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Porras-Arena, M. Sylvina; Martín-Román, Ángel L.;
Dueñas Fernández, Diego; Llorente Heras, Raquel

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Articles

# Okun's Law: The effects of the COVID-19 pandemic and the temporary layoffs procedures (ERTEs) on Spanish regions

*M. Sylvina Porras-Arena*, Ángel L. Martín-Román**, Diego Dueñas Fernández ***, Raquel Llorente Heras *****

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## Abstract:

Official statistics indicated a break in Okun's law in all the Spanish regions due to the COVID-19 pandemic; however, herein, evidence of the validity of the law is shown. The temporary layoff procedures (ERTEs) allowed many workers to maintain their jobs. From the productive point of view, the law remained in effect in the regions, showing a strong relationship between idle labour resources and economic activity, and from the social point of view, the apparent breakdown of the law can be interpreted as the implementation of a policy that mitigated the dramatic impact of the economic crisis.

**Keywords:** Okun's law; ERTE; expanded unemployment rate.
**JEL Classification:** E23; E24; J64.

## Ley de Okun: Los efectos de la pandemia de COVID-19 y los procedimientos de despido temporal (ERTE) en las regiones españolas

## Resumen:

Las estadísticas oficiales indicaban una ruptura de la ley de Okun en todas las CCAA por la pandemia del COVID-19, sin embargo, aquí se muestra evidencia sobre la vigencia de la ley. Los ERTE permitieron el mantenimiento del vínculo laboral de muchos trabajadores. Desde el punto de vista productivo se observa que la ley continuó vigente mostrando una fuerte relación entre los recursos laborales ociosos y la actividad económica, y, desde el punto de vista social, la aparente ruptura de la ley puede interpretarse como la implementación de una política que mitigó el dramático impacto de la crisis económica.

**Palabras clave:** Ley de Okun; ERTE; tasa de desempleo ampliado.
**Clasificación JEL:** E23; E24; J64.

## 1. Introduction

Did Okun's law fail in Spain after the COVID-19 pandemic? Okun's relationship that was known prior to the health crisis unleashed by COVID-19 infections indicated for Spain that, for each percentage point (pp) of growth in economic activity, unemployment dropped by approximately one percentage point.

* Facultad de Ciencias Económicas y Empresariales, Universidad de Valladolid. España Facultad de Ciencias Económicas y de Administración, Universidad de la República. Uruguay. sylvina.porras@fcea.edu.uy
** Facultad de CC. Sociales, Jurídicas y de la Comunicación. Segovia. España. almartin@uva.es
*** Universidad de Alcalá (UAH). Alcalá de Henares. España. diego.duenas@uah.es
**** Facultad de Ciencias Económicas y Empresariales, Universidad Autónoma de Madrid. España. Instituto Universitario de Análisis Económico y Social (IAES) de la Universidad de Alcalá. Alcalá de Henares. España. raquel.llorente@uam.es
**Corresponding Author:** almartin@uva.es

If this relationship had been complied with, the unemployment rate should have increased to 35% in the second quarter of 2020 since economic activity fell by 21.5%. However, the unemployment rate barely increased 1.3 pp and stood at 15.3%.

Unemployment recorded by official statistics is measured from the criteria of the International Labor Organization (ILO) and indicates, from the point of view of people, the total lack of employment and, from the point of view of production, the existence of idle resources. However, as Dolado et al. (2021) note, during the COVID-19 pandemic, the unemployment rate has not been a good indicator of the underutilization of labour. Following the methodology of the United States Bureau of Labor Statistics, these authors introduce different alternative indicators to that of the conventional unemployment rate. Added to this measurement, are people who stopped looking for work but were available to start a job, and workers covered by the temporary layoff procedures (called ERTE in Spanish for "*Expediente de Regulación Temporal de Empleo*") for suspension of contract or reduced working day. This unemployment rate, in a broader sense, reached, according to the authors, 40.6% of the economically active population in the second quarter of 2020.

From the perspective of the production function, where there is a positive relationship between the demand for productive factors and production, the variation in economic activity also implies variations in the requirements of productive factors, specifically the labour factor. With the dramatic fall in the level of activity due to the restrictions placed on mobility imposed during the COVID-19 pandemic, some workers lost their jobs, while others, from the implementation of various measures of job retention policies, suffered a partial reduction in their working hours or a complete and temporary suspension of the employment contract. In this way, many resources became idle when economic activity fell, in accordance with this positive relationship between economic activity and the demand of the labour factor, thus validating Okun's law, which is based on production logic, although this was not reflected in the estimated Okun's coefficient based on unemployment statistics due to the implementation of these policies.

It is logical to think that Okun's underlying relationship did not change from the COVID-19 pandemic forward and that, beyond the cyclical variations of the labour supply (Martín-Román, 2022), it is the way in which idle labour resources are measured, which explains why the variable "unemployment rate" would have reflected the evolution of only a part of the resources that were idle over the pandemic. In turn, to the extent that this would respond to the implementation of policy measures protecting jobs and reducing the negative socioeconomic impact on people implied by the COVID-19 pandemic crisis, the difference between the expected impact on unemployment based on the previous estimates of Okun's relationship and what actually happened can be interpreted in part as the positive impact of the economic policy implemented (Leandro, 2020; Barišić & Kovač 2022).

On the other hand, given that the crisis caused by the COVID-19 pandemic had differentiated impacts at the sectoral and territorial levels, the impact of mobility restriction measures and the palliative employment policy measures implemented also had varied intensities in the different regions of Spain. According to Romero et al. (2021), the differential economic impacts in the sector are noticeable, since the most affected sectors have been those involving greater social contact (retail trade, hospitality, restaurants, transport, leisure and cultural activities). As a consequence of the differentiated impact in the sector, effects of different magnitudes were also generated at the territorial level, since the provincial economies most affected by the COVID-19 crisis were those with the highest level of specialization in some of those sectoral activities that were most hit by the crisis. It is therefore not surprising that the regions most affected have been those of the two archipelagos (Balearic and Canary Islands) and some provinces on the Mediterranean.

Therefore, in this research, we try, first, to analyse the validity of Okun's law at the level of the Spanish regions (NUTS II) and to identify the change that occurred since the COVID-19 pandemic. Next, with a broader measure than that of the official statistics that includes the people covered by the ERTEs, which also represent idle resources from the productive point of view, we estimated the Okun's relationship for each region of Spain, whose results describe the continuity of this relationship throughout the Spanish territory. Finally, as a way to evaluate the positive impact of the implemented employment protection policy, we projected the unemployment rate of each region for the four quarters of the first year of the COVID-19 pandemic from the pre-pandemic data and compared these results with the real

evolution of unemployment and with "extended" unemployment. The results vary according to region, but in all cases, it is concluded that if this policy had not been mediated, the unemployment rate would have been sitting, depending on the region, between 8pp and 31pp above the level recorded by the statistics of the National Institute of Statistics (INE) in the quarter with the greatest negative impact on economic activity due to COVID-19 (2020.Q2).

The article is structured as follows. Section 2 presents a brief description of the evolution of the COVID-19 pandemic and the implementation of ERTEs in Spain. The evidence shown in the literature on the application of workforce reduction strategies and their impacts is discussed in section 3. Then, Okun's law and the empirical evidence for Spain are formally presented in section 4. Next, section 5 describes the methodology and data used in this research; in section 6, the results are presented; and finally, the conclusions are presented.

## 2. Background

### 2.1. COVID-19 and the ERTE

The first case of COVID-19 in Spain was diagnosed in January 2020. After it, and due to its rapid expansion, the government decreed a state of alarm in March, suspending nonessential activity and establishing the confinement of the majority of the population. Limiting mobility, as well as the hibernation of the economy, allowed reducing the number of infections, following successive extensions of the state of alarm, in a process of asymmetric de-escalation in April 2020. The de-escalation gave rise to a certain relaxation of the containment measures during the summer months.

Unfortunately, after the summer, infections increased again, causing the issue of a new state of alarm, albeit of a different nature. In this new stage, health containment measures were decentralized to the regions, establishing a great heterogeneity of action scenarios. Limiting mobility, setting curfews or local confinements were some of the measures applied by the governments of the Spanish regions.

In December 2020, the vaccination process of the population by age group began, and with it, both infections and deaths were gradually reduced, which allowed the progressive lifting of the restrictive measures implemented.

