence. However, this evolved over time, where governorates on the front lines in the west and the north began experiencing more severe conflict.

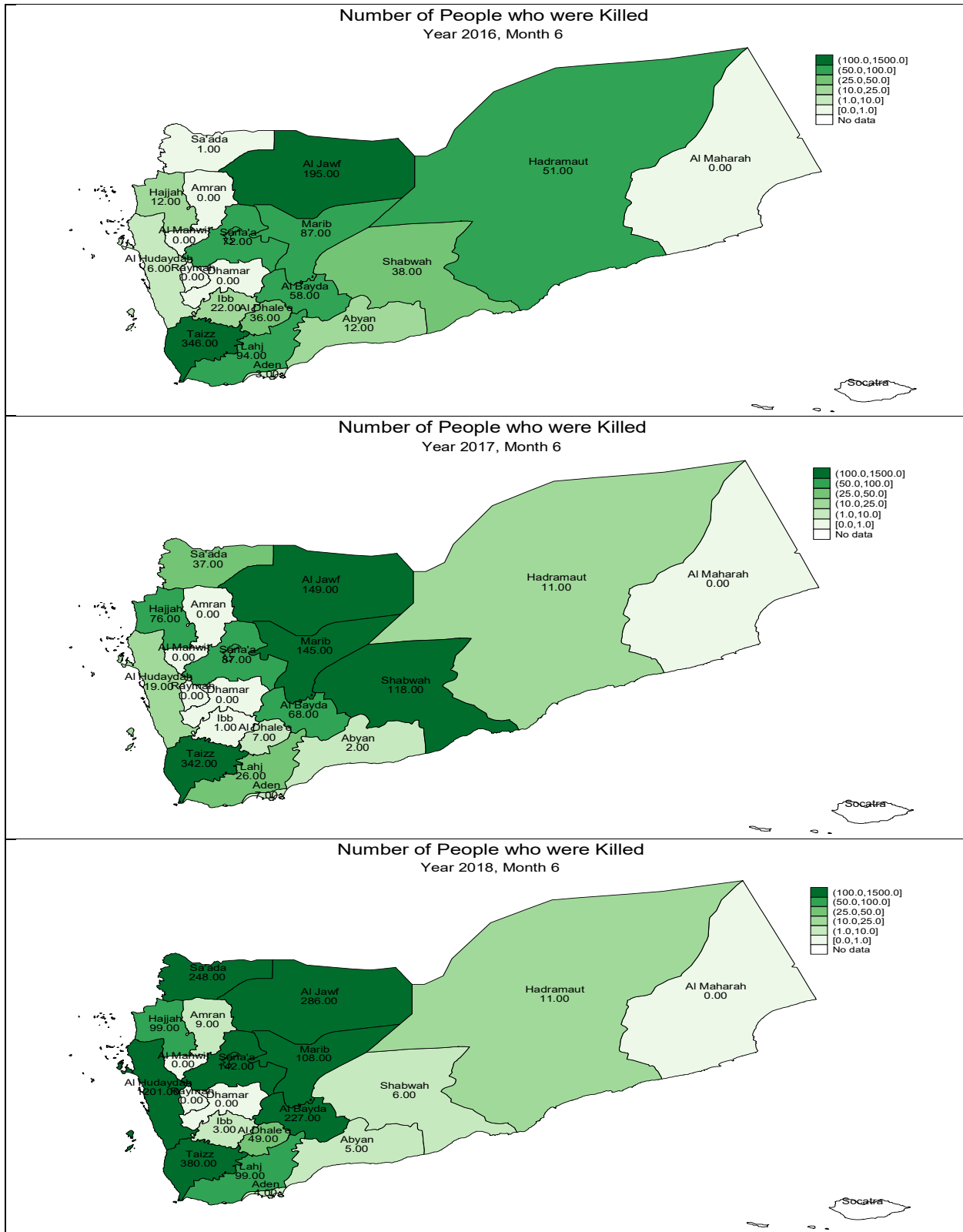
However, figure 4 presents the geographic distribution of food access over time. The regional distribution of food access has been relatively fixed- the regions that had poorer food access in 2016 still had poorer food access in 2018. Furthermore, the regions with the poorest access to food were not necessarily those that experienced the most violence. Specifically, regions in the north that were worse affected by the port blockages tended to have the worst access to food, regardless of whether the regions were on the front lines and experienced violence or not.

