COVID-19 IMPACT ON THE LABOUR MARKET OF TOURISM DEPENDENT NATIONS

THE SOUTHERN EUROPE CASE

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Nova Economics Club is the Economics club at Nova School of Business and Economics. Since 2012, its focus is to create a bridge between the theory learnt in classes with the work performed by economists on a daily basis.

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Abstract

Our project intends to analyse the impact of the COVID-19 pandemic on the labour market. As tourism-related activities were one of the most affected ones, we decided to compare Portugal, Spain, Greece, and Italy since they are all similar nations regarding the weight of tourism in the economy. We decided to use both the unemployment rate and the labour slack as our dependent variables, focusing our analysis on the latter, as it also accounts for people who cannot seek a job due to pandemic reasons. We used cross-sectional data to perform multiple linear regressions to analyse what variables are more likely to affect the labour slack. Our results show that COVID-19 cases, the relevance of tourism, and the percentage of young employment (used as a proxy for temporary contracts), are the most significant variables. Contrarily, the results do not show any significance of lockdowns in the change of the labour market slack of the nations we analysed.

Contents

1. Introduction

The purpose of our work is to deeply understand the effects that COVID-19 had on the labour market. Since this paper was made in a partnership with GPEARI (to which we are very grateful), it was also relevant to reach important results specifically for the Portuguese labour market. Therefore, we decided to compare the Portuguese reality with the one from other countries.

As we will further explain later, this pandemic hit different sectors of the economy asymmetrically. Tourism and face-to-face services are amongst the most harmed ones. In Portugal, tourism represents most of the exports, and has an enormous importance to the country's economy. According to Eurostat, 14.6% of the Portuguese non-financial companies offered services related fully or partially to tourism, representing a contribution of 17.1% to the GDP in 2019, according to WTTC (2021). Since tourism was severely affected, this extremely large value might represent a problem for Portugal, due to its dependence on this sector. Therefore, to establish a fairer comparison, we decided to compare Portugal with nations that have a similar dependence on tourism. We chose some of the Southern Europe nations: Spain, Greece, and Italy. Using the same indicators, Spain had 11.2% of its non-financial companies offering services related fully or partially to tourism, representing a contribution of 14.1% to the GDP in 2019. As for Greece, it had 20.4% of its non-financial companies offering services fully or partially related to tourism, representing a contribution of 20.3% to the GDP in 2019. Finally, Italy had 10.5% of its non-financial companies offering services related fully or partially to tourism, representing a contribution of 13.1% to the GDP in 2019. Despite the values still differing a lot between these nations, they all have a strong influence of tourism on their economies, making them a good sample for our analysis.

Finally, we decided to analyse by NUTS 2 regions, in order to account for regional differences. For example, in Portugal, Algarve depends much more on tourism than other regions do. So, a better analysis is achieved when the econometric regression is performed by regions, instead of nationally. Furthermore, increasing the sample number by analysing regionally allowed us to have a much higher number of degrees of freedom, which improves the quality of our regressions.

2. Literature Review

The impact of a crisis is commonly measured through the unemployment rate, despite this indicator not considering all the factors behind changes in the labour market. Neubourg (1987) marks the importance of the labour slack by saying that "[it] takes into account non-utilised labour time due to unemployment, due to changes of the number of hours actually worked and due to changes in labour force participation". It acknowledges the labour slack as a better way to analyse the labour market than just by using unemployment rate.

As for pandemic developments, COVID-19 cases have varied across countries. In the nations analysed, Italy and Spain were the most affected ones, despite regional differences (for example, the North of Italy was heavily penalized by this pandemic). Portugal was also very affected in some periods, which required two full confinements in the country. Greece is, from these four countries, the one that performed better in terms of infections, being also one of the best nations in Europe facing the virus. So, it is vital to understand how COVID-19 cases and deaths might have affected the labour market, before conducting our work, since it seems to be the feeling across people that "more" COVID-19 is worse for the economy. There is already some existent literature regarding this topic. For example, in Su, Chi-Wei, et al. (2021) the authors found a strong positive significant correlation between COVID-19 cases and unemployment in some European nations over the pandemic period.

As for lockdowns, the scientific explanations go against the major economical literature on the topic. For example, in Correia et al. (2020) authors based themselves on evidence from the 1918 Flu to conclude that lockdowns do not harm the economy as people use to think. They recognize that pandemics are terrible for an economy, but not lockdowns. This data was obtained from American cities, but the effects are expected to be the same for other towns and nations.

Furthermore, economic sectors were asymmetrically affected during this pandemic, and so has unemployment rates amongst those sectors. Confinements affected people differently depending on their job, since they forced remote work to be implemented anywhere possible. So, for jobs allowing remote work, the impacts of the pandemic were much diminished, when comparing to jobs that are impossible to be performed that way. Again, here lies the explanation for our chosen countries, since these four nations depend a lot on tourism, an economic activity that cannot be performed remotely. Existing literature corroborates with this thesis, and states that jobs related to tourism or face-to-face services (like barbers) are some of the most affected ones, since they represent services that require an actual meeting to be done. As other topics before, this leads to tremendous regional asymmetries, making the same country harmed differently across itself. Again, this is why we decided to analyse not by countries but by NUTS 2, to account for the severe regional differences that some countries faced (especially these four countries, since they have regions almost fully focused on tourism). Taking Portugal as an example, in Carvalho et. al (2021), the authors have concluded that Algarve (country's most touristic region, and that depends a lot on international mobility, mainly from France, the United Kingdom, and the Netherlands) was the NUTS 2 region that suffered the most from the pandemic, stating that this is "a consequence of Algarve region being highly dependent on tourism and hospitality services, which suffered a severe downturn due to the restrictions imposed in the country".

As for social problems, findings have shown that the higher one's level of education, the better one's chances of getting a job and keeping the status of employed person in times of crisis on labour market. That is, better-educated people typically have lower unemployment as, regularly, unemployment rates decline with increasing levels of qualifications. Moreover, those with higher educational attainment have greater "ability to benefit from disequilibria" (Bowles et al., 2001), while the least qualified workers are the most vulnerable to unemployment during economic downturns (Gangl, 2001). Therefore, as there were regional differences across nations, that are also major differences in hopes and possibilities across individuals. Less educated people are expected to be more impacted by this pandemic. This effect might be exacerbated by the typology of the countries analysed. Tourism related activities employ a lot of unskilled labour, and people that are less educated. Therefore, their lack of hard skills might lead to them facing even more the impacts of this pandemic. Again, this helps to understand why this analysis becomes way more relevant by being done with these four nations.

3. Data

3.1 Description of Observation Units

To study the impact of the COVID-19 pandemic on the labour market in Portugal as well as in Greece, Spain, and Italy, this project applies cross-sectional data with regards to each of those Southern European countries. Data is collected at the level 2 of the Nomenclature of Territorial Units for Statistics (NUTS 2), in its updated version of 2021. Hence, the dataset the project relies on includes the following NUTS 2: 7 from Portugal, 13 from Greece, 19 Spanish, and 21 from Italy, which leads to a total of 60 observations.

The advantage of using NUTS 2 lies in the fact that a greater number of observations can be obtained in contrast to what would occur whether relying on country-level data instead. Therefore, this approach allows to increase the statistical power of the analysis carried out.

It is further advanced here that the correlation matrix of the variables explained afterwards and whose observations are at a NUTS 2-level can be found in the Appendix.

