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DISCUSSION PAPER SERIES

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ABSTRACT

The Impacts of COVID-19 on Female Labor Force Participation in Iran*

While female labor force participation (LFP) in Iran is among the lowest in the world, there is hardly any study on the COVID-19 pandemic effects on the country's female LFP. We find that female LFP decreased during the pandemic years by around 1 percentage point in 2021 and 2022. When controlling for excess mortality rates, the declines could increase to between 3.9 and 8.7 percentage points, with the larger impacts occurring in late 2021 and early 2022. Compared to modest, pre-pandemic female LFP rates, these figures translate into 5 percent and 18-40 percent decreases, respectively. Heterogeneity exists, with more educated individuals being more likely to work. Compared to married individuals, divorcees were more likely to work while those that were divorced or never married were less likely to work. Our results offer relevant inputs for labor policy, particularly those aimed at reducing gender inequalities.

JEL Classification: E24, I30, J21, O12

Keywords: COVID-19, employment, women's labor force participation, differences-in-differences, triple differences, labor force survey, Iran

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1. Introduction

COVID-19 has worsened gender inequalities in many countries around the world. In particular, the pandemic resulted in more job loss and labor income decreases for women than men (Dang and Nguyen, 2021; Alon *et al.*., 2022). Yet, the existing literature focuses on richer countries and there are fewer studies for poorer countries, perhaps due to a shortage of nationally representative survey data that span the pandemic in the latter.[1] Furthermore, recent studies offer mixed evidence on the impacts of COVID-19 on gender gaps in employment for poorer countries.

Examining the pandemic effects in India, Deshpande (2022) finds that in August 2020, for women, the likelihood of being employed was 9 percentage points lower than for men, compared to April 2019, conditional on previous employment. However, by December 2020, gender gaps in employment were at the pre-pandemic December 2019 levels. Alfonsi *et al.* (2023) find that lockdowns imposed in Uganda reduced employment by 69% for women and by 45% for men, and the gap persisted eighteen months after the onset of the pandemic. On the other hand, Dang, Nguyen, and Carletto (2023) analyze Vietnam's Labor Force Surveys spanning 2015 to 2020 and find negative pandemic effects on employment, temporary layoff rates, and employment quality, but this study does not find differential effects for women. Halim *et al.* (2023) even observe that the pandemic has reduced the gender gap in employment and participation for Indonesia.

We offer an early study on the pandemic impacts on the labor market in Iran. Iran offers an interesting, even unique, case study for several reasons. Female labor force participation (LFP) in Iran is among the lowest in the world. Recent data indicate that the LFP rate for Iranian women

[1] Most existing studies for developing countries rely on high-frequency phone surveys (Egger *et al.*, 2021; Khamis *et al.*, 2021; Mahmud and Riley, 2021; Krafft *et al.*, 2022; Bundervoet, Dávalos, and Garcia, 2022), which can be prone to various data quality issues. These issues include low response rates or undercoverage and shorter questionnaires with fewer variables than the typical household survey, so typically do not allow for the rigorous and comprehensive analysis that can be implemented with nationally representative data (Miguel and Mobarak, 2022).

hovers around 14%, which is less than one-third of the global average of 46%. In fact, it is even smaller than the regional average of 19% for MENA (World Bank, 2022). On the other hand, the country has been under international sanctions for an extended time (Salehi-Isfahani, 2023). If the pandemic affected all sectors in the economy, as it did in richer countries, women were likely affected more severely. But if the pandemic effects were muted—for example, because the U.S. sanctions worked as a buffer against international trade shocks—women were likely less affected. Whether, and how much, these effects translate into reduced employment or labor participation of women are therefore empirical issues which we investigate in this paper.

In addition, after China, Iran was the epicenter of the COVID-19 pandemic in the first months of its global spread starting from early 2020, when protection measures such as vaccines were unavailable. A better understanding about whether, and to what extent, the early waves of the pandemic could have negative impacts on female LFP can be useful for policy makers in the fight against future pandemics.

We find that female LFP decreased during the pandemic years by around 1 percentage point in 2021 and 2022. When controlling for excess mortality rates, the decline could be between 3.9 and 8.7 percentage points, with the larger impacts occurring in late 2021 and early 2022. Compared to a modest female LFP that hovers around 21.5 percent for the 5-year period before the pandemic, these decreases translate into those of 5 percent and 18-40 percent decreases. We also find that individuals with more education were more likely to work. Compared to married individuals, divorcees were more likely to work while those that were divorced or never married were less likely to work.

To our knowledge, Yousefi *et al.* (2022) is the only study that analyzes the impacts of the pandemic on Iranian women's labor market outcomes, but this study stops short of a casual

analysis. The authors show that, controlling for individual and provincial characteristics, women's labor market participation was more negatively affected than men during the pandemic period. Yet, given that the authors rely on only the time dimension for identification (i.e., the only identifying variables in their model are the year and the quarter of observation), it is not straightforward to attribute the change in labor market outcomes to the pandemic alone. At the time, other external shocks rocked Iran's economy, which may have had a similar asymmetric effect on the labor market outcomes of men and women. For example, the U.S. "maximum pressure campaign" of sanctions against Iran in 2018 worsened economic conditions in Iran in 2019 and 2020 (Bajoghli *et al*, 2024; Salehi-Isfahani, 2023), which overlapped with the pandemic.

Most COVID-19-related labor market research focuses on the impacts of specific *policies* in response to the pandemic, such as lockdowns and school closures. Unfortunately, systematic data on lockdowns and school closures by province are not available in Iran.[2] To separate the effect of the pandemic from other factors, including sanctions, we introduce an additional source of variation which is more specific to COVID-19. We use the provincial excess death rate in a quarter as a proxy for the severity of the pandemic. The excess death variable is plausibly correlated with the family decisions to stay home to reduce exposure of its working members and school-age children to the pandemic but is uncorrelated with the timing and intensity of the U.S. sanctions in 2020-2021.

We estimate excess mortality rates using all registered deaths since 2015 that are provided by the government's office of birth and death registry. Using the pre-pandemic number of deaths for 31 provinces over 16 quarters, we predict the number of expected deaths during the pandemic. Excess deaths are the difference between the linear prediction of deaths and their actual number

[2] Rosenberg and Nada (2022) describe lockdowns in 2020 and 2021, but the information is sporadic and not sufficient to build a data set that covers the entire 31 provinces.

during the COVID-19 quarters. We do not distinguish COVID-19 mortality risks by gender or age because the province-level excess death rates for men and women are nearly perfectly correlated during the past 8 years, and we believe that mortality risks of all ages are relevant for household decisions.

The justification for measuring the pandemic shock to labor markets with excess deaths is that, even in the absence of lockdowns, families weigh the risks of infection against the benefits of market work or sending their children to school. Whereas some workers can work from home and stay employed, some may have to quit their jobs or leave the labor force. For example, low-skilled service workers who cannot work remotely and for whom the benefits of staying at home exceed going to work and risking infection, may leave employment. This is particularly important for women with school-age children, who, given Iran's patriarchal gender norms, are most likely to stay home to take care of children and deal with the extra household chores imposed by the pandemic. We assume that the excess death rate is a good measure of the perceived risks that affect family decisions regarding going to work and sending their children to school. This approach helps us pick up additional exogenous variation in the intensity of the pandemic shock across provinces and over time, which is not captured if exposure to the pandemic is defined by either the year (or quarter) and province dummy variables alone.

This paper consists of six sections. We describe the data in the next section and the country background and COVID-19 situation in Section 3. We discuss the analytical framework in Section 4, the estimation results in Section 5, and conclude in Section 6.

2. Data

Our main source of data for this study is the Iran Labor Force Surveys (LFS), which are available in unit records since 2005. Each survey round contains information on about 120,000

households and 700,000 individuals. We analyze eight rounds of the repeated cross-sections covering 2015-2022. The large sample sizes of the LFSs allow us to control for province and year-quarter fixed effects in the econometric analysis. To avoid issues related to adult decisions regarding going to school and retirement, we focus on prime age workers (ages 25-54). The summary statistics for this age group are presented in Table 1.