Figure 2. Geographic Distribution of Food Access and Violence



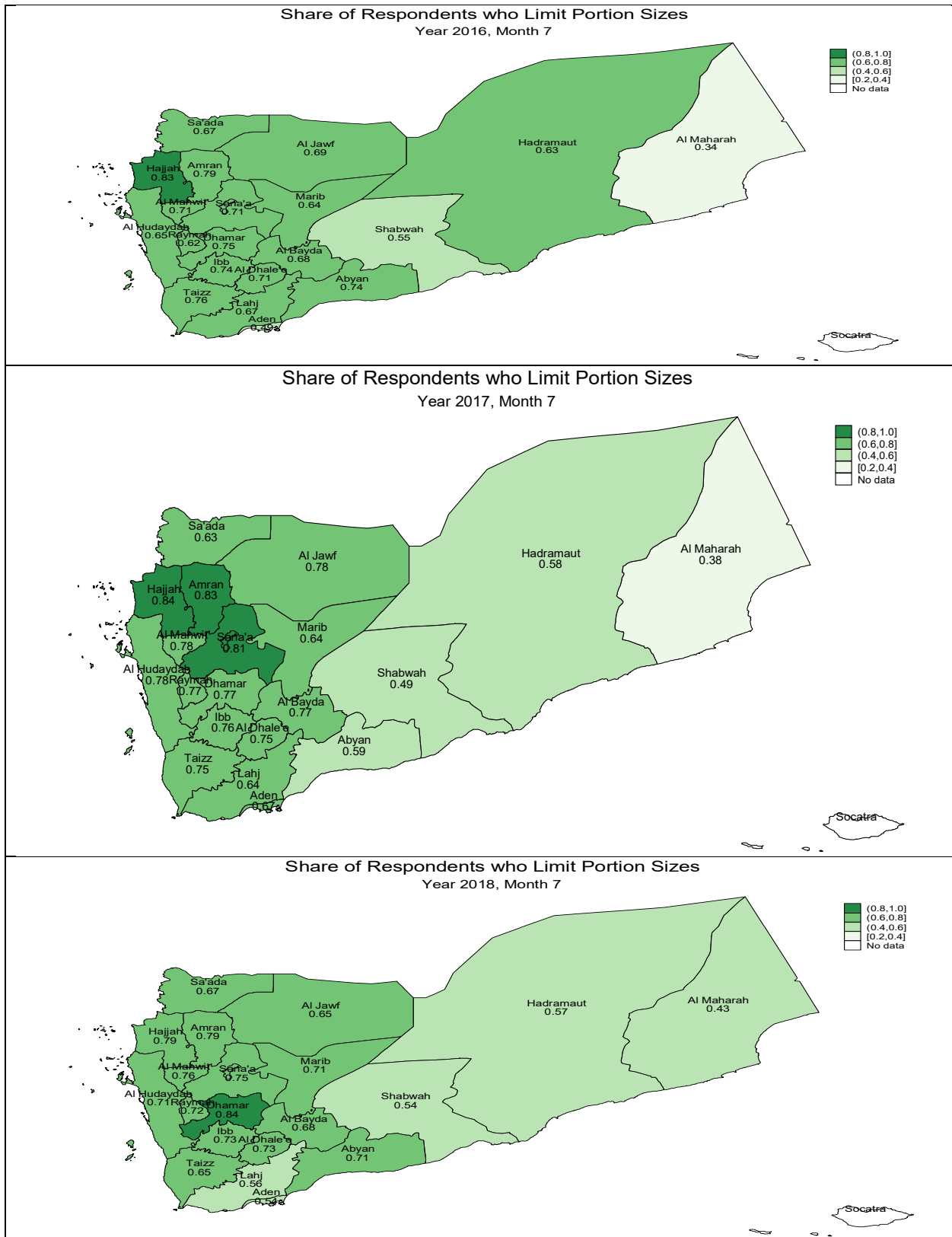
Sources: WFP mobile phone survey; ACLED conflict data base.

Figure 3. Regional Distribution of Violence over Time



Source: ACLED Conflict Database.

**Figure 4. Geographic Distribution of Food Access over Time**



Source: WFP Mobile Phone Survey.