Table 1: Observations' description

CODES	***Greek NUTS II***	***CODES***	***Portuguese NUTS II***
EL30	Attiki	**PT11**	Norte
EL41	Voreio Aigaio	**PT15**	Algarve
EL42	Notio Aigaio	**PT16**	Centro (PT)
EL43	Kriti	**PT17**	Área Metropolitana de Lisboa
EL51	Anatoliki Makedonia, Thraki	**PT18**	Alentejo
EL52	Kentriki Makedonia	**PT20**	Região Autónoma dos Açores (PT)
EL53	Dytiki Makedonia	**PT30**	Região Autónoma da Madeira (PT)
EL54	Ipeiros	***CODES***	***Italian NUTS II***
EL61	Thessalia	**ITC1**	Piemonte
EL62	Ionia Nisia	**ITC2**	Valle d'Aosta
EL63	Dytiki Ellada	**ITC3**	Liguria
EL64	Sterea Ellada	**ITC4**	Lombardia
EL65	Peloponnisos	**ITH1**	Provincia Autonoma di Bolzano

CODES	**Spanish Nuts II**	**ITH2**	Provincia Autonoma di Trento
ES11	Galicia	**ITH3**	Veneto
ES12	Principado de Asturias	**ITH4**	Friuli-Venezia Giulia
ES13	Cantabria	**ITH5**	Emilia-Romagna
ES21	País Vasco	**ITI1**	Toscana
ES22	Comunidad Foral de Navarra	**ITI2**	Umbria
ES23	La Rioja	**ITI3**	Marche
ES24	Aragón	**ITI4**	Lazio
ES30	Comunidad de Madrid	**ITF1**	Abruzzo
ES41	Castilla y León	**ITF2**	Molise
ES42	Castilla-la Mancha	**ITF3**	Campania
ES43	Extremadura	**ITF4**	Puglia
ES51	Cataluña	**ITF5**	Basilicata
ES52	Comunitat Valenciana	**ITF6**	Calabria
ES53	Illes Balears	**ITG1**	Sicilia
ES61	Andalucía	**ITG2**	Sardegna
ES62	Región de Murcia		
ES63	Ciudad de Ceuta		
ES64	Ciudad de Melilla		
ES70	Canarias		

3.2 Dependent Variables

3.2.1 Variation in the Unemployment Rate

The influence of the COVID-19 pandemic in the labour market is measured namely through the evolution of the unemployment rate, which corresponds to the percentage of the labour force aged 15 to 74 who is not employed but has actively sought for a job in the previous four weeks also demonstrating availability to start working in the immediate or conceivably within a period of two weeks.

In this context, both the total unemployment rate of 2019 and 2020 are retrieved from the database of the Eurostat regions. Afterwards, its percentage variation is computed and considered the first dependent variable in the analysis, within the scope of which the acceleration of changes in the unemployment rate are analysed in percentage points.

Table 2: Description of the first dependent variable

Variable	*Description*	*Source*
ΔUnempRate	Percentage variation of the unemployment rate (population aged 15-74) between 2019 and 2020.	Eurostat

Considering the descriptive statistics in table 3, NUTS 2 from Greece, Spain, and Portugal had a positive variation in the unemployment rate, contrarily to the negative evolution regarding the Italian case. Furthermore, the highest positive variation was registered in Greece (47.86%) whereas Portugal obtained the greatest decline (-22.78%) in the unemployment rate in 2020. It is important to refer that unemployed people seeking for a job were no longer able to go to job centers during the pandemic. Therefore, many of these unemployed were no longer counted in the unemployment statistics in 2020.

Table 3: Descriptive statistics of the change in the unemployment rate (2019-2020)

Variable	*Country*	*Obs*	*Mean*	*Min*	*Max*	*Stand Dev*
ΔUnempRate	Greece	13	4.00	-19.92	47.86	19.70
	Spain	19	9.34	-12.22	36.44	11.01
	Italy	21	-6.40	-22.13	31.03	11.05
	Portugal	7	2.72	-22.78	18.31	15.62

3.2.2 Variation in the Labour Market Slack

Beyond the percentage of the unemployed labour force, a new dependent variable capturing a larger panorama of the labour reality is additionally considered, allowing comparisons to be made between both.

In fact, the labour market slack covers a broader number of categories as it also includes the population who is seeking for work despite not being immediately available and those who are available to be employed but are not looking for a job. In addition, it considers underemployed part-time workers, who did not reach a full-time contract. Within this scope, the extended labour force is used in detriment of the labour force itself since the first one additionally comprises those who are available to be employed but are not seeking as well as those seeking for a job but not available and the involuntary part-time (Eurostat, 2021).

Following a similar reasoning as before, both the labour market slack in percentage of the labour extended force in 2019 and 2020 are retrieved from the Eurostat regions database and its variation is subsequently computed, hence originating the second dependent variable. The acceleration of changes in the variation of the labour market slack in proportion of the extended labour force will be analysed afterwards in percentage points.

Table 4: Description of the second dependent variable

Variable	*Description*	*Source*
ΔLabourSlack	Percentage variation of the labour market slack (population 15-74) in proportion of the extended labour force between 2019 and 2020.	Eurostat

The variation of the labour market slack in percentage of the extended labour force was positive between 2019 and 2020 for all four Southern European countries. Greece registered the highest decline (-14.00%) whilst the greatest increase occurred in Italy (45.76%) as it is observable through the following table. The negative variation should be related with the number of people who asked for retirement in 2020. In fact, people who were unemployed, not seeking work (disheartened), looking but not available to work or involuntarily on a part-time basis, would have chosen to apply for age retirement. Alternatively, they would have reached retirement age and did not continue to work as the denominator includes people aged up to 74 and age of retirement is lower than 70.

Table 5: Descriptive statistics of the change in the labour market slack rate (2019-2020)

Variable	*Country*	*Obs*	*Mean*	*Min*	*Max*	*Stand Dev*
ΔLabourSlack	Greece	13	7.08	-14.00	40.30	17.41
	Spain	19	9.54	-8.82	38.86	10.15
	Italy	21	8.00	-4.67	45.76	10.99
	Portugal	7	9.45	-4.69	23.08	10.11

3.2 Independent Variables

3.2.1 COVID-19 related variables

Since this project aims to study the determinants behind the evolution of both the total unemployment rate and the labour market slack in 2020, the first set of independent variables is related with the pandemic itself. We decide to include COVID-19 cases as a variable for our model, for us to fully understand the direct impact of the pandemic on the labour market and on its performance. According to Su, Chi-Wei, et al. (2021), the impact of COVID-19 cases is stronger than the number of deaths, with this contributing almost nothing to changes in the labour market. Therefore, we neglected *COVID-19 Deaths* as a possible variable. Furthermore, for our analysis to be comprehensive and accurate, we found important to account for the impact of the COVID-19 cases, since this virus was what changed our reality drastically in the first place. The choice of the *Lockdown* variable, on the other hand, is justified by the relevance of the daily life restrictions for the labour market. As it is commonly known, closing the entire country was a policy applied by several countries worldwide. Since lockdowns were something that derived directly from the pandemic, we believed they would be important to consider in our analysis. Besides, we wanted to confirm if the conclusions presented in Correia et al. (2020) also applied for Southern European nations.

Table 6: COVID-19 variables' description

Variable	***Description***	***Source***
CasesCOVID	Number of cases of COVID-19 per 100 000 inhabitants in 2020.	EDPC
Lockdown	Number of days in lockdown during 2020.	RMD

Data on the population infected with COVID-19 per 100 000 inhabitants was retrieved from the European Centre for Disease Prevention and Control (EDPC) Epidemic Intelligence, whose subnational weekly database provide the number of cases in each NUTS 2 pertaining to countries from the European Union and the European Economic Area for every week since the beginning of the pandemic. The database was restricted to 2020 and to the regions of the countries in analysis. Afterwards, all new weekly cases were summed for each NUTS 2, originating the number of COVID-19 cases per 100 000 inhabitants in 2020 at the NUTS 2-level. As illustrated in the table 7, the highest mean of COVID-19 infection cases was registered in Spain whereas the lowest number occurred in Greece. Italy was the country whose regions registered both the sharpest minimum and maximum levels of cases in 2020, whilst the lowest extremes emerged in Greek NUTS 2 regions.

On the other hand, the number of days in lockdown was retrieved from the Response Measures Database (RMD) of the European Centre for Disease Prevention and Control (EDPC) and the Joint Research Center (JRC) of the European Commission. The database has measures which have been taken in response to the COVID-19 pandemic at the national level also including regional information. From the whole set, only the stay-at-home orders, correspondent to the days in lockdown, were considered.

