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FOOD INSECURITY: THE ROLE OF INCOME INSTABILITY AND SOCIAL TRANSFERS IN TUNISIA DURING COVID-19[1]

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Abstract

In this study, we assess the implications of COVID-19 shocks on household income, food security, and the role of social protection in Tunisia. We used data from the four waves of the Combined COVID-19 MENA Monitor Household Survey conducted by the Economic Research Forum between February 2020 and June 2021. First, the results show that low-income and labor income-dependent households are the most vulnerable to shocks induced by COVID-19 and that their food habits deteriorated considerably. A total of 78.4 percent of respondents declared that they are in severe food insecurity. Second, we find that food insecurity showed a higher increase in urban areas than in rural areas; self-produced food by farmers who inhabit rural areas represented a food safety net during the pandemic. Finally, households that received a social transfer did not manage to overcome severe food insecurity. The study proves that government social policies have failed to absorb the harmful effects of COVID-19. This is because social protection is mainly oriented toward retired people and excludes those who are most vulnerable to economic shocks. As a result, extending social protection coverage to households that face transitory poverty poses a challenge.

Keywords: Food security, Income volatility, Social protection, Multinomial logit, Tunisia.
JEL Classifications: J4, Q18, F52.

ملخص

في هذه الدراسة، نقيم آثار صدمات وباء الكورونا على دخل الأسرة والأمن الغذائي ودور الحماية الاجتماعية في تونس. استخدمنا بيانات من الموجات الأربع لمسح الكوفيد-19 المشترك لمراقبة الشرق الأوسط وشمال إفريقيا للأسر المعيشية الذي أجراه منتدى البحوث الاقتصادية بين فبراير 2020 ويونيو 2021. أولاً، تظهر النتائج أن الأسر المعيشية ذات الدخل المنخفض والمعتمدة على العمل هي الأكثر عرضة للصدمات الناجمة عن الكوفيد-19 وأن عاداتها الغذائية تدهورت بشكل كبير. أعلن ما مجموعه 78.4 في المائة من المستجيبين أنهم يعانون من انعدام الأمن الغذائي الشديد. ثانيا، نجد أن انعدام الأمن الغذائي أظهر زيادة في المناطق الحضرية تفوق الزيادة في المناطق الريفية ؛ ويمثل الغذاء المنتج ذاتيًا من قبل المزارعين الذين يعيشون في المناطق الريفية شبكة أمان غذائي أثناء الوباء. أخيرًا، لم تتمكن الأسر التي حصلت على تحويل اجتماعي من التغلب على انعدام الأمن الغذائي الحاد. تثبت الدراسة أن السياسات الاجتماعية الحكومية فشلت في استيعاب الآثار الضارة لكوفيد-19. وذلك لأن الحماية الاجتماعية موجهة بشكل أساسي نحو المتقاعدين وتستبعد أولئك الأكثر عرضة للصدمات الاقتصادية. ونتيجة لذلك، فإن توسيع نطاق تغطية الحماية الاجتماعية لتشمل الأسر المعيشية التي تواجه فقرا مؤقتا يشكل تحديا.

1. Introduction

Food security is one of the main concerns of the Sustainable Development Goals (SDGs) established in 2015 by the United Nations (UN). SDG 2, which was entitled, "End hunger, achieve food security, improve nutrition, and promote sustainable agriculture," targets a "zero hunger" objective, especially in developing regions. As defined by the Food and Agriculture Organization (FAO, 1996): "Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life."

Household exposure to the different crises that hit the economy remains an important reason behind social and economic vulnerability in developing countries (Edelbloude et al., 2017; Habib, 2022; Nguyen et al., 2020; World Bank, 2021). For example, the emergence of the COVID-19 pandemic has had global consequences, including strong inflationary surges, food shortages, and disruptions to global supply chains (Barrett, 2020). FAO estimates show that between 702 and 828 million people were undernourished in 2021 worldwide. This number increased by around 103 million additional people between 2019 and 2020 and 46 million more in 2021 (FAO, 2022). The same source indicates that the prevalence of moderate or severe food insecurity increased by around 2.3 billion people worldwide in 2021. In addition, the food sector has been disrupted by emerging diseases, including the COVID-19 pandemic followed by the war between the world's largest grain producers (Russia and Ukraine) and climate extreme changes (Abis and Mordacq, 2022). The burden of this shock is not equally borne by society as a whole; low-income households are already suffering from declining income and poverty. In the literature, several studies have revealed many job losses that have affected income, prices, and food availability in many markets around the world, particularly in low-income and vulnerable groups (FAO, 2022; Forsythe et al., 2020; Krafft et al., 2021).

