

**REGIONAL OUTLOOK ON LABOR  
PRODUCTIVITY IN SPAIN, 2000–2022**

2026

**BANCO DE ESPAÑA**  
Eurosistema

**Documentos Ocasionales  
N.º 2605**

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## REGIONAL OUTLOOK ON LABOR PRODUCTIVITY IN SPAIN, 2000–2022 <sup>(\*)</sup>

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(\*) This paper is part of the research project: "Dinámicas empresariales y variedad del capitalismo: industrialización, desindustrialización y resiliencia en el Mediterráneo noroccidental", Ministerio de Ciencia, Innovación y Universidades. Gobierno de España, PID2024-157174/NB-100.

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Documentos Ocasionales. N.º 2605

February 2026

NumeroDOI

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ISSN: 1696-2230 (online edition)

## Abstract

This paper analyzes the evolution of labor productivity in Spanish regions during 2000–2022, with attention to their sectoral structure and productive specialization. Using data from the National Statistics Institute and the Fundación de Estudios de Economía Aplicada, we compute labor productivity as the ratio of gross value added at constant prices to effective hours worked. Through cluster analysis, we group the regions into five clusters based on their relative productive specialization. The results highlight the sustained leadership of the cluster formed by Madrid, the Balearic Islands, and the Canary Islands, marked by strong tertiarization. They also show greater resilience of industrially oriented clusters during economic crises. At the same time, differences in labor productivity dynamics do not always match the groupings suggested by cluster analysis, due to the heterogeneous role of service subsectors.

**Keywords:** productivity, labor productivity, Spanish regions, economic diversification, Spanish economy.

**JEL classification:** E01, O40, R11.

## Resumen

Este documento analiza la evolución de la productividad laboral de las regiones españolas durante el período 2000-2022, prestando especial atención a la estructura sectorial y a la especialización productiva. Utilizando datos del Instituto Nacional de Estadística y de la Fundación de Estudios de Economía Aplicada, calculamos la productividad laboral como el cociente entre el valor añadido bruto a precios constantes y las horas efectivas trabajadas. Mediante un análisis de conglomerados, agrupamos las regiones en cinco clústeres según su especialización productiva relativa. Los resultados ponen de manifiesto el liderazgo sostenido del clúster formado por Madrid, las Illes Balears y Canarias, caracterizado por una fuerte terciarización. Asimismo, en los períodos de recesión económica se observa una mayor resiliencia de los clústeres con mayor orientación industrial. Por otro lado, las diferencias en la dinámica de la productividad laboral no siempre coinciden con las agrupaciones sugeridas por el análisis de conglomerados, debido al papel heterogéneo de los subsectores de servicios.

**Palabras clave:** productividad, productividad laboral, regiones españolas, diversificación económica, economía española.

**Códigos JEL:** E01, O40, R11.

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## 1 Introduction

Labor productivity holds a central place in economic analysis because of its dual technical and social dimensions. From a technical perspective, it reflects the efficiency with which an economy transforms labor resources into goods and services. Higher labor productivity means producing more with the same number of hours, which suggests improvements in technology, organization, or workforce skills. From a social perspective, productivity shapes living standards by influencing real wages, international competitiveness, and the capacity for sustained growth.

The importance of measuring and explaining labor productivity has grown in contexts where economic growth does not translate into proportional gains in productivity. This has given rise to what some scholars describe as “productivity paradoxes” (Prados de la Escosura & Rosés, 2021; Brondino & Casaú-Guirao, 2025). Spain offers a striking case: during expansions, labor productivity tends to stagnate, while during recessions it often rises. This countercyclical behavior contrasts with other European economies and raises questions about the links between productive structure, sectoral specialization, and productivity dynamics.

The literature offers several explanations. One highlights the weight of low-productivity sectors—such as construction or certain labor-intensive services—in Spain’s growth model. In booms, employment growth in these activities drags down average productivity, while in crises, job losses in the same sectors artificially raise it. Other analyses emphasize institutional factors, such as labor market duality, wage rigidities, or the dominance of small and medium-sized enterprises with limited innovative capacity. More recent studies stress the effects of tertiarization and the international fragmentation of production, which have weakened the traditional role of manufacturing as a driver of productivity (Herrero & Rial, 2023; Casaú-Guirao, 2025).

Against this backdrop, our article investigates the dynamics of labor productivity across Spanish regions between 2000 and 2022. We calculate productivity as the ratio of gross value added (GVA) at constant prices to effective hours worked, using data from the National Statistics Institute (INE) and the Fundación de Estudios de Economía Aplicada (FEDEA). We divide the period into four phases—two expansions (2000–2007 and 2014–2019) and two recessions (2008–2013 and 2020–2022)—following FUNCAS criteria. We apply hierarchical cluster analysis to group the regions according to their relative productive specialization and differential productivity growth. We also complement this with a sectoral and subsectoral decomposition,

focusing in particular on the heterogeneous role of services. This combined approach allows us to identify the structural sources of regional differences in productivity and to assess the resilience of different clusters under contrasting economic cycles.

The paper is structured as follows. Section 2 reviews the theoretical framework and competing approaches to measuring productivity. Section 3 explains the data and methods, including the clustering technique and the construction of differential growth indicators. Section 4 presents the results, first at the regional and sectoral level and then with a focus on service subsectors. Section 5 concludes by highlighting the main findings, discussing their implications for regional economic performance, and suggesting directions for further research.

## 2 Data and information processing

The International Labour Organization defines labor productivity as the variable that measures the efficiency of a country. Thus, per capita income relates positively to productivity per worker. GDP per worker reveals two basic aspects: the technological level of a country and its general macroeconomic evolution. The denominator may be either hours worked or the number of workers. Productivity per worker is a useful variable to compare regions or countries and to evaluate changes in technology use and its distribution over time (Ghosh, 2021).

Slower productivity growth is a common trend in Western economies, mainly due to the rising weight of services (Navinés, 2006). The International Monetary Fund (1997) showed that service productivity growth fell from 3% in 1960–1970 to 1.1% in 1971–1994. In industry, it fell from 4.6% to 3.1% in the same periods. Employment, however, grew faster in services: 2.4% in 1960–1970 and 2.2% in 1971–1994. In contrast, industrial employment fell from +1.7% to –0.6%. According to the IMF, specialization in activities with low productivity growth, such as traditional services, slowed down productivity growth.

This link between tertiarization, productivity slowdown, and lower economic growth has been central since Nicholas Kaldor's theories.<sup>2</sup> It characterizes most developed economies in the second half of the twentieth century. But measurement problems may exist. The Center for Latin American Monetary Studies (CEMLA, 2018) notes that service productivity may be undervalued due to rapid innovation in the digital economy, especially in the United States. The same issue affects other advanced economies, where tertiary, quaternary, and quinary activities have expanded but lack specific metrics. This is visible in R&D records collected in official statistics. These are designed with an industrial logic, which makes it hard to capture innovation in services beyond digital processes or advanced microelectronics. Lack of data may also stem from firms' reluctance to disclose information about new activities and from weak public initiatives to gather relevant data through tailored surveys.

The main variable analyzed in this study is Labor Productivity (hereafter LP). It is defined as the ratio between Output and Effective Hours Worked. For Output, we use data from the

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<sup>2</sup> Kaldor (1957, 1969) proposed three laws that stress the role of industry as the main source of economic growth. The first law states that total output growth depends on industrial output growth. The second, known as the Kaldor-Verdoorn law, argues that increasing returns to scale mean that rapid industrial output growth leads to higher labor productivity in industry. The third law claims that labor productivity growth in the whole economy is positively related to industrial output growth (Targetti, 1991; King, 2009).

*Fundación de Estudios de Economía Aplicada* (FEDEA).<sup>3</sup> Output is measured as Gross Value Added (GVA) at constant 2016 prices. FEDEA publishes these data with the *Instituto de Análisis Económico* (CSIC) and *BBVA Research* (De la Fuente & Ruíz Aguirre, 2024). For Effective Hours Worked, we use data from the regional accounts of the Spanish *National Statistics Institute* (INE).<sup>4</sup>

FEDEA reports regional GVA by sector: Agriculture, Industry, Construction, and Services. The Services sector is divided into Public Services (Health and Education) and Private Services (excluding Health and Education). Private Services are further split into Financial and Insurance Services; Trade, Hospitality, Transport, and Communications; and Other Market Services. This last group includes high value-added private services, characterized by strong investment in digitalization and knowledge. Using this classification, we adjust INE's Effective Hours Worked (from the Annual National Accounts of Spain) to the sectoral structure applied by FEDEA.

To construct the variables, we use a purely descriptive methodology. We define the following variables:

- $\pi = \frac{Y}{H} = LP$ : Total productivity, where  $Y$  is GVA at constant 2016 prices and  $H$  is effective hours worked.
- $\pi_{i,t}$ : LP of economic sector  $i$  in period  $t$ .
- $fc(\pi) = \left( \frac{\pi_{i,t}}{\pi_{i,t-1}} \right) * 100$ : Growth factor of LP, with  $t$  as the upper bound of the interval and  $t-1$  as the lower bound. This factor comes from the sum of sectoral LP growth factors:

$$fc(\pi) = \sum_{i=1}^n fc(\pi'_i) = \sum_{i=1}^n \left[ \left( \frac{\pi'_{i,t}}{\pi'_{i,t-1}} \right) * \frac{Y_{i,t-1}}{Y_{t-1}} \right] * 100 = \sum_{i=1}^n \left[ \left( \frac{\pi'_{i,t}}{\pi_{t-1}} \right) * 100 \right] = \frac{\pi_t}{\pi_{t-1}} * 100$$

- $\bar{\pi}_i$ : Average LP of sector  $i$  (arithmetic mean).

We also define:

- $\pi'_i$ : Contribution of sector  $i$  to total LP. This variable shows the euro value that sector  $i$  adds to LP. It is calculated as:

$$\pi'_i = \frac{Y_i}{H_i} * \frac{H_i}{H} = \frac{Y_i}{H} \rightarrow \pi = \sum_{i=1}^n \pi'_i = \sum_{i=1}^n \frac{Y_i}{H} = \frac{Y}{H}$$

<sup>3</sup> Fundación de Estudios de Economía Aplicada. <https://fedea.net/> (2024).

<sup>4</sup> Instituto Nacional de Estadística. <https://www.ine.es/> (2024).

- $fc(\pi'_i)$ : Contribution of sector  $i$  to the total LP growth factor:

$$fc(\pi'_i) = \left( \frac{\pi'_{i,t}}{\pi'_{i,t-1}} \right) * \frac{Y_{i,t-1}}{Y_{t-1}}$$

- $dfc(\pi) = (fc(\pi_{CCAA}) - fc(\pi_{Spain}))$ : Differential of regional LP growth factor compared to Spain, at both aggregate and sectoral levels.

