Título: 'Regional resilience to the COVID-19 crisis in Spain: Paradoxical results to a singular crisis'

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Abstract (not to be quoted)

1. Introduction and data base. Conceptual aspects.

Recent economic crisis derived from the socio-sanitary global pandemic caused by the COVID-19 has generated significant and particularly negative effects on the Spanish economy (Bank of Spain, 2020). Although all regions have been negatively affected, there have been notable differences among Autonomous Communities. But the singularity arises when comparing these regional differences to ones observed after previous economic crisis. The aim of this paper is to measure, compare to and explain these differences using economic resilience indicators both in sectoral and regional level. All the Spanish regions were strongly affected by economic crises, albeit with significant differences. Some figures suggest that a group of regions have shown a 'resilience capacity' to overcome the effects of the crisis.

The aim of this paper is not to analyze the impact of the COVID-19 crisis on the Spanish regions, which is going to be described rather synthetically, but to contribute to understand the different behavior of some regions compared to other and the factors which may contribute to explain the positive reaction of those resilient regions. Data supplied by Angel de la Fuente, FEDEA, based on the Regional Accounts provided by the INE and the BBVA data series.

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Although the conceptual discussion of 'resilience' may be largely extended and a good number of empirical research has been recently developed[2], we take the definition by Martin and Sunley (2015) as the starting point of our conceptual framework. Once set out the economic concept of 'resilience', the main question is to clarify which the factors are esteeming it. From this point of view, our motivation is to explore some (possible) factors explaining the unlike reactions of regional economies. In doing so, we have chosen the relationships between regional specialization patterns and productivity as explaining factor. The main contribution of this paper is to enlighten the resilience behaviors experienced by some Spanish regions since the last economic crisis in terms of specialization and productivity, particularly from a sectoral point of view. The group of regions which have sooner and stronger recovered are those which previously have specialized and reinforced in those more productive industries, such as some manufacturing, energy, or some advanced services.

2. Analysis

The paper sets out the differences of the previous footprint and the impact of the COVID-19 crisis in the Spanish NUTS-2 regions, from 2019 until the most recent time data allow. In fact, this part of the paper tries to provide empirically supported answer to the following two questions: i) how different regions have been affected by the crisis; and ii) which regions are proving to be – apparently - more resilient? From this starting point, our analysis delves particularly[3] deeper into specialization and productivity. The aim of this second block of the paper is to test the following two research hypothesis:

- *Resilient regions during previous crises were those which specialized in more productive sectors before the crisis. This helped them to faster and stronger recover from the recessionary shock.*
- *However, the special characteristics of the COVID-19 crisis have changed this photograph and show paradoxical results*.

These hypotheses are related to the economic literature relating productivity and regional resilience using the Friedman's so called 'plucking model' of business cycles (Friedman, 1993). According to this model, the path of an economy's growth can be likened to a string attached to the underside of an upward-sloping board, which is 'plucked' downward at irregular intervals by recessionary shocks (Fingleton et al., 2011). The board represents a slowly rising upper limit or ceiling set by an economy's productivity. Path is assumed to rebound in each case to the (upward-

[2] See, among others, de Groot et al. (2011) for the EU regions; Fingleton et al. (2012) and Martin (2012) for the UK case; Patuelli et al. (2012) for Germany; Doran and Fingleton (2013), for the US metropolitan areas; and Psycharis et al. (2014) for Greek regions. See also the special issue edited by the *Cambridge Journal of Regions, Economy and Society* in 2010 on 'The resilience region'.

[3] There are other likely explanations for different regional paths during downturns and resilience (De Groot et al., 2011). Among others, the financial markets (Claesens et al., 2010; Obstfeld and Taylor, 2004; Kaminsky and Reinhart, 1999) and international trade linkages (Rose and Spiegel, 2010); the institutional framework (De Groot et al., 2006); the household debt (Chmelar, 2013) and fiscal austerity (Estevao and Samake, 2013) and government debt (Alter and Beyer, 2013); or the labour market characteristics (Hijzen and Venn, 2010; Keeley and Love, 2010).

sloping) ceiling level. The higher productivity levels show an economy, the upper ceiling level reaches, the quicker is the recovery from the recession shocks, and more likely this economy behave as resilient.