Tunisia, like many developing countries, is committed to achieving SDGs by 2030 through its national development strategies. However, several obstacles hinder the achievement of these goals, in particular SDG 2, which aims to eliminate hunger and ensure food security. The food security situation in Tunisia is not favorable. According to a FAO-published report, more than 1.5 million Tunisians faced severe or moderate levels of food insecurity in 2022, representing 12.6 percent of the Tunisian population. The inflation rate continued to rise to reach 10.2 percent in December 2022 after 9.8 percent in the previous month (INS, 2022). According to the Tunisian National Institute of Statistics (INS), the main reason for this increase in inflation is the steady increase in the consumer price index (CPI) of food products by about 13 percent in September 2022, although a large range of basic food products was previously reported as being in limited quantities on the markets in Tunisia. Rising unemployment and food prices caused by the COVID-19 pandemic and the Russian-Ukrainian conflict are among the reasons behind the prevalence of severe food insecurity in Tunisia. Such insecurity was recorded at three percent between 2019 and 2021 (FAO, 2022). In addition, the deterioration of purchasing power and the increase in regional disparities significantly reduced the ability of vulnerable households to ensure a balanced and sufficient diet, thereby threatening social stability.

Although there is a plethora of studies on estimating the economic impacts of the COVID-19 pandemic on economic indicators such as poverty, GDP growth, employment…etc. (ILO, 2020; Nicola et al., 2020; Sumner et al., 2020; World Bank, 2021), these models failed to predict how the pandemic and associated lockdown policies would affect the vulnerability of individuals at the household level to food insecurity. The economic impact of the COVID-19 crisis has differently affected households in proportion to their socioeconomic status, access to markets, food strategies…etc. Severe social measures to limit the spread of COVID-19, including self-isolation, social distancing, and school and workplace closures, have come alongside job losses and income volatility (Aggarwal et al, 2020; Krafft et al., 2021; Maredia et al., 2022). The decrease in working hours in 2020 was about four times greater than during the 2009 global financial crisis (ILO, 2020). Consequently, this may have affected the well-being of low-income families by reducing their ability to meet basic food needs and increasing their food insecurity (Mueller et al., 2021; Torero, 2020).

Generally, the effects of these shocks are much more severe in countries where social insurance mechanisms and remedial strategies are relatively limited (Dabla-Norris and Gündüz, 2014). In this regard, the development literature supports the assumption that social transfer programs such as direct cash and in-kind transfers improve food security, especially among employees whose incomes have been affected by the COVID-19 restrictions (Jeong and Trako, 2022; Miller et al., 2020; Ozili, 2020). However, the factors of food insecurity mainly relate to poverty, poor access to basic social services, and the inadequacy of certain public policies (Abdullah et al., 2019; FAO, 2015; Sriram and Tarasuk, 2016).

For Tunisia, studies about these issues are limited. Therefore, the contribution of this paper is twofold. First, to the best of our knowledge, this paper is among the first studies to examine the effects of COVID-19 on household income and food insecurity in Tunisia. Second, we used a new survey consisting of a rich panel dataset covering the four waves of the COVID-19 pandemic. The main objective of this survey is to monitor the impact of the health crisis on Tunisian households while taking the strong labor market fluctuations into account. When measured against the pre-pandemic period and subsequent periods, these fluctuations would help determine the impact of the COVID-19 pandemic on households' well-being. This is an extremely important feature, as food insecurity increased significantly at the beginning of the pandemic.

This study complements existing knowledge to guide policymakers and development practitioners toward prioritizing the households most at risk during the pandemic and designing better coping mechanisms. In this regard, a better understanding of the potential role of social transfers (cash and food) in improving household well-being can provide important policy lessons to support more successful food security transitions and sustainable resilience.

The objective of this study is to examine the implications of income instability and social protection measures adopted by the Tunisian government during the global COVID-19 pandemic on food insecurity in Tunisian households. First, we use the Food Insecurity

Experience Scale (FIES) proposed by FAO to determine food insecurity levels. Following the item-response theory, we identify three food insecurity levels (mild, moderate, severe) among respondents aged between 15 and 64. Second, we used a multinomial logistic model to examine the impact of income instability and social protection mechanisms on food security during the pandemic. This model is considered flexible because the dependent variable is not limited to two categories.

The results of our study illustrate that a substantial burden of food insecurity is prevalent among wage earners and business owners who depended on labor income during the COVID-19 period. We find that low-income households are more likely to be affected by the negative consequences of COVID-19 and experience seriously deteriorated eating habits. Food insecurity has increased more in urban areas than in rural areas, and self-produced food by farmers who inhabit rural areas may have acted as a food safety net during the pandemic. Our study also shows that households that received a social transfer (food or cash) did not manage to survive the basket of severe food insecurity.

The rest of this paper is structured as follows. The second section presents a brief overview of our data sources, the COVID-19 pandemic in Tunisia, and the policy response to mitigate the effects of the pandemic during the four waves. The third section provides a detailed description of our methodology. The fourth section is a summary of the obtained results. The last section concludes and proposes recommendations and policy implications.

2. Framework and data

2.1 Overview of COVID-19 in Tunisia and policy response

In March 2020, the World Health Organization (WHO) gave the SARS-CoV-2 disease the official name of "Coronavirus Disease-2019, COVID-19" (Cucinotta and Vanelli, 2020). As an exogenous shock in a globalized world, the pandemic resulted in various socioeconomic and political outcomes for all countries regardless of their development levels (IMF, 2021; Nicola et al., 2020; Ozili, 2020; Sumner et al., 2020). Historically, when pandemics happen, they come in waves. Then, each country adopts a set of economic and social measures to manage the waves of the pandemic and to mitigate their harmful effects on society and the economy (ILO, 2020; IMF, 2021).