Conducted annually by the Statistical Center of Iran since 2005, the Iran LFS is a nationally representative survey that provides annual and quarterly assessments of the country's labor markets. The survey follows a two-stage stratification with cluster sampling design, with stratification by rural and urban residence and at the province level and clusters and blocks chosen to yield a random nationally representative sample. The new survey replaced the old Employment and Unemployment Survey and conforms more closely to the International Labour Organization (ILO) guidelines for labor force surveys. The survey covers the country's non-nomadic households (about 98% of the total population). Each household is on a quarterly rotation in which each household is interviewed for two consecutive quarters in one year (i.e., a household leaves the survey for two quarters and is interviewed again in the same two quarters a year later). By allowing for quarterly rotation, the survey provides estimates of the level as well as changes in the labor market outcomes by quarter for rural and urban areas at the province level. The master sample is based on the latest three population censuses for 2006, 2011 and 2016.

3. Country background and COVID-19

3.1. Iranian context

As in other MENA countries, employment and labor force participation rate of Iranian women is low, about one-fourth that of men. This occurs despite high education and below replacement fertility, a combination that Assaad *et al.* (2020) call the MENA paradox. The sharp contrast between male and female LFP rates for prime age men and women (25-54) since 2005 is shown

in the left panel in Figure 1. This figure draws on data from all rounds of LFS since 2005. During the period 2005-2022, participation rates for women fluctuated between 15% to 25%, while men's participation rates stayed above 85%.

The impacts of COVID-19 on participation of both men and women are noticeable in this graph after the winter quarter of 2020 (2020_q1). The right panel of the figure brings the divergent effects on men and women into sharper focus and shows a more dramatic decrease in women's participation. In this graph, participation is measured as change relative to winter 2019 (2019_q1). A few months after the first COVID-19 cases were reported in Iran, women's participation rate fell by about 15% in spring 2020 and by more than 20% in 2021. In contrast, men's participation rates fell by 3% only.[3]

Personal characteristics like age and education that affect the participation of women in the labor market could also have influenced the severity of COVID-19's impacts on labor market outcomes. In MENA, marital status is perhaps the most important determinant of employment. Assaad *et al.* (2022) show that most Arab women quit their jobs after marriage. In Iran, too, there is a distinct duality in the labor market behavior of women based on marital status. As Figure 2 shows, never-married and divorced women behave similarly, with LFP rates around 40%, while married and widowed women are less than half as likely to participate in market work.

Given the prevailing gender norms and division of labor, we should expect the impacts of COVID-19 on women to vary according to their marital status. In Figure 3 we compare the participation rates of single men and women with those of married men and women. Interestingly, the initial experience of unmarried men and women under the pandemic were quite similar, though

[3] Plotting the changes in employment produce a figure that mirrors those in labor force participation (not shown). Women's employment rates are lower than their participation rates, by about 5 percentage points, but follow the same path as participation.

with time they diverged. Single men's participation rate rose after an initial decline, though it had not returned to its pre-pandemic level by 2022, while for women the decline has been continuous. In contrast, for married men and women, the impact of COVID-19 shocks were different from the start. Married men had the smallest decline in participation of the four groups, while married women experienced a sizeable decline, though less than that of unmarried women.

Education is another important determinant of participation in market work, especially for women, and unsurprisingly seemed to have affected women's response to the pandemic. The participation rate of college-educated women is generally the highest but had been declining over time, from close to 70% in 2005 to 50% in 2016. In 2021, it fell further to below 40% in 2021 (Figure 4). The decrease in participation might be a selection issue, related to the expansion of women's college attendance since 2005. Women with university and graduate degrees more than doubled their share of the prime age population during this time, although they still account for only 10% of all women in the labor force.

3.2. COVID-19 in Iran

After China, Iran was the epicenter of the COVID-19 pandemic in the first months of its global spread in winter 2020. The pandemic hit Iran hard and early with its first reported cases on February 19, 2020, in the Qom province (Nojomi *et al.*, 2021). Travelers from Qom soon spread the pandemic first to Tehran and subsequently to the northern Caspian provinces of Gilan and Mazandaran, where many Iranians vacation in late March as they celebrate the Persian New Year (Salehi-Isfahani, 2020a). By March 2020, COVID-19 had spread to all provinces and by December 2020, about 1.5 million COVID-19 cases had been identified and about 54,000 had died as a result of contracting the virus.

The high death toll of the pandemic in its first two years in Iran has been in part blamed on lack of access to vaccination and unwillingness of the government to enforce total lockdowns, both of which were related to shortage of government revenues. Historically, the government has earned most of its revenues from oil exports, which U.S. sanctions had reduced to a trickle in 2020. Furthermore, although medical supplies were exempt from sanctions, paying for them was difficult even for richer Iranians since most banks were unwilling to make international transfers for fear of breaching U.S. extra-territorial sanctions against trading with Iran. As a result, early on, vaccination lagged behind other countries (Figure 5), although vaccination rates later rose and reached 66.1% in 2022.

Unlike most other countries with acute spread of the pandemic, Iran "refused to impose a full lockdown within cities, though it … encouraged people to stay at home."[4] In countries that resorted to extensive lockdowns, governments often supported workers and employers while they are not working. In Iran, lack of funds to support lockdowns limited general lockdowns. School closures were more frequent than lockdowns of businesses and government offices. At the height of the pandemic in April 2020, Iran's parliament rejected a government bill to impose a national lockdown (Rosenberg and Nada, 2022). The only concession came two days later when the Supreme Leader banned mass gatherings during the holy month of Ramadan which coincided with the second month of the pandemic. In contrast to business lockdowns, schools were easier to close, perhaps because they did not involve loss of output and shifted the burden of the pandemic from the state to the families, which mostly involved mothers who had to take care of children at home. This shift in burden naturally affected mothers who were engaged in market work and contributed to their reduced participation in market work. Only a few weeks after COVID-19's presence in

[4] "Coronavirus: Iran to resume 'low-risk' economic activity despite continuing deaths", *Middle East Eye*, 5 April 2020.

Iran was confirmed, in March 2020, schools closed across the country, although the pandemic was not yet a serious concern in some provinces.[5] The lack of correlation between lockdowns and school closures on the one hand, and COVID-19 death rates on the other, is an issue to which we will return shortly when we discuss excess deaths.

The fact that Iran was hit early and more severely than other MENA countries is evident in Figure 6, which compares Iran's death rate from COVID-19 with Egypt, Saudi Arabia, Turkey—the region's three largest economies—and Tunisia. During the first year of the pandemic, Iran did much worse than the first three countries but better than Tunisia later in 2021 in terms of deaths per million, presumably because of increased vaccination.

Measuring the intensity of the pandemic with excess deaths

The connection between COVID-19 and market work is multifaceted. Pre-emptive lockdowns to slow the spread of the virus can disrupt labor market participation even before the risks of exposure rise to elevated levels. However, in Iran, lockdowns do not appear to have been the main reason for labor market disruptions. The primary reason for this is likely the government's inability to support people's income and consumption if it prevented them from working. News reports in Persian that we have surveyed mention school closures and inter-provincial travel bans much more often than workplace closures. But, despite a lack of official announcements of stay-at-home policies, men and women lost or quit their jobs or dropped out of the labor force during the pandemic. Reductions in employment appeared not to be the result of any one factor but a combination of factors, including official closures of schools and offices and parental decisions to weigh the costs and benefits of work in view of the increased health risks from going to work or

[5] Iran announced a six-day lockdown in August 2021 (Motamedi, 2021).

attending schools. Thus, even in the absence of government-ordered lockdowns and school closures, individuals may wish to cut back on market work to avoid exposure to the virus in public spaces. Naturally, in the context of the traditional gender division of labor, the shift from market work to working at home imposed by the pandemic would likely affect women more than men.

Useful tools to measure the impacts of COVID-19 on labor market outcomes include the timing and effectiveness of lockdowns and school closures. However, as noted earlier, we do not have access to such data for Iran. Gleaning the occurrence of administrative lockdowns from news reports and for individual provinces proved highly imprecise, so we opted for measures of excess deaths at the province level. No information is available on enforcement of closures or penalties for not observing them. Schools and non-business establishments—stadiums, sport clubs, art galleries, theatres—were closed most of the time during COVID-19 before vaccination became available.

We estimate excess deaths using a simple regression of the number of deaths in each province on dummy variables for province and time (quarter of observation) and the population size for four years (16 quarters in total) before the arrival of the pandemic (2015-2019). The linear regression with quarter and province fixed effects offers a good fit ($R^2 = 0.99$), resulting in good estimates for the predicted number of deaths in each province for the remaining 12 post-pandemic quarters, 2020 through 2022, had COVID-19 not arrived. The results are presented in Table 2 and Figure 7.

