

# Covid4EU+ Dissertation — Economy

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# Analysis of Labor Market decisions of men and women during the COVID-19 pandemic in the 4EU+ countries.

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# 1 Introduction

For the project, we decided to work on the analysis of the decisions of men and women in the labor market during the COVID-19 pandemic.

To do so, we selected several datasets from The World Bank and Our World in Data, one provides us information about the employment rate, the second one about the unemployment rate in twenty-seven countries around the world and the last one provides the Spread rate of the pandemic from May 2020 to December 2021. We decided to separate them based on international classification scale for countries, which mention two major group of countries: the **developed countries** group and the **countries in development** group.

In the first group, we divided countries into two categories, one contains industrialized countries and developed industrial powers with advanced technology, per capita income and human development index have always remained at a very high level, and the second one with newly industrialized countries - this is a group of countries that have basically completed the industrialization process, behind developed countries but above developing agricultural countries, socio-economic indicators remain at medium to high.

The second group contains three categories of countries. In the first one, we can find developing countries who has a stable economic growth on a long period of time, but who is still depend on agriculture. The next one also contains countries with unstable economic development due to political or managerial factors, high dependence on natural resources, agriculture, low industrial proportion. The last group contains the least developed countries and countries with low per capita income, this is the group of countries with the least developed economies in the world due to various reasons such as conflicts, wars, civil wars, crime, dictatorship, sanctions,... protracted, self-isolated, isolated from the rest of the world, economic shutdown, economic collapse, severe lack of information, backward industrial level,...

We choose to work from 2018 to 2021 to cover a large period of time during COVID-19 but to also have an idea of what the situation was before the outbreak of the virus. Each group contains five to six countries picked from different continents of the world.

## 2 Choosing datasets and countries

Each of us selected articles on Google Scholar we thought were relevant to the essay. However, we quickly realized things were going to be a bit harder because, in the ten different articles we found, only one provided us with datasets. So we got back on Google and finally came across The World Bank where we found datasets for every country we were looking for.

During our research, we also found Eurostat, the statistical office of the European Union (EU) but it only provides statistics at a European level which was not enough for our work. We then found Statista, a German company providing business data across +150 countries and OECD (The Organisation for Economic Co-operation and Development) but we preferred using The World Bank data for reliability purposes and because we had everything we needed in one place.

For the countries, we tried to select various countries to portray the diversity and have a look at different situations.

We wanted to be able to represent rich countries such as Germany or USA but also provide datasets and information about poorer countries. Since the situations can be very different from one country to another, we separated them into different categories.

### 3 Tools we used and how we processed data

We have used several tools to handle and process data. In addition to NumPy and Matplotlib (which were introduced in the course), we used Pandas to read and filter datasets. Pandas enables to create data frames from .csv files and provides a simple interface to get statistics about rows and columns, filter data points and perform data cleaning. We also used RStudio to simplify the data engineer task, then export the data from .xlsx file to .csv file.

The major issue we ran into when we started working on this project comes from the lack of datasets of this subject. Most of the results, despite our keywords “Labor force”, “Labor decisions”..., return a bunch of folder of Vaccinations Rate, Spread Rate... And the most efficient datasets found on The World Bank that we decided to use only represent the workforce rate yearly. For our case study, the data only varies from 2020 in order of 2018 is another minor issue when we dive deeper in the relation of the Spread rate and the Labor force development.

The two figure below show an example of the datasets respectively before and after the data cleaning process.

Country Name	Country Code	Indicator Name	Indicator Code	1960	1961	1962	1963	1964	1965	...	2013	2014	2015	2016	2017	2
Aruba	ABW	Employment to population ratio, 15+ female (%..	SLEMPOTLSPFEZS	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	f
Africa Eastern and Southern	AFE	Employment to population ratio, 15+ female (%..	SLEMPOTLSPFEZS	NaN	NaN	NaN	NaN	NaN	NaN	...	61.110867	61.134879	61.231237	61.232767	61.383053	61.450
Afghanistan	AFG	Employment to population ratio, 15+ female (%..	SLEMPOTLSPFEZS	NaN	NaN	NaN	NaN	NaN	NaN	...	14.401000	15.237000	16.104000	17.009001	17.950001	18.253
Africa Western and Central	AFW	Employment to population ratio, 15+ female (%..	SLEMPOTLSPFEZS	NaN	NaN	NaN	NaN	NaN	NaN	...	52.829044	52.141498	51.988543	51.173758	50.741865	50.779
Angola	AGO	Employment to population ratio, 15+ female (%..	SLEMPOTLSPFEZS	NaN	NaN	NaN	NaN	NaN	NaN	...	69.040001	69.039001	69.039001	69.039003	69.061996	69.086
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Kosovo	XKK	Employment to population ratio, 15+ female (%..	SLEMPOTLSPFEZS	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	f

Figure 1 - How the dataset originally look

	France	Germany	US	UK	Canada	Japan
2018	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2019	0.209000	0.707001	0.476002	0.657001	0.285000	0.831001
2020	-0.377998	-0.126003	-3.785000	-0.228001	-4.288998	-0.291000
2021	1.142998	0.124001	1.557999	-0.619999	2.427998	0.105000

Figure 2 - Example of the a ready-to-use dataset

To make sure that the analysis process works out smoothly, we have to build many different datasets extracted from the main one, which contains all information needed from the twenty-seven countries selected; each one is constructed based on gender (men or women) and labor status (employed or unemployed). We analyze the data collected based on the Macroeconomic Theory that will be explained below.

## 4 A simple guide to the Labor Market definition

### What is Labor Market?

The labor market, also known as the job market, refers to the *supply* of and *demand for labor*, in which employees provide the supply and employers provide the demand. It is a major component of any economy and is intricately linked to markets for capital, goods and services.

#### Key takeaways

- The labor market should be viewed at both the *macroeconomic* and *microeconomic levels*.
- Unemployment rates and labor productivity rates are two important macroeconomic gauges.
- Individual wages and the number of hours worked are two important microeconomic gauges.

At the macroeconomic level, supply and demand are influenced by domestic and international market dynamics, as well as factors such as immigration, the age of the population, and education levels. Relevant measures include unemployment, productivity, participation rates, total income, and gross domestic product (GDP).

At the microeconomic level, individual firms interact with employees, hiring them, firing them, and raising or cutting wages and hours. The relationship between supply and demand influences the number of hours employees work and the compensation they receive in wages, salary, and benefits.

Labor productivity is another important gauge of the labor market and broader economic health, measuring the output produced per hour of labor. Productivity has risen in many economies, the US included, due to advancements in technology and other improvements in efficiency.