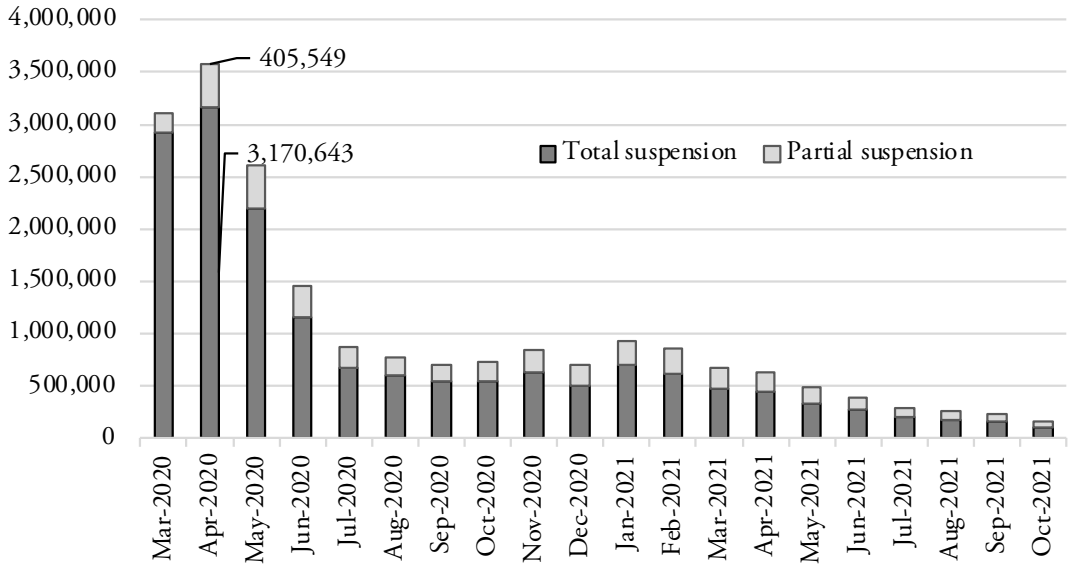
In labour matters, as the health crisis developed, measures were implemented to defend jobs and support the unemployed. **Royal Decree-Law 8/2020** (03/17/2020) allowed the application and development of ERTE. The ERTEs were established as a procedure that allowed companies the total suspension of contracts or the reduction of the working day on a temporary basis. Therefore, the workers covered by ERTEs constitute a group of people who would surely have joined the ranks of the unemployed had this measure not existed. The ERTEs born in the pandemic are regulated in Article 47 of the Workers' Statute and update or adapt, due to the exceptional circumstances imposed by the pandemic, the former layoff procedures (ERE) for economic, technical organizational or production (ETOP) reasons. The workers under the ERTEs maintain their status as employees both at the level of Social Security and in the statistics of the Labour Force Survey (LFS) of the INE, so they do not become part of the unemployed count.

After the initial establishment of the ERTEs in March 2020, successive regulations in the form of the Royal Decree (RD) have been extending their use and extension more or less automatically. Certainly, complex legislation has been established where we highlight the main measures developed.

- **Royal Decree-Law 15/2020** (04/21/2020), on urgent complementary measures to support the economy and employment, modified the regulation of ERTEs due to force majeure provided for in Royal Decree-Law 8/2020, of extraordinary urgent measures to address the economic and social impact of COVID-19, establishing that force majeure may be partial.
- **Royal Decree-Law 30/2020** (09/29/2020) made possible the automatic extension of the ERTE in force until January 31, 2021.

- **Royal Decree** (01/26/2021), again extended the ERTEs based on a force majeure related to COVID-19, regulated in article 22 of Royal Decree-Law 8/2020 until May 31, 2021.
- **Royal Decree-Law 11/2021** (05/27/2021), on urgent measures for the defence of employment, economic reactivation and protection of self-employed workers, included a series of measures that affect unemployment benefits, as well as the automatic extension until September 30, 2021.
- **Royal Decree-Law 18/2021** (09/28/2021), of urgent measures for the protection of employment, economic recovery and job improvement, established a new extension until February 28, 2022, of the ERTEs in accordance with various articulations.
- In short, through successive extensions, the ERTEs have been maintained over time, allowing the country to cope with the pandemic, although it is also true that it has been carried out under the public budget and that its management has presented certain inefficiencies. As shown in Figure 1, the ERTEs were intensively applied when first established, reaching more than 3 and a half million workers sheltered under this modality, mostly with total suspension; subsequently, it was gradually reduced until reaching the official figure of 292,722 workers in ERTEs in July 2021.

FIGURE 1.
**Affiliates in the ERTE linked to the COVID-19 according to type of suspension**




**Source:** Ministerio de Inclusión, Seguridad Social y Migraciones

## 2.2. Evidence on the application of workforce reduction strategies

The workforce reduction strategies have been analysed by academic literature from different perspectives. Since its inception, the analysis has focused on the study of short-time work (STW) tools, attempting to demonstrate whether these systems are effective tools for maintaining employment in times of economic crisis, compared to traditional benefit systems.

Pioneering studies from the 1990s validated the use of STW as a form of employment preservation. Publications such as Abraham & Houseman (1994) and Van Audenrode (1994) show their effectiveness in retaining jobs. Similarly, during the Great Recession of 2008, Giupponi & Landais (2020) and Pavlopoulos & Chkalova (2022) also established that STW was a useful tool for job preservation and overcoming the crisis. Arranz et al. (2021) demostrated that STW effectively preserved jobs in Spain during the 2008 crisis. However, as the use of STW became more widespread, some criticisms also emerged in

the academic literature. The results obtained were heavily dependent on the environment and the type of STW implementation.

The heterogeneity of results based on the environment was confirmed through cross-country comparative studies. Lea (2020) analyzed the international diffusion of these systems, highlighting a high heterogeneity of implementation. In a study of 19 OECD countries during the 2008 crisis, Hijzen & Venn (2011) found a positive impact only in the case of Germany and Japan.

Nevertheless, each country has carried out these systems differently, through subsidies to companies, social security contribution suspensions, tax exemptions, etc., making international comparisons complex. Fitzroy & Hart (1985) argue that STWs were efficient in the US not only due to the institutional context but also because of their different application through payroll tax systems. Burdett & Wright (1989) compared systems based on unemployment insurance perception against reduced working hours using a theoretical model and statistical evidence, showing that while the latter preserved employment, it could result in inefficient hours per worker. Osuna & García-Pérez (2015) evaluated STWs based on the 2012 labour reform using a matching model demonstrating that STWs do not necessarily reduce unemployment or lost jobs, so that the effectiveness of the system depends on the degree of subsidy implemented. In a more recent work, Osuna & García-Pérez (2021) analysed schemes for reducing working hours during COVID-19, assessing the need to implement these schemes in light of the increase in the fiscal deficit. The authors state that STWs do not prevent the increase in unemployment and the job destruction, as their adverse effects depend on the degree of subsidies implemented and the design of the regulations themselves.

Overall, a significant portion of the academic literature focuses on analysing different systems implemented by countries to defend employment, concluding that these systems are palliative and generally temporary. Burdett & Wright (1989) advocate the use of STW systems only temporarily. In the case of Spain, Arranz et al. (2019) analyse the propensity to lay off workers during the crisis of the early 1990s compared to the crisis of the late 2000s, showing that the job preservation policy through STW should focus on the short term and always take into account the composition of the workforce.

Apart from confirming the positive aspects of STWs while acknowledging their limitations, Hijzen & Venn (2011) indicate that the positive impacts are limited, as the segmentation of the labour market increases between workers with full-time jobs and workers with temporary and part-time jobs. In a later study, Hijzen & Martin (2013) stated that the positive impact depended on the timing of program implementation and that their use during the recovery period could have slowed job creation. The study by Boeri & Bruecker (2011) suggests that these systems come with significant "dead weight" costs, meaning that the number of jobs "saved" is estimated to be fewer than the number of jobs covered by the programs. Cahuc & Carcillo (2011) also point out that these systems can lead to an inefficient reduction in hours worked, and later Cahuc et al. (2021) argue that they significantly increase the costs of public policies.

With the COVID-19 crisis, the STW systems have been reintroduced as a measure for the preservation of employment, with a greater intensity, given that, in this period, the suspension of employment has been for total working time. Studies have largely focused on the analysis of the furloughed workers schemes (FWS) or job retention (JR) schemes. However, the academic discussion has again focused on the validity of these instruments as a defence of employment against traditional systems. Juranek et al. (2020) analyses layoffs during the COVID-19 crisis in Norway using administrative data, demonstrating that the FWS limited the impact of the pandemic. The work of Stuart et al. (2021) shows that the FWS system has helped retain jobs in the United Kingdom and should be implemented as part of companies' human resources policies for workforce retention. Castle et al. (2021), using forecasting techniques, demonstrate that furlough policies have stabilized unemployment in the United Kingdom. Pope et al. (2020) show, through statistical analysis, that job retention schemes have mitigated the negative effects of the pandemic on the labour market in the case of the United Kingdom, although the extension of these schemes varied across sectors. However, the effectiveness of such measures was mainly observed in the short term. Research of Izquierdo et al. (2021) shows how the FWS was the most used tool for the Spanish labour market adjustment in the face of the global pandemic, particularly during the second quarter of 2020 due to economic activity restrictions.

Nonetheless, the comparison should be made with caution given that until recently, these types of schemes have not been analysed in depth, and we still do not have sufficient historical perspective for their

assessment. Additionally, the environment and the different modes of implementation are once again emphasized as key factors for the success of such tools.