In accordance with WHO guidelines and as in most countries around the world, Tunisian authorities proposed a series of measures to mitigate the effects of the pandemic. Tunisia reported the first confirmed case on 2 March 2020. Thanks to the government's actions in adopting a series of dynamically applied health and lockdown measures, the spread of the virus remained relatively contained. At this point, the country had the lowest number of cumulative deaths per million people due to COVID-19 by the end of April 2020 (Roser et al., 2020). On 13 June 2020, the date of total control of the health situation, Tunisia initiated a strategy of relaxation and the reopening of the economy in phases, in addition to the reopening of borders. Such measures led to a further increase in the number of new cases in Tunisia, where a second wave hit during the last quarter of 2020 and the first quarter of 2021 (Roser et al., 2020). The death rate increased exponentially to reach 745 individuals per

million at the end of March 2021 (Hale et al., 2020; Roser et al., 2020). As a result, the government re-announced a series of measures to reduce the transmission rate of COVID-19 and to prevent this exponential increase of the virus. In March 2021, Tunisia launched its vaccination campaign, starting with health professionals and the elderly. The arrival of the Delta variant marked the fourth wave of COVID-19 since early June 2021. The Tunisian health infrastructure became overloaded and there was a sharp increase in the number of COVID-19 positive cases and deaths due to the lack of vaccines and delays in receiving them. As a result, many regions were in full lockdown for two weeks.

These measures all had an impact on many professional categories. Using comparative figures recorded in February 2020 and November 2021, Krafft et al. (2021) finds that 82 percent of the unemployed remained unemployed, 16 percent of private sector workers lost their jobs, and individuals working in the public sector retained the same status. Therefore, loss of employment means loss of income and financial benefits. Due to COVID-19, surveyed Tunisian households experienced income declines by more than half (51 percent) between February 2020 and February 2021. The second and third quartiles recorded the largest losses of about 49 percent. Because of this drop in income, more than three-quarters of the surveyed households reported being unable to purchase the usual quantities of food (Krafft et al., 2021). Yabilé (2013) asserts that the households most exposed to undernutrition risks are those with the lowest income. Moreover, the rapid increase in world food prices due to supply chain disruptions had devastating effects on the poorest and the most vulnerable households (FAO, 2022), as these households suffered from increased food insecurity levels. In addition to food insecurity, abundant literature indicated that job losses and income volatility during the COVID-19 crisis led to depression or anxiety (Mimoun et al., 2020; Mojtahedi et al., 2020; Nasri et al., 2022). For these reasons, food insecurity is an essential variable for households to measure and mitigate.

The literature shows that social transfers are effective in improving basic needs outcomes, such as food insecurity and hunger of the most vulnerable in precarious conditions (Bastagli et al., 2016; Jeong and Trako, 2022). Well-designed and well-implemented social protection programs can effectively deal with the causes of food insecurity (Makhlouf et al., 2017). Therefore, the main coping strategies to deal with the adverse effects of COVID-19, especially for low-income households, are savings and assistance in the form of direct social transfers in cash and in-kind. In this regard, the Tunisian government provided cash and food aid to vulnerable households, as a response to the negative effects of the COVID-19 crisis. Tunisia's economic and social support measures account for around 2.3 percent of GDP (IMF, 2021). Moreover, recent studies have shown that these social protection programs could have produced more positive outcomes for these households, particularly for vulnerable employees who experienced a deterioration in their income due to mobility restrictions (Miller et al., 2020; Ozili, 2020). However, the inadequacy of some public policies is one of the other significant factors behind food insecurity (Abdullah et al., 2019).

2.2 Study data

To better understand the impact of the COVID-19 pandemic-induced shock on Tunisia and

assess policy responses in a rapidly changing context, reliable data is a must. In this regard, we use micro-data collected from the Combined COVID-19 MENA Monitor Household Survey (CCMMHH) conducted by the Economic Research Forum (ERF) to track the impact of COVID-19 on households in Tunisia and study food insecurity instances at the individual level during the health crisis. Thus, we include the same households that experienced the first wave of COVID-19 in this study. This gives us a national random sample of 2,000 households aged between 18 and 64. The data was pooled from four waves of COVID-19 covering the periods of November 2020, February 2021, April 2021, and June 2021, with the aim of increasing sample sizes to 8,000 observations.

Because of social distancing and COVID-19-induced lockdowns, face-to-face interviews were not possible. The CCMMHH survey was constructed using a series of telephone surveys which are conducted approximately every two months. It collects detailed information on a wide range of topics, including demographic and household characteristics, education and children, labor market status, income, food security, employment and unemployment detection, job characteristics, and social distancing. Moreover, panel data on households makes it possible to solve several methodological issues, specifically simultaneity and reverse causality, and it omits variables bias, which hinders any economics study.