**Important:** The fact that productivity growth has outstripped wage growth means that the supply of labor has outpaced the demand for it.

### The Macroeconomic Theory

According to macroeconomic theory, *the fact that wage growth lags productivity growth indicates that the supply of labor has outpaced demand*. When that happens, there is downward pressure on wages, as workers compete for a scarce number of jobs and employers have their pick of the labor force.

Conversely, if demand outpaces supply, there is upward pressure on wages, as workers have more bargaining power and are more likely to be able to switch to a higher paying job, while employers must compete for scarce labor.

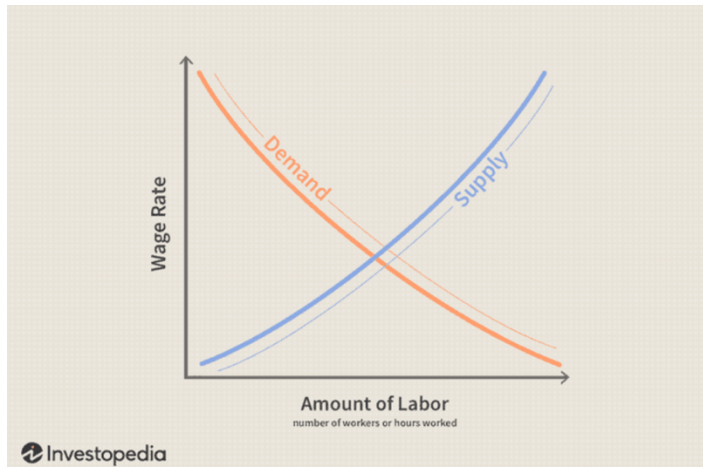


Figure 3 - source: Investopedia

Some factors can influence labor supply and demand. For example, an increase in immigration to a country can grow the labor supply and potentially depress wages, particularly for unskilled jobs. An aging population can deplete the supply of labor and potentially drive up wages.

These factors don't always have such straightforward consequences, though. A country with an aging population will see demand for many goods and services decline, while demand for healthcare increases. Not every worker

who loses their job can simply move into healthcare work, particularly if the jobs in demand are highly skilled and specialized, such as doctors and nurses. For this reason, demand can exceed supply in certain sectors, even if supply exceeds demand in the labor market as a whole.

## Our method

During the COVID-19 pandemic, we have known that *“The COVID-19 pandemic has triggered one of the worst jobs crises since the Great Depression. There is a real danger that the crisis will increase poverty and widen inequalities, with the impact felt for years to come. Countries now need to do everything they can to stop this jobs crisis from turning into a social crisis. Reconstructing a better and more resilient labor market is an essential investment in the future and in future generations.”*, OECD, The impact of COVID-19 on employment and jobs. Enormous amount of employee face the risk of being in the list of man power reduction in order to maintain the function of the whole company. According to the Macroeconomic theory, if the situation continues, an upward pressure on wages will occurs.

Here, we want to answer the question: “Did the increase of the unemployment is mainly caused by the spread of the COVID-19 pandemic?”. We will give the answer after our two-steps process below: Analysis of the employment and unemployment rate across countries and a case study of the relation of the Spread rate of the pandemic and the Labor force development. In our project, we use Descriptive Analysis as the main concept for all figures and indexes.

### Note:

- We define the unemployment rate in the labor force to only includes workers who is actively looking for jobs (according to the *Macroeconomic Unemployment concept*)

# Statistical work

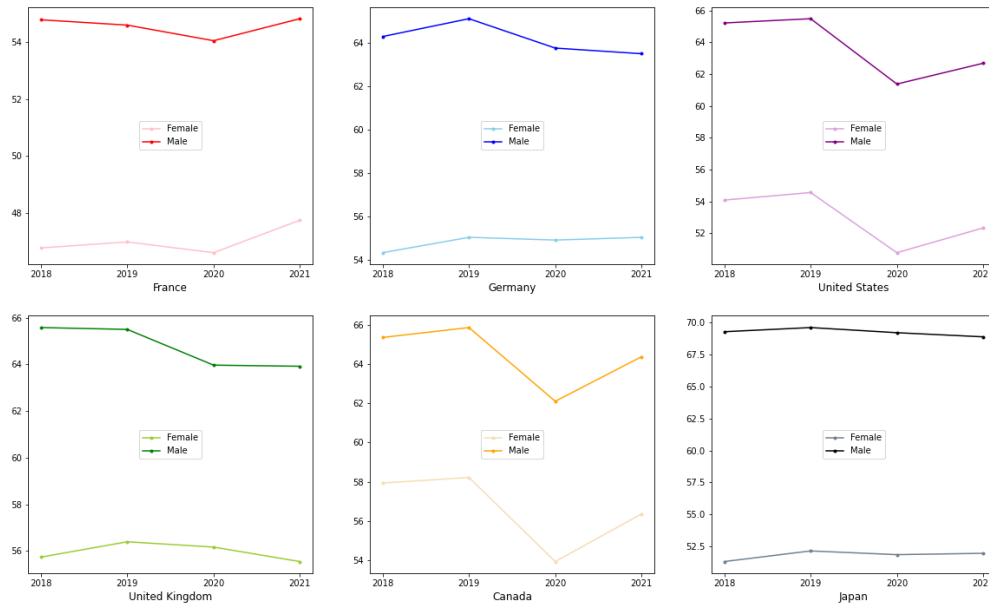
## 5 The evolution of the workforce across countries

### 5.1 Developed countries

#### 5.1.1 France, Germany, United States, United Kingdom, Canada, Japan

From multiple graphs below of six countries in the highest developed group, we denoted that the employment rate for men is higher than 54%, despite the effect of the pandemic, and 45% for women.

Developed countries T1.1 Employment rate of men and women 2018-2021



	France	Germany	US	UK	Canada	Japan
2018	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2019	0.209000	0.707001	0.476002	0.657001	0.285000	0.831001
2020	-0.377998	-0.126003	-3.785000	-0.228001	-4.288998	-0.291000
2021	1.142998	0.124001	1.557999	-0.619999	2.427998	0.105000

