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Households' Food Insecurity in the Era of Covid-19: Application on MENA Countries

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Abstract

The COVID-19 pandemic may have threatened food security, an important issue for economic development. In this paper, we use surveys on five MENA countries to assesses the food insecurity situation during the pandemic. Using descriptive statistics and the logit method, we show that characteristics such as age, income, and being employed increase/decrease the level of food insecurity of an individual. We also examine the government policies implemented during the period, such as stay-at-home requirements. To this end, we use a new instrument variable for COVID-19, the Google Trends index. We show that these policies have no significant effect on food insecurity.

Keywords: MENA region, Food security, Food consumption, Economic access, COVID-19.
JEL Classifications: E21, E31, I15, I18, I31, Q18.

ملخص

قد يكون وباء كوفيد-19 قد هدد الأمن الغذائي، وهي قضية مهمة للتنمية الاقتصادية. وفي هذه الورقة، نستخدم دراسات استقصائية عن خمسة بلدان في منطقة الشرق الأوسط وشمال أفريقيا لتقييم حالة انعدام الأمن الغذائي أثناء الوباء. باستخدام الإحصائيات الوصفية وطريقة التسجيل، نوضح أن الخصائص مثل العمر والدخل والتوظيف تزيد/تقلل من مستوى انعدام الأمن الغذائي للفرد. نقوم أيضًا بفحص السياسات الحكومية التي تم تنفيذها خلال هذه الفترة، مثل متطلبات البقاء في المنزل. لتحقيق هذه الغاية، نستخدم متغير أداة جديد لـ كوفيد-19 ، مؤشر جوجل. نظهر أن هذه السياسات ليس لها تأثير كبير على انعدام الأمن الغذائي.

1. Introduction

Middle East and North African (MENA) countries are net food importers, with more than 50 percent of their cereal consumption depending on food imports. This dependence left the food security of MENA countries vulnerable to external shocks, such as the COVID-19 pandemic and the Russo-Ukraine war. The pandemic had a strong impact on the daily lives of citizens across the world. Therefore, its effects and consequences on health and the economy quickly became one of the most important subjects of study. The precautionary measures and the economic slowdown resulted in job and income losses, leaving several individuals vulnerable to poverty and food insecurity. This paper aims to contribute to the literature discussing the impacts of the pandemic on food security.

Food insecurity is studied under the prism of two of the most important components of the Food and Agriculture Organization's (FAO) definition of food security: availability and accessibility. Food availability is "achieved when sufficient quantities of food are consistently available to all individuals within a country," and food accessibility is "achieved when food is accessible physically and economically to everyone." In the MENA region, food security is correlated with poverty. Using macroeconomic data, Mandour (2021) finds that in the MENA region, the most critical aspect is accessibility. The most important component of the accessibility pillar is affordability, which refers to the ability to afford food considering income and food prices.

Multiple papers (Krafft, Assaad, Marouani, Cheung, et al., 2022; Krafft, Assaad, and Marouani, 2022; Krafft, Selwaness, et al., 2022) use similar surveys, produced by the Economic Research Forum (ERF), to assess employment, care work, and income. To the best of our knowledge, only El-Shal et al. (2022) use a similar survey to examine the issue of food security in the MENA region by studying the extent to which existing social safety nets and unusual support in the region have mitigated food insecurity during the pandemic. The results show that unusual government support had no significant effects on food security in Egypt, Jordan, and Morocco, whilst support from non-governmental institutions played a significant role in food security during the pandemic. Similarly, Ramadan (2022) uses wave 2 of the COVID-19 ERF MENA Monitor data to examine the determinants of food security in Egypt in June 2021, after the spread of COVID-19. The results show that females, the low-educated, the self-employed, those working in hard-hit sectors, and those who lost their income and households with a high share of children under the age of six are all more likely to be food insecure, measured by food access and food consumption.

This paper aims to fill this gap in the vast literature on the effect of COVID-19 in the MENA region. There is heterogeneity in the food insecurity situation according to the countries, the regions/districts, and the socioeconomic characteristics of the individuals assessed. The populations of the five countries have been negatively affected, particularly in the "accessibility" component. Tunisia is the most impacted country and the only one with a strong effect on the

"availability" pillar. There is an important heterogeneity between the different regions, and it seems that the ones with a higher population density or a higher nightlight intensity are less afflicted by food insecurity. The socioeconomic characteristics of individuals that increase the probability of being food insecure are being a Tunisian woman, not married, with low education, living in an urban area, and participating in the labor force while unemployed. In the second part, we use a new instrumental variable, the Google Trends index for the search term "Covid," to estimate the effect of government policies implemented during the pandemic. It seems that those policies had no effect on food insecurity during the period of the study.

The remainder of the paper is structured as follows. Section 2 describes the food security and COVID-19 background in the MENA region. Section 3 describes and presents the data. Section 4 outlines the empirical strategy. Section 5 presents the results, while section 6 concludes.

2. MENA background

2.1. Food security in the MENA region

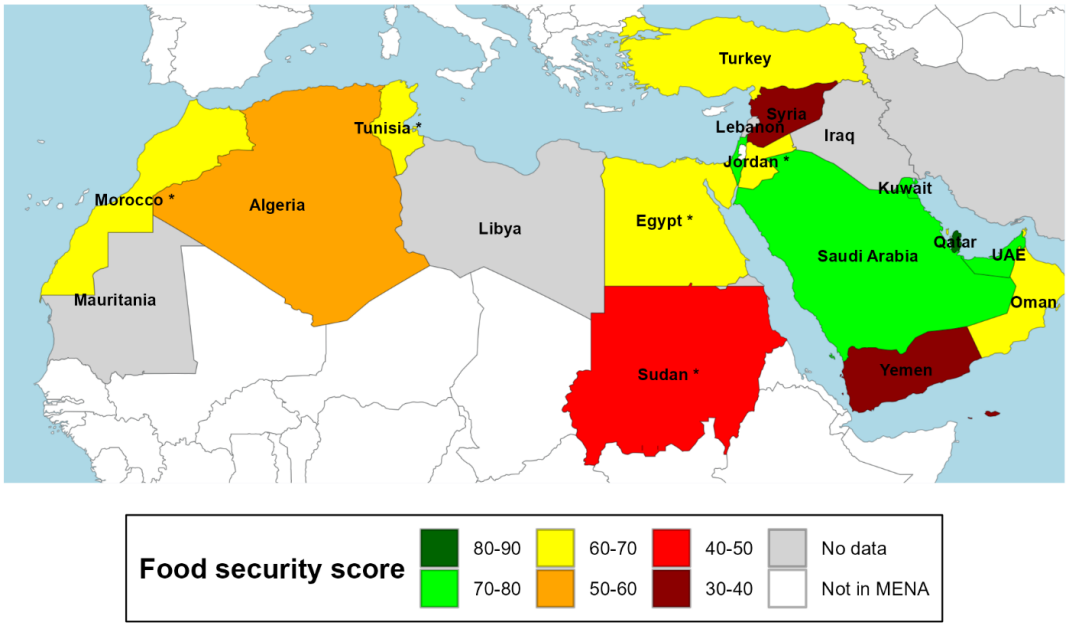
Food security and adequate nutrition are some of the most important development priorities according to the Sustainable Development Goals of the United Nations. Food security is inherently linked to economic development, while the meaning of the causal relationship is debated.[3] According to FAO, the concept of food security corresponds to a situation where "human beings have, at all times, the physical, social, and economic ability to secure sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life." An individual is considered undernourished if their habitual food consumption is insufficient to provide the dietary energy levels required to maintain a normally active and healthy life. This definition highlights the multifaceted nature of food security and allows for the extraction of four dimensions: accessibility, availability, use, and stability.

MENA countries face multiple challenges to tackle food insecurity. First, it is the most water-scarce region in the world. Climate change, in addition to being responsible for this water stress, will probably worsen the conditions suitable for local agriculture. Second, the population is growing fast. In 2018, 484 million people were living in the MENA region. There will be 723 million in 2050, according to the UN projection (UNICEF, 2019). These two challenges lead to the third: the MENA region is highly dependent on food imports. In fact, half of the food consumed is imported, leaving the region vulnerable to external shocks. Wheat, the foundation of MENA diets, represents one-third of the calories absorbed (Larson et al., 2012). This cereal is heavily imported compared to the rest of the world; MENA contains six percent of the world's population while importing around 33 percent of the international wheat (Abis, 2012). In 2019, 55 million inhabitants of the MENA region (i.e., 13.2 percent of the population) were undernourished (FAO, 2020). However, the diversity of MENA countries resulted in a very heterogeneous food security

[3] See Fernandes and Samputra (2022) for a recent literature review on the debate.

situation. This prevalence varies between three percent in Tunisia and 17 percent in Jordan in 2020 (WDI, 2022). Figure 1 shows the overall food security score of the MENA region in 2019, calculated by The Economist on three core issues: affordability, availability, and quality and safety (Economist Intelligence Unit, 2019). It shows that member countries of the Gulf Cooperation Council (GCC) are not food insecure. The median score of the 113 countries analyzed is 64. Egypt is the only non-GCC country above this median, by half a point.