The period under analysis is 2000–2022. It is divided into four phases: two expansions (2000–2007 and 2014–2019) and two recessions (2008–2013 and 2020–2022), following FUNCAS criteria (Miyar Bustos, 2023). The chosen periodization highlights regional productivity trends and sectoral dynamics:

- **2000–2007**: Expansion driven by construction, fueled by speculative international capital flows channeled through Spanish banks and savings banks.
- **2008–2013**: Recession caused by the Great Recession. It hit savings banks hard and hurt regional economies with large industrial or construction sectors.
- **2014–2019**: Recovery before the COVID-19 crisis. Tertiary economies grew strongly. Tourism boomed first due to instability in the Eastern Mediterranean after the Arab Spring. Later, a wave of investment modernized the hotel sector. These investments adopted digital technologies that improved management and marketing. Labor productivity rose sharply in tourism, especially in hotels.
- **2020–2022**: Recession triggered by COVID-19, the war in Ukraine, and the uneven recovery of demand, especially tourism, from 2021–2022.

Based on this chronology, we group Spanish regions by productive specialization, using a cluster analysis.<sup>5</sup>

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<sup>5</sup> We also applied the Shift-Share analysis to group Spanish regions for the period 2000–2022. For each interval, we separated structural and competitive effects. This helped us identify patterns of sectoral specialization and comparative advantages across regions, following Cuadrado-Roura and Maroto-Sánchez (2012). The method allowed us to classify Spanish regions into six broad groups. However, the results from 2000 to 2022 do not reveal a robust pattern that explains regional economic dynamics in a consistent way. Instead of a stable classification over time, many regions move from one group to another depending on the period. This volatility suggests that a classification based only on this method cannot capture the complexity of regional development. The finding supports the need to complement Shift-Share analysis with other approaches, such as clustering.

### 3 Methodology: cluster analysis

We assume that economic structure explains part of the productivity gap among Spanish regions. Based on this idea, we group the regions through cluster analysis and dendrograms. The grouping variable is the differential growth (DF) of LP in each region compared to Spain as a whole, across four main sectors: Agriculture, Industry, Construction, and Services (see Annexes 1 and 2, which show the dendrogram changes across the different periods analyzed).

Cluster analysis is a multivariate technique that forms groups of individuals (here, regions) that are similar to each other and different from the rest. The dendrogram provides a graphical representation of this process. Also known as cluster analysis or classification analysis, this method belongs to interdependence techniques. Its goal is to create groups that are as homogeneous as possible.

Cluster analysis includes two main approaches: hierarchical and non-hierarchical. We use the hierarchical method. It organizes groups according to the distances between variable values. Hierarchical methods can be agglomerative or divisive. In agglomerative methods (bottom-up), each individual starts as a separate group, and groups are merged step by step until only one remains. In divisive methods (top-down), the process begins with one general group that splits into progressively smaller subgroups. Both approaches build dendrograms that display the grouping process as a tree.<sup>6</sup>

The most common distance used in clustering is Euclidean distance. But the criterion for forming groups is not unique. It depends on the chosen strategy, which introduces a degree of subjectivity. In RStudio, the most common algorithms are:

- a) *Single*: uses the shortest distance between members of different clusters.
- b) *Average*: calculates the average distance among all pairs formed by members of both clusters.
- c) *Complete*: uses the longest distance between members of different clusters.

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<sup>6</sup> For the construction of the cluster and its graphical representation in a dendrogram, we applied a hierarchical agglomerative clustering method, using the “dist” and “hclust” functions in the RStudio software. For further information, see <https://www.rstudio.com/>.

We apply these three methods to our data. Taking  $K = 5$  as the target number of clusters, we finally select the *complete* method. This choice is justified because the complete method offers stronger internal cohesion, lower sensitivity to outliers or noise, and better separation among groups.

## 4 Empirical results

### 4.1 Regional clustering of Spanish regions

The clustering method groups Spanish regions into five clusters:

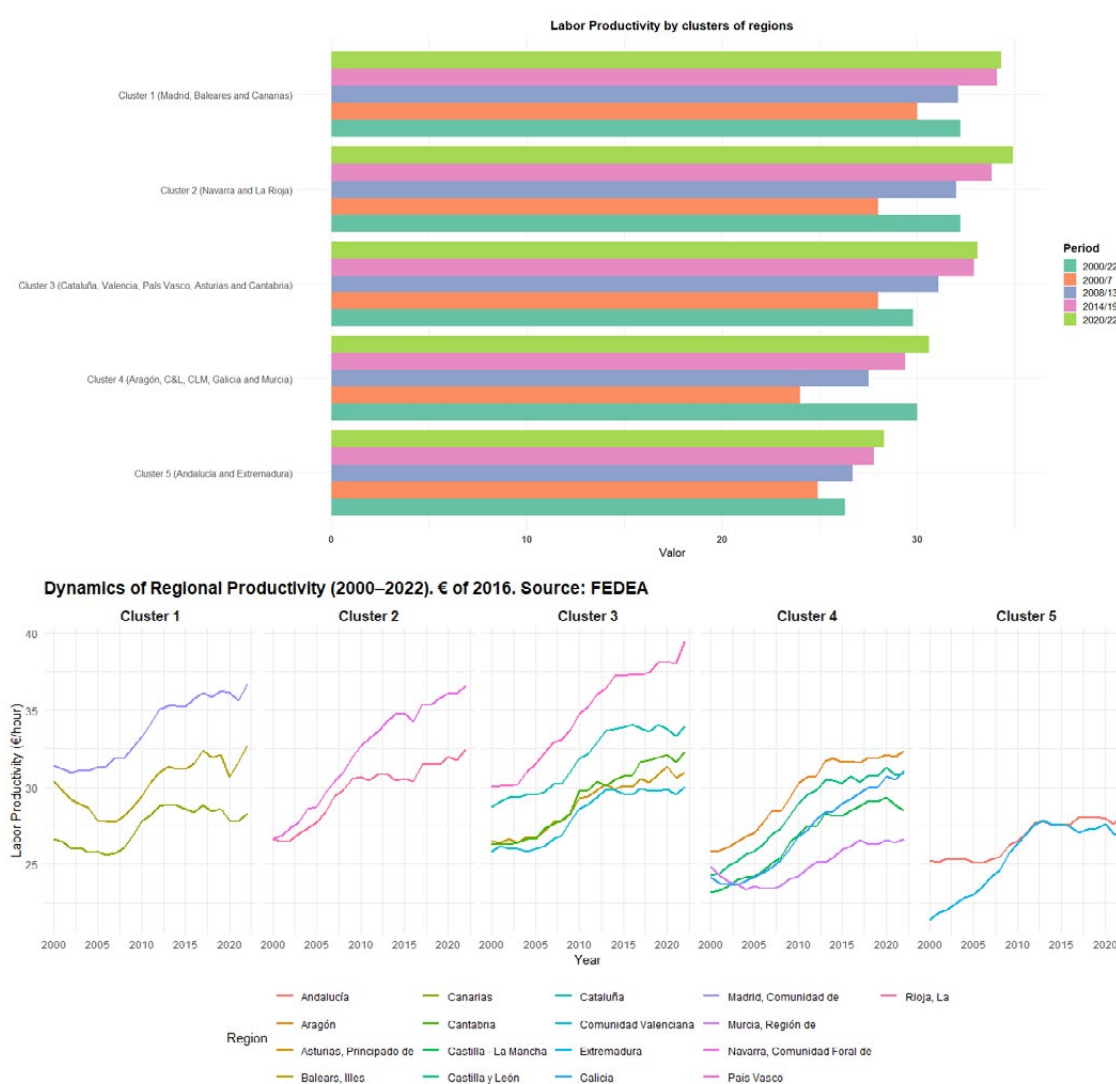
- **Cluster 1:** Composed by Madrid, the Balearic Islands, and the Canary Islands. This cluster remains stable in all periods, including the overall period (2000–2022). Its key feature is a high degree of tertiarization, with shares well above the national average and far from the rest of the regions.
- **Cluster 2:** Composed by Navarra and La Rioja. In all subperiods, these regions show an industrial share of GVA above the national average. In La Rioja, construction and agriculture also play a significant role.
- **Clusters 3 and 4:** Cluster 3 includes Catalonia, Valencia, Aragon, Castile & León, the Basque Country, Asturias, and Cantabria. Cluster 4 is composed by Castile-La Mancha, Galicia, and Murcia. Both groups, with stronger industrial specialization, show more volatile behavior depending on the period, especially in terms of resilience during crises. During the Great Recession (2008–2013), a reorganization occurred: Castile & León and Aragon moved from Cluster 3 to Cluster 4. Later, in 2020–2022, Galicia and Murcia left Cluster 4 and moved to Cluster 5.
- **Cluster 5:** Initially formed by Andalusia and Extremadura. This group remains stable in the first three subperiods, but in 2020–2022, Galicia and Murcia join it after leaving Cluster 4. Andalusia and Extremadura show higher relative specialization in agriculture and construction compared to the national average throughout the whole period.

The results show a clear difference between growth phases and crises. Dendrograms remain stable in expansion phases but change sharply in recessions. The period 2008–2013 is especially relevant. During these years, tertiary investments reemerged in Cluster 1, particularly in digitalization and, in the archipelagos, in the modernization and restructuring of hotel facilities, especially in the Balearic Islands. For Clusters 2, 3, and 4, with larger industrial shares, the years of the Great Recession also marked the return of “Industry 4.0” investments. We interpret these business strategies as regional attempts to recover profit margins through new investments, which shaped regional productivity performance in later periods, as analyzed in the following sections.

## 4.2 Labour productivity by periods and dendrograms

Figure 1 shows labor productivity for the five clusters identified by the cluster analysis (see Annex 3). Cluster 1 includes Madrid, the Balearic Islands, and the Canary Islands. Cluster 2 includes Navarre and La Rioja. Cluster 3 includes Catalonia, Valencia, Aragon, Castile and León, the Basque Country, Asturias, and Cantabria (though Castile and León and Aragon move to Cluster 4 during the Great Recession). Cluster 4 includes Castile-La Mancha, Galicia, and Murcia. Cluster 5 includes Andalusia and Extremadura (though in 2020–2022, Galicia and Murcia also join it after leaving Cluster 4).

**Figure 1.** Labor productivity (euros per hour worked, constant 2016 prices) of the five clusters of regions in the different periods analyzed.



**Note:** This figure shows labour productivity for the five clusters of Spanish regions identified in the cluster analysis. Cluster 1 includes Madrid, the Balearic Islands, and the Canary Islands. Cluster 2 includes Navarre and La Rioja. Cluster 3 includes Catalonia, Valencia, Aragon, Castile and León, the Basque Country, Asturias, and Cantabria (though Castile and León and Aragon move to Cluster 4 during the Great Recession). Cluster 4 includes Castile-La Mancha, Galicia, and Murcia. Cluster 5 includes Andalusia and Extremadura (though in 2020–2022, Galicia and Murcia also join it after leaving Cluster 4).

