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The robustness of Okun's law in Spain, 1980–2004 Regional evidence

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Abstract

The purpose of this paper is to analyse Okun's law for the Spanish regions over the period 1980–2004. Based on its "gap" specification, the results show that an inverse relationship between unemployment and output holds for most of the regions and for the whole country. However, the quantitative values of Okun's coefficients are quite different, a result that is partially explained by regional disparities in productivity growth. These differences imply that, when it comes to policy issues, conventional aggregate demand/supply management policies should be combined with region-specific policies.

JEL classification: R11; R15

Keywords: Okun's law; Unemployment; Output; Productivity; Spanish regions

1. Introduction

Although in the last quarter of the century, Spain has largely and gradually reduced its per capita GDP differences with the EU, these continue to be relatively high: in PPS terms the per capita Spanish GDP was 74.2% of the EU[1] in 1980 while it was 89.9% in 2004. As for the Spanish regions, it is also happens that all of them have converged to the European average. However, the speed of convergence has varied considerably across them; among other things, this result

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[1] All references to EU in this paper include the 15 Member States, as before the last two EU-enlargements of 2004 and 2007.

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seems to be related to the ample and persistent differences in regional unemployment rates, this showing, as in Italy (Mauro, 2004), the existence of a dualistic economy.

Thus, the implementation of adequate policies to continue with the convergence process via the reduction of unemployment rates is also one of the main goals of Spanish national and regional policymakers. In order to devise these policies it would be crucial to elucidate if there is a long-term relationship between unemployment and output. This connection, known as Okun's law (Okun, 1962, 1970), simply postulates the existence of a negative empirical link between changes in the unemployment rate and changes in real output.

Okun's law is important for both theoretical and empirical reasons. From a theoretical point of view, Okun's law, which is rooted in old and new Keynesianism is, along with the Phillips curve, a key element to derive the aggregate supply curve; from an empirical perspective, "*Okun's coefficient is a useful "rule of thumb" in forecasting and policy –making*" (Harris & Silverstone, 2001).[2]

In the last two decades a large number of empirical studies have investigated the validity of this law with findings that, on the whole, tend to support it (Adanu, 2005). Notwithstanding, it has been shown that the absolute value of the estimated Okun coefficient, initially considered to be in the vicinity of three, not only varies substantially according to the time and spatial samples under consideration (Perman & Tavera, 2004), but also tends to be well below three. Furthermore, it is also important to note that, generally speaking, the values of this coefficient change according to the model specification of Okun's law and the method employed to estimate it.

Although the empirical study of Okun's law has indeed blossomed since the publication of Prachowny's paper (1993), most of it only deals with data at national level. Fortunately, in the last few years some studies have tried to overcome this shortcoming, thus introducing a regional dimension in the analysis of the relationship between output and unemployment. Freeman (2000), Adanu (2005) and Christopoulos (2004) are among the most relevant contributions.

Drawing from this regional literature, this paper aims to estimate Okun's coefficient for the seventeen Spanish regions over the 1980–2004 period. This is important in order to know by how much the unemployment rate of these regions causes changes in output. For a country that has suffered considerably from the persistence of high regional unemployment dispersion, the knowledge of this relationship for every region is important from the point of view of the implementation of sound and efficient economic policies.

The remainder of the paper is organized as follows. Section 2 describes the methodology. In Section 3 the empirical results are discussed. After that, Section 4 analyses whether any kind of pattern is present in the regional Okun's coefficients and offers a tentative explanation of regional differences. Finally, Section 5 offers the main conclusions and some policy recommendations.

2. Methodology

As suggested by Okun (1970), there are two classes of Okun's law specifications: the first-difference model and the "gap" model. According to the first-difference model, the relationship between the natural log of observed real output (y_t) and the observed unemployment rate (u_t) is given by the expression

$$y_t - y_{t-1} = \alpha + \beta(u_t - u_{t-1}) + \varepsilon_t \tag{1}$$

[2] In addition, Okun's law has been used in macroeconomic models, as in Dreger and Marcellino (2007).

where α is the intercept, β ($\beta < 0$) is Okun's coefficient measuring by how much changes in the unemployment rate produce changes in output, and ε is the disturbance term. In order for this specification to be correct either the series between brackets have to be stationary or, if they were nonstationary, they have to be cointegrated to avoid spurious regressions.