Figure 1. Food security in the MENA region



Source: The Economist
Note: This map shows the food security score of MENA countries. The food security score is estimated by The Economist in 2019.

2.1. COVID-19

On 11 March 2020, the World Health Organization (WHO) declared that the COVID-19 epidemic was now a pandemic. This statement meant that the disease had spread worldwide. The virulence of the coronavirus led governments in almost all countries to take measures to contain its spread. The governments' responses and the spread of the disease severely disrupted the global economy. Substantial literature has been devoted to understanding the implications for a wide range of topics, mainly in high-income countries. The consequences on the labor market have been negative, with an increase in unemployment (Coibion et al., 2020; Gupta et al., 2020). This increase is heterogeneous based on the job typology. Employees unable to perform their tasks remotely faced higher job loss risks, except for "essential workers" (Béland et al., 2020). This heterogeneity led to an increase in poverty and inequality as it affected the financially vulnerable population, workers with lower levels of education, younger adults, and immigrants (Yasenov, 2020). Additionally, women have been more concerned than men about the loss of jobs or work hours (Bui et al., 2020;

Forsythe et al., 2020). This effect can be explained by their job and skill characteristics since they are less involved in "essential industries" and mainly concentrated in informal jobs without contracts or social security. Additional explanations include the government's policies, especially the school closures that led women to devote more of their time to childcare, with limited internet access making working from home implausible (Couch et al., 2020).[4]

The "Oxford COVID-19 Government Response Tracker," which collected data on government measures, identifies nine metrics to create a "Stringency Index." Eight of the nine measures used to create this index are "Containment and closure policies." It shows that the governments of the countries included in the study took very stringent measures at the beginning of the pandemic. Those measures had negative effects on the employment rates and income of the populations in those countries (Krafft, Assaad, and Marouani, 2022). COVID-19 harmed the living conditions of workers across the world. The five countries included in the study established a very stringent set of measures that led to a decrease in income and employment rates.

2.2. Food security during COVID-19

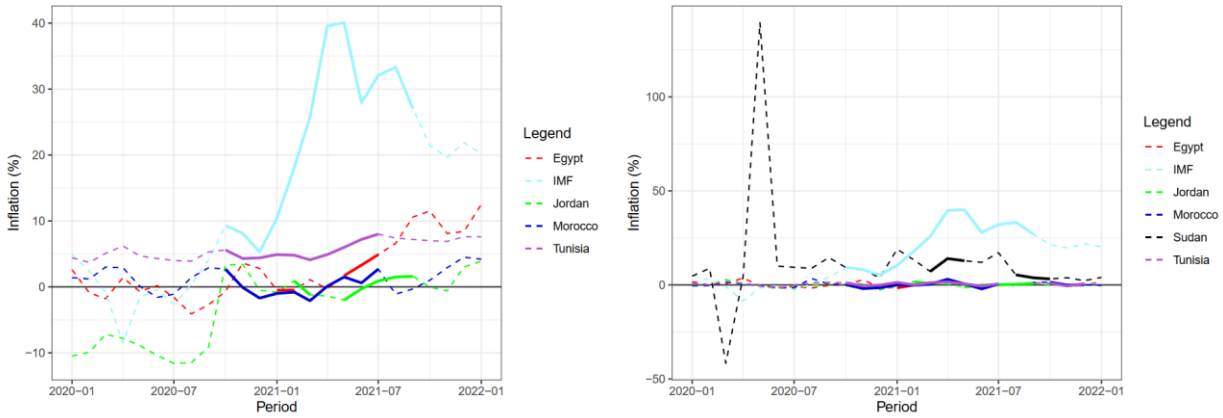
To understand how COVID-19 impacted the food situation of MENA countries, the effect on the four pillars of food security should be examined. The first pillar is "food availability," which is "achieved when sufficient quantities of food are consistently available to all individuals within a country." Due to the COVID-19 pandemic, as was observed during the 2008 food price crisis, multiple countries introduced food export restrictions, notably Ukraine and Russia, two of the biggest wheat exporters (Laborde et al., 2020). The high reliance on importation could have led to a lack of food availability. However, thanks to the appropriate stock of food products saved by the governments upstream of the crisis, it seems that, globally, no significant food shortage was observed.

The second pillar is "food accessibility," which is achieved when food is physically and economically accessible to everyone. The main component of the food accessibility pillar is the affordability of food, which can be affected by the price of the product and/or the income of the individual. From the offer side, Figure 2 shows the food price inflation compared to the corresponding month of the previous year for each country included in the study and for the international market. The inflation on the international market is even higher than the level reached during the 2008 peak.[5] However, international prices do not translate into food inflation in the countries included in the study – at least during the COVID-19 period studied – with the exception of Sudan. Despite the food supply chain disruption resulting from export restrictions, the increase in transport costs and closure of food processing factories did not drive the food price of those

[4] See Brodeur et al. (2021) for an extensive literature review.
[5] 36.47 percent of inflation compared to the corresponding month of the previous year.

MENA countries. This is expected given the important food subsidies and the government measures implemented to protect the vulnerable populations. On the demand side, multiple studies assess an unemployment increasein MENA countries, which mechanically leads to a decrease in the available income. This income decrease can affect the ability to purchase food products. There is no reason for the third pillar, "utilization," to be affected by COVID-19. "Food utilization" is achieved when individuals have basic nutrition knowledge and access to water and sanitation for preparing food; these factors were not affected by the pandemic. The last pillar, "stability," is the capacity of an individual to be food secure regardless of sudden shocks or cyclical events. Since food accessibility is negatively impacted by a crisis, by definition, the stability pillar is also affected.

Figure 2. Food price inflation



Note: Panel A shows food price inflation, according to Trading Economics, based on a government source in each country. Panel B shows food price inflation according to the International Monetary Fund. Both panels show the percentage change from the corresponding month of the previous year. Dotted lines indicate periods not in the survey, while filled periods correspond to those in the survey.

3. Data

3.1. COVID-19 MENA Monitor Household Survey

To study the situation of households in the era of COVID-19, ERF led a four-wave survey. The COVID-19 MENA Monitor Household Survey (CMMHH) was conducted in Egypt, Jordan, Morocco, Sudan, and Tunisia between October 2020 and October 2021. Additionally, ERF harmonized and included a survey conducted and prepared by Baseera[6] in June 2020. Approximately 2,000 individuals from different households are surveyed in each country and each wave.

The survey covered a national random sample of mobile phone users aged 18-64. The method to contact those individuals was to pick a random digit dialing, within the range of valid numbers,

[6] It is the Egyptian Center for Public Opinion Research, described as "an independent and nonpartisan organization that aims to conduct public opinion research impartially and professionally."

and try three times to contact them for the interview. Due to this sampling procedure, the individuals surveyed are not nationally representative. The individuals surveyed are mostly urban (71 percent) and a few work on a farm (three percent), while 57 percent of Egyptians live in a rural area and around 28 percent work in agriculture. To reduce bias, ERF constructed weights using three different inputs: telephone operators and their market shares; the number of phones by operator for individuals and households; and representative data with comparable demographic and household characteristics to weight for non-response.[7] This last input is obtained through the most recent publicly available data with individual phone ownership and relevant demographic and labor market characteristics.

The main variables of interest for the study of food security are five variables indicating whether the respondent had difficulties in consuming food. These five variables are nominal, taking the value of 1 if the respondent agrees with the sentences and 0 otherwise. Agreement corresponds to an increase in food insecurity for five of the six variables. A variable named "food insecurity" summing up the five variables was built. It is a score from 0 to 5, 0 if the individual disagrees with the five sentences, and 5 if they agree with every sentence. This variable indicates the number of difficulties, over five, that the individual has had.

The five variables correspond to the answer to the following five sentences: "In the past seven days, they or any household member experienced any of the following":

1. Access market: "difficulties in going to food markets due to mobility restrictions imposed by government/closures."
2. Shortages: "unable to buy the amount of food we usually buy because of shortages of food in markets."
3. Price: "unable to buy the amount of food we usually buy because the price of food increased."
4. Income: "unable to buy the amount of food we usually buy because our household income has dropped."
5. Reduce food: "had to reduce the number of meals and/or the portion of each meal we would usually eat."

The variables are described in Table A1 in the Appendix.

3.2 Oxford COVID-19 Government Response Tracker

Policy responses to COVID-19 may have indirectly impacted the food security of MENA

[7] Sex, age group, education level, household size, labor market status in Feb. 2020, administrative geography, urban vs rural, interaction between admin. geo. and urban, marital status, presence of kids aged 0-5, presence of kids in school, nationality, interaction of covariates and sex, household income/wealth quartile, interaction of covariates and urban.