For the food security variable, the CCMMHH survey included this question: "Have you or a member of your household experienced any of the following situations?" The proposed items include whether, during the seven days preceding the interview, the respondent had been exposed to any of the following possibilities: (1) difficulties in accessing food markets due to government-imposed mobility restrictions/closures; (2) unable to buy the quantity of food we usually buy due to food shortages in the markets; (3) unable to buy the quantity of food we usually buy because the price of food has increased; (4) unable to buy the quantity of food we usually buy because our household income has dropped; (5) we had to reduce the number of meals and/or the portion of each meal that we usually ate; and, finally, (6) no food change.

3. Methodology

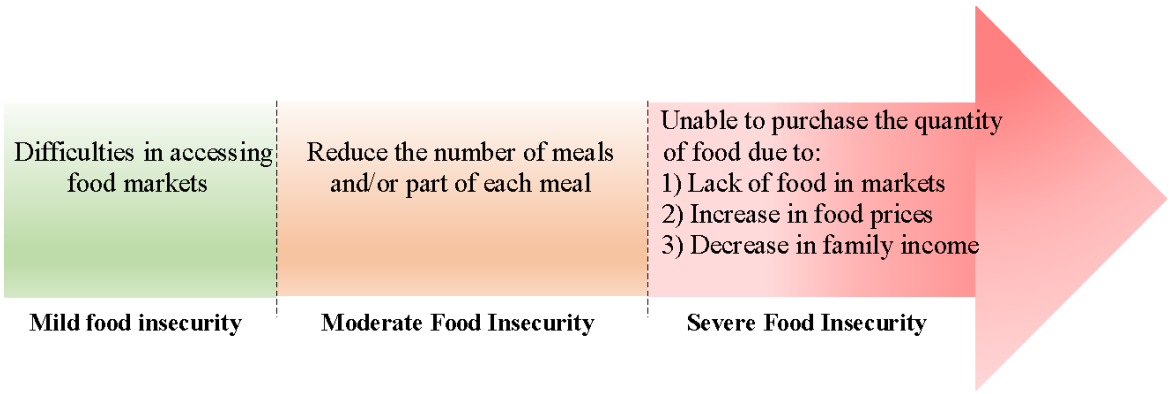
3.1 Empirical method

Methodologically, we use the CCMMHH "Food Security" survey module, which consists of the six responses shown above. The respondents were asked about their experience with varying degrees of food security during the COVID-19 period (OAMDI, 2020, 2021). Food insecurity at the individual level was assessed using the Food Insecurity Experience Scale (FIES) developed by FAO (Ballard et al., 2013). This measure covers a range of food insecurity levels. The FIES scale includes items representing a decrease in the quantity of food due to poor access to markets, lack of money, or lack of food in markets. Saint-Ville et al. (2019) show that the FIES is used in developing countries to monitor Zero Hunger, SDG 2.

Using Item Response Theory methods, in addition to the global reference scale (FIES) (FAO, 2015), we construct three food insecurity categories: Mild Food Insecurity, Moderate Food Insecurity, and Severe Food Insecurity. Consistent with the literature, respondents who

answered yes to one or more of these three categories were considered food insecure (Hadley et al., 2009). Otherwise, they were considered food secure. Using the survey data, we present the FIES schema as follows:

Figure 1. The Food Insecurity Experience Scale (FIES)



Source: Constructed by the authors from the CCMMHH survey.

The qualitative data was analyzed using a multinomial logistic model, which was used to highlight the likelihood that a respondent's eating habits were degraded by the COVID-19 crisis. Long and Freese (2001), Heck et al. (2012), and Field (2018) show that the use of a multinomial logistic regression is to predict the probability of several independent variables belonging to a category of a dependent variable. As in a binary logistic regression, a multinomial logistic regression uses the maximum likelihood estimation to assess the probability of categorical membership. Then, this type of model allows us to determine the decision probability of a respondent in a particular discrete multinomial choice, conditioned by the values of the independent variables. Nevertheless, this type of model does not allow for directly reading the model's coefficient estimation results. It is necessary to first calculate the relative risk ratio (RRR) as well as the marginal effects in order to be able to interpret the results.

In our study, we use the multinomial logit model where the dependent variable, food security (FS_i), can take more than two categories ($m>2$) (Heck et al., 2012). We assume that the number of categories ($m_i = 1, 2, \ldots M_i$ with $M_i = 4$) of a qualitative dependent variable FS_i, observed for the i^{th} individual ($i = 1, \ldots N$ with $N = 2000$). We limit ourselves to the simpler case where this number is assumed to be fixed for the entire sample. Equation (1) expresses which of the independent variables (X_i) significantly predict(s) whether a household chooses the categories "Mild food insecurity" (coded 1), "Moderate food insecurity" (coded 2), or "Food security" (coded 4) against the reference category of "Severe food insecurity" (coded 3).

$$Prob(FS_i = m / X_i = X_1, X_2, \ldots X_N) = Prob(FS_i = m / N);\ m = 1, 2 \ldots M \quad (1)$$

Then, the aim is to find the m probabilities ($Prob(FS_i = 1)$, $Prob(FS_i = 2)$, $\ldots$, $Prob(FS_i =$

m)) $car\ Prob(FS_i = 3) = 1 - \sum^{M} P(FS_i = m)$.