From the point of view of the "gap" model, the specification is given by the expression

$$y_t - y_t^* = \alpha + \beta(u_t - u_t^*) + \varepsilon_t \tag{2}$$

where y^* represents the log of potential output, u^* is the natural rate of unemployment and the other symbols have the same meaning as in Eq. (1). In this second specification, the left-hand side term represents the output gap, whereas $(u_t - u_t^*)$ captures the unemployment gap. In other words, the difference between the observed and potential real GDP captures the cyclical level of output. Likewise, the difference between the observed and natural rate of unemployment represents the cyclical rate of unemployment. It is obvious that the stationary or cointegration conditions of these gaps also have to be fulfilled.

Of these two Okun's law specifications we have opted for the "gap" model. A major problem with this model is that there are no observable data on y^* and u^* so they have to be estimated, which means it is necessary to generate y and u trend series. A problem then arises concerning the choice of the detrending method. To relatively overcome it, and in order to test for the robustness of the Okun's coefficients, we apply three different detrending techniques: a quadratic trend (QT), the Hodrick–Prescott (HP) filter and the Baxter–King (BK) filter.

3. Empirical results: the regional Okun coefficients

In this section we test the "gap" model of Okun's law for Spain and its 17 regions. In order to do so, we follow a four-step process. In the first step the unemployment and output gaps are generated using the aforementioned detrending techniques.

In the second step, the cyclical components of the unemployment and output series for all regions and the nation are plotted (see Fig. 1),[3] showing that, as a general rule, the inverse relationship hypothesised by Okun seems to hold; the only obvious exceptions are those of Extremadura and La Rioja (see their plots for the initial years of the sample). It is also important to note that the plots of the cyclical components of output and unemployment of the largest regions (Andalucía, Cataluña and Madrid) tend to be very similar to the plot for Spain. As expected, this simply means that the impact of these larger regions on the national gaps is larger than that of the smaller regions.

After that, the third step of the empirical analysis consists of performing unit root tests on the gaps of the unemployment and output series. Although the standard test for unit roots is the augmented Dickey-Fuller (ADF) we have not only employed it, but for robustness we have also used the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test. According to the ADF test most of the series are stationary, in particular when the quadratic trend and HP filter are employed. The stationarity of the series is even more clearly established when the KPSS test is computed; in this case, all series prove to be $I(0)$ for the three detrending methods.[4]

The fourth and final step involves the OLS estimation of Okun's law by using the output and unemployment gaps series generated in the first step. The most interesting results (Table 1) are as follows: Firstly, Okun's law is confirmed for 15 out of 17 regions when the first two detrending

[3] For ease of reference we only show the gaps obtained with the HP filter for some selected regions.

[4] For the sake of saving space the results are not offered in the paper. However, they are available upon request.