Demystifying the values presented in table 7, Greece had a national stay-at-home order between March 23^{rd} and May 4^{th} while the second nationwide lockdown occurred from November 7^{th} to November 30^{th}, which was preceded by a regional lockdown order in the NUTS 2 of Kentriki Macedonia from November 3^{rd} to November 6^{th}. In Spain, a nationwide lockdown emerged from March 14^{th} to May 3^{rd}; the country entered then in the phase 0 of deconfinement excepting the NUTS 2 of Comunidad Madrid and Catalunya which continued in lockdown until May 24^{th}. In the case of Italy, a regional order in the NUTS 2 of Piedmont, Lombardia, Emilia-Romagna, Marche, and Veneto led to a confinement starting on March 8^{th} followed by a nationwide lockdown starting from March 10^{th} until May 4^{th}; afterwards, the regions of Lombardia, Piedmont, Calabria, and Vale d'Aosta entered from November 6^{th} in the red zone defined by the Italian Ministry of Health, to which the regions of Campania, Tuscany, and Bolzano joined from November 15^{th}, thus implying a new lockdown that was extended until December 3^{rd}. Finally, Portugal had only one continuum period of confinement in 2020 evolving the whole country from March 19^{th} to May 2^{nd}.

Table 7: Descriptive statistics of COVID-19 related variables

Variable	***Country***	***Obs***	***Mean***	***Min***	***Max***	***Stand Dev***
	Greece	13	2061.85	765.36	5132.47	1512.1
CasesCOVID	Spain	19	14796.01	4857.01	21207.96	4405.7

	Italy	21	13591.57	6844.75	26793.32	4511.5
	Portugal	7	12047.05	4170.58	18506.77	5171.0
Lockdown	Greece	13	67.31	67	71	1.11
	Spain	19	60.37	59	72	4.10
	Italy	21	64.52	56	86	12.12
	Portugal	7	45	45	45	0

3.2.2 Labour market variables

The impact of COVID-19 on labour market might have been related to some of its characteristics in each region. The nature of the contracts, the predominance of in-person services, the employees' education and the in and out flows in the labour force might have also been factors affecting the job destruction. The length of the lockdown or the strength of COVID infection may have not influenced the labour market directly, as the capability of maintaining jobs may be related to the characteristics of the employers and regional economy.

All the variables mentioned in this section were computed from regional data obtained in Eurostat.

Table 8: Labour market variables' description

Variable	***Description***	***Source***
YoungEmp	Percentage of the employed population aged 15-24 on the total employment in 2019.	Eurostat
NACE_GHI	Percentage of employment associated to wholesale and retail trade, transport, accommodation, and food service activities in 2019.	Eurostat
Educ	Percentage of employed population with tertiary education (ISCED levels 5-8) in 2019.	Eurostat
ΔActivRate	Variation of the economically active population rate between 2019 and 2020.	Eurostat

Firstly, as mentioned in the literature review, one of the factors that has affected mostly the employment in this crisis was the nature of contracts. A temporary contract has been less resistant to the shock rather than a permanent one. This is easily understandable, as the costs to firms related to fire a temporary employee are lower than the ones associated to a permanent one. Due to the unavailability of regional data about the nature of contracts, we used as a proxy the percentage of young employees, as a large majority of employed population aged 15-24 have a temporary contract. In 2019, 62.2%, 30.7%, 69.5% and 63.3% of Portuguese, Greek, Spanish, and Italian young employees had a temporary contract. Thus, the percentage of the employed population aged 15-24 on the total employment may be a good proxy of the share of temporary contracts – a younger employed population is more likely composed by temporary workers. Therefore, we expect this variable to have a positive coefficient, as a younger employed population may lead to an increase in unemployment.

Furthermore, as this was a sectorial crisis, the predominance of employment associated to in-person economic activities is expected to propel unemployment. We considered the economic activities that belong to NACE G-I, which is the statistical classification of economic activities in the European Community for wholesale and retail trade, transport, accommodation, and food service. In the four countries analysed, these activities related to tourism were highly affected by the pandemic, but regional differences may be observed according with the share of employment allocated to them. Thus, we used as a variable the percentage of employment associated to wholesale and retail trade, transport, accommodation, and food service activities in 2019. We expect this variable to have a positive coefficient, since an economy more dependent on these in-person activities is more likely exposed to job destruction.

The education of an employee may also affect his/her propensity to be fired, as the jobs requiring a higher education were the ones whose adaptation to remote work was easier. Thus, we computed the percentage of employed population with tertiary education (ISCED levels 5-8) in 2019 and use it as an independent variable. Following the literature, the effect on the change in unemployment or in labour market slack is predicated to be negative, as a more educated population is less likely exposed to unemployment.

Finally, both our dependent variables include the labour force in the denominator. Thus, a reduction in the labour force may lead to an increase in the unemployment and labour market slack rates. Therefore, we will use as variable the variation of the economically active population rate between 2019 and 2020, expecting a negative coefficient with both dependent variables. However, when analysing the change in the unemployment rate, this variable will explain the labour force outflows due to retirement or to stop seeking to work, although available, for example. When analysing the change in the labour market slack rate, the first outflow example is considered, but not the second one, as this indicator is expressed as percentage of the extended labour force, including the total number of people employed plus unemployed, plus those seeking work but not immediately available plus those available to work but not seeking.

Table 9: Labour market variables' descriptive statistics

Variable	*Country*	*Obs*	*Mean*	*Min*	*Max*	*Stand Dev*
NACE_GHI	Greece	13	33.65	22.41	54.75	8.71
	Spain	19	28.65	22.41	44.89	5.30
	Italy	21	26.07	22.72	30.21	2.48
	Portugal	7	28.48	22.73	40.59	6.00
YoungEmp	Greece	13	3.98	2.32	5.63	1.05
	Spain	19	4.96	3.16	6.71	0.92
	Italy	21	4.65	3.03	8.74	1.23
	Portugal	7	6.19	5.37	6.88	0.57
Educ	Greece	13	31.08	23.98	46.60	6.38
	Spain	19	42.12	29.68	57.13	7.35
	Italy	21	22.65	17.14	30.30	2.58
	Portugal	7	24.65	16.42	37.40	6.45
ΔActivRate	Greece	13	-2.37	-7.90	0.99	2.37
	Spain	19	-1.98	-4.53	4.42	1.88
	Italy	21	-2.80	-5.83	0.17	1.38
	Portugal	7	-2.48	-3.75	-0.46	1.15

3.3.3 National dummy variables

After considering the regional differences, it might be interesting to test for national effects. Thus, we rely on three dummy variables for Greece, Spain, and Italy, having Portugal as the base group. The national effect may reflect the strictness of employment protection caused by national labour laws and the central government measures in response to COVID-19 crisis to protect employment.

Regarding the strictness of employment protection, the OECD index emerges as a synthetic indicator of the firmness of regulation on dismissals, according to which a higher value of the index indicates a stronger employment protection. With regards to the countries of interest for this study, slightly different values are observed for the index in 2019: 2.45, 2.56, 2.05 and 3.14 in Greece, Italy, Spain, and Portugal, respectively.

The major policy differences across the four tourism dependent countries in analysis allow to understand the relevance of the national paradigm, highlighting the relevance of dummy variables for each nation. Moreover, to analyse their differences more rigorously, we rely on the Economic Support Index, from the University of Oxford. We computed an average of the daily values since the beginning of the pandemic until the end of 2020 and compared each country's response. This index is based on two indicators: Income support for households and Debt/Contract Relief. The indicators varied from 0 to 2:

Table 10: Indicators of the Economic Support Index

Value of the Indicator	**Income Support**	**Debt/Contract Relief**
0	No income support	No debt/contract relief
1	Government is replacing less than 50% of lost salary (or if a flat sum, it is less than 50% median salary)	Narrow relief, specific to one kind of contract
2	Government is replacing 50% or more of lost salary (or if a flat sum, it is greater than 50% median salary)	Broad debt/contract relief

The indicator Income Support records whether the government was providing direct cash payments to people who lose their jobs or cannot work. Spain obtained the highest average value of this indicator, with 1.92, followed by Greece, Portugal, and Italy, with 1.67, 0.99 and 0.92, respectively.