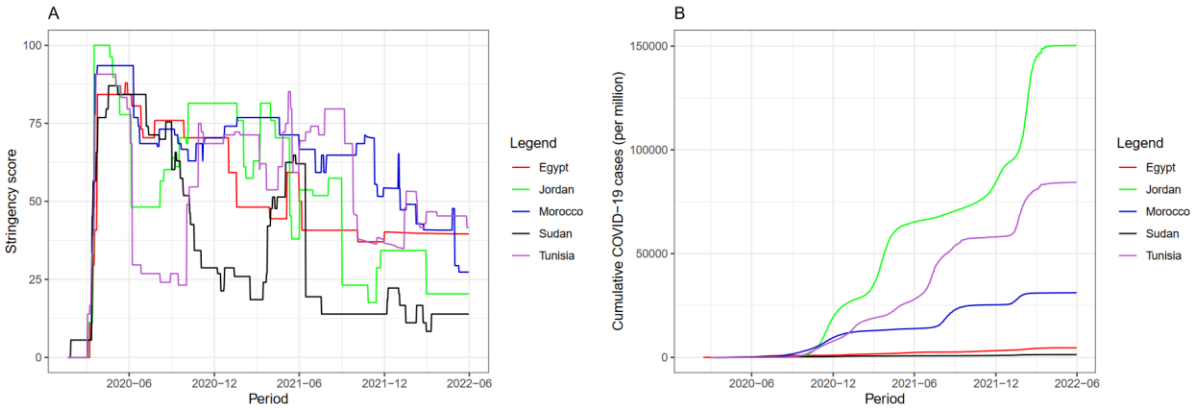
households. The Oxford COVID-19 Government Response Tracker (OxCGRT) is an initiative that "collects systematic information on policy measures that governments have taken to tackle COVID-19." The indicators are ordinal variables. The mobility variables are ranked from 0 to 4, with 0 being an absence of measures and 4 being the strictest measures.

We use the "Stringency index," a composite of nine response indicators (eight on "Closures and Containment" and one on "public information campaign"). Figure 3 shows the stringency index for the five countries, besides the cumulative number of COVID-19 cases. Figure 3A shows that there was a huge increase in restrictive measures around March 2020. This period does not correspond to the period with a huge number of cases as shown in Figure 3B. It could be due to a low detection capacity of COVID-19 patients. There is an important heterogeneity of the stringency measures between the countries. Sudan is the least strict country, while Morocco is the strictest. The variables are described in Table A1 in the Appendix.

3.3. Geographic variables

The CMMHH survey collects information on the level 2 administrative area of individuals. This level corresponds to the districts in Sudan, Tunisia (Mutamadiyat), and Jordan (Liwaa), to the prefectures/provinces in Morocco (Aqalim/Eumalate), and the municipalities in Egypt (Markaz/Kism). Henceforth, "district" is used to refer to all the level 2 areas. The administrative information can be crossed with a geographic dataset characterizing the districts. The economic development of the districts is proxied by the nightlights (Chen and Nordhaus, 2011; Henderson et al., 2012; Kocornik-Mina et al., 2020), using the "Visible and Infrared Imaging Suite" dataset (VIIRS) as suggested by Gibson et al. (2021). The population density is estimated through the "Grilled Population of the World, v4." Estimates of the distance from the center of the district to the county capital and the nearest seaport are also calculated. The variables are described in Table A1 in the Appendix.

Figure 3. Stringency index and cumulative COVID-19 cases



Note: Panel A shows the Stringency index since the beginning of the pandemic. Panel B shows the number of cumulative COVID-19 cases since the beginning of the pandemic.

3. Descriptive statistics

This section presents the descriptive statistics of the dataset and illustrates some stylized facts. Tables 1 and 2 present the different variables at the individual level and at the geographical location level, respectively. The descriptive statistics already highlight some interesting aspects of the dataset.

Table 1 indicates that there is heterogeneity between the different average scores of different countries. Tunisians report, on average, more difficulties than citizens from other countries in almost every aspect of food security measured. They report on average of 2.92 issues out of five while Egyptians report just 1.68. Nearly half of all survey respondents are women. Half are employed, and three-quarters of the surveyed are part of the labor force. They are mostly rural as a little less than three-quarters of the individuals live in urban areas. A majority of the surveyed are married and own a secondary or higher education diploma. The relationship to the respondent's head of household is unknown. Table 2 presents the descriptive statistics at the district level. We can observe an important heterogeneity between the high number of districts in Tunisia (210), and Jordan (47), for example. The nightlight intensity reflects the GDP difference between the countries, with Egypt having a high nightlight intensity while Sudan has a low one. Tunisia's small size is reflected in the low values for distance from a port or the capital.

Table 1. Descriptive statistics at the individual level

	Egypt	Jordan	Morocco	Sudan	Tunisia	Overall
Individuals	**(N=4007)**	**(N=7625)**	**(N=8120)**	**(N=4401)**	**(N=8143)**	**(N=32296)**
Access market (Difficulties food market b/c govt. mobility restrictions/closures						
Mean (SD)	0.136 (0.477)	0.129 (0.539)	0.222 (1.01)	0.146 (0.966)	0.350 (1.01)	0.211 (0.865)
Median [Min, Max]	0 [0, 1.00]	0 [0, 1.00]	0 [0, 1.00]	0 [0, 1.00]	0 [0, 1.00]	0 [0, 1.00]
Shortages (Unable to buy usual amount b/c of shortages)						
Mean (SD)	0.204 (0.574)	0.131 (0.525)	0.118 (0.747)	0.378 (1.59)	0.523 (1.21)	0.270 (0.993)
Median [Min, Max]	0 [0, 1.00]	0 [0, 1.00]	0 [0, 1.00]	0 [0, 1.00]	0 [0, 1.00]	0 [0, 1.00]
Price (Unable to buy usual amount b/c of price increases)						
Mean (SD)	0.455 (0.775)	0.477 (0.904)	0.517 (1.45)	0.810 (2.22)	0.786 (1.41)	0.608 (1.41)
Median [Min, Max]	0 [0, 1.00]	0 [0, 1.00]	0 [0, 1.00]	1.00 [0, 1.00]	1.00 [0, 1.00]	1.00 [0, 1.00]
Income (Unable to buy usual amount b/c of decreased income)						
Mean (SD)	0.457 (0.773)	0.560 (0.955)	0.618 (1.54)	0.555 (2.00)	0.714 (1.38)	0.600 (1.39)
Median [Min, Max]	0 [0, 1.00]	1.00 [0, 1.00]	1.00 [0, 1.00]	0 [0, 1.00]	1.00 [0, 1.00]	1.00 [0, 1.00]
Reduce food (Reduced meals/portions)						
Mean (SD)	0.432 (0.766)	0.411 (0.878)	0.327 (1.18)	0.506 (1.92)	0.543 (1.26)	0.439 (1.23)
Median [Min, Max]	0 [0, 1.00]	0 [0, 1.00]	0 [0, 1.00]	0 [0, 1.00]	1.00 [0, 1.00]	0 [0, 1.00]
Food insecurity						
Mean (SD)	1.68 (2.56)	1.71 (3.00)	1.80 (4.70)	2.40 (7.20)	2.92 (5.46)	2.13 (4.83)
Median [Min, Max]	2.00 [0, 5.00]	2.00 [0, 5.00]	1.00 [0, 5.00]	2.00 [0, 5.00]	3.00 [0, 5.00]	2.00 [0, 5.00]
Female						
Mean (SD)	0.445 (0.853)	0.490 (0.922)	0.376 (1.28)	0.414 (1.52)	0.460 (1.17)	0.438 (1.17)
Median [Min, Max]	0 [0, 1.00]	0 [0, 1.00]	0 [0, 1.00]	0 [0, 1.00]	0 [0, 1.00]	0 [0, 1.00]
Employed						
Mean (SD)	0.533 (0.762)	0.401 (0.770)	0.488 (1.37)	0.457 (1.69)	0.541 (1.11)	0.482 (1.18)
Median [Min, Max]	1.00 [0, 1.00]	0 [0, 1.00]	1.00 [0, 1.00]	0 [0, 1.00]	1.00 [0, 1.00]	1.00 [0, 1.00]
Labor force participation						
Mean (SD)	0.741 (0.825)	0.674 (0.956)	0.715 (1.63)	0.784 (2.20)	0.794 (1.35)	0.738 (1.44)
Median [Min, Max]	1.00 [0, 1.00]	1.00 [0, 1.00]	1.00 [0, 1.00]	1.00 [0, 1.00]	1.00 [0, 1.00]	1.00 [0, 1.00]
Age						
Mean (SD)	36.2 (37.6)	36.8 (45.5)	37.4 (69.8)	32.4 (84.4)	38.4 (58.4)	36.7 (61.0)
Median [Min, Max]	34.0 [18.0, 64.0]	35.0 [18.0, 64.0]	36.0 [18.0, 64.0]	27.0 [18.0, 64.0]	40.0 [18.0, 64.0]	35.0 [18.0, 64.0]
Rural						
Mean (SD)	0.512 (0.815)	0.128 (0.470)	0.326 (1.16)	0.501 (1.72)	0.286 (0.877)	0.316 (1.04)
Median [Min, Max]	0 [0, 1.00]	0 [0, 1.00]	0 [0, 1.00]	0 [0, 1.00]	0 [0, 1.00]	0 [0, 1.00]
Married						
Mean (SD)	0.719 (0.860)	0.699 (1.00)	0.581 (1.33)	0.591 (2.00)	0.628 (1.28)	0.639 (1.32)
Median [Min, Max]	1.00 [0, 1.00]	1.00 [0, 1.00]	1.00 [0, 1.00]	0 [0, 1.00]	1.00 [0, 1.00]	1.00 [0, 1.00]
Income (by quartile)						
1st	1197 (29.9%)	2042 (26.8%)	2946 (36.3%)	414 (9.4%)	1477 (18.1%)	8076 (25.0%)
2nd	1085 (27.1%)	2632 (34.5%)	2089 (25.7%)	737 (16.7%)	1484 (18.2%)	8027 (24.9%)
3rd	938 (23.4%)	1449 (19.0%)	868 (10.7%)	808 (18.4%)	2186 (26.8%)	6249 (19.3%)
4th	454 (11.3%)	1191 (15.6%)	382 (4.7%)	1737 (39.5%)	1733 (21.3%)	5497 (17.0%)
Missing	333 (8.3%)	311 (4.1%)	1835 (22.6%)	705 (16.0%)	1263 (15.5%)	4447 (13.8%)
Education						
Less than basic	687 (17.1%)	836 (11.0%)	3088 (38.0%)	464 (10.5%)	2128 (26.1%)	7203 (22.3%)
Basic	507 (12.7%)	2159 (28.3%)	1482 (18.3%)	458 (10.4%)	1341 (16.5%)	5947 (18.4%)
Secondary	1866 (46.6%)	2463 (32.3%)	1485 (18.3%)	1808 (41.1%)	2915 (35.8%)	10537 (32.6%)
Higher education	947 (23.6%)	2167 (28.4%)	2065 (25.4%)	1671 (38.0%)	1759 (21.6%)	8609 (26.7%)
Wave						
1	0 (0%)	0 (0%)	2007 (24.7%)	0 (0%)	2000 (24.6%)	4007 (12.4%)
2	2000 (49.9%)	2549 (33.4%)	2002 (24.7%)	0 (0%)	2077 (25.5%)	8628 (26.7%)
3	0 (0%)	0 (0%)	2105 (25.9%)	2400 (54.5%)	2057 (25.3%)	6562 (20.3%)
4	2007 (50.1%)	2503 (32.8%)	2006 (24.7%)	0 (0%)	2009 (24.7%)	8525 (26.4%)
5	0 (0%)	2573 (33.7%)	0 (0%)	2001 (45.5%)	0 (0%)	4574 (14.2%)