From a global perspective, the analysed macroeconomic effects of both measures (STW and FWS) are generally positive in relation to job preservation and preventing layoffs, but they also tend to have some adverse effects in relation to labour costs, reduced wages, inefficiencies and dead weights. Moreover, these measures accentuate the segmentation between employed and unemployed workers in the labour market. However, the legislative characteristics of each measure prevent a detailed comparison at the aggregate level so that the legislative framework is decisive in the success of the measures. Finally, it is worth noting that the majority of the authors advocate for these measures to be temporary or established for a limited duration, specifically during periods of economic recession.

This research contributes to the literature on the effects of total suspension FWS systems in the Spanish context, where the existing literature is still emerging.

## 2.3. Okun's law

Okun's law establishes the inverse relationship between unemployment and economic activity (Okun, 1962). This relationship has been estimated in different ways, with the modelling in differences (1) and in gaps (2) being the most used (Porras-Arena & Martín-Román, 2023).

$$u_t - u_{t-1} = \beta_0 + \beta_1 g_{yt} \quad (1)$$

$$(u_t - u_t^*) = \gamma_0 + \gamma_1 (y_t - y_t^*) \quad (2)$$

where $u_t$ is the unemployment rate, $g_{yt}$ the growth rates of the economy, $u_t^*$ the natural unemployment rate, $y_t$ the logarithm of the output and $y_t^*$ the logarithm of the potential output. $\beta_1$ in (1) and $\gamma_1$ in (2) correspond to the so-called Okun's coefficient, which takes a negative value. In the first case, this coefficient indicates how much the unemployment rate decreases when economic activity grows by 1%, and in the second case, how much the unemployment rate moves away from its potential or natural level when economic activity moves away by 1% from its potential level.

Table 1 shows the results for Spain of the studies that estimate Okun's law for several developed countries. The values vary depending on the period or the methodology used and are between -0.63 and -0.94. In all cases, the estimated coefficients indicate that Spain's unemployment rate is most sensitive to changes in economic activity. On the other hand, Buendía & Sánchez (2017) estimated, with panel data from Spanish provinces, at 2.5% to the minimum growth rate that the Spanish economy should register to achieve reductions in unemployment (2001-2011), which is equivalent to an Okun's coefficient at a lower level in absolute value than those in the range of values indicated above. However, the authors do not indicate what might account for these differences.

In this way, the forecasts on the evolution of unemployment, in the context of the collapse of economic activity due to the health measures imposed by the COVID-19 infection, predicted a dramatic increase in the number of people who would lose their jobs and would swell the ranks of the unemployed.

On the other hand, there are studies that indicate that the Okun's relationship varies at the regional level in Spain (Villaverde & Maza, 2009; Bande & Martín-Román, 2018; Porras-Arena & Martín-Román, 2019), due, among other things, to differential characteristics of their labour markets. This implied at the beginning of 2020 regional differentiated forecasts about what could be the increase in unemployment in the context of a probable fall in economic activity due to COVID-19. In addition, as already indicated, the Government of Spain determined at some point the decentralisation of health containment measures to the regions, establishing a great heterogeneity of action scenarios. That is why the analysis of the effects of the COVID-19 pandemic and of the ERTEs on Okun's law is carried out in this research at the level of the Spanish regions (NUTS II).

TABLE 1.
Estimates of Okun's law for Spain

| Author | Period | Okun coefficient |
|---|---|---|
| Perman & Tavera (2005) | 1970-2002 | -0.79 |
| Perman & Tavera (2007) | 1970-2002 | -0.71 |
| Ball et al. (2017) | 1980-2013 | -0.94 |
| | | -0.82 |
| | | -0.8 |
| | | -0.74 |
| Jalles (2019) | 1978-2015 | -0.9 |
| | | -0.89 |
| | | -0.81 |
| Gil-Alana et al. (2020) | 2000-2015 | -0.69 |
| | | -0.66 |
| | | -0.63 |
| Villanueva and Cárdenas (2021) | 1998-2018 | -0.73 |

Several studies report the differences between regions of Spain with respect to the reaction of unemployment to changes in economic activity (or the inverse relationship). Some authors estimated the relationship for one single region and compared it with that of the country as a whole (Pérez et al., 2003; Usabiaga & Hernández-Salmerón, 2021). Other authors estimated the relationship for each region (Villaverde & Maza, 2007, 2009; Bande & Martín-Román, 2018, Porras-Arena & Martín-Román, 2019) and found significant differences in the estimated coefficients. Melguizo (2017), on the other hand, carries out the study of the relationship at the provincial level in Spain, suggesting with the results obtained that it is also appropriate to consider a greater territorial division to analyse Okun's law (50 provinces instead of 17 regions). The results obtained by Clar-López et al. (2014) show additional elements on the relative importance of studying Okun's law at the regional level in Spain, since they found that applying this relationship improves the predictive capacity of econometric models in such a way that the unemployment rate in most regions is predictable.

On the other hand, Usabiaga & Hernández-Salmerón (2021) found that the Okun's coefficients were -0.8 and -0.7 for Spain and Andalusia, respectively, with data up to 2019. However, when re-estimating the relationship incorporating the data since 2020, there is a significant change in the regression results, obtaining relationship coefficients lower in absolute value and lower coefficients of determination ($R^2$) as well. The new estimates are approximately -0.4 for both cases. According to the authors, the strong shock caused by the pandemic and the widespread use of ERTEs would be the factors that would explain these results.

Barišić & Kovač (2022), based on estimations of Okun's law for a total of 26 European countries, including Spain, projected the expected values of the variation in the unemployment rate for the first and second quarters of 2020 compared with real variations. For several countries, the difference between the projected value and the true value shows a positive sign, with Spain standing out among them. These differences are interpreted as the successful application of fiscal policy measures to mitigate the negative impacts of the COVID-19 crisis.

Likewise, with the objective of evaluating the effectiveness of the fiscal effort in times of pandemic by COVID-19, Leandro (2020) estimated Okun's law for several countries in Europe which implemented measures much like those of Spain's ERTEs. Based on these models, the respective unemployment rates for the first and second quarters were projected and compared with the current ones, showing that in Spain, the negative effect of the crisis on employment is significantly reduced, mainly in the second quarter of 2020.

## 3. Methodology and data

When working with quarterly data, it is common to find dynamic estimates of Okun's law, which include delays of the dependent and independent variables. For the difference model, it would be:

$$\Delta u_t = \alpha + \sum_{i=1}^{p} \delta_i \Delta u_{t-i} + \sum_{i=0}^{q} \beta_i g_{yt-i} \quad (3)$$

where $u_t$ is the unemployment rate and $g_{yt}$ the growth rates of the economy.

In this case, it is not only the coefficient of the contemporary relationship that matters but also the total effect that operates through the lags of the variables, which is the one that is comparable with the effect that is calculated from the variables with annual periodicity. The total effect is calculated as follows:

$$Total\ effect = \frac{\sum_{i=0}^{q} \beta_i}{(1-\sum_{i=1}^{p} \delta_i)} \quad (4)$$

The estimation process was carried out in three stages. The first consisted of estimating the dynamic Okun relationship (3), using the INE unemployment rate (UR) as dependent variable. We estimated Model 1, which includes data from 2005.Q1 to 2019.Q4 and compared the results with those of Model 2, which includes data up to 2020.Q4. This is the procedure used by Usabiaga & Hernández-Salmerón (2021) to study the case of Spain and Andalusia, which allows us to observe the changes that were processed in Okun's relationship when the crisis caused by the COVID-19 pandemic was unleashed. But, as Dolado et al. (2021) note, during the COVID-19 pandemic, the unemployment rate has not been a good indicator of the underutilization of labour and therefore, the Okun's relationship estimated with INE's UR as dependent variable does not reflect the true relationship between unemployment and output.

Thus, the second stage consisted, in the first place, in constructing for each region a new variable: "expanded unemployment rate" (URE), reflecting the existence of idle labor resources. That is, a variable that included the unemployed and the workers covered by the former EREs and currently by the ERTEs. By using the microdata from the LFS of the INE, we identified those individuals who were not classified as unemployed by the INE since they were in furlough schemes. Then we added them to the unemployed persons computed by the INE to obtain the figures relative to URE variable within each region:[1] The objective of having this new variable was to have an approximate measure of the level that unemployment might have reached in the absence of the palliative policies that were applied due to the COVID-19 pandemic, such as the ERTE program.

Using the new variable URE, we proceeded to estimate first the dynamic Okun relationship (3) for each region, using URE variable as dependent variable for the period 2005.Q1-2019.Q4 (Model 3). Considering that prior to the COVID-19 pandemic the application of temporary programs such as the ERE had very limited utilization, we expect the estimation results of Model 1 to be similar to those of Model 3. Then, we proceeded to estimate the dynamic Okun relationship (3), using URE variable as dependent variable but for the full period (2005.Q1-2020.Q4) (Model 4). Since the URE variable collects information on idle labor resources, whether or not they are counted as unemployed by the INE, we expect the estimated relationship for the full period between URE and output to be strong, as was the relationship between UR and output in the pre-pandemic period of COVID-19 for Spain. If this is confirmed, we will be able to conclude that Okun's relationship remained in place during the COVID-19 pandemic with no structural changes.

