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Education and employment: An analysis from the effects of COVID 19 in the framework of educational processes

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Abstract---Unemployment as an effect of COVID-19, increased in some countries, with this study the behavior of the labor market was analyzed because of the pandemic whose main purpose is to offer indicators after the health situation in education and employment. The analysis was carried out with data from the third quarters of the years 2018 to 2021 from the National Occupation and Employment Survey (ENOE). The main results indicate that men lost more jobs than women, as well as older and single people and those with a basic level of studies, among workers with higher education it is highlighted that the jobs that were lost are in engineering areas, manufacturing, and construction.

Keywords---unemployment, education level, higher education, training areas, COVID-19.

Introduction

The COVID 19 pandemic has significantly affected employment in Mexico, the measures to control it have affected the economy in general and companies in particular, especially Small and Medium Enterprises (SMEs), which are facing serious problems to maintain themselves. involving the loss of jobs as demonstrated by the average unemployment rate from March 2020 to February 2021 which was 4.53%, when previously from January 2017 to February 2020 it was 3.42% from March 2020 to February of 2021 presented by the National Institute of Statistics and Geography (INEGI). Said rate (3.42%) was calculated with the seasonally adjusted data that eliminates the periodic seasonal factors that are unrelated to the economic nature of the data, in such a way that they can be adequately compared without being affected.

For its part, the International Labor Organization (ILO, 2020) analyzed the effects of the unemployment situation generated by the health emergency in terms of GDP, taking three hypothetical cases according to the incidence of the virus in the population: low, medium or high. The OIT estimated that, in the case of low incidence, the GDP would decrease around 2%, in the medium incidence, 4% and, in high incidence, 8%; These data will lead to an increase in global unemployment that would range from 3.5 to 36 million people. Employment after the pandemic, according to the ILO (2020), will be affected in three aspects: quantity, quality and effects on vulnerable groups (youth, women, self-employed workers, among others). These results coincide with those presented by Urzi et al. (2020), who argue that the impact of the COVID-19 crisis in Spain is concentrated on these most vulnerable groups in the labor market, including those workers with temporary contracts. Likewise, employment in commerce, restaurants, hotels and the manufacturing industry is highly affected, while the agricultural sector has a medium-low risk of loss (CEPAL/OIT, 2020). In addition, self-employment will be affected more than salaried employment, although it is expected that, once the emergency situation ends or eases, it will gradually recover, but with prospects that the population with a lower educational level and those who perform routine manual tasks have labor insertion problems. As for informal employment, there is a massive loss, which indicates that the impact of the health crisis has been stronger in vulnerable low-income segments. This effect of the crisis, which deepens inequality in the labor market, is confirmed with the information on the variation in employment by occupation group and by educational level (Weller et al., 2020).

Another issue that is expected is the increase in jobs in new occupations, especially related to electronic commerce and the purchase and distribution of products, as well as health services (Weller, 2020). It is also interesting to observe the impact that the health emergency is having on the employment of people with a high academic level, by professional profile. Barrero et al. (2020) emphasize the effect of intra and intersectoral relocation of employment that takes place in this context. They argue that this relocation is not temporary, since many of the

changes in consumption patterns and business practices would persist. In this context, they highlight that according to their estimates, 42% of recent layoffs would lead to a permanent loss of jobs.

Added to all this is the fact that Latin America is immersed in the process of the fourth industrial revolution. There is a high diffusion of 4.0 technologies, especially in sectors with high export power, which creates new occupations that will demand new skills and abilities from workers, especially those who have completed technical-professional higher education (Inter-American Development Bank, 2020). In the case of Mexico, Contreras-Cueva and González-Morales (2020) showed that the higher the level of education, the greater the opportunities people have to get a job; They also highlighted that, by professional area, employability in computer sciences is independent of the sex of the worker, while there is a greater difference in opportunities for men in information sciences, arts and industrial security, and for women, in teacher and veterinary training.