Note: This table presents the descriptive statistics of the main variables. The mean and its clustered standard error are calculated using individual weights.

Table 2. Descriptive statistics at the district level

	Egypt	Jordan	Morocco	Sudan	Tunisia	Overall
Districts	**(N=159)**	**(N=47)**	**(N=67)**	**(N=49)**	**(N=210)**	**(N=532)**
Crop density						
Mean (SD)	64.7 (36.4)	18.7 (18.4)	39.8 (28.9)	25.9 (30.7)	55.1 (30.8)	50.1 (34.8)
Median [Min, Max]	85.3 [0, 98.0]	16.6 [0, 62.9]	45.0 [0, 87.1]	9.49 [0, 88.2]	68.2 [0, 94.3]	59.5 [0, 98.0]
Population density (log)						
Mean (SD)	8.23 (1.46)	5.64 (1.89)	4.80 (1.85)	4.58 (1.60)	5.63 (1.88)	6.21 (2.21)
Median [Min, Max]	7.89 [2.08, 11.1]	5.93 [-0.117, 9.42]	4.82 [-0.0336, 9.32]	4.52 [1.46, 8.39]	5.27 [0.888, 9.34]	6.07 [-0.117, 11.1]
Nightlight intensity (log)						
Mean (SD)	2.88 (1.02)	1.63 (1.15)	0.218 (1.23)	-0.658 (1.03)	1.11 (1.59)	1.41 (1.72)
Median [Min, Max]	2.51 [0.0334, 4.80]	1.55 [-1.06, 4.21]	-0.199 [-1.14, 3.99]	-1.12 [-1.45, 3.37]	0.563 [-0.941, 4.67]	1.40 [-1.45, 4.80]
Distance to the capital (log)						
Mean (SD)	4.42 (1.29)	6.32 (0.102)	5.49 (0.924)	5.44 (0.992)	4.48 (1.30)	4.84 (1.32)
Median [Min, Max]	4.67 [0.810, 6.64]	6.33 [6.10, 6.71]	5.52 [1.88, 7.39]	5.58 [1.91, 7.06]	4.89 [0.257, 6.14]	5.09 [0.257, 7.39]
Distance to a port (log)						
Mean (SD)	6.13 (0.151)	5.55 (0.437)	4.53 (1.09)	6.57 (0.691)	3.80 (1.07)	5.00 (1.38)
Median [Min, Max]	6.12 [5.63, 6.80]	5.69 [3.97, 6.20]	4.76 [1.39, 6.88]	6.57 [2.45, 7.49]	4.02 [0.147, 5.49]	5.30 [0.147, 7.49]

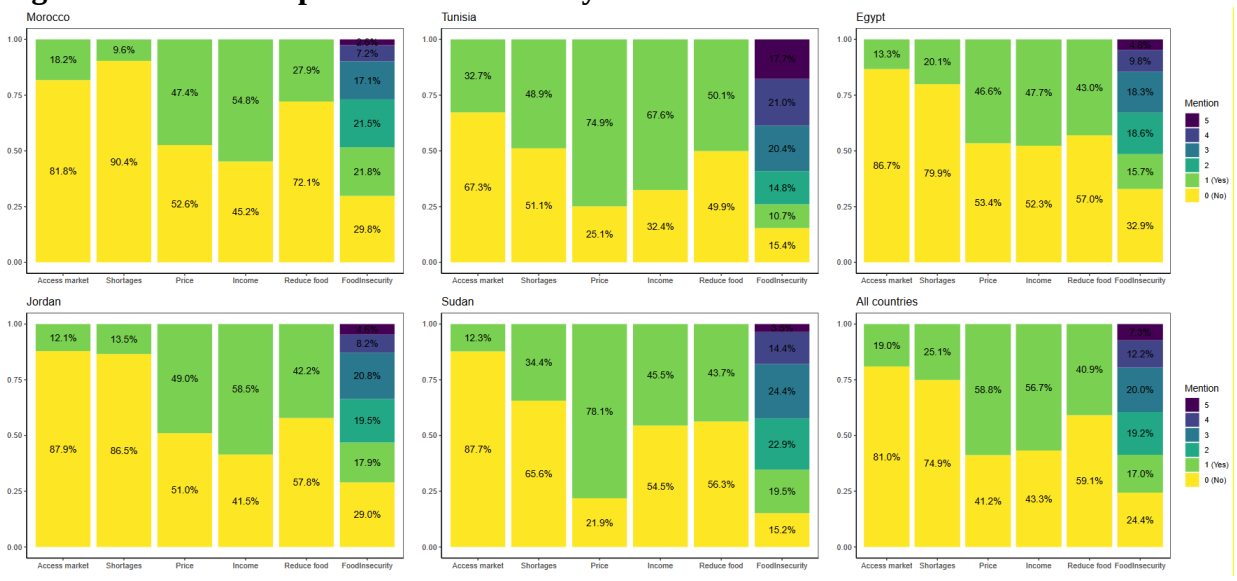
Note: This table presents the descriptive statistics of the main geographic variables.

The first five bars in Figure 4 show the answers to the five variables presented above, while the sixth bar shows the aggregation of the five previous variables, "food insecurity." According to panel F of this figure, it seems clear that the main issue faced by the population in those five countries was less related to the availability aspect of food security but rather the affordability aspect. The other panels, by country, do not change this finding while introducing some heterogeneity. The Sudanese and the Tunisians had an important problem of food shortages compared to their neighbors, with one-third and half of them mentioning it, respectively, while that number for other countries is around 15 percent.

However, even in those countries, the main issue remains affordability, with 78 percent and 75 percent of the population claiming that food price increase prevents them from buying the same amount of food as usual. Even if the situation is better in the three other countries, almost half the individuals surveyed report the same phenomenon. This food price increase is of even greater concern as around 57 percent of the interviewed believe they have suffered a drop in income. These problems of availability, especially affordability, led to a decrease in the amount of food consumed among 41 percent of respondents.

The "food insecurity" bar shows how widespread food insecurity is. More than 75 percent of the individuals experienced at least one food issue and around 40 percent experienced at least three. Again, there is heterogeneity, with Sudan and Tunisia being the most affected with around 85 percent of the population for at least one issue and 58 percent of the Tunisians affected by at least three issues.