In the third stage, like Leandro (2020), we project the unemployment rate (UR) for each region for the four quarters of 2020, based on Okun's law estimated for the pre-COVID-19 period (*Model 1*) and considering the evolution of the economic activity in those four quarters. Then, we compared those projections with the actual values of the INE unemployment rates. This allows us to identify, on the one hand, the effect of the application of the ERTEs on unemployment, i.e., what could have been expected to happen to unemployment in the absence of this policy. On the other hand, in this article we also

[1] Data are available from authors upon request.

compare the results of these projections with those of the URE variable. The closer these two variables are, two things can be concluded: 1) the URE variable would be the unemployment rate if the application of the ERTE had not been mediated, that is, unemployment would have grown significantly; 2) the nearly fit between the UR projections and URE implies that Okun's relationship continued in force even in the pandemic period.

Regarding the data used, the microdata of the LFS of the INE (2005-2020) were processed to construct the UR and URE series for each region on a quarterly basis. The URE implies a broader notion of unemployment than that established using the ILO criteria, since the latter records the total lack of employment (with availability to work and actively seeking employment).

Regarding the variable related to output, the quarterly GDP series of the regions prepared by the Independent Authority for Fiscal Responsibility (AIREF) were used. According to the methodology, the construction of these variables combines three types of statistical information for regional analysis: the monthly data of economic indicators broken down at the territorial level, the annual data compiled by the Spanish Regional Accounts and the estimates for the national set published by the Quarterly National Accounts.

## 4. Results

### 4.1. Regional Okun's law in Spain

As a first step prior to modelling, unit root tests were performed on the variables. As the model being estimated (equation (3)) contains the variables in first differences, the unit root tests were performed on the variables in first differences. In all cases the null hypothesis of the existence of a unit root was rejected (Table A.1 of the Appendix), so it is possible to apply the Ordinary Least Squares method to estimate the parameters of interest.

As mentioned in the methodological section, the first estimation stage consisted of estimating Okun's law for the Spanish regions using the official unemployment rate (UR) as dependent variable. The first four columns of Table 2 show the results of *Model 1* and *2*, which differ in that *Model 1* goes through the last quarter of 2019, and *Model 2* also includes the four quarters of 2020. The coefficients reflect the total effect (equation (4)) of the variations of GDP on unemployment, that is, the one that results once the lagged effects of all the variables (dependent and independent) have operated. The table shows the results of the specifications of the models whose residuals passed the Normality, Heteroscedasticity and Autocorrelation tests (Table A.2 of the Appendix).

As seen in the first column of this table, the Okun's coefficients were relatively high in absolute value in the different regions before the crisis unleashed by COVID-19 (*Model 1*), although there was great dispersion, oscillating between a coefficient of -0.34 in the Balearic Islands to -1.25 in the Canary Islands. As a point of comparison, Ball et al. (2019) estimated the mean value of the Okun's coefficient in advanced economies at -0.4. On the other hand, in some regions, the adjustment coefficient of the model ($R^2$) is relatively low, which indicates that the variations in economic activity would not explain all the variability of the unemployment rate.

We next analyse the existence of any regional pattern with respect to the response of unemployment to output changes in the pre-pandemic period of COVID-19. To do so, we estimate Moran's I statistic and Geary's C statistic that inquire about the possible spatial autocorrelation of the data, using three different spatial weight matrices: the inverse of the standardised distance, the five nearest neighbours and the three nearest neighbours. We do not include the Canary Islands in the analysis because of their spatial remoteness. The results of the tests are presented in Table 3, and as can be seen, in all cases the null hypothesis indicating the absence of spatial autocorrelation is not rejected. This was an expected result, given that the study by Villaverde & Maza (2009), using also Moran's I with the inverse of the standardised distance matrix over Okun's law in Spanish regions, does not find a spatial pattern in the results either. Variables such as the rate of productivity growth (Villaverde & Maza, 2009) or the importance of self-employment (Porras-Arena & Martín-Román, 2019) are pointed out as factors influencing the different

levels of reaction of output to unemployment in the first case and of unemployment to output in the second case.

**TABLE 2.**
**Regional Okun's coefficients**

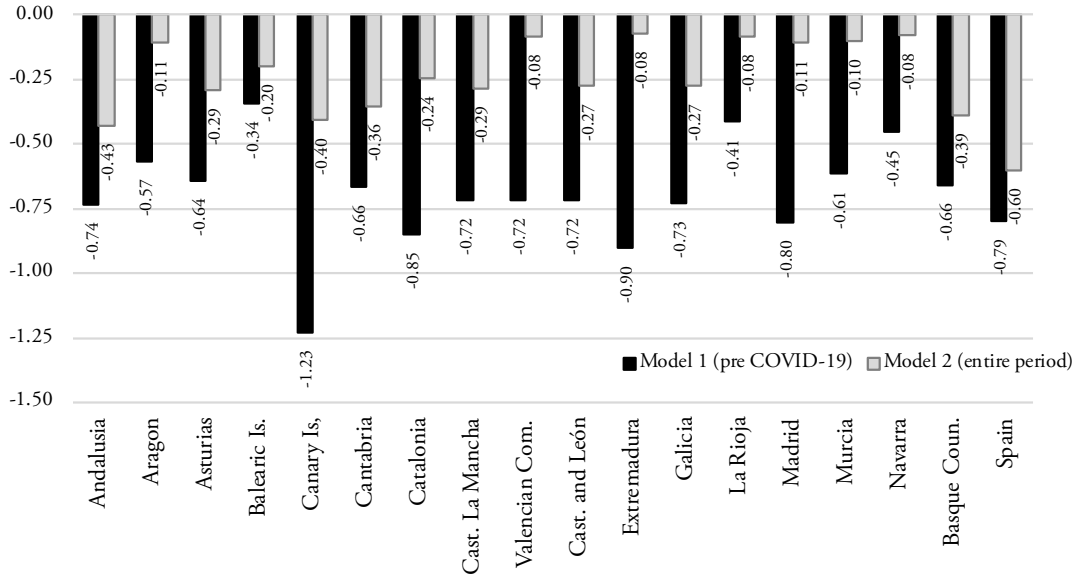
| Region | Dependent variable: | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Unemployment rate (UR) | | | | Expanded Unemployment Rate (URE) | | | |
| | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
| | *Okun coef.* | $R^2$ | *Okun coef.* | $R^2$ | *Okun coef.* | $R^2$ | *Okun coef.* | $R^2$ |
| Andalusia | -0.74 | 0.82 | -0.43 | 0.75 | -0.72 | 0.82 | -0.99 | 0.98 |
| Aragon | -0.57 | 0.46 | -0.11 | 0.38 | -0.59 | 0.47 | -1.06 | 0.95 |
| Asturias | -0.64 | 0.47 | -0.29 | 0.41 | -0.71 | 0.46 | -1.14 | 0.93 |
| Balearic Islands | -0.34 | 0.90 | -0.20 | 0.91 | -0.58 | 0.57 | -0.74 | 0.98 |
| Canary Islands | -1.25 | 0.52 | -0.40 | 0.56 | -1.25 | 0.52 | -1.42 | 0.95 |
| Cantabria | -0.66 | 0.16 | -0.36 | 0.19 | -0.72 | 0.18 | -1.07 | 0.93 |
| Catalonia | -0.85 | 0.71 | -0.24 | 0.68 | -0.86 | 0.64 | -1.06 | 0.98 |
| Castilla La Mancha | -0.72 | 0.58 | -0.29 | 0.55 | -0.70 | 0.36 | -0.81 | 0.86 |
| Valencian Community | -0.72 | 0.86 | -0.08 | 0.76 | -0.85 | 0.64 | -0.92 | 0.97 |
| Castile and León | -0.72 | 0.53 | -0.27 | 0.46 | -0.75 | 0.60 | -0.99 | 0.98 |
| Extremadura | -0.90 | 0.33 | -0.08 | 0.36 | -0.93 | 0.38 | -0.97 | 0.84 |
| Galicia | -0.73 | 0.58 | -0.27 | 0.51 | -0.74 | 0.57 | -0.97 | 0.98 |
| La Rioja | -0.41 | 0.20 | -0.08 | 0.17 | -0.49 | 0.27 | -0.89 | 0.86 |
| Madrid | -0.80 | 0.44 | -0.11 | 0.34 | -0.82 | 0.49 | -1.07 | 0.97 |
| Murcia | -0.61 | 0.23 | -0.10 | 0.33 | -0.62 | 0.31 | -0.69 | 0.86 |
| Navarra | -0.45 | 0.48 | -0.08 | 0.34 | -0.58 | 0.57 | -0.96 | 0.91 |
| Basque Country | -0.66 | 0.65 | -0.39 | 0.54 | -0.81 | 0.50 | -1.03 | 0.97 |
| Spain | -0.79 | 0.94 | -0.60 | 0.90 | -0.79 | 0.94 | -0.91 | 1.00 |

**Notes:** UR is the unemployment rate of the LFS. URE is the expanded unemployment rate (unemployed + people covered by the ERTE). The period in Model 1 and 3 is 2005.Q1 – 2019.Q4 and in Model 2 and 4 is 2005.Q1-2020.Q4. The coefficients for each region and each model correspond to the total effect of GDP on the dependent variable (UR or URE), equation (4).