**Source:** Authors' elaboration based on FEDEA and INE data.

The main conclusions of this first analysis are the following:

1. Cluster 1 shows sustained leadership in average productivity. It is the only cluster with clear tertiary specialization, regardless of changes in the dendrograms of Clusters 3, 4, and 5. Only during the COVID-19 crisis (2020–2022) does Cluster 2 surpass Cluster 1, by 0.6 points in average productivity. This happened even though the crisis hit tourism-intensive regions, such as the Balearic and Canary Islands, hardest, with the sharpest drop in GVA.
2. The COVID-19 crisis had a stronger negative effect on average productivity growth than the Great Recession. In both crises, Clusters 2, 3, and 4 proved more resilient. These groups are characterized by a higher industrial share of GVA.

### 4.3 Regional differential growth of labor productivity by sector, periods, and dendrograms

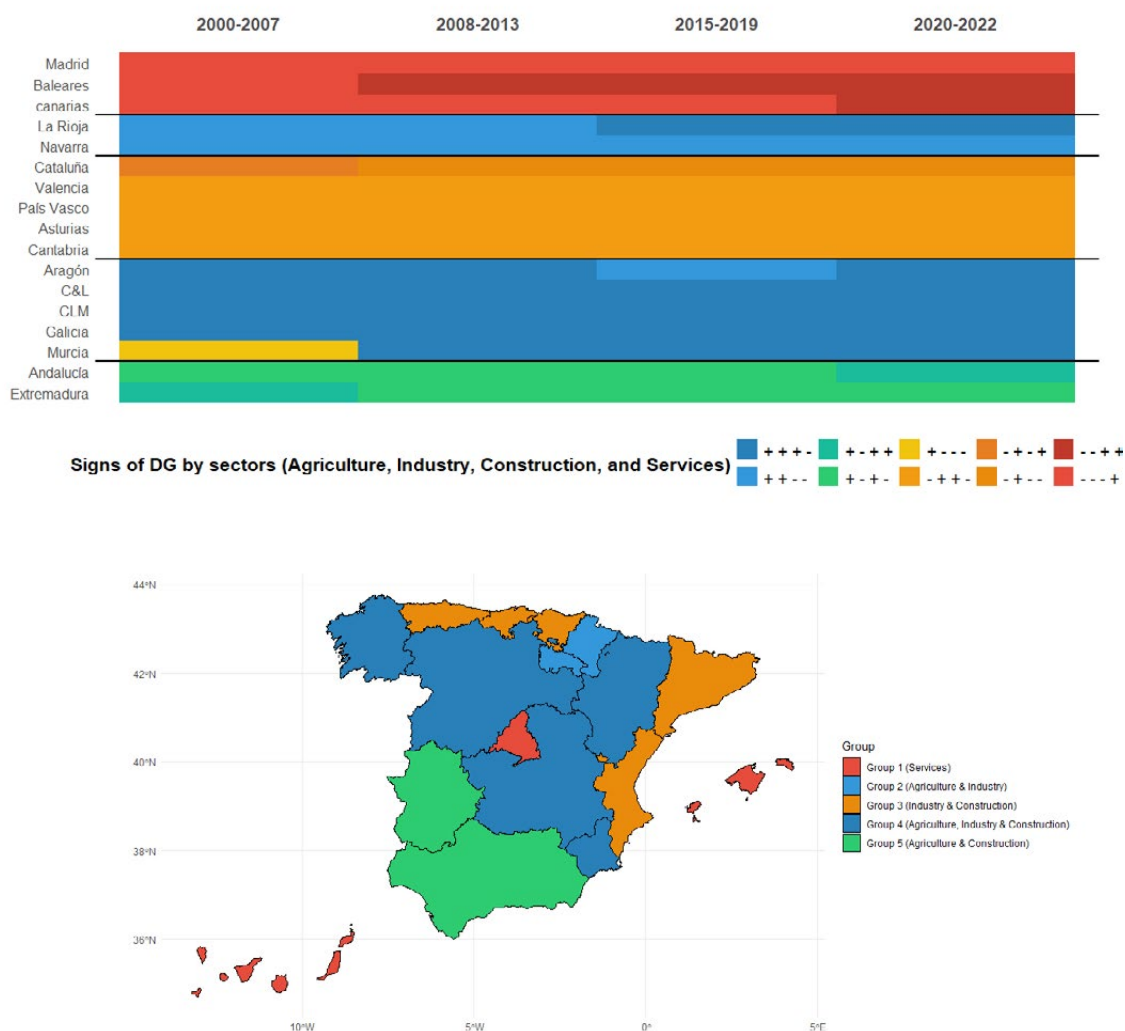
We now turn to the differential growth (DG) of regional productivity. The DG of a region is defined as the percentage difference between its productivity growth and the national average. The same concept applies at the sectoral level, so the sum of sectoral DGs gives the total regional DG. Thus, if a region shows a positive DG in all four sectors, its aggregate productivity will necessarily have a positive DG compared to the Spanish average. Since four sectors are considered (Agriculture, Industry, Construction, and Services), there are 16 possible DG combinations: a region might show a positive (or negative) DG in all four sectors, or any intermediate combination, resulting in sixteen possible cases.

Combining cluster analysis with sectoral DG allows us to identify the sectors in which the regional productivity differences originate. Figure 2 summarizes the results. It shows DG combinations for each region across the four periods analyzed. Each color indicates a specific DG combination. For example, the red color (– – + +) indicates that the region shows a negative DG in Agriculture and Industry, but a positive DG in Construction and Services.

Figure 2 reveals that Navarra and La Rioja (both in Cluster 2) share the same pattern in the first two periods. In 2014–2022, however, the construction sector in La Rioja no longer shows a positive DG, so the region changes category. Asturias, Cantabria, País Vasco, and Valencia, all in Cluster 3 in every period, also share the same sectoral pattern: positive contribution from Industry and Construction, negative from Agriculture and Services. Castilla La Mancha, Castilla & León, and Galicia (with Castilla La Mancha always in Cluster 4, Castilla & León shifting between Clusters 3 and 4, and Galicia between Clusters 4 and 5) also share the same pattern in

all periods: positive DG in all sectors except Services. In Cluster 1, Canarias and Madrid share the same pattern (negative DG in all sectors except Services) in all periods except the last. Baleares differ, since Construction shows a positive DG in the last three phases.

**Figure 2.** Sectoral differential growth (DG) patterns of productivity



**Note:** The table shows the combinations of DGs in each sector (Agriculture, Industry, Construction, and Services) for every Spanish region across the four periods analyzed. Each color represents a different DG combination. For example, light blue (+ + - -) indicates that the region shows a positive DG in Agriculture and Industry but a negative DG in Construction and Services.

**Source:** Authors' elaboration based on FEDEA and INE data.

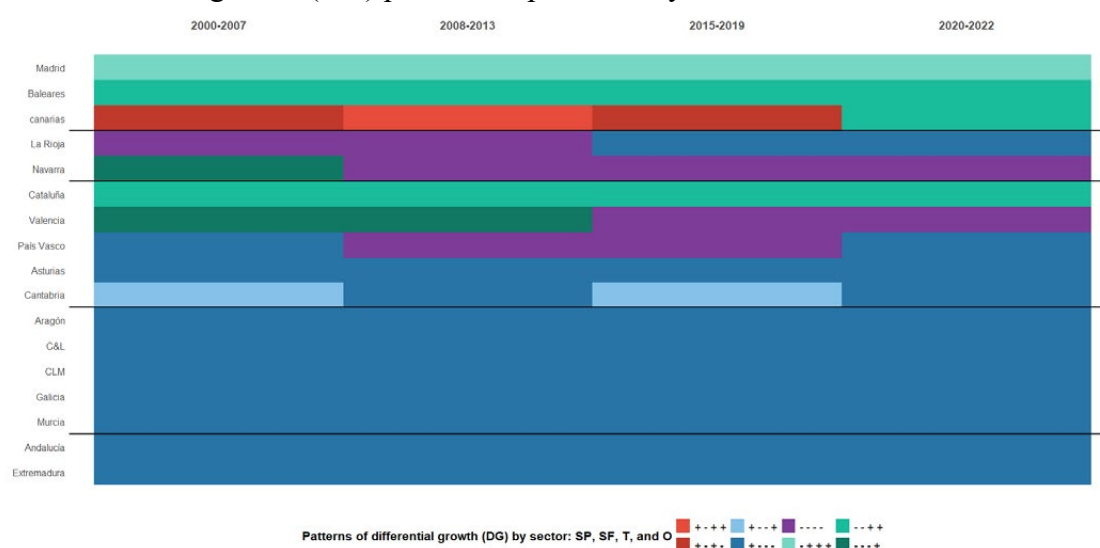
Regarding the dynamics of sectoral pattern changes, we observe that shifts are stronger in the first crisis period than in the second one. In contrast, the expansive period 2014–2019 shows greater stability than the previous one (2000–2007).

Figure 2 therefore complements the cluster analysis by grouping Spanish regions according to their DG of relative sectoral productivity. The map in Figure 2 summarizes the results, which

match the results of the cluster analysis results quite well: Group 1 (Services), Group 2 (Agriculture and Industry), Group 3 (Industry and Construction), Group 4 (Agriculture, Industry, and Construction), and Group 5 (Agriculture and Construction).

Given the significant weight of services in Spain's productive structure, we also analyze the DG of labour productivity in the service subsectors: Public services, health, and education (SP); Financial and insurance services (SF); Trade, hospitality, transport, and communications (T); and Other market services (O). The sum of subsectoral DGs equals the DG of the service sector for each region. Thus, if all four service subsectors of a region show a positive (negative) productivity DG relative to the national average, the region's service sector DG will necessarily be positive (negative) relative to the Spanish average. Figure 4 presents the results of this analysis. It shows the combinations of service subsector DGs for each region across the four periods. The subsectors considered are SP, SF, T, and O, as already described. Each color represents a different DG combination; for example, the dark blue color (+ – – –), which is the most frequent case, indicates that the region shows a positive DG in SP but a negative DGs in the other service subsectors (SF, T, and O, respectively).

**Figure 3.** Differential growth (DG) patterns of productivity in service subsectors



**Note:** The table shows the combinations of service subsector DGs for each Spanish region across the four periods analyzed. The subsectors considered are Public services, health, and education (SP); Financial and insurance services (SF); Trade, hospitality, transport, and communications (T); and Other market services (O). Each color represents a different DG combination. For example, dark blue (+ – – –), the most frequent case, indicates that the region shows a positive DG in SP but negative DGs in the other service subsectors (SF, T, and O, respectively).