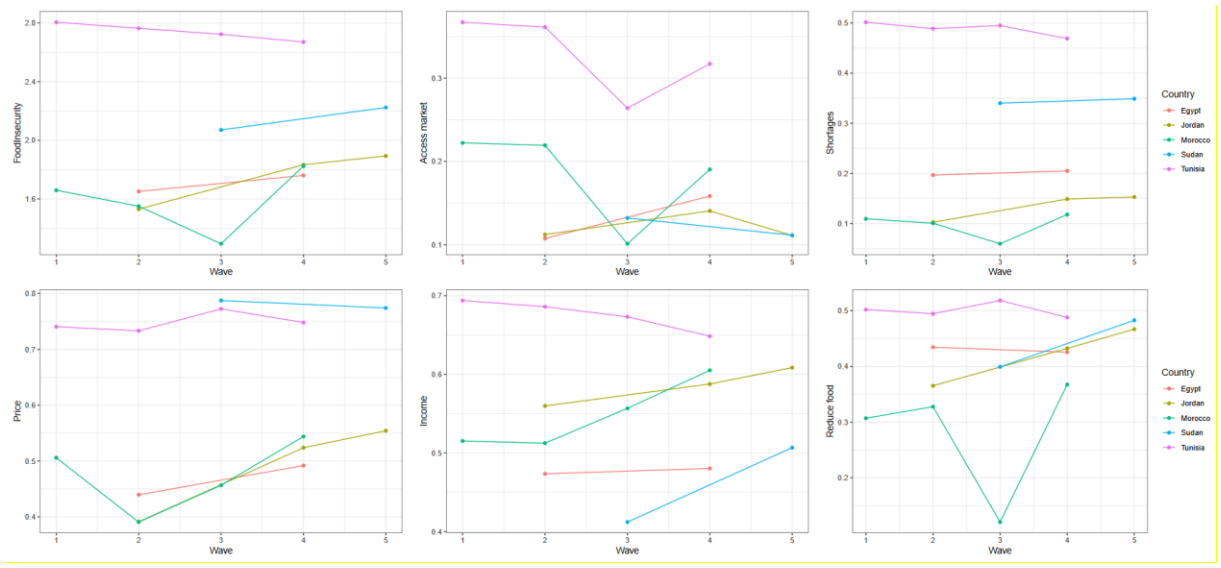
Figure 4. Stacked barplot of food insecurity variables



Note: Those figures show stacked barplot of food insecurity variables, by country and overall.

Figure 5 presents another way to visualize the food security situation. Each plot shows the average answer score, by wave, for each country, and overall. Again, Tunisia is a clear outlier. Tunisians mention way more that they face issues related to food security. These graphs also allow us to see a slight upward tendency across the waves, especially for "Income," "Price," and "Reduce food."

Figure 5. Food insecurity score by month



Note: Panels show the average food insecurity score by country, and by month, according to the different variables of food insecurity.

There is heterogeneity between countries and, likely, there is also heterogeneity between

individuals according to their sociodemographic profile. Table 3 presents student t-tests between each issue that an individual could have faced and its characteristics. This table indicates that for every issue, being more educated reduces the probability of reporting food insecurity, as well as being rich, living in a rural area, and not participating in the labor force. Being a male and being currently married also reduce the probability of being food insecure, except for food market access, which is not significant. Being employed has mixed results. Being an employee leads to mentioning that they do not have market access, but they do not mention buying less either because of the price increase or their income decrease. Logically, they report less frequently that they reduce the amount of food they eat.

Table 3. Student t-tests – All countries

Variables	Access market			Shortages			Price			Income			Reduce food		
	0	1	Difference	0	1	Difference	0	1	Difference	0	1	Difference	0	1	Difference
Education	0.260	0.140	0.12 ***	0.301	0.224	0.078 ***	0.661	0.530	0.132 ***	0.696	0.461	0.235 ***	0.507	0.340	0.168 ***
Female	0.210	0.213	-0.004	0.257	0.286	-0.029 ***	0.580	0.644	-0.064 ***	0.583	0.622	-0.039 ***	0.411	0.475	-0.063 ***
Labor force participation	0.156	0.231	-0.076 ***	0.202	0.293	-0.091 ***	0.552	0.628	-0.076 ***	0.550	0.618	-0.067 ***	0.395	0.454	-0.059 ***
Rural	0.196	0.245	-0.049 ***	0.252	0.308	-0.056 ***	0.592	0.642	-0.05 ***	0.593	0.616	-0.023 ***	0.422	0.475	-0.053 ***
Married	0.214	0.210	0.004	0.259	0.276	-0.017 ***	0.563	0.633	-0.071 ***	0.545	0.631	-0.086 ***	0.372	0.477	-0.105 ***
Age > 35	0.209	0.214	-0.005	0.263	0.275	-0.012 **	0.576	0.637	-0.061 ***	0.559	0.638	-0.078 ***	0.392	0.482	-0.091 ***
Employed	0.206	0.217	-0.011 **	0.266	0.273	-0.006	0.623	0.591	0.032 ***	0.627	0.571	0.055 ***	0.466	0.410	0.056 ***
Income > 2nd	0.241	0.157	0.084 ***	0.279	0.258	0.021 ***	0.650	0.559	0.091 ***	0.693	0.464	0.229 ***	0.511	0.350	0.161 ***

Note: This table presents students' t-test on five issues of food insecurity in all the countries. All estimations are weighted using individual weights. * p<0.1, ** p<0.05, *** p<0.01.

The Jordan waves include two additional questions on the change in household spending on foods/goods compared to February 2020, before COVID-19. Table 4 presents the results of similar student t-tests using those additional questions. It indicates that individuals being less educated, male, living in a rural area, not married, older, not employed, and with a lower income, reduce their spending on food. All results are in line with those shown in Table 2.

Table 4. Student t-test – Jordan

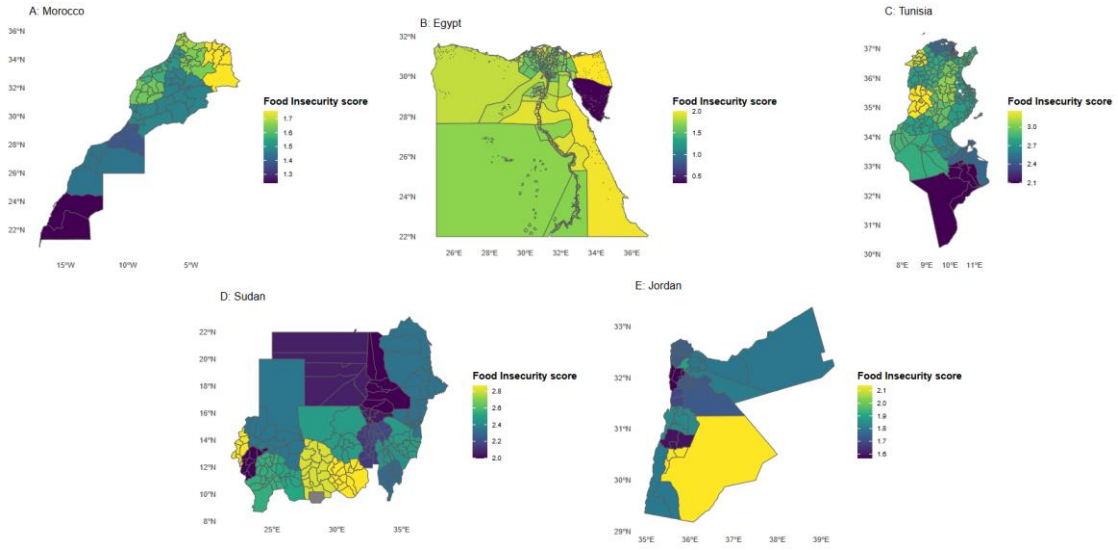
Variables	0	1	Difference	0	1	Difference
Education	0.498	0.323	0.175 ***	0.447	0.322	0.126 ***
Female	0.383	0.425	-0.043 ***	0.369	0.390	-0.021 *
Labor Force Participation	0.402	0.404	-0.002	0.387	0.376	0.011
Rural	0.412	0.343	0.069 ***	0.387	0.333	0.054 ***
Married	0.369	0.418	-0.049 ***	0.339	0.397	-0.059 ***
Age > 35	0.363	0.440	-0.077 ***	0.334	0.421	-0.086 ***
Employed	0.447	0.338	0.109 ***	0.420	0.319	0.101 ***
Income > 2nd	0.481	0.291	0.19 ***	0.432	0.296	0.135 ***

Note: This table present student t-tests on two variables of food and goods spending in Jordan. All estimations are weighted using individual weights. * p<0.1, ** p<0.05, *** p<0.01.

In addition to the intra-country heterogeneity due to individual characteristics, spatial heterogeneity is also expected. The economic development is not the same across the different regions of each country and, therefore, the intensity of reported food insecurity can vary. Figure 6 shows the average score of the variable "food insecurity" for each region. While the district level is available, the low number in some districts makes the maps less trustworthy. The regional maps show the importance of spatial differences. In Egypt, the difference between the food security score of the least food secure region and most food secure region is almost one point and half, and almost one point in Tunisia and Sudan. These are important gaps as the score is ranked from 0 to 5.