Figure 4 - Employed Women indexes

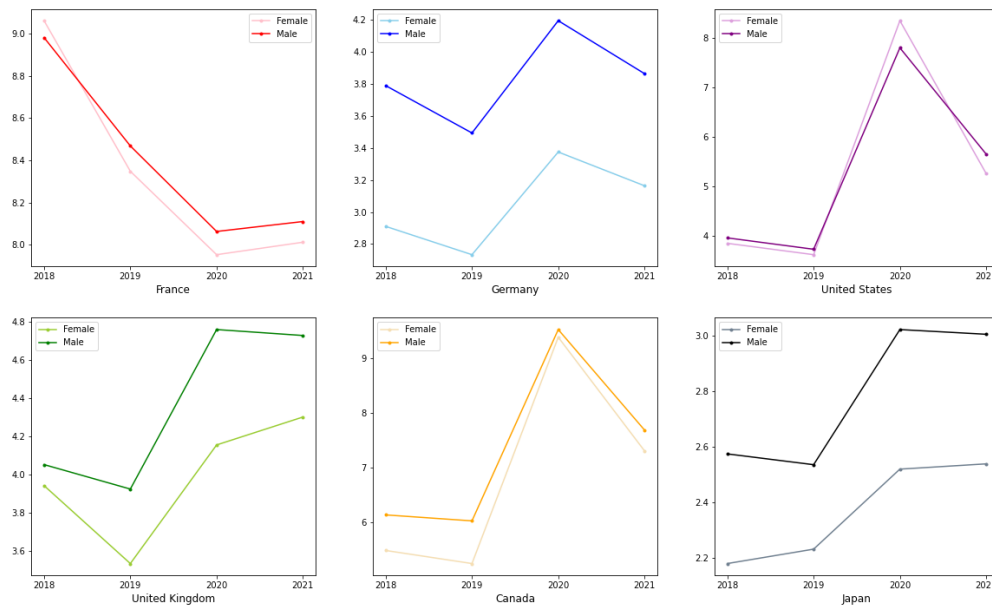
	France	Germany	US	UK	Canada	Japan
<b>2018</b>	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
<b>2019</b>	-0.187000	0.820000	0.267998	-0.079994	0.503998	0.326004
<b>2020</b>	-0.549000	-1.350998	-4.110001	-1.530003	-3.759998	-0.402000
<b>2021</b>	0.774998	-0.259003	1.308002	-0.048000	2.271999	-0.323006

Figure 5 - Employed Men indexes

We observed a trend:

- Before the COVID-19 pandemic (2019, as it occurs from the end of that year), the employment rate of these countries went up from 0.2~1%, and during the pandemic, it went down quickly and lower than the index of 2018.
- In 2021, the employment rate went up, some countries did that incredibly, but some don't improve, for example the employment rate for women in the United Kingdom or the E.R. for men in Japan.

Developed countries T1.1 Unemployment rate of men and women 2018-2021



	France	Germany	US	UK	Canada	Japan
<b>2018</b>	0.000	0.000	0.000	0.000	0.000	0.000
<b>2019</b>	-0.713	-0.177	-0.230	-0.408	-0.239	0.052
<b>2020</b>	-0.395	0.642	4.734	0.621	4.136	0.289
<b>2021</b>	0.059	-0.211	-3.092	0.146	-2.077	0.019

Figure 6 - Unemployed Women indexes



	France	Germany	US	UK	Canada	Japan
<b>2018</b>	0.000000	0.000	0.000	0.000	0.000	0.000
<b>2019</b>	-0.513000	-0.296	-0.230	-0.128	-0.109	-0.039
<b>2020</b>	-0.405001	0.702	4.075	0.835	3.496	0.488
<b>2021</b>	0.047000	-0.331	-2.150	-0.031	-1.836	-0.017

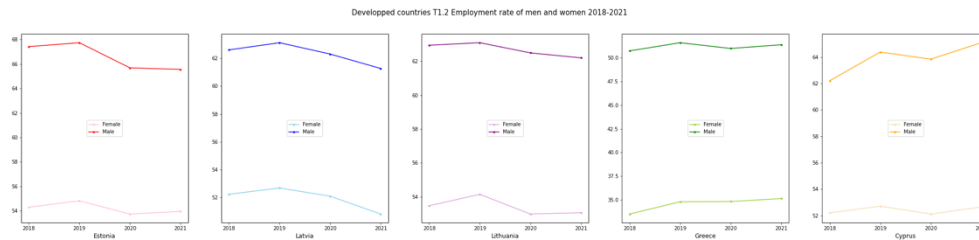
Figure 7 - Unemployed Men indexes

For the unemployment rate, we also observed a trend:

- In 2019, the unemployment rate of these countries went down from 0.15~1%, and during the pandemic (2020), it went up quickly and even a lot higher than the index of 2018, the highest increase rate is of the USA, with 4.734%.
- In 2021, the employment rate went down, and it seems to be a really good sign.
- Except for France, from 2018 to 2020, the unemployment rate went down 1.108% for women and 0.918% for men.

#### 5.1.2 Estonia, Latvia, Lithuania, Greece, Cyprus

From multiple graphs below of five countries in the second developed group, we denoted that most employment rate for men is higher than 62% (except for Greece is higher than 50%), despite the effect of the pandemic, and 52% for women (for Greece is ~32.5%).



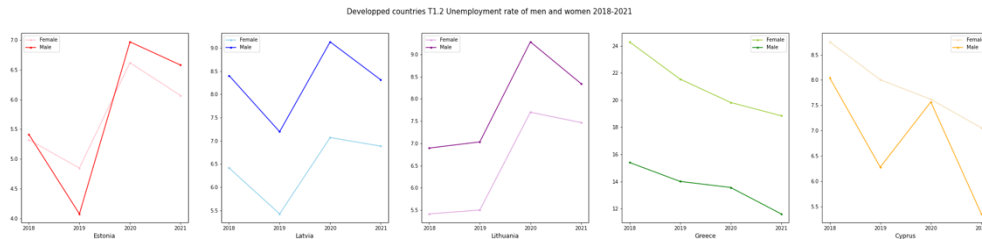
	Estonia	Latvia	Lithuania	Greece	Cyprus
<b>2018</b>	0.000000	0.000000	0.000000	0.000000	0.000000
<b>2019</b>	0.518002	0.447998	0.674000	1.292999	0.507999
<b>2020</b>	-1.077999	-0.591000	-1.165001	0.028999	-0.596001
<b>2021</b>	0.218998	-1.285000	0.077999	0.309002	0.534000

Figure 8 - Employed Women indexes

	Estonia	Latvia	Lithuania	Greece	Cyprus
2018	0.000000	0.000000	0.000000	0.000000	0.000000
2019	0.318001	0.514999	0.147999	0.866001	2.169998
2020	-2.050995	-0.818001	-0.601002	-0.604000	-0.535999
2021	-0.124001	-1.040001	-0.293999	0.387997	1.243000

Figure 9 - Employed Men indexes

We denoted the same trend as for the first group. As we can see, Greece has the lowest employment rate, but the E.R. rate for women is increasing though year compared to the other countries. In 2019, Greece's employment rate for women is the highest index on the table. Under the effect of the pandemic, it decreases a lot but maintains its evolution positively. Greece's employment rate for men follows the same path as the other countries.