**Source:** Authors' elaboration based on FEDEA and INE data.

Figure 3 shows that in Groups 4 and 5 only the public sector shows a positive DG; all other service subsectors show negative DGs. Groups 2 and 3, by contrast, display more heterogeneity:

For example, Asturias has the same profile as the regions in Groups 4 and 5 (only the Public Sector shows a positive DG). The Basque Country and La Rioja alternate periods in which only the Public Sector shows a positive DG with periods in which all service subsectors show negative DGs. Cantabria shows a positive DG in the Public Sector only during recessions, while Other Services shows a positive DG during expansions. Valencia and Navarra alternate between periods in which only Other Services shows a positive DG and periods in which all service subsectors show negative DGs.

On the other hand, the regions in Group 1 and Catalonia (in Group 3) show a positive DG in the service sector. Specifically, three regions show a negative DG in the Public Sector (Madrid, the Balearic Islands, and Catalonia). Madrid is the only region with a positive DG in the Financial Sector. Madrid is also the only region where the Public Sector is the only service subsector with a negative DG (all other subsectors are positive). The Balearic Islands and Catalonia, by contrast, show a negative DG in the Public Sector and in Financial Services, but a positive DG in Tourism and Other Services. On the other hand, the Canary Islands shows a positive DG in the Public Sector. This region alternates periods where only the Public Sector and Tourism show positive DGs with periods where Other Services also shows a positive DG.

From Figures 2 and 3 we can extract several relevant conclusions:

1. In existing regional analyses, productivity leadership is usually associated with high levels of per capita income, as in the Basque Country, Madrid, Navarre, and Catalonia. However, the productive structures of these regions reflect very different realities. Madrid and Catalonia host the two largest metropolitan areas in Spain, far ahead of the rest, with strong specialization in high value-added private services. Even between them, there are significant differences in the weight of industry, which explains their divergent productivity dynamics. Similarly, although the Basque Country and Navarre appear to form a homogeneous block, their productivity growth dynamics differ across periods. As shown in Figure 2, they never share the same pattern of sectoral specialization.
2. Regions that share cluster of productive specialization may, in some periods, display divergent productivity dynamics. This apparent contradiction becomes clear when analyzing subsectoral variations in services (Figure 3). This is the case of Extremadura and Andalusia in the first and last periods of analysis.

3. The opposite may also occur: regions that appear in different clusters may, after 22 years, end up in very similar positions in the regional productivity ranking. This phenomenon is explained by the fact that, in terms of productive and service subsectoral patterns, they have shared the same structure throughout the whole period. This is the case of the two Castiles and Asturias.
4. A compact group also stands out: the three regions with the highest level of tertiarization, clearly differentiated from the rest—Madrid, the Balearic Islands, and the Canary Islands. These regions differ widely in income and productivity levels, so grouping them into a single homogeneous cluster for the 22 years might seem excessive. However, this is resolved by observing that they only share the same service subsectoral pattern in the first period. The Balearic Islands later diverge, adopting their own subsectoral modality in the following periods, except in the last, when they converge again with the Canary Islands. In terms of service subsectors, the Balearic Islands share the same profile only with Catalonia in all periods. The Canary Islands deviate from the Balearic trajectory from the second period onwards and from Madrid's from the third. Madrid constitutes a special case: it is the only region throughout the whole period in which financial and insurance services contribute positively to differential productivity growth relative to the national average. It is also the only region where the public sector is the only subsector with a negative contribution to service-sector DG.
5. This distinctive role of Madrid's financial and insurance services is the main determinant of its singularly positive dynamics in per capita income growth and overall economic growth compared to the rest of the regions. Financial and insurance services consistently show the highest productivity levels, both across economic sectors and within service subsectors, and between 1,5 and 2 times higher than industry productivity, the second-best productivity ratio after financial and insurance services.

## 5 Conclusions

This paper has examined the dynamics of labor productivity across Spanish regions over the period 2000–2022. By grouping regions into clusters based on their sectoral differential growth of productivity, we provide a comparative perspective on how structural specialization shapes regional performance.

Our results confirm the importance of analyzing productivity growth rates over distinct phases of the business cycle. The division into two expansions (2000–2007 and 2014–2019) and two recessions (2008–2013 and 2020–2022), following FUNCAS criteria, proved particularly useful. It allowed us to disentangle cyclical effects from structural patterns and to isolate the disruptive impact of the COVID-19 crisis, especially on tourism-dependent economies.

Cluster analysis identified five groups of regions with distinctive productive profiles. Cluster 1 (Madrid, the Balearic Islands, and the Canary Islands) consistently led in average productivity, reflecting its strong tertiary orientation. Yet, clusters with greater industrial specialization displayed stronger resilience during recessions, underlining the stabilizing role of manufacturing in adverse contexts. Complementary analysis of sectoral differential growth (DG) showed that regions within the same cluster often share similar DG patterns, although important exceptions emerged.

A more detailed decomposition of the service sector revealed significant heterogeneity across regions. Even within the same cluster, regional economies sometimes followed divergent trajectories depending on the performance of service subsectors such as financial services, tourism, or other market services. These findings stress the need to move beyond broad sectoral classifications and to account for the internal composition of services when studying productivity dynamics.

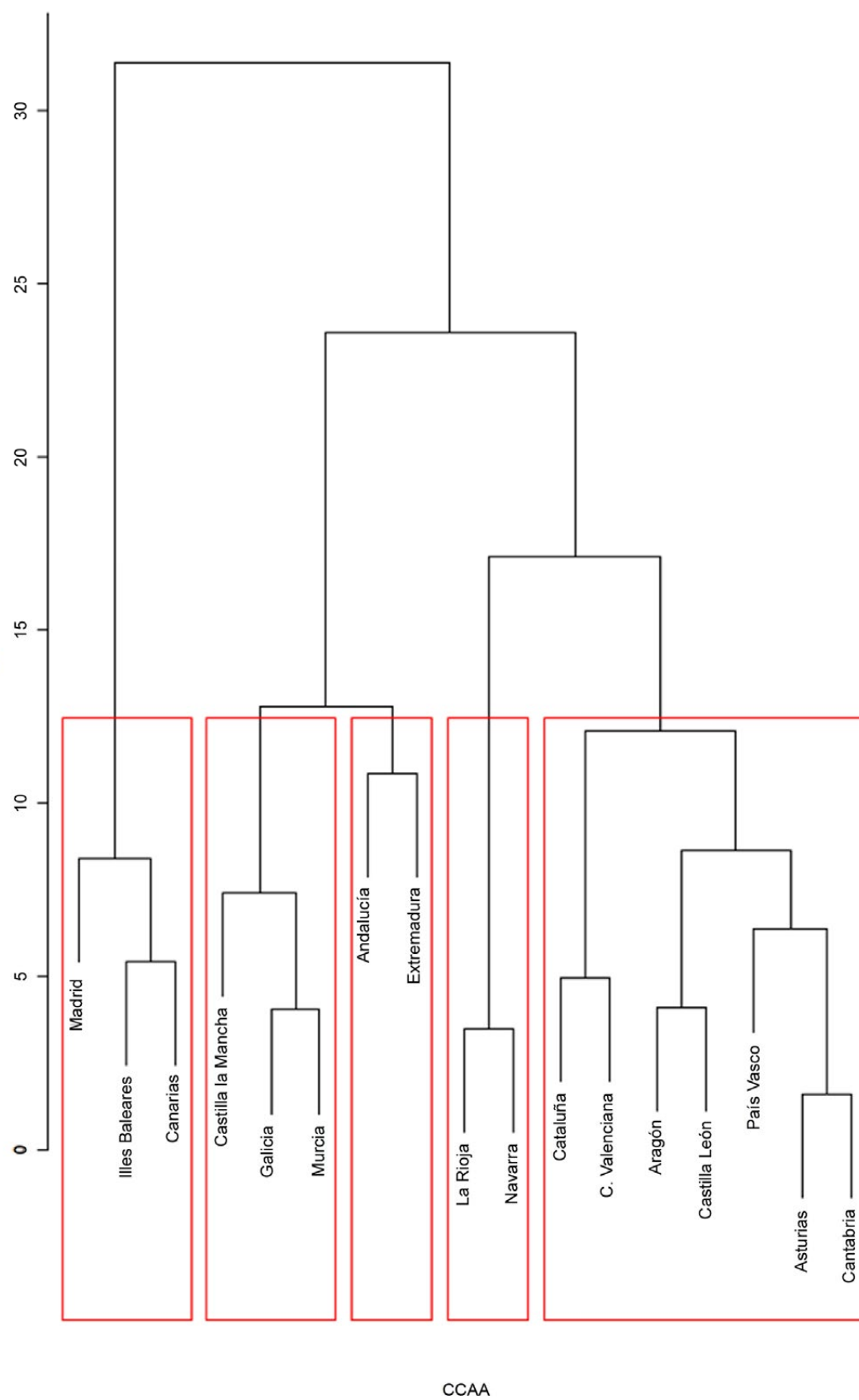
Overall, the study provides evidence that regional specialization plays a key role in explaining differences in labor productivity growth in Spain. It also demonstrates that tertiary-oriented regions can achieve higher productivity growth than expected, but their dependence on volatile subsectors exposes them to greater cyclical risks. Future research should extend this approach by incorporating firm-level data, exploring the role of technological adoption, and comparing Spanish regions with other European economies. Such extensions would help clarify how structural specialization, institutional settings, and innovation systems interact to shape long-run productivity performance.