Based on this result, the objective of this work is proposed: to identify the characteristics of the Economically Active Population (EAP) that presented greater vulnerability in Mexico as a result of the pandemic, estimating the probability of losing employment, considering their level of study, and, in the case of those with a higher level, identify which areas of professional training had greater and fewer opportunities. This with the purpose of offering indicators on the effect of the emerging health situation in the field of education. The analysis will be carried out with data from the third quarter of the last four years from the National Occupation and Employment Survey (ENOE), using descriptive statistics and the logit model to determine the probability of losing employment in the event of health contingencies..

Method

This study is quantitative in nature as we seek to validate the hypotheses and measure the situation regarding the effects of COVID-19 on education and employment in Mexico. It starts from the conclusions of Urzi et al. (2020), who point out that the confinement measures are affecting women and young people more, groups that are more involved in economic activities that were closed due to official regulations, such as restaurants, hotels and cultural activities.

Hypothesis 1: Employability after the COVID-19 pandemic affects to a different extent depending on the sex and age of the workers. Regarding the educational level of the workers, Urzi et al. (2020), point out that there are economic activities that are part of the essential activities that could not be closed in the health contingency, such as, among others, those related to health professionals, and education, the latter were adjusted to be offered online, so it is expected that:

Hypothesis 2: Employability during the pandemic is affected to a different extent for workers depending on their level of studies.

Hypothesis 3: Investment in education guarantees greater probability and better employment opportunities.

In this sense, the theory of human capital continues to be relevant in cases of pandemic, accentuated by the demands of the knowledge economy in which, in

addition to a high educational level, certain capacities and skills are required that complement the acquired human capital. in the formal educational system.

In the case of Mexico, Contreras-Cueva and González-Morales (2020) showed that employability depended on the professional area of study, likewise the OECD (2019) pointed out that the professional fields with the highest employment rate were education, information technology, information, business administration and law, manufacturing engineering and construction. With this research we intend to identify if these professions continue to guarantee employment, therefore, the following hypothesis is proposed. Hypothesis 4. There are different employment opportunities depending on the profiles by areas of professional training of workers during the pandemic than before it.

The data

To validate these hypotheses, the microdata from the third quarters collected by the National Occupation and Employment Survey (ENOE) were used, corresponding to the period 2018-2021. The third quarter is used because it reflects more stable information on the behavior of employment. This survey is applied quarterly to households by the National Institute of Statistics and Geography (INEGI) with the purpose of obtaining information on the Mexican labor market. For this study, some variables of the questionnaire were selected, disaggregating the Economically Active Population (EAP) between those who declared having a job and those who are looking for a job (Class 1=1; Class 2 = 1 and 2).

The variables used were sex, age, marital status, and level of education and career, adjusted in the following terms: Marital status was constructed from the variable E_CON in two options, single and married, instead of those established by the ENOE, considering the interviewees as single when their answer is: Separated, divorced, widowed and single, and as married, to those who answered as: Free union and married. Educational level, it was taken from the question of the ENOE, instruction level, cs_p13_1 Up to what year or grade did you pass in school? defined from 01 to 09, which correspond from preschool to doctorate. To determine the probability of having or not having a job, the variable was used as presented by the ENOE, later to deepen the analysis, since what is sought is to identify which areas of professional training had greater opportunities, the variable level of Instruction was transformed into three groups: the basic one integrates the preschool, primary and secondary levels, the middle high school, normal (degree programs for teacher training in basic education) and technical career, the higher, bachelor's, master's and doctoral degrees.

Employability, for this variable, was taken from the Class 2 variable with options from 1 to 4, where 1 and 2 correspond to the EAP, which are the interviewees who answered that they had a job or that they were looking for one (they do not have a job); 3 and 4 to the non-economically active population (PNEA). Professional training, based on the question career cs_p14_c, the broad and specific field variables were constructed, whose codes are in the Mexican Classification of Study Programs by Academic Training Fields (CMPE, 2011), which structures professional training into 8 broad levels, 22 specific and 88 detailed, grouped by

the similarity of theoretical content, learning objective, object of study and methods, tools and equipment used for training. Table 1 presents the classification of the broad and specific fields.

