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Job loss during COVID-19: Estimating the poverty and food security effects in Egypt, Tunisia and Morocco

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An ILO/ERF working prepared by

Adel Ben Youssef[1] and Burim Prenaj[2]

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[1] GREDEG-CNRS & University Côte d'Azur, France ISEM 24, Avenue des Diables Bleus, 06300 Nice - France
E-mail: adel.ben-youssef@univ-cotedazur.fr
[2] Faculty of Economics, University of Prishtina "Hasan Prishtina" Str. Agim Ramadani, n.n., 10000 Prishtina, Kosovo
E-mail: prenajburim@gmail.com

Abstract

COVID-19 mobility restrictions have disrupted labor markets in Egypt, Tunisia and Morocco; thousands of workers have lost their jobs which has had consequences for poverty, food security, borrowing behavior and internal migration. However, empirical evidence regarding the effects of COVID-19 in these countries is scarce, due mainly to lack of data. This paper explores the effects of job losses due to COVID-19 on household income and food security. It investigates the coping mechanisms triggered and explores the heterogeneous effects of COVID-19 induced job losses on the same outcomes for different vulnerable population subgroups e.g. women, young workers, informal workers, rural workers, etc. Methodologically, we assess the effects of the COVID-19 pandemic on individual outcomes in Tunisia, Morocco and Egypt by comparing differences in the outcomes of interest between respondents who lost their jobs due to the pandemic and those who did not. To account for selection into job loss, we employ propensity score weighting which balances job-losses and retained jobs for a set of common characteristics. Our results show that job-losers have suffered greater decreases in household income and a simultaneous considerably lower level of food security compared to job retainers. We show also that job-losers have a higher propensity to consume their savings, get help from relatives, sell assets and borrow from family.

Keywords: labor market, COVID-19, job loss, food security, poverty, Tunisia, Egypt, Morocco.
JEL Classification: J0, J21, J23, J64

Key Messages:

- The impact of COVID-19 crisis on job and income loss has pushed more people in extreme poverty in Tunisia, Egypt and Morocco
- The permanent jobs losers were more impacted than the temporary job losers in Tunisia, Egypt and Morocco
- Job-losers have suffered greater decreases in household income and a simultaneous considerably lower level of food security compared to job retainers.
- The probability of being unable to afford buying food has increased for job losers due to the COVID-19 crisis
- The most important mechanism employed by job losers was the savings and seeking help from relatives
- The effect of job-loss on household income per capita and in food security is larger for females, young workers, informal workers, rural workers, and less educated workers

1. Introduction

Measures to prevent the spread of the COVID-19 pandemic have been accompanied by a significant negative labor market impact on all the sectors of the economy. In some sectors which are considered essential, employment and salaries remained uninterrupted throughout the crisis. Other sectors have suffered severe closures to reduce risk of virus transmission and this reduced employee numbers severely. However, the effects of the pandemic have differed across occupations and labor market segments (ILO, 2020a) and the possibility to work from home has become important and has had (Acemoglu et al., 2021) repercussions for productivity, location, working hours and the traditional separation between the work and home environments (Caringal-Go et al., 2022; Wong et al., 2021). While in some sectors, working from home has allowed job retention (Dingel and Neiman, 2020; Gottlieb et al., 2020), in others working from home was not feasible and many people were laid off.

Adoption of digital technologies by businesses was accelerated by the onset of the pandemic and the need to work from home (Vargo et al., 2021). Digital transformation and digital infrastructure have become essential for business survival across industries (Gadhi, 2020; Melhem et al., 2020). Although before the pandemic several businesses were already heavily reliant on digital technologies, the crisis has revealed that digital transformation involves more than digital equipment. The impact of the digital transition on professions and sectors is fundamental, and development of transversal skills and competencies adapted to the digitization of production and use of big data to complement more domain-specific technical skills are key to the shift to digitalization.

There is a growing body of work on the different aspects of the impact of the COVID-19 pandemic on labor markets. There is a strand of work that focuses on the feasibility of working from home (Dingel and Neiman, 2020; Gottlieb et al., 2020; Hatayama et al., 2020) which suggests that only a limited number of individuals are able to do their work from home and that the possibility to work from home differs by occupation (Dingel & Neiman, 2020; Avdiu & Nayyar, 2020; Mongey, et al., 2020), sector and employee socioeconomic characteristics (Mongey et al., 2020). The feasibility of working from home depends also on national economic development; less developed countries tend to engage in more hands on physical work which uses fewer digital technologies (Hatayama et al., 2020).

The COVID-19 pandemic has also revealed labor inequalities (Adams-Prassl et al., 2020; Perugini and Vladisavljevic,2020). Previous economic crises resulted in recessions which had gender-based effects on employment with men particularly vulnerable (Rubery and Rafferty, 2013; Hoynes et al., 2012). Following the 2008 financial crisis, huge job losses were experienced in male-dominated economic sectors such as construction and manufacturing whereas the working hours of women increased. Recent studies (Hupkau and Petrongolo, 2020; Alon et al., 2020) show that the impacts of the current crisis on male and female employment are likely to be similar since the social measures taken have affected sectors employing both men and women (ILO, 2020b). There is a stream of work that investigates labor inequalities in different countries including a group of European countries (Palomino et al., 2020; Perugini and Vladisavljevic, 2020), Italy (Brunori et al. 2020; Bonacini et al., 2021), Turkey (Duman, 2020) and the Latin American countries (Leone, 2020).

The effects of the pandemic on jobs is affecting the wellbeing of families and especially children by reducing the ability to satisfy basic food and other needs. Food insecurity is a continuous problem especially for low-income families (Loopstra and Tarasuk, 2013), and job losses and the accompanying reduced income result in increased food insecurity and affect health and wellbeing. According to Milovanska-Farrington (2022) a job loss in the family increases food insecurity, reduces the likelihood that the family has sufficient amounts of food and affects the wellbeing and nutrition of the children in the family.

This paper examines the effects of COVID-19 on job losses and income and food security in households in Egypt, Tunisia and Morocco. It explores the coping mechanisms employed to try to mitigate the effects of job and income losses and food insecurity, and the heterogeneous impact of job losses due to the COVID-19 pandemic on the same outcomes for different vulnerable population subgroups e.g. women, young workers, informal workers, rural workers, etc. Our results show that compared to job retainers' job-losers face a bigger decrease in household income and greater food insecurity. Moreover, job-losers are more likely to consume their savings, seek help from relatives, sell assets and borrow from family.

Our paper offers three novelties. First, the survey and dataset are new and are being exploited for the first time. Second, empirical works on the effects of COVID-19 on the labor market are scarce and to our knowledge this is the first work that compares the effects on Egypt, Morocco and Tunisia. Third, we adopt a new approach to estimate the effect of COVID-19 on household income, food security and coping mechanisms. We account for potential selection bias by employing propensity score weighting to balance the observable characteristics of job losers and job retainers. We conduct separate heterogeneity analyses and estimations for a range of dimensions. The robustness of our results is checked by use of different samples and different definitions of job loss.

The paper is structured as follows. Section 2 describes the empirical analysis; section 3 presents the estimation and discusses the results and section 4 offers some conclusions.

2. Empirical analysis

2.1 Data and variables

We analyze the effect of job losses due to the COVID-19 pandemic on poverty and food security using data from the COVID-19 MENA Monitor Household Survey conducted by the Economic Research Forum (ERF). This is a specially designed survey which provides reliable data enabling investigation of the effect of the pandemic on MENA (middle east and north African) households and vulnerable groups including women, informal and irregular workers, low skilled workers and youth in particular. It is a nationally representative panel survey addressing a range of variables such as demographic and household characteristics, education, labor market information, data on income and earnings, food security and coping strategies.

The COVID-19 MENA Monitor Household Survey collected data on five countries: Tunisia, Morocco, Egypt, Jordan and Sudan. We analyze the data for Tunisia, Morocco and Egypt. The baseline survey wave was administered in June 2020 for Egypt and was followed by two more waves in February 2021 and June 2021; the baseline survey waves for Tunisia and Morocco were administered in October 2020 and were followed by three more waves in February 2021, April 2021 and June 2021. Respondents were selected randomly by means of random digit dialing using valid phone numbers for a range of users aged 18-64. The aim was to include at least 2,000 unique households in each wave; panel wave attrition was addressed by adding new households in order to maintain numbers.