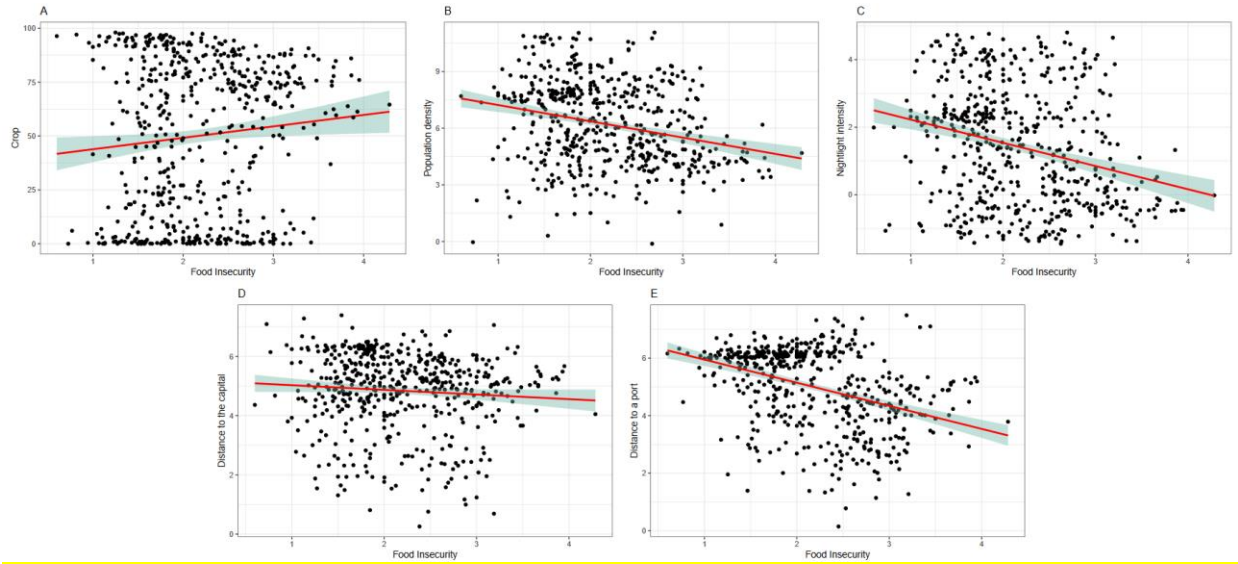
To understand which geographic aspect affects the food insecurity score, spatial data are employed. Using a simple correlation between the food insecurity score and measure of crop, as well as nightlight intensity, population density, and the distance to the capital or the closest port are estimated and plotted in Figure 7. The estimations are at the district level. The results seem to indicate that there is no correlation between the distance to the capital/seaport, the crop intensity, and the food insecurity score. However, the nightlight intensity as well as the population density correlate. The higher the nightlight/density, the lower the "food insecurity." It is not surprising as nightlight and density are proxies for economic development, and economic development is positively correlated with food security. However, it is interesting to verify that this link also holds at the district level.

Figure 6. Food insecurity score by region



Note: Those figures show the average food insecurity score by region for Morocco, Jordan, Tunisia, Egypt, and Sudan.

Figure 7. Correlation between food insecurity and geography



Note: Panel A shows the correlation between average districts' food insecurity score and crop intensity, Panel B with density population, Panel C with nightlight intensity, Panel D with distance to the capital, and Panel E with distance to a port. The correlations do not include districts with less than 10 individuals.

4. Empirical framework

The food security variables are regressed on a range of explanatory variables using a logit model for the five binary variables and an ordered logit regression for the food insecurity variable. All estimations are weighted using ERF individual weights.

The equation of the logit estimation is:

$$P(Y = 1) = \frac{1}{1+e^{-b_0-b_1x_1 \ldots . -b_kx_k}} \qquad (1)$$

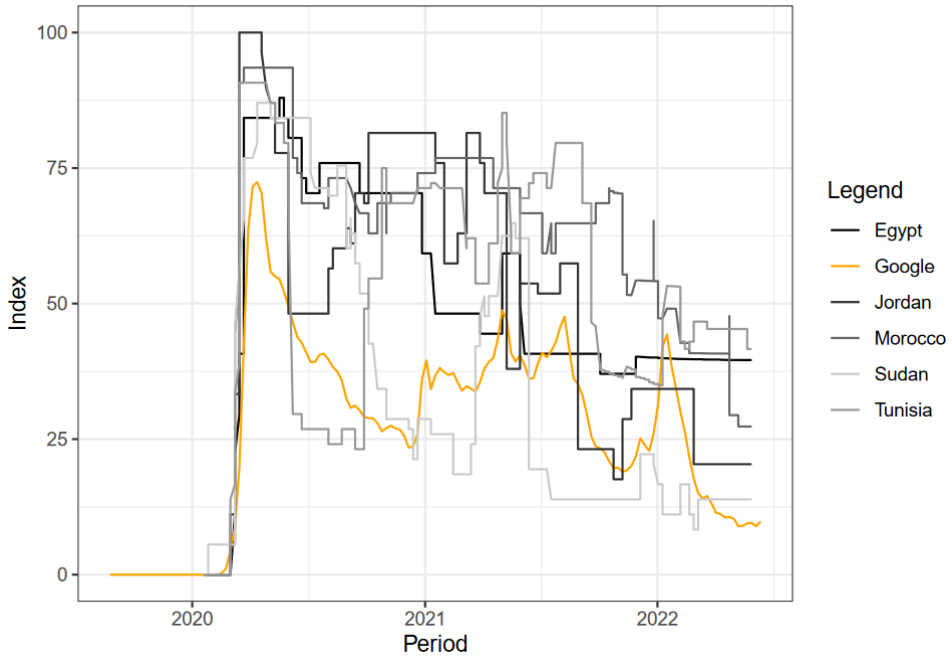
Y is one of the five dummy variables that mention a food insecurity issue, and x_1, x_2,… x_k are independent variables, such as the respondent's sex, employment status, labor force participation, age, education, urban/rural, country, and wave.

Another aspect that this study aims to analyze is the effect of the COVID-19 government policies on food insecurity. For this purpose, it is necessary to use an instrumental variables approach. Indeed, it is plausible that the stringency of government policies affects food insecurity through restricted mobility and closures. It is also plausible that the food insecurity situation of individuals may affect the stringency of COVID-19 policies. Although government stringency is more likely to be related to health indicators, such as the age structure of the population, hospitalization capacity, and access to vaccines, COVID-19 policies are also politically motivated. The choice

of the intensity of mobility restrictions or closure is determined by the ability of citizens to endure its policies. Thus, an endogeneity problem arises due to simultaneity.

To overcome the endogeneity issue, this study suggests relying on an instrumental variable: the Google Trends index for the search term "Covid." The Google Trends index gives the interest evolution of a topic in a country or region. The research term "Covid" is strongly correlated with the COVID-19 stringency measures. People were searching on Google for information on the pandemic while the government applied responses to it. To be sure to respect the "exclusion restriction," the Google Trends index of the term "Covid" is the average of those of MENA neighbors of each country except for the ones included in this study. Morocco is paired with Algeria and Mauritania, Tunisia with Algeria, and Libya, Sudan with Libya, and Chad, Jordan with Saudi Arabia, Iraq, Israel, and Syria, and, finally, Egypt is paired with Saudi Arabia, Israel, and Libya. Figure 8 shows the Google Trends index compared to the "Stringency Index." Graphically, it appears that both are correlated.

Figure 8. Google Trend Index and Stringency Index



Note: The figure plots together the Google Trend index and the Stringency Index since the beginning of the pandemic.

The equation using this instrumental variable approach is:

$$Y_{ijt} = \alpha + \beta Stringency_{jt} + \delta X_{ijt} + \mu_j + \gamma_t + \varepsilon_{ijt} \qquad (2)$$

Y_{ijt} is the aggregated score "food insecurity." $Stringency_{jt}$ is the score of the Stringency index of the country/region j, lagged by two weeks. X_{ijt} a set of variables on the characteristics of the individual i, in country/region j, at period t. μj is a country/region fixed effect, and γ_t is a period fixed effect. $Stringency_{jt}$ is the variable instrumented by the Google Trends index.

5. Results

Following those descriptive statistics, Table 4 presents the results of multiple logistic estimations for the five food security indicators. The results confirm what has been illustrated with the student t-tests. Being female, not employed, participating in the labor force, and having a low level of education are factors that increase the likelihood of reporting food insecurity. The age criteria have mixed results according to thefood security dimension. Table 5 presents similar results with an ordered logistic regression for all countries and for each country separately.

The government policies to tackle COVID-19 could partly explain the food insecurity score of individuals. Table7 presents the estimations of equation 2 with and without using the instrumental approach. The estimations using a simple OLS show a negative and significant effect of government policies on food insecurity. It indicates that people report fewer issues linked to food insecurity when stringency policies are high. When studying countries separately, the effect is positive and significant only for Jordan. However, the instrumental approach indicates that the government policies are not correlated with the food insecurity score used in this study. The F-statistic, computed by following Olea and Pflueger (2013), confirms that the instrument is strong enough for the estimations (except for Morocco).

