sustainability

MDPI

Article

The Impact of COVID-19-Induced Responsibilities on Women's Employment in Arab Countries

Suzan Abdel-Rahman [1], Mohamed R. Abonazel [2,*], Fuad A. Awwad [3] and B. M. Golam Kibria [4]

[1] Department of Biostatistics and Demography, Faculty of Graduate Studies for Statistical Research, Cairo University, Giza 12613, Egypt
[2] Department of Applied Statistics and Econometrics, Faculty of Graduate Studies for Statistical Research, Cairo University, Giza 12613, Egypt
[3] Department of Quantitative Analysis, College of Business Administration, King Saud University, P.O. Box 71115, Riyadh 11587, Saudi Arabia
[4] Department of Mathematics and Statistics, Florida International University, Miami, FL 33199, USA
* Correspondence: mabonazel@cu.edu.eg

Abstract: The COVID-19 pandemic has created massive challenges for women's employment. Women's responsibilities were exacerbated by the closure of schools and child daycare facilities. Investigating the determinants of job losses among women is critical to avoiding dropouts and supporting re-entry into the labor market. This study investigates the factors driving women's workforce losses during the pandemic in five Arab countries (Egypt, Tunisia, Morocco, Jordan, and Sudan). The current study focuses mainly on how COVID-19-induced responsibilities affected women's employment during the pandemic. The study depends on the COVID-19 MENA Monitor Household Survey produced by the Economic Research Forum. The factor analysis of mixed data is used to construct the women's responsibilities index that is made up of 18 variables. The mixed-effect logistic model is used to consider changes in working arrangements across economic activities. The results indicate that women with high family caregiving responsibilities were more likely to lose their jobs. Women working in the government sector and with health insurance were protected from job losses. Telecommuting played a significant role in helping women maintain their jobs. Work arrangements should be improved to consider increased unpaid domestic work. Family-friendly policies must be activated, and childcare leave must be facilitated and funded. The private sector should also be urged to improve workplace flexibility.

Keywords: COVID-19; women's responsibilities; job loss; public sector; work arrangements; mixed-effect logistic model

Citation: Abdel-Rahman, S.; Abonazel, M.R.; Awwad, F.A.; Kibria, B.M.G. The Impact of COVID-19-Induced Responsibilities on Women's Employment in Arab Countries. *Sustainability* **2023**, *15*, 9856. https://doi.org/10.3390/su15139856

Academic Editors: Tomasz Rokicki, Sebastian Saniuk and Dariusz Milewski

Received: 22 April 2023
Revised: 16 June 2023
Accepted: 19 June 2023
Published: 21 June 2023

1. Introduction

Although progress has been achieved in enhancing women's access to the labor market, is still significantly limited in Arab countries. Discrimination against women continues as a long-standing pattern in the Arab region. Before the pandemic, labor force participation and employment rates varied substantially by gender. Women's participation in the labor force remained significantly lower than that of men and persisted in long-term patterns, coinciding with higher unemployment rates [1]. Moreover, the increase in the employment rate in the recent waves compared to the onset of the pandemic did not hold for women, and their employment rate remained much lower compared to that of men in the Arab countries [2–4].

On the other hand, working women had a heightened risk of losing their jobs and suffering income drops during the pandemic, especially since childcare responsibilities are not evenly distributed among parents [5]. Previous studies documented that the pandemic negatively affected women's employment due to increased duties [6–8]. Most women spent more time in unpaid care due to increased childcare responsibilities, shifting to online

education, performing household chores, and performing healthcare-related activities more than before the pandemic. In total, 62% of Tunisian women and 24% of Yemeni women reported an increase in the time they spent on domestic chores after the pandemic [9].

The COVID-19 pandemic has worsened the social and economic well-being of women worldwide. Women were more likely to experience job losses and income reductions [10]. Women were concentrated in industries negatively affected by lockdown measures such as clothing, retail, and leisure industries and were more likely to lose their jobs than be furloughed [11]. Women were challenged by the burdens of housework, childcare, and caring for the elderly and sick household members. Therefore, they had to reduce working hours and experience income drops [12–14]. The consequences of the COVID-19 crisis should be addressed, as it could undermine the acquired progress in women's economic empowerment and widen gender inequality in employment outcomes [15].

However, recent research highlighted that the COVID-19 crisis has affected women's employment patterns differently in contrast to previous recessions. Lockdown measures, layoffs, and home-based work arrangements have allowed childcare responsibilities to be shared between parents and reduced the care gap, allowing women to maintain their jobs [16]. Andrew et al. [17] found that the crisis has increased parents' share of care responsibilities. Sevilla and Smith [18] found that the allocation of childcare hours during COVID-19 became more equal between fathers and mothers compared to the previous periods. Hupkau and Petrongolo [19] indicated that childcare responsibilities shift to fathers, whereas working mothers have to work outside the home.

The pandemic affected women and men differently, causing disproportionate losses of jobs and incomes [20]. Some countries, including Arab countries, have sought to provide broad social protection programs to support vulnerable segments including informal workers and working mothers. The Egyptian government has considered the increased unpaid domestic work and allowed more flexible work arrangements for women during the pandemic. The Egyptian government issued special policies to empower working women during the COVID-19 pandemic. Working mothers caring for children $\leq$12 years old and pregnant working women have been granted exceptional leave, as well as working women in contact with infected spouses. These exceptional leaves are paid and applied to working women in all units of the state's administrative apparatus as ministries, government agencies, local administration units, public bodies, and public sector companies. Rural women leaders received a three-fold increase in their monthly incomes from the ministry of social solidarity.

Several studies have explored the structure of employment and job creation in the pre-pandemic period in Arab countries [21–26]. An increasing number of studies have also been concerned with the changes shaping the Arab labor market during the pandemic. Krafft et al. [27] assessed the COVID-19 implications for informal workers and indicated that informal workers were the most affected groups who faced worse labor market outcomes in Arab countries.

From a gender perspective, some studies investigated changes in the Arab labor market, highlighting the gender inequality in negative labor outcomes [28–31]. Yassin and Hendy [28] focused on the effect of the increased burden of domestic work on women's time use, employment, and work preferences. They found that women's employment rate declined more than men's and that COVID-19 fundamentally changed working mothers' job preferences because they had to restructure their time use. ElBehairy et al. [29] examined how the COVID-19 health crisis has affected the gender gap in labor market outcomes and highlighted that the unemployment rate has been substantially higher after the pandemic compared to the pre-pandemic rate, especially for women, because they had higher exit flows in the private sector. Hendy and Yassin [30] investigated the amount of time shifted toward household chores during the pandemic and how time shifts have affected women's employment using the Employment and Time-Use Survey in Egypt and found that the crisis forced women to spend more time on domestic work.

Abdel-Rahman et al. [31] provided empirical evidence that women were more likely to change their main activity and be permanently laid off than males. Additionally, the increased childcare and housework responsibilities significantly shaped women's labor market outcomes during the pandemic. The findings of their study contribute to a better understanding of the impact of COVID-19 on gender inequality in MENA countries.

To date, a limited number of studies have investigated the impact of COVID-19 on women's employment in Arab countries, and their analyses have been largely descriptive. Unlike the previous studies, which focus on measuring the gender gap in labor market outcomes, the current study focuses on clarifying the significant factors driving women's workforce losses during the pandemic. We focus mainly on how COVID-19-induced changes affected women's employment status during the pandemic. Additionally, we paid special attention to the role of pre-pandemic work characteristics in protecting women from job losses, including occupation, sector type, social insurance, and work stability. We used factor analysis of mixed data to construct the women's responsibilities index. We used a mixed-effect logistic model to consider the variability in job losses across economic activities.

Women are mainly responsible for domestic work in Arab countries. Social norms prevailing in Arab countries encourage fathers to leave childcare and house chores to women. In this context, the current research hypothesizes that the increased women's responsibilities during the pandemic substantially affected their employment and increased the barriers to retaining their jobs. We also assume that the safe work characteristics, especially the existence of social insurance and work in the public sector, have mitigated the negative effects of the health crisis.