To model the probability of job-loss We use retrospective information (February 2020) as our baseline for modeling the. We restricted our sample to respondents who were employed at the beginning of the pandemic. The sample includes only employed individuals for whom we have complete information regarding demographic characteristics, education, income and job characteristics. We excluded individuals with missing information for job-loss status at the time of the first interview which resulted in a total of 5,257 individuals - 3,583 job-retainers and 1,674 job-losers.

The relatively high attrition rate reduced our main focus to the first interview with each individual which means that we assess the contemporaneous effects of job-loss on the outcomes of interest and measure the short-term effects of job-loss. In our robustness checks we also estimated the effect of job-loss at the time of the first interview (time t) on the outcome at the time of the second interview (t+1) conditional on the fact that the respondent-maintained job-loser status.

2.2 Identification strategy

Methodologically, we assess the effect of job-loss due to the COVID-19 pandemic on poverty, food security and coping mechanisms by comparing differences in the outcomes of interest between job-losers and the control group. To assess this we estimated the following baseline model:

$$Y_{i,t} = \beta_0 + \beta_1 LostJob_{i,t} + \Gamma X_{i,t-1} + \tau_{t-1} + \epsilon_{i,t}$$

where:
Y_(i,t) is the dependent variable for individual i at time t[3] and captures a poverty measure (logarithm of household income per capita), two food security measures (food affordability and reduced meals) and five coping strategies (using savings, getting help from relatives, migrating back to family, borrowing, selling assets). The variable of interest 〖LostJob〗_(i,t) is a dummy for whether in the previous 60 days the individual i lost his or her job as a result of the COVID-19 pandemic; ΓX_(i,t) is a vector of the baseline covariates including age and its square, gender, marital status, living area, informal job, working from home, regular job, education level and firm size; τ_(i,t) captures country, industry, occupation and wave fixed effects to account for trends in these segments.

This strategy would be foolproof in an experimental context with randomly assigned job-loss; however, in a real context job-loss is far from random. Therefore, we are faced with selection problems driven primarily by individual characteristics such as education, skills and ability, and job characteristics such as occupation and industry. It can be assumed that individuals at the lower end of the distribution for education, ability and skills face a higher risk of job-loss due to the pandemic compared to their peers at the upper end of the distribution. Similarly, certain occupations and industries and especially those involving routine and manual jobs carry higher job-loss risk. Another possible important driver of selection into job-loss status is related to the stability of the firm; firms that were struggling before the outbreak of the pandemic were at greater risk of failing during the pandemic and increasing the pool of job-losers. The unweighted means in table 1 confirm this by showing that job-losers differ significantly from job-retainers, and direct comparison would produce biased estimates.

2.2.1 Propensity score weighting

As noted above and shown in table 2 the differences between job-losers and job-retainers do not rely solely on job-loss status. They differ significantly in almost all characteristics which does not allow direct comparison. To address this selection issue we employ the propensity score weighting procedure proposed by Imbens (2004), to model the probability of job-loss due to COVID-19 conditional on observable characteristics. We then use the probabilities as weights to balance the distribution of the observable characteristics of job-losers and job-retainers. In other words, this procedure aims to identify individuals with similar probabilities of job-loss irrespective of their actual job-loss status.

The probability of job-loss (JL=1) is modeled formally by employing a probit model as in the following equation:

$$P^R[JL_i] = \alpha + \delta X_i + \varepsilon_i$$

where the vector δX_i captures a wide range of individual and job characteristics considered important for affecting the job-loss probability. Specifically, this vector includes individual characteristics such as age and its square, gender, marital status, household size, education level and the number of children in the household aged under six years. These individual characteristics provide useful information and enable us to identify trends in experience based on age, ability based on education and other drivers such as marital status or having children which serve as

[3] Time t refers to the time of the first interview.

motivation for the primary income earner to work harder to retain his or her job. This vector also includes baseline job characteristics such as formality of the job which is an indicator for whether the work is performed inside, firm size, industry and occupation. These variables serve as useful proxies to capture trends in job-losses during the pandemic because it has been acknowledged that the crisis has had different effects on different industries and occupations with routine jobs and medium skill jobs affected more than high skill jobs which are more likely to accommodate teleworking. Finally, the same vector also includes wave and country fixed effects which capture some important time and country trends that matter since the survey waves were collected at different times; in the case of Egypt, the first wave was conducted in June-2020 whereas in the cases of Tunisia and Morocco it was conducted in October-2020.

Appendix table A1 presents the results of the above-described probit model. The findings suggest some significant differences in job-loss probabilities in relation to the variables included in the model. Job characteristics seem to be the most important factor explaining the job-loss probability, for instance, the job-loss probability appears to be lower (-12.8%) for regular jobs and around 10% higher in the case of informal employment; firm size seems to be correlated negatively to job loss probability. In terms of individual characteristics, as expected education seems to play an important role; the more highly educated the worker the lower the probability of job-loss. Location also matters with the probability of job loss higher for rural workers compared to others which may be explained in part by the restrictions imposed on mobility of people and goods since most rural employment is in agriculture. Finally, gender and marital status show differences in the probability of job-loss due to the COVID-19 pandemic, with females around 5% more likely to lose their jobs compared to males, and married individuals around 3% less likely to lose their jobs compared to their single peers.

In the next step we use the estimated probabilities to construct propensity score weights based on job-loss status, by weighting each job-loser by $\frac{1}{\rho_i}$ and each job retainer by$\frac{1}{(1-\rho_i}$)[4].

To test whether this method operates as expected, we performed a balancing test . The weighted panel in table 1 shows that the method balances the observable characteristics of job-losers and job retainers and that the remaining differences are minimal.

In the final step we use the first equation as the weighted least squares estimator to estimate the effect of job-loss due to COVID-19 on the set of selected outcomes; this method should reduce the bias in parameter β_1 significantly and allow a causal interpretation.

2.3 Descriptive statistics

Table 1 presents the descriptive statistics of our sample of 3,583 workers job retainers and 1,674 job-losers. The left panel reports the raw means of the selected characteristics by job-loss status, and the right panel reports the same characteristics based on propensity score weights.

The left panel in table 1 shows that job-retainers and job losers differ in almost all dimensions: individuals who lost their jobs because of the COVID-19 pandemic belong mostly to marginalized groups with a higher probability of job loss from any internal or external shock. On average, job-losers are younger, less likely to be married, more likely to be female, more likely to live in a rural area and more likely to work in the informal sector.

[4] i is the estimated job loss probability.

In addition, the groups differ substantially in terms of education and type of firm, industry and occupation; job-losers are less educated, and typically work in smaller firms mostly in agricultural, manufacturing and construction jobs.

These differences indicate that direct comparison of their outcomes would not be sensible because the differences in outcomes between these groups are certainly the result of differences in observable characteristics. Direct comparison would result in the effects being attributed entirely to COVID-19 when in reality the main drivers of the differences in outcomes are individual and job characteristics. For this reason, we employ propensity score weighting to balance the two groups and provide a more reliable analysis.

The right panel in table 1 presents the results of a balancing test and shows that the weights balance the groups in almost all the dimensions which previously showed significant differences. Among those dimensions where some differences persists, the weights reduce them. The differences in individual characteristics are close to zero with some small but very reduced differences remaining for education, firm size and industry. It is important to note that the method does not produce a counter effect which would pose a real threat to our identification strategy. We believe that our approach achieves an optimum balance between the samples which enables bias-free comparison.