Combining the temporal and geographic discrepancies noted in figures 1-4, we estimate the correlation between the share of respondents in a governorate reporting to rely on a food coping strategy and measures of violence in the month before the survey. Specifically, estimates of the following specification are presented:

$$\text{Share\_Coping}_{gt} = \gamma_g + \phi_t + \beta \ln(\text{Violence}_{g,t-1}) + \varepsilon_{gt}$$

where  $g$  denotes governorate and  $t$  denotes the month-year time period; *Share\_Coping* denotes the share of the respondents that report relying on the food coping strategy being analyzed, where specifications are estimated using each of the five coping strategies collected by the WFP survey; *Violence* denotes the measure of violence being analyzed, where there are different specifications for the number of incidents and the number of fatalities;  $\gamma$  denotes a governorate fixed effect that captures all time-invariant factors that affect coping strategies in governorate  $g$ ; and  $\phi$  denotes time-specific factors that affect all governorates at the same time period (such as a sudden tightening of the ports).

The coefficient of interest is  $\beta$ , which denotes the correlation between violence in the month before the WFP survey and the share of respondents in a governorate who report relying on the food coping strategy for at least one day in the previous week, once controlling for governorate and time-specific factors. If coping strategies were higher (corresponding to worse food access) in regions where there was more violence in the month before the survey, one would expect  $\beta$  to be greater than zero. The actual coefficient can be interpreted as the change in the share of the mobile phone-using population relying on food coping strategies in response to a doubling of the violence, which represents an increase of 70 fatalities in a governorate in a month.<sup>17</sup>

Table 1 reports estimates from the empirical specification. Columns (1)-(4) report specifications using the number of people killed as the measure of violence; and columns (5)-(8) report specifications using the number of incidents as the measure of violence. Each panel uses a different food coping strategy as the dependent variable. Columns (1) and (5) estimate a sparse specification omitting the governorate and time-specific factors; columns (2) and (6) add only the governorate-specific factors; columns (3) and (7) add both governorate and time-specific factors; and columns (4) and (8) estimate a specification adding a Houthi indicator to the specification and only includes time-specific factors.<sup>18, 19</sup>

The estimates in all columns corroborate the graphical patterns presented above- there appears to be very little evidence of a correlation between violence the month before the survey and access to food. One cannot reject the hypothesis of no relationship between violence and food coping strategies at conventional significance levels in all specifications, and all estimated coefficients suggest a very small relationship between violence and food coping strategies. The most complete specification including both governorate and time-specific effects suggests that a doubling of fatalities is associated with an increase in the share of respondents reporting to have reduced the number of meals they consume by 0.0002

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<sup>17</sup> For ease of interpretation, the specification uses the natural logarithm of violence as the dependent variable. All results are qualitatively identical if the specification instead estimates the relationship in levels.

<sup>18</sup> Since the Houthi indicator does not vary over time, governorate-specific factors cannot be added to the specification.

<sup>19</sup> There are 22 governorates and 28 time periods, so in the most complete specification, the number of observations is still significantly larger than the number of independent variables.

(panel 1, column 3); and a doubling in the number of incidents is associated with a *decrease* in the share respondents reducing meals by 0.007.

Furthermore, the coefficients of all specifications are precisely estimated, which implies that one can reject the hypothesis of a meaningful relationship between violence and food coping strategies at standard significance levels. For example, in specifications including both time and governorate-specific effects, one can reject the hypothesis that a doubling of the number of fatalities is larger than 0.008 at the 95 percent significance level for any food coping strategy (column 3).

Lastly, columns 4 and 8 of table 1 further demonstrate that much larger shares of respondents report relying on food coping strategies in governorates that are largely controlled by Houthi forces, which are the regions that are likely more affected by the partial sea blockade and the lack of governance than the rest of the country. Furthermore, the difference in food coping strategies between the regions that are largely held by Houthi forces and the rest of the country is much larger than the implied effect of doubling violence for all panels. One can reject the hypothesis that the two effects are equal in all specifications at conventional significance levels (p-values range between 0.001 and 0.015).

Overall, these results are qualitatively identical to the graphical evidence presented in figures 1-4. Specifically, food coping strategies are higher in the north of the country that is worse affected by port blockages, which also tend to have more violence. However, this higher level of violence is not universally true across those regions (there are governorates in the north with little reported violence), and the correlation between violence and food coping strategies is very close to zero.