For the most part, excess death estimates confirm the timing and severity of the COVID-19 pandemic as reported in the news. Most provinces experienced unusually high death rates in 2020 and 2021, but not in the same quarter (see Figure 7). For example, in the Gilan province, where the pandemic disrupted life early in the pandemic (Salehi-Isfahani, 2020a), government vital registrations data report a one-third increase in the number of deaths winter 2020 (the first quarter

of the pandemic) over winters 2019 and 2018, one quarter ahead of other provinces. The variation in the arrival dates of the pandemic across provinces adds to the variation that we need to identify the causal impacts of the pandemic on women's market work because other shocks, like sanctions, are unlikely to have impacted provinces in the same way. [6]

Excess deaths and official lockdowns are different indications of disruptions in normal life and the labor market that affect individual decision to participate in market work. Each has its advantages and drawbacks as markers of labor market shocks. While excess deaths are less precise than lockdowns as markers of labor market disruptions, they are considered the gold standard for the impacts of COVID-19 on mortality (Beaney *et al.*, 2020) and are generally found to be strongly correlated with lockdowns (Meyerowitz-Katz *et al.*, 2021; Konstantinoudis *et al.*, 2022; Ege *et al.*, 2023).

In the case of Iran, where government-enforced lockdowns were idiosyncratic and reliable data on lockdowns that were enforced is not available, excess deaths are the only source of systematic information on the timing and intensity of the pandemic shock to the labor market. Excess death rates cover all provinces and are available on a monthly and quarterly basis. Excess deaths offer glimpses of the perceived risks faced by individuals of exposure to the virus in public places, at work or in school.[7] As such, they are expected to affect decisions to work or send children to school.

There are limitations with using excess deaths as indicators of the intensity of the negative labor market shock in a community. First, effective lockdowns reduce COVID-19 deaths while

[6] Ghafari *et al.* (2021) use excess deaths in Iran to show that the official counts of COVID-19 deaths underestimate actual deaths by a factor of 2 to 3. Note that the data in Figure 7 are based on official counts and appear to be under-estimates when compared to the actual number of registered deaths.

[7] Actual perceived risks are subjective and might also be influenced by public health conditions, such as vaccination rates, access to good health care if infected, and other similar factors.

keeping labor markets disrupted. As such, without controlling for administrative social distancing regulations, excess deaths may offer biased estimates of impacts. Low death rates may appear as low disruption when in reality social distancing laws may have prevented workers from going to work. Similarly, excess deaths may misstate the extent of the risks that individuals actually perceive. For example, in a region with high rates of vaccination and superior health services, excess deaths may overstate the extent of the shock to the labor market if some individuals feel safe to go to work or send their kids to schools (e.g., because people they interact with are vaccinated, wear masks, etc. and pay less attention to high observed death rates). In this case, unobserved community characteristics related to healthy behavior and health facilities induce a correlation between excess deaths and the error term, causing bias in the estimates of impacts. This bias can be reduced by including data on regional health infrastructure quality, such as access to sanitation and clean water and the quality of the health infrastructure.

This bias may be small if public health measures actually reduce the excess death rates, in which case excess deaths correctly measure the intensity of the pandemic. It may also be the case that administrative lockdowns and their enforcement are a function of the prevailing death rates, in which case, again, excess deaths are correlated with labor market disruptions due to the pandemic. In this case, we are estimating the impacts of a combination of imposed rules that may keep a person from going to work or a child from attending school, as well as the perceived risks of going to work or school, both of which result from the pandemic.

4. Analytical framework

We first estimate the effects of the pandemic using the LFS repeated cross sections in a difference-in-difference (DD) model with province and year fixed effects (FE):

$$y_{ijt} = \alpha_0 + \alpha_1 Female_{ij} * Year_t + \alpha_2 X_{ijt} + Prov_j + Year_t + \varepsilon_{ijt}, \qquad (1)$$

where y_{ijt} is a dummy variable indicating female labor force participation (LFP) for individual *i* living in province *j* (=1,.., 31) in year *t*. $Female * Year_{ijt}$ is an interaction term, which interacts the individual's gender with a dummy variable indicating the specific year under consideration. The coefficient of interest is α_1, which provides the estimated changes in female LFP relative to men during the COVID-19 pandemic and relative to female LFP before the pandemic. X_{ijt} are individual-level control variables such as age, gender, education level, and marital status. $Prov_i$ and $Year_t$ are, respectively, the province and year fixed effects that help control for household time-invariant unobservables and unobserved macro-economic trends occurring in the same year. ε_{ijt} denotes the error term.

To ensure our results are robust to potential fluctuations in female LFP over time, we analyze seven rounds (years) of the LFS, including five years preceding the pandemic (i.e., 2015-2019) and the most recent four years since the pandemic started (i.e., 2020, 2021, 2022, and quarter 1 of 2023). In other words, we analyze female LFP during four post-pandemic years in comparison with those in the preceding five pre-pandemic years as the reference group.

We further estimate a variant of Equation (1) where we disaggregate the year dummy variables for the post-pandemic years into 13 quarter dummy variables. Doing this allows us to examine more closely whether, and to what extent the pandemic effects change in each quarter. Specifically, we estimate the following equation:

$$y_{ijt} = \gamma_0 + \gamma_1 Female_{ij} * (\sum_{t=2020}^{2023} \sum_{k=1}^{4} Year_t * Quarter_k) + \gamma_2 Z_{ijt} + Prov_j + Year_t + \sigma_{ijt}, \qquad (2)$$

where the post-pandemic interaction terms $Year_t * Quarter_k$ include the quarters during 2020-2022 and quarter 1 of 2023. The vector of control variables Z_{ijt} now include both X_{ijt} and the interaction terms $Female_{ij} * Year_{t'}$, for the pre-pandemic years *t'*= 2015, 2016, …, 2019.

Yet, while Equations (1) and (2) offer estimates on the changes with female LFP during the pandemic, they do not provide insights on the potential mechanisms through which these changes could happen. To further investigate these mechanisms, we hypothesize that the COVID-19-related excess death rates could be a key mechanism that might affect women's decision to stay in the labor force as discussed in Section 3. For example, if the pandemic excess death rate is exceedingly high in a certain province, it might result in the provincial government taking stronger action to implement lockdown measures such as closing down businesses and schools. Even in the absence of such state policies, families themselves may decide to avoid workplaces and schools where the risk of transmission is high. In principle, these policies measures and the COVID-19 health risks negatively affect everyone, but in view of the traditional division of labor in Iran, we surmise that women might bear disproportionate consequences regarding their LFP decision.

We thus estimate the following equation, where we further interact the $Female * Year_{ijt}$ in Equation (1) with the provincial excess death rate,

$$y_{ijt} = \beta_0 + \beta_1 Female_{ij} * Year_t * Excess\_death_{jt} + \beta_2 X_{ijt} + Prov_j + Year_t + \omega_{ijt}, \quad (3)$$

where we include the same control variables as with Equation (1). In fact, Equation (3) can be regarded as an augmented triple differences (DDD) model, which improves on the standard DDD model since the variable $Excess\_death_{jt}$ is a categorical variable. The coefficient of interest is β_1, which estimates the changes with female LFP during the COVID-19 pandemic that are caused by the provincial excess mortality rate.

Similar to Equation (2), we also estimate a variant of Equation (3) that further disaggregates the year dummy variables for the post-pandemic years into quarter dummy variables. We estimate the following equation,

$$y_{ijt} = \delta_0 + \delta_1 Female_{ij} * \left(\sum_{t=2020}^{2023} \sum_{k=1}^{4} Year_t * Quarter_k * Excess\_death_{jt}\right) + \delta_2 Z_{ijt} + Prov_j + Year_t + \varphi_{ijt}, \quad (4)$$

where the variables are similarly defined as with Equation (2).

For easier interpretation, we estimate all the equations using the OLS model (linear probability model). Consequently, we can just read off the estimated coefficients. Logit estimates imply similar effects but are harder to interpret.