Table 5. Logit table - Five issues

Variable	Access Market		Shortages		Price		Income		Reduce food	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Female (Male omit)										
Female	0.041	0.043	0.032	0.035	0.236***	0.235***	0.052*	0.053*	0.175***	0.172***
	(0.038)	(0.038)	(0.035)	(0.036)	(0.032)	(0.032)	(0.031)	(0.031)	(0.031)	(0.031)
Employed (Not employed omit)										
Employed	-0.051	-0.059	-0.107***	-0.109***	-0.249***	-0.248***	-0.487***	-0.492***	-0.348***	-0.352***
	(0.041)	(0.042)	(0.039)	(0.040)	(0.036)	(0.037)	(0.036)	(0.037)	(0.035)	(0.035)
Labor force participation (Not in labor omit)										
In labor force	0.391***	0.387***	0.394***	0.392***	0.548***	0.546***	0.744***	0.739***	0.610***	0.613***
	(0.049)	(0.049)	(0.046)	(0.046)	(0.040)	(0.040)	(0.040)	(0.041)	(0.039)	(0.039)
Rural (Urban omit)										
Rural	0.119***	0.098**	0.079**	0.082**	-0.061*	-0.029	-0.116***	-0.062*	-0.101***	-0.051
	(0.036)	(0.039)	(0.035)	(0.039)	(0.032)	(0.035)	(0.032)	(0.035)	(0.031)	(0.034)
Married (Not married omit)										
Married	-0.046	-0.049	-0.015	0.000	0.156***	0.164***	0.140***	0.152***	0.077**	0.080**
	(0.041)	(0.041)	(0.039)	(0.040)	(0.034)	(0.035)	(0.034)	(0.034)	(0.034)	(0.034)
Age by group (18-24 omit)										
25-29	-0.014	-0.015	0.090	0.099*	0.208***	0.206***	0.305***	0.304***	0.285***	0.293***
	(0.058)	(0.059)	(0.055)	(0.055)	(0.048)	(0.048)	(0.047)	(0.047)	(0.049)	(0.049)
30-34	-0.095	-0.086	-0.011	0.009	0.263***	0.253***	0.365***	0.356***	0.357***	0.358***
	(0.061)	(0.061)	(0.058)	(0.059)	(0.050)	(0.051)	(0.050)	(0.050)	(0.051)	(0.051)
35-39	-0.240***	-0.237***	-0.126**	-0.115*	0.340***	0.335***	0.419***	0.412***	0.417***	0.415***
	(0.067)	(0.067)	(0.063)	(0.064)	(0.055)	(0.055)	(0.054)	(0.055)	(0.054)	(0.055)
40-44	-0.215***	-0.215***	-0.204***	-0.203***	0.312***	0.305***	0.427***	0.425***	0.457***	0.463***
	(0.067)	(0.067)	(0.064)	(0.065)	(0.055)	(0.056)	(0.055)	(0.056)	(0.055)	(0.056)
45-49	-0.307***	-0.295***	-0.235***	-0.236***	0.324***	0.318***	0.441***	0.437***	0.559***	0.568***
	(0.074)	(0.075)	(0.071)	(0.072)	(0.061)	(0.062)	(0.061)	(0.061)	(0.060)	(0.061)
50-54	-0.198***	-0.200***	-0.060	-0.060	0.457***	0.451***	0.555***	0.545***	0.728***	0.735***
	(0.072)	(0.073)	(0.069)	(0.070)	(0.062)	(0.062)	(0.061)	(0.062)	(0.060)	(0.061)
55-59	-0.234***	-0.238***	-0.130	-0.139*	0.351***	0.340***	0.304***	0.294***	0.510***	0.518***
	(0.086)	(0.087)	(0.082)	(0.083)	(0.072)	(0.073)	(0.071)	(0.072)	(0.071)	(0.072)
60-64	-0.262***	-0.267***	-0.121	-0.119	0.267***	0.261***	0.142*	0.123*	0.415***	0.413***
	(0.087)	(0.088)	(0.083)	(0.084)	(0.075)	(0.076)	(0.074)	(0.074)	(0.073)	(0.074)
Education (Less than basic omit)										
Basic	-0.101**	-0.123**	-0.126***	-0.137***	-0.046	-0.045	-0.114**	-0.104**	-0.171***	-0.167***
	(0.049)	(0.049)	(0.049)	(0.049)	(0.045)	(0.045)	(0.046)	(0.046)	(0.043)	(0.043)
Secondary	-0.341***	-0.367***	-0.382***	-0.409***	-0.271***	-0.272***	-0.411***	-0.398***	-0.499***	-0.494***
	(0.046)	(0.047)	(0.045)	(0.046)	(0.042)	(0.043)	(0.042)	(0.042)	(0.040)	(0.040)
Higher Education	-0.534***	-0.562***	-0.724***	-0.761***	-0.478***	-0.479***	-0.843***	-0.833***	-0.800***	-0.799***
	(0.054)	(0.055)	(0.052)	(0.053)	(0.045)	(0.046)	(0.045)	(0.045)	(0.044)	(0.045)
Level of income (First quartile omit)										
Second quartile	-0.236***	-0.251***	-0.302***	-0.308***	-0.290***	-0.299***	-0.407***	-0.409***	-0.406***	-0.417***
	(0.042)	(0.042)	(0.042)	(0.042)	(0.037)	(0.037)	(0.037)	(0.037)	(0.035)	(0.036)
Third quartile	-0.547***	-0.550***	-0.607***	-0.601***	-0.619***	-0.626***	-0.909***	-0.925***	-0.843***	-0.865***
	(0.049)	(0.050)	(0.047)	(0.048)	(0.042)	(0.043)	(0.042)	(0.042)	(0.041)	(0.041)
Fourth quartile	-0.919***	-0.936***	-0.940***	-0.949***	-1.391***	-1.417***	-1.586***	-1.609***	-1.452***	-1.481***
	(0.060)	(0.061)	(0.053)	(0.054)	(0.049)	(0.050)	(0.047)	(0.048)	(0.048)	(0.049)
Country (Egypt omit)										
Jordan	0.038		-0.493***		-0.047		0.368***		-0.191***	
	(0.065)		(0.060)		(0.047)		(0.048)		(0.047)	
Morocco	0.284***		-1.096***		-0.213***		0.081		-0.982***	
	(0.064)		(0.066)		(0.049)		(0.050)		(0.051)	
Sudan	0.604***		1.102***		1.903***		0.469***		0.768***	
	(0.086)		(0.073)		(0.069)		(0.064)		(0.064)	
Tunisia	1.358***		1.508***		1.422***		1.105***		0.457***	
	(0.060)		(0.054)		(0.051)		(0.050)		(0.048)	
Wave (First wave omit)										
Wave 2	-0.144**	-0.147***	-0.118*	-0.114*	-0.351***	-0.349***	-0.008	-0.014	-0.027	-0.028
	(0.056)	(0.057)	(0.061)	(0.061)	(0.054)	(0.054)	(0.054)	(0.054)	(0.053)	(0.053)
Wave 3	-0.571***	-0.578***	-0.118*	-0.120*	-0.014	-0.010	-0.028	-0.033	-0.368***	-0.370***
	(0.061)	(0.061)	(0.063)	(0.063)	(0.057)	(0.057)	(0.056)	(0.056)	(0.056)	(0.056)
Wave 4	-0.102*	-0.113**	0.001	-0.003	0.084	0.088	0.121**	0.116**	0.111**	0.112**
	(0.056)	(0.057)	(0.061)	(0.061)	(0.054)	(0.055)	(0.054)	(0.054)	(0.053)	(0.054)
Wave 5	-0.446***	-0.460***	0.066	0.070	0.179***	0.183***	0.333***	0.334***	0.229***	0.234***
	(0.080)	(0.081)	(0.075)	(0.076)	(0.066)	(0.067)	(0.066)	(0.066)	(0.065)	(0.065)
Observations and Fixed effect										
Num.Obs.	27849	27849	27849	27849	27849	27849	27849	27849	27849	27849
F.E	Country	Admin	Country	Admin	Country	Admin	Country	Admin	Country	Admin

Note: All estimations are weighted using individual weights. * p<0.1, ** p<0.05, *** p<0.01.