Table 1: Characteristics of the sample by job-loss status

	Raw means			Propensity score weighted means		
	Job-retainers	Job-losers	Difference %	Job-retainers	Job-losers	Difference %
Age	38.15 (10.79)	35.58 (10.44)	-6.74%	37.17 (10.77)	36.98 (10.86)	-0.51%
Married	0.68 (0.47)	0.61 (0.49)	-10.29%	0.66 (0.48)	0.65 (0.48)	-1.52%
Female	0.24 (0.42)	0.22 (0.41)	-8.33%	0.23 (0.42)	0.22 (0.41)	-4.35%
Rural	0.26 (0.44)	0.34 (0.47)	30.77%	0.28 (0.45)	0.28 (0.45)	0.00%
HH.Size	4.47 (1.98)	4.77 (2.08)	6.71%	4.56 (2.08)	4.55 (2.04)	-0.22%
No. of children under 6	0.56 (0.82)	0.70 (0.92)	25.00%	0.60 (0.88)	0.60 (0.81)	0.00%
Informal job	0.41 (0.49)	0.67 (0.47)	63.41%	0.49 (0.50)	0.48 (0.50)	-2.04%
Work inside an establishment	0.69 (0.46)	0.49 (0.50)	-28.99%	0.63 (0.48)	0.63 (0.48)	0.00%
Regular job	0.75 (0.43)	0.47 (0.50)	-37.33%	0.67 (0.47)	0.67 (0.47)	0.00%
Education: Less than basic	0.16 (0.37)	0.24 (0.43)	50.00%	0.18 (0.39)	0.19 (0.39)	5.56%
Basic	0.12 (0.33)	0.18 (0.38)	50.00%	0.14 (0.35)	0.14 (0.35)	0.00%
Secondary	0.31 (0.46)	0.36 (0.48)	16.13%	0.33 (0.47)	0.32 (0.47)	-3.03%
Tertiary	0.41 (0.49)	0.22 (0.41)	-46.34%	0.35 (0.48)	0.36 (0.48)	2.86%
Firm Size: Micro	0.41 (0.49)	0.55 (0.50)	34.15%	0.45 (0.50)	0.45 (0.50)	0.00%
Small	0.10 (0.30)	0.11 (0.32)	10.00%	0.11 (0.31)	0.10 (0.30)	-9.09%
Medium	0.15 (0.35)	0.11 (0.32)	-26.67%	0.14 (0.34)	0.13 (0.34)	-7.14%
Large	0.34 (0.47)	0.22 (0.41)	-35.29%	0.30 (0.46)	0.32 (0.47)	6.67%
Industry: Agriculture, fishing or mining	0.05 (0.22)	0.10 (0.30)	100.00%	0.06 (0.25)	0.06 (0.24)	0.00%
Manufacturing	0.13 (0.33)	0.18 (0.39)	38.46%	0.15 (0.35)	0.15 (0.35)	0.00%
Retail or Wholesale	0.12 (0.32)	0.11 (0.31)	-8.33%	0.11 (0.32)	0.11 (0.32)	0.00%

Construction or utilities	0.10 (0.30)	0.19 (0.39)	90.00%	0.12 (0.33)	0.13 (0.33)	8.33%
Transportation and storage	0.09 (0.29)	0.10 (0.30)	11.11%	0.09 (0.29)	0.10 (0.29)	11.11%
Accommodation and food services	0.08 (0.27)	0.12 (0.33)	50.00%	0.09 (0.29)	0.10 (0.29)	11.11%
Information and communication	0.04 (0.20)	0.02 (0.15)	-50.00%	0.04 (0.19)	0.04 (0.20)	0.00%
Financial activities or real estate	0.05 (0.22)	0.02 (0.15)	-60.00%	0.04 (0.20)	0.05 (0.21)	25.00%
Education	0.14 (0.35)	0.05 (0.22)	-64.29%	0.11 (0.31)	0.10 (0.30)	-9.09%
Health	0.06 (0.23)	0.03 (0.18)	-50.00%	0.05 (0.22)	0.05 (0.22)	0.00%
Other services	0.15 (0.35)	0.08 (0.26)	-46.67%	0.12 (0.33)	0.12 (0.32)	0.00%
Occupation: Manager/professional	0.19 (0.39)	0.10 (0.31)	-47.37%	0.16 (0.37)	0.16 (0.37)	0.00%
Technicians/associate professionals	0.26 (0.44)	0.17 (0.38)	-34.62%	0.23 (0.42)	0.25 (0.43)	8.70%
Clerks/service workers	0.33 (0.47)	0.24 (0.43)	-27.27%	0.31 (0.46)	0.30 (0.46)	-3.23%
Blue collar, skilled agricultural	0.22 (0.42)	0.48 (0.50)	118.18%	0.30 (0.46)	0.29 (0.45)	-3.33%
Observations	**3583**	**1674**		**3583**	**1674**	

Notes: Authors' calculations using COVID-19 MENA Monitor Household Survey data. Standard deviations are reported in parentheses. Columns 1-3 report the raw unweighted means; columns 4-6 report the propensity score weighted means.

Figure 1 plots the proportion of workers who lost their jobs due to the COVID-19 pandemic, the job loss shares for different subsamples along the dimensions of gender, residential location, job status, education, age group and occupation. Job-loss status falls into three categories of permanent job-loss, temporary job loss and a cumulative indicator denoted job-loss. We observe that along all dimensions most job losses are temporary. We observe also that more vulnerable groups show higher job loss rates.

Overall, males experienced relatively greater job-loss but females experienced slightly higher rates of permanent job-loss. We observe high heterogeneity in the share of job losses based on residential location with rural compared to urban workers showing higher rates of job loss; this applies also to permanent job losses with higher rates among rural compared to urban workers. Informal workers suffered the highest rates of job-loss with overall job losses twice as high as those experienced by formal workers. While most informal job losses are temporary a large share is permanent.

As expected, we observe significant differences in the job-loss share by education level. Among workers with lower than tertiary education, the share of job losses is similar for all workers with lower than tertiary education but this share changes dramatically for workers with tertiary education who appear to have been twice as likely to lose their job as a result of COVID-19.

Figure 1 shows also that age is an important source of heterogeneity in job-loss with higher rates of job loss among younger compared to older workers; the majority of job losers are aged under 34 years. Finally, blue collar workers seem to have suffered the greatest job-loss with almost 50% experiencing some form of job-loss and 18% experiencing permanent job loss.

Appendix figure A1 uses the same subsamples and dimensions to show the changes in household income between February 2020 and the first interview. It shows that all subgroups experienced a reduction in household income but compared to what is depicted in the job-loss graph we see that the most vulnerable groups were less affected than their peers.

The two upper panels in figure 2 show the differences in household income before and after the COVID-19 pandemic; the left upper panel plots the data for individuals who lost their jobs as a result of the pandemic, the right upper panel plots the data for individuals who retained their jobs. It is clear that irrespective of job-loss status, the COVID-19 pandemic has had a negative impact on household income but that job-losers have been more affected.

The bottom panels in figure 2, show the differences between job-losers and job-retainers; the left bottom panel compares the two groups based on February 2020 data, the right bottom panel compares the same groups at the time of the first interview. Again, we see that irrespective of job-loss status household income shifted upwards for both groups[5] but that by definition the household incomes of job-losers suffered a relatively larger hit.

[5] See appendix figure A1 for a detailed breakdown of the changes in household income.