## References

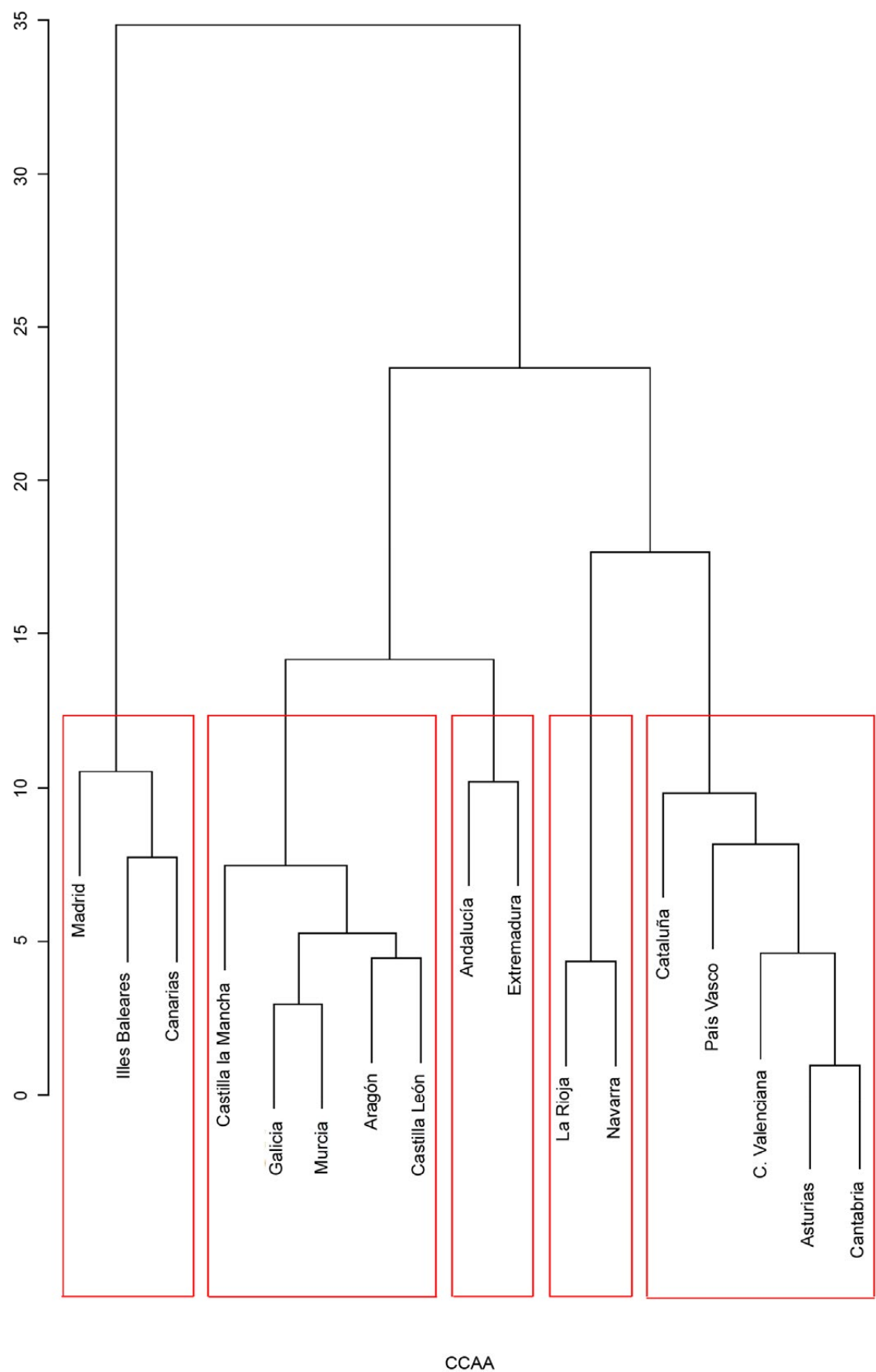
- Brondino, Gabriel, Facund Foral-Alcalde and Miguel Ángel Casaú Guirao. (2024). "Measuring total labour productivity in the open economy: A proposal". *PSL Quarterly Review*, 77(309), pp. 173-193.
- Conesa, Juan Carlos, and Timothy J. Kehoe. (2017). "Productivity, taxes, and hours worked in Spain: 1970-2015". NBER Working Paper Series, 23592, National Bureau of Economic Research. <https://doi.org/10.3386/w23592>
- Felipe, Jesus, and John S. L. McCombie. (2013). *The Aggregate Production Function and the Measurement of Technical Change: Not Even Wrong*. Edward Elgar Publishing. <https://doi.org/10.4337/9781782549680>
- Franconetti, Javier, and Ferran Navinés. (2022). "Contrastación empírica sobre los resultados en I+D e innovación, que se están produciendo a nivel regional por parte de los distintos sistemas regionales de innovación a partir de modelos de asociación y agrupación". XIII Congreso Internacional de la AEHE Bilbao 2022. Ciencia, tecnología, innovación y desarrollo económico en perspectiva histórica.
- Fuente, Ángel de la, and Pep Ruiz Aguirre. (2024). "Series largas de VAB y empleo regional por sectores, 1955-2022. Actualización de RegData- Sect hasta 2022". Estudios sobre la Economía Española. FEDEA, Instituto de Análisis Económico (CSIC) y BBVA Research. <https://documentos.fedea.net/pubs/eee/2024/eee2024-07.pdf>
- Garegnani, P. (1970). "Heterogeneous Capital, the Production Function and the Theory of Distribution". *The Review of Economic Studies*, 37(3), pp. 407-436. <https://doi.org/10.2307/2296729>
- Ghosh, Jayati. (2021). "Interrogating the holy grail of productivity growth". *Real-World Economics Review*, 96, pp.119-126. <https://www.paecon.net/PAEReview/issue96/Ghosh96.pdf>
- Hirschman, Albert O. (1961). *La estrategia del desarrollo económico*. FCE.
- Juan, Oscar de, and Eladio Febrero. (2000). "Measuring Productivity from Vertically Integrated Sectors". *Economic Systems Research*, 12(1), pp. 65-82. <https://doi.org/10.1080/095353100111281>
- Kaldor, Nicholas. (1957). "A model of economic growth". *The Economic Journal*, 67(268), pp. 591-624. <https://doi.org/10.2307/2227704>
- Kaldor, Nicholas. (1969). *Ensayos sobre estabilidad y desarrollo económico*. Tecnos.
- King, J. E. (2009). *Una historia de la economía poskeynesiana desde 1936*. Akal.
- Labini, Paolo Sylos. (1995). "Why the interpretation of the Cobb-Douglas production function must be radically changed". *Structural Change and Economic Dynamics*, 6(4), pp. 485-504. [https://doi.org/10.1016/0954-349X\(95\)00025-I](https://doi.org/10.1016/0954-349X(95)00025-I)
- Miyar Busto, María. (2023). "Juntos en los malos tiempos: la percepción social de la economía en España (2000-2023)". *Panorama Social: Economía y Sociedad*, 37, pp. 111-127. <https://www.funcas.es/articulos/juntos-en-los-malos-tiempos-la-percepcion-social-de-la-economia-en-espana-2000-2023/>
- Navinés, Ferran. (2006). "Algunes reflexions fetes des de l'enfocament clàssic de l'excedent sobre el procés de terciarització i especialització productiva: el cas de Balears". In A. Forcades (dir.), *Repensem el model de creixement balear*. Cambra de Comerç de Mallorca, Eivissa and Formentera-Cercle d'Economia de Mallorca.
- Navinés, F., J. Balagué, Ll. Planas and A. Sansó. (2006). "Aproximación clásica al análisis del crecimiento económico y del empleo: el caso de la economía española (1954-1995)". *Economie Marche. Review of Regional Studies*, 1.
- Navinés, Ferran, José Pérez-Montiel, Carles Manera and Javier Franconetti. (2022). "Ranking the Spanish regions according to their resilience capacity during 1965-2011". *The Annals of Regional Science*, 71, pp. 415-435. <https://doi.org/10.1007/s00168-022-01171-5>
- Pasinetti, Luigi L. (1973). "The notion of vertical integration in economic analysis". *Metroeconomica*, 25(1), pp. 1-29. <https://doi.org/10.1111/j.1467-999x.1973.tb00539.x>
- Pasinetti, Luigi L. (2012). "Critique of the neoclassical theory of growth and distribution". *PSL Quarterly Review*, 53(215). <https://doi.org/10.13133/2037-3643/9924>
- Raa, Thijs ten, and Pierre Mohnen. (2002). "Neoclassical Growth Accounting and Frontier Analysis: A Synthesis". *Journal of Productivity Analysis*, 18, pp.111-128. <https://doi.org/10.1023/A:1016558816247>
- Robinson, Joan. (1953). "The Production Function and the Theory of Capital". *The Review of Economic Studies*, 21(2), pp 81-106. <https://doi.org/10.2307/2296002>
- Rodrik, Dani. (2011). *Una economía, muchas recetas. La globalización, las instituciones y el crecimiento económico*. FCE.
- Sember, Florencia R. (2024). "The Solow-Pasinetti debate on the measurement of productivity in the light of modern growth theory". *PSL Quarterly Review*, 77(39).
- Shaikh, Anwar. (1974). "Laws of Production and Laws of Algebra: The Humbug Production Function". *The Review of Economics and Statistics*, 56(1), pp. 115-120. <https://doi.org/10.2307/1927538>
- Sraffa, Piero. (1961). *Production of Commodities by Means of Commodities. Prelude to a critique of economic theory*. Cambridge University Press.
- Targetti, F. (1991). "Change and Continuity in Kaldor's Thought on Growth and Distribution". In E. J. Nell and W. Semmler (eds.), *Nicholas Kaldor and Mainstream Economics. Confrontation or Convergence?* MacMillan. [https://doi.org/10.1007/978-1-349-10947-0\\_23](https://doi.org/10.1007/978-1-349-10947-0_23)

## Annex 1 Dendrograms

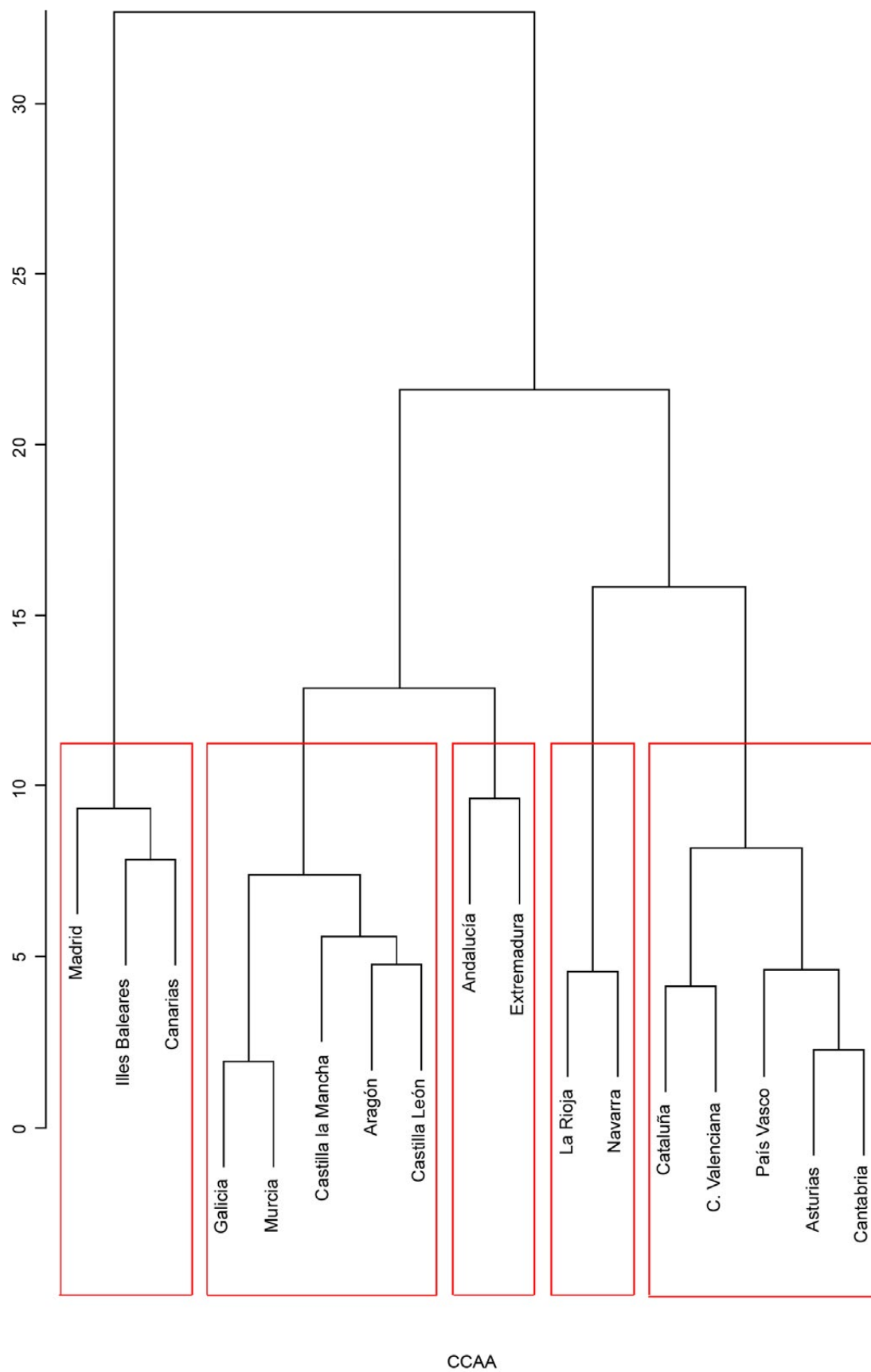
Sectoral contributions to the growth factors of total labor productivity in the period 2000–2007  
(Dendrogram – Complete method)