5. Estimation results

Using Equation (1) and Equation (2), Table 3 shows the estimation results where the first column examines the pandemic effects on a yearly basis and the second column examines these effects on a quarterly basis. (The full estimation results are shown in Appendix A, Table A.1). Table 3 shows that, controlling for other factors, when COVID-19 started, female LFP decreased by 0.6 percentage points in 2021 compared to the reference year of 2015, which represents a reversal from an increase of 0.7 percentage points in 2020. This decrease doubled to 1.2-1.3 percentage points in 2022 and 2023 (Table 3, column 1). These changes are statistically significant at the 1 percent level.

The puzzle why female LFP could increase in 2020 is explained when we look at female LFP during each quarter. While female LFP increased by 3.3 percentage points in quarter 1 of 2020, it started decreasing by 0.1 percentage points in quarter 2 of the same year. But these decreases were not statistically significant (Table 3, column 2). The decreases became steadily stronger at 1 percent and were strongly statistically significant from quarter 2 of 2021 up to quarter 1 of 2023,

the last data point in our sample.[8] Notably, if we compare these decreases to the average female LFP of 21.5 percent during 2015-2019 (bottom of Table 3), then these decreases amount to around 5 percent decreases.

Table (4) shows the estimation results using Equations (3) and (4) where we add excess mortality to better identify the pandemic's impacts (with the full estimation results shown in Appendix A, Table A.2). Given the same level of excess mortality, women are 3.9 to 8.7 percentage points less likely to participate in the labor force during 2020-2023. The decreases were strongest and reached 11 percentage points for quarter 4 of 2021 and quarter 1 of 2022 but tapered off soon after. Although the declines were still considerable at around 8 percentage points in the last two quarters in our samples (quarter 4 of 2022 and quarter 1 of 2023), they were not statistically significant for 2023 for both quarters (Table 4, column 1). Again, compared to the average female LFP of 21.5 percent during 2015-2019, these decreases are larger at around 18-40 percent decreases.

The results are shown more clearly when we look at female LFP for each quarter. Starting from quarter 1 of 2020 up to quarter 3 of 2022, the declines with female LFP were steady and strongly statistically significant. However, these decreases become not statistically significant from quarter 4 of 2022, indicating that the effects of Covid became less perceptible with time.

Consistent with the descriptive analysis discussed above (Section 3), Tables A.1 and A.2 show that individuals with more education were more likely to participate in the labor market. Compared

[8] For pre-pandemic years, the year dummy variables pick up the impacts of changes in the labor markets on the gender gap in labor force participation, some of which are due to COVID-19. The gap is higher in 2016-2018, most likely because of economic growth following the Iran nuclear deal which went into effect in January 2016, allowing Iran access to its frozen funds abroad and to sell its oil. During 2016-2017, the economy grew by 20%. President Trump's withdrawal from the accord in May 2018 and the return of the harshest U.S. sanctions hit the economy hard. In 2019, women's participation fell relative to 2018 (but was still higher by 1.3% relative to 2015).

to married individuals, divorced individuals were more likely to work while widows and never married women were less likely to work.

6. Concluding remarks

The pandemic was a large shock to the economies of the MENA region, especially for its labor markets. Even before the pandemic, women's LFP in the region, and Iran is no exception, appeared far too low given their education and fertility. In this paper we ask how the shocks of the pandemic affected this already fragile type of employment. We employ extensive survey data to show that women's employment was indeed harder hit than that of men.

The Iranian case is complicated by the fact that its labor markets have been negatively affected by U.S. sanctions before and during COVID-19 (Fardoust, 2020; Salehi-Isfahani, 2023). This necessitates adding more identifying variation than the timing of COVID-19. Lacking reliable data on lockdowns as a well-known mechanism for the transmission of the pandemic's shock to labor market outcomes, we resort to the excess-deaths method to gauge the intensity of the pandemic in individual provinces. The variation in the excess death rates over time and across provinces offers convincing evidence of the pandemic's asymmetric negative impacts by gender.

Our results show that compared to 2015, female LFP decreased during the pandemic years in Iran by around 1 percentage point in 2021 and 2022. When controlling for excess mortality rates, the decline could be between 3.9 and 8.7 percentage points, with the larger impacts occurring in the most recent quarters. Compared to a modest female LFP that hovers around 21.5 percent for the 5-year period before the pandemic, these decreases translate into more substantial decreases of 5 percent (without controlling for excess mortality) and between 18 and 40 percent (controlling for excess mortality), respectively.

Further research can investigate other labor outcomes such as employment by sectors or hours of work and wages. It is also useful to examine the pandemic effects on other vulnerable population groups such as migrant workers and low-wage workers.

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Table 1. Summary statistics for LFS surveys (ages 25-54)

	% IN LF	%UNEMP LOYED	AGE	%URBAN	ILLITE RATE	PRIMARY	UPPER SECONDARY	UNIVERSITY	HOURS WORKED	RELATION	MARRIED	DEATH RATE
WOMEN												
2015	18.96	17.03	37.69	74.70	.12	.44	.23	.21	35.25	2.16	.80	1.14
2016	20.42	18.47	37.75	74.75	.12	.43	.23	.22	35.05	2.15	.81	1.17
2017	22.43	18.01	37.92	76.30	.11	.42	.24	.23	35.60	2.14	.81	1.16
2018	22.57	17.55	37.82	76.83	.10	.42	.25	.24	34.88	2.13	.82	1.16
2019	22.29	16.29	38.03	76.99	.09	.42	.25	.25	34.68	2.13	.83	1.19
2020	19.15	15.28	38.32	77.22	.08	.42	.25	.25	34.19	2.12	.83	1.53
2021	18.01	14.42	38.60	77.56	.08	.41	.25	.25	35.76	2.12	.83	1.61
2022	18.13	14.78	38.91	77.86	.08	.41	.26	.26	36.46	2.11	.83	1.22
MEN												
2015	88.17	8.32	37.68	75.60	.05	.47	.24	.23	50.26	1.44	.80	1.14
2016	88.56	8.83	37.77	75.83	.05	.47	.24	.24	50.15	1.46	.79	1.17
2017	89.35	9.14	37.91	76.52	.05	.46	.25	.24	50.13	1.47	.78	1.15
2018	89.85	9.42	37.95	76.74	.04	.45	.25	.26	50.39	1.45	.79	1.16
2019	90.04	8.42	38.12	76.97	.04	.45	.25	.27	50.2	1.46	.78	1.19
2020	88.69	7.75	38.47	77.33	.04	.45	.25	.27	49.00	1.46	.78	1.53
2021	89.05	7.37	38.78	77.70	.04	.44	.25	.27	48.99	1.45	.78	1.61
2022	89.22	6.94	39.12	77.93	.04	.43	.25	.28	49.49	1.46	.78	1.22

A note on the Iranian calendar:
The dates marked in graphs refer to Iranian calendar years, which run from 21 March 2019 to 20 March 2020. As such each Iranian year falls on two consecutive Gregorian years. We follow the convention adopted by international organizations, such as the IMF and the World Bank, by writing 2019 instead of 2019/2020 to refer to the Iranian year 1398. Thus 2019_q1 refers to spring 2019 (first quarter of Iranian year 1398), which is the second quarter of the Gregorian year 2019. Gregorian years are Iranian years plus 621, except for winter quarters when they are plus 622.