Table 1
Classification of professional training areas, by broad field and specific field

Broad field	Specific
1. Education	11. Educational sciences 12. Teacher training
2. Arts and humanities	21. Arts 22. Humanities
3. Social sciences, administration and law	31. Social sciences and behavioral studies 32. Information sciences 33. Business and administration 34. Law
4. Natural, exact and computer sciences	41. Natural sciences 42. Physical, chemical and earth sciences 43. Mathematics and statistics 44. Computer sciences
5. Engineering, manufacturing, and construction	51. Industrial engineering, mechanics, electronics and technology 52. Manufacturing and processes 53. Architecture and construction
6. Agronomy and veterinary medicine	61. Agronomy, forestry and fisheries 62. Veterinary
7. Health	71. Health
8. Services	81. Personal services 82. Transportation services 83. Industrial safety 84. Security services

Source: Mexican Classification of Study Programs by Fields of Academic Training (CMPE, 2011)

The sample analyzed corresponds to 643,934 people, with a median age of 38 years, 96% answered that they have a job, 60% are men, 59% are married, regarding the educational level, 47% have basic level, 27% average and 26% higher.

Discussion

Data analysis

After describing the characteristics of the analyzed data, X2 the possible association between the dependent variable employability with the independent

ones, year of the interview, sex, educational level and marital status. Subsequently, the descriptors differentiated by sex, level of instruction, broad field and specific field of study are presented. We continue with the discrete choice model of logistic regression with which the probability of losing a job is estimated. This model is useful when, as in this case, the dependent variable is categorical and the independent variables are quantitative or qualitative.

Specifically, in this research the dependent variable is detailed in equation 1.

$$Y = \begin{cases} 1 & \text{Does not have a job} \\ 0 & \text{has a job} \end{cases} \quad (1)$$

The quantitative variable age and the qualitative variables sex, marital status, year of the interview and educational level are used as independent variables. The logistic regression model allows adjusting the probability that the respondent, based on the set of independent variables, belongs to one of the two groups of Y, that is, the purpose is to obtain a linear combination of the independent variables that allows estimating the probability that an interviewee has or does not have a job, these probabilities are given by equation 2.

$$Y = \beta_0 + \beta_1 \text{ age} + \beta_2 \text{ male} + \beta_3 \text{ marital status} + \beta_4 \text{ 2021} + \beta_5 \text{ 2018} + \beta_6 \text{ 2019} + \beta_7 \text{ 2020} + \beta_8 \text{ primary} + \beta_9 \text{ secondary} + \beta_{10} \text{ high school} + \beta_{11} \text{ normal} + \beta_{12} \text{ technical} + \beta_{13} \text{ professional} + \beta_{14} \text{ master's degree} + \beta_{15} \text{ doctorate} \quad (2)$$

Where Y is the linear combination presented, and is a dichotomous qualitative variable, which indicates the probability that a respondent does not have a job or otherwise that, if he does, the Independent variables correspond to personal characteristics, the database of the year from which they were obtained, and the level of education. Finally, the descriptors are presented by areas of professional training that had greater and fewer opportunities as a result of the pandemic, disaggregated by sex and selecting the years 2019 and 2020, which are the ones that reflect the variation in employability.

This section presents the results of the analysis of the people interviewed from the economically active population (EAP) of the ENOE of the data corresponding to the third quarters of the years 2018 to 2020. The results obtained with the X² statistic to verify the associations between the variables, the dependent variable employability with the independent ones, year of the interview, sex, level of education and marital status, which are summarized in table 2.

Table 2
Tests

	Bilateral asymptotic significance
Sex	0.837
Marital Status (Married)	0.000
Base	0.000
Education level	0.000

Source: Own elaboration based on the results

Table 2 shows that apart from the sex variable (Sig. 0.837), the interviewee's employability depends on the variables analyzed. The sex of the interviewee, as shown by the X2 statistic, does not influence employability; however, it will later be included in the logistic regression model to estimate, together with the other explanatory variables, the probability that the interviewee belongs or not to the employed population. Meanwhile, we will use it to differentiate the descriptive by sex. Once the relationship of the variables has been verified, it is highlighted descriptively, how employability was presented in the last 4 years. Figure 1 summarizes the information regarding employability by sex and by year of analysis.