2. Materials and Methods

The study depends on the COVID-19 MENA Monitor Household Survey (HH/CMMHH) produced by the Economic Research Forum. The data were collected through phone interviews with a random sample of mobile phone users aged 18–64. The survey integrates and harmonizes questions across five countries (Egypt, Tunisia, Morocco, Jordan, and Sudan). The survey covers demographic and family characteristics, education and children, labor market conditions, and employment and unemployment situations before and after the pandemic. The survey includes several modules. The worker module provides pre-pandemic work characteristics (occupation, economic activity, social insurance status, work stability, and formality) and indicates the impact of COVID-19 on employment and work arrangements. There is also a women's module that covers the caregiving time for children and housework and explains, in detail, the activities carried out for the household. To measure the impact of the pandemic on women and their vulnerability to job losses, the analysis is limited to women who were employed prior to COVID-19. The sample size consists of 2309 women, distributed as 544 in Jordan, 493 in Morocco, 164 in Sudan, 825 in Tunisia, and 283 in Egypt.

2.1. Women's Responsibilities Index

COVID-19 affected children's education through school closures, pushing women to devote more time to helping their children continue learning through online platforms and books. Closures of children's daycare homes also increased the time spent in childcare. Women became the main health and education caregivers in households. We used factor analysis to create a responsibilities index that expresses women's responsibilities during the COVID-19 period. There are 22 variables that make up the woman's responsibilities index (WRI), including household size and composition; the number of children under six years; the number of children enrolled in school; having children spend time in education (online education, educational television, written materials); the mother teaches her children herself; the number of hours spent in childcare and carrying out household chores; and other variables describing the different activities women carried out during the COVID-19 period. For more details, see Table A1.

We used Factor Analysis of Mixed Data (FAMD) to identify the underlying factors of 22 responsibility items. FAMD is a principal component method suitable for analyzing a dataset containing a mix of quantitative and qualitative variables. FAMD also allows for revealing the similarity between observations by considering a mixed type of variables. All included variables are normalized to balance the influence of the different sets of variables. Before conducting the FAMD, we assessed factorability using the Kaiser–Meyer–Olkin Index (KMO) test and Bartlett's test of sphericity. KMO measures sampling adequacy and ranges between 0 and 1, where large values demonstrate higher suitability for the factor analysis. Bartlett's test of sphericity investigates whether a correlation matrix differs significantly from the identity matrix. The significance of Bartlett's test indicates the suitability of the correlation matrix for the factor analysis [32].

We performed FAMD using singular value decomposition (SVD), which examines covariance correlations between variables and individuals simultaneously in contrast to the commonly used spectral decomposition (ED), which only considers covariances/correlations between variables [33]. The active variables used for constructing FAMD are the 22 items that constitute women's responsibilities. Eigenvalues and the scree plot were used to indicate the variance explained by the principal components (PCs), while parallel analysis is executed to determine the optimal number of factors that should be extracted.

The Tucker Lewis Index of factoring reliability, root mean square of residuals (RMSR) and root mean square error of approximation (RMSEA) index were also used to validate the factor analysis and determine its goodness of fit. Loadings are interpreted as the correlation values between each item and PCs and are used as coordinates on the factor maps. The square of each coordinate (correlation value) represents the proportion of variance explained by each PC. Squared coordinates (Cos2) are visualized to show the quality of representation of all variables on the factor map. A high Cos2 value indicates that the variable is perfectly represented by the extracted PCs. The sum of the Cos2 of each variable on all principal comments equals one. We used a cut-off value of 0.4 to determine whether a variable loads or correlates in a meaningful way on the factor. Any variable having a factor loading less than 0.4 was deleted from the model. To improve visibility and avoid overlapping between factors, variables were restricted to load on one single factor.

2.2. Mixed-Effect Logistic Regression

Economic activities have been unevenly affected by the pandemic. Accommodation and food service activities, real estate, manufacturing, wholesale, and trade were high-risk industries and the most affected during the pandemic, while education, health, and social work activities were the least affected by the negative effects of the pandemic [33]. In this context, we strongly suggest that labor market outcomes, especially job losses, are highly correlated within economic activities and are different across them at the same time. We considered the variation across economic activities using the random intercept model. Moreover, there are significant differences in the proportion of workers who were able to work remotely across different economic activities. Additionally, reporting changes in working hours varied significantly across economic activities. Therefore, Random slopes are defined with respect to economic activities (E) interacting with COVID-19-related variables. We used the mixed-effect logistic regression (MELR) to identify the most contributing factors to women's job losses. MELR is a type of generalized linear mixed model that allows for the estimation of both fixed and random effects. Our model takes the following form:

$$logit(p(y = 1)) = \beta_0 + \alpha_{0,E} + \beta_k X_k + \alpha_{CWH,E} CWH + \alpha_{WFH,E} WFH + \alpha_{WRI,E} WRI$$

Our response variable y is job loss, taking 1 if the woman lost her job during the pandemic and taking 0 otherwise. β_0 is the average log of odds across the economic activities (fixed effect for the model's intercept). $\alpha_{0,E}$ is the random intercept for the economic activity E. $\beta_1, \ldots\ldots, \beta_k$ are the fixed-effect coefficients for k predictors. X_k is the explanatory variables (fixed effects), including the place of residence (rural/urban),

age, education level, occupation, economic sector, and dummy variables that indicate the work stability, the presence of social insurance, and work inside establishments. The random-effect parts were added to the slope of the COVID-19-related variables, which include working from home (WFH), change in working hours (CWH), and the women's responsibilities index (WRI). $\alpha_{WH,E}$ is the random slope of a change in working hours, $\alpha_{WFH,E}$ is the random slope of working from home, and $\alpha_{WRI,E}$ is the random slope of the women's responsibilities index for economic activity E.

We measured the interclass correlation coefficient (ICC) to assess the validity of MELR. ICC is an important statistic that describes the correlation within the clusters and the variability across them. If the ICC value is higher than 0.05, it means that there is a lot of variability between the clusters. The Lme4 package is used to fit the MELR [34]. The model's goodness of fit is measured using the Akaike information criterion (AIC) and the Bayesian information criterion (BIC); the lower the AIC and BIC are, the better the model is. Additionally, the likelihood ratio test is used to indicate the significant difference between the two nested models by comparing their log-likelihoods.

3. Results

3.1. Sample Characteristics

Table 1 provides the baseline characteristics of the study women. The average age of women is 36.87 years. More than half of women have university education, and about 23% have secondary education. The majority are urban residents (83%) and are currently married (61%). Regarding their work characteristics before the pandemic, 69% of women worked in the private sector, while 31% worked in the government sector. Women are not evenly distributed in economic activities: 29% work in educational activities, 11.7% work in health services, and 13.9% work in manufacturing activities. A third of the women are clerks/service workers, and 18% are blue collar, skilled agricultural, production, and transport workers. About three-quarters of the women are engaged in regular work (permanent or temporary) and work inside the establishment. More than half of them have social security (57.6%).

Table 1. Baseline characteristics of the study women (N = 2309).

Variable	Level	n (%)
Age	Mean ± SD	36.87 ± 10.29
Education	Less than basic	245 (10.6)
	Basic	221 (9.6)
	Secondary	522 (22.6)
	Higher education	1321 (57.2)
Place of residence	Urban	1910 (82.7)
	Rural	399 (17.3)
Marital status	Never Married	720 (31.2)
	Currently Married	1400 (60.6)
	Widowed/divorced	189 (8.2)
Economic activity	Agriculture, fishing, or mining	72 (3.1)
	Manufacturing	322 (13.9)
	Construction or utilities	42 (1.8)
	Retail or wholesale	216 (9.4)
	Transportation and storage	49 (2.1)
	Accommodation and food services	110 (4.8)
	Information and communication	115 (5.0)
	Financial activities or real estate	133 (5.8)
	Education	670 (29.0)
	Health	270 (11.7)
	Other services	310 (13.4)

Table 1. *Cont.*

Variable	Level	n (%)
Occupation	Manager/professional	542 (23.5)
	Technicians/associate professionals	585 (25.3)
	Clerks/service workers	764 (33.1)
	Blue collar, skilled agricultural, production, and transport	418 (18.1)
Employment stability	Regular (permanent or temporary)	1724 (74.7)
	Irregular (causal, seasonal, or intermittent)	585 (25.3)
Social insurance	Yes	1330 (57.6)
	No	979 (42.4)
Economic sector	Government/public sector	716 (31.0)
	Private sector/NGO	1593 (69.0)
Work in establishment	Yes	1713 (74.2)
	No	596 (25.8)
Work from home	Yes	800 (37.3)
	No	1345 (62.7)
Changes in working hours	Decreased by more than 25%	193 (8.4)
	Decreased by 1–25%	251 (10.9)
	Stayed the same	1761 (76.3)
	Increased by 1–25%	63 (2.7)
	Increased by more than 25%	41 (1.8)
Country	Jordan	544 (23.6)
	Morocco	493 (21.4)
	Sudan	164 (7.1)
	Tunisia	825 (35.7)
	Egypt	283 (12.3)

3.2. Women's Responsibilities Index

The Kaiser–Meyer–Olkin measure is 0.89, and the Bartlett's test of sphericity measure is highly significant (p-value < 0.001), indicating high sampling adequacy and suitability for conducting factor analysis. The mean item complexity equals 1.4. The root mean square of the residuals (RMSR) has an acceptable value and closes to zero (0.02), the Tucker Lewis Index of factoring reliability has an acceptable value (0.093), and the RMSEA index equals 0.049 (90% confidence interval (CI): 0.046–0.052), showing a good model fit, as it is below 0.05.