**TABLE 3.**
**Spatial autocorrelation test: Moran's I and Geary's C**

| | Moran's I | | Geary's c | |
|---|---|---|---|---|
| Weights matrix | Statistic | p-value | Statistic | p-value |
| Inverse Distance | -0.01 | 0.23 | 0.92 | 0.15 |
| 5 nearest neighbors | 0.05 | 0.31 | 0.83 | 0.19 |
| 3 nearest neighbors | 0.03 | 0.56 | 0.85 | 0.40 |

FIGURE 2.
**Regional Okun's coefficients with the unemployment rate (UR) as dependent variable**




When data from the four quarters of 2020 were included in the estimates (*Model 2*), it is seen that the Okun's coefficients are significantly lower in absolute value (Table 2 and Figure 2), that is, with only four additional data. Moreover, the relationship for the entire period becomes weaker in all regions. The reduction of the estimated coefficient ranges from 0.27pp to 0.83pp in absolute value, depending on the region (on average 0.47). These four additional observations correspond to the period in which, although economic activity was dramatically reduced in all regions, unemployment did not see the expected increase according to the pre-pandemic Okun's relationship. In addition, to achieve significant coefficients and model adjustments, more lags of the variables had to be included in many cases. With these results, it seems that the relationship between unemployment and economic activity would have undergone a structural change in 2020 for all regions of Spain.

In the second stage, Okun's relationship (*Model 3* and *Model 4* of Table 2) was estimated using the "extended unemployment rate" (URE) as the dependent variable for the same periods than *Model 1* and *2* respectively. As shown in Figure 3, there are no significant differences in the estimates with pre-pandemic data between the use of UR or URE as a dependent variable in the modelling. This was a predictable result, since the large differences between these two variables are concentrated in the pandemic period, with the implementation and extensive use of ERTEs.

Then, when data from the four quarters of 2020 are added to the estimation with URE, it is observed that the relationship becomes even stronger in all regions (Figure 4), and the models offer, in almost all cases, an adjustment coefficient above 0.9. This is because we are adding data that show a period in which economic activity collapsed in each region, and at the same time, the URE was subject to a significant increase, mainly in the second quarter of 2020, due to a slight increase in registered unemployment together with a large increase in "hidden unemployment" linked to the containment exercised by the ERTEs. Therefore, the doubt arises that if the people who took advantage of the ERTEs had been counted as idle resources (unemployed) in the labour market statistics or if they had not mediated these employment containment policies, most of these people would have become strictly unemployed. Therefore, the original Okun's relationship, which takes UR as a dependent variable, not only would not have become weaker but, on the contrary, would have become stronger, showing a solid impact of variations in activity on unemployment.

FIGURE 3.
**Regional Okun's coefficiencts with UR (Model 1) and URE (Model 3)**

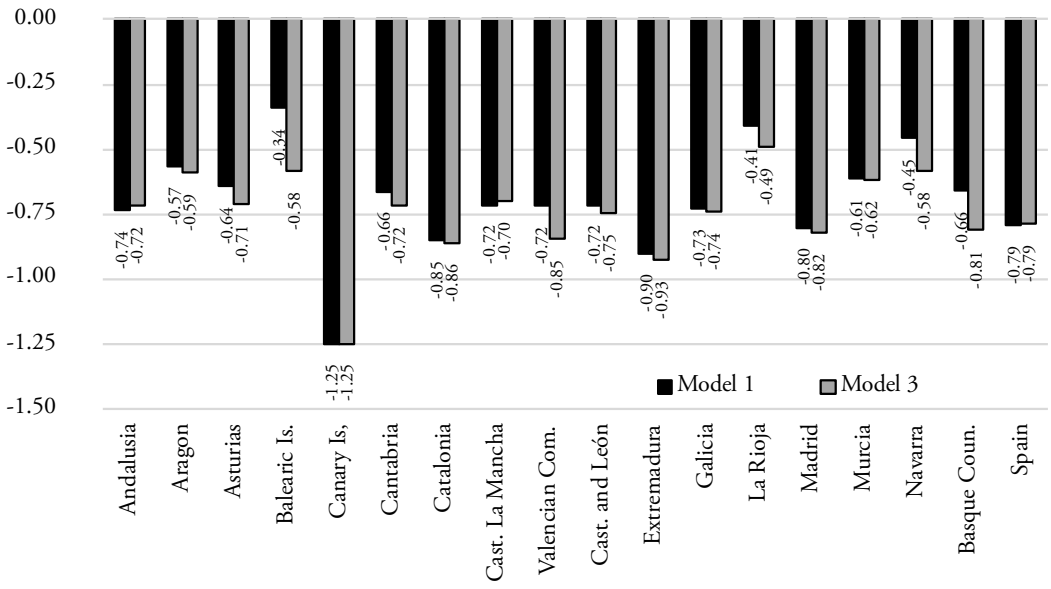
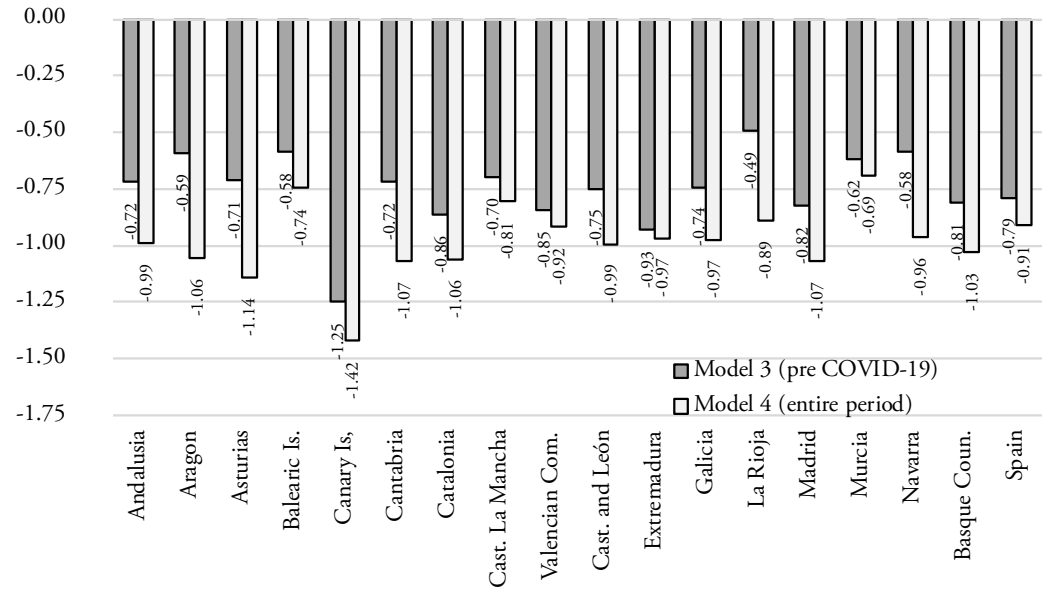



FIGURE 4.
**Regional Okun's coefficients with expanded unemployment rate (URE) as dependent variable**




## 4.2. PROJECTED UR

From the previous analysis it is clear that if the people who had been taken in by the ERTEs had been counted as unemployed, given that they were not actually employed, Okun's law, which relates the unemployment rate and output, would not have suffered significant alterations in the Spanish regions during the economic crisis provoked by the COVID-19 pandemic. As a way of reinforcing this hypothesis, in the third stage of this research, we compare the real unemployment generated during the COVID-19 pandemic, that is, the one that includes the unemployed as counted by the INE plus the "hidden unemployment", that is workers covered by the ERTEs, with the unemployment expected from the

dramatic fall in economic activity during the pandemic, taking into account the Okun relationship in force in the Spanish regions in the pre-pandemic period. If these two variables follow a similar evolution during the pandemic, it supports the notion that without the ERTEs, the unemployment rate measured by INE would have significantly risen during the pandemic, as predicted by Okun's law. Consequently, the relationship estimated using the conventional variables (INE unemployment rate and GDP) would not have experienced significant changes.

Thus, as indicated in the methodological section, we use the estimated relationship between unemployment and output (Okun's law) from *Model 1* to project the unemployment rate (UR) for the four quarters of 2020, incorporating in the model the information on what happened with economic activity in each region of Spain in that period. Thus, we obtained a measure of what would have happened to the unemployment in each Spanish region during the first four quarters of the pandemic, if Okun's relationship had been maintained during the pandemic. Then we compared those values with the true evolution of UR and with URE in the same period.