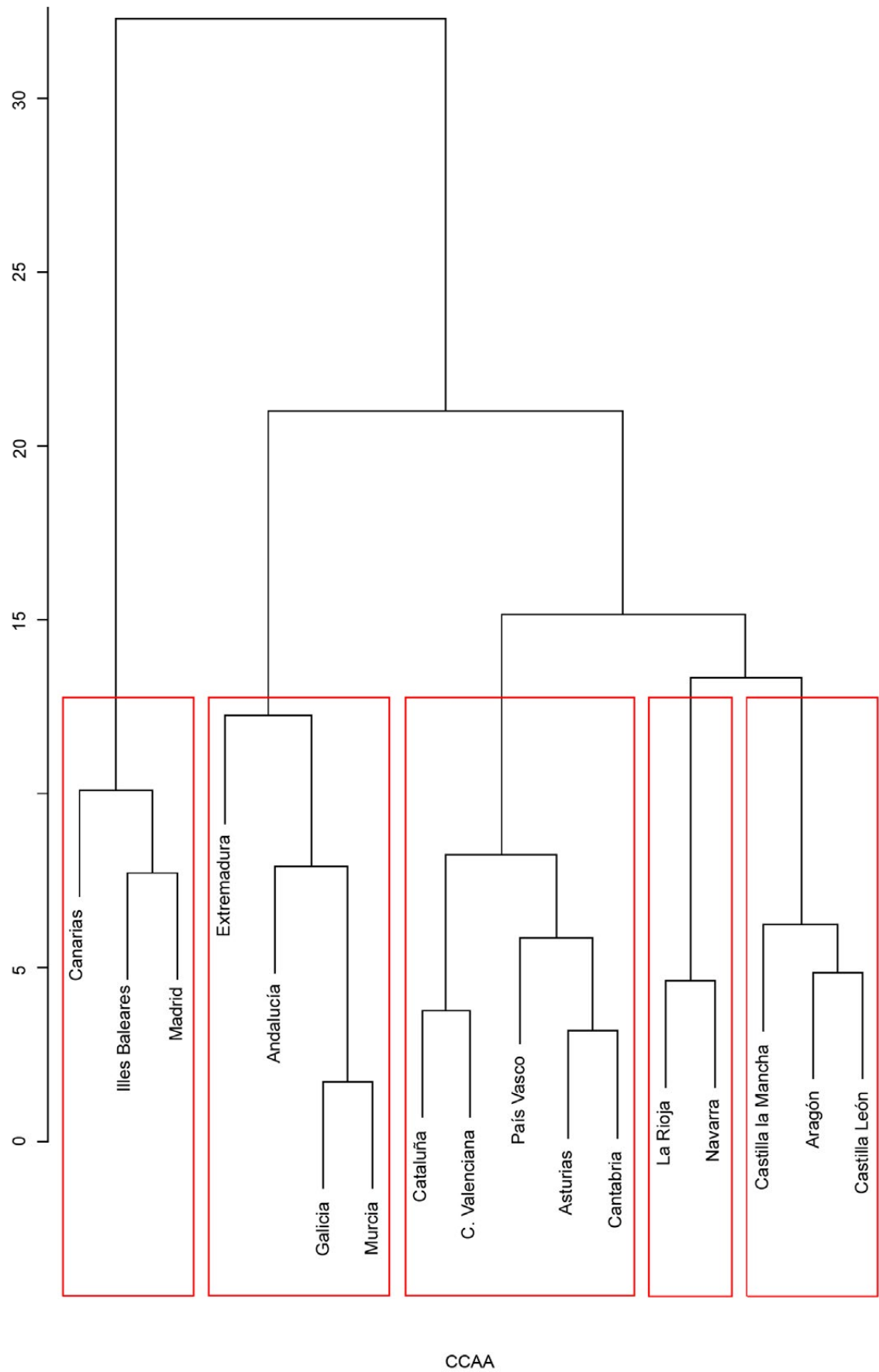
Labor factor in the period 2008–2013 (Dendrogram – Complete method)



Sectoral contributions to the growth factors of total labor productivity in the period 2014–2019  
(Dendrogram – Complete method)



Sectoral contributions to the growth factors of total labor productivity in the period 2020–2022



## Annex 2 Movements of groups by autonomous communities

| 2000/2007                                                                                     | 2008/2013                                                            | 2014/2019                                                            | 2020/2022                                                                                        |
|-----------------------------------------------------------------------------------------------|----------------------------------------------------------------------|----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| 1 Madrid<br>Illes Balears<br>Canarias                                                         | 1 Madrid<br>Illes Balears<br>Canarias                                | 1 Madrid<br>Illes Balears<br>Canarias                                | 1 Canarias<br>Illes Balears<br>Madrid                                                            |
| 2 La Rioja<br>Navarra                                                                         | 2 La Rioja<br>Navarra                                                | 2 La Rioja<br>Navarra                                                | 2 La Rioja<br>Navarra                                                                            |
| 3 Cataluña<br>C. Valenciana<br>Aragón<br>Castilla León<br>País Vasco<br>Asturias<br>Cantabria | 3 Cataluña<br>País Vasco<br>C. Valenciana<br>Asturias<br>Cantabria   | 3 Cataluña<br>C. Valenciana<br>País Vasco<br>Asturias<br>Cantabria   | 3 Cataluña<br>C. Valenciana<br>País Vasco<br>Asturias<br>Cantabria                               |
| 4 Castilla la Mancha<br>Galicia<br>Murcia                                                     | 4 Galicia<br>Murcia<br>Castilla la Mancha<br>Aragón<br>Castilla León | 4 Galicia<br>Murcia<br>Castilla la Mancha<br>Aragón<br>Castilla León | 4 Castilla la Mancha<br>Aragón<br>Castilla León<br>Extremadura<br>Andalucía<br>Galicia<br>Murcia |
| 5 Andalucía<br>Extremadura                                                                    | 5 Andalucía<br>Extremadura                                           | 5 Andalucía<br>Extremadura                                           | 5 Extremadura<br>Andalucía<br>Galicia<br>Murcia                                                  |

Source: INE, FEDEA, and own elaboration.

### Annex 3 Fundamental variables in the period 2000-2022. Average values

#### Fundamental variables in the period 2000–2007. Average values

| Grouping | Autonomous Community | GVA             | Hours        | LP   | ALP  |
|----------|----------------------|-----------------|--------------|------|------|
| 1        | Madrid               | 1.279.008.542,7 | 40.864.422,3 | 31,3 | 30,0 |
|          | Illes Balears        | 186.910.081,6   | 6.511.886,8  | 28,7 |      |
|          | Canarias             | 279.145.191,0   | 10.740.956,2 | 26,0 |      |
| 2        | La Rioja             | 53.475.060,7    | 1.946.973,4  | 27,5 | 28,0 |
|          | Navarra              | 117.364.830,9   | 4.149.621,1  | 28,3 |      |
| 3        | Andalucía            | 976.374.298,3   | 38.673.304,3 | 25,2 | 24,9 |
|          | Extremadura          | 118.436.423,5   | 5.216.356,1  | 22,7 |      |
| 4        | Castilla la Mancha   | 248.201.589,1   | 10.317.826,9 | 24,1 | 24,0 |
|          | Galicia              | 369.113.876,2   | 15.324.632,0 | 24,1 |      |
|          | Murcia               | 177.823.075,5   | 7.480.594,6  | 23,8 |      |
| 5        | Cataluña             | 1.369.355.986,3 | 46.497.656,2 | 29,5 | 28,0 |
|          | C. Valenciana        | 701.030.595,2   | 26.846.795,2 | 26,1 |      |
|          | Aragón               | 223.092.496,8   | 8.315.624,7  | 26,8 |      |
|          | Castilla León        | 365.737.569,1   | 14.365.920,9 | 25,5 |      |
|          | País Vasco           | 427.308.612,1   | 13.764.427,5 | 31,0 |      |
|          | Asturias             | 153.592.501,6   | 5.729.046,1  | 26,8 |      |
|          | Cantabria            | 87.282.121,0    | 3.267.606,7  | 26,7 |      |

Source: INE, FEDEA, and own elaboration.