The Scree plot details the percentage of explained variance by each PC and shows that more than half of the information contained in the data can be retained on the first four PCs (Figure A1). The first four PCs have eigenvalues exceeding 1 and explained 51.5% of the variation (cumulative variance percent). A total of 28.5% of the total variance is explained by the first PC only. We depended on the parallel analysis to determine the optimal number of factors to retain. Figure A2 shows the non-graphical solutions to the Scree test. We extracted four factors based on optimal coordinate suggestions and parallel analysis.

The correlation values (loadings) between responsibility items and PCs are used as the coordinates on the PCs in Figure A3 (Correlation circle). For example, V1 is positively correlated with the two dimensions (PC1 and PC2), in contrast to V2, which is positively correlated with Dim1 and negatively correlated with Dim2. Variables close to the circumference are perfectly represented by the first two PCs based on Cos2's values. Most variables have high Cos2 values, indicating that they are well represented by the extracted PCs (Figure A4). Variables highly correlated with these PCs are the most important in explaining the variability in the dataset. Figure A5 arranges the variables according to their contributions in each PC. Most variables had high factor loadings and were associated with distinct factors. We excluded only three variables from the analysis because their loadings were less than the cutoff value (0.4) and have retained 19 variables. Tables A2 and A3

provide standardized loadings (pattern matrix) based upon the correlation matrix and measures of factor score adequacy. We used factor scores as standardized weighted averages. We added the extracted PCs to create a composite index by weighing each PC according to its proportion in explaining the total variance. The lower the WRI, the lower the responsibilities women incurred during the pandemic. The index scores are divided into three equally sized and ordered parts. The WRI has three categories (low, medium, and high).

3.3. Women's Job Losses According to Their Characteristics

Overall, 24.3% of women lost their jobs temporarily or permanently during the pandemic. Table 2 shows the characteristics of women who lost their jobs. A total of 41.6% of women with primary education lost their jobs during the pandemic, and the higher the education level, the lower the percentage of women who lost their jobs. Significant differences are found between the economic activities: 41% of women in manufacturing activities, 35.2% in retail or wholesale, 15.1% in education, and 18.5% in health services lost their jobs. High proportions of women working in blue collar, skilled agricultural, production, and transport jobs (43.5%), in the private sector (31.3%), in irregular jobs (44.4%), outside establishments (34.9%), and without social insurance coverage (34%) lost their jobs during the pandemic. The proportion of women who have lost their jobs differs significantly across countries. A total of 33.2% of Egyptian women and 29.7% of Tunisian women lost their jobs, compared to 18.8% of Jordanian women.

Table 2. Characteristics of working women who lost their jobs during the pandemic.

Variable	Level	No	Yes	*p*-Value
Age	Mean (SD)	37.5 (10.1)	35.0 (10.7)	<0.001 ***
Education	Less than basic	143 (58.4)	102 (41.6)	<0.001 ***
	Basic	139 (62.9)	82 (37.1)	
	Secondary	353 (67.6)	169 (32.4)	
	Higher education	1113 (84.3)	208 (15.7)	
Place of residence	Urban	1462 (76.5)	448 (23.5)	0.062
	Rural	283 (71.5)	113 (28.5)	
Marital Status	Never Married	529 (73.5)	191 (26.5)	0.048 *
	Currently Married	1084 (77.4)	316 (22.6)	
	Widowed/divorced	135 (71.4)	54 (28.6)	
Economic activity	Agriculture, fishing, or mining	34 (47.2)	38 (52.8)	<0.001 ***
	Manufacturing	190 (59.0)	132 (41.0)	
	Construction or utilities	31 (73.8)	11 (26.2)	
	Retail or Wholesale	140 (64.8)	76 (35.2)	
	Transportation and storage	42 (85.7)	7 (14.3)	
	Accommodation and food services	64 (58.2)	46 (41.8)	
	Information and communication	91 (79.1)	24 (20.9)	
	Financial activities or real estate	119 (89.5)	14 (10.5)	
	Education	569 (84.9)	101 (15.1)	
	Health	220 (81.5)	50 (18.5)	
	Other services	248 (80.0)	62 (20.0)	

Table 2. *Cont.*

Variable	Level	No	Yes	*p*-value
Occupation	Manager/professional	448 (82.7)	94 (17.3)	<0.001 ***
	Technicians/associate professionals	477 (81.5)	108 (18.5)	
	Clerks/service workers	587 (76.8)	177 (23.2)	
	Blue collar, skilled agricultural, production, and transport	236 (56.5)	182 (43.5)	
Employment stability	Regular (permanent or temporary)	1423 (82.5)	301 (17.5)	<0.001 ***
	Irregular (causal, seasonal, or intermittent)	325 (55.6)	260 (44.4)	
Social insurance	Yes	1102 (82.9)	228 (17.1)	<0.001 ***
	No	646 (66.0)	333 (34.0)	
Economic sector	Government/public sector	653 (91.2)	63 (8.8)	
	Private sector/NGO	1095 (68.7)	498 (31.3)	
Work inside establishment	Yes	1360 (79.4)	353 (20.6)	<0.001 ***
	No	388 (65.1)	208 (34.9)	
Work from home	Yes	648 (81.0)	152 (19.0)	<0.001 ***
	No	963 (71.6)	382 (28.4)	
Changes in working hours	Decreased by more than 25%	115 (59.6)	78 (40.4)	<0.001 ***
	Decreased by 1–25%	173 (68.9)	78 (31.1)	
	Stayed the same	1380 (78.4)	381 (21.6)	
	Increased by 1–25%	48 (76.2)	15 (23.8)	
	Increased by more than 25%	32 (78.0)	9 (22.0)	
WR index	Low	438 (81.0)	103 (19.0)	0.003 **
	Moderate	355 (75.7)	114 (24.3)	
	High	955 (73.5)	344 (26.5)	
Country	Jordan	442 (81.2)	102 (18.8)	<0.001 ***
	Morocco	400 (81.1)	93 (18.9)	
	Sudan	137 (83.5)	27 (16.5)	
	Tunisia	580 (70.3)	245 (29.7)	
	Egypt	189 (66.8)	94 (33.2)	

Percentages between brackets. In the last column of the table, the *t*-test and chi-square/Fisher's exact test were applied to check the association between job loss and women characteristics. *** *p*-value < 0.001, ** *p*-value < 0.01, * *p*-value < 0.05.

During the pandemic, 62.7% were unable to work remotely and gave the following reasons: 15.8% indicated that they were not allowed to work remotely, 4.9% lacked the technological capabilities, 77.7% were unable to complete work outside the workplace, and 1.3% were unable to work remotely due to care responsibilities. In total, 28.4% of women who were unable to work remotely lost their jobs, compared to 19% of women who worked from home. A total of 40.4% of women who witnessed a decrease in working hours by more than 25% lost their jobs, compared to 21% of women who kept the same number of working hours as before the pandemic. A significant relationship is found between the job loss and WRI levels; the increased responsibilities of women during the pandemic negatively affected their employment status.