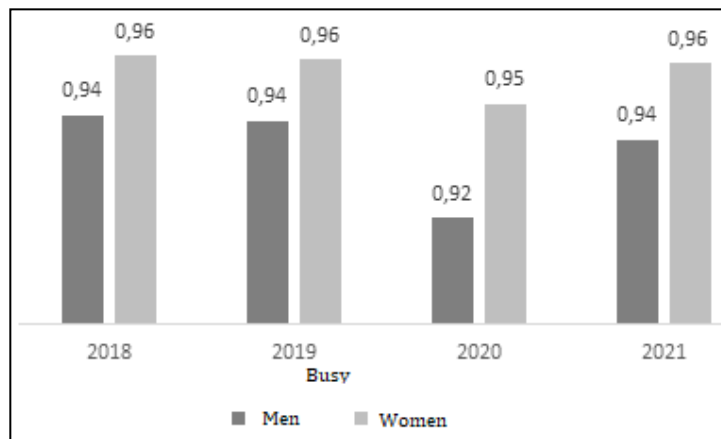


Figure 1. Employability by sex and by year

Source: Own elaboration based on data from the third quarter of the ENOE

Figure 1 shows that, in 2020, the year in which the health contingency caused by COVID 19 began, there were 2% decrease in unemployment for men and 1% for women. Regarding the employed population and by year the level of education grouped into basic, intermediate, and higher level, Figure 2 represents the results in which it is highlighted that the majority of people in the EAP who have a job and basic education, and that women in all the years analyzed have a higher level of middle and higher education than men.

Regarding the percentage of employed men with higher education, it was detected that it oscillates between 23 and 25%, while for women it is 28 to 32%, in this sense we do not know if the employment opportunity for professional women is greater, or they simply have a better chance of having a job if they have higher education. On the other hand, it is observed that, in the year the pandemic began, the occupation for the basic level dropped 2% for men and 4% for women, the medium level remained constant, and the upper level increased 2% for men. and 4% for women. In this sense, it seems that the loss of jobs mainly affected people with a lower level of education and was an opportunity for those with professional levels. Figure 2 reveals the employability by year, educational level and sex of the sample.

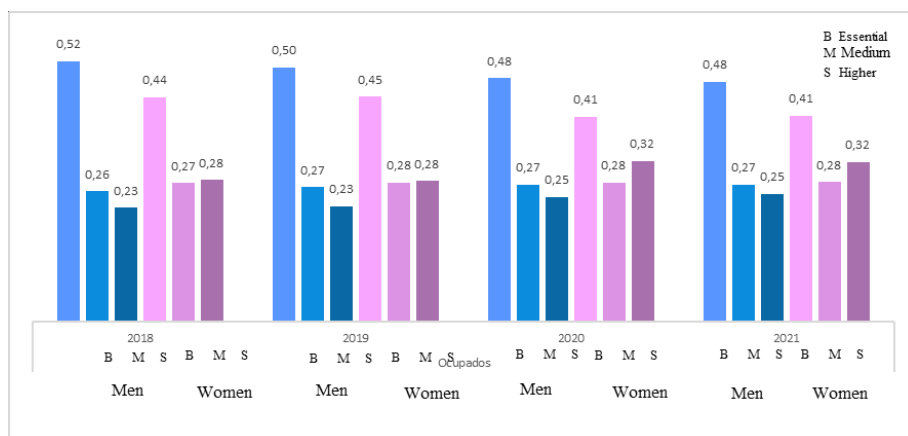


Figure 2. Employability by year, educational level, and sex
Source: Own elaboration based on ENOE data

In addition to these results, one of the objectives of this study is to detect, through the logistic regression model, the probability of losing employment as a result of the pandemic, under certain personal and educational characteristics. The starting point for the application of the model was to verify the assumptions of non-multicollinearity and the independence of errors, both assumptions were validated because, in the first case, for all the variables included in the model, the IVF was higher but close to 1 and for the second case, the Durbin-Watson test was 1,941, a value that included between 1 and 3. After validating the assumptions, the logistic regression model was estimated, the results of which are shown in tables 3 and 4, the first presents the indicators of the overall goodness of fit of the model, and the second the variables included in the model.