	Estonia	Latvia	Lithuania	Greece	Cyprus
2018	0.000	0.000	0.000	0.000000	0.000000
2019	-0.476	-0.989	0.087	-2.740000	-0.747001
2020	1.772	1.643	2.200	-1.720001	-0.388999
2021	-0.553	-0.184	-0.232	-0.980999	-0.561000

Figure 10 - Unemployed women indexes

	Estonia	Latvia	Lithuania	Greece	Cyprus
2018	0.000	0.000	0.000	0.000	0.000
2019	-1.337	-1.209	0.139	-1.395	-1.762
2020	2.893	1.934	2.250	-0.445	1.287
2021	-0.390	-0.817	-0.937	-1.946	-2.210

Figure 11 - Unemployed men indexes

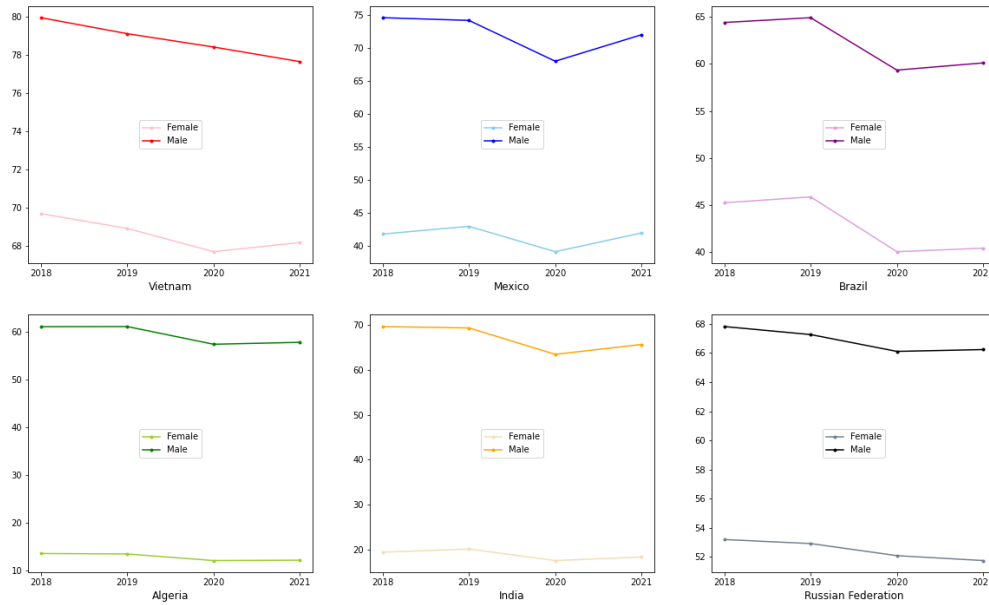
The unemployment rate for these five countries follows the same trend as for the previous group, except for Greece and Cyprus. The unemployment rate for countries other than Greece varied from 4% to ~9.5%. Greece has made an outstanding improvement. In 2018, the unemployment rate for women is higher than 24% and ~16% for men, which is a bigger part of the population than the rest of the group. But in 2021, the U.R. for women has gone down to ~20% and lower than 12% for men.

## 5.2 Countries in development

### 5.2.1 Vietnam, Mexico, Brazil, Algeria, India, Russian Federation

This group has a high and stable employment rate for both men and women, especially in Vietnam, where the employment rate for men is even higher than 80% before the pandemic and ~70% after it, and the employment rate for women is approximately 70% before and superior to 60% after the pandemic. Except for Algeria where the employment rate for women is just about 10% and India for about ~17.5%, which is a very low rate.

Developing countries T2.1 Employment rate of men and women 2018-2021



During the pandemic, in 2020, most countries in this group are hardly affected by the COVID-19, which decreases the employment rate for both men and women from ~1% to ~7%. In 2021, the employment rate increased but they still lower then before the pandemic (2018).

	Vietnam	Mexico	Brazil	Algeria	India	Russian Federation
2018	0.000000	0.000000	0.000000	0.000	0.000000	0.000000
2019	-0.771004	1.167000	0.629002	-0.094	0.695002	-0.275002
2020	-1.220001	-3.845001	-5.825001	-1.375	-2.556002	-0.832001
2021	0.481003	2.834999	0.369999	0.080	0.784000	-0.335999

Figure 12 - Employed Women indexes

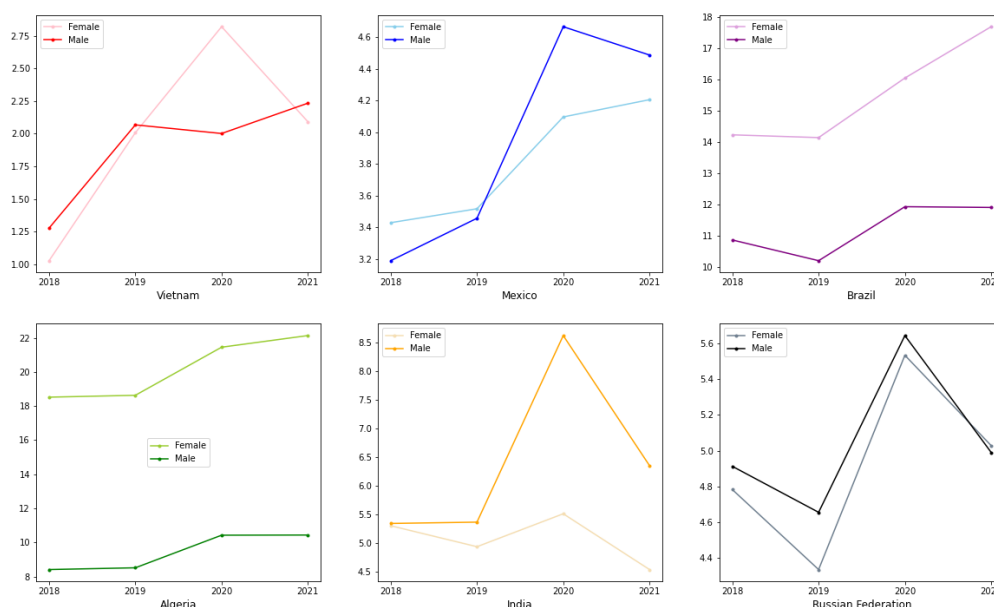
	Vietnam	Mexico	Brazil	Algeria	India	Russian Federation
2018	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2019	-0.837997	-0.411995	0.506996	0.023998	-0.306999	-0.549004
2020	-0.698997	-6.188004	-5.566998	-3.696999	-5.871002	-1.155998
2021	-0.764999	4.014000	0.762001	0.403000	2.195000	0.124001