3.4. Determinants of Women's Job Losses

Table 3 provides adjusted odds ratio (OR) estimates and 95% confidence intervals (CI) for the random intercept logistic model and the random intercept and random slope logistic model. The results are in favor of retaining the random intercept model. The likelihood ratio test indicates a significant difference between the fixed intercept model and the random intercept model (χ^2 = 13.28; *p*-value < 0.001). Additionally, the variance of the random intercept (σ^2_{00}) is 0.33, and the ICC value is large and exceeds 0.05, indicating that the random intercept is appropriate for estimating the clustered data in each economic activity. Accordingly, we accepted the heterogeneity of odds across the different economic countries. We tested the significance of the random slopes for COVID-19-related variables using the likelihood ratio test. Adding random slopes improves the model fit, and they were supported by the AIC and likelihood ratio test (χ^2 = 29.24; *p*-value = 0.003). Table 3 also provides the variance of the random slopes. The variance of increasing working hours by more than 25% is relatively high compared to other changes in working hours (σ^2_{11} = 1.75). We checked for multicollinearity between independent variables using the variance inflation factor (VIF), and all the variables had a VIF < 5.

Based on the random intercept and random slope model, a one-year increase in age reduced the odds of losing a job by about 3%, controlling for other variables (OR: 0.97, 95% CI: 0.96–0.98). Women with higher education were 53% less likely to lose their jobs than women with less than basic education (OR: 0.47, 95% CI: 0.31–0.72). Other demographic variables, place of residence and marital status, did not significantly affect the employment status of the women during the pandemic. Work characteristics before the pandemic significantly affected the odds of losing jobs, except for the type of occupation and work within the establishments. The odds of losing a job among women engaged in irregular jobs were about two and a half times the corresponding odds for women in regular jobs (OR: 2.46, 95% CI: 1.92–3.08). Women who lacked social insurance were 74% more likely to lose their jobs than insured ones (OR: 1.74, 95% CI: 1.36–2.22). Women working in the public sector were less likely to experience job loss compared to those working in the private sector; working in the public sector is associated with an estimated 62% reduction in the odds of losing jobs (OR: 0.38, 95% CI: 0.27–0.53).

Turning to the effects of COVID-19-induced changes in the work environment, experiencing a decrease in working hours by 1–25% during the pandemic decreases the odds of losing a job by 46% compared to the odds for those who experienced a more than 25% decrease in working hours. The odds of losing jobs decreased by 65% and 62%, respectively, among those who maintained the same working hours and those who witnessed a more than 25% increase in the working hours. Women with high responsibilities were at the highest risk of losing jobs, having 52% greater odds than women with low responsibilities. Women with moderate responsibilities also had 44% greater odds of losing jobs than women with low responsibilities. Additionally, women who were not able to work remotely had 12% higher odds of losing their jobs than women who were able.

Table 3. Random intercept versus random intercept and random slope logistic model.

Predictor	Random Intercept Model		Random Intercept and Random Slope Model	
	Odds Ratio	95% CI	Odds Ratio	95% CI
Intercept	1.12	0.32–2.45	1.22	0.49–3.00
Age	0.98 ***	0.96–0.99	0.97 ***	0.96–0.98
Education				
Basic	0.83	0.53–1.29	0.75	0.48–1.16
Secondary	0.92	0.62–1.38	0.85	0.57–1.26
Higher education	0.55 **	0.36–0.86	0.47 ***	0.31–0.72
Place of residence (urban)	1.17	0.87–1.58	1.22	0.91–1.64

Table 3. *Cont.*

Predictor	Random Intercept Model		Random Intercept and Random Slope Model	
	Odds Ratio	**95% CI**	**Odds Ratio**	**95% CI**
Marital Status				
Currently married	1.13	0.86–1.49	1.05	0.80–1.38
Widowed/divorced	1.25	0.80–1.95	1.23	0.79–1.91
Occupation:				
Technicians	0.80	0.56–1.13	0.81	0.57–1.14
Clerks/service workers	0.83	0.60–1.16	0.81	0.59–1.13
Blue collar, skilled agricultural, etc.	1.20	0.81–1.77	1.25	0.85–1.84
Employment stability (Irregular)	2.35 ***	1.85–2.98	2.46 ***	1.92–3.08
Social insurance (No)	1.63 ***	1.27–2.09	1.74 ***	1.36–2.22
Work inside establishment (No)	1.08	0.82–1.43	1.15	0.87–1.52
Economic sector (Public sector)	0.38 ***	0.27–0.53	0.38***	0.27–0.53
WR index				
Moderate	1.41	0.99–2.00	1.44 *	1.02–2.04
High	1.50 **	1.12–1.99	1.52 **	1.14–2.01
Working hours				
Decreased by 1–25%	0.48 **	0.30–0.79	0.54 **	0.34–0.86
Stayed the same	0.34 ***	0.22–0.52	0.35 ***	0.24–0.51
Increased by 1–25%	0.47	0.22–1.00	0.51	0.25–1.07
Increased by ≥25%	0.46	0.14–1.49	0.38 *	0.15–0.97
Work from home (No)	1.16 *	1.11–1.53	1.12 *	1.09–1.44
Random effects				
σ^2	3.29		3.29	
σ^2_{00}	0.33 Economic activity		0.28 Economic activity	
σ^2_{11}			0.25 Economic activity. Work from home (No)	
			0.65 Economic activity. WH decreased by 1–25%	
			1.23 Economic activity. WH stayed the same	
			0.65 Economic activity. WH increased by 1–25%	
			1.75 Economic activity. WH increased by ≥25%	
			0.09 Economic activity. WR index (Moderate)	
			0.23 Economic activity. WR index (High)	
ICC	0.09			
N	11 Economic activity		11 Economic activity	
Observations	2309		2309	
Marginal R^2	0.398		0.411	
AIC	2501.0		2113.8	
BIC	2181.4		2242.8	
Fixed-effect country	Yes		Yes	

Note: The reference categories are Less than basic education; Rural; Never married; Manager/Professional; Regular work; Having social insurance; Work outside the establishment; Private sector; Low responsibilities; Working hours decreased by more than 25%; and Unable to work remotely, respectively. It is worth noting that we tested the random intercept for the country and found that the ICC is 0.02, indicating that there is no variability across countries. * p-value < 0.05; ** p-value < 0.01; *** p-value < 0.001.

4. Discussion

Our study aimed to investigate the employment status of women during the pandemic and determine whether they were forced to lose their jobs due to the changes triggered by the pandemic. We created a responsibility index that reflects the increased responsibilities that women incurred during the pandemic and measured its impact on the probability of losing jobs. Some sectors have been shut down to counter the virus spread, such as the tourism and aviation sectors, non-food and nonmedical stores, hotels and restaurants, and leisure services. Job losses have been concentrated among workers in these sectors; therefore, we used a mixed effect logistic regression model to account for variability across economic sectors while measuring the determinants of job losses among women.

COVID-19 differs from previous crises, as it forced everyone to stay at home and increased women's shares of household-related tasks. Women have seen a one-third increase in unpaid care work [35]. We found that the odds of losing jobs among women who have high responsibilities are one and a half times the corresponding odds among women with low responsibilities. Our findings are in line with previous studies that found that working women had to spend more time in childcaring and homeschooling and were more likely to lose their jobs [6,30], and their incomes have been reduced due to the burden of childcare and carrying out fragmented tasks [36]. Previous studies found that increased childcare led to reduced working hours and forced women to exit the labor market [7,11,18,37]. Dubois [38] found contrary results, as women are more concentrated in part-time jobs that enable them to take care of children. Work arrangements during the pandemic highly predicted the likelihood of losing jobs among women. We found that women whose working hours decreased by more than 25% during the pandemic had a higher likelihood of losing jobs. In support of other studies [6,19], we also found that the likelihood of losing jobs has decreased significantly for women who succeeded in completing their work from home

We elaborate on the impact of pre-COVID-19 work characteristics, investigating the relative importance of the public sector versus the private sector in reducing job losses. We found that job losses were more concentrated among women in the private sector. Previous studies also supported that layoffs and income reductions are more pronounced among private sector workers and those working outside establishments [2,6]. This result could be attributed to the fact that the government sector provides family-friendly jobs. The government policies implemented by the public sector have played a vital role in smoothing the implications of COVID-19 for workers. The governmental sector allowed women to keep their jobs and reduced their working hours at the same time, meaning they were able to care for their children [28]. Moreover, public sector workers have permanent contracts and are involved in regular work, unlike private sector workers; the public sector has witnessed the intensive use of furloughs during the COVID-19 outbreak, while the private sector is characterized by a high rate of layoffs [6]. Similarly, women without social insurance and those working in irregular jobs were more likely to lose their jobs during the pandemic. Previous studies also demonstrated that irregular and informal workers were the most affected, as they lost their jobs and left the labor market [28,29].