According to IMF (2021), the measures taken by national governments to protect employment and support income due to the COVID-19 crisis varied across nations. In Spain, the government facilitated the ERTE (temporary employment adjustment procedures) that consisted of contract suspensions or reductions in working hours and access to the unemployment benefits which did not detract from their right in the future. Greece made temporary transfers to individuals in vulnerable situations, particularly short-term employees. On the other hand, Portugal adopted a simplified temporary layoff scheme support for the maintenance of employment contracts for companies in crisis equal to two thirds of the wage (70% paid by social security, 30% by the employer) also attributing state-guaranteed credit lines for small and medium enterprises (SMEs) pertained to affected sectors. Lastly, the Italian government relied on measures to support income of self-employed and laid-off workers, additionally promoting credit supply within the scope of the "Cura Italia" emergency package and those that emerged afterwards.

The indicator Debt/Contract Relief recorded whether the government was freezing financial obligations for households (e.g., stopping loan repayments, preventing services like water from stopping, or banning evictions). Portugal obtained 1.96, the biggest average value, followed by Spain, Italy, and Greece, with 1.90, 1.60 and 1.43, respectively.

The Portuguese government allowed the exemption of payment of employer's social security contributions up to three months (provided by the simplified temporary lay-off scheme) and allowed tax deferrals. In Spain, firms with less than 50 workers did not have to pay the social contributions, and those above 50 must pay 25% of them. In addition, the Spanish government extended the deadlines to fill tax returns for self-employed and SMEs, deferring tax payment with the first three to four months free from interest. Italy postponed utility bills payments and prompted tax deferrals in the most disturbed municipalities also extending the SMEs' moratorium. In Greece, social security contributions for workers and employers were suspended for four months in enterprises that were ordered to close by state decree. Tax payments were also deferred, and rents reduced (IMF, 2021).

Finally, the Economic Support Index allocate these values from the previous two indicators into a formula to obtain a value ranging from 0 to 100, where the higher the index value the highest the economic support from the government. It also considers whether the support was only provided for formal or informal sector workers, or on the other hand for all workers. The daily average from this index was, from the highest to the lowest, 83.56, 73.74, 62.74 and 39.63, for Spain, Portugal, Italy, and Greece, respectively.

Despite the OECD index indicating that employment is prone to be less affected in Portugal comparatively to the remaining tourism dependent nations, the previous policy measures in response to the COVID-19 pandemic are expected to have a higher influence. Hence, Spain is the country that protected the most the employment, followed by Portugal. Italy and Greece provided a weaker economic support to protect employment than Portugal. Therefore, the dummy variable Spain may lead to a negative signal of its coefficient, but Greece and Italy are predicted to have a positive magnitude.

4. Methodology

4.1 Impact on the variation of the Unemployment Rate

Since the aim of this project is, on the one hand, to examine the effects that COVID-19 pandemic had on the variation of the unemployment rate between 2019 and 2020 in the Southern Europe, we will test several specifications grouped in four estimation categories. In this way, we will be allowed to perform a complete analysis and study how each group of added variables interfere in the model.

Considering the presence of heteroskedasticity demonstrated through the Breusch-Pagan tests (see Appendix), each specification will follow both the methods of Ordinary Least Squares (OLS) with robust standard errors and Feasible Generalized Least Squares (FGLS). The first one allows to get unbiased standard errors under the presence of heteroskedasticity, but such approach is more indicated for a larger number of observations while the generalized estimating methods produce more efficient estimators for smaller samples as we have. Since the function of heteroskedasticity is not known, the Weighted Least Squares (WLS) method is ruled out in detriment of the FGLS to correct for the heteroskedasticity issue (Hayes & Cai, 2007). Therefore, and despite the models being estimated by both referred methods, the interpretations in the results section will be conducted based mainly on the FGLS.

Firstly, we will start by estimating the impact of COVID-19 cases and days in lockdown using simple models just regressing the unemployment rate variation on the number of cases and on the lockdown:

$$\Delta UnempRate_{nc} = \alpha + \beta_1 CasesCOVID_{nc} + \varepsilon_{nc} \quad (1.1)$$

$$\Delta UnempRate_{nc} = \alpha + \beta_1 Lockdown_{nc} + \varepsilon_{nc} \quad (1.2)$$

Each model will allow to independently assess the impact of both variables and examine its contribution for the determination capacity of the models, where all reported values are reported from each NUTS n located in the Southern European country c. Additionally, both COVID-19 related variables are regressed in the same baseline model, to which variables will be thereafter added:

$$\Delta UnempRate_{nc} = \alpha + \beta_1 CasesCOVID_{nc} + \beta_2 Lockdown_{nc} + \varepsilon_{nc} \quad (1.3)$$

Afterwards, national dummies are included in the three previous models in order to study the influence that belonging to each country has on the evolution of the proportion of unemployed people on the labour force:

$$\Delta UnempRate_{nc} = \alpha + \beta_1 CasesCOVID_{nc} + \gamma Country + \varepsilon_{nc} \quad (2.1)$$

$$\Delta UnempRate_{nc} = \alpha + \beta_1 Lockdown_{nc} + \gamma Country + \varepsilon_{nc} \quad (2.2)$$

$$\Delta UnempRate_{nc} = \alpha + \beta_1 CasesCOVID_{nc} + \beta_2 Lockdown_{nc} + \gamma Country + \varepsilon_{nc} \quad (2.3)$$

Here, *Country* is a vector of dummies such as *Country* = {Greece, Spain, Italy}. Greece takes the value 1 if the specific NUTS II belong to the Greek territory, whilst the similar occurs to Spain and to Italy. Otherwise, it assumes the value 0 in the case the region pertains to Portugal.

The labour market related variables will be added to the baseline model, allowing to get not only a broader but also a more concrete analysis on the factors impacting the unemployment rate evolution:

$$\Delta UnempRate_{nc} = \alpha + \beta_1 CasesCOVID_{nc} + \beta_2 Lockdown_{nc} \quad (3)$$

$$+\beta_3 NACE\_GHI_{nc} + \beta_4 YoungEmp_{nc} + \beta_5 Educ_{nc} + \beta_6 \Delta ActivRate_{nc} + \varepsilon_{nc}$$

This model allows to characterize those workers directly affected by the pandemic in 2020 according to the influence of either pertaining to a sector associated with tourism and retail trade as well as having a temporary contract and the average pattern of the ones with tertiary education. Beyond these factors, the influence of the change in the activity rate will be also examined.

The last model studying the unemployment rate variation will encompass the national dummies in the context of the previous model to assess the influence of belong to a specific country from the four under analysis:

$$\Delta UnempRate_{nc} = \alpha + \beta_1 CasesCOVID_{nc} + \beta_2 Lockdown_{nc} \quad (4)$$

$$+\beta_3 NACEGHI_{nc} + \beta_4 YoungEmp_{nc} + \beta_5 Educ_{nc} + \beta_6 \Delta ActivRate_{nc} + \gamma Country + \varepsilon_{nc}$$

Hence, this is the more complete model as it includes all the independent variables: both the COVID-19 and the labour market variables together with the national dummies.

4.2 Impact on the variation of the Labour Market Slack

On the other hand, the factors behind the variation in the labour market slack in the context of the pandemic will be also examined to further compare each variables' influence with regards to the unemployment rate path in Greece, Spain, Italy, and Portugal. The previous approach will be applied here as well since the specifications are categorized in four groups and the different models will be regressed according to the OLS robust standard errors and FGLS methods, with this one having a more prominent role in the subsequent analysis.