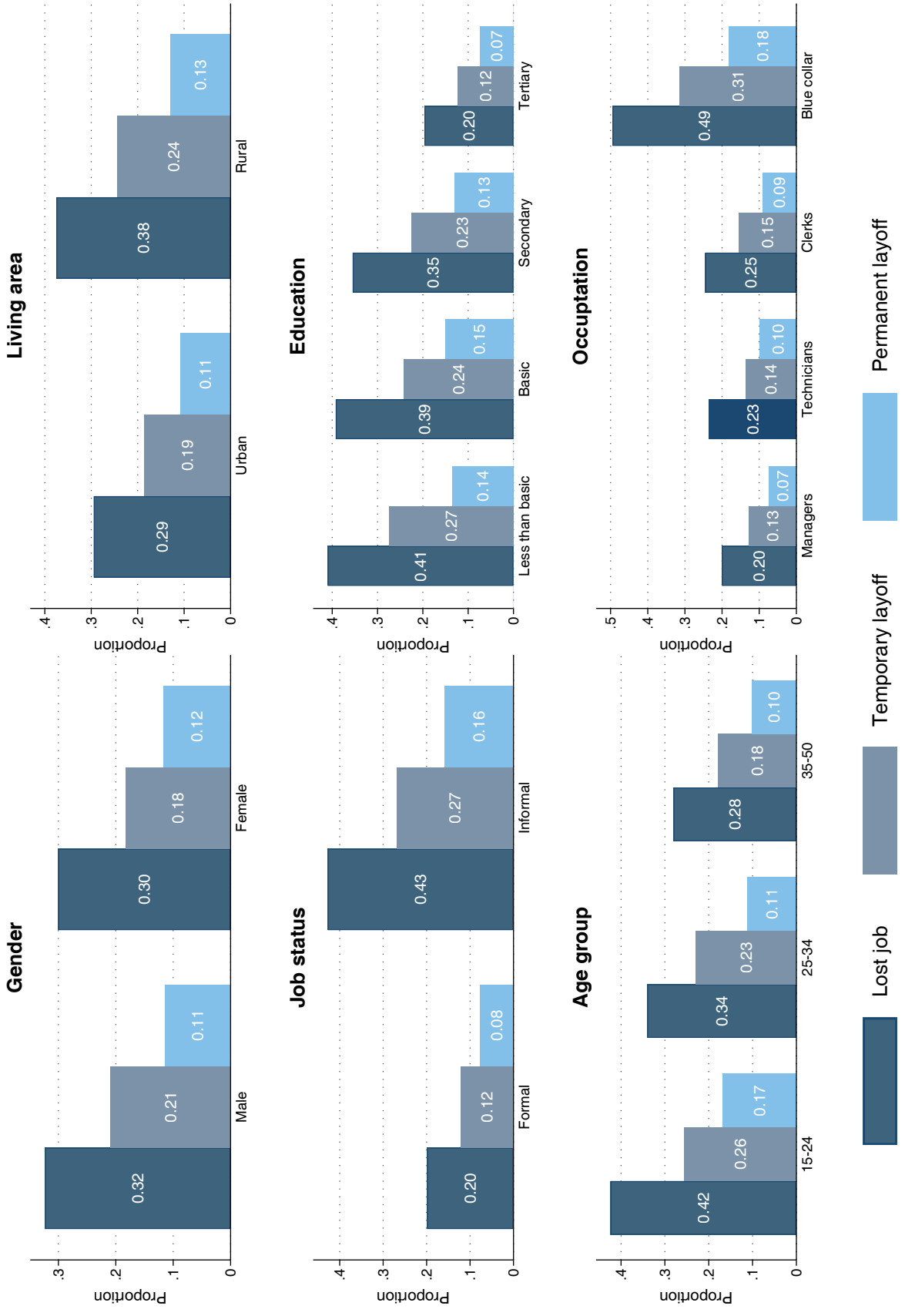

Figure 1: Job-loss shares by gender, living area, job status, education, age group and occupation

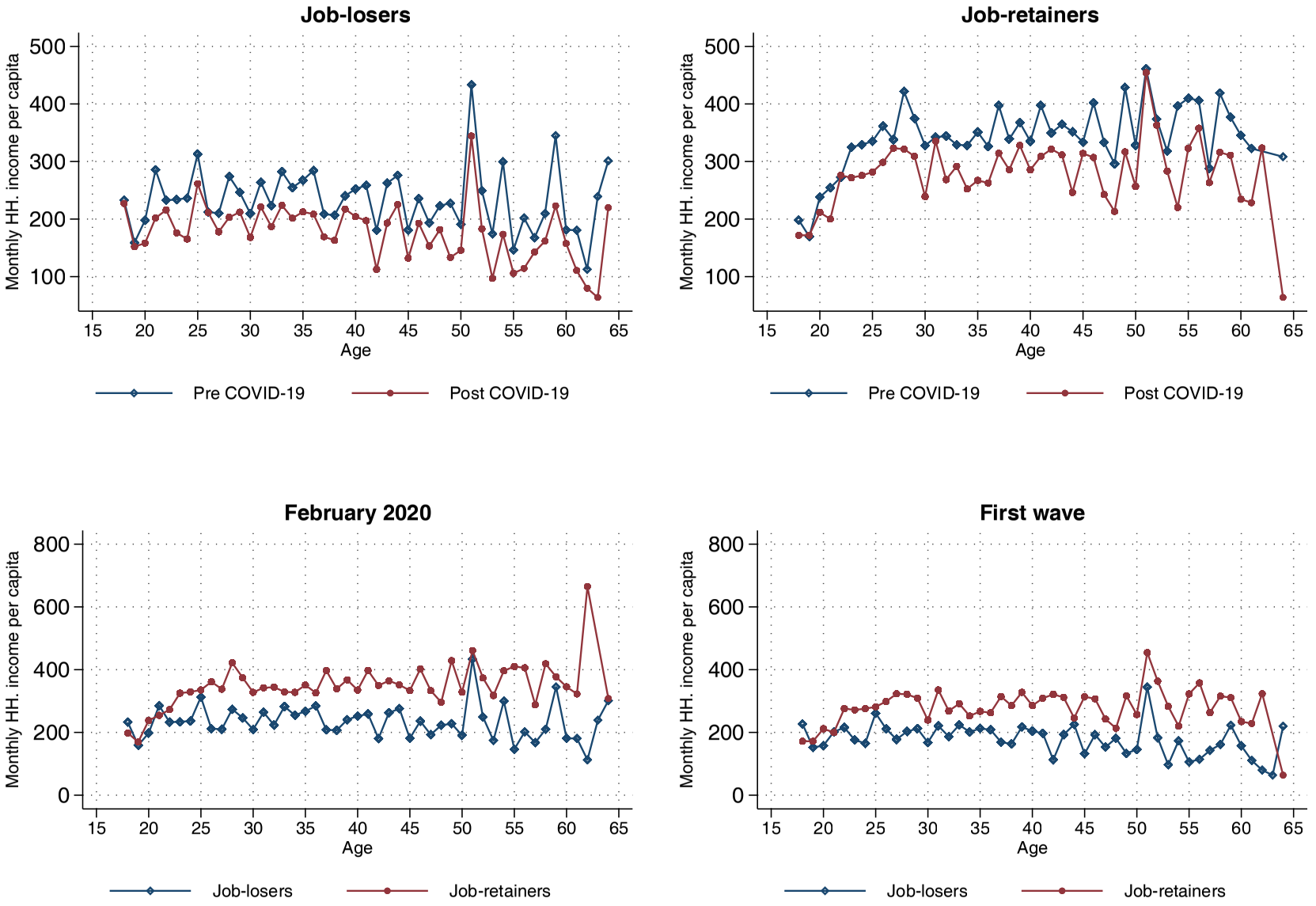

Figure 2: Household income per capita plotted by age. The upper left graph compares job-losers pre and post COVID; the upper right graph compares job-retainers pre and post COVID; the bottom left graph compares job-losers in February 2020; and the bottom right panel compares job-losers and job retainers at the first interview.

3. Estimation results

This section presents our empirical findings. Subsection 3.1 discusses the main results for the effect of job-losses due to COVID-19 on poverty, food security and coping mechanisms; subsection 3.2 provides a robustness analysis showing the effect change from using different indicators of job-loss; subsection 3.3 describes a heterogeneity analysis which shows how the effect differs across groups.

3.1 Main results

Table 2 shows the dy/dx effects of the parameters; we focus on understanding the effect of job-loss on the selected outcome variables. The upper panel in table 2 summarizes the coefficients of job-loss derived from an unweighted ordinary least square (OLS) estimation and shows a significant negative correlation between job-loss and the logarithm of household income per capita (-18%), and a positive correlation with the probability of inability to afford to buy food or reduced meals (12.9%/11.6%) There are also positive correlations with all the variables except borrowing. However, OLS estimates are likely to be biased due to observed differences between job-losers and job-retainers and inclusion of the results of an unweighted OLS provide a benchmark to allow comparison with the weighted regressions in the lower panel of table 2.

The lower panel in Table 2 presents the results of the regression including propensity score weights (see section 2.2.1). Compared to the unweighted OLS estimation, the weighted regression estimates are qualitatively unchanged but show some quantitative differences. Job-loss due to the COVID-19 pandemic decreases household per capita income by 11.5% which is 7 percentage points lower compared to the unweighted OLS, suggesting that unobserved characteristics driving job-loss status have inflated the negative effect.

Further, job loss resulting from the pandemic seems to affect food security to a quite large extent, with the probability of being unable to afford to buy food around 14 percentage points higher for job-losers compared to job-retainers, and the probability of reduced meals of around 11%. The remaining variables refer to coping strategies; specifically, actions taken by job-losers. The results on the bottom panel in Table 2 suggest that the main coping mechanisms employed by those who lost their jobs as a result of the COVID-19 pandemic were seeking help from relatives and relying on savings -

Table 2: Effect of job-loss on selected outcomes (Unweighted)

	(1) HH. income per capita	(2) Could not afford food	(3) Reduced meals/ portions	(4) Taking money out of savings	(5) Help from relatives	(6) Migrating backto family	(7) Borrowing	(8) Selling assets
A.Unweighted Job-loss	-0.183*** (0.032)	0.129*** (0.016)	0.116*** (0.016)	0.068*** (0.017)	0.093*** (0.017)	0.077*** (0.012)	-0.001 (0.012)	0.071*** (0.012)
R-squared	0.39	0.15	0.18	0.06	0.08	0.11	0.03	0.05
B.Weighted Job-loss	-0.115*** (0.033)	0.141*** (0.018)	0.110*** (0.016)	0.084*** (0.018)	0.099*** (0.018)	0.061*** (0.011)	-0.000 (0.013)	0.062*** (0.012)
R-squared	0.42	0.12	0.17	0.08	0.08	0.11	0.02	0.05
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2396	4768	4768	4768	4768	4768	4768	4768

*Notes: Authors' calculations. Robust standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01*

3.2 Robustness checks

In this subsection, we conduct four robustness checks to test the robustness of our findings; the results are presented in table 3.