Each of these probabilities is written as a function of the independent variables Xi and a vector of parameters β. The response probability of the individual who chooses the categories ($m = 1, \ldots M$) is defined by the following equation:

$$Prob(FS_i = m \,/\, X_i) = \frac{\exp(X_i\beta_m)}{1+\sum_{h=1}^{M}(X_i\beta_h)} = Prob_m(X_i, \beta)\ ; \quad m = 1, \ldots M \tag{2}$$

Thus, equation (3) defines the probability of the reference category (m=3):

$$Prob(FS_i = 3 \,/\, X_i) = \frac{1}{1+\sum_{h=1}^{M}(X_i\beta_h)} = Prob_0(X_i, \beta) \tag{3}$$

We use the maximum likelihood estimator (MLE) to estimate the model's parameters (β), which are expressed by the RRRs. This method is expressed by equation (4) as follows:

$$L(\beta) = \sum_{i=1}^{n}\sum_{m=0}^{M} 1[FS_i = m]\ log[Prob_m(X_i, \beta\ )] \tag{4}$$

The maximum likelihood estimator (β ˜) is convergent and asymptotically distributed according to a logistic law on the real value of the model's parameters (β).

3.2 Empirical model specification

We follow the methodology of McFadden (1974) to estimate the following model:

$$FS_{it} = \alpha_i + \beta_0 A_{it} + \beta_1 V_{it} + \beta_2 I_{it} + \beta_3 Z_{it} + \beta_4 SP_{it} + \beta_5 X_{it} + w_t + \varepsilon_{it} \tag{5}$$

The independent variables Ai, Vi, Ii,, and Zi respectively designate the employment status, change in employment status, family income groups in February 2020, and change in family income compared to the pre-COVID-19 period.

Whether the policy response has been effective in reducing the seriousness of the pandemic's impact on food security remains an important question. In this regard, the model attempts to examine political support (response) to mitigate the effects of the pandemic throughout the four waves. We include the variable *SPi*, which is government support in the form of food and cash as social protection measures.

For the purpose of this study, other independent variables are conceptualized in a vector denoted Xi (gender, age, geographical location, region, household size, and education level).

The wt waves are added as time effects to capture changes over time without considering individual changes. αi represents the fixed effects that capture unobserved heterogeneity, i.e., the attributes specific to each individual, and, εit is the error term.

In our study, we consider the effect of COVID-19 on household well-being through two crucial variables: change in employment status and income volatility (Eq 5). However, according to the literature, selection biases can occur. First of all, it is impossible to control the attitudes of individuals toward the pandemic. These are considered one of the factors affecting governments' ability to control the spread of COVID-19 (Durizzo et al., 2020).

Adherence to government restrictions and other COVID-19 protocols to limit the spread is considered a positive attitude. According to Wolfson and Leung, 2020, this attitude can significantly affect household food security. Then, one of the variables used to correct for potential endogeneity is distance to COVID-19 epicenters (Bukari et al. 2021; Schotte et al., 2021). This variable perfectly predicts variation in employment status (job loss). Explicitly, if the distance to cities affected by COVID-19 changes, this will increase the likelihood of job/business loss which will subsequently affect households' food security status. The use of this variable can improve the results of our study. However, it is impossible to include it in the model because of data unavailability.

4. Results and discussion

4.1 Characteristics of respondents

Statistics on the demographic and socioeconomic traits of Tunisian respondents show that about two-thirds of respondents are male (61.6 percent). The age categories of the respondents share similar proportions, with those aged between 50 to 64 (27.5 percent) as a majority. In addition, the survey indicated that a large proportion of the respondents (36.8 percent) had secondary education, followed by respondents with a lower basic education (26.5 percent). In addition, half of the respondents belong to households with around three and four members (51 percent).

According to the labor market status in February 2020, more than half of the respondents were employees (53 percent), while the other main statuses included those who are inactive (17 percent). Further, about 14.2 percent were business owners, 6.3 percent unemployed, and 3.6 percent farmers. Due to the COVID-19 crisis, Tunisian households experienced a disruption in their employment status. Approximately, 48.6 percent of respondents became employees and 12.56 percent became business owners. We also note a slight decrease in the number of farmers, whose percentage varies between 3.85 percent during the first wave and 2.65 percent during the third wave. The results indicate that the number of unemployed has increased by almost half, from 6.3 percent before COVID-19 to around 10 percent during the first wave and 12.4 percent during the second and third waves of the pandemic. Additionally, an increase of two percentage points (19 percent) was observed for inactive people.