A) **Economic regional resilience in Spain after 2007**

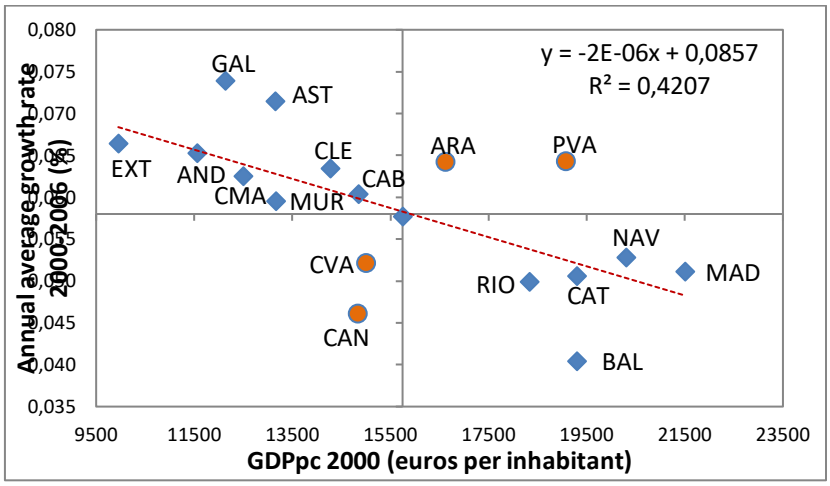
As can be seen in Figures 1 a) and b), in the 2000-2007 period where convergence was experienced, most of the poorer regions (or those with lower GDPpc) reached higher levels of growth than richer regions, except the Basque Country, a region that can be classified as richer, but which experienced rates of GDPpc growth above the Spanish average. Later, between 2008 and 2013, this behavior reversed significantly: regions with lower GDPpc showed more negative changes than the average, while the richer regions (although not all of them) performed more positively, among them the Basque C., Navarra, La Rioja and Catalonia.

Taking this data into account, more specifically the data regarding GDPpc change, we believe that it was possible to distinguish two large regional groups, although there were of course some internal differences. The first group included the regions that exited the economic crisis earlier and stronger for the experience, and which already had per capita income levels above the Spanish average. This group, as shown in Figure 1a and 1b, included the regions from around the Ebro River (Basque Country, La Rioja, Navarra, Aragon and Catalonia) which experienced above average growth since 2007, as well as Madrid and Baleares[4] which, although they have experienced below-average growth levels in recent years, still show a difference in terms of per capita income in comparison to the remaining Spanish regions. Additionally, these regions were those which scored a higher competitiveness index according to the regional indicator estimated by Annoni and Dijkstra (2013). We will identify this group of regions as '*resilient'* ones.

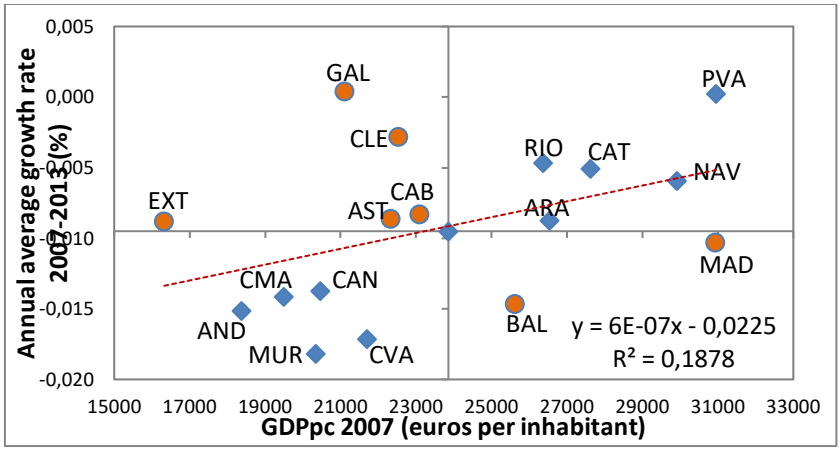
Figure 1. **Regional GDP per capita and annual growth rate in Spain**

a) Pre-crisis period (2000-2007)

[4] Baleares is a peculiar case within the regional development in Spain. Tourism (hotels and restaurants) and related activities (such as air transport, travel agencies…) account for more than the 80 per cent of its total employment and value added. For this reason, both national and international tourism have mainly provoked its positive behavior in 2012 and more intensively in 2013.



b) During the crisis (2008-2013)



NOTE: AND = Andalusia; ARA = Aragon; AST = Asturias; BAL = Balearic Islands; CAN = Canary Islands; CAB = Cantabria; CLE = Castilla y León; CMA = Castilla-La Mancha; CAT = Catalonia; CVA = Com. Valenciana; EXT = Extremadura; GAL = Galicia; MAD = Madrid; MUR = Murcia; NAV = Navarra; PVA = Basque Country; and RIO = La Rioja.

Source: Own elaboration with data from INE (2014)

On the other hand, we had the remaining Spanish regions, already experiencing lower per capita income levels before the crisis and which were unable to catch up with the leading regions, remaining below the national average in 2013. Within this second group, which we will identify as '*not resilient'*, differences can also be observed, which will be explained. Thus, the conclusion was that the 2007-2008 crisis clearly differently affected the Spanish regions. There was a small group of resilient regions which had better and more flexible responded to the general negative economic framework. But the next question is why this uneven regional behavior? To answer this, we analyzed the role of production specialization, structural changes, and its impact on regional productivity, focusing on the group of resilient regions (Cuadrado and Maroto, 2016). Methodologically, the productive specialization analysis carried out will be based on the known specialization coefficients, which compare the relative weight of a sector within a region with the

percentage participation of that sector on a national level. A generic expression of this index would be:

$$IE_{irt} = \left[\frac{\xi_{ir}}{\sum_{i=1}^{m} \xi_{ir}} \Big/ \frac{\sum_{r=1}^{N} \xi_{ir}}{\sum_{i}\sum_{r} \xi_{ir}} \right]_{t=t_k}$$