Panel A in Table 3 estimates the persistence of the effects of job-loss due to COVID-19 on the same outcomes as above. The analysis shows that if the worker remained unemployed in the period between the two interviews, job loss at first interview (time t) this has an impact on the outcomes at the next interview (time t+1). We also observe some other effects: we observe that effect on per capita household income is slightly higher (15% vs. 11.5%), and the effect on ability to afford to buy food is slightly lower (6% vs 14%); the effect on reduced meals is very similar. The findings for the remaining variables are interesting: while getting help from relatives remains an important coping mechanism for job-losers, taking money out of savings becomes insignificant with the point estimate almost zero, while the probability of selling assets increases by 2 percentage points indicating that it is a last resort mechanism. The probability of back migration remains higher for job-losers but smaller compared to the previous estimation.

Table 3: Effect of job-loss on selected outcomes in t+1 (Propensity score weighted)

	(1) HH. income per capita	(2) Could not afford food	(3) Reduced meals/portions	(4) Taking money out of savings	(5) Help from relatives	(6) Migrating back to family	(7) Borrowing	(8) Selling assets
A. Outcomes t+1								
Lost job	-0.150**	0.060*	0.117***	0.002	0.086***	0.037*	-0.004	0.086***
	(0.062)	(0.033)	(0.033)	(0.034)	(0.031)	(0.020)	(0.025)	(0.022)
Observations	743	1432	1432	1432	1432	1432	1432	1432
R-squared	0.44	0.21	0.15	0.07	0.13	0.08	0.05	0.08
B. Temporary lay off								
Lost job	-0.086**	0.138***	0.113***	0.115***	0.104***	0.060***	0.012	0.048***
	(0.040)	(0.022)	(0.020)	(0.022)	(0.022)	(0.012)	(0.017)	(0.013)
Observations	2141	4414	4414	4414	4414	4414	4414	4414
R-squared	0.46	0.13	0.17	0.09	0.08	0.11	0.03	0.05
C. Permanent lay off								
Lost job	-0.228***	0.180***	0.214***	0.051	0.166***	0.115***	-0.039	0.048**
	(0.053)	(0.040)	(0.033)	(0.044)	(0.047)	(0.024)	(0.024)	(0.024)
Observations	1573	3488	3488	3488	3488	3488	3488	3488
R-squared	0.42	0.18	0.30	0.10	0.12	0.22	0.07	0.09
D. Control group unaffected[6]								
Lost job	-0.119***	0.133***	0.097***	0.079***	0.095***	0.052***	-0.015	0.059***
	(0.037)	(0.021)	(0.018)	(0.021)	(0.021)	(0.012)	(0.014)	(0.014)
Observations	2109	4322	4322	4322	4322	4322	4322	4322
R-squared	0.42	0.13	0.16	0.08	0.08	0.11	0.02	0.06
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Notes: Authors' calculations. Robust standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01*

[6] This estimation compares job-losers only with workers who were not affected by the COVID crisis, namely workers who kept the same job, the same hours of work and the same wages.

In a second robustness check, we provide separate results for workers who suffered permanent job loss and workers who suffered temporary job loss (panels B and C). As expected, the effect of permanent job loss has a stronger effect on all the dimensions compared to those who lost their jobs temporarily.

The effect of permanent job-loss on household income per capita is around 23%, while for workers suffering temporary job loss the effect is around 9%. These two groups differ also in relation to food security which is lower for those whose job loss was permanent compared to temporary job loss. Similar differences are observed for coping strategies but probability of getting help from friends and relatives is higher for permanent job-losers and the probability of back migration for this group is almost twice as high. The main coping mechanism for temporary job-losers seems to be using savings whereas in the case of permanent job-loss this is not significant although the point estimate is much smaller suggesting that permanent job-losers were in a worse position initially – probably struggling already and with fewer savings.

Figure 2 showed that the negative effects of COVID on household income have been universal regardless of employment status which suggests that there are some workers who although they managed to retain their jobs have been affected by reduced incomes or reduced working hours. Therefore, to ensure that our main estimation strategy is not providing misleading estimations due to the existence of individuals who retained their jobs but experienced cuts in working hours or wage reductions, in a final robustness check we conducted an analysis in which the control group is individuals who maintained their jobs and their same working hours and pay levels. The results of this analysis are presented in table 3 panel D.

The results of this robustness check suggests that the main estimation strategy is valid because although it includes individuals who may have experienced a reduction in working hours or income, the results are qualitatively and quantitatively almost identical. This means that in practical terms, the effect on the dependent variables is almost the same apart from small differences for food security, migration and sale of assets.

3.3 Heterogeneity

In this subsection, we discuss the results of the heterogeneity analysis. The heterogeneity analysis is conducted in two steps (respectively figures 3a and 3b and table 4).

The first heterogeneity analysis shows the heterogeneous effects across several dimensions such as gender, country, education, job-characteristics, etc. However, the same job-loss probability model is used for all dimensions; in this case, we assume that the factors used to model the job-loss probability have a homogeneous effect on the job-loss probability across all dimensions. Using this strategy, we find heterogeneous effects of job-loss due to the COVID-19 pandemic for males, females, individuals aged under 30 years, individuals aged over 30 years, rural workers, urban workers, informal jobs, formal jobs, tertiary educated workers and non-tertiary educated workers, and find differences also among Morocco, Tunisia, and Egypt.

Figure 3 panel (a) depicts the heterogeneous effects of job-loss on per capita household income. We see that the more vulnerable groups suffered the most job-loss. The effect of job-loss on per capita household income is comparatively larger for females, young workers, informal workers,

rural workers and less educated workers compared to their peers. Also, the effects of job loss on per capita household income are largest for Tunisia followed by Egypt and Morocco. Figure 3 panel (b) depicts the heterogeneous effects of job-loss on food affordability. In this case, the groups are generally more balanced; with the exception of females, all other groups show the same effect confidence intervals. Panel (c) depicts the heterogeneous effects of job-loss on an indicator for reduced meals. The effect is positive and statistically significant for almost all groups but seems to be larger for females, workers aged over 30 years, urban workers and workers with tertiary education. Among countries, the largest effects are observed for Egypt followed by Tunisia and Morocco. Panel (d) plots the heterogeneous effects of job-loss on using savings in order to survive. The effect is mostly positive and statistically significant with the exception of young workers, workers with tertiary education and the Tunisian subsample. For all remaining dimensions, the effects are larger for females, for workers aged over 30, urban workers and the Egyptian subsample. Figure 3b panel (e) plots the heterogeneous effects of job-loss on getting help from relatives and shows that the groups are balanced with effects between 10% and 15% for all groups except rural workers and the Moroccan subsample where the effects are below 10%. Panel (f) plots the heterogeneous effects of job-loss on back migration. The effect is largest for young workers, those with tertiary education and workers in rural areas. The effects of job loss on back migration are largest for Egypt followed by Tunisia, while for the Moroccan subsample the point estimate is almost zero and non-significant. Panel (g) presents the heterogeneous effects of job-loss on borrowing and shows that the effect is near zero for all groups and is non-significant. Finally, panel (f) plots the heterogeneous effects of job-loss on the probability of selling assets and shows that for females the effect is nearly zero and for the other groups it is fairly similar. However, if we compare countries the probability of selling assets is highest for Egypt followed by Tunisia, and is only around 2% for Morocco.