Table 2. Excess deaths per 1000, by province

	1398 (2019/2020)				1399 (2020/2021)			
	spring	summer	Fall	Winter	spring	summer	Fall	Winter
Markazi	-0.060	-0.083	0.035	0.016	-0.023	0.104	0.442	1.046
Gilan	-0.048	-0.058	0.120	0.680	0.174	0.416	0.107	0.312
Mazandaran	-0.049	-0.006	0.106	0.289	0.085	0.348	0.431	0.220
E. Azarbaijan	-0.035	-0.030	0.140	0.004	0.020	0.187	0.524	1.237
W. Azarbaijan	-0.017	-0.030	0.083	0.032	0.017	0.127	0.383	1.135
Kermanshah	-0.056	-0.020	0.125	-0.005	0.011	0.117	0.332	1.059
Khuzestan	-0.019	-0.035	0.142	0.067	0.039	0.242	0.570	0.311
Fars	-0.071	-0.036	0.036	0.022	-0.012	-0.025	0.296	0.869
Kerman	-0.040	-0.004	0.067	0.058	0.020	0.000	0.389	0.654
Khorasan Razavi	-0.053	-0.022	0.115	-0.009	0.008	0.115	0.489	0.654
Isfahan	-0.058	0.084	0.113	0.124	0.066	0.202	0.433	0.974
Sistan	-0.217	-0.086	-0.056	-0.078	-0.109	-0.223	0.127	0.250
Kurdestan	-0.098	-0.093	0.010	-0.079	-0.065	0.119	0.516	1.085
Hamadan	-0.027	0.049	0.121	-0.006	0.034	0.132	0.540	0.862
Bakhtiari	-0.212	-0.091	-0.110	-0.166	-0.145	-0.151	0.236	0.638
Lorestan	0.000	0.036	0.064	0.000	0.025	0.185	0.508	0.702
Ilam	-0.214	-0.159	-0.030	-0.251	-0.163	-0.126	0.205	0.801
Kohkiloyeh	-0.149	-0.071	-0.049	-0.190	-0.115	-0.109	0.078	0.359
Bushehr	-0.145	-0.129	0.059	-0.060	-0.069	-0.170	0.411	0.247
Zanjan	-0.147	-0.114	0.111	-0.068	-0.054	0.133	0.425	0.895
Semnan	-0.123	-0.060	-0.033	-0.093	-0.077	-0.037	0.142	0.799
Yazd	-0.041	-0.049	0.070	-0.021	-0.010	0.130	0.208	1.229
Hormozgan	-0.166	-0.156	-0.003	-0.031	-0.089	-0.087	0.370	0.062
Tehran	-0.032	-0.028	0.098	0.150	0.047	0.225	0.397	0.797
Ardebil	-0.048	0.015	0.089	-0.012	0.011	0.259	0.619	0.774
Qom	-0.085	-0.092	0.060	0.469	0.088	0.137	0.311	0.635
Qazvin	-0.141	-0.104	0.096	0.052	-0.024	0.323	0.404	0.764
Golestan	-0.100	-0.045	0.117	0.281	0.063	0.243	0.469	0.356
N. Khorasan	-0.201	0.065	0.168	-0.058	-0.006	0.015	0.349	0.510
S. Khorasan	-0.109	-0.062	0.128	-0.166	-0.052	-0.053	-0.032	0.748
Alborz	-0.036	0.035	0.127	0.123	0.062	0.229	0.491	0.868

Notes. Deaths in the Bakhtiari province for 2015 are set to missing because of the unusually high number reported (see also, Ghafari *et al.* 2021).
Source: Iran Ministry of birth and death registrations.

Table 3. Female labor force participation during the COVID-19 pandemic, OLS regressions with provincial fixed effects, Iran 2015- 2023

	(1)	(2)
Female* Year 2016	0.011***	0.011***
	(0.002)	(0.002)
Female* Year 2017	0.022***	0.022***
	(0.002)	(0.002)
Female* Year 2018	0.022***	0.022***
	(0.002)	(0.002)
Female* Year 2019	0.021***	0.021***
	(0.002)	(0.002)
Female* Year 2020	0.007***	
	(0.002)	
Female* Year 2021	-0.006***	
	(0.002)	
Female* Year 2022	-0.012***	
	(0.002)	
Female* Year 2023	-0.013***	
	(0.003)	
Female* Year 2020_Quarter 1		0.033***
		(0.003)
Female* Year 2020_Quarter 2		-0.001
		(0.003)
Female* Year 2020_Quarter 3		-0.004
		(0.003)
Female* Year 2020_Quarter 4		-0.001
		(0.003)
Female* Year 2021_Quarter 1		0.002
		(0.003)
Female* Year 2021_Quarter 2		-0.009***
		(0.003)
Female* Year 2021_Quarter 3		-0.008***
		(0.003)
Female* Year 2021_Quarter 4		-0.010***
		(0.003)
Female* Year 2022_Quarter 1		-0.013***
		(0.003)
Female* Year 2022_Quarter 2		-0.010***
		(0.003)
Female* Year 2022_Quarter 3		-0.011***
		(0.003)
Female* Year 2022_Quarter 4		-0.014***
		(0.003)

Female* Year 2023_Quarter 1		-0.013***
		(0.003)
R2	0.49	0.49
F test	52776	43217
N	2529554	2529554

Mean LFP during 2015-2019 (%)	
Men	89.3
Women	21.5

Note: *p<0 .1, **p<0.05, ***p<0.01. Robust standard errors are in parentheses. Individuals are restricted to those in the working ages (25 to 55 years old). All the regressions control for province and year fixed effects. The regression with the interaction with quarters (Column 2) additionally controls for quarter fixed effects. Full regression results are shown in Appendix A, Table A.1.

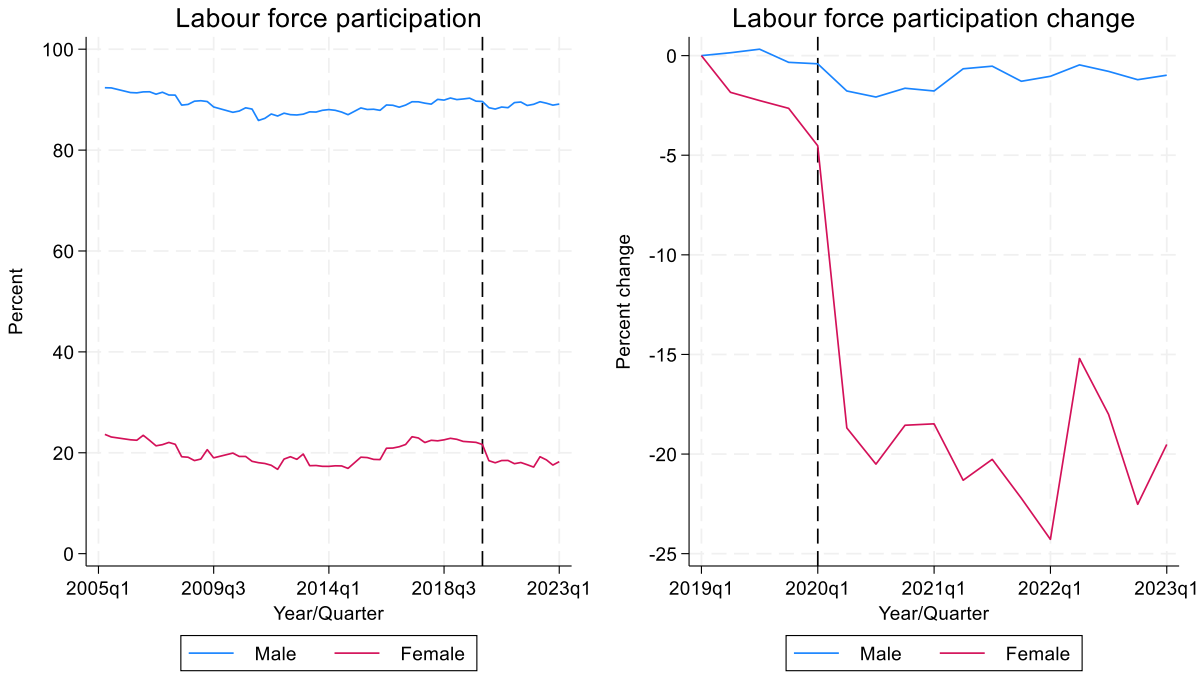
Table 4. Female labor force participation during the COVID-19 pandemic with excess mortality, OLS regressions with provincial fixed effects, Iran 2015- 2023

	(1)	(2)
Female* Year 2016* Excess mortality	0.026	0.026
	(0.020)	(0.020)
Female* Year 2017* Excess mortality	-0.037*	-0.037*
	(0.021)	(0.021)
Female* Year 2018* Excess mortality	0.013	0.013
	(0.019)	(0.019)
Female* Year 2019* Excess mortality	-0.073***	-0.073***
	(0.015)	(0.015)
Female* Year 2020* Excess mortality	-0.039***	
	(0.004)	
Female* Year 2021* Excess mortality	-0.044***	
	(0.004)	
Female* Year 2022* Excess mortality	-0.058***	
	(0.008)	
Female* Year 2023* Excess mortality	-0.087	
	(0.066)	
Female* Year 2020* Quarter 1* Excess mortality		-0.031***
		(0.012)
Female* Year 2020* Quarter 2* Excess mortality		-0.040***
		(0.013)
Female* Year 2020* Quarter 3* Excess mortality		-0.054***
		(0.013)
Female* Year 2020* Quarter 4* Excess mortality		-0.052***
		(0.007)
Female* Year 2021* Quarter 1* Excess mortality		-0.064***
		(0.013)
Female* Year 2021* Quarter 2* Excess mortality		-0.066***
		(0.009)
Female* Year 2021* Quarter 3* Excess mortality		-0.030***
		(0.007)
Female* Year 2021* Quarter 4* Excess mortality		-0.110***
		(0.012)
Female* Year 2022* Quarter 1* Excess mortality		-0.109***
		(0.016)
Female* Year 2022* Quarter 2* Excess mortality		-0.050***
		(0.012)
Female* Year 2022* Quarter 3* Excess mortality		-0.045***
		(0.012)
Female* Year 2022* Quarter 4* Excess mortality		-0.084
		(0.068)