Figure 13 - Employed Men indexes

The unemployment rate for men and women follows the same path as for the previous group. Vietnam got the lowest unemployment rate, which only varied from 1% to 2.75% for women in 2020. Brazil and Algeria are two countries where the unemployment rate maintains really high:

- Algeria:
  - From 8% (2018) to approximately 10% for women (2021)
  - From >18% (2018) to >22% for men (2021)
- Brazil:
  - From ~11% (2018) to ~12% for women (2021), which includes a decrease to 10% in 2019
  - From >14% (2018) to approximately 18% (2021) for men

Developping countries T2.1 Unemployment rate of men and women 2018-2021



	Vietnam	Mexico	Brazil	Algeria	India	Russian Federation
2018	0.000	0.000	0.000000	0.000000	0.000	0.000
2019	0.979	0.088	-0.088000	0.109999	-0.366	-0.447
2020	0.811	0.580	1.903000	2.820002	0.575	1.198
2021	-0.727	0.109	1.639999	0.681999	-0.974	-0.505

Figure 14 - Unemployed Women indexes

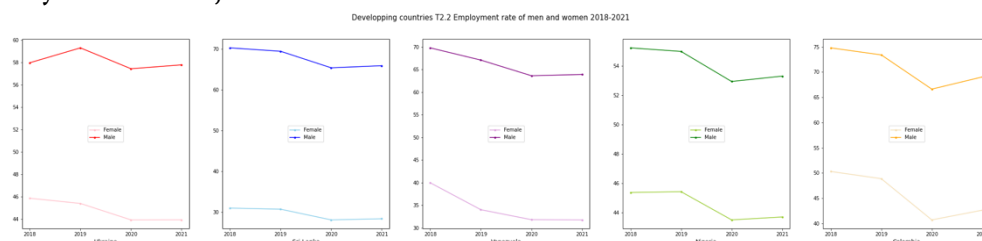
	Vietnam	Mexico	Brazil	Algeria	India	Russian Federation
2018	0.000	0.000	0.000000	0.000	0.000	0.000
2019	0.790	0.268	-0.662000	0.103	0.023	-0.257
2020	-0.066	1.210	1.724999	1.911	3.258	0.988
2021	0.232	-0.179	-0.024000	0.010	-2.271	-0.653

Figure 15 - Unemployed Men indexes

### 5.2.2 Ukraine, Sri Lanka, Venezuela, Nigeria, Colombia

From multiple graphs of employment rate and unemployment rate, we can conclude that this group has an unstable development of the labor force. Both the employment rate and unemployment rate don't follow the same trend compared to the three previous groups.

The employment rate for women in these five countries varies from approximately 30% to 50%, and from 52% to 75% for men.



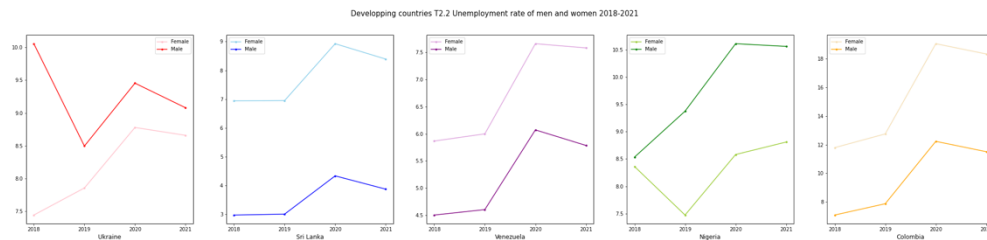
	Ukraine	Sri Lanka	Venezuela	Nigeria	Colombia
2018	0.000000	0.000000	0.000000	0.000000	0.000000
2019	-0.466000	-0.261002	-5.945999	0.054001	-1.428001
2020	-1.470001	-2.623999	-2.205002	-1.920002	-8.166000
2021	0.007999	0.274000	-0.048000	0.198002	1.924000

Figure 16 - Employed Women indexes

	Ukraine	Sri Lanka	Venezuela	Nigeria	Colombia
<b>2018</b>	0.000000	0.000000	0.000000	0.000000	0.000000
<b>2019</b>	1.331001	-0.837997	-2.701004	-0.242001	-1.391006
<b>2020</b>	-1.866001	-4.050003	-3.456001	-2.046001	-6.784996
<b>2021</b>	0.346001	0.514999	0.276001	0.364002	2.414001

Figure 17 - Employed Men indexes

Especially, half of the countries in this group have an opposite development of unemployment rate, for example, Ukraine and Nigeria from 2018 to 2019. The indexes vary from 3% to 10.5%, except for Colombia with the highest rate that varies from approximately 6% up to higher than 18%.



	Ukraine	Sri Lanka	Venezuela	Nigeria	Colombia
<b>2018</b>	0.000	0.000000	0.000	0.000	0.000000
<b>2019</b>	0.413	0.010000	0.132	-0.890	0.957000
<b>2020</b>	0.923	1.974000	1.658	1.109	6.292001
<b>2021</b>	-0.120	-0.533999	-0.077	0.229	-0.717001

Figure 18 - Unemployed Women indexes

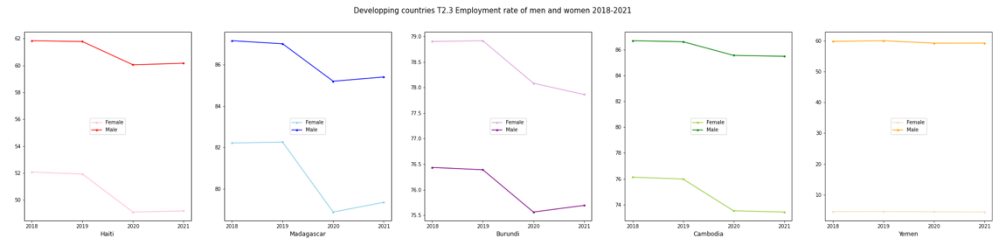
	Ukraine	Sri Lanka	Venezuela	Nigeria	Colombia
<b>2018</b>	0.000	0.000	0.000	0.000000	0.000000
<b>2019</b>	-1.561	0.032	0.100	0.842000	0.789000
<b>2020</b>	0.959	1.328	1.466	1.237000	4.350999
<b>2021</b>	-0.375	-0.461	-0.286	-0.049001	-0.723000

Figure 19 - Unemployed Men indexes

### 5.2.3 Haiti, Madagascar, Burundi, Cambodia, Yemen

From multiple graphs of employment rate and unemployment rate, we can conclude that the pandemic didn't affect these countries' labor force development. The employment rate maintains high, varies from approximately

45% to higher than 86% for both men and women, except for Yemen where women's employment rate is lower than 10%.