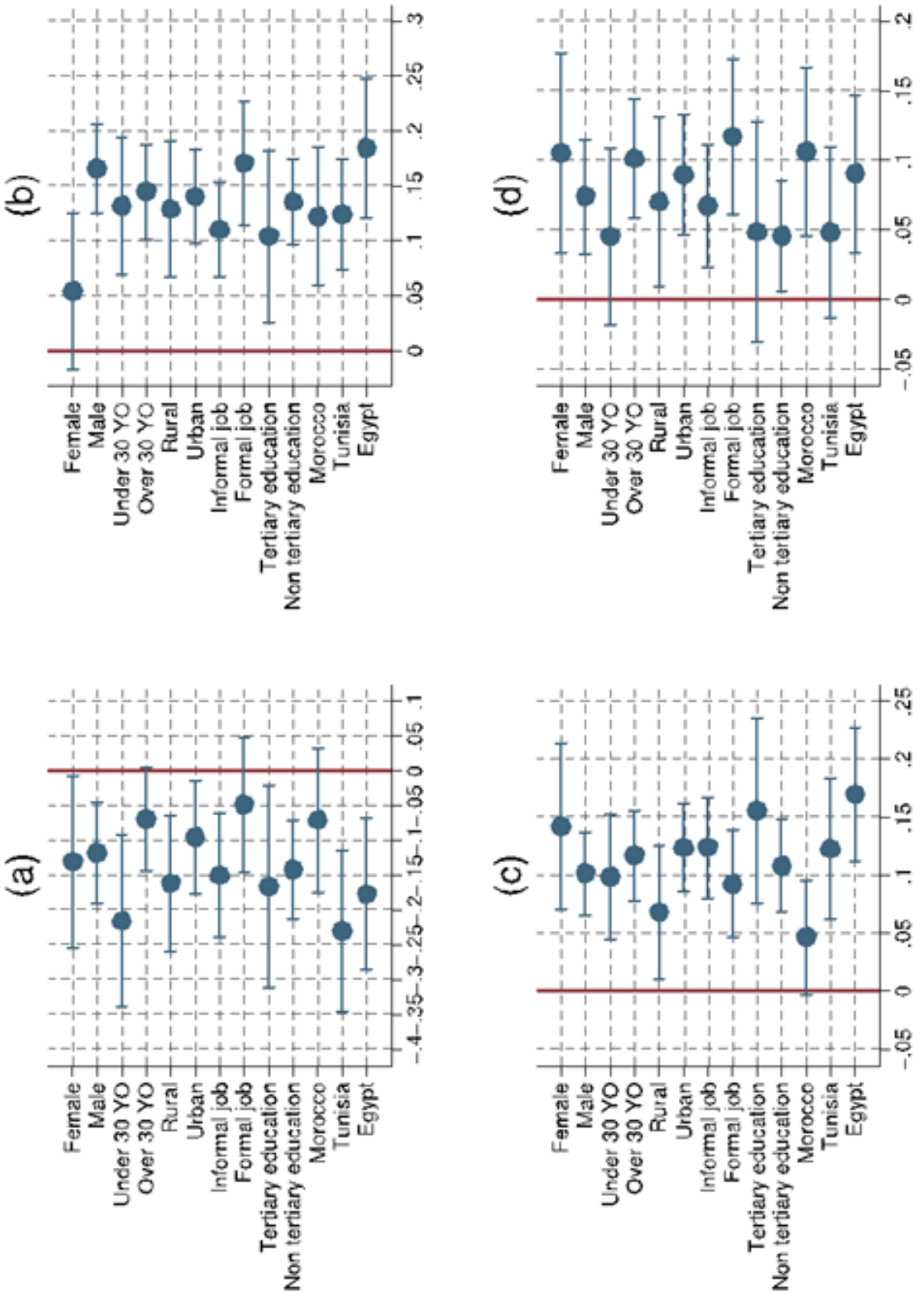

Figure 3a: Heterogeneous treatment effects

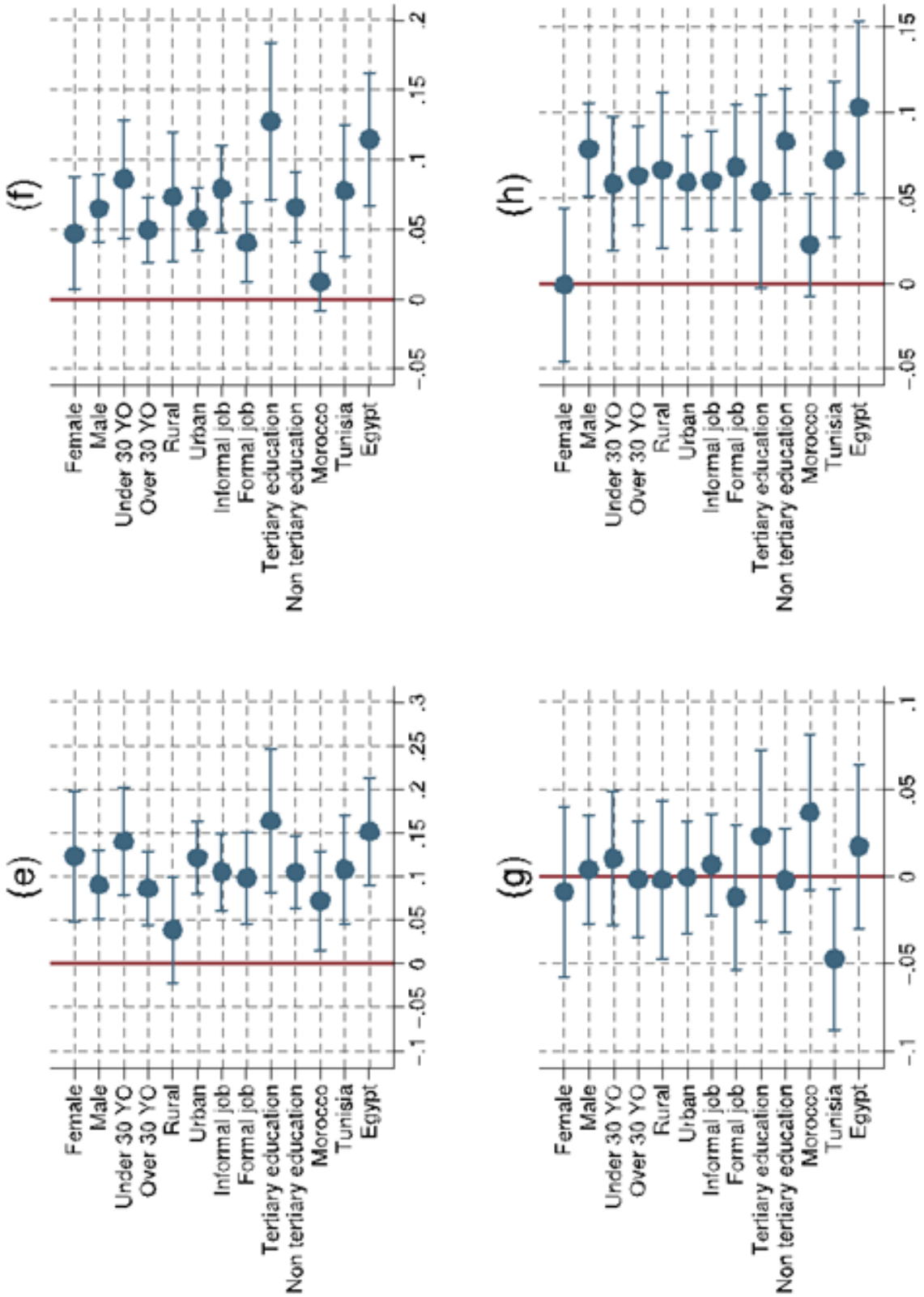

Figure 3b: Heterogeneous treatment effects. All the graphs report propensity score weighted average marginal effects for HH. income per capita in panel (a), food affordability in panel (b), reduced meals in panel (c) Taking money out of savings in panel (d), Help from relatives in panel (e), Migrating back to family panel (f), Borrowing panel (g), and Sellingassets panel (h).

The second step in the heterogeneity analysis shows the heterogeneous effects by country and by gender. Instead of employing the one job-loss probability model for all the dimensions, here we model the job-loss probability for all dimensions separately based on the idea that the effects on job---loss probability might be different across the dimensions considered.