#### Fundamental variables for the period 2008–2013. Average values

| Grouping | Autonomous Community | GVA             | Hours        | LP   | ALP  |
|----------|----------------------|-----------------|--------------|------|------|
| 1        | Madrid               | 1.090.938.297,0 | 32.442.887,9 | 33,6 | 32,1 |
|          | Illes Balears        | 151.222.842,1   | 5.085.942,3  | 29,7 |      |
|          | Canarias             | 223.319.062,7   | 8.063.491,4  | 27,7 |      |
| 2        | La Rioja             | 43.920.296,6    | 1.439.293,7  | 30,5 | 32,0 |
|          | Navarra              | 98.213.570,6    | 3.002.490,3  | 32,7 |      |
| 3        | Cataluña             | 1.111.749.949,2 | 34.849.639,4 | 31,9 | 31,1 |
|          | País Vasco           | 351.810.234,9   | 10.107.265,4 | 34,8 |      |
|          | C. Valenciana        | 554.209.653,8   | 19.458.642,4 | 28,5 |      |
|          | Asturias             | 122.850.056,8   | 4.226.886,4  | 29,1 |      |
|          | Cantabria            | 69.827.241,4    | 2.382.938,9  | 29,3 |      |
| 4        | Castilla la Mancha   | 209.020.414,2   | 7.755.628,8  | 27,0 | 27,5 |
|          | Galicia              | 308.379.805,6   | 11.480.458,7 | 26,9 |      |
|          | Murcia               | 148.105.583,5   | 6.056.698,8  | 24,5 |      |
|          | Aragón               | 184.989.157,9   | 6.141.935,5  | 30,1 |      |
|          | Castilla León        | 298.999.973,0   | 10.325.366,9 | 29,0 |      |
| 5        | Andalucía            | 796.373.259,0   | 29.785.281,5 | 26,7 | 26,7 |
|          | Extremadura          | 100.370.620,6   | 3.794.570,8  | 26,5 |      |

Source: INE, FEDEA, and own elaboration.

### Fundamental variables for the period 2014–2019. Average values

| Grouping | Autonomous Community | GVA             | Hours        | LP   | ALP  |
|----------|----------------------|-----------------|--------------|------|------|
| 1        | Madrid               | 1.178.945.166,3 | 32.962.793,9 | 35,8 | 34,1 |
|          | Illes Balears        | 164.152.109,0   | 5.172.020,6  | 31,7 |      |
|          | Canarias             | 232.542.967,5   | 8.130.574,1  | 28,6 |      |
| 2        | La Rioja             | 43.688.747,5    | 1.410.107,1  | 31,0 | 33,7 |
|          | Navarra              | 103.725.651,9   | 2.957.964,1  | 35,1 |      |
| 3        | Cataluña             | 1.169.102.776,0 | 34.511.403,9 | 33,9 | 32,9 |
|          | C. Valenciana        | 571.067.363,5   | 19.222.668,6 | 29,7 |      |
|          | País Vasco           | 368.696.364,9   | 9.847.970,7  | 37,4 |      |
|          | Asturias             | 119.365.082,9   | 3.939.794,4  | 30,3 |      |
|          | Cantabria            | 70.328.464,7    | 2.251.440,5  | 31,2 |      |
| 4        | Galicia              | 319.708.763,7   | 10.884.634,2 | 29,4 | 29,4 |
|          | Murcia               | 159.554.286,9   | 6.105.350,6  | 26,1 |      |
|          | Castilla la Mancha   | 209.358.462,9   | 7.312.645,7  | 28,6 |      |
|          | Aragón               | 188.609.559,0   | 5.937.734,4  | 31,8 |      |
|          | Castilla León        | 299.779.781,1   | 9.816.539,0  | 30,5 |      |
| 5        | Andalucía            | 818.297.532,7   | 29.414.831,1 | 27,8 | 27,8 |
|          | Extremadura          | 102.582.324,2   | 3.746.355,9  | 27,4 |      |

Source: INE, FEDEA, and own elaboration.

### Fundamental variables for the period 2020–2022. Average values

| Grouping | Autonomous Community | GVA         | Hours      | LP   | ALP  |
|----------|----------------------|-------------|------------|------|------|
| 1        | Canarias             | 109333023,2 | 3904005,4  | 28,0 | 34,3 |
|          | Illes Balears        | 76004512,3  | 2394217,8  | 31,7 |      |
|          | Madrid               | 608778094,4 | 16831535,9 | 36,2 |      |
| 2        | La Rioja             | 21753556,6  | 678434,0   | 32,1 | 34,9 |
|          | Navarra              | 52411897,7  | 1445245,5  | 36,3 |      |
| 3        | Cataluña             | 583495626,2 | 17333696,1 | 33,7 | 33,1 |
|          | C. Valenciana        | 289526039,9 | 9718188,1  | 29,8 |      |
|          | País Vasco           | 184395548,7 | 4783316,9  | 38,5 |      |
|          | Asturias             | 58151455,9  | 1877917,2  | 31,0 |      |
|          | Cantabria            | 35289694,5  | 1102779,1  | 32,0 |      |
| 4        | Castilla la Mancha   | 105949508,9 | 3671547,5  | 28,9 | 30,6 |
|          | Aragón               | 94774807,5  | 2947103,3  | 32,2 |      |
|          | Castilla León        | 148651072,6 | 4797457,3  | 31,0 |      |
| 5        | Extremadura          | 50804720,2  | 1873773,4  | 27,1 | 28,3 |
|          | Andalucía            | 409408024,0 | 14670388,6 | 27,9 |      |
|          | Galicia              | 161345121,2 | 5242596,3  | 30,8 |      |
|          | Murcia               | 81496794,6  | 3072095,8  | 26,5 |      |

Source: INE, FEDEA, and own elaboration.

## Appendices

### Appendix 1 Real productivity per hour worked (€2015) in Spain

|                                | 2000  | 2001  | 2002  | 2003  | 2004  | 2005  | 2006  | 2007  | 2008  | 2009  | 2010  |
|--------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| National total                 | 29,89 | 29,94 | 29,99 | 30,08 | 30,18 | 30,28 | 30,45 | 30,8  | 30,87 | 31,62 | 32,43 |
| 01 Andalucía                   | 28,21 | 28,1  | 28,4  | 28,33 | 28,31 | 28,03 | 27,9  | 28,01 | 28,02 | 28,63 | 29,03 |
| 02 Aragón                      | 28,87 | 28,89 | 29,11 | 29,46 | 29,75 | 29,95 | 30,53 | 31,18 | 30,96 | 31,73 | 32,66 |
| 03 Asturias, Principado de     | 29,2  | 29,17 | 29,39 | 29,23 | 29,66 | 29,68 | 29,99 | 30,38 | 30,3  | 30,74 | 31,98 |
| 04 Balears, Illes              | 33,03 | 32,24 | 31,69 | 31,3  | 30,93 | 30,12 | 30,01 | 29,82 | 30,17 | 30,78 | 31,74 |
| 05 Canarias                    | 30,13 | 29,81 | 29,4  | 29,34 | 28,83 | 28,85 | 28,53 | 28,43 | 28,58 | 29,34 | 30,38 |
| 06 Cantabria                   | 29,48 | 29,33 | 29,18 | 29,25 | 29,38 | 29,37 | 29,94 | 30,11 | 30,28 | 30,82 | 32,42 |
| 07 Castilla y León             | 27,8  | 27,87 | 28,38 | 28,63 | 29,03 | 29,11 | 29,43 | 29,78 | 30,02 | 30,74 | 31,53 |
| 08 Castilla - La Mancha        | 24,42 | 24,7  | 25,12 | 25,69 | 25,99 | 26,22 | 26,61 | 27,13 | 27,54 | 28,75 | 29,52 |
| 09 Cataluña                    | 31,01 | 31,49 | 31,83 | 31,95 | 32,12 | 32,28 | 32,49 | 33    | 32,89 | 33,68 | 34,58 |
| 10 Comunidad Valenciana        | 28,19 | 28,61 | 28,49 | 28,48 | 28,25 | 28,46 | 28,64 | 29,03 | 29,16 | 30,11 | 31,11 |
| 11 Extremadura                 | 23,7  | 24,14 | 24,27 | 24,65 | 24,97 | 25,17 | 25,56 | 25,95 | 26,26 | 27,36 | 28,22 |
| 12 Galicia                     | 26,47 | 26,14 | 26,1  | 26,16 | 26,51 | 26,81 | 27,08 | 27,34 | 27,75 | 28,4  | 29,22 |
| 13 Madrid, Comunidad de        | 34,34 | 34,16 | 33,75 | 34,01 | 33,94 | 34,25 | 34,39 | 34,94 | 34,82 | 35,44 | 36,31 |
| 14 Murcia, Región de           | 28,06 | 27,33 | 26,76 | 26,52 | 26,08 | 26,26 | 25,98 | 25,86 | 25,96 | 26,37 | 26,68 |
| 15 Navarra, Comunidad Foral de | 29,37 | 29,72 | 30,26 | 30,79 | 31,69 | 31,93 | 32,96 | 33,53 | 34,16 | 35,05 | 35,61 |
| 16 País Vasco                  | 33,46 | 33,48 | 33,51 | 33,62 | 34,43 | 35,05 | 35,77 | 36,31 | 36,41 | 37,1  | 37,98 |
| 17 Rioja, La                   | 29,16 | 29,02 | 29,14 | 29,74 | 30,16 | 30,73 | 31,44 | 32,44 | 32,85 | 33,64 | 33,78 |
| 18 Ceuta                       | 44,81 | 41,78 | 39,94 | 38,83 | 37,63 | 35,39 | 33,56 | 32,63 | 31,21 | 29,58 | 29,11 |
| 19 Melilla                     | 41,14 | 39,18 | 38,54 | 37,05 | 35,52 | 34,41 | 32,48 | 31,21 | 29,78 | 28,28 | 27,51 |