Demographic characteristics played a significant role in influencing women's job losses. Age is the best predictor of work experience and job retention potential, even during the pandemic outbreak. We found that the higher the women's age, the lower the probability of experiencing job loss. This result is supported by Béland et al. [39], Crowley et al. [40], and Mamgain [41], who found that younger workers are more vulnerable to disruptions associated with the COVID-19 pandemic and suffered relatively more job losses than others. We also found that education has protected women from losing their livelihoods. Highly educated women were more likely to maintain their jobs during COVID-19 outbreaks. Blundell et al. [20] and Mongey et al. [42] also found that college-educated employees experienced relatively fewer job losses. Marital status and place of residence did not contribute significantly to explaining women's employment status during the pandemic.

Policy frameworks in Arab countries should be precisely reviewed to respond better in future crises. The labor market continues to face shortcomings in employment and labor protection policies. The challenges caused by COVID-19 reveal the need to reformulate plans to empower women and enhance their role in the labor market. The livelihoods of women in the private sector, those in irregular jobs, and those who lack social insurance have been hit hard by the pandemic, underscoring the need to implement safe work arrangements and expand the existing social protection systems' scope. The results indicated that the economic effects of the pandemic have disproportionately affected women. Women with high family caregiving responsibilities were more likely to lose their jobs. Work arrangements should be reviewed and improved to consider the increased unpaid domestic work. Family-friendly policies must be activated, and childcare leave should be facilitated

and partially funded. The private sector should be urged to allow for more flexibility in women's employment arrangements. The crisis also emphasizes the importance of having a better information technology infrastructure that ensures the continuation of work through remote work mechanisms. On the other hand, men's participation in life activities such as childcare and household chores must be slightly increased to allow women to partially maintain their professional lives. It is imperative to change social norms to be more flexible by increasing fathers' participation in bearing the childcare responsibilities with mothers, especially working mothers who seek to provide a source of income for the family.

5. Conclusions

This paper examines the impact of the pandemic on women's employment status in Arab countries using the COVID-19 MENA Monitor Household Survey (HH/CMMHH). We quantify the most contributing factors to women's job losses. The closure of schools and childcare facilities has disturbed the balance between work and household responsibilities. Women have been increasingly assigned to housework and childcare responsibilities. We used factor analysis to create an index that expresses women's responsibilities during the COVID-19 period. The study also examines the role of the government sector and the current social insurance system in protecting women from losing their job.

We found that the size of responsibilities women shouldered during the pandemic was positively associated with the probability of job loss. The youngest and the least educated women incurred the heaviest employment losses. Women who have been able to work remotely have a higher probability of keeping their jobs. Pre-pandemic work characteristics shaped the vulnerability of losing jobs. Women in the public sector are less likely to lose jobs than their counterparts in the private sector. In addition, women in regular employment and those who were covered by social insurance were protected from job loss. The results acknowledge the need to adopt flexible work arrangements and family-friendly policies to maintain women's employment.

Another critical aspect that should be considered is the impact of COVID-19 on women's participation rates in the labor force. The current study is unable to indicate the entire negative impact of the COVID-19 crisis on women's employment, as women could move from unemployment to inactivity. It is increasingly important for future studies to identify the determinants of women's withdrawal from the labor force during the crisis.

Author Contributions: Methodology, S.A.-R., M.R.A., F.A.A. and B.M.G.K.; Software, S.A.-R.; Validation, M.R.A.; Formal analysis, S.A.-R., M.R.A., F.A.A. and B.M.G.K.; Investigation, S.A.-R., F.A.A. and B.M.G.K.; Resources, B.M.G.K.; Data curation, M.R.A.; Writing—original draft, S.A.-R. and M.R.A.; Writing—review and editing, F.A.A. and B.M.G.K.; Visualization, S.A.-R.; Project administration, M.R.A., F.A.A. and B.M.G.K. All authors have read and agreed to the published version of the manuscript.

Funding: This research received funding from King Saud University through Researchers Supporting Project Number RSPD2023R576, King Saud University, Riyadh, Saudi Arabia.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The datasets analyzed in the current study are available in: "OAMDI, 2021. COVID-19 MENA Monitor Household Survey (CCMMHH), http://www.erfdataportal.com/index.php/catalog (accessed on 7 September 2021). Version 3.0 of the licensed data files; CCMMHH _Nov-2020-Apr-2021. Egypt: Economic Research Forum (ERF)".

Acknowledgments: Researchers Supporting Project Number RSPD2023R576, King Saud University, Riyadh, Saudi Arabia.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Variables of women's responsibilities index.

Variable	Description	Label
V1	Number of children under the age of six who live in the household	Count variable
V2	Number of children enrolled in school who live in the household	Count variable
V3	Children spent time on online education	Dummy variable (yes–no)
V4	Children spent time on educational television	Dummy variable (yes–no)
V5	Children educated through educational content and written materials	Dummy variable (yes–no)
V6	Children educated in an in-person school	Dummy variable (yes–no)
V7	Women teach children in their households	Dummy variable (yes–no)
V8	Household size	Count variable
V9	Household includes children less than 18 years of age	Dummy variable (yes–no)
V10	Household include includes elderly persons aged 60 or over	Dummy variable (yes–no)
V11	Number of hours spent taking care of children in the past week	Continuous variable
V12	Time spent caring for children during the past week compared to time spent in a typical week before the pandemic (February 2020)	Categorical variable (less than usual–same–less than usual)
V13	Time spent caring for children during the past week compared to the period while schools were closed during the pandemic	Categorical variable (less than usual–same–less than usual)
V14	Number of hours spent carrying out housework in the past week.	Continuous variable
V15	Time spent carrying out housework during the past week compared to time spent in a typical week before the pandemic (February 2020)	Categorical variable (less than usual–same–less than usual)
V16	Spending time cooking, serving meals, and washing dishes	Dummy variable (yes–no)
V17	Spending time cleaning and carrying out other housework	Dummy variable (yes–no)
V18	Spending time carrying out house repairs	Dummy variable (yes–no)
V19	Spending time shopping or transporting household members	Dummy variable (yes–no)
V20	Spending time feeding, bathing, and playing with children aged 5 years or less.	Dummy variable (yes–no)
V21	Spending time tutoring and playing with or providing other care for children aged 6–17 years	Dummy variable (yes–no)
V22	Caring for ill or dependent adults in the household	Dummy variable (yes–no)

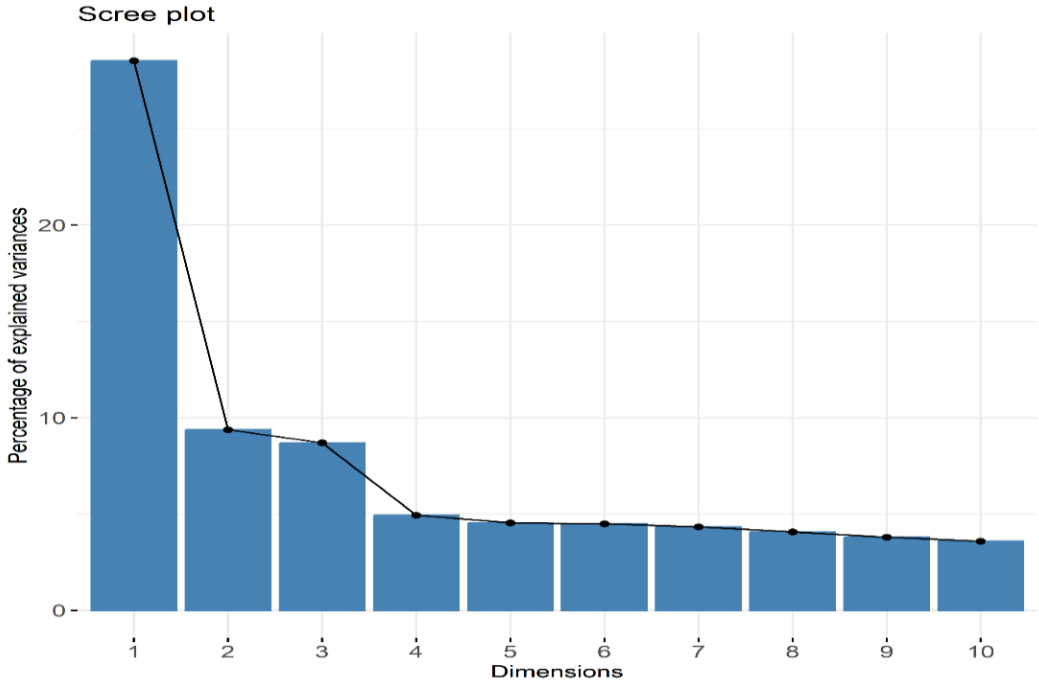

Figure A1. Scree plot for the percentage of explained variance by each PC.