### **Robustness Checks**

Table 2 demonstrates that these empirical results are robust to a number of important concerns. First, it is possible that there is an effect of violence on food coping strategies, but the effect dissipates over the course of a month. However, column (1) of table 2 demonstrates this is not a likely explanation. The column re-estimates the baseline specification, but breaks up the conflict incidents by those that occurred four weeks before the survey, three weeks before the survey, two weeks before the survey, and those that occurred one week before the survey. One cannot reject the hypothesis that all four coefficients are jointly equal to zero (p-value 0.326), only one of the coefficients is individually significant at conventional significance levels, and all coefficients are small in magnitude and precisely estimated. Additionally, the pattern is far from one in which the correlation becomes stronger as the events happen closer to the survey.

Second, table 2 demonstrates that there appears to be little evidence of a relationship when total conflict events are broken up into the actors involved and broken up by the type of violence (e.g., airstrike versus ground battle). Column (2) breaks up all conflict events into those in which coalition forces are engaged with Yemeni forces, coalition forces are engaged with other forces, and those in which organizations are involved that have long been designated as terrorist organizations (e.g., Al Qaeda in the Arabian Peninsula); and column (3) breaks up all conflict events into those that involve a form of battle, those that involve remote violence (e.g., airstrike), and all other types of events. In both columns, there is little evidence of violence in any form having a correlation with food coping strategies.

**Table 1. Correlation between Violence the Month Before the Survey and Food Coping Strategies**

		Coping Strategy- Reduce the Number of Meals							
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Number of Fatalitis in the Month Before the Survey	0.002659 [0.008]	0.000294 [0.003]	0.000240 [0.003]	0.005041 [0.008]	-	-	-	-	
Number of Incidents in the Month Before the Survey	-	-	-	-	0.004111 [0.012]	-0.006818 [0.004]	-0.003985 [0.004]	0.006912 [0.011]	
Indicator for the Governorate Being Controlled by Houthi Forces	-	-	-	0.098022*** [0.031]				0.097521*** [0.031]	
		Coping Strategy- Restrict Consumption							
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Number of Fatalitis in the Month Before the Survey	0.002391 [0.010]	0.001406 [0.003]	-0.000467 [0.003]	0.004900 [0.009]	-	-	-	-	
Number of Incidents in the Month Before the Survey	-	-	-	-	0.003625 [0.014]	-0.004073 [0.005]	-0.002896 [0.005]	0.006761 [0.013]	
Indicator for the Governorate Being Controlled by Houthi Forces	-	-	-	0.122391*** [0.036]	-	-	-	0.121914*** [0.036]	
		Coping Strategy- Borrow to Purchase Food							
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Number of Fatalitis in the Month Before the Survey	0.001514 [0.008]	-0.007232 [0.005]	-0.000939 [0.003]	0.005818 [0.007]	-	-	-	-	
Number of Incidents in the Month Before the Survey	-	-	-	-	0.003178 [0.011]	-0.010796 [0.007]	-0.005935 [0.006]	0.006696 [0.010]	
Indicator for the Governorate Being Controlled by Houthi Forces	-	-	-	0.094337*** [0.030]	-	-	-	0.093447*** [0.030]	
		Coping Strategy- Rely on Less Expensive Foods							
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Number of Fatalitis in the Month Before the Survey	0.005672 [0.009]	0.011320 [0.008]	-0.002305 [0.002]	0.003690 [0.008]	-	-	-	-	
Number of Incidents in the Month Before the Survey	-	-	-	-	0.005162 [0.013]	0.000703 [0.012]	-0.011109*** [0.003]	0.004692 [0.012]	
Indicator for the Governorate Being Controlled by Houthi Forces	-	-	-	0.081716** [0.032]	-	-	-	0.081260** [0.032]	
		Coping Strategy- Limit Portion Size							
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Number of Fatalitis in the Month Before the Survey	0.002988 [0.009]	0.000296 [0.003]	-0.001794 [0.002]	0.004986 [0.009]	-	-	-	-	
Number of Incidents in the Month Before the Survey	-	-	-	-	0.005358 [0.013]	-0.005674 [0.005]	-0.006359 [0.005]	0.007706 [0.013]	
Indicator for the Governorate Being Controlled by Houthi Forces	-	-	-	0.104777*** [0.035]	-	-	-	0.104493*** [0.034]	
Governorate Fixed Effects	N	Y	Y	N	N	Y	Y	N	
Month-Time Fixed Effects	N	N	Y	Y	N	N	Y	Y	
Observations	614	614	614	614	614	614	614	614	