Appendix table A2 presents the separate job-loss probabilities by country and gender. It suggests that although the probabilities are qualitatively almost identical, there are some quantitative differences. For instance, for female workers the job-loss probability is statistically significant for Egypt and Tunisia but not Morocco. Further, being married shows a negative association with job-loss across all dimensions except being female; the point estimate is statistically significant only for male dimension. We observe differences also in relation to living area; for Morocco and for male workers living area seems not to have an effect on job-loss probability but for Tunisia and Egypt and females living in rural locations living area seems to be negatively correlated with job-loss probability. Work that is conducted indoors seems to be important in the case of Tunisia, Egypt and male workers while for Morocco and for female workers we find no statistically significant correlation. Finally, for maintaining regular employment we find some quantitative differences: the effect of type of job on job-loss probability is negative and quite large for Tunisia and Egypt, and both males and females but is small and only marginally significant for Morocco.

This analysis confirms the findings derived from the first heterogeneity analysis that the effects are stronger for females compared to males, and that Tunisia and Egypt have been more adversely affected than Morocco. Essentially, the results of this and the initial analyses and almost identical; there are no significant differences which is not surprising since the effects of the factors used to model job-loss probability had identical qualitative effects on all dimensions and the quantitative differences were quite small.

Table 4: Effect heterogeneity based on a separate analysis by country and gender (Propensity score weighted)

	(1) HH. income per capita	(2) Could not afford food	(3) Reduced meals/portions	(4) Taking money out of savings	(5) Help from relatives	(6) Migrating backto family	(7) Borrowing	(8) Selling assets
Morocco	-0.094*	0.119***	0.042*	0.109***	0.082***	0.013	0.034	0.024
	(0.051)	(0.033)	(0.025)	(0.031)	(0.030)	(0.011)	(0.022)	(0.015)
Observations	968	1779	1779	1779	1779	1779	1779	1779
R-squared	0.36	0.06	0.11	0.08	0.07	0.06	0.05	0.05
Tunisia	-0.197***	0.130***	0.130***	0.047	0.107***	0.087***	-0.056***	0.069***
	(0.058)	(0.027)	(0.032)	(0.033)	(0.033)	(0.027)	(0.021)	(0.024)
Observations	651	1518	1518	1518	1518	1518	1518	1518
R-squared	0.38	0.11	0.13	0.07	0.07	0.08	0.04	0.06
Egypt	-0.189***	0.189***	0.175***	0.082***	0.155***	0.119***	0.026	0.106***
	(0.054)	(0.032)	(0.029)	(0.029)	(0.031)	(0.025)	(0.025)	(0.026)
Observations	777	1471	1471	1471	1471	1471	1471	1471
R-squared	0.26	0.09	0.15	0.11	0.08	0.09	0.03	0.05
Female	-0.132**	0.061*	0.152***	0.097***	0.122***	0.051**	-0.011	-0.001
	(0.063)	(0.036)	(0.037)	(0.037)	(0.038)	(0.022)	(0.027)	(0.023)
Observations	531	1097	1097	1097	1097	1097	1097	1097
R-squared	0.45	0.17	0.22	0.09	0.09	0.09	0.05	0.10
Male	-0.133***	0.170***	0.105***	0.073***	0.093***	0.068***	-0.002	0.083***
	(0.036)	(0.020)	(0.018)	(0.021)	(0.020)	(0.013)	(0.015)	(0.014)
Observations	1865	3671	3671	3671	3671	3671	3671	3671
R-squared	0.41	0.14	0.16	0.07	0.08	0.13	0.03	0.06
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Standard errors in parentheses * p < 0.10, ** p < 0.05, *** p < 0.01*

4. Conclusions

This paper explored the effects of the COVID-19 pandemic on job losses, household income and food security, by exploring the coping mechanisms employed and the heterogeneous effects of job-loss on the same outcomes for different vulnerable population subgroups e.g. women, young workers, informal workers and rural workers in Tunisia, Morocco and Egypt.

First, we found that job-losers experienced a greater decrease in household income, and the effect of job-loss on household income per capita is comparatively larger for females, young workers, informal workers, rural workers, and less educated workers compared to their peers and appears higher in Tunisia followed by Egypt and then Morocco. Second, job loss due to the COVID-19 pandemic has had a large effect on food security and led also to reduced meals and in the latter case especially for females, workers aged over 30 years, urban workers and workers with tertiary education. Third, we showed that job-losers are more likely to consume savings, seek help from relatives, sell assets and migrate back to their family homes.

This paper provides the following policy recommendations. First, during the COVID-19 crisis the countries included in the analysis gave assistance to everyone without taking into consideration job loss. Some of the job losses are permanent and some were temporary. Therefore, the effects on those people who lost their jobs are different and this should be taken into account so that those affected by job -loss receive higher levels of assistance. Second, strategies should be implemented to sustain the revenues of job losers. Social welfare systems require modernization and improvements to protect workers against sudden loss of income due to shocks such as the COVID-19 crisis. Welfare systems need to ensure that job-losers' incomes are sustained. Third, job-losers suffered the additional problem of securing food. Welfare programs and subsidies should be implemented to ensure the food security of people who lose their jobs. Fourth, we shoed that gender matters; females were more vulnerable than males to the crisis which suggests the need for support targeted at women. Fifth, in sectors where remote working is feasible, efforts should be made to modernize digital infrastructures and provide more opportunities for home working as an alternative to laying off employees.

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ANNEX

Table 1: Characteristics of the sample by job-loss status

	(1) Probability of job loss
Age	0.000 (0.004)
Age^2	-0.000 (0.000)
Female	0.053*** (0.016)
Married	-0.028* (0.017)
Rural	-0.040*** (0.015)
HH.Size	0.007** (0.003)
No. of children under 6	0.023*** (0.008)
Informal job	0.098*** (0.014)
Work inside an establishment	-0.045*** (0.015)
Regular job	-0.128*** (0.013)
educ_level==2	0.000 (0.021)
educ_level==3	-0.018 (0.018)
educ_level==4	-0.037* (0.022)
firmsize_f20==2	0.025 (0.021)
firmsize_f20==3	-0.018 (0.020)
firmsize_f20==4	-0.048*** (0.016)
Industry FE	Yes
Occupation FE	Yes
Wave FE	Yes
Country FE	Yes
Number of observations	**4768**

Standard errors in parentheses p < 0.10, ** p < 0.05, *** p < 0.01*

Table A2: Probability of job-loss by country and gender

	(1) Morocco	(2) Tunisia	(3) Egypt	(4) Female	(5) Male
Age	0.007 (0.007)	-0.004 (0.008)	-0.004 (0.009)	-0.007 (0.009)	0.004 (0.005)
Age^2	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Female	0.034 (0.024)	0.053** (0.026)	0.071** (0.034)		
Married	-0.031 (0.023)	-0.038 (0.031)	-0.012 (0.032)	0.007 (0.029)	-0.048** (0.020)
Rural	-0.012 (0.027)	-0.052* (0.028)	-0.060** (0.024)	-0.086** (0.034)	-0.020 (0.016)
HH.Size	0.003 (0.004)	0.017*** (0.006)	0.007 (0.007)	0.003 (0.007)	0.006 (0.004)
No. of children under 6	0.029** (0.013)	0.026* (0.015)	0.014 (0.015)	0.059*** (0.018)	0.017* (0.010)
Informal job	0.088*** (0.022)	0.101*** (0.024)	0.131*** (0.027)	0.062** (0.028)	0.106*** (0.016)
Work inside an establishment	0.035 (0.022)	-0.095*** (0.027)	-0.067** (0.028)	-0.038 (0.031)	-0.033* (0.017)
Regular job	-0.036* (0.022)	-0.154*** (0.022)	-0.204*** (0.023)	-0.167*** (0.026)	-0.120*** (0.015)
educ_level==2	-0.002 (0.031)	-0.046 (0.037)	-0.007 (0.046)	-0.084* (0.051)	0.030 (0.024)
educ_level==3	-0.013 (0.029)	-0.038 (0.032)	-0.046 (0.036)	-0.043 (0.044)	0.015 (0.020)
educ_level==4	-0.036 (0.031)	-0.093** (0.040)	-0.071* (0.043)	-0.128*** (0.048)	0.007 (0.025)
firmsize_f20==2	0.033 (0.031)	-0.014 (0.037)	0.060 (0.041)	-0.011 (0.044)	0.029 (0.024)
firmsize_f20==3	0.029 (0.031)	-0.039 (0.034)	-0.045 (0.036)	-0.004 (0.039)	-0.021 (0.023)
firmsize_f20==4	0.025 (0.025)	-0.100*** (0.029)	-0.066** (0.030)	-0.057* (0.032)	-0.042** (0.019)
Industry FE	Yes	Yes	Yes	Yes	Yes
Occupation FE	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes
Number of observations	**1779**	**1518**	**1471**	**1097**	**3671**