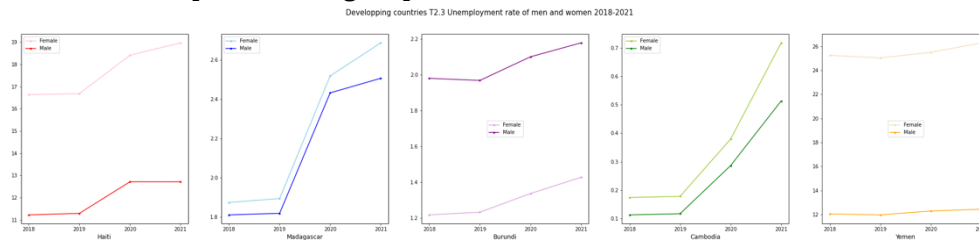
	Haiti	Madagascar	Burundi	Cambodia	Yemen
<b>2018</b>	0.000000	0.000000	0.000000	0.000000	0.000
<b>2019</b>	-0.146999	0.041000	0.014999	-0.147995	0.031
<b>2020</b>	-2.827000	-3.379997	-0.832001	-2.454002	-0.072
<b>2021</b>	0.082001	0.469002	-0.221001	-0.097000	-0.111

Figure 20 - Employed Women indexes

	Haiti	Madagascar	Burundi	Cambodia	Yemen
<b>2018</b>	0.000000	0.000000	0.000000	0.000000	0.000000
<b>2019</b>	-0.061001	-0.148003	-0.044998	-0.076996	0.226002
<b>2020</b>	-1.730999	-1.809998	-0.827995	-1.058006	-0.783001
<b>2021</b>	0.116001	0.204002	0.129997	-0.070999	0.023003

Figure 21 - Employed Men indexes

Most countries' unemployment rate in this group is reported incredibly low. We take the example of Cambodia, where the unemployment rate for both men and women varies only from 0.1% to 0.7%. The minor part of this group: Haiti and Yemen attain >26%.



	Haiti	Madagascar	Burundi	Cambodia	Yemen
<b>2018</b>	0.000	0.000	0.000	0.000	0.000000
<b>2019</b>	0.046	0.020	0.015	0.004	-0.222000
<b>2020</b>	1.726	0.623	0.104	0.201	0.466999
<b>2021</b>	0.555	0.168	0.091	0.338	0.788000

Figure 22 - Unemployed Women indexes

	Haiti	Madagascar	Burundi	Cambodia	Yemen
<b>2018</b>	0.000	0.000	0.000	0.000	0.000
<b>2019</b>	0.069	0.008	-0.012	0.004	-0.079
<b>2020</b>	1.419	0.612	0.132	0.169	0.323
<b>2021</b>	-0.001	0.074	0.078	0.227	0.146

Figure 23 - Unemployed Men indexes

## 6 Case study: Relation of the Spread rate of the pandemic and the Labor force development

At the Macroeconomic level, many factors could affect the supply and demand in the Labor Market, such as domestic market dynamic, international market dynamic, and other factors like immigration, age of the population, and education level... During the COVID-19 pandemic, factors that affected the most the Labor force is the apparition of new variants and their spread velocity, the vaccination rate, and many other clinical factors.

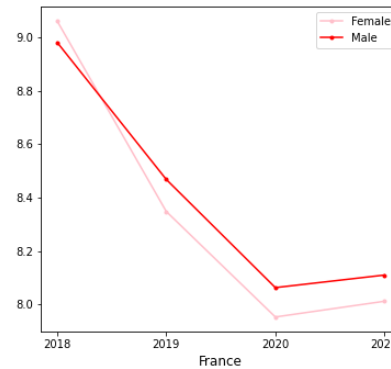
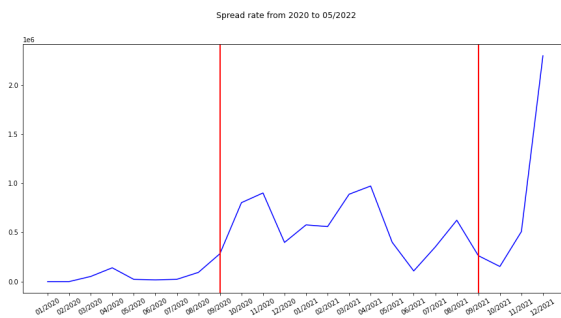
We choose eight countries among twenty-seven countries selected for our project, of different types with a spread rate that varies from low to high. We then divided them into two groups: Countries with high spread rates (>1 million per month) and countries with lower spread rates (<1 million per month).

### 6.1 France, Germany, Brazil, India

The pandemic started to spread rapidly in France in September 2020 and was turned down in April 2021. The number of cases grows quickly from November 2021, two months before the second wave. Despite all effects of the COVID-19, during the one year from September 2020 to September 2021, the unemployment rate in France has made no significant increase (< 0.1%, as included in Figures 6 and 7, Unemployed Women (reps. Men) indexes).

*France belongs to the first group of developed countries.*

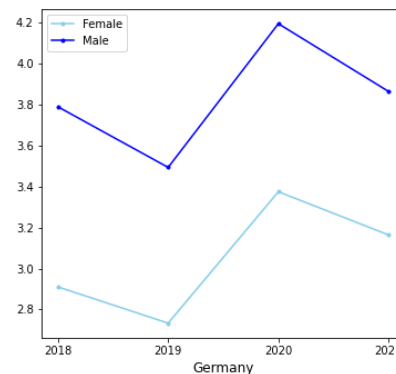
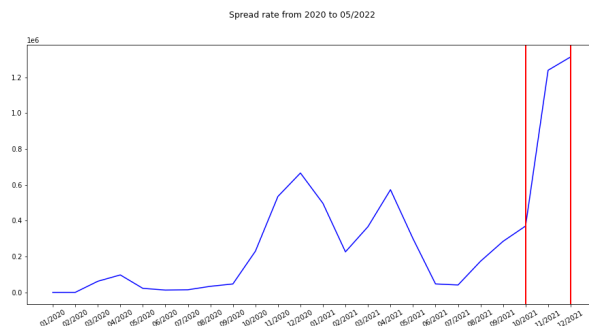




In Germany, the pandemic' spread follows the same path as in France and started to grow in October 2021. The unemployment rate for men and women develops nearly the same, as we can observe on the graph below, the two plots are approximately parallel.

The spread rate for Germany is a lot lower than in France (1.3 million per month compared to 2 million per month on the y-axis) and the unemployment rate decreased approximately 0.5% for both men and women, compared to < 0.1% for France.