Notes: This table estimates the correlation between food coping strategies and violence in the month before the survey between February 2016 and August 2018, using monthly data reported for each governorate. Data on food coping strategies were obtained from the WFP mVAM mobile phone survey; and violence data was obtained from ACLED. Columns (1) and (5) estimate a sparse specification without any time or governorate-specific factors; columns (2) and (6) estimate a specification including governorate-specific factors; columns (3) and (7) estimate a specification including both time (month-year) and governorate-specific factors; and columns (4) and (8) estimate a specification that includes a Houthi indicator and only time-specific factors. Standard errors clustered by governorate are reported in parentheses; \* denotes statistical significance at the 10 percent level, \*\* denotes statistical significance at the 5 percent level, and \*\*\* denotes statistical significance at the 1 percent level.

**Table 2. Robustness Checks**

VARIABLES	Dependent Variable: Number of Days Household Reduced Number of Meals						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Number of People Killed- All Violence	0.000008 [0.000]	-0.000419 [0.003]	0.002226 [0.004]	0.001623 [0.003]	-0.001491 [0.004]	-0.003240 [0.003]	-0.000505 [0.003]
Number of People Killed- Second Week of Month Before	-0.000134 [0.000]	-	-	-	-	-	-
Number of People Killed- Third Week of Month Before	0.000194** [0.000]	-	-	-	-	-	-
Number of People Killed- Fourth Week of Month Before	0.000010 [0.000]	-	-	-	-	-	-
Number of People Killed- AQAP Involved	-	-0.002025 [0.004]	-	-	-	-	-
Number of People Killed- Coalition	-	-0.000086 [0.003]	-	-	-	-	-
Number of People Killed- Yemen Forces	-	0.002772 [0.003]	-	-	-	-	-
Number of People Killed- Remote Violence	-	-	0.000037 [0.004]	-	-	-	-
Number of People Killed- Battle Violence	-	-	-0.002536 [0.003]	-	-	-	-
Number of People Killed- 2 Months Before	-	-	-	0.002977 [0.003]	-	-	-
Number of People Killed- 3 Months Before	-	-	-	0.000240 [0.003]	-	-	-
Number of People Killed- 4 Months Before	-	-	-	0.002099 [0.003]	-	-	-
Number of People Killed- 5 Months Before	-	-	-	-0.000174 [0.003]	-	-	-
Number of People Killed- All Violence x 2017 Indicator	-	-	-	-	0.002314 [0.003]	-	-
Number of People Killed- All Violence x 2018 Indicator	-	-	-	-	0.003234 [0.005]	-	-
Number of People Killed- All Violence x Houthi-Controlled	-	-	-	-	-	0.007553* [0.004]	-
Observations	614	614	614	484	614	614	374
Include Food Assistance in Specification	N	N	N	N	N	N	Y

Notes: This table estimates a number of robustness checks investigating the relationship between violence and food coping strategies. Column (1) estimates a specification breaking up the violence by week in the month before the survey; column (2) estimates a specification breaking up violence by the actors involved; column (3) estimates a specification breaking up violence by the type of event; column (4) estimates a specification investigating the relationship between more lagged events and food coping strategies; column (5) estimates a specification allowing the relationship to vary by year; column (6) allows violence to vary between regions controlled by the internationally-recognized government and regions controlled by Houthi forces; and column (7) adds the share of respondents receiving food assistance to the baseline specification. All specifications include time and regional fixed effects. Standard errors clustered at the governorate level are reported in parentheses; \* denotes statistical significance at the 10 percent level, \*\* denotes statistical significance at the 5 percent level, and \*\*\* denotes statistical significance at the 1 percent level.

Third, table 2 further demonstrates that the lack of a correlation in the past month is not being obscured by violence that occurred previously. Specifically, column (4) re-estimates the baseline specification, but adds lagged conflict events up to five months before the WFP survey. However, again, there is little evidence of a correlation between food coping strategies and any of these variables describing past or future violence, and one cannot reject the hypothesis that all additional lagged violence coefficients are jointly equal to zero (p-value 0.829).

Fourth, table 2 demonstrates that there does not appear to be any correlation between violence and food coping strategies in any of the years of available data. Specifically, column (5) re-estimates the baseline specification, but interacts the violence measure with year dummies and includes all lower-order terms in the specification. The results suggest that one cannot reject the hypothesis that there is no correlation between violence and food coping strategies in 2016, 2017, or 2018.