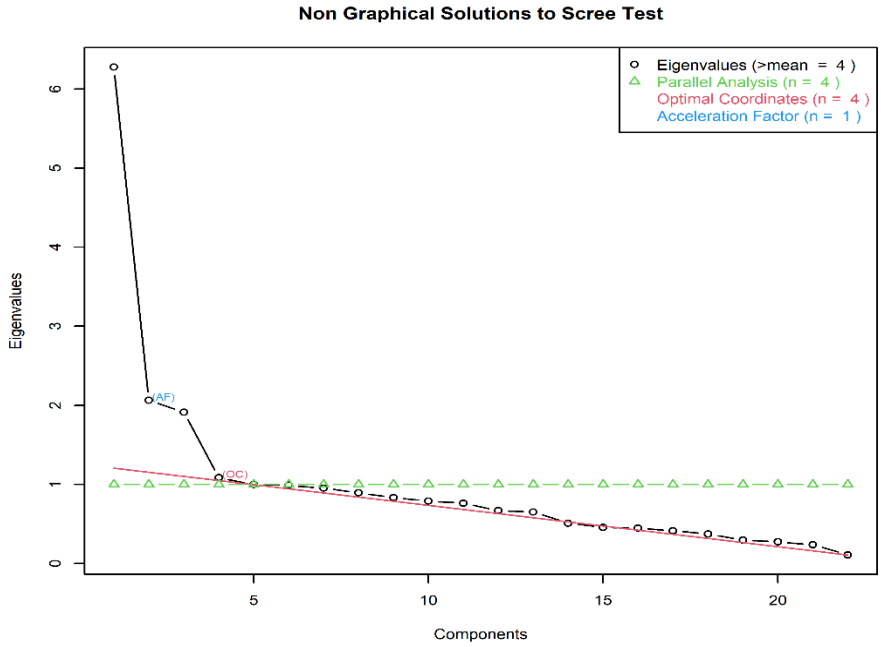

Figure A2. Parallel analysis for non-graphical solutions to the Scree test.

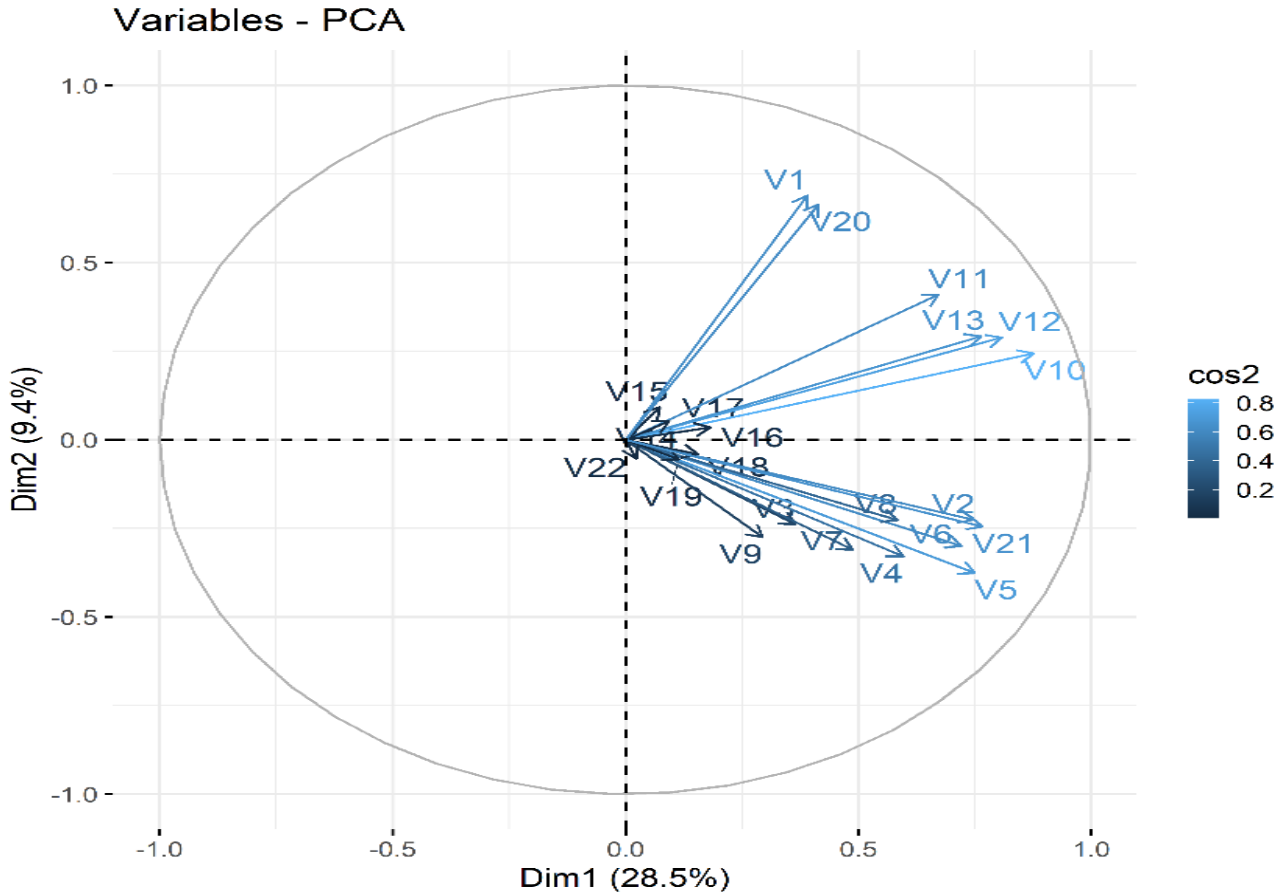

Figure A3. Correlation circle.

Figure A3 shows the correlation between each variable and the first two principal components; the coordinates of each variable on the factor map are the correlation values. Variables are well represented on the factor map as the distance between them and the origin increases.

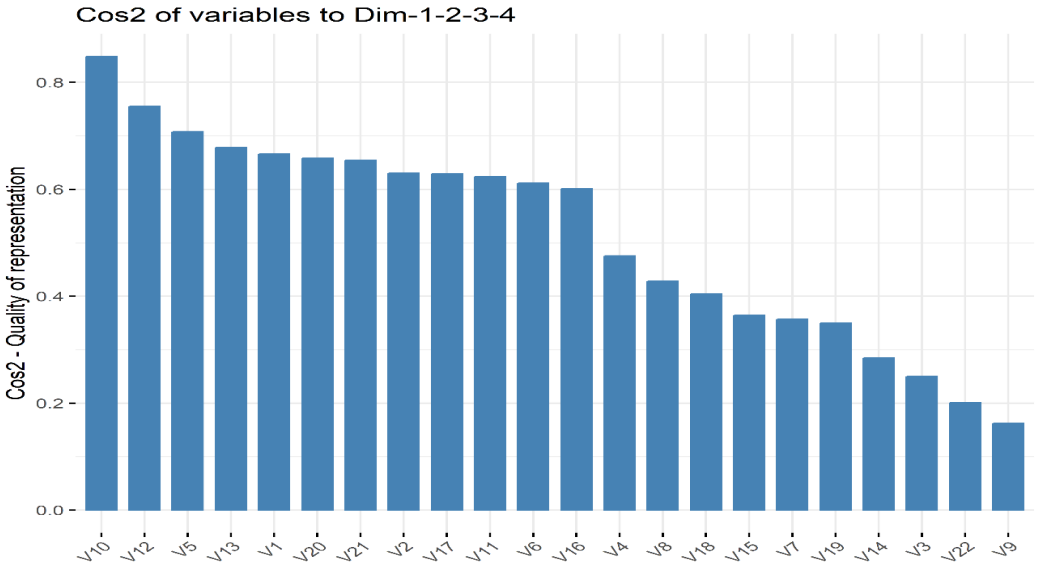

Figure A4. Total Cos2 of variables on dimensions.