Figure 5 shows the results. As seen, in all the regions, the pre-pandemic models predicted a significant increase in unemployment, mainly in the second quarter of 2020 (dotted lines), when the greatest fall in economic activity was recorded. Therefore, the expected values for unemployment rates in the regions predicted a dramatic situation in regional labour markets. On the one hand, from the productive point of view, the projections indicated a significant increase in the number of people who would increase the amount of idle resources in the regional economies, and, on the other hand, from the point of view of workers, a high percentage of employed persons would see their employment and source of income disappear.

When comparing these projections with the actual evolution of the INE unemployment rates in that period, it is observed that the official statistics did not reflect these behaviours, registering in all cases a slight increase in unemployment. In effect, the interannual increase in the unemployment rate (INE) in the second quarter of 2020 was between 0.25 pp and 4.75 pp according to regions (La Rioja and Cantabria, respectively), while the gap between the expected value of the unemployment rate from *Model 1* and the real value measured by the INE ranges according to region between 8 pp and 33 pp in the second quarter of 2020 (Castilla La Mancha and Canary Islands, respectively). Initially, this could be interpreted as a "breakdown" of Okun's law in the regions from the COVID-19 pandemic. As shown in Figure 6, these differences seem to be negatively related to the estimated Okun coefficients (correlation coefficient = -0.79). That is, those regions with the highest Okun coefficients in absolute value, such as the Canary Islands, Catalonia, Extremadura, Madrid and Andalusia, are those with the greatest distance between the UR value projected by the model and the unemployment rate measured by INE, which is logical given that a high Okun coefficient in absolute value implies a strong increase in unemployment in the face of an abrupt fall in economic activity, but in these cases it was not fully reflected in the official statistics.

When we compare these projections with the evolution of the URE variable, it is observed that, although there is not a nearly perfect fit between the two variables in all the regions, in the cases in which this does not occur, the evolution of these variables is much better fit with respect to what was observed with UR, locating the URE variable somewhat above the projections of the models. As Figure 7 shows, the fit between these two variables is positively related to the estimated Okun's coefficient (correlation coefficient=0.75).

The fit between the UR projections and URE is almost perfect in some regions (Andalusia, Asturias, Canary Islands, Catalonia, Extremadura and Madrid), the same regions that have the largest gap between the projected value of UR and the unemployment rate of the INE (UR) and the highest Okun coefficients in absolute value (Figure 7). In these cases, the near perfect fit can have two interpretations. On the one hand, if the application of the ERTE had not been mediated, surely the evolution of unemployment would have shown a trajectory as predicted by *Model 1*, which is reflected in the URE variable; that is, unemployment would have grown significantly. The unemployment rate in the second quarter of 2020 would have been between 17pp and 31pp above the levels observed in almost all of these regions. On the other hand, the nearly perfect fit between the UR projections and URE implies that Okun's relationship continued in force even in the pandemic period.

FIGURE 5.
**Unemployment Rate (UR), Expanded Unemployment Rate (URE) and projected UR with pre-pandemic Okun's law**

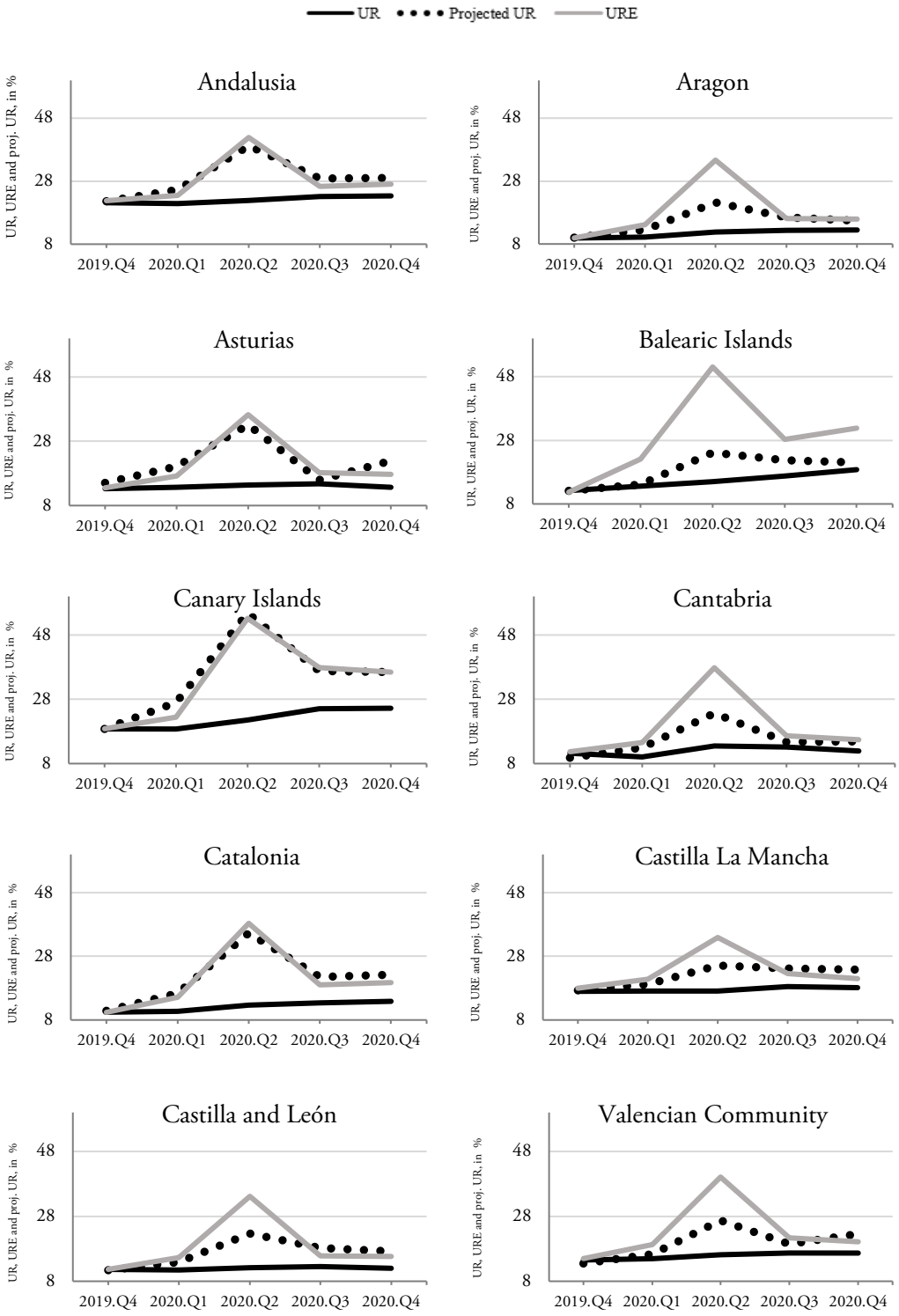
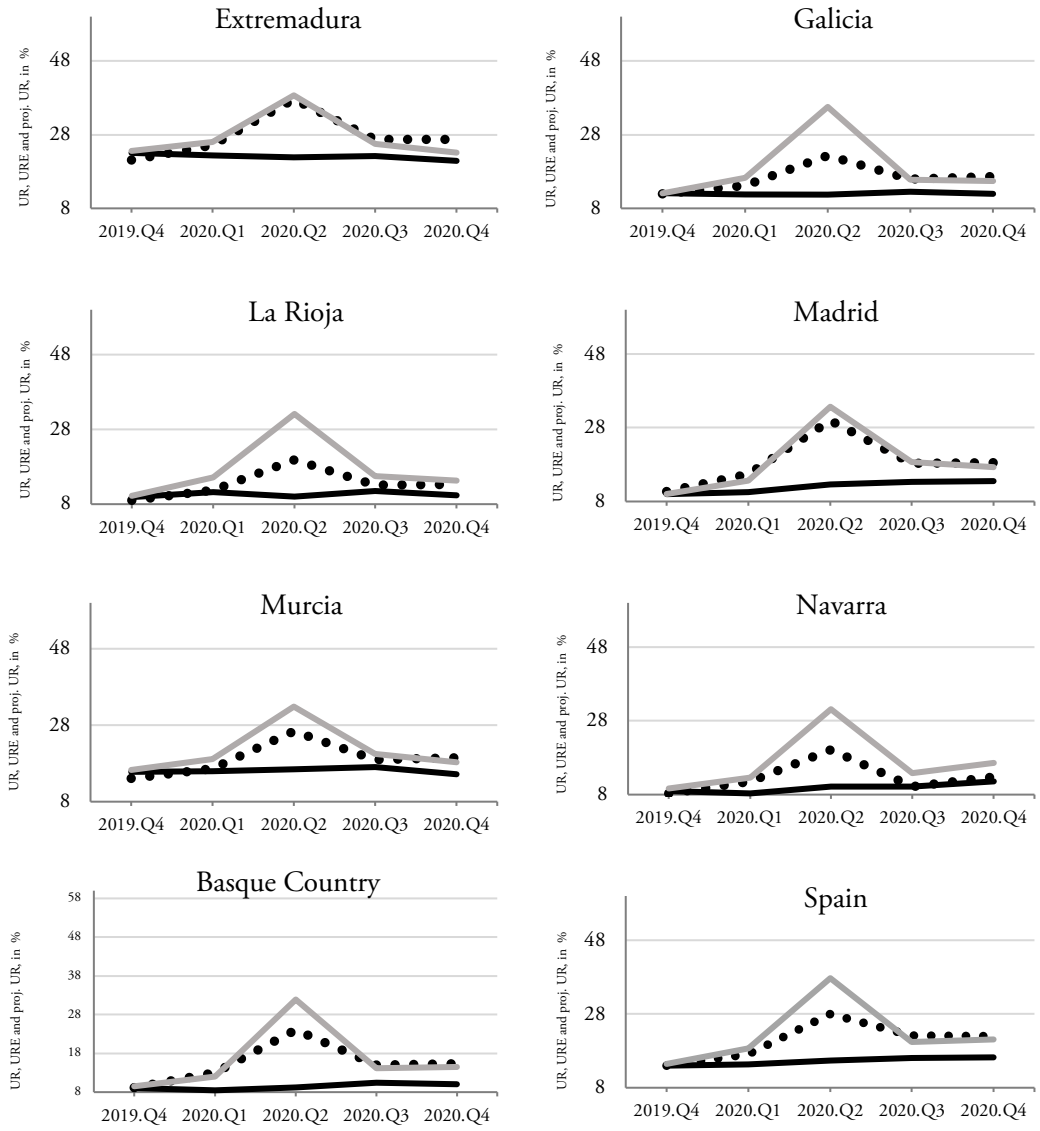