Where i is the sector in question, r the regional indicator, ξ the analyzed variable calculated in terms of a specific year t_k. This IE_{irt} is always positive. When it exceeds the unit, we can confirm that region r shows specialization in sector i for year t. In our case, the variable used to calculate these indicators was employment, segregating for the different Spanish NUTS 2 regions. A Table will show the specialization coefficients (eq 0.1) - related to total employment - for the two regional groups analyzed in 1990, 2006, and 2013, as well as the cumulate variation of these coefficients between these reference years. The results provisionally obtained suggested that an increasing equality in the productive structures of the regions did not take place during the 2007 crisis. Instead, it seemed that the registered changes left the regions in similar positions to the ones they were in at the beginning of the studied period.

Finally, our analysis of the change in productive structures and its effect on advantages and disadvantages for Spanish regions concluded with a *shift-share* analysis which broke down the regional growth of a specific variable –in our case, sectoral occupation. The *national component* (*NS*) in eq. 0.3 measures which part of the total growth of employment in a sector and region can be explained through the aggregated growth of the country it belongs to over the studied period. Meanwhile, the *structural component* (*IM*) in *eq. 1.4* identifies the productive sectors of a region with a faster or slower growth rate than the national average. Thus, a region with a percentage which is above the average for dynamic sectors should grow faster compared to another in which low growth sectors are predominant. The sum of these two components (*NS* + *IM*) is the growth expected for a specific sector *i* in a region *r*. Finally, the *regional component* or regional competitive advantage (*RS*) in eq 0.4 will be the difference between real and expected growth. That is, it measures the competitive advantage of a specific sector *i* in a region *r*, allowing us to identify the leading activity sectors (when the sector in region *r* grows faster than the national average) compared to other, slower sectors (when the sector in region *r* grows at a slower rate than the national average). The sum of the structural and regional components (*IM*+*RS*) is defined as the aggregated *regional effect* (*RE*). Figure 3 summarizes the results obtained for Spanish regions in 1990-2013.

B) **Economic regional resilience in Spain during COVID-19 crisis**

To contrast the economic regional resilience in Spain during the recent COVID-19 crisis we use the resistance index introduced by Hu et al. (2020) when analyzing the resilience of Chinese cities for the same period. This resistance indicator R_i relates the real change of the

production (or employment) in region *i* during the period of contraction (2019-2020 in our case) and the expected production change in region *i* during the same period:

$$Ri = \frac{\Delta \text{Ri} - \Delta \text{R}_\text{i}^{\text{EXPECTED}}}{\Delta \text{R}_\text{i}^{\text{EXPECTED}}} \qquad (0.5)$$

where $\Delta R_i^{EXPECTED}$ is defined as follows:

$$\Delta R_I^{EXPECTED} = \sum_j^n R_{ij}^t * G_n^{t+k} \qquad (0.6)$$

where R_{ij}^t is the production of the industry *j* within the region *i* at the beginning time *t* (2019 in our case) and G_n^{t+k} is the production change during the period *t+k*.

A positive resistance index means that impact of the crisis in that region has been lower than the national average, and the economic regional resilience is high as the recovering of the region has been faster than the national average. On the contrary, a negative index shows a low resilience for that region. Figure 4 shows the resistance indexes for the Spanish Autonomous Communities for 2020. Once regional resilience analyzed we estimate the sectoral resilience as it might explain at a certain level why some regions are more resilient than others. Figure 5 summarizes these estimates. Once estimated those activities more resilient to COVID-19 in Spain, we analyze how they have changed and their effect to economic regional resilience. In doing so, we compare the regional specialization and the changes in economic structure during the 2019-2020 period in Table 2. It shows the sectoral activities from that which lower resilience (from 1 to 4) to those which higher resilience (5-11) according to the resistance index. We observe there is not much difference between both regional clusters. More resilient activities (5-11) have nearly decreased both in resilient and not resilient regions during 2020. Nevertheless, the less resilient industries (1-4) have radically decreased in all regions but specially in those less resilient regions. Finally, as initially introduced, the population has a key role in the regional economic analysis of the COVID-19 as crisis has deeply affected to more populated regions. Table 3 shows the regional population figures in Spain in 2020. All regions with positive resistance have an average population under the half of the regions with negative resistance. Even among the resilient regions those less populated show better resistance indices.

3.Conclusions (very provisional)

After previous economic crises (Cuadrado and Maroto, 2016) more resilient regions were Madrid, Catalunya, or the Basque Country. But these regions show negative indexes during 2020. Then we can conclude the regional resilience to the COVID-19 crisis is not related to structural economic factors which explained the regional resilience during previous crises, but to short run demographic and specialization issues.

Then, traditional structural long-term definition for resilience should not be applied to our analysis. However, territorial resilience at the short run might be defined as the 'ability of a region

to mitigate at some extent the economic consequences of a negative shock only with the economic resources which immediately has, such as its specialization or demographic characteristics'. This new conjunctural definition of regional resilience is robust with the fact that all regions have applied similar political measures to face the COVID-19.