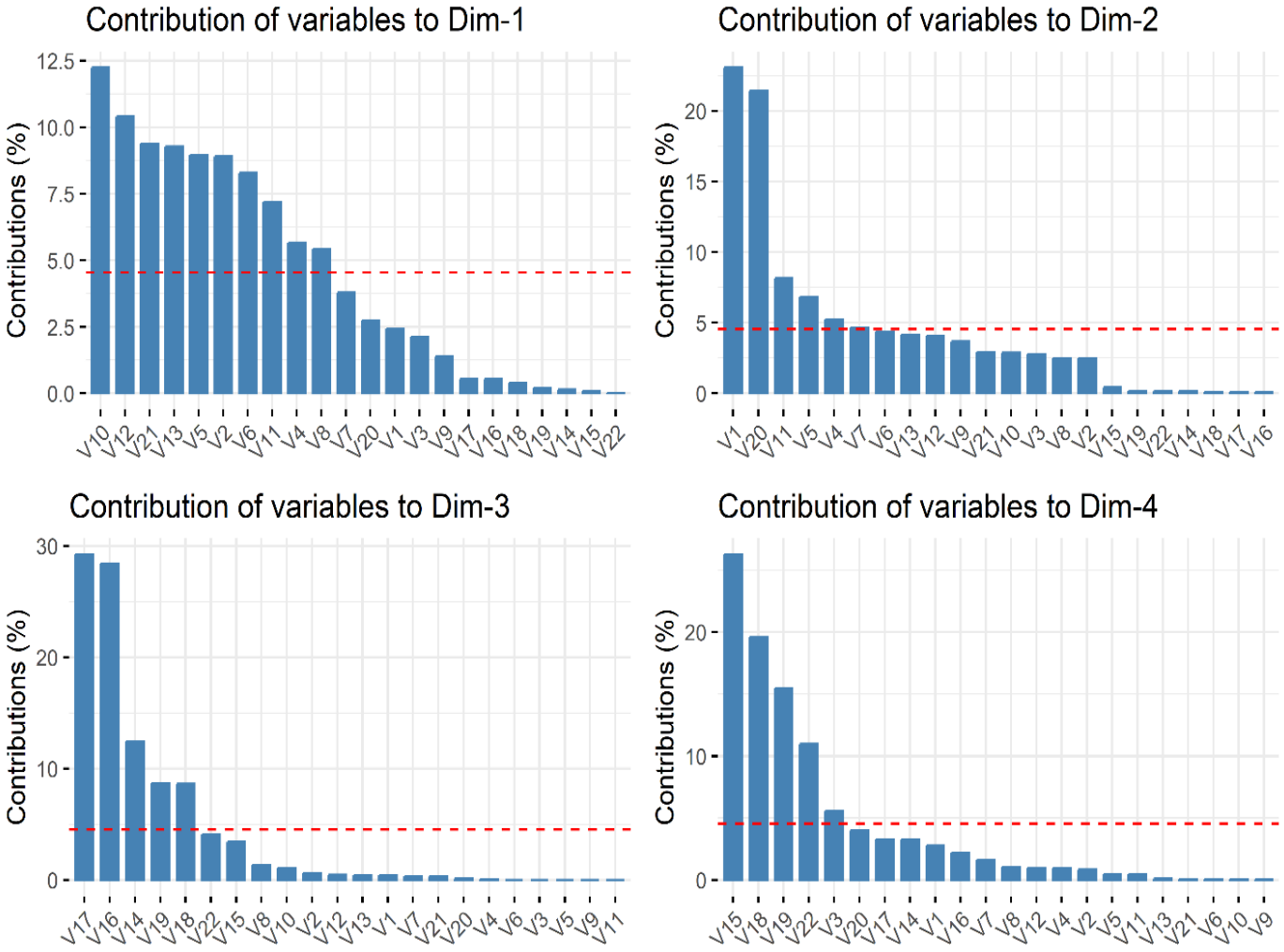

Figure A5. Contributions of variables to the four extracted principal components. Note: The higher the contribution value, the greater the contribution of the variable to the component. Red line refers to the expected average contribution of each variable.

Table A2. Standardized loadings (pattern matrix) based upon the correlation matrix.

Variable	PC1	PC2	PC3	PC4
V1	0.3903	0.6894	−0.0896	0.1743
V2	0.7474	−0.2258	−0.1081	−0.0955
V3	0.3643	−0.2381	0.0139	0.2454
V4	0.5962	−0.3287	−0.0366	−0.1014
V5	0.7495	−0.3754	−0.0045	0.0702
V6	0.7211	−0.2997	0.0162	0.0281
V7	0.4872	−0.3098	−0.0798	0.1315
V8	0.5835	−0.2260	−0.1609	−0.1058
V9	0.2941	−0.2748	0.0033	0.0204
V10	0.8763	0.2435	−0.1428	−0.0259
V11	0.6716	0.4097	0.0015	−0.069
V12	0.8076	0.2888	−0.0938	−0.1028
V13	0.7632	0.2923	−0.0927	−0.0336
V14	0.0932	0.0525	0.4876	−0.1879
V15	0.0736	0.0918	0.2559	−0.5341
V16	0.1815	0.0346	0.7368	−0.1546
V17	0.1821	0.0355	0.7477	−0.1882
V18	0.1549	−0.0403	0.4065	0.4617
V19	0.1146	−0.0544	0.4071	0.4098
V20	0.4147	0.6642	0.0458	0.2079
V21	0.7666	−0.2446	0.0751	−0.0285
V22	0.0288	−0.0526	0.2787	0.3453

Table A3. Measures of factor score adequacy.

Measure	PC1	PC2	PC3	PC4
Correlation of (regression) scores with factors	0.95	0.97	0.89	0.85
Multiple R square of scores with factors	0.90	0.95	0.80	0.72
Minimum correlation of possible factor scores	0.80	0.90	0.60	0.44

References

1. Hendy, R. Women's participation in the egyptian labor market: 1998–2012. In *The Egyptian Labor Market in an Era of Revolution*; Economic Research Forum Working Paper Series No. 907; The Economic Research Forum: Cairo, Egypt, 2015.
2. Krafft, C.; Assaad, R.; Marouani, M.A. The Impact of COVID-19 on Middle Eastern and North African Labor Markets: Employment Recovering, but Income Losses Persisting Caroline. In *Economic Research Forum Policy Brief No. 73*; The Economic Research Forum: Cairo, Egypt, 2022; pp. 1–19.
3. Krafft, C.; Assaad, R.; Marouani, M.A. The impact of COVID-19 on Middle Eastern and North African labor markets: Vulnerable workers, small entrepreneurs, and farmers bear the brunt of the pandemic in Morocco and Tunisia. In *Economic Research Forum Policy Brief No. 55*; The Economic Research Forum: Cairo, Egypt, 2021; pp. 1–14.
4. Krafft, C.; Assaad, R.; Marouani, M.A. The Impact of COVID-19 on Middle Eastern and North African Labor Markets: Glimmers of Progress but Persistent Problems for Vulnerable Workers a Year into the Pandemic. In *Economic Research Forum Policy Brief No. 57*; The Economic Research Forum: Cairo, Egypt, 2021; pp. 1–20. [CrossRef]
5. Yassin, S.; Hendy, R. *COVID19 and the Value of Non-Monetary Job Attributes to Women: Evidence from A Choice Experiment in Egypt*; The Economic Research Forum: Cairo, Egypt, 2022; pp. 1–38.
6. Adams-Prassl, A.; Boneva, T.; Golin, M.; Rauh, C. Inequality in the impact of the coronavirus shock: Evidence from real time surveys. *J. Public Econ.* **2020**, *189*, 104245. [CrossRef]
7. Del Boca, D.; Oggero, N.; Profeta, P.; Rossi, M.C. Women' s Work, Housework and Childcare, before and during COVID-19. *IZA–Inst. Labor Econ.* **2020**, *18*, 1001–1017.
8. Alon, T.; Doepke, M.; Olmstead-rumsey, J.; Tertilt, M. The Impact of COVID-19 on Gender Equality in Europe. *Intereconomics* **2021**, *56*, 248. [CrossRef]
9. UNDP. *Assessing the Potential Impact of COVID-19 on Women and Girls in Arab States*; United Nations Development Programme: New York, NY, USA, 2021.