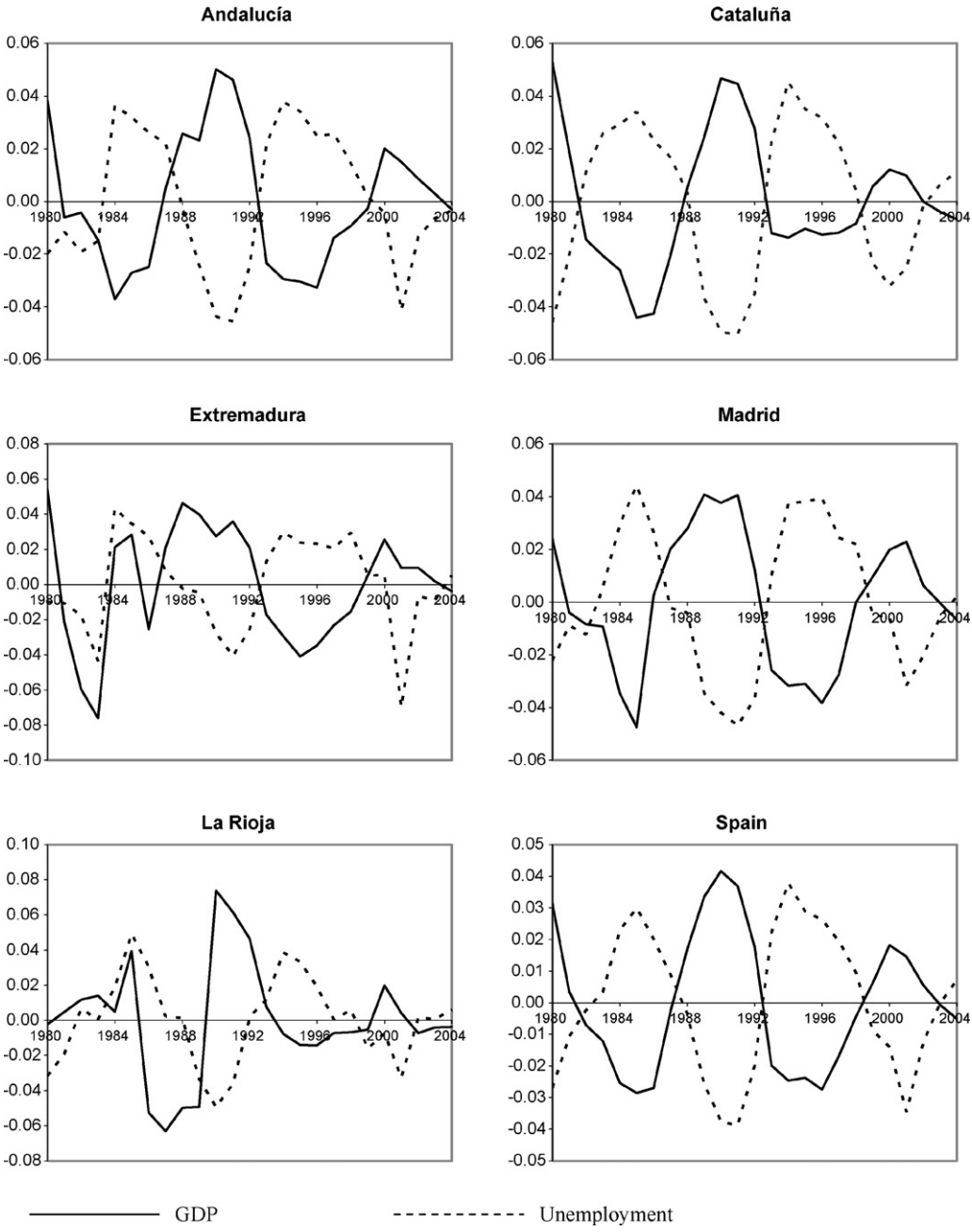

Fig. 1. Regional and national differences in business cycles.

techniques are considered and for 11 regions when the BK filter is applied; as for Spain, Okun's law holds whatever the detrending method employed. Secondly, the results obtained with the QT and HP filter show, for each region, roughly the same coefficients, whereas those obtained with the BK filter tend to be a bit lower, this indicating a close correspondence throughout the

Table 1
Parametric estimates of Okun's law.

Regions	Quadratic trend		HP filter		BK filter	
	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic
Andalucía (A)	−0.92	−8.45	−0.83	−7.73	−0.60	−4.38
Aragón (Ar)	−0.79	−6.14	−0.73	−6.13	−0.55	−2.94
Asturias (As)	−0.45	−2.52	−0.32	−2.08	−0.14	−0.82
Baleares (B)	−0.60	−7.33	−0.58	−5.96	−0.42	−2.87
Canarias (C)	−0.92	−4.86	−1.04	−6.02	−1.03	−3.89
Cantabria (Cn)	−0.85	−3.69	−0.79	−3.36	−0.31	−0.80
Castilla y León (CL)	−0.62	−2.90	−0.49	−2.50	−0.15	−0.78
Castilla-La Mancha (CM)	−1.41	−5.11	−1.55	−5.81	−0.77	−1.98
Cataluña (Ct)	−0.80	−8.18	−0.76	−9.95	−0.63	−6.19
C. Valenciana (CV)	−0.89	−13.16	−0.86	−12.62	−0.80	−6.00
Extremadura (E)	−0.31	−1.04	−0.11	−0.44	0.35	1.54
Galicia (G)	−0.54	−3.38	−0.61	−3.64	−0.32	−1.08
Madrid (M)	−0.90	−9.86	−0.83	−8.47	−0.78	−5.10
Murcia (Mu)	−0.95	−9.20	−0.97	−9.77	−0.79	−3.94
Navarra (N)	−1.35	−5.03	−1.50	−6.90	−1.12	−3.44
País Vasco (PV)	−1.08	−7.73	−1.08	−8.38	−1.06	−5.01
Rioja (La) (R)	−0.38	−1.40	−0.35	−1.29	−0.24	−0.56
Spain	−0.96	−13.84	−0.91	−13.92	−0.74	−7.03
Regions Group 1	−0.94	−21.09	−0.93	−22.07	−0.75	−12.07
Regions Group 2	−0.55	−6.47	−0.45	−5.63	−0.08	−0.78

Notes: (a) Regions Group 1: Murcia, Canarias, Madrid, Baleares, Cataluña, Comunidad Valenciana, Navarra, Andalucía, País Vasco, Castilla-La Mancha; (b) Regions Group 2: Cantabria, Aragón, Castilla y León, Rioja (La), Asturias, Galicia, Extremadura. Source: Spanish National Statistics Institute (INE).

three detrending methods. Thirdly, differences in Okun's coefficients are notable and statistically significant across regions.