Once again, we will estimate two simple models with either the impact of COVID-19 cases and the number of days in lockdown but also a baseline one including the two COVID-19 related variables:

$$\Delta LabourSlack_{nc} = \alpha + \beta_1 CasesCOVID_{nc} + \varepsilon_{nc} \quad (1.1)$$

$$\Delta LabourSlack_{nc} = \alpha + \beta_1 Lockdown_{nc} + \varepsilon_{nc} \quad (1.2)$$

$$\Delta LabourSlack_{nc} = \alpha + \beta_1 CasesCOVID_{nc} + \beta_2 Lockdown_{nc} + \varepsilon_{nc} \quad (1.3)$$

The variation of the proportion of the labour market slack on the extended labour force will be additionally encompass the national dummies representing Greece, Spain, and Italy since the absence of these three countries indicates that the region belongs to Portugal. The following models illustrate this reasoning:

$$\Delta LabourSlack_{nc} = \alpha + \beta_1 CasesCOVID_{nc} + \gamma Country + \varepsilon_{nc} \quad (2.1)$$

$$\Delta LabourSlack_{nc} = \alpha + \beta_1 Lockdown_{nc} + \gamma Country + \varepsilon_{nc} \quad (2.2)$$

$$\Delta LabourSlack_{nc} = \alpha + \beta_1 CasesCOVID_{nc} + \beta_2 Lockdown_{nc} + \gamma Country + \varepsilon_{nc} \quad (2.3)$$

Beyond the COVID-19 related variables, the following specification includes both the proportion of people in the tourism and similar activities' sector and the weight of young employees in the total employment, but also the percentage of people with tertiary education and the activity rate variation between 2019 and 2020:

$$\Delta LabourSlack_{nc} = \alpha + \beta_1 CasesCOVID_{nc} + \beta_2 Lockdown_{nc} \quad (3)$$

$$+\beta_3 NACE\_GHI_{nc} + \beta_4 YoungEmp_{nc} + \beta_5 Educ_{nc} + \beta_6 \Delta ActivRate_{nc} + \varepsilon_{nc}$$

Lastly, the evolution of the labour market slack will be examined by all COVID-19, labour market, and national dummy variables, through the following model:

$$\Delta LabourSlack_{nc} = \alpha + \beta_1 CasesCOVID_{nc} + \beta_2 Lockdown_{nc} \quad (4)$$

$$+\beta_3 NACEGHI_{nc} + \beta_4 YoungEmp_{nc} + \beta_5 Educ_{nc} + \beta_6 \Delta ActivRate_{nc} + \gamma Country + \varepsilon_{nc}$$

The results from all these specifications will be exposed in the subsequent section, after which the patterns arising from the estimation with regards to the unemployment and the labour slack scopes will be subject to discussion.

5. Results

5.1 Analysis of the impact on the Unemployment Rate

5.1.1 Influence of COVID-19 variables

The evolution of the unemployment rate from 2019 to 2020 will start to be analysed through the impact deduced by the number of people reported with the virus as well as the days people were forced to stay at home due to lockdown orders.

Table 11: Variation of the Unemployment Rate regressed on the COVID-19 variables

	(1.1)		(1.2)		(1.3)	
	OLS Robust s.e.	FGLS-log(BP)	OLS Robust s.e.	FGLS-log(BP)	OLS Robust s.e.	FGLS-log(BP)
CasesCOVID	0.0002	0.001***			0.0002	0.001**
	(0.0004)	(0.0003)			(-)	(0.0003)
Lockdown			0.028	0.089	0.037	0.105
			(0.183)	(0.211)	(0.183)	(0.179)
Constant	-0.210	-9.766**	0.208	-3.490	-2.550	-14.483
	(5.272)	(4.867)	(11.293)	(12.560)	(11.293)	(11.128)
Observations	60	60	60	60	60	60
R-squared	0.006	0.190	0.0003	0.017	0.007	0.160
Adjusted R-squared	-0.011	0.163	-0.017	-0.017	-0.028	0.116
Residual Std. Error (df = 54)	15.098	1.933	15.143	2.035	15.225	1.976

Notes: *p<0.1; **p<0.05; ***p<0.01 / In parenthesis - Standard Errors

Considering the model 1.1, and notwithstanding the coefficient near zero, the influence of COVID-19 cases is observed to be positive as expected and significant at a 1% significance level predicting that 100 additional people infected with the virus per 100 000 inhabitants originated a rise of 0.1 percentage points (henceforth pp) in the 2020 unemployment rate, ceteris paribus. In addition, the constant is significant at a 5% level, suggesting that the unemployment declines on average 9.8% in the absence of people reported with the virus, ceteris paribus. On the other hand, the impact of the lockdown, that is estimated through the model 1.2, reveals a positive contribution for the unemployment rate variation although without any significance.

In the context of the model 1.3, both the effects of COVID-19 cases and number of days in lockdown are estimated. The number of cases remains significant despite the decline to a 5% significance level whereas the lockdown's coefficient slightly increases but is not significant once again. It is important to note that the number of days in lockdown does not remove the significance associated with the COVID-19 reported cases, which can be due to the less variation in the lockdown data. Within the scope of the model's determination, the adjusted R-squared decreases, therefore suggesting that the predictor does not improve the model as it could be expected.

5.1.2 Influence of COVID-19 and national dummy variables

The analysis of the impact of COVID variables on the unemployment rate variation now considers each of the four countries in order to account for the specific national effect of each previous model in Greece, Spain, and Italy comparing to Portugal.

Table 12: Variation of the Unemployment Rate regressed on the COVID-19 variables and on the National dummies

	(2.1)		(2.2)		(2.3)	
	OLS Robust s.e.	FGLS-log(BP)	OLS Robust s.e.	FGLS-log(BP)	OLS Robust s.e.	FGLS-log(BP)
CasesCOVID	0.001	0.001***			0.001	0.001**
	(0.001)	(0.0003)			(-)	(0.0004)
Lockdown			0.241	0.246	0.168	0.436
			(0.170)	(0.173)	(0.183)	(0.273)
Greece	7.630	12.730	-4.098	-4.211	3.129	0.457
	(10.169)	(9.195)	(8.847)	(10.242)	(-)	(12.782)
Spain	4.874	3.298	2.923	2.855	2.494	-4.715
	(6.011)	(6.598)	(6.864)	(6.857)	(-)	(7.712)
Italy	-10.100*	-10.770*	-13.819**	-13.919*	-13.269	-15.233*
	(5.547)	(6.241)	(6.563)	(7.091)	(-)	(7.759)
Constant	-4.947	-11.225	-8.116	-8.334	-11.615	-29.249**
	(9.674)	(7.191)	(9.548)	(9.741)	(11.293)	(12.868)
Observations	60	60	60	60	60	60
R-squared	0.221	0.394	0.207	0.321	0.228	0.358
Adjusted R-squared	0.165	0.339	0.149	0.259	0.156	0.286
Residual Std. Error (df = 54)	13.726	1.849	13.853	2.149	13.794	1.807

Notes: *p<0.1; **p<0.05; ***p<0.01 / In parenthesis - Standard Errors

Considering the general pattern, the COVID-19 variables' estimation remain similar since only the coefficient of the number of cases is significant both in models 2.1 and 2.3.

In the model 2.1, within the scope of which the country dummies are added to the COVID-19 cases estimation, the unemployment rate is expected to have increased the most in Greece but also in Spain comparing with Portugal, despite both coefficients not being significant. In contrast, the Italian coefficient is negative and significant at a 10% significance level, meaning that a region pertained to Italy registered a decline in the 2020 unemployment rate by 10.8% having Portugal's values as comparison. These are not the expected results but adding the labour market variables may solve the problem.

While the number of days in lockdown is included in the national dummy in the model 2.1, the inverse occurs in the model 2.2 since the reported COVID-19 cases are comprised in the dummies. This can be particularly behind the new Greek coefficient's magnitude in the model 2.2, which suggests a negative correlation between Greece's regions and the number of cases (see correlation matrix in Appendix). On average, a region pertained to Spain remains associated with a higher increase in the unemployment rate comparatively to Portugal whereas Italian regions verified, on average, a 10% significant level decrease by 13.9%.