The goodness of fit indicator represented in Table 3 as Nagelkerke's indicates that 5.3% of the variance of the dependent variable is explained by the independent variables. The adjustment, therefore, is low, however, this is usual, as indicated in Minitab Blog Editor (2019), for data that try to predict the behavior of people, or that are influenced by others, such as the decision of whether or not to continue to employ a worker. Table 3 summarizes the model used

Table 3
Summary of the model

Step	Log-likelihood -2	Cox and Snell R-squared	Nagelkerke R-squared
1	217416.110a	0.016	0.053

Note: The estimation finished at iteration number 7 because the parameter estimates have changed by less than .001. Source: Results based on ENOE data.

Another aspect to continue considering that the estimated model is valid is because all the variables included in the model have significant coefficients (Sig.<0.05), as shown in table 4, so that, being significant, they adequately explain the probability of losing employment as an effect of the pandemic,

representing, as the case may be, the average change in the response for a unit of change in the variable, as long as the rest of the variables included in the model remain constant. After making these notes, we can say that regarding the first three variables that correspond to personal aspects, young people are more likely to be affected by the pandemic to lose their job, in addition to men, married people are the ones with the highest unemployment presented.

Regarding the years selected for the analysis of the ENOE, it is shown that in years 18 and 19 people were less likely to be unemployed, which leads us to confirm that the pandemic affected employability. Finally, regarding the level of education of the interviewees, which for the logistic regression model are not grouped, since it is of interest to know the detailed level of studies acquired by the interviewees, the results show that those least affected by the pandemic, were those who had normal, doctoral and master's studies. Table 4 shows the variables used in the equation.

Table 4
Variables in the equation

	B	Standard error	Wald	df	Sig.	Exp (B)
Age	-0.030	0.001	2736.527	1	0.000	0.971
Sex(male)	0.075	0.013	33.934	1	0.000	1.078
Civil Status (Married)	0.632	0.014	2091.201	1	0.000	1.882
Foundation (2021)			622.959	3	0.000	
Foundation (2018)	-0.108	0.018	37.373	1	0.000	0.898
Foundation (2019)	-0.064	0.017	13.793	1	0.000	0.938
Foundation (2020)	0.294	0.018	282.536	1	0.000	1.342
Primary			279.889	7	0.000	
Secondary	0.130	0.023	33.089	1	0.000	1.139
Baccalaureate	0.176	0.023	58.362	1	0.000	1.193
Normal	-0.755	0.336	5.059	1	0.024	0.470
technical career	0.144	0.041	12.504	1	0.000	1.154
Professional	0.307	0.023	185.599	1	0.000	1.359
master's degree	-0.151	0.057	6.879	1	0.009	0.860
Doctorate	-0.446	0.180	6.151	1	0.013	0.640
Constant	-2.606	0.036	5275.694	1	0.000	0.074

Nota. Variables specified in step 1: age, sex, marital status, Base, cs_p13_1. Source: Results from the data.