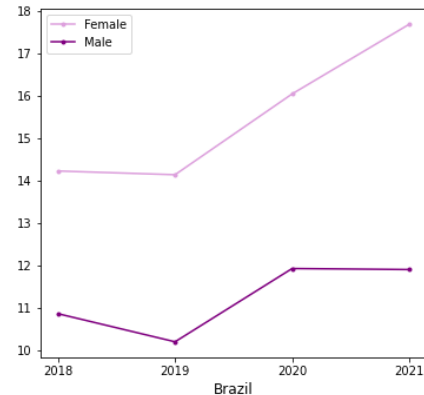
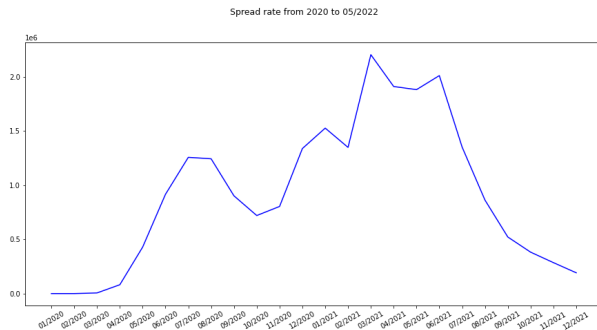
*Germany belongs to the first group of developed countries.*



The pandemic spread in Brazil hit 2 million on Mars, in 2021. Despite the COVID-19 wage that lies from April 2020 to June 2021, the unemployment rate for men and women follows two opposite trends: one went up and one went down.

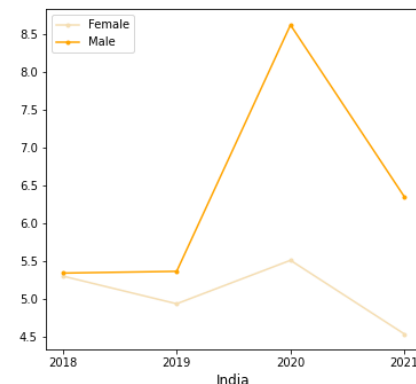
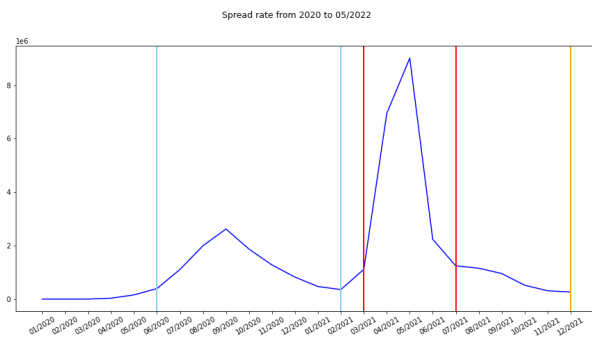
Brazil is one of the countries that have a high unemployment rate in the labor force. Due to the effect of the pandemic, the U.R. for men went up from 16% to approximately 18% and made a not too significant decrease for women in the range of 11.5-12%.

*Brazil belongs to the first group of countries in development.*



India is a country that was affected terribly by the COVID-19 pandemic, as reported in 2021, which hit over 9 million cases in just May 2021. But despite all, the unemployment rate of the workforce all decrease incredibly from 2020 to 2021.

*India belongs to the first group of countries in development.*

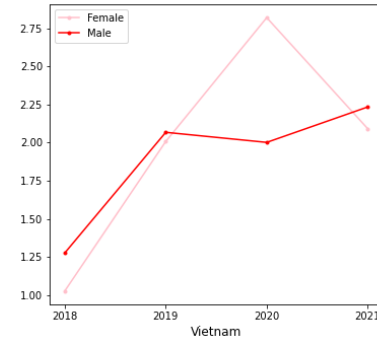
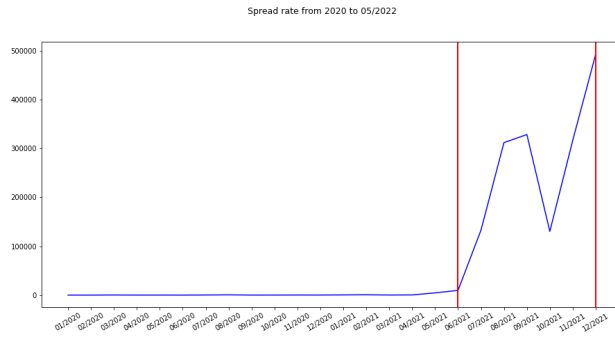


## 6.2 Vietnam, Cyprus, Greece, Haiti

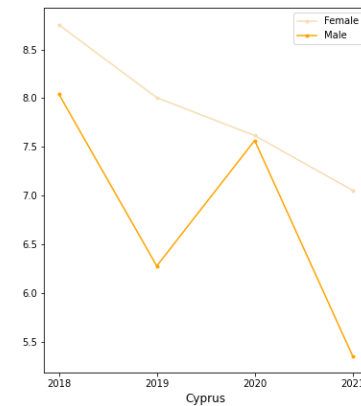
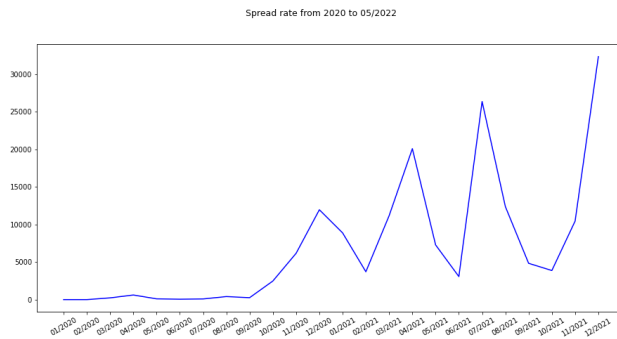
First Vietnam's COVID-19 wave started in June 2021 and continued to increase a few months after the New Year's Eve 2022. In the two years from 2020 until the end of 2021, the spread rate hit the highest in December 2021 with approximately 500 miles cases per month.

Due to the enormous pandemic, the unemployment rate of the labor force develop oppositely, with an insignificant increase in the range of 1% to approximately 2.8%: The U.R. for men increase from 2% to 2.25%, the U.R. for women increase from 2% to 2.75% from 2019 to 2020, then decrease back to the same with 2019 in 2021.