Table 6. Logit table – Food insecurity

Variable	Food insecurity						
	Country	Admin	Morocco	Tunisia	Egypt	Sudan	Jordan
Female (Male omit)							
Female	0.198***	0.225***	0.274***	0.187***	0.349***	0.276***	0.147***
	(0.025)	(0.026)	(0.057)	(0.054)	(0.078)	(0.069)	(0.051)
Employed (Not employed omit)							
Employed	-0.332***	-0.336***	-0.642***	-0.341***	-0.478***	0.263***	-0.245***
	(0.028)	(0.028)	(0.060)	(0.060)	(0.089)	(0.070)	(0.059)
Labor force participation (Not in labor omit)							
In labor force	0.791***	0.783***	0.893***	1.169***	0.828***	0.846***	0.515***
	(0.032)	(0.032)	(0.071)	(0.069)	(0.094)	(0.089)	(0.058)
Rural (Urban omit)							
Rural	-0.127***	-0.100***	-0.117**	0.015	0.088	-0.147*	-0.008
	(0.026)	(0.028)	(0.055)	(0.056)	(0.077)	(0.081)	(0.070)
Married (Not married omit)							
Married	0.186***	0.172***	0.315***	0.099*	0.202**	-0.099	0.347***
	(0.028)	(0.028)	(0.057)	(0.059)	(0.083)	(0.077)	(0.058)
Age by group (18-24 omit)							
25-29	0.212***	0.211***	-0.288***	0.242***	0.544***	0.381***	0.288***
	(0.040)	(0.040)	(0.088)	(0.091)	(0.115)	(0.095)	(0.081)
30-34	0.116***	0.128***	-0.248***	0.088	0.366***	0.374***	0.153*
	(0.042)	(0.042)	(0.090)	(0.092)	(0.122)	(0.111)	(0.086)
35-39	0.158***	0.145***	-0.175*	0.139	0.112	0.485***	0.193**
	(0.045)	(0.045)	(0.098)	(0.099)	(0.125)	(0.115)	(0.092)
40-44	0.160***	0.171***	-0.442***	0.095	0.151	0.769***	0.322***
	(0.046)	(0.047)	(0.103)	(0.104)	(0.132)	(0.143)	(0.087)
45-49	0.167***	0.208***	-0.528***	0.109	0.350**	0.890***	0.486***
	(0.048)	(0.049)	(0.101)	(0.108)	(0.144)	(0.161)	(0.092)
50-54	0.262***	0.307***	-0.482***	0.425***	0.364**	0.409***	0.660***
	(0.050)	(0.051)	(0.106)	(0.106)	(0.146)	(0.158)	(0.098)
55-59	-0.096*	-0.070	-0.740***	-0.033	-0.109	-0.211	0.314***
	(0.056)	(0.057)	(0.115)	(0.114)	(0.166)	(0.186)	(0.119)
60-64	-0.034	-0.036	-0.705***	0.169	-0.494***	0.385*	0.240**
	(0.061)	(0.062)	(0.136)	(0.126)	(0.173)	(0.217)	(0.116)
Education (Less than basic omit)							
Basic	-0.231***	-0.231***	-0.152**	-0.541***	-0.068	-0.251**	-0.091
	(0.032)	(0.033)	(0.065)	(0.068)	(0.123)	(0.098)	(0.065)
Secondary	-0.587***	-0.571***	-0.751***	-0.668***	-0.412***	-0.246***	-0.558***
	(0.034)	(0.034)	(0.094)	(0.069)	(0.080)	(0.095)	(0.072)
Higher Education	-0.981***	-0.975***	-0.980***	-1.271***	-0.891***	-0.170*	-0.917***
	(0.036)	(0.037)	(0.119)	(0.075)	(0.097)	(0.100)	(0.072)
Level of income (First quartile omit)							
Second quartile	-0.424***	-0.423***	-0.678***	-0.246***	-0.276***	-0.102	-0.526***
	(0.029)	(0.029)	(0.055)	(0.065)	(0.078)	(0.100)	(0.057)
Third quartile	-0.911***	-0.918***	-1.201***	-0.814***	-0.616***	-0.539***	-1.112***
	(0.035)	(0.035)	(0.107)	(0.068)	(0.088)	(0.106)	(0.070)
Fourth quartile	-1.370***	-1.412***	-1.641***	-1.584***	-1.123***	-0.590***	-1.681***
	(0.040)	(0.041)	(0.171)	(0.083)	(0.123)	(0.107)	(0.081)
Country (Egypt omit)							
Jordan	-0.029						
	(0.041)						
Morocco	-0.314***						
	(0.044)						
Sudan	1.226***						
	(0.052)						
Tunisia	1.592***						
	(0.043)						
Wave (First wave omit)							
Wave 2	-0.032	-0.045	0.121*	-0.149**			
	(0.044)	(0.044)	(0.069)	(0.066)			
Wave 3	-0.236***	-0.239***	-0.198***	-0.201***			
	(0.045)	(0.045)	(0.066)	(0.066)			
Wave 4	0.188***	0.175***	0.868***	-0.390***	0.156***		0.348***
	(0.044)	(0.044)	(0.070)	(0.066)	(0.060)		(0.053)
Wave 5	0.364***	0.341***				0.690***	0.418***
	(0.053)	(0.054)				(0.063)	(0.053)
Observations and fixed effects							
Num.Obs.	27614	27614	6155	6882	3650	3711	7216
F.E	Country	Admin	Admin	Admin	Admin	Admin	Admin

Note: All estimations are weighted using individual weights. * p<0.1, ** p<0.05, *** p<0.01.

Table 7. Instrumental variables table – Food insecurity

Variable	Country	Admin	Egypt	Morocco	Jordan	Sudan	Tunisia
OLS							
Stringency	-0.0052**	-0.0047**	0.0064	-0.0181	0.0228**	-0.0062	-0.0011
IV							
Stringency	0.0094	0.0066	0.0184	1.7973	0.0269	-0.0733	-0.0012
	1764.076	443.109	77.096	4.968	67.408	719.28	1694.306
Num.Obs.	32296	32296	4007	8120	7625	4401	8143
F.E	Country	Admin	Admin	Admin	Admin	Admin	Admin

Note: All estimations are weighted using individual weights. * p<0.1, ** p<0.05, *** p<0.01.

6. Conclusion

This study assesses the food insecurity situation during the COVID-19 pandemic in Egypt, Jordan, Morocco, Sudan, and Tunisia. Focusing on the five food security issues asked by the ERF interviewers, the heterogeneity between countries, regions, and individuals has been measured using descriptive statistics and logit estimation.

At the country level, Tunisia and (to a lesser extent) Sudan are much more affected by food insecurity than their neighbors. Both countries are more affected in every aspect than others, but it is important to note that the availability aspect of food security is strongly affected only in Tunisia. The accessibility dimension is still the major driver of food insecurity, but food shortages seem to have been an important phenomenon in Tunisian daily life during COVID-19. At the regional/district level, descriptive statistics show that heterogeneity exists between the different regions up to one point on a grading of five. In addition, the nightlight and the population density seem to be correlated with the food security of the districts.

At the individual level, the estimations show that multiple socioeconomic characteristics emerge to understand which profile is more at risk of being food insecure in the five MENA countries: it is a woman, not married, with low education, lives in an urban area, and participates in the labor force while unemployed. The profile found was expected and close to what can be found in many studies tackling inequality. This shows that the pandemic exacerbates the existing inequalities.

Using an instrumental variable approach, the results show that the government policies set up during the pandemic had no effect on the population's food security. The Google Trends Index is used as an instrumental variable.

An aspect that this paper did not focus on but should be of interest is how few people mention having received support from the government during the pandemic. Few individuals received support, except for Egypt, thanks to its ration cards program. In Morocco, Tunisia, and Sudan, around 90 percent of the individuals had no support from the government. Egypt is the country that helped the most people, with almost 80 percent of individuals mentioning support. It is also the country with a higher number of people declaring having no food insecurity issue.

To conclude, these results are policy-relevant. Designing policy interventions based on the sociodemographic characteristics of vulnerable individuals would reduce the threat of food insecurity while taking into consideration the limited fiscal space of the governments in the region. These targeted policies are required, especially in the context of shocks such as the pandemic and the Russian invasion of Ukraine.

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Appendix

Table A1. Description of the variables

Variables	Description	Units	Source
Access market	Difficulties in going to food markets due to mobility restrictions imposed by government/closures.	Binary	CMMHH
Shortages	Unable to buy the amount of food we usually buy because of shortages of food in markets.	Binary	CMMHH
Price	Unable to buy the amount of food we usually buy because the price of food increased.	Binary	CMMHH
Income	Unable to buy the amount of food we usually buy because our household income has dropped.	Binary	CMMHH
Reduce food	Had to reduce the number of meals and/or the portion of each meal we would usually eat.	Binary	CMMHH
Food Insecurity	Sum of the five previous variables.	Score (0-5)	CMMHH
Female	Sex of the individual.	Binary	CMMHH
Employed	Employment status of the individual.	Binary	CMMHH
Labor force participation	Participation at the labor market of the individual.	Binary	CMMHH
Age	Age of the individual.	Value (18-64)	CMMHH
Rural	Type of area where the individual lived.	Binary	CMMHH
Married	Marital situation of the individual.	Binary	CMMHH
Income (by quartile)	Quartile of income of the individual.	Quartile	CMMHH
Education	Level of education of the individual.	Score (1-4)	CMMHH
Crop Density	Percent crop cover of the district.	Percent of crop cover	Lu et al. (2020)
Population Density	Population density of the district.	Ln of people per km2	CIESIN
Nightlight intensity	Nightlight intensity of the district.	Ln of value	VIIRS
Distance to the capital	Closest distance between the capital and the district.	Ln of km	Natural Earth
Distance to a port	Closest distance between a port and the district.	Ln of km	AmeriGeo

Note: This table presents the variables, their units, source, and a description.