Equation 3 for the logit model obtained is represented below:

$$\begin{aligned}
 \text{Dropout Probability} = & -2.606 - 0.03_{age} + 0.075_{male} + \\
 & 0.632_{married} - 0.108_{2018} - 0.064_{2019} + 0.294_{2020} + 0.13_{secondary} + \\
 & 0.176_{high\ school} - 0.755_{normal} + 0.144_{technical} + \\
 & 0.307_{professional} - 0.151_{master's\ degree} - 0.446_{doctorate} \quad (3)
 \end{aligned}$$

After identifying the probabilities of losing a job depending on the personal characteristics of the interviewees and their level of study and observing that the

least affected were those who had a normal level, a doctorate and a master's degree, we continued the analysis with the purpose of to identify which areas of professional training had greater opportunities as a result of the pandemic. For this purpose, we present the descriptors disaggregating the data by sex and selecting the years 2019 and 2020, which are the ones that reflect the variation in employability. Figure 3 graphically presents employability by vocational training area for men and women.

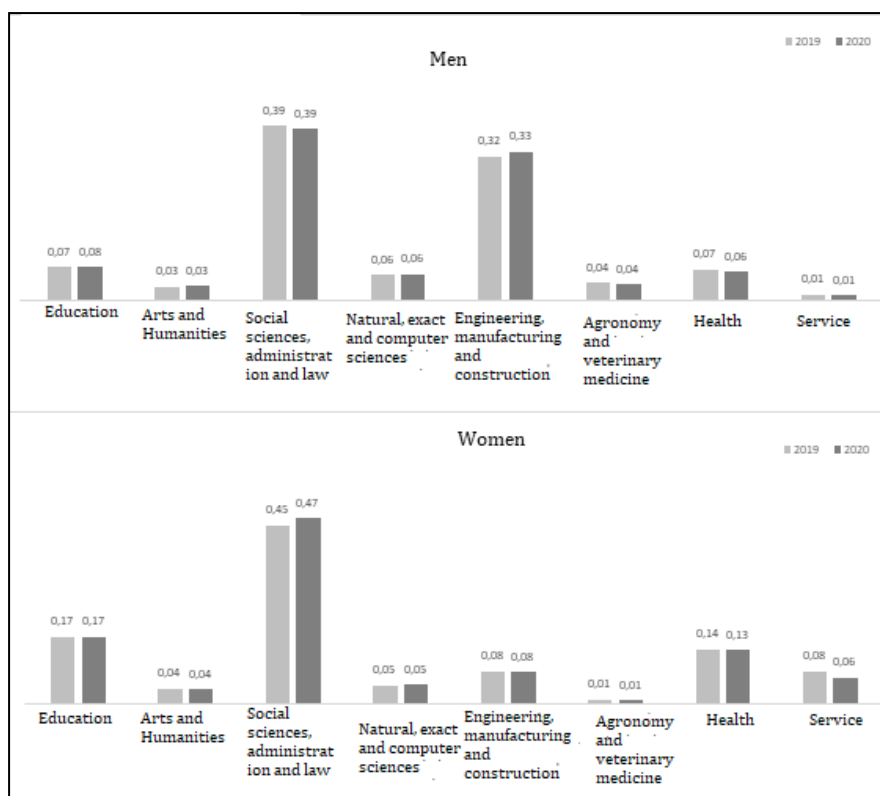


Figure 3. Employability by area of training, by sex and by year
Source: Own elaboration based on data from the third quarter of the ENOE

Figure 3 highlights that for men employability increased in the fields of education (1%), engineering, manufacturing, and construction (1%); and for women, in the field of social sciences, administration and law (2%). Continuing in depth, from the broad fields identified that increased employability, with the specific fields, detecting as presented in figure 4, the information that shows the professions not affected by the pandemic Figure 4. Employability in the specific.

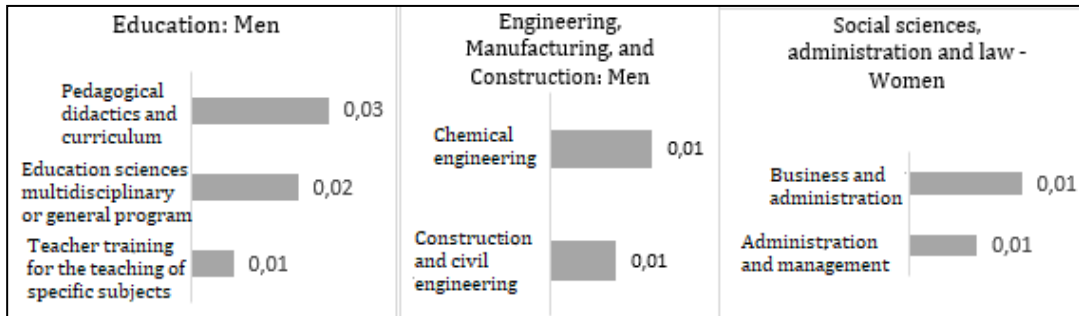


Figure 4. Employability in the specific fields that increased in 2020 with the pandemic