Female* Year 2023* Quarter 1* Excess mortality		-0.087
		(0.066)
R2	0.49	0.49
F test	40189	31038
N	2529554	2529554
Mean LFP during 2015-2019 (%)		
Men	89.3	
Women	21.5	

Note: *p<0 .1, **p<0.05, ***p<0.01. Robust standard errors are in parentheses. Individuals are restricted to those in the working ages (25 to 55 years old). The reference categories are male, no education, married, and year 2015. All the regressions control for province and year fixed effects. The regression with the interaction with quarters (Column 2) additionally controls for quarter fixed effects. Full regression results are shown in Appendix A, Table A.2.

Figure 1. Labor force participation rates by gender (ages 25-54), 2005-2023 (left panel), change relative to 2019_Q1 (right panel).



Note: Change in LFP for men and women is relative to their values in 2019_q1, before the pandemic. The dashed line marks winter 2020 (the fourth quarter of Iranian year 1398) when the pandemic entered Iran.

Figure 2. Female LFP by marital status (25-54)

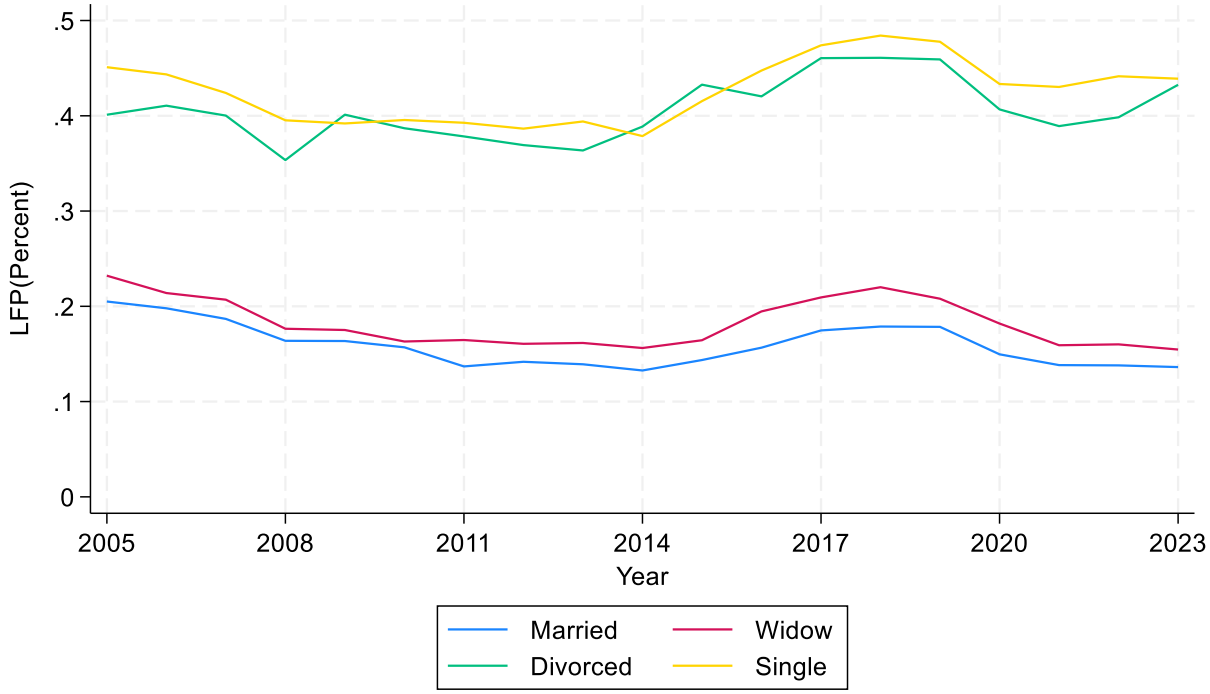


Figure 3. Labor force participation by gender and marital status.