*Standard errors in parentheses * p < 0.10, ** p < 0.05, *** p < 0.01*

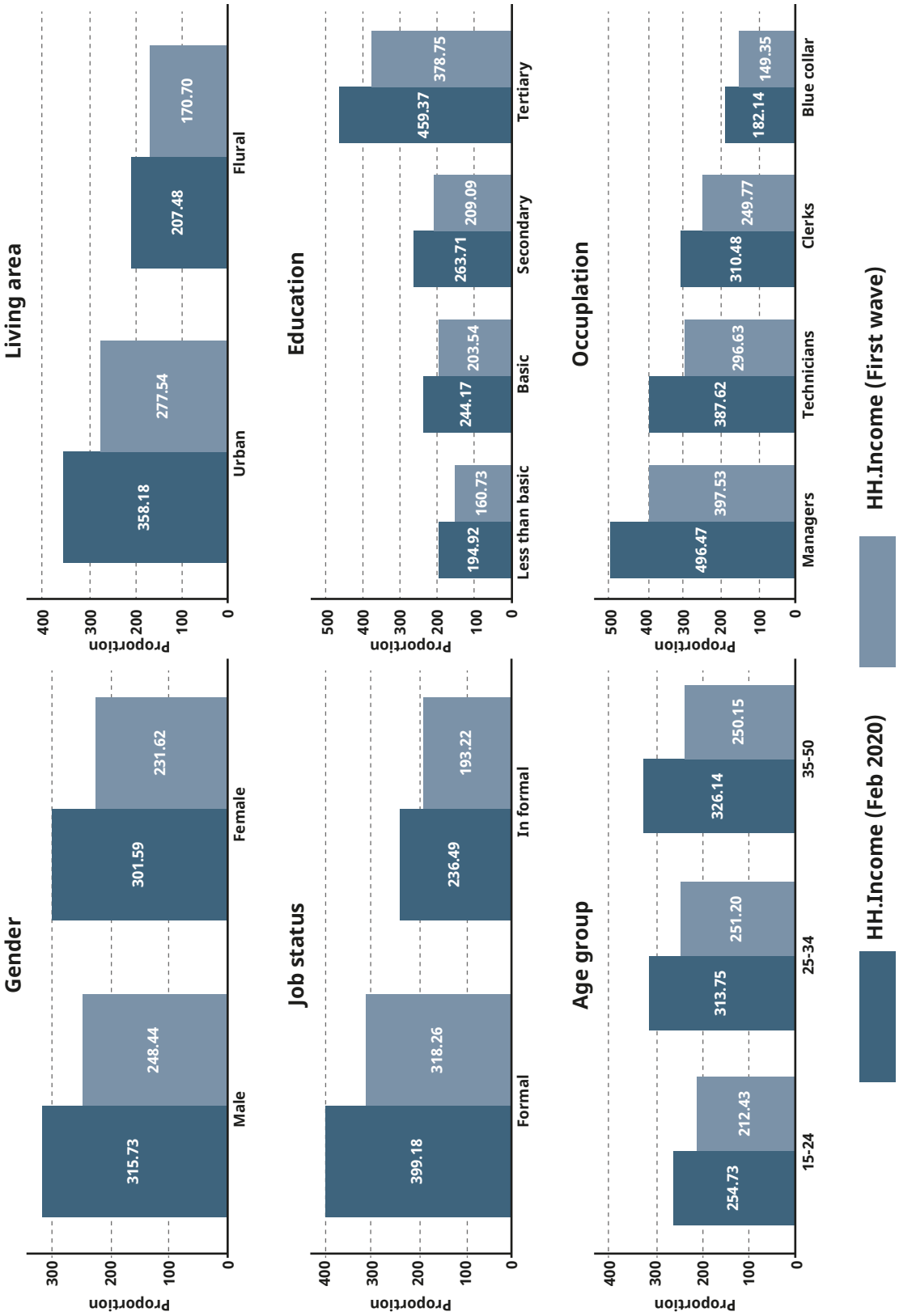

Figure 1A: Household income in February 2020 and at the time of first interview separated by gender, living area, job status, education, age group and occupation.

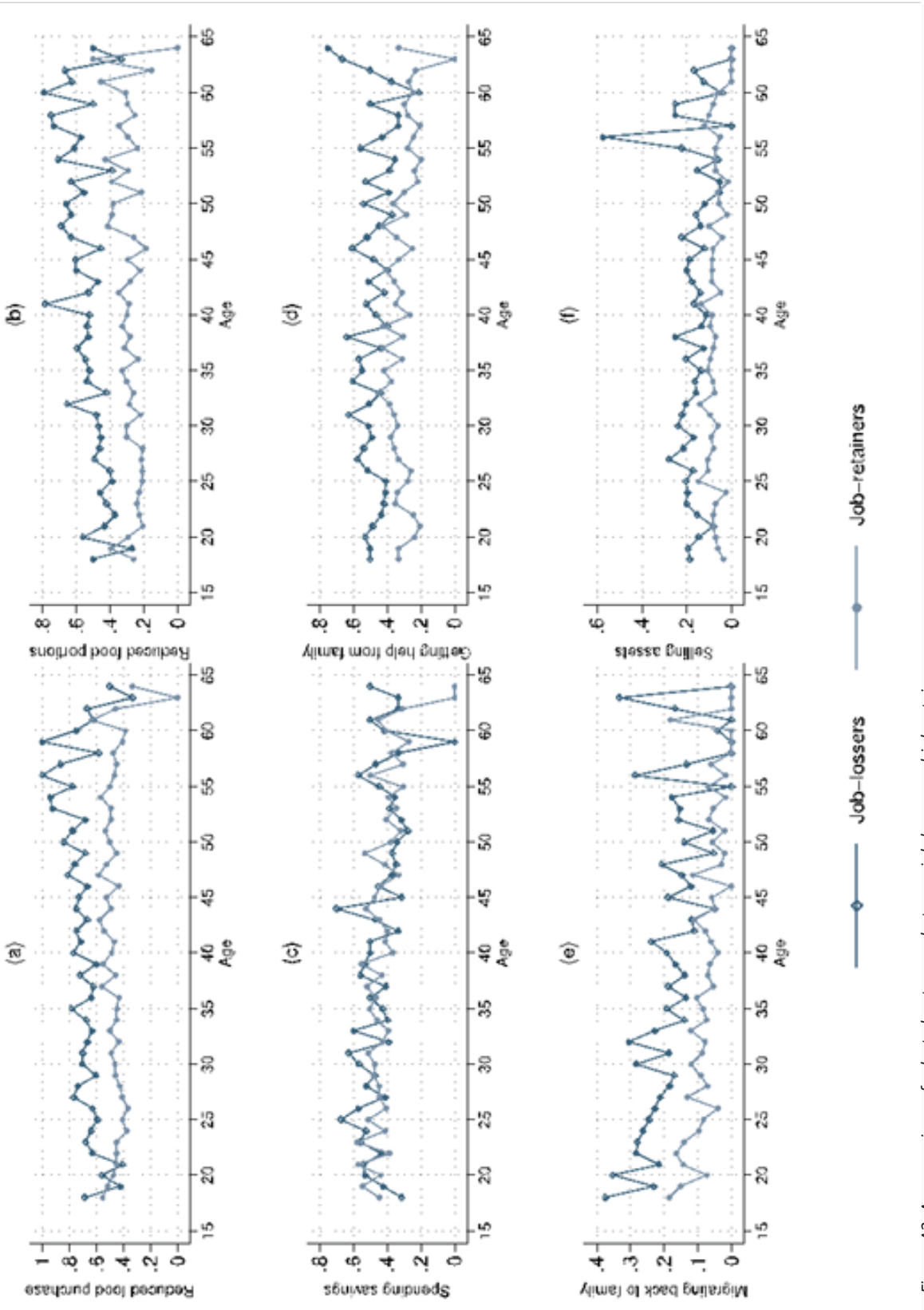

Figure A2: A comparison of selected outcomes between job-losers and job retainers.

Sweden
Sverige

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- **Email:** adwa@ilo.org
- **Address:** 13 Brazil St., Zamalek, 11211, Cairo, Egypt
- ilo.org/Cairo|Twitter| Facebook|YouTube