Source: Own elaboration based on data from the third quarter of the ENOE

As can be seen in Figure 4, the professions not affected by the pandemic, in the case of men, were: Didactics, pedagogy and curriculum, Educational Sciences, multidisciplinary or general programs, Teacher training for the teaching of specific subjects, Engineering chemical, construction and civil engineering. For women: Business and administration, multidisciplinary or general programs, Business administration and management. Once the behavior of employability was detected, depending on the level of study of the worker, pointing out that unemployment in general low, and that most of this decrease was for people with a basic educational level, contrary to this, employment increased for the who had higher education in three areas: Education, engineering and social sciences. Additionally, the fields of training that are most vulnerable to the emerging situation are presented in figure 5, which presents the summary of the unemployment percentages for men and women by broad field of training.

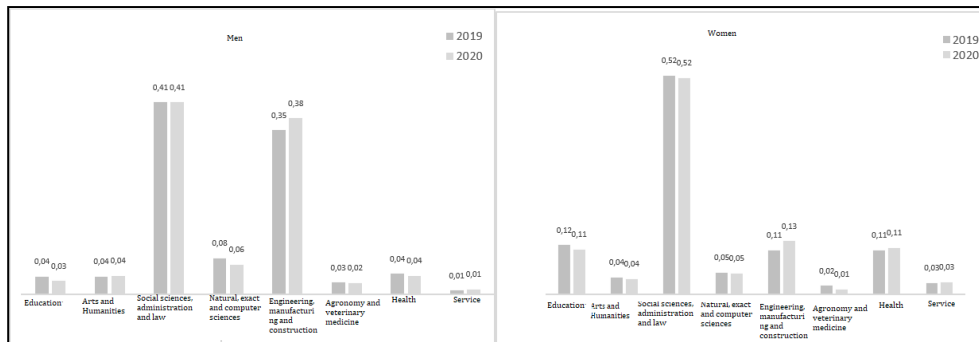


Figure 5. Unemployment by area of training, by sex and by year

Source: Own elaboration based on data from the third quarter of the ENOE

It is worth noting that for men, as well as for occupation, unemployment increased in the field of engineering, manufacturing, and construction (3%). This result does not represent a contradiction to what was said before, but rather reflects that in this field there were opportunities for some professional areas and disadvantages for others. For women, the highest unemployment was also in the field of engineering, manufacturing, and construction (2%) in addition to the field of health sciences (0.05%).

The broad fields of the professional areas with the highest unemployment presented in Figure 6 specify the professions affected by the pandemic.