Figure 4. LFP rates by education level (ages 25-54), 2005-2022

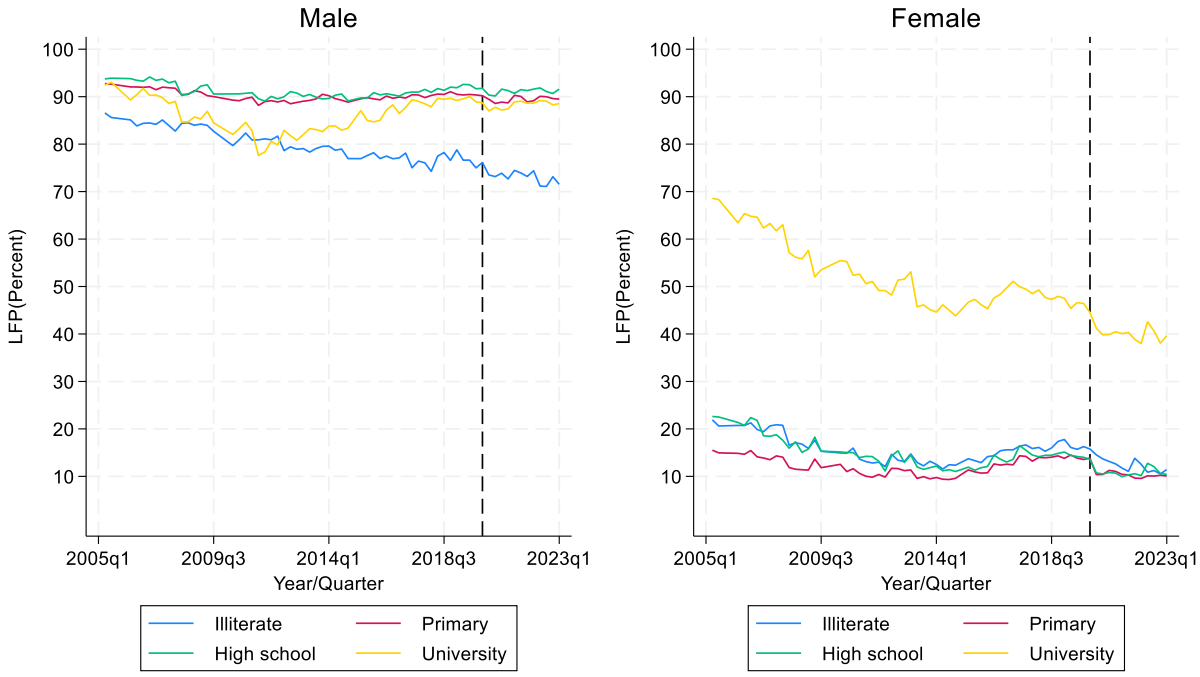
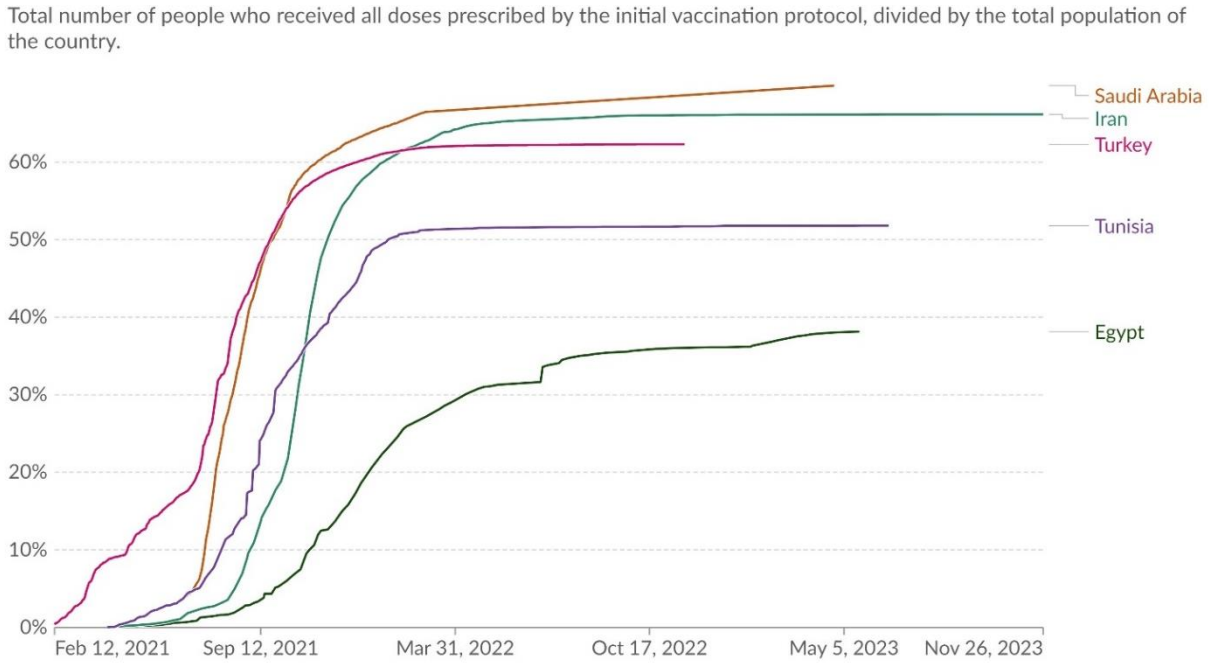
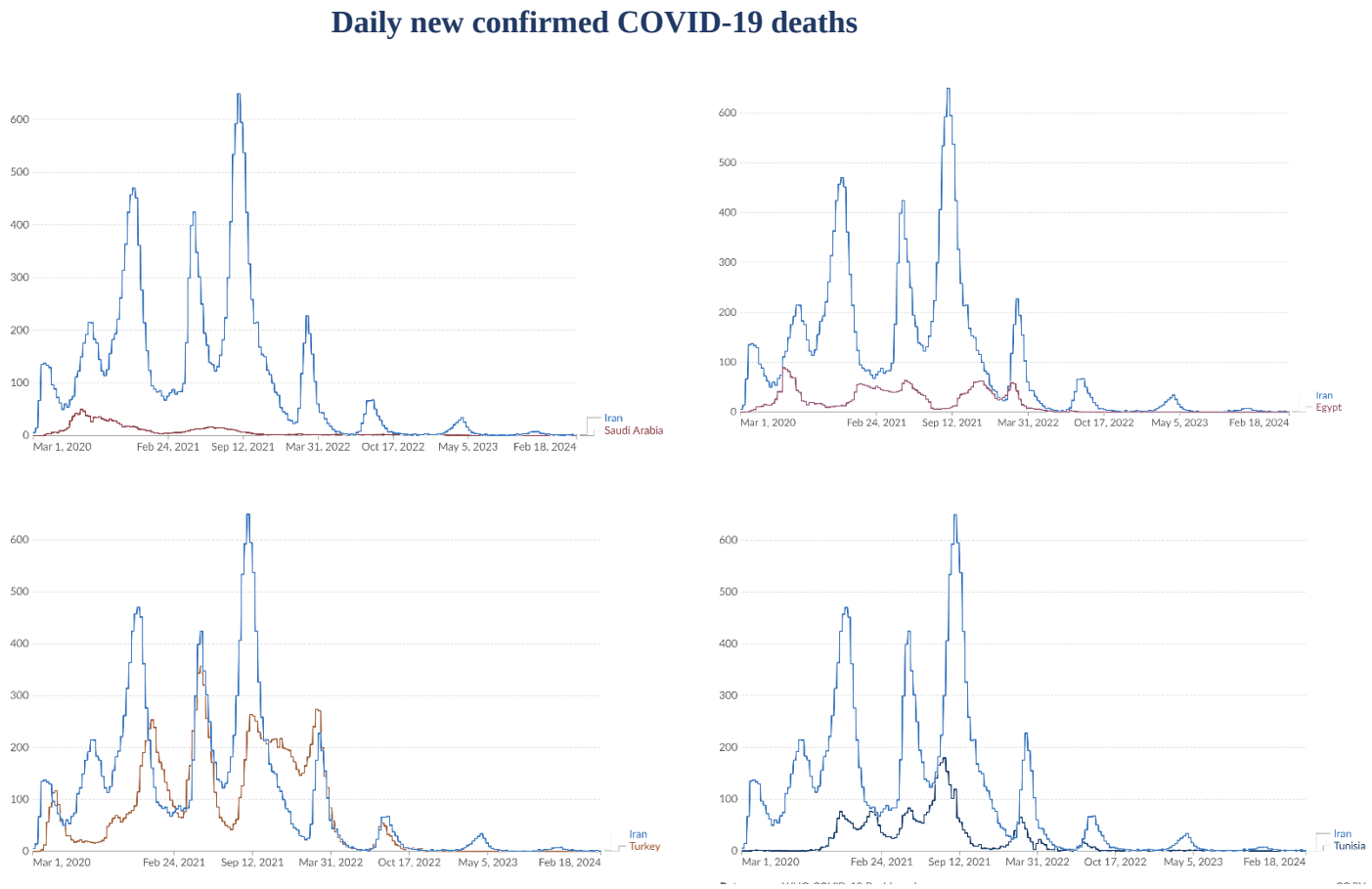


Figure 5. Vaccination rates in Iran and selected MENA countries started a year after COVID-19's arrival. Iran was slow to vaccinate its population but caught up by fall 2021.



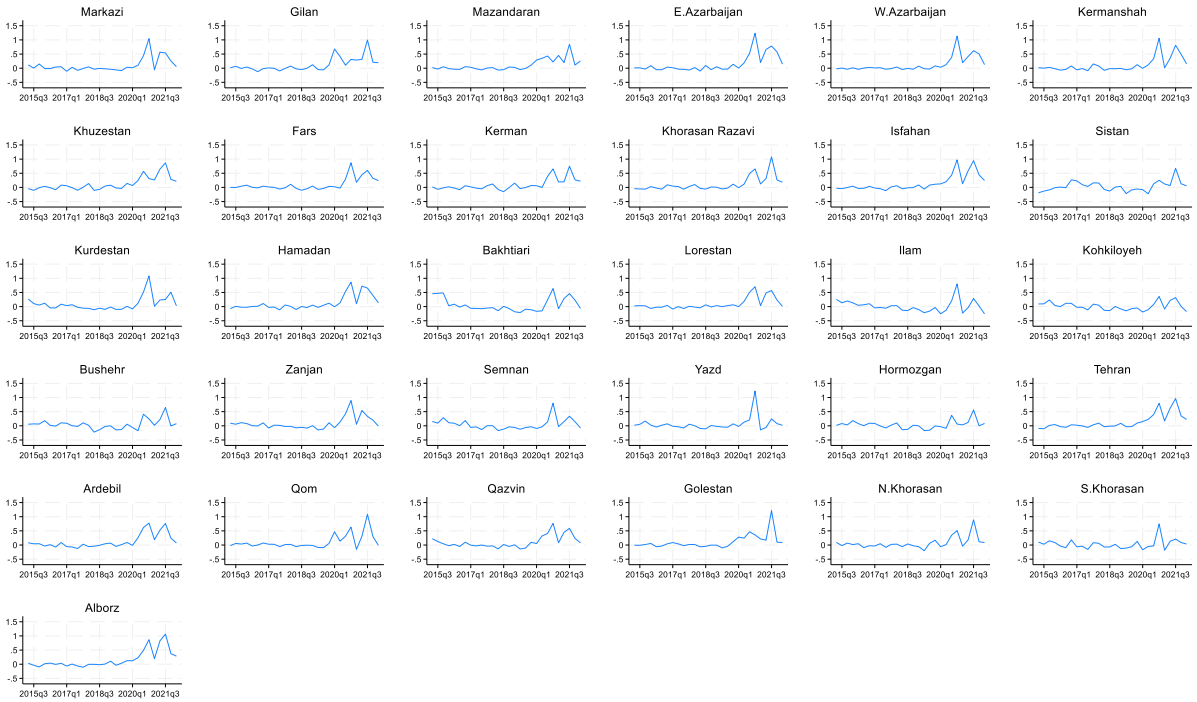
Source: Our World in Data

Figure 6. Cases and deaths resulting from COVID-19 19, Iran and selected MENA countries, 2020-2022.