Fifth, table 2 demonstrates that there appears to be little relationship between violence and food access in both regions controlled by the internationally-recognized government and the rest of the country. Specifically, column (6) re-estimates the baseline specification but interacts the violence measure with an indicator equaling one if the respondent resided in regions not controlled by the internationally-recognized government. Only one of the coefficients is marginally significant (relationship in regions not controlled by the internationally-recognized government), and the upper bound of the confidence interval for both estimates corresponds to a very small decrease in access to food in response to a doubling of fatalities in a month.

Sixth, it is possible that violence is causing a much larger decline in access to food, but food assistance targeted to violence-prone regions is mitigating its effects. However, table 2 demonstrates that this explanation is not likely. The WFP survey began inquiring about whether the household is receiving food assistance beginning in 2017, and column (7) includes this in the baseline specification. The estimate is qualitatively identical with the addition of food assistance to the specification.

And lastly, it is not likely that the lack of a correlation between violence and food coping strategies is being completely driven by internal displacement. The primary concern is that those who were worst affected by the conflict simply left the governorate before the next month's survey to re-locate where it was safer, and this could obscure the identification of the correlation. However, the WFP data collect information on the displacement status of households, and the date of displacement and the governorate from where the household moved. In the WFP survey to which we have access to the unit-level data (November 2017), only 8 households (of more than 2,422) reported to have been displaced from their original governorate the month before. And this is despite the fact that there was significant violence in October 2017, including 6 governorates that had more than 100 fatalities each.

### **Impact of Port Blockages and the Tightening of the Ports**

Although we find little correlation between the local effects of violence and food access, we find further evidence of the supply chain blockages having an immediate and significant effect. The monthly mobile phone surveys began after imports through the ports supplying the north of the country significantly dropped (e.g., WFP 2017), and it is difficult to estimate how food access changed in response. However, we analyze the effects on food access of a sharp event that caused this port blockage to get significantly worse.

Specifically, we use the complete sea and air blockade of *all* of Yemen's ports (not just the ports that supply the north),<sup>20</sup> and compare food access of those surveyed immediately before to those surveyed immediately after the event. Importantly, there was an ongoing mobile phone survey conducted by the World Food Programme (WFP) that interviewed 2,424 respondents. Of these interviews, approximately 900 occurred in the five days before the blockade was implemented; approximately 900 occurred during the full blockade on the entire country (November 6-13); and approximately 600 occurred during the time period during which only northern ports were blockaded (November 13-November 18). The ongoing survey and the distribution of responses over time allows one to gauge how households adapted to the economic difficulties, and whether this affected their access to food.

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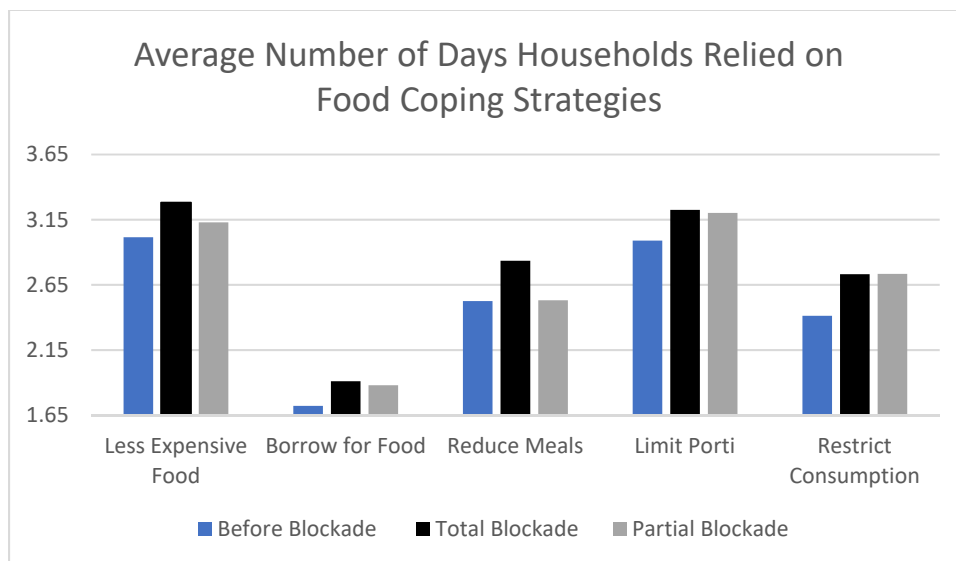
<sup>20</sup> For example, see (accessed April 2017) <https://reliefweb.int/report/yemen/escalating-humanitarian-crisis>.