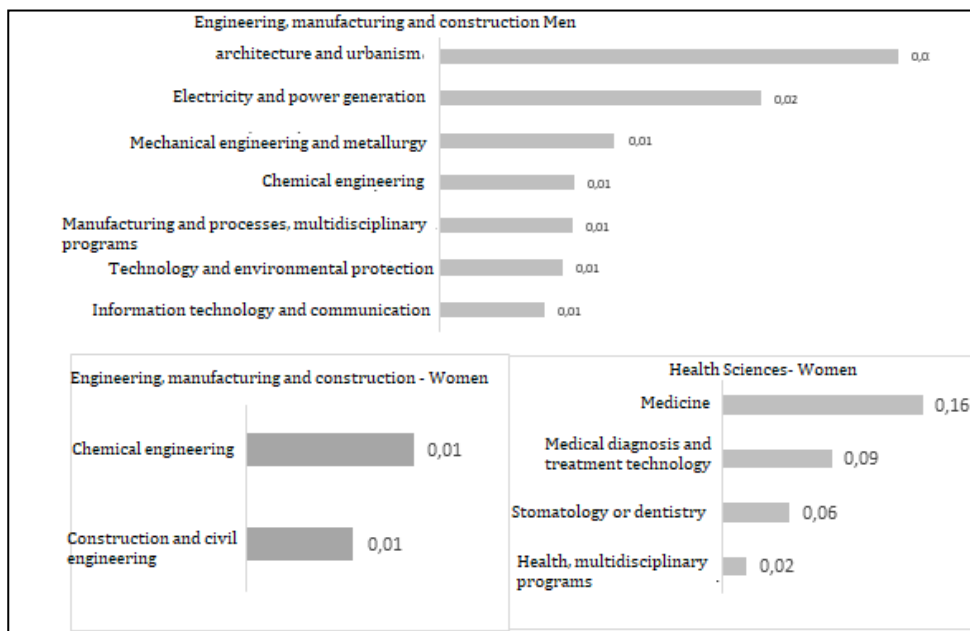


Figure 6. Unemployment in the specific fields that increased in the year that the pandemic began

Source: Own elaboration based on data from the third quarter of the ENOE

For men, the areas are Architecture and urbanism, Electricity and power generation, Mechanical engineering and metallurgy, Chemical engineering, Manufacturing, and processes, multidisciplinary or general programs, Electricity and power generation, Technology and environmental protection, Information Technologies, information and communication. For women: Industrial, mechanical, electronic and technological engineering, multidisciplinary or general programs, Construction and civil engineering, Information and communication technologies, Chemical engineering, Various materials industries (wood, paper, plastic and glass), Manufacturing and processes, multidisciplinary or general programs, Motor vehicle, ship and aircraft engineering, Electronics and automation, Medicine, Medical diagnosis and treatment technology, Stomatology and dentistry, Health, multidisciplinary or general programs.

Education and employment have been violated by the COVID-19 pandemic, which leads us to question which workers were most vulnerable? What is the impact that the health emergency had on employment in Mexico? Regarding professional profiles, were employment opportunities different before and during the pandemic? The answer to the first question that validates hypothesis 1 highlights that young people, men and married people, They were more likely to be affected by the pandemic to lose their job; These results coincide, to a certain extent, with those presented by the ILO (2020) and Urzi et al. (2020), who detected that young people are the most vulnerable, however, different results are obtained with respect to sex since this study shows that men were the most affected.

Regarding hypothesis 2, which answers the question about the impact that the health emergency has had on employment in Mexico, it was identified that employment for the EAP decreased from 2020 compared to 2019 by 2% for men and 1 % for women, by level of studies, it was reflected that those with a basic level were the most affected, especially in the case of women for whom it decreased by 4% while men decreased by 2%, workers with medium level of education were apparently stable, for their part, those with a higher level, men increased 2% and women were the most favored with an increase of 4%. These results lead us to conclude that job loss mostly affected people with a lower level of education, validating hypothesis 3, stating that investment in education guarantees greater probability and better opportunities for people with a professional level.

Finally, after confirming that even in a health emergency situation, the human capital theory is sustained, hypothesis 4 is also confirmed, noting that there are different employment opportunities depending on the profiles by areas of training during the pandemic than before it. , as Contreras-Cueva and González-Morales (2020) and the OECD (2019) pointed out, that employability depended on the professional area of studies, maintaining after the pandemic those of education, engineering, manufacturing and construction, social sciences, and administration and law, excluding information technology, which the authors argued is one with the greatest employment opportunity.

Conclusion

Employability after the COVID-19 pandemic affects people to a different extent according to their sex, age, level of studies, in addition, few differences are observed in employment opportunities depending on the profiles by areas of professional training during the pandemic than before her. Finally, it is verified that the theory of human capital, that is, investment in education guarantees a greater probability and better employment opportunities before the pandemic and during it.

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