FIGURE 5. CONT.
**Unemployment Rate (UR), Expanded Unemployment Rate (URE) and projected UR with pre-pandemic Okun's law**




In the other regions, a gap is observed between the URE variables and the UR projections. Within this group, the regions of Murcia, the Valencian Community, the Basque Country and Castilla La Mancha have the best fit between both variables, with gaps lower than 9 pp in the peak of the second quarter of 2020. All these regions present Okun coefficients at intermediate levels within the range of values estimated for the Spanish regions (Figure 7). In this quarter, the unemployment would have been between 8 pp and 15 pp higher than that recorded by labour market statistics if the ERTEs had not been mediated.

In the rest of the regions, although the gap between the UR projections and the URE variable is greater than 10 pp in the highest peak, in all of them, the unemployment forecast was approximately 10 pp higher than that recorded by the statistics of the INE.

Therefore, despite the fact that the fits between URE and UR projections are not perfect, the observed evolution allows us to affirm that, although official statistics did not demonstrate the validity of Okun's law with the COVID-19 pandemic, in all regions the idle resources increased with the falling GDP,

and although perhaps not all would have become strictly unemployed had the ERTEs not been mediated, Okun's relationship continued to be relatively strong in all these regions.

FIGURE 6.
**Gap between Projected Unemployment rate and INE Unemployment rate in 2020.Q2 and the Okun's coefficients (*Model 1*)**

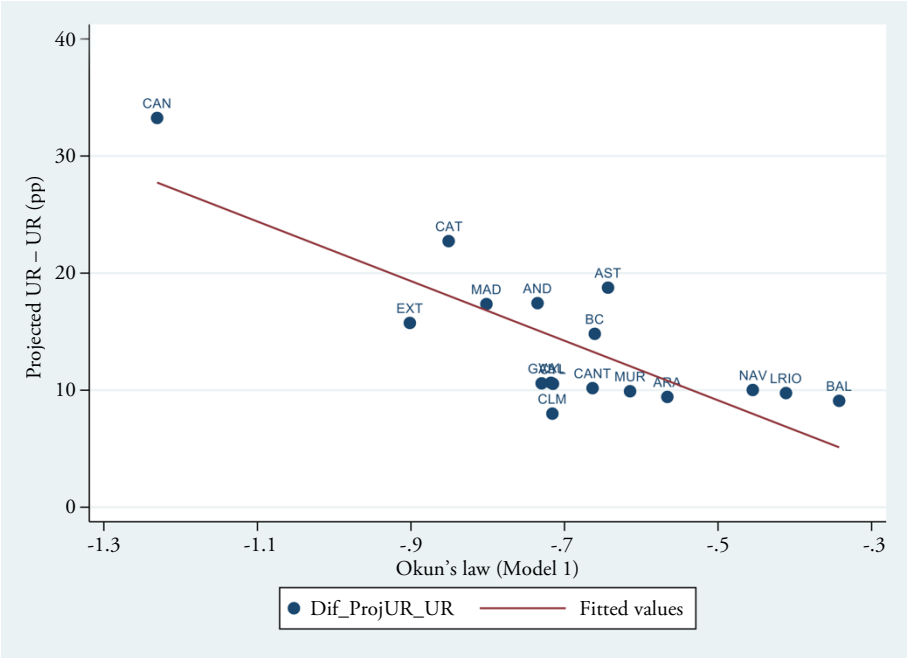
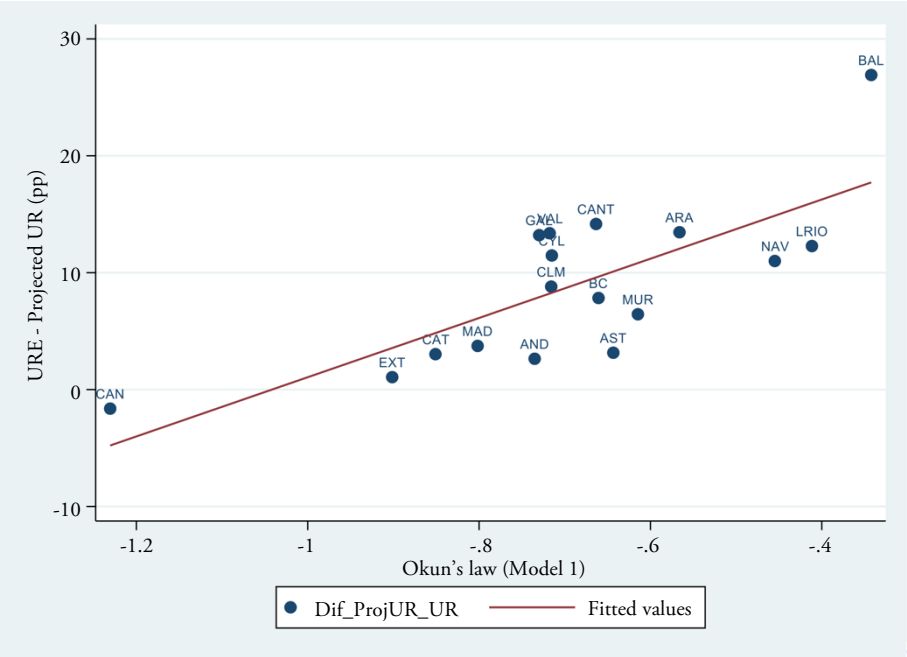



FIGURE 7.
**Gap between Expanded Unemployment Rate (URE) and Projected Unemployment rate in 2020.Q2 and the Okun's coefficients (*Model 1*)**



## 5. Conclusions

From this analysis, it can be concluded that, in those Spanish regions where the relationship between unemployment and output were among the strongest in Spain in the pre-pandemic period of COVID-19, if the ERTEs had not been implemented, unemployment would have suffered a dramatic increase in the worst moment of the crisis (2020.Q2), standing between 17pp and 31pp above the unemployment levels recorded by official statistics. Therefore, it is this unemployment "hidden by the ERTEs" that prevented Okun's law from being confirmed during the pandemic. In other regions, where the Okun relationship before the pandemic was somewhat weaker, even though the rise in the unemployment rate would have been somewhat smaller compared to the scenarios mentioned earlier without the ERTEs, it would still not have resulted in a difference of less than 8pp when compared to the official statistics' unemployment rate.

This leads us to think that the estimation of this relationship depends on how unemployment is measured. Under the "promise" of the companies that it would be a temporary situation, the people sheltered by the ERTEs were in general people who became part of the idle resources of the economy. In other words, they were unemployed and receiving unemployment insurance due to the limitation of mobility and the consequent hibernation of the economy in order to prevent the spread of the COVID-19 pandemic.

Therefore, from the productive point of view, it seems that Okun's law continued to be met, that is, the relationship between the variation in economic activity and the variation in idle labour resources continued in force. In addition, if the assumption were made that all the people who took advantage of the ERTEs would have fallen into unemployment if this containment policy had not been mediated, the relationship between economic growth and unemployment would have become even stronger in all regions.

From the social point of view, this situation can be visualized as the implementation of a policy that managed to mitigate the dramatic impact of the fall in the level of economic activity on people, which if the reception of the ERTEs had not been mediated would have meant total loss of their jobs, with the consequent uncertainty about future job placement. In fact, the results of this analysis indicate that if this policy had not been mediated, the unemployment rate would have been, depending on the region, between 8pp and 31pp above the level recorded by the INE statistics.