The survey included the standard WFP food security module that captures food coping strategies and household information, as well as an access to basic services module inserted into the WFP survey by the World Bank. The module was designed to capture access to a number of key services and dimensions of welfare that are captured in the World Bank’s proposed multi-dimensional poverty index. In particular, access to water, electricity, municipal sanitation services, and food were all captured in the survey.

Figure 5 demonstrates that immediately following the blockade, there was an increase in the reliance on all five food coping strategies captured by the WFP survey. The increase was most noticeable for households surveyed during the full blockade, but there was still a larger reliance on food coping strategies for those interviewed during the partial blockade. The most surprising part of this result is the speed with which the blockade affected household behavior, where the effects began the day after the onset of the blockade. However, it is not clear whether these results were driven by price increases, shortages of food, or anticipation of the blockade continuing. Regardless of the actual cause, these results can offer an explanation for why food insecurity is equally poor in the north of the country where supply chains are more disrupted, regardless of the level of violence.

In addition to investigating the effects of the blockade on access to food, the survey can also be used to identify how access to a variety of basic services was also affected. Importantly, the survey allows one to investigate the degree to which access to each of these basic and necessary services changed, as well as the degree to which these deprivations overlap. Although estimates of monetary poverty have dramatically increased following the start of the conflict (e.g., World Bank 2017), monetary poverty potentially has less meaning in a setting where nearly everyone is poor, and the vast majority of people are facing extreme challenges in sustaining life. However, each of these non-monetary dimensions of welfare each has an important meaning in this setting, and the degree to which each of them overlaps is an indicator of the amount of stress faced by an individual household.

**Figure 5. Food Coping Strategies Before and After the Blockade**



Source: WFP Mobile Phone Survey, November 2017.

Figure 6 investigates the change in both food and non-food deprivations together. The thresholds defining deprivations are extreme relative to non-conflict settings. Deprived households are defined as those that describe their primary water source as not sufficient for their needs, have access to only primitive forms of electricity (candles, flashlights, etc.) for their primary source of electricity, do not have waste collected directly from the household, and households that employ any of the five coping strategies for at least one day. The figure further reports the share of households that face deprivations in at least three of the four deprivations as well.

Figure 6 demonstrates that non-food deprivations also increased immediately following the imposition of the blockade. Thus, the blockade made deprivations worse in all available dimensions, and not just in access to food. These results are consistent with concern over gasoline shortages spilling over into other dimensions- the ability of water trucks to reach households, the ability of households to run their generators, and the ability of garbage trucks to reach households. Furthermore, we see that all the dimensions overlap, and that nearly half of the respondents reported being deprived in most of the dimensions. Importantly, there was a substantial increase in the share of households facing at least three overlapping dimensions following the blockade.

Formalizing the estimation of these changes, this paper further reports estimates from the following specifications:

$$\text{Food\_Coping}_{igt} = \gamma_g + \beta \text{After\_Blockade}_{igt} + \varepsilon_{igt}$$

where  $i$  denotes individual,  $r$  denotes district,  $g$  denotes governorate, and  $t$  denotes day of survey;  $\text{Food\_Coping}$  denotes the number of days the household reported to relying on the specific food coping strategy; and  $\text{After\_Blockade}$  denotes an indicator equaling one if the household was surveyed after the beginning of the blockade. The data available for this survey are at the individual level, as opposed to the governorate-level data that were analyzed in the violence section.<sup>21</sup>