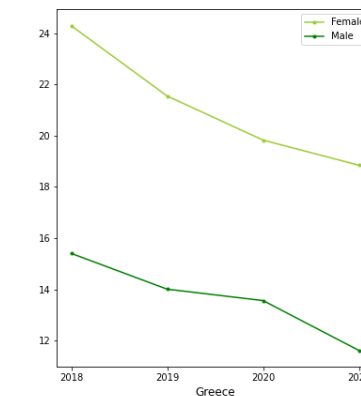
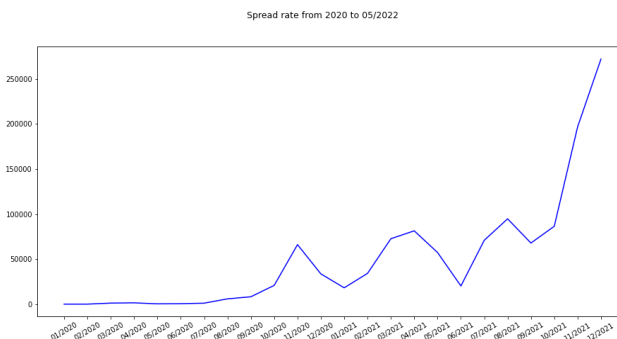
*Vietnam belongs to the first group of countries in development.*



Cyprus' spread rate seems quite to predict, as it increased and decreased quickly in just a short period and attained the highest rate by the end of 2021 with just about 30 miles cases per month. The unemployment rate of the labor force all decreases remarkably from 2020 to 2021.

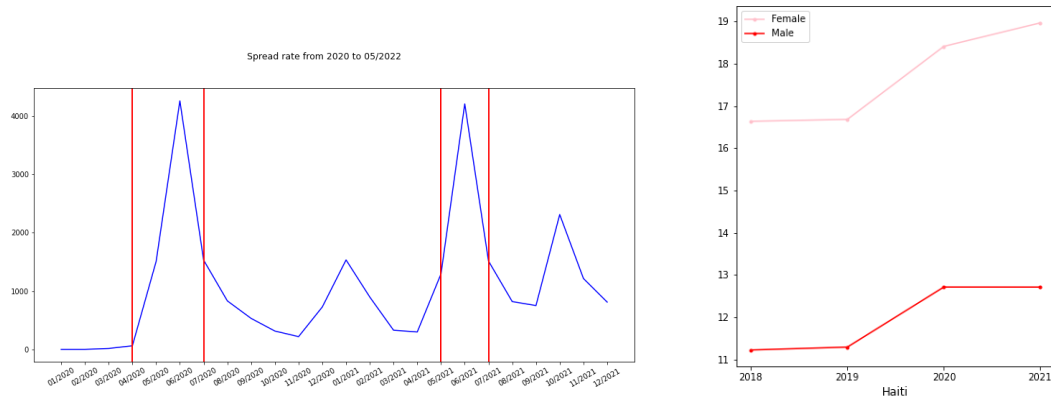


Greece's unemployment rate lies as one of the countries that have a high level of the unemployed labor force. But according to the graph below, the unemployment rate of this country seems to decrease incredibly despite the rapid increase in the spread rate, which hit almost 250 miles cases per month in December 2021.



Among eight countries taken for the case study, Haiti is the country with the lowest spread rate, which the highest only attained 400 per month in June 2020 and June 2021. But the number of cases reported monthly is the same as for Cyprus, it varies continuously over time.

And Haiti has the biggest difference compared to all seven other countries: its unemployment rate of the labor force increase constantly through the year, with an incredibly high rate varies in the range from 11% to approximately 13% for women and from approximately 17% to 19% for men.



## 7 Conclusion

Although the spread of COVID-19 has a substantial impact all over the world, the influence on labor market decisions during the observed period has not been uniform in all countries. The analysis we have done allows us to observe trends in the labor sector.

Clustering countries according to the development level enabled us to shed light on one particular thing: the pandemic, even though it's a global crisis impacting everyone around us, does have different repercussions depending upon prior economical conditions.

As observed, in the first countries we analyzed, the employment and unemployment rate hardly crosses 1%. It is associated with the fact that these countries managed to limit the damage caused by the virus. They set restrictions such as distance working and reducing hours of shifts for some employees.

We observed the same trend in Eastern European countries. These countries managed to also limit the damage of the pandemic. However, the situation in Greece is relatively different because the country had relatively worse initial economic conditions, for instance, it still has been tackling the consequences of a financial crisis in 2008. As a result, the influence of the pandemic on work-life in Greece appeared to be severe.

Among emerging countries, Vietnam has a high employment rate and a low unemployment rate despite having to deal with the COVID-19. We cannot say the same for its counterparts, the rest of the countries have to fight the virus but also fight poverty which does not help at all when dealing with a deadly virus.

The most alarming thing is the number (for E.R and U.R) that keeps going higher as the GDP per country goes lower.

However, we can note a contrast in the last group we've analyzed. The scale for the unemployment rate between Haiti/Yemen and Madagascar/Burundi/Cambodia is very unusual. For the latter, the scale barely exceeds 2.5% but for the two other countries, the scale goes up to 19% for Haiti and 26% for Yemen. This disparity can be explained by the political status of

the last two countries. Yemen is dealing with terrorism and starvation since 80% of the population lives in extreme poverty and Haiti has a very unstable government with the murder of its last president.

By analyzing the correlation between the spread of the virus and the development of the labor force, we can make observations and link certain factors between them. Here, the spread of the virus and the labor force.

For big countries, the spread of the virus can be explained by the size of the population of these countries (>1 billion for India, etc...). Tourism also helps with the spread of the virus, which explains why countries like Germany or France have many cases and why countries like Cyprus or Haiti have fewer cases. This is how we end up with more than 1 million new cases per month for large countries and a lower number of cases for smaller countries that also don't have many tourists. However, something is interesting in these plots, with waves of cases the rate of unemployment will increase. Since these countries are vast and very populated, the virus continues to spread and the rate of unemployment decreases very slowly.

## 8 Who did what

- Outline and overall presentation: Vu Hoang Thuy Duong, Lakshya Selvakumar, Aleksandra Kowalczyk, Kamilla Kizbayeva;
- Data research and identification: Lakshya Selvakumar, Vu Hoang Thuy Duong;
- Powerpoint presentation: Aleksandra Kowalczyk;
- Section 1 (Introduction): Lakshya Selvakumar;
- Section 2 (Choosing datasets and countries): Lakshya Selvakumar;
- Section 3 (Tools we used and how we processed data): Lakshya Selvakumar;
- Section 4 (Guide to the Labor market): Vu Hoang Thuy Duong;
- Report formatting; data cleaning programs, Python functions for generating figures shown in the report and for data processing and visualization; Statistical work part, including section 5 (The evolution of the workforce across countries) and section 6 (Case study): Vu Hoang Thuy Duong;
- Section 7 (Conclusion): Lakshya Selvakumar, Kamilla Kizbayeva;

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