4. Okun's law regional differences: what factors are behind?

Looking back to the previous results we are interested in knowing whether there is any pattern in them, be it a development degree and/or a spatial pattern. To do that, and for reasons of simplicity, we have only considered the case of HP filter as detrending technique. As to the searching for a development degree pattern, we have computed the correlation coefficient between the average of the regional per capita GDP for the sample period and the Okun coefficients. The value obtained (−0.39) does not result statistically significant at 95% level, which clearly reveals that there is not any link between these two sets of variables.

In order to examine whether a spatial pattern regarding the value of Okun's coefficients exists, the well-known Moran's I statistic has been computed, using as distance matrix the inverse of the standardized distance. Once again, the result obtained (−0.12) is not statistically significant, this showing that there is no spatial pattern between the regional aforementioned coefficients. Nevertheless, and because Moran's I statistic offers just a single figure for the entire data set, it does not allow us to perceive the regional structure of spatial autocorrelation. These limitations are overcome by the Moran scatterplot which, plotting the spatial lag against the original Okun's

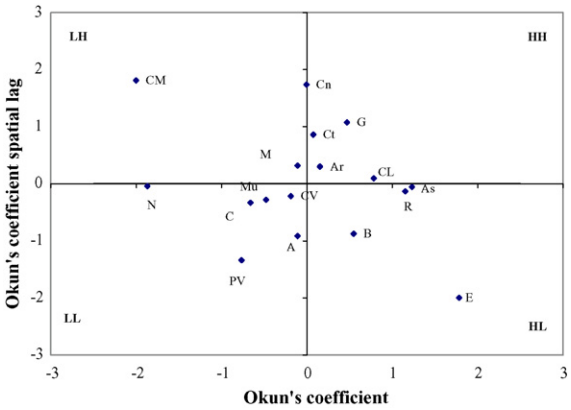

Fig. 2. Moran scatterplot for Okun's coefficients.

coefficients,[5] is displayed in Fig. 2. The four quadrants of this figure refer to the four types of spatial association: on the one side, the quadrant HH (LL) represents regions with high (low) values[6] surrounded by regions with high (low) values; on the other side, the quadrant HL (LH) represents regions with high (low) values surrounded by regions with low (high) values. As it can be seen, two regions (Extremadura and Castilla-La Mancha) are, to a great extent, responsible for the absence of spatial dependence. In fact, if these two regions were removed from the analysis, Moran's I statistic would become positive as can be noted by looking at the Moran scatterplot.

Although we have shown that there is no apparent pattern (neither related to the development degree nor to geographical location) in explaining regional differences in the Okun coefficients, there is no doubt that these differences are related to many and diverse factors. In particular, as a simple decomposition of the GDP growth shows that one of its main determinants is the growth in productivity, we consider necessary to pay attention to it. The rationale behind the value of Okunís coefficient is that, for a given increase in the unemployment rate, the higher the increase in productivity, the lower the fall in output. Put it in a different way, this means that – all other things being held constant – we should expect a positive relationship between the evolution of productivity and the Okun coefficient. This is, in fact, what happens in the Spanish case for the period 1980–2004. As can be seen in Fig. 3, there is a positively and statistically significant correlation between the aforementioned variables; to be precise, the correlation coefficients takes a value of 0.67.

As regions with relative low (high) increases in productivity tend to have a high (low) Okun's coefficient, it seems useful to estimate Okun's law for both groups. In our case these two groups are made up of regions with an annual productivity growth below the Spanish average (Group 1) and above it (Group 2). The results obtained (see the last two rows in Table 1) confirm that the differences on the Okun coefficients between the two groups are remarkable and statistically significant, especially when the BK filter is being used. Thus, our conclusion is that the explanation for the regional differences in the Okun coefficient partially rests on differences in productivity growth.

[5] Both values are standardized.

[6] As the Okun coefficient is negative, high values refer to less negative values.