In the context of the model with both COVID and country dummies variables, the Spanish coefficient becomes negative, implying a smaller variation in the 2020 unemployment rate comparatively with Portugal whilst the positive magnitude signal of the model 2.1 prevails in the Greek case. With regards to Italy, its coefficient is negative and significant at a 10% level, thus inducing that the unemployment rate has registered a variation of -15.2% during the first year of the COVID-19 pandemic. Lastly, the absence of both cases and lockdown would have originated a decline by 29.2% in the Portuguese unemployment rate, as revealed by the coefficient of the constant in the model 2.3.

5.1.3 Influence of COVID-19, Labour Market, and national dummy variables

In the following results table, the labour market related variables are added creating the model 3 together with COVID-19 variables. Afterwards, national dummies' inclusion allows to constitute the model 4, that is the most complete one as it covers all the data subject to analysis.

Table 13: Variation of the Unemployment Rate regressed on the COVID-19 and the Labour Market variables and on the National dummies

	(3)		**(4)**	
	OLS Robust s.e.	FGLS-log(BP)	OLS Robust s.e.	FGLS-log(BP)
CasesCOVID	0.0003	0.0003	0.001	0.001
	(-)	(0.0004)	(-)	(0.0005)
Lockdown	0.076	0.093	-0.003	-0.091
	(0.183)	(0.140)	(0.183)	(0.216)
NACE_GHI	1.272	0.776*	1.209	0.928*
	(-)	(0.460)	(-)	(0.463)
YoungEmp	4.227	5.512***	3.541	5.521***
	(-)	(1.477)	(-)	(1.582)
Educ	0.466	0.604***	0.204	0.538**
	(-)	(0.122)	(-)	(0.226)
ΔActivRate	0.600	-1.555**	0.093	-1.876**
	(-)	(0.688)	(-)	(0.769)
Greece			9.870	16.936*
			(-)	(9.788)
Spain			4.921	3.920
			(-)	(6.980)
Italy			-1.525	4.673
			(-)	(6.522)
Constant	-76.294***	-78.222***	-68.309***	-84.586***
	(11.293)	(15.915)	(11.293)	(17.681)
Observations	60	60	60	60
R-squared	0.484	0.530	0.507	0.603
Adjusted R-squared	0.426	0.467	0.418	0.524

Residual Std. Error (df = 54)	11.379	1.412	11.455	1.393

Notes: *p<0.1; **p<0.05; ***p<0.01 / In parenthesis - Standard Errors

In model 3, the number of COVID-19 cases maintains its positive magnitude although losing significance that is captured by the new added variables whereas the days in lockdown remain a positive but insignificant influence on the unemployment rate variation. However, the lockdown's coefficient change in model 4, exerting a negative impact on the proportion of unemployed people in the labour force.

Within the scope of the new variables related to the labour market, a 1pp increase in the pre-pandemic percentage of employment associated to wholesale and retail trade, transport, accommodation, and food service activities was related to an unemployment rate increase by 0.8pp in model 3 and to a larger increase of 0.9pp in model 4. Both coefficients are significant at a 10% significance level, and its positive impact allows to confirm the expectations retrieved from previous literature that these workers are more exposed to a situation of losing their jobs.

The coefficient of the proportion of young employment exhibits a positive and highly significant influence at a 1% level. In fact, an increase by 1pp in this proportion is expected to have originated a rise of 5.5 and 5.5pp in the 2020 unemployment rate, according respectively to models 3 and 4. These results highlight the greater fragility of workers with temporary contracts in the Southern European countries' labour market, hence demonstrating the literature's effectiveness.

On the other hand, an interesting pattern emerges in the case of the proportion of employees with tertiary education since an increase of a 1pp is expected to have promoted a rise in the 2020 unemployment rate by, respectively, 0.6 and 0.5pp, in models 3 and 4. In addition, this influence is even significant at a 1% level in model 3 and 5% significance level in model 4. The correlation with the dependent variable can be a plausible explanation to consider. In fact, Spain is the country with higher variation of unemployment rate between 2019 and 2020 also having the greatest percentage of tertiary educated people, whose correlation could be in the origin of the *Educ*'s positive coefficient. In contrast, Italy verified, on average, a decline regarding the unemployment rate. Its correlation with the lower Italian education can also contribute for the positive coefficient. Since Spain and Italy have, jointly, 40 NUTS 2, the positive signal of *Educ*'s coefficient is therefore propitiated to emerge.

Still regarding the *Educ*'s coefficient, it can eventually imply that the variable is capturing the effect of an omitted variable. We hypothesize two possible variables to be missing in our model. The first one may be the proportion of young employees in the age group from 25 to 35 years old, as they are a group of employees high qualified. However, these workers are not included in our variable *YoungEmp*, but a big share of their contracts are also temporary. Therefore, not controlling for this relatively young age group may be creating a bias on the variable *Educ*. The other possible omitted variable is the share of female workers, that is prevalent among the four countries in analysis (OECD, 2019). If women are more affected by the pandemic, the expected positive coefficient of this omitted variable is probably captured by the education.

The activity rate variation between 2019 and 2020 negatively impacted the unemployment rate variation, thus meeting initial expectations on this matter. In fact, a 1pp increase is observed to have lowered the unemployment rate, ceteris paribus, by 1.6pp in model 3 and 1.876 in model 4, both at a 5% significance level.

Regarding the national dummies in model 4, regions from Greece as well as Spain and Italy verified a higher variation in the unemployment rate in 2020 in comparison with Portugal. However, this impact just assumes significance at a 10% level in the Greek case. On average, a region pertained to Greece is expected to have had a greater variation in the unemployment rate by 16.9pp, ceteris paribus, which can be due to the comparatively higher employment protection carried out in Portugal.

Overall, it is important to highlight that all labour market variables introduced in this context were observed to be significant while the adjusted R-squared highly increases both in models 3 and 4, meaning that the predictor improved the model.

5.2 Analysis of the impact on the Labour Market Slack

5.2.1 Influence of COVID-19 variables

Using the labour market slack as the dependent variable instead of the unemployment rate leads to different and interesting results.

Table 14: Variation of the Labour Market Slack regressed on the COVID-19 variables

	(1.1)		**(1.2)**		**(1.3)**	
	OLS Robust s.e.	FGLS-log(BP)	OLS Robust s.e.	FGLS-log(BP)	OLS Robust s.e.	FGLS-log(BP)
CasesCOVID	0.0003	0.001***			0.0003	0.001**
	(-)	(0.0003)			(-)	(0.0003)
Lockdown			0.114	0.072	0.131	0.265*
			(0.183)	(0.163)	(0.183)	(0.149)
Constant	4.863	-4.216	1.452	3.944	-3.360	-16.280*
	(11.293)	(4.263)	(11.293)	(9.718)	(11.293)	(9.255)
Observations	60	60	60	60	60	60
R-squared	0.028	0.526	0.009	0.344	0.040	0.506
Adjusted R-squared	0.012	0.509	-0.008	0.321	0.006	0.480
Residual Std. Error (df = 54)	11.988	1.729	12.108	1.574	12.021	1.643

Notes: *p<0.1; **p<0.05; ***p<0.01 / In parenthesis - Standard Errors

When analysing both COVID variables alone, in models 1.1 and 1.2, only the cases of COVID variable is significant, with an expected positive coefficient – an increase of 100 cases of COVID-19 per 100 000 residents is predicted to lead to an average increase of 0.1pp in the growth of unemployment, ceteris paribus.

However, when regressing the labour market slack on the COVID variables, in model 1.3, both regressors are significant with positive coefficients. As we include in the labour market slack persons seeking work but not immediately available and persons available to work but not seeking, the number of days in lockdown is also significant – a region in lockdown does not allow people without work to get and even to look for a new job. Thus, the longer the lockdown, the harder the possibility to look for a job due to containment measures – an additional week of lockdown is expected to increase the growth of labour market slack by 1.9pp, on average, ceteris paribus. Moreover, the constant was also significant in this model, concluding that if there were no COVID cases and no days of lockdown the labour market slack had decreased by 16.3%, on average, ceteris paribus.

5.2.2 Influence of COVID-19 and national dummy variables

We will now control the previous models for possible national effects.