10. Dang, H.A.H.; Viet Nguyen, C. Gender inequality during the COVID-19 pandemic: Income, expenditure, savings, and job loss. *World Dev.* **2021**, *140*, 105296. [CrossRef] [PubMed]
11. Alon, T.; Doepke, M.; Olmstead-Rumsey, J.; Tertilt, M. *The Impact of COVID-19 on Gender Equality*; National Bureau of Economic Research: Cambridge, MA, USA, 2020.
12. Tverdostup, M. COVID-19 and Gender Gaps in Employment, Wages, and Work Hours: Lower Inequalities and Higher Motherhood Penalty. *Comp. Econ. Stud.* **2022**, 1–23. [CrossRef] [PubMed]
13. Reichelt, M.; Makovi, K.; Sargsyan, A. The impact of COVID-19 on gender inequality in the labor market and gender-role attitudes. *Eur. Soc.* **2021**, *23*, S228–S245. [CrossRef]
14. Collins, C.; Landivar, L.C.; Ruppanner, L.; Scarborough, W.J. COVID-19 and the gender gap in work hours. *Gend. Work Organ.* **2021**, *28*, 101–112. [CrossRef] [PubMed]
15. OECD. COVID-19 crisis in the MENA region: Impact on gender equality and policy responses. In *OECD Tackling Coronavirus Contributing to a Global Effort*; Organisation for Economic Co-Operation and Development: Paris, France, 2020; pp. 1–38. Available online: https://read.oecd-ilibrary.org/view/?ref=134_134470-w95kmv8khl&title=COVID-19-crisis-in-the-MENA-region-impact-on-gender-equality-and-policy-responses (accessed on 10 November 2022).
16. Bluedorn, J.; Hansen, N.-J.; Shibata, I.; Caselli, F.; Tavares Mendes, M. Gender and Employment in the COVID-19 Recession: Evidence on 'She-cessions'. *Labour Econ.* **2023**, *81*, 102308. [CrossRef]
17. Andrew, A.; Cattan, S.; Dias, M.C.; Farquharson, C.; Kraftman, L.; Krutikova, S.; Phimister, A.; Sevilla, A. *How Are Mothers and Fathers Balancing Work and Family under Lockdown?* IFS: London, UK, 2020; Volume 37.
18. Sevilla, A.; Smith, S. Baby steps: The gender division of childcare during the COVID-19 pandemic. *Oxford Rev. Econ. Policy* **2020**, *36* (Suppl. S1), S169–S186. [CrossRef]
19. Hupkau, C.; Petrongolo, B. Work, Care and Gender during the COVID-19 Crisis. *Fisc. Stud.* **2020**, *41*, 623–651. [CrossRef] [PubMed]
20. Blundell, R.; Dias, M.C.; Joyce, R.; Xu, X. COVID-19 and Inequalities. *Fisc. Stud.* **2020**, *41*, 291–319. [CrossRef]
21. Krafft, C.; Assaad, R.; Rahman, K.W. *Introducing the Egypt Labor Market Panel Survey 2018*; Sciendo: Warsaw, Poland, 2021; pp. 1–40.
22. Assaad, R.; Salemi, C. *The Structure of Employment and Job Creation in Jordan: 2010–2016*; Economic Research Forum Working Paper Series No. 1259; The Economic Research Forum: Cairo, Egypt, 2018. Available online: https://www.erf.org.eg (accessed on 10 November 2022).
23. Assaad, R. *Prospects for Egypt's Population and Labor Force: 2000 to 2050*; No. 1398; The Economic Research Forum: Cairo, Egypt, 2020.
24. Assaad, R.; Krafft, C.; Selwaness, I. The Impact of Marriage on Women's Employment in the Middle East and North Africa. *Fem. Econ.* **2022**, *28*, 247–279. [CrossRef]
25. Assaad, R.; Krafft, C.; Keo, C. The Composition of Labor Supply and Its Evolution from 2010 to 2016 in Jordan. In *Economic Research Forum Working Paper Series*; No. 1183; The Economic Research Forum: Cairo, Egypt, 2019; pp. 1–37. [CrossRef]
26. Assaad, R.; Krafft, C. The Egypt labor market panel survey: Introducing the 2012 round. *IZA J. Labor Dev.* **2013**, *2*, 8. [CrossRef]
27. Krafft, C.; Assaad, R.; Marouani, M.A. The Impact of COVID-19 on Middle Eastern and North African Labor Markets: A Focus on Micro, Small, and Medium Enterprises. In *Economic Research Forum Policy Brief No. 60*; The Economic Research Forum: Cairo, Egypt, 2021; pp. 1–14.
28. Yassin, S.; Hendy, R. Promoting Family-friendly Jobs and Labor Market Policies in Egypt in the Context of COVID-19 and Beyond. In *Economic Research Forum Policy Brief No. 82*; The Economic Research Forum: Cairo, Egypt, 2022.
29. ElBehairy, H.; Hendy, R.; Yassin, S. The Impact of COVID-19 on MENA Labor Markets: A Gendered Analysis from Egypt, Tunisia, Morocco and Jordan. In *Economic Research Forum Working Paper Series*; No. 1559; The Economic Research Forum: Cairo, Egypt, 2022; pp. 1–31.
30. Hendy, R.; Yassin, S. COVID-19 . . . Who Will Wash the Dishes and Change the Diapers? Evidence from A Post COVID-19 Time Use Survey on Egypt. In *Economic Research Forum Working Paper Series*; No. 1565; The Economic Research Forum: Cairo, Egypt, 2022.
31. Abdel-Rahman, S.; Awwad, F.A.; Qasim, M.; Abonazel, M.R. New evidence of gender inequality during COVID-19 outbreak in the Middle East and North Africa. *Heliyon* 2023, *accepted paper*. [CrossRef]
32. Jolliffe, I.T. *Principal Components Analysis*; Springer: Berlin/Heidelberg, Germany, 2006.
33. Husson, F.; Le, S.; Pagès, J. *Exploratory Multivariate Analysis by Example Using R*; CRC Press: Boca Raton, FL, USA, 2017.
34. Bates, D.; Mächler, M.; Bolker, B.M.; Walker, S.C. Fitting Linear Mixed-Effects Models Using lme4. *J. Stat. Softw.* **2015**, *67*, 1–48. [CrossRef]
35. İlkkaracan, İ.; Memiş, E. Transformations in the Gender Gaps in Paid and Unpaid Work During the COVID-19 Pandemic: Findings from Turkey. *Fem. Econ.* **2021**, *27*, 288–309. [CrossRef]
36. Cajner, T.; Crane, L.D.; Decker, R.A.; Grigsby, J.; Hamins-Puertolas, A.; Hurst, E.; Kurz, C.; Yildirmaz, A. *The U.S. Labor Market during the Beginning of the Pandemic Recession*; National Bureau of Economic Research: Cambridge, MA, USA, 2020. [CrossRef]
37. Farré, L.; Fawaz, Y.; González, L.; Graves, J. How the COVID-19 lockdown affected gender inequality in paid and unpaid work in Spain. In *Discussion Paper Series*; No. 13434; IZA–Institute of Labor Economic: Bonn, Germany, 2020.

38. Dubois, C.; Lambertini, L.; Wu, Y. Gender effects of the COVID-19 pandemic in the Swiss labor market. *Swiss J. Econ. Stat.* **2022**, *158*, 23. [CrossRef] [PubMed]
39. Béland, L.-P.; Brodeur, A.; Wright, T. The short-term economic consequences of COVID-19: Exposure to disease, remote work and government response. In *Discussion Paper Series*; No. 13159; IZA–Institute of Labor Economic: Bonn, Germany, 2020; Volume 90.
40. Crowley, F.; Doran, J.; Ryan, G. The impact of COVID-19 restrictions on workers: Who is most exposed? In *SRERC Working Paper Series No. SRERCWP2020-3*; University College Cork, Spatial and Regional Economic Research Centre (SRERC): Cork, Ireland, 2020.
41. Mamgain, R.P. Understanding labour market disruptions and job losses amidst COVID-19. *J. Soc. Econ. Dev.* **2021**, *23*, 301–319. [CrossRef] [PubMed]
42. Mongey, S.; Pilossoph, L.; Weinberg, A. Which Workers Bear the Burden of Social Distancing Policies? *J. Econ. Inequal.* **2020**, *19*, 509–526. [CrossRef] [PubMed]