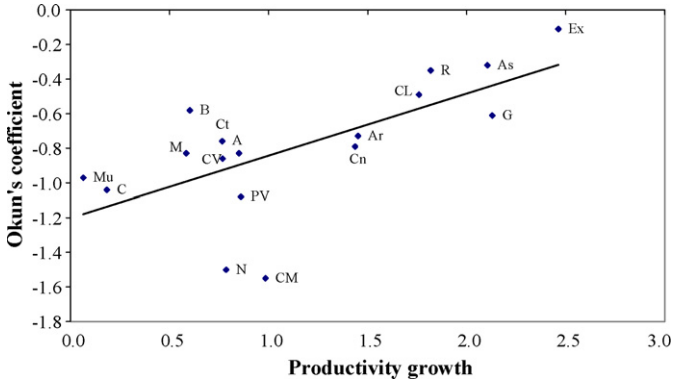

Fig. 3. Productivity growth and Okun's coefficients.

5. Concluding remarks and policy issues

This paper has estimated Okun's coefficients for the Spanish regions as it is an interesting case study due to their noticeable high unemployment rates dispersion. By using a conventional "gap" specification and (for the sake of robustness) different detrending techniques, several findings have emerged from our empirical analysis. First of all, Okun's law holds for most regions and, in particular, for the whole country; this means it could be considered as a "near-rationale rule of thumb" (Bajo-Rubio, Díaz-Roldán, & Esteve, 2007) to be used, with some caveats, to offer unemployment/income forecasts. Secondly, the regional response of output to unemployment is found to be particularly varied with values ranging[7] from a minimum of 0.32 to a maximum of 1.55, which points out to the existence of a certain dualism between regions with very high/low Okun's coefficients. Thirdly, although there is no pattern whatsoever explaining the regional aspects of Okun's law in Spain, the paper illustrates that differences in Okun's coefficients across regions are somehow related to regional differences in productivity growth. Fourthly, it is worth noting that our values of Okun's coefficients are much lower than those estimated by authors such as Okun (1962), Gordon (1984) and Moosa (1997) at national level and Freeman (2000) and Adanu (2005) at regional level; however, our results are more in accordance with those produced by Christopoulos (2004) for the Greek regions.

The previous conclusions allow us to assert that the situation of the labour market in Spain – and its regions – has been hindering the rate of real convergence to the EU mentioned in Section 1. Thus, from a political perspective, two additional conclusions can be drawn. In order to accelerate the speed of convergence with the EU it would be necessary, both at the national and regional level, to implement policies devoted to reduce the unemployment rate and, at the same time, boost productivity. To try to successfully deal with this issue it is crucial to note that we have highlighted two types of regions: those for which the Okun's coefficient is very high and those for which this coefficient is very low or, alternatively, the law simply does not hold. It is obvious that policymakers should have in mind this dualism when planning and implementing appropriate (region-specific) policy measures.

As for the reduction in unemployment, a better performance of the national and regional labour markets is needed to make them more efficient and flexible. It should also be evident

[7] When the HP filter is employed.

that in those regions for which Okun's coefficient is high, different types of short-term demand management policies could be implemented to reduce the unemployment rate. On the other hand, for those regions for which Okun's law does not hold or the coefficient is very low, aggregate supply policies would be more adequate; in these cases, tax and benefit system reforms aimed at increasing work incentives (e.g. reducing the tax wedge and the level of job security provisions on layoffs) and greater wage flexibility (based on a less centralised collective bargaining system and a better understanding between the parties involved in the wage bargaining process)[8] might be pertinent (Arpegis, 2005; Maza & Villaverde, 2007). Additionally, an increase in interregional labour mobility, removing restrictions related to issues such as housing, employment information (with better labour market search and matching institutions) and the use of different official (national or regional) languages, could also contribute to the fall in unemployment.

On the other hand, to heighten productivity growth, the conventional recipes are appropriate. We mainly refer to medium and long-term policies committed to promoting human capital, R+D and innovation. However, we also refer to policies related to product market reforms (mainly through an increase in competitive pressure), institutional changes facilitating the reallocation of resources towards productivity-enhancing activities as well as improvements in basic (road, railways, water, etc.) and technological infrastructures.

Finally, it is important to notice Okun's law predicts that rising unemployment typically coincides with growth slowdowns. As this is in fact what is currently happening in the Spanish regional economies, the kind of labour market policies previously mentioned seem to go straight to the point. However, policies promoting productivity growth can by no means be discarded because, although in the short term they can contribute to increasing unemployment, in the long-term Spanish regional income convergence with the EU should mainly rely on productivity growth.

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[8] These developments may be supported by the induced pressure of globalisation on wages and the increase of migratory flows to Spain and, in particular, some of its regions.

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