Source: ourworldindata.org.

Figure 7. Excess death rates by province (deaths per 1000).



Appendix A: Additional Tables

Table A.1. Female labor force participation during the COVID-19 pandemic, full OLS regression results with provincial fixed effects, Iran 2015- 2023

	(1)	(2)
Female* Year 2016	0.011***	0.011***
	(0.002)	(0.002)
Female* Year 2017	0.022***	0.022***
	(0.002)	(0.002)
Female* Year 2018	0.022***	0.022***
	(0.002)	(0.002)
Female* Year 2019	0.021***	0.021***
	(0.002)	(0.002)
Female* Year 2020	0.007***	
	(0.002)	
Female* Year 2021	-0.006***	
	(0.002)	
Female* Year 2022	-0.012***	
	(0.002)	
Female* Year 2023	-0.013***	
	(0.003)	
Female* Year 2020_Quarter 1		0.033***
		(0.003)
Female* Year 2020_Quarter 2		-0.001
		(0.003)
Female* Year 2020_Quarter 3		-0.004
		(0.003)
Female* Year 2020_Quarter 4		-0.001
		(0.003)
Female* Year 2021_Quarter 1		0.002
		(0.003)
Female* Year 2021_Quarter 2		-0.009***
		(0.003)
Female* Year 2021_Quarter 3		-0.008***
		(0.003)
Female* Year 2021_Quarter 4		-0.010***
		(0.003)
Female* Year 2022_Quarter 1		-0.013***
		(0.003)
Female* Year 2022_Quarter 2		-0.010***
		(0.003)
Female* Year 2022_Quarter 3		-0.011***
		(0.003)

Female* Year 2022_Quarter 4		-0.014***
		(0.003)
Female* Year 2023_Quarter 1		-0.013***
		(0.003)
Female	-0.685***	-0.685***
	(0.001)	(0.001)
Age	-0.001***	-0.001***
	(0.000)	(0.000)
Widow	-0.005***	-0.005***
	(0.002)	(0.002)
Divorced	0.075***	0.075***
	(0.002)	(0.002)
Never married	-0.013***	-0.013***
	(0.001)	(0.001)
Education levels		
Primary education	0.021***	0.021***
	(0.001)	(0.001)
Secondary	0.024***	0.024***
	(0.001)	(0.001)
College/ University	0.164***	0.164***
	(0.001)	(0.001)
R2	0.49	0.49
F test	52776	43217
N	2529554	2529554

Note: *p<0 .1, **p<0.05, ***p<0.01. Robust standard errors are in parentheses. Individuals are restricted to those in the working ages (25 to 55 years old). The reference categories are male, no education, married, and year 2015. All the regressions control for province and year fixed effects. The regression with the interaction with quarters (Column 2) additionally controls for quarter fixed effects.

Table A.2. Female labor force participation during the COVID-19 pandemic with excess mortality, full OLS regressions with provincial fixed effects, Iran 2015- 2023

	(1)	(2)
Female* Year 2016* Excess mortality	0.026	0.026
	(0.020)	(0.020)
Female* Year 2017* Excess mortality	-0.037*	-0.037*
	(0.021)	(0.021)
Female* Year 2018* Excess mortality	0.013	0.013
	(0.019)	(0.019)
Female* Year 2019* Excess mortality	-0.073***	-0.073***
	(0.015)	(0.015)
Female* Year 2020* Excess mortality	-0.039***	
	(0.004)	
Female* Year 2021* Excess mortality	-0.044***	
	(0.004)	
Female* Year 2022* Excess mortality	-0.058***	
	(0.008)	
Female* Year 2023* Excess mortality	-0.087	
	(0.066)	
Female* Year 2020* Quarter 1* Excess mortality		-0.031***
		(0.012)
Female* Year 2020* Quarter 2* Excess mortality		-0.040***
		(0.013)
Female* Year 2020* Quarter 3* Excess mortality		-0.054***
		(0.013)
Female* Year 2020* Quarter 4* Excess mortality		-0.052***
		(0.007)
Female* Year 2021* Quarter 1* Excess mortality		-0.064***
		(0.013)
Female* Year 2021* Quarter 2* Excess mortality		-0.066***
		(0.009)
Female* Year 2021* Quarter 3* Excess mortality		-0.030***
		(0.007)
Female* Year 2021* Quarter 4* Excess mortality		-0.110***
		(0.012)
Female* Year 2022* Quarter 1* Excess mortality		-0.109***
		(0.016)
Female* Year 2022* Quarter 2* Excess mortality		-0.050***
		(0.012)
Female* Year 2022* Quarter 3* Excess mortality		-0.045***
		(0.012)
Female* Year 2022* Quarter 4* Excess mortality		-0.084

		(0.068)
Female* Year 2023* Quarter 1* Excess mortality		-0.087
		(0.066)
Female* Year 2016	0.011***	0.011***
	(0.002)	(0.002)
Female* Year 2017	0.022***	0.022***
	(0.002)	(0.002)
Female* Year 2018	0.022***	0.022***
	(0.002)	(0.002)
Female* Year 2019	0.021***	0.021***
	(0.002)	(0.002)
Female* Year 2020	0.019***	
	(0.002)	
Female* Year 2021	0.009***	
	(0.002)	
Female* Year 2022	-0.010***	
	(0.002)	
Female* Year 2023	-0.011***	
	(0.003)	
Excess mortality* Year 2016	-0.000**	-0.000**
	(0.000)	(0.000)
Excess mortality* Year 2017	-0.000	-0.000
	(0.000)	(0.000)
Excess mortality* Year 2018	-0.000	0.000
	(0.000)	(0.000)
Excess mortality* Year 2019	0.000	0.000
	(0.000)	(0.000)
Excess mortality* Year 2020	-0.000	-0.000
	(0.000)	(0.000)
Excess mortality* Year 2021	0.000**	0.000**
	(0.000)	(0.000)
Excess mortality* Year 2022	0.000***	0.000***
	(0.000)	(0.000)
Excess mortality* Year 2023	-0.000*	-0.000*
	(0.000)	(0.000)
Female* Year 2020* Quarter 1		0.033***
		(0.003)
Female* Year 2020* Quarter 2		0.003
		(0.003)
Female* Year 2020* Quarter 3		0.017***
		(0.005)
Female* Year 2020* Quarter 4		0.035***
		(0.005)

Female* Year 2021* Quarter 1		0.012***
		(0.003)
Female* Year 2021* Quarter 2		0.015***
		(0.004)
Female* Year 2021* Quarter 3		0.006
		(0.005)
Female* Year 2021* Quarter 4		0.019***
		(0.004)
Female* Year 2022* Quarter 1		-0.006**
		(0.003)
Female* Year 2022* Quarter 2		-0.008***
		(0.003)
Female* Year 2022* Quarter 3		-0.008***
		(0.003)
Female* Year 2022* Quarter 4		-0.014***
		(0.003)
Female* Year 2023* Quarter 1		-0.011***
		(0.003)
Excess mortality	0.005	0.006
	(0.007)	(0.007)
Female	-0.685***	-0.685***
	(0.001)	(0.001)
Age	-0.001***	-0.001***
	(0.000)	(0.000)
Marital status		
Widow	-0.005***	-0.005***
	(0.002)	(0.002)
Divorced	0.075***	0.075***
	(0.002)	(0.002)
Never married	-0.013***	-0.013***
	(0.001)	(0.001)
Education levels		
Primary education	0.021***	0.021***
	(0.001)	(0.001)
Secondary	0.024***	0.024***
	(0.001)	(0.001)
College/ University	0.164***	0.164***
	(0.001)	(0.001)
R2	0.49	0.49
F test	40189	31038
N	2529554	2529554

Note: *p<0 .1, **p<0.05, ***p<0.01. Robust standard errors are in parentheses. Individuals are restricted to those in the working ages (25 to 55 years old). The reference categories are male, no education, married, and year 2015. All the regressions control for province and year fixed effects. The regression with the interaction with quarters (Column 2) additionally controls for quarter fixed effects.