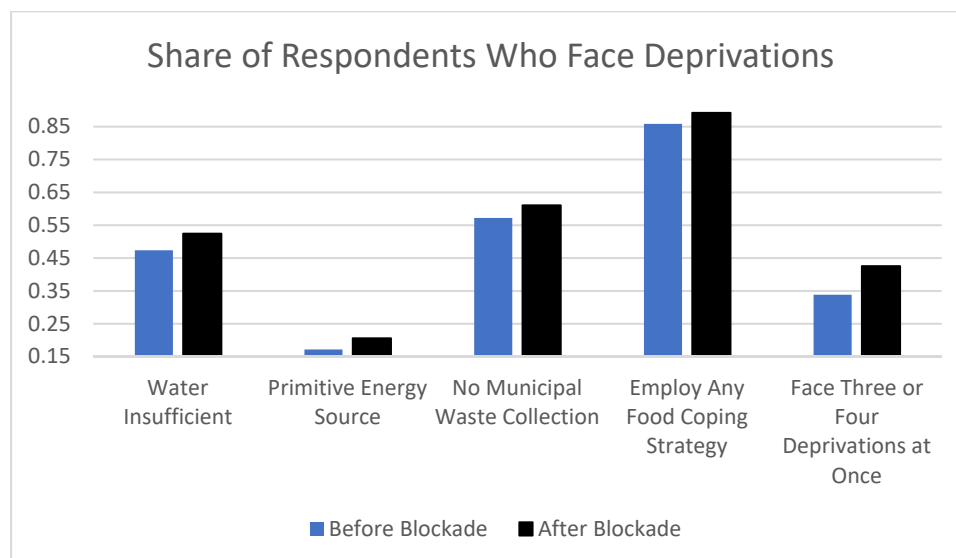
The coefficient of interest in the first specification is  $\beta$ , which captures the difference in the average number of days that respondents report relying on the food coping strategies between households surveyed prior to the blockade and those surveyed after the blockade began. If the blockade increased the reliance on food coping strategies, one would expect  $\beta > 0$ .

Table 3 reports estimates of the above empirical specifications. The estimates confirm that all patterns reported in figures 5-6 are statistically significant at conventional levels and are robust to including governorate-specific factors. In addition to the food access results, the change in the share of households reporting at least 3 deprivations of the four captured by the survey increased by 9.7 percentage points, which represents an increase of approximately 29 percent in a matter of days following the imposition of the blockade. This suggests that the blockade had an immediate and large impact on the number of people who were exposed to extreme deprivations.

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<sup>21</sup> Given the use of the individual-level data and treatment variable, robust standard errors are reported as opposed to the standard errors clustered at the governorate level in the first specification (where the data were a repeated cross-section and the treatment variable was correlated within a governorate over time).

**Figure 6. The change in non-food deprivations**



Source: WFP Mobile Phone Survey, November 2017.

**Table 3. Changes in Food Coping Strategies Following the Blockade**

Dependent Variable:										
	Reduce Number of Meals	Restrict Consumption	Borrow to Pay for Food	Relied on Less Expensive Food	Limit Portion Size	Water Insufficient	Primitive Energy Source	No Municipal Waste Service	Relied on a Food Coping Strategy for at Least One Day	Experienced Deprivations in at Least 3 Dimensions
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Post Ind.	0.215**	0.373***	0.160*	0.186*	0.204*	0.061***	0.035**	0.048**	0.039***	0.097***
	[0.105]	[0.107]	[0.089]	[0.108]	[0.109]	[0.020]	[0.016]	[0.020]	[0.013]	[0.020]
Obs.	2,422	2,422	2,422	2,422	2,422	2,422	2,422	2,422	2,422	2,422

Notes: This table estimates how food coping strategies and household deprivations changed immediately following the imposition of the blockade. All specifications include governorate fixed effects. Robust standard errors are reported in parentheses; \* denotes statistical significance at the 10 percent level, \*\* denotes statistical significance at the 5 percent level, and \*\*\* denotes statistical significance at the 1 percent level.

## Conclusions

This paper demonstrates that there is little correlation between the localized effect of violence and access to food, and that food access is significantly correlated with the blockage of ports during the conflict. These results have important implications for the regional targeting of food assistance, where it could be important to de-emphasize indicators of violence in the determination of food assistance.

It is important to reiterate that these results do not suggest that violence has no impact on households. Rather these results provide information on how better to target households for assistance once the

conflict has already started. Without question, humanitarian aid targeting households and the regions most affected by violence is needed. However, these results suggest that development and food assistance is also necessary for households and regions that are not necessarily the most affected by violence.

There are a number of issues that we are unable to explore here. In particular, we only have access to a subset of the unit-level data for three WFP mobile phone surveys that have been conducted since August 2015 (September 2017-November 2017), and we only have access to the complete survey for one month (November 2017). Although we are able to make a number of inferences using the variation in food security at the governorate level that is publicly available, there are a number of additional inferences that would be better answered by household-level data that identify the exact date of the survey, the district of the respondent, and other household-level information. In particular, this includes issues related to the decision to migrate, distributional issues that might affect aid-receiving, IDP, or poor households differently from other respondents, and so on. We leave these issues to future collaborations with the WFP.

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