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## ORCID

*M. Sylvina Porras-Arena* https://orcid.org/0000-0003-0507-9814
*Ángel L. Martín Román* https://orcid.org/0000-0002-4777-4324
*Diego Dueñas-Fernández* https://orcid.org/0000-0002-1120-8873
*Raquel Llorente-Heras* https://orcid.org/0000-0001-9496-1811

## Appendix

Table. A.1
Unit Root test - Augmented Dickey Fuller Test (Null hypothesis: the series has a unit root)

| | D(UR) | | D(URE) | | D(Log_GDP) | |
|---|---|---|---|---|---|---|
| | statistic | p-value | statistic | p-value | statistic | p-value |
| Andalusia | -1.761 | 0.074 | -11.370 | 0.000 | -10.142 | 0.000 |
| Aragon | -5.523 | 0.000 | -11.308 | 0.000 | -10.237 | 0.000 |
| Asturias | -4.190 | 0.000 | -11.582 | 0.000 | -10.079 | 0.000 |
| Balearic Islands | -1.543 | 0.115 | -10.227 | 0.000 | -9.372 | 0.000 |
| Canary Islands | -5.694 | 0.000 | -9.959 | 0.000 | -9.637 | 0.000 |
| Cantabria | -8.595 | 0.000 | -11.736 | 0.000 | -10.273 | 0.000 |
| Catalonia | -4.134 | 0.000 | -11.313 | 0.000 | -10.147 | 0.000 |
| Castilla La Mancha | -3.434 | 0.001 | -9.246 | 0.000 | -9.703 | 0.000 |
| Valencian Community | -2.414 | 0.016 | -10.615 | 0.000 | -9.990 | 0.000 |
| Castile and León | -2.616 | 0.010 | -11.553 | 0.000 | -10.242 | 0.000 |
| Extremadura | -5.308 | 0.000 | -9.238 | 0.000 | -7.888 | 0.000 |
| Galicia | -1.979 | 0.047 | -11.586 | 0.000 | -9.753 | 0.000 |
| La Rioja | -8.938 | 0.000 | -7.129 | 0.000 | -7.915 | 0.000 |
| Madrid | -5.884 | 0.000 | -7.404 | 0.000 | -10.084 | 0.000 |
| Murcia | -2.205 | 0.028 | -9.262 | 0.000 | -9.921 | 0.000 |
| Navarra | -7.797 | 0.000 | -12.420 | 0.000 | -10.178 | 0.000 |
| Basque Country | -6.011 | 0.000 | -12.072 | 0.000 | -9.973 | 0.000 |
| Spain | -1.895 | 0.056 | -10.830 | 0.000 | -10.120 | 0.000 |

**Notes:** The tests were performed on the first difference of the variables: unemployment rate (UR), extended unemployment rate (URE) and logarithm of GDP (log_GDP). The null hypothesis is rejected when the p-value is less than 0.05. In the tests on D(UR) for Andalusia, Balearic Islands and Spain, the H0 was not rejected, and therefore the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test was also applied, yielding LM statistics of 0.29, 0.17 and 0.30 respectively. Therefore, in both cases the H0 that the series are stationary was not rejected since the statistics are below d 0.463 (5%).

TABLE A.2
Test on the residuals of Model 1, 2, 3 and 4: Normality, Heteroskedasticity and Serial Correlation (p-values)

| | Dep. variable: Unemployment Rate (UR) | | | | | | | | Dep. variable: Expanded Unemployment Rrate (URE) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Model 1* | | | | *Model 2* | | | | *Model 3* | | | | *Model 4* | | | |
| | | | Serial Corr. | | | | Serial Corr. | | | | Serial Corr. | | | | Serial Corr. | |
| | Norm. | Het. | LM(1) | LM(4) | Norm. | Het. | LM(1) | LM(4) | Norm. | Het. | LM(1) | LM(4) | Norm. | Het. | LM(1) | LM(4) |
| Andalusia | 0.76 | 0.52 | 0.77 | 0.05 | 0.86 | 0.87 | 0.49 | 0.38 | 0.75 | 0.49 | 0.89 | 0.06 | 0.71 | 0.82 | 0.24 | 0.05 |
| Aragon | 0.37 | 0.68 | 0.73 | 0.58 | 0.35 | 0.68 | 0.99 | 0.74 | 0.88 | 0.28 | 0.99 | 0.30 | 0.31 | 0.48 | 0.03 | 0.07 |
| Asturias | 0.78 | 0.70 | 0.03 | 0.09 | 0.80 | 0.79 | 0.07 | 0.32 | 0.86 | 0.67 | 0.02 | 0.08 | 0.81 | 0.86 | 0.02 | 0.19 |
| Balearic Islands | 0.45 | 0.65 | 0.37 | 0.01 | 0.65 | 0.71 | 0.36 | 0.01 | 0.56 | 0.13 | 0.04 | 0.02 | 0.69 | 0.69 | 0.69 | 0.08 |
| Canary Islands | 0.58 | 0.61 | 0.86 | 0.98 | 0.55 | 0.63 | 0.85 | 0.94 | 0.48 | 0.66 | 0.90 | 0.99 | 0.83 | 0.92 | 0.68 | 0.99 |
| Cantabria | 0.13 | 0.92 | 0.08 | 0.05 | 0.30 | 0.75 | 0.24 | 0.41 | 0.26 | 0.68 | 0.15 | 0.25 | 0.38 | 0.07 | 0.39 | 0.23 |
| Catalonia | 0.71 | 0.09 | 0.47 | 0.61 | 0.91 | 0.80 | 0.11 | 0.29 | 0.63 | 0.18 | 0.24 | 0.35 | 0.79 | 0.89 | 0.61 | 0.73 |
| Castilla La Mancha | 0.61 | 0.48 | 0.67 | 0.13 | 0.73 | 0.41 | 0.42 | 0.16 | 0.33 | 0.84 | 0.05 | 0.05 | 0.39 | 0.65 | 0.56 | 0.07 |
| Valencian Community | 0.89 | 0.87 | 0.12 | 0.10 | 0.98 | 0.08 | 0.23 | 0.01 | 0.61 | 0.55 | 0.03 | 0.02 | 0.50 | 0.91 | 0.13 | 0.40 |
| Castile and León | 0.67 | 0.86 | 0.33 | 0.25 | 0.69 | 0.82 | 0.18 | 0.11 | 0.56 | 0.74 | 0.08 | 0.14 | 0.87 | 0.77 | 0.15 | 0.39 |
| Extremadura | 0.41 | 0.70 | 0.19 | 0.19 | 0.71 | 0.07 | 0.21 | 0.35 | 0.41 | 0.67 | 0.27 | 0.44 | 0.48 | 0.62 | 0.10 | 0.38 |
| Galicia | 0.88 | 0.14 | 0.74 | 0.96 | 0.73 | 0.52 | 0.55 | 0.94 | 0.68 | 0.85 | 0.49 | 0.80 | 0.28 | 0.49 | 0.02 | 0.22 |
| La Rioja | 0.33 | 0.72 | 0.27 | 0.77 | 0.23 | 0.64 | 0.65 | 0.52 | 0.28 | 0.63 | 0.38 | 0.71 | 0.50 | 0.41 | 0.48 | 0.96 |
| Madrid | 0.52 | 0.55 | 0.40 | 0.52 | 0.16 | 0.15 | 0.30 | 0.85 | 0.46 | 0.77 | 0.07 | 0.27 | 0.94 | 0.77 | 0.05 | 0.32 |
| Murcia | 0.58 | 0.42 | 0.21 | 0.09 | 0.65 | 0.78 | 0.11 | 0.05 | 0.49 | 0.39 | 0.40 | 0.09 | 0.48 | 0.63 | 0.65 | 0.09 |
| Navarra | 0.92 | 0.85 | 0.63 | 0.58 | 0.81 | 0.84 | 0.79 | 0.79 | 0.88 | 0.65 | 0.13 | 0.06 | 0.29 | 0.88 | 0.93 | 0.31 |
| Basque Country | 0.78 | 0.72 | 0.45 | 0.62 | 0.20 | 0.95 | 0.39 | 0.62 | 0.79 | 0.39 | 0.44 | 0.82 | 0.59 | 0.90 | 0.35 | 0.73 |
| Spain | 0.70 | 0.92 | 0.41 | 0.85 | 0.42 | 0.84 | 0.98 | 0.98 | 0.66 | 0.04 | 0.03 | 0.21 | 0.89 | 0.27 | 0.96 | 0.49 |

**Notes:** UR is the unemployment rate of the LFS. URE is the expanded unemployment rate (unemployed + people covered by the ERTE). The period in Model 1 and 3 is 2005.Q1 – 2019.Q4 and in Model 2 and 4 is 2005.Q1 -2020.Q4. The residual test are: Normality test Jarque-Bera (Null hypothesis: normality), Heteroskedasticity Test Breusch-Pagan-Godfrey (Null hypothesis: Homoskedasticity), Serial Correlation: Breusch-Godfrey LM Test (Null hypothesis: No serial correlation at up to 1 lag or 4 lags).