The largest percentage of respondents earned an income between TND 550 and 1,100 (third quartile) (29 percent). Significant proportions of 21.4 percent and 21.3 percent of respondents were in the lowest income groups, respectively less than TND 400 TND (first quartile) and between TND 400 and 550 (second quartile). The COVID-19 pandemic had a significant impact on income volatility. Compared to February 2020 (pre-COVID-19), almost half (48.7 percent) of respondents claimed a deterioration in income of one to 25 percent and even a severe decrease of more than 25 percent. As a result of this drop in income, the surveyed households reported that they were unable to purchase the usual quantity of food and that the specter of food insecurity haunts them. Severe food insecurity levels have been exacerbated; around 78.4 percent of the households in question suffered from a severe deterioration in food habits against only 17 percent who are food secure.

This deterioration in household food security requires social protection programs as a means of helping them adapt to the adverse effects of the pandemic. In Tunisia, only 1.8 percent of the surveyed respondents participated in national social security schemes in the form of cash transfers (0.4 percent) and food transfers (1.4 percent).

4.2 Deterioration of food security

Table 1 highlights the results of the multinomial logit estimation of the determinants of whether respondents' eating habits were affected during the COVID-19 pandemic. This table reports responses to the five questions on food insecurity categories that make up the FIES items listed above. The RRR represents the predicted multiplicative change in the relative risk of belonging to a food security category (food security, mild food insecurity, or moderate food insecurity) compared to the reference category where respondents are included in the Severe Food Insecurity basket caused by the COVID-19 pandemic. In this regard, individuals are unable to buy the usual quantity of food for three reasons, including the lack of food in markets, the increase in food prices, and/or the decrease in family income.

Individuals identified as females are 0.5145 times more likely than male respondents to be affected by the COVID-19 crisis and to belong to the severe food insecurity basket. They also exhibit a lower probability of belonging to the food security category. This is partly explained by the fact that interviewed males are the most involved in the labor market and in various income-generating activities that help smooth the shock of the pandemic. These results are consistent with those of Alon et al. (2020) and Wenham et al. (2020), who conclude that in addition to women's family responsibilities, the COVID-19 pandemic has further contributed to depriving women in labor markets. For age categories, we find that the probabilities of individuals aged 30-39, 40-49, and 50-64 are, respectively, 0.6413, 0.4742, and 0.2922 times more likely to be included in the basic category of severe food insecurity than individuals aged 18-29 years. In addition, the RRR of the education variable indicates that respondents with secondary and higher levels of education have strong probabilities, respectively, of 2.6563 and 3.4843 times more likely to be in the category of stable food security compared to individuals with a lower basic level who belong to the severe food insecurity category due to the health crisis.

Furthermore, the effects of COVID-19 on the labor market status show statistically significant results. The unemployed and the inactive have probabilities of 0.2201 and 0.4353 times of being in severe food insecurity than farmers, respectively. In the pre-COVID-19 period, we find that these probabilities are lower by 0.1075 and 0.1269 times, respectively. Moreover, employees and business owners are less likely to belong to the food security category and the probabilities of being in the severe food insecurity basket are, respectively, 0.1479 and 0.1156 times in February 2020 and, respectively, 0.3344 and 0.2395 times during COVID-19, compared to farmers. This may mean that employees encounter difficulties in accessing markets and buying food, mainly due to the restrictions and distancing measures imposed and the decrease in purchasing power because they lost their jobs. This was pointed out by several other studies that focused on the devastating effects of COVID-19 on employment and income sources (Krafft et al., 2021; ILO, 2020). In contrast, self-produced food by farmers who inhabit rural areas can be like a safety net during the pandemic. These rural individuals are less likely to be included in the food insecurity basket than urban households. With these results, we show that the effect of COVID-19 is more pronounced in urban households than in rural households. This indicates their resilience against food insecurity compared to their urban counterparts (Alon et al., 2020; Wenham et al., 2020). For geographic location, our results reinforce this conclusion and indicate that rural households have a significant 1.4909 times probability of being in the food security category than households living in cities. This is also explained by the concentration of COVID-19 cases in cities where there is more contact between people than in rural areas (McGranahan and Dobis, 2021).

In addition to the effects of COVID-19 on income sources, the surveyed respondents indicated that their income decreased by more than 25 percent compared to pre-COVID-19 and that they are more likely to experience severe food insecurity. The results indicate a statistically significant and negative correlation between the deterioration of food conditions and the increase in income. This implies that poor individuals with monthly incomes below TND 400 are more likely to be affected by COVID-19 and that their eating habits deteriorate significantly compared to a normal period, which is expected.

Table 1. Multinomial logistic regression of the model[4]