Table 15: Variation of the Labour Market Slack Rate regressed on the COVID-19 variables and on the Country dummies

	(2.1)		(2.2)		(2.3)	
	OLS Robust s.e.	FGLS-log(BP)	OLS Robust s.e.	FGLS-log(BP)	OLS Robust s.e.	FGLS-log(BP)
CasesCOVID	0.001	0.001***			0.0005	0.001**
	(0.001)	(0.0003)			(-)	(0.0004)
Lockdown			0.287*	0.316*	0.225	0.509**
			(0.164)	(0.178)	(0.183)	(0.244)
Greece	3.375	9.947	-8.766	-9.441	-2.652	-3.932
	(8.269)	(9.319)	(7.159)	(12.326)	(-)	(11.411)
Spain	-1.493	-3.488	-4.317	-4.736	-4.679	-11.097
	(4.894)	(5.580)	(5.157)	(8.081)	(-)	(6.885)
Italy	-2.337	-1.234	-7.046	-7.655	-6.581	-7.243
	(4.050)	(5.442)	(4.661)	(8.600)	(-)	(6.927)
Constant	2.518	-5.850	-3.450	-4.755	-6.412	-26.085**
	(7.779)	(6.460)	(8.248)	(10.914)	(11.293)	(11.488)
Observations	60	60	60	60	60	60
R-squared	0.043	0.536	0.038	0.467	0.061	0.544
Adjusted R-squared	-0.026	0.494	-0.032	0.419	-0.026	0.494
Residual Std. Error (df = 54)	12.216	2.247	12.250	2.842	12.211	1.614

Notes: *p<0.1; **p<0.05; ***p<0.01 / In parenthesis - Standard Errors

Comparing the results, we may say that the national effects were not significant and did not change the signal and the significance of *CasesCOVID* and *Lockdown* variables' coefficients. The major difference is that the number of days in lockdown turned out to be significant alone with the dummy variables in the model 2.2. On the other hand, the regions with longer lockdowns saw their underutilization of labor increase. In fact, the magnitude of the *Lockdown*'s coefficient increased from model 1.3 to 2.3, reenforcing the impact of the days in lockdown to a higher increase in the labour market slack – an additional week of lockdown is expected to increase the growth of labour market slack by 3.6pp, on average, ceteris paribus.

5.2.3 Influence of COVID-19, labour market, and national dummy variables

It is important to also control for the labour market characteristics as we have done, firstly, in model 3 and afterwards, in model 4, within which national dummy variables were added.

Table 16: Variation of the Labour Market Slack regressed on the COVID-19 and the Labour Market variables and on the Country dummies

	(3)		(4)	
	OLS Robust s.e.	FGLS-log(BP)	OLS Robust s.e.	FGLS-log(BP)
CasesCOVID	0.001	0.001**	0.001	0.001**
	(-)	(0.0003)	(-)	(0.0004)
Lockdown	0.153	0.185	0.052	0.016
	(0.183)	(0.115)	(0.183)	(0.172)
NACE_GHI	1.126	0.777**	1.127	1.012***
	(-)	(0.377)	(-)	(0.370)
YoungEmp	2.494	2.990**	2.881	4.985***
	(-)	(1.212)	(-)	(1.263)
Educ	-0.042	0.023	0.071	0.450**
	(-)	(0.100)	(-)	(0.180)
ΔActivRate	-0.652	-1.872***	-0.855	-1.460**
	(-)	(0.565)	(-)	(0.614)
Greece			6.275	8.970
			(-)	(7.813)
Spain			-0.810	-3.478
			(-)	(5.571)
Italy			3.082	10.314*
			(-)	(5.206)
Constant	-53.996***	-52.242***	-58.266***	-76.898***
	(11.293)	(13.058)	(11.293)	(14.113)
Observations	60	60	60	60
R-squared	0.470	0.627	0.484	0.732
Adjusted R-squared	0.410	0.578	0.392	0.678
Residual Std. Error (df = 54)	9.263	1.158	9.406	1.112

Notes: *p<0.1; **p<0.05; ***p<0.01 / In parenthesis - Standard Errors

Comparing the two models, there is no difference regarding the significance and the signal of the common variables' coefficients, excepting *Educ*. The adjusted R-squared increases by a lot when adding the labour market variables from model 1.3 to 3. Moreover, adding the national dummy variables also led to a much higher adjusted R-squared from model 2.3 to 4. The model 4 has the highest R-squared and adjusted R-squared.

Once controlling for variables related to the labour market, we verified that the lockdown effect becomes insignificant while the impact of the pandemic remains significant. The days in lockdown are not significant anymore as the effect of the closure of economic activities was captured by the characteristics of the labour market. In fact, for example, an important factor to people not seeking for a job is to work for in-person activities, as people working remotely have the possibility to work or to seek working during a lockdown. Thus, the number of days in lockdown loses significance in favour of the variable *NACE_GHI*, in this case. It is interesting to observe that *CasesCovid*'s coefficient and its significance remained unchanged from model 1.1 to 4, concluding that the deterioration of expectations and confidence in the future due to the severity of the pandemic in each national region affected employment in other sectors of activity.

The variable *NACE_GHI* is significant and has, as expected, a positive coefficient in both models, increasing its value when controlling for national effects. Interpreting the coefficient in model 4, we may say that an increase of 1pp in the percentage of employment in the economic activities categorised in NACE G-I, the variation in the labour market slack is expected to increase by 1pp, on average, ceteris paribus.

YoungEmp is the labour market's variable with a higher coefficient value in both models, increasing from model 3 to 4. As expected, it is positive, as a higher share of young employees (higher share of temporary contracts) increases the propensity to be fired and to stop seeking work. Interpreting the coefficient in model 4, we may say that for an increase of 1pp in the percentage of young employment, the variation in the labour market slack is expected to increase by 5pp, on average, ceteris paribus.

Educ was the only labour market variable that led to non-expected results. From the findings in the literature review, we were expecting a negative coefficient, as a higher share of employment with high education was expected to be less vulnerable to unemployment and to stop seeking work. Once again, the correlation between the variation of the labour market slack and the percentage of people with tertiary education in Spain could be in the origin of this coefficient. We might also be dealing with a biased variable that is probably capturing the effect of an omitted variable highly correlated with *Educ*, as we have previously referred for the unemployment rate case.

The change in the activity rate had the expected results – a negative coefficient – as a higher activity rate leads to a higher extended labour force, reducing the labour market slack rate. Thus, analysing the coefficient of the model 4, the increase of 1pp in the variation of the activity rate led to an average fall of 1.5pp in the labour market slack variation.

Finally, analysing the national dummy variables added in model 4, we may conclude that the only significant national effect is from Italy. If a certain region is under Italian national territory, the change in its labour market slack was 10.3pp higher than in a region in Portugal, on average, ceteris paribus. This might be explained by the higher strictness of employment protection as well as the greater Economic Support Index in Portugal than in Italy.

6. Conclusions

In general, the COVID-19 variables lose their significance when adding the labour market variables. *CasesCOVID* stops being significant in the presence of labour market variables for the unemployment rate, but it is significant in all models when regressing on labour market slack. On the other hand, *Lockdown* is never significant when analysing its impact on the change of unemployment rate. However, when using labour market slack as dependent variable, it is significant until controlling for labour market characteristics. Thus, we observe a higher significance of this couple variables when regressing on the labour market slack than on the unemployment rate. This might be explained by the higher magnitude of the second dependent variable analysing the job destruction. As we analysed, in this specific crisis, there was a higher increase on people available but not seeking work than in unemployment. Individuals could not search for work or were not available due to the containment measures, thus not counting as unemployed, but counting for the labour market slack. Therefore, considering our most complete model, we may conclude that the number of cases led people who lost their jobs not to search for a new one. Moreover, the number of days in lockdown did not affect the labour market, as its characteristics were more important than the length of the economic activities' closure.