Basic Modality: Severe Food Insecurity	Sample Label	Comparison Modality: Food Security	Comparison Modality: Mild Food Insecurity	Comparison Modality: Moderate Food Insecurity
Sociodemographic Characteristics				
Gender	COR6			
Female		0.5145***	0.3941**	0.7775
Age	COR5			
18-29 (basic)				
30-39		0.6413*	0.5918	0.4775**
40-49		0.4742***	0.2447**	0.4133**
50-64		0.2922***	0.4932	0.4244**
Location	COR8_3			
Rural		1.4909*	1.5147	1.2204
Education	COR14			
Less than basic (basic)				
Basic		1.5127	1.5589	0.8237
Secondary		2.6563***	1.2506	1.5392
Higher education		3.4843***	2.2624	1.6204
HHsize				
1-2 (basic)	COR9			
3-4		0.6950	0.7625	0.8162
≥ 5		0.5451	0.3471	0.7503
Socioeconomic Characteristics				
Employment Status (February 2020)	COR18			
Farmer (basic)				
Business		0.1479**	6.26e+07	1.58e+09
Work wage		0.1156**	1.82e+08	1.04e+09
Unemployment		0.1075**	2.10e+08	0.8926
Inactive		0.1269**	2.50e+08	1.49e+09
Unpaid work		1.98e-10	0.5623	0.8110
Other		0.1666	1.61e+08	2.82e+09
Employment Status (COVID-19)	COR20			
Farmer (basic)				
Business		0.3344**	0.4504	0.4969
Work wage		0.2395***	0.2922	0.4299*
Unemployment		0.2201***	0.3427	0.3720*
Inactive		0.4353*	0.5329	0.4657
Unpaid work		0.1827	2.81e-10	0.3361
Other		0.8261	0.6267	0.6261
Total Monthly Income Group	COR22			
Less than 400 TND (basic)				
400-less than 550 TND		1.1857	1.5568	1.2802
550-less than 1100 TND		2.4135***	2.2329	1.4153
1100 or more		13.396***	8.1202***	2.3682*
Other		6.9065***	0.5082	3.9617**
Change in Total Monthly Income	COR23			
Decreased by more than 25% (basic)				
Decreased by 1-25%		1.8422***	1.4490	1.4999
Remained the same		7.2323***	4.0788***	2.9385***
Increased by 1-25%		6.6385***	2.6618	3.9889***
Increased by more than 25%		6.4008***	7.0205**	5.2830***
Social Protection	COR25_1	0.9355	6.72e-10	1.53e-09
Cash Transfer Food Transfer	COR25_2	0.6028	5.99e-10	7.56e-10
Observations		8000		
Wald chi2(110)		408.35		
Prob > chi2		0.0000		
Log Maximum Likelihood		-2157.7566		

Note. ***, **, and * represent the 1%, 5%, and 10% significance levels, respectively. The food security modalities are, respectively, Mild Food Insecurity (coded 1), Moderate Food Insecurity (coded 2), Severe Food Insecurity (coded 3 = Basic modalities) and Food Security (coded 4).
Source: Calculation by the authors based on the CCMMHH survey.

[4] Like the dependent variable, "Food Security" is an ordinal variable from Mild insecurity to Severe insecurity. We re-estimated using an ordered logit model but found virtually the same result.

4.3 The impact of social transfers on food insecurity

Table 2 of the marginal effects shows that for an individual who has not received a social transfer (food or cash), the probabilities of being included in the mild food insecurity basket are 1.6 percent and 1.7 percent, respectively. These results are similar to those of the moderate food insecurity basket where we record probabilities of 1.9 percent and two percent for individuals who benefited from a cash and food transfer, respectively. Along the same lines, we note that the probabilities of being included in the mild and moderate food insecurity baskets are not significant for individuals who received a social transfer. This finding shows that for the mild or moderate insecurity basket, the social measures taken by the state have helped individuals cope with the crisis.

Furthermore, we find that individuals who received a social transfer (food or monetary) did not manage to stay out of the severe food insecurity basket. These individuals have almost the same probability of being included in the food insecurity basket with or without a social transfer. This proves that the social policies adopted by the Tunisian government have failed to absorb the adverse effects of COVID-19. The results also show that receiving a social transfer does not change the food security situation of the individuals in question.

These results are consistent with the initial distribution of transfers where we notice that only 0.4 percent of individuals benefited from cash transfers and 1.4 percent of food transfers. This can be explained by the fact that, in Tunisia, the legal framework for social protection is mainly aimed at retired people. This conclusion is consistent with studies that recommended the need to extend social security coverage to those most affected by shocks even if they are not eligible for social assistance (Bodewig et al., 2020; Nasri et al., 2022).

Table 2. Marginal effects: Social transfers-food insecurity

	Cash Transfer		Food Transfer	
	Marginal Effect	**SE**	**Marginal Effect**	**SE**
Mild Food Insecurity				
No Transfers	0.0165***	(0.0023)	0.0166**	(0.0023)
Transfers	3.56e-12	(4.19e-07)	3.43e-12	(2.41e-07)
Moderate Food Insecurity				
No Transfers	0.0195***	(0.0022)	0.0197***	(0.0022)
Transfers	4.57e-12	(6.53e-07)	3.20e-12	(2.34e-07)
Severe Food Insecurity				
No Transfers	0.8090***	(0.0068)	0.8083***	(0.0068)
Transfers	0.8451**	(0.0935)	0.8772**	(0.0408)
Food Security				
No Transfers	0.1548***	(0.0066)	0.1551***	(0.0066)
Transfers	0.1548**	(0.0935)	0.1227**	(0.0408)

Notes. ***, **, and * represent 1%, 5%, and 10% significance levels, respectively. (.): t-student in parentheses.
Source: Calculation by the authors based on the CCMMHH survey.

4.4 Regional distribution of food insecurity in Tunisia

Table 3 shows the regional distribution of food insecurity in terms of the geographic location of respondents. The results show that individuals from rural areas are the most secure in terms of food availability than urban areas. Urban residents are much more likely to report that they are in a severe food insecurity condition (68.5 percent) and access to food products becomes a major obstacle during the pandemic than rural residents (31.5 percent). This is because agricultural households that mainly inhabit these rural areas can benefit from self-

produced food. Therefore, individuals who practice farming as a job may have better adapted themselves against COVID-19-induced food disruptions, consistent with the previous conclusions of Adjognon et al. (2021).

These results are confirmed by regional distribution, where we distinguish that the eastern regions are the most affected by severe food insecurity than the western regions, which are characterized by a labor market based mainly on agriculture. From Table 3, we see higher percentages of severe food insecurity in the North-Eastern, Middle-Eastern, and South-Eastern regions with 39.7 percent, 26.2 percent, and 6.7 percent, respectively, compared to low percentages in the North-Western, Middle-Western, and South-Western regions with 8.9 percent, 12.76 percent, and 5.5 percent, respectively. We conclude that these regions are the source of national food production.

Table 3. Regional distribution of food insecurity in Tunisia

	Food Security	**Food Insecurity**		
		Mild	**Moderate**	**Severe**
Location				
Urban (%)	75.89	75.16	73.30	68.54
Rural (%)	24.11	**24.84**	**26.70**	**31.46**
Region				
North East (%)	42.95	43.95	49.51	39.71
North West (%)	7.67	**3.18**	**10.19**	**8.89**
Center East (%)	25.42	28.03	21.36	26.16
Center West (%)	9.42	**11.46**	**12.14**	**12.76**
South East (%)	10.23	8.92	3.40	6.94
South West (%)	4.31	**4.46**	3.40	**5.54**

Source: Calculation by the authors based on the CCMMHH survey.

5. Conclusions and policy recommendations

This paper examined whether food security deteriorated during the COVID-19 crisis and whether the social protection policies implemented by the Tunisian government led to positive responses to this shock. Although this topic is important, the literature did not sufficiently examine it in Tunisia during the COVID-19 crisis. This crisis represented a particular challenge to vulnerable people. In this context, assessing the effects of COVID-19 on Tunisians is essential to designing policy responses to the crisis and developing plans for a sustainable and fair economic recovery.

To estimate this relationship, we used food insecurity classes proposed by FAO and data from the ERF COVID-19 MENA Monitor Household Survey conducted over four waves of COVID-19 (November 2020, February 2021, April 2021, and June 2021) with the aim of monitoring the effects of the crisis on households in Tunisia.

First, the results show evidence of a deterioration in the food security of wage earners and business owners who depend on working income during the COVID-19 period. This is attributed to loss or reduction of income, reduced access to markets due to mobility restrictions, low purchasing power, and the inadequacy of some public policies. Second, households with low incomes are more likely to be affected by COVID-19 and have their eating habits deteriorate significantly. Third, households that received a social transfer (cash

or food) did not manage to stay out of the severe food insecurity basket. This proves that the social policies adopted by the Tunisian government failed to absorb the negative effects of COVID-19. In Tunisia, social protection is mainly exclusive to retired people and excludes those most vulnerable to economic shocks. Fourth, self-produced food from farmers who inhabit rural areas may have been a food safety net during the pandemic. This last conclusion is confirmed by regional distribution where we distinguish that the eastern regions are the most affected by severe food insecurity than the western regions. The latter are characterized by a labor market based mainly on agriculture, which is considered the source of national food production.

Despite the hope that the world would survive the COVID-19 pandemic in 2021 and that food security would begin to improve, global hunger increased further in 2022. This increase is due to a new wave of economic shocks caused by the Russian-Ukrainian conflict, which impacted the prices and availability of basic food needs in international markets. Therefore, it is necessary to identify some economic and political implications for our results that may be relevant to mitigating the impact of the current global crisis on food security.

First, there is a need to employ adaptation and mitigation strategies based on investing in sustainable food security. This is likely to mitigate the income shock and strengthen the national food system to make it more resilient against future disruptions. Second, we find that the Tunisian government's policies to protect against the COVID-19 crisis are inadequate. As a result, there is a need to extend social protection coverage to people who are generally not eligible for social transfers but who are pushed into transitory poverty by the COVID-19 pandemic. Third, formal measures to better target the social safety net, such as direct cash and food transfers aimed at the most vulnerable, such as the elderly and low-income individuals, remain essential during expected challenges (climate change, disruptions in international markets, emerging diseases…etc.). These measures would reduce the harm of income losses, restore livelihoods, and help support a sustainable and resilient economic recovery. Among the lessons learned from the COVID-19 pandemic is that we need to ensure that the resources we use to rebuild are sustainable and that the solutions are long-term.

Therefore, clear and coherent national and multi-sector strategies would contribute to achieving SDGs, in particular SDG 2, which aims to eradicate hunger, achieve food security, improve nutrition, and promote sustainable agriculture (UN, 2015).

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