The proportion of people employed in the tourism and retail trade sector was observed to produce a higher and more significant impact in the variation of the labour market slack in detriment of the unemployment rate. This sector implies a direct contact with people, which was not possible in most of the time during the pandemic. It becomes highly affected by the pandemic since many businesses were forced to close and teleworking alternative was not plausible. Hence, people lost confidence relatively to the chances on be employed again and stopped seeking for a new job. Since they were not actively seeking for a new job, they are not considered as being unemployed but instead as part of the labour slack, also referred as underutilised workers. It is important to refer that the labour slack definition includes layoff workers, who can be in the origin for the different impact comparatively to the unemployment.

The weight of young employees in the total employment as a proxy of temporary contracts importance impacts significant and positively both the unemployment rate and the labour slack. However, the influence appears to be greater in the case of the unemployment, which can be justified by the link between temporary workers and lower remunerations, frequently indispensable for workers who do not have enough savings and start seeking again for a new job. In addition to this, the youth recurrently seek work to have resources either to pursue studies or to be more independent, which makes them immediately available. On the other hand, the new generation have the tools and the knowledge to candidate for a job via online while the fact that the direct contact is not required keeps them seeking work. The employers' perspective may also be taken into account since it is easier for them to fire workers with temporary contracts.

The share of employees with tertiary education was the only variable that led to unexpected results since the obtained results suggest that the higher this share, the higher the impact on both the unemployment and labour market slack variation. As we have already identified, this might be due to the correlation between the variable *Educ* with each of the dependent variables. The reason behind such result can also be, alternatively, an omitted variable bias problem: either the proportion of young employees in the age group from 25 to 35 years old or the share of female workers. This is one point that we suggest exploring in further research.

The evolution of the proportion of economically active population is negatively related to both the unemployment rate and labour slack variation, having a similar significance level. This was not a surprisingly result since the rise in the labour force and, consequently, in the extended labour force can be translated into an increase in the base on which the number of unemployed and underutilized workers falls, which leads to a decline in both variations, ceteris paribus.

Finally, when analysing the national effects on the growth of unemployment rate and of labour market slack, after controlling for labour market characteristics, Greece and Italy were significant alone, respectively. In both cases, we observed an extra increase in the change of these job destruction indicators when compared to Portugal. A lower strictness of employment protection, according to the OECD index, as well as weaker measures taken by Greek and Italian national governments, according to the Economic Support Index, may explain these results.

To sum up, the variation in both the unemployment rate and the labour market slack was impacted the most by COVID-19 cases as well as by the higher weight of tourism and related activities in the employment structure and by the preponderance of young employees who tend to be less protected. Nonetheless, while people who lost their jobs because of the pandemic would have been classified as unemployed under normal conditions, they are considered instead inactive due to mobility restrictions and reduced access to job offers, that do not allow them to actively seek for a new job. Therefore, since the labour market slack covers a reality of the labour market that is hidden by the unemployment rate, it is based on the 1% significance of these variables that we retrieve the conclusion according to which the COVID-19 pandemic mainly affected the regions more dependent on direct contact activities and where the temporary contracts are predominant.

Indeed, our research project is not exempt of limitations. Lockdowns were, according to our model, non-significant increasing unemployment. So, at a first glance, one may argue that lockdowns are not bad for the economy, as people usually say. In fact, as lockdowns lower the number of COVID-19 cases (that is significant), one might even believe they can be good for a tourism-based economy, as they allow the nations to be inserted in more "Green Lists for Travel", increasing the number of tourists. However, our model does not account for all other variables that are somehow correlated with lockdowns, or for variables that can have similar effects as lockdowns. Therefore, it is not possible for us to confirm or reject the thesis presented in Correia et al. (2020) that lockdowns are not harmful for employment.

For further research on this topic, there is the possibility of analysing all variables that are somehow related to lockdowns, in order to capture the full effect that they might have both in the economy and in the labour market. Only by going deeper in the analysis of the lockdown effects, and its relations with many other aspects (and not only economic ones) we could fully confirm or reject the thesis presented in Correia et al. (2020). For now, we must remain with the conclusions we can take, i.e. lockdowns were not significant increasing unemployment in Southern Europe during the COVID-19 pandemic.

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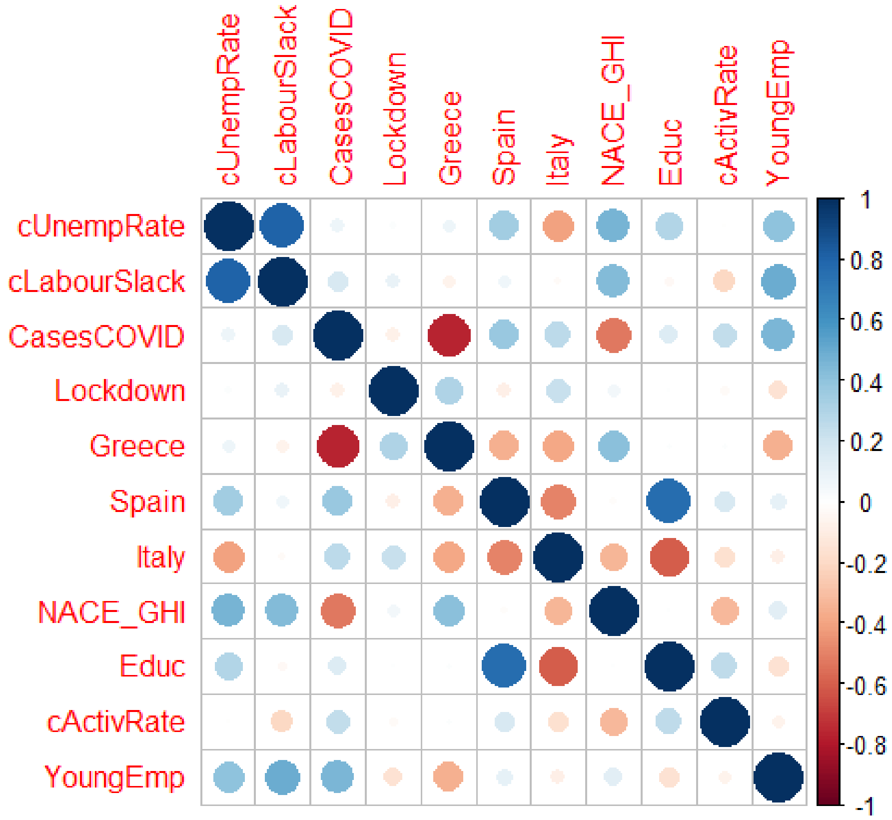
8. Appendix

Figure 1: Variables' correlation-matrix



Heteroskedasticity tests having unemployment rate variation as dependent variable

Breusch-Pagan test for heteroskedasticity			
Null hypothesis: heteroskedasticity not present			
Model	**Test statistic LM**	**p-value**	**Heteroskedasticity**
1.1	4.86892	0.0273446	YES (at a 5% significance level)
1.2	0.146305	0.702091	NO
1.3	4.91799	0.085521	YES (at a 10% significance level)
2.1	12.7991	0.0123005	YES (at a 5% significance level)
2.2	10.2217	0.0368548	YES (at a 5% significance level)
2.3	13.1014	0.0224467	YES (at a 5% significance level)
3	24.1894	0.000481977	YES (at a 1% significance level)
4	22.4162	0.00764958	YES (at a 1% significance level)

Heteroskedasticity tests having labour market slack variation as dependent variable

Breusch-Pagan test for heteroskedasticity			
Null hypothesis: heteroskedasticity not present			
Model	**Test statistic LM**	**p-value**	**Heteroskedasticity**
1.1	3.17937	0.0745735	YES (at a 10% significance level)
1.2	2.42742	0.119229	NO
1.3	5.30583	0.0704456	YES (at a 10% significance level)
2.1	11.881989	0.018251	YES (at a 5% significance level)
2.2	9.907700	0.042012	YES (at a 5% significance level)
2.3	12.399691	0.029703	YES (at a 5% significance level)
3	13.825439	0.031648	YES (at a 5% significance level)
4	18.538450	0.029416	YES (at a 5% significance level)

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