|                                | 2011  | 2012  | 2013  | 2014  | 2015  | 2016  | 2017  | 2018  | 2019  | 2020  | 2021  | 2022  |
|--------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| National total                 | 32,92 | 33,53 | 34,04 | 34,14 | 34,41 | 34,56 | 34,87 | 34,78 | 34,99 | 34,92 | 34,65 | 35,3  |
| 01 Andalucía                   | 29,55 | 30,2  | 30,4  | 30,25 | 30,46 | 30,36 | 30,93 | 30,85 | 30,89 | 30,72 | 30,42 | 30,97 |
| 02 Aragón                      | 32,99 | 33,05 | 34,22 | 34,49 | 34,5  | 34,52 | 34,39 | 34,76 | 34,63 | 34,85 | 34,88 | 35,18 |
| 03 Asturias, Principado de     | 32,04 | 32,49 | 32,99 | 32,76 | 33,19 | 33,14 | 33,7  | 33,45 | 33,96 | 34,5  | 33,78 | 34,12 |
| 04 Balears, Illes              | 32,64 | 33,31 | 33,81 | 33,7  | 34,02 | 34,33 | 35,26 | 34,76 | 34,91 | 33,3  | 34,5  | 35,6  |
| 05 Canarias                    | 30,74 | 31,28 | 31,51 | 31,55 | 31,39 | 31,03 | 31,52 | 31,08 | 31,19 | 30,38 | 30,41 | 30,92 |
| 06 Cantabria                   | 32,35 | 32,96 | 32,75 | 33,3  | 33,61 | 33,71 | 34,63 | 34,73 | 34,88 | 34,99 | 34,64 | 35,27 |
| 07 Castilla y León             | 32,07 | 32,36 | 33,24 | 33,35 | 33,34 | 33,71 | 33,26 | 33,73 | 33,65 | 34,26 | 33,78 | 33,88 |
| 08 Castilla - La Mancha        | 30,04 | 29,98 | 31,11 | 31,04 | 31,28 | 31,47 | 31,73 | 32,16 | 32,06 | 32,33 | 31,91 | 31,43 |
| 09 Cataluña                    | 34,83 | 35,64 | 36,5  | 36,73 | 37,09 | 37,28 | 36,97 | 36,77 | 37,2  | 36,82 | 36,44 | 37,08 |
| 10 Comunidad Valenciana        | 31,38 | 31,83 | 32,36 | 32,44 | 32,42 | 32,33 | 32,76 | 32,55 | 32,55 | 32,6  | 32,34 | 32,85 |
| 11 Extremadura                 | 28,89 | 29,47 | 29,93 | 29,75 | 29,96 | 29,75 | 29,25 | 29,52 | 29,52 | 29,78 | 29,16 | 28,98 |
| 12 Galicia                     | 29,63 | 30,36 | 31    | 31,09 | 31,94 | 32,17 | 32,62 | 32,95 | 32,94 | 33,74 | 33,58 | 34,19 |
| 13 Madrid, Comunidad de        | 37,15 | 38,08 | 38,22 | 38,3  | 38,56 | 39,36 | 39,81 | 39,46 | 39,88 | 39,68 | 39,28 | 40,4  |
| 14 Murcia, Región de           | 27,17 | 27,64 | 27,71 | 28,08 | 28,94 | 29    | 29,42 | 29,13 | 29,05 | 29,35 | 29,26 | 29,45 |
| 15 Navarra, Comunidad Foral de | 36,01 | 36,51 | 37,17 | 37,76 | 38,15 | 37,51 | 38,71 | 38,67 | 39,11 | 39,38 | 39,5  | 40,05 |
| 16 País Vasco                  | 38,32 | 39,11 | 39,6  | 40,47 | 40,82 | 40,93 | 40,84 | 41,06 | 41,65 | 41,69 | 41,71 | 43,22 |
| 17 Rioja, La                   | 33,57 | 34,02 | 34,2  | 33,91 | 34,31 | 33,89 | 35,07 | 35,15 | 35,07 | 35,59 | 35,44 | 36,16 |
| 18 Ceuta                       | 28,42 | 28,47 | 28,28 | 27,48 | 26,26 | 25,78 | 32,22 | 32,24 | 32,82 | 32,03 | 31,43 | 31,99 |
| 19 Melilla                     | 26,65 | 25,96 | 25,05 | 24,52 | 24,25 | 23,56 | 32,17 | 31,92 | 31,8  | 30,22 | 30,18 | 31,03 |

Source: INE.

Note: Own elaboration based on INE data.

## Appendix 2 Real productivity per hour worked (€2016) in Spain

|                                | 2000  | 2001  | 2002  | 2003  | 2004  | 2005  | 2006  | 2007  | 2008  | 2009  | 2010  |
|--------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| National total                 | 27,13 | 27,15 | 27,2  | 27,26 | 27,39 | 27,46 | 27,65 | 28,09 | 28,27 | 29,04 | 29,76 |
| 01 Andalucía                   | 25,23 | 25,12 | 25,4  | 25,32 | 25,35 | 25,16 | 25,08 | 25,32 | 25,51 | 26,23 | 26,51 |
| 02 Aragón                      | 25,82 | 25,87 | 26,12 | 26,47 | 26,81 | 27,05 | 27,68 | 28,48 | 28,45 | 29,3  | 30,26 |
| 03 Asturias, Principado de     | 26,5  | 26,42 | 26,61 | 26,41 | 26,79 | 26,75 | 27,15 | 27,71 | 27,78 | 28,27 | 29,29 |
| 04 Balears, Illes              | 30,37 | 29,76 | 29,17 | 28,89 | 28,67 | 27,86 | 27,8  | 27,72 | 28,12 | 28,69 | 29,38 |
| 05 Canarias                    | 26,66 | 26,47 | 26,01 | 26,06 | 25,76 | 25,81 | 25,63 | 25,73 | 26,06 | 26,86 | 27,78 |
| 06 Cantabria                   | 26,35 | 26,3  | 26,27 | 26,41 | 26,64 | 26,63 | 27,31 | 27,62 | 27,85 | 28,32 | 29,76 |
| 07 Castilla y León             | 24,25 | 24,37 | 24,9  | 25,19 | 25,67 | 25,82 | 26,3  | 26,92 | 27,33 | 28,14 | 28,94 |
| 08 Castilla - La Mancha        | 23,21 | 23,32 | 23,59 | 24    | 24,18 | 24,22 | 24,54 | 25,08 | 25,44 | 26,43 | 26,94 |
| 09 Cataluña                    | 28,73 | 29,05 | 29,34 | 29,35 | 29,53 | 29,53 | 29,69 | 30,2  | 30,23 | 31    | 31,88 |
| 10 Comunidad Valenciana        | 25,86 | 26,18 | 26,03 | 26,01 | 25,86 | 26,02 | 26,19 | 26,66 | 26,89 | 27,78 | 28,59 |
| 11 Extremadura                 | 21,4  | 21,85 | 22,05 | 22,44 | 22,81 | 23,04 | 23,54 | 24,18 | 24,64 | 25,72 | 26,36 |
| 12 Galicia                     | 24,17 | 23,75 | 23,69 | 23,65 | 23,94 | 24,14 | 24,43 | 24,78 | 25,27 | 26,02 | 26,81 |
| 13 Madrid, Comunidad de        | 31,39 | 31,21 | 30,93 | 31,11 | 31,08 | 31,28 | 31,35 | 31,95 | 31,87 | 32,55 | 33,24 |
| 14 Murcia, Región de           | 24,88 | 24,29 | 23,87 | 23,72 | 23,37 | 23,58 | 23,41 | 23,43 | 23,61 | 24,05 | 24,24 |
| 15 Navarra, Comunidad Foral de | 26,66 | 26,89 | 27,35 | 27,75 | 28,57 | 28,71 | 29,65 | 30,39 | 30,97 | 31,95 | 32,69 |
| 16 País Vasco                  | 30,04 | 30,08 | 30,12 | 30,18 | 31    | 31,51 | 32,23 | 32,93 | 33,08 | 33,73 | 34,73 |
| 17 Rioja, La                   | 26,64 | 26,47 | 26,53 | 27    | 27,32 | 27,73 | 28,35 | 29,39 | 29,83 | 30,57 | 30,64 |

|                                | 2011  | 2012  | 2013  | 2014  | 2015  | 2016  | 2017  | 2018  | 2019  | 2020  | 2021  |
|--------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| National total                 | 30,26 | 30,88 | 31,31 | 31,33 | 31,35 | 31,5  | 31,78 | 31,71 | 31,92 | 31,9  | 31,55 |
| 01 Andalucía                   | 27,02 | 27,65 | 27,81 | 27,58 | 27,58 | 27,54 | 28,08 | 28,02 | 28,08 | 27,96 | 27,6  |
| 02 Aragón                      | 30,66 | 30,71 | 31,72 | 31,88 | 31,63 | 31,69 | 31,6  | 31,94 | 31,85 | 32,1  | 32,02 |
| 03 Asturias, Principado de     | 29,41 | 29,79 | 30,18 | 29,87 | 30,1  | 30,02 | 30,58 | 30,33 | 30,85 | 31,36 | 30,59 |
| 04 Balears, Illes              | 30,33 | 30,96 | 31,35 | 31,17 | 31,21 | 31,51 | 32,4  | 31,95 | 32,11 | 30,67 | 31,67 |
| 05 Canarias                    | 28,21 | 28,74 | 28,88 | 28,84 | 28,58 | 28,37 | 28,84 | 28,44 | 28,57 | 27,86 | 27,81 |
| 06 Cantabria                   | 29,78 | 30,37 | 30,1  | 30,51 | 30,71 | 30,78 | 31,66 | 31,76 | 31,94 | 32,09 | 31,65 |
| 07 Castilla y León             | 29,49 | 29,78 | 30,46 | 30,46 | 30,24 | 30,71 | 30,33 | 30,76 | 30,72 | 31,32 | 30,76 |
| 08 Castilla - La Mancha        | 27,49 | 27,47 | 28,31 | 28,13 | 28,16 | 28,49 | 28,74 | 29,13 | 29,05 | 29,32 | 28,84 |
| 09 Cataluña                    | 32,15 | 32,91 | 33,66 | 33,78 | 33,9  | 34,06 | 33,82 | 33,63 | 34,07 | 33,75 | 33,29 |
| 10 Comunitat Valenciana        | 28,9  | 29,36 | 29,84 | 29,79 | 29,55 | 29,49 | 29,91 | 29,73 | 29,77 | 29,85 | 29,5  |
| 11 Extremadura                 | 27    | 27,55 | 27,87 | 27,58 | 27,61 | 27,47 | 27,05 | 27,3  | 27,32 | 27,6  | 26,96 |
| 12 Galicia                     | 27,22 | 27,88 | 28,38 | 28,4  | 28,94 | 29,22 | 29,66 | 29,96 | 29,97 | 30,74 | 30,49 |
| 13 Madrid, Comunidad de        | 34,12 | 35,05 | 35,28 | 35,28 | 35,2  | 35,72 | 36,16 | 35,87 | 36,27 | 36,11 | 35,64 |
| 14 Murcia, Región de           | 24,72 | 25,13 | 25,17 | 25,43 | 25,97 | 26,17 | 26,57 | 26,32 | 26,27 | 26,56 | 26,41 |
| 15 Navarra, Comunidad Foral de | 33,16 | 33,6  | 34,21 | 34,77 | 34,79 | 34,26 | 35,37 | 35,35 | 35,8  | 36,09 | 36,08 |
| 16 País Vasco                  | 35,2  | 36,02 | 36,45 | 37,21 | 37,22 | 37,33 | 37,28 | 37,48 | 38,07 | 38,14 | 38,01 |
| 17 Rioja, La                   | 30,41 | 30,85 | 30,88 | 30,45 | 30,57 | 30,36 | 31,46 | 31,54 | 31,49 | 31,98 | 31,74 |

Source: FEDEA.

Note: Own elaboration based on FEDEA data.

### Appendix 3 Real productivity per hour worked by branches of activity (€2015) in Spain

| Divisiones CNAE rev.2 |                                             | 2000   | 2001   | 2002   | 2003   | 2004   | 2005   | 2006   | 2007   | 2008   | 2009   |
|-----------------------|---------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| GDP                   | GDP                                         | 29,89  | 29,94  | 29,98  | 30,07  | 30,17  | 30,29  | 30,46  | 30,8   | 30,88  | 31,62  |
| De 1 a 3              | Agriculture and Fishing                     | 13,15  | 12,96  | 13,28  | 13,55  | 13,68  | 13,07  | 14,71  | 16,29  | 16,61  | 16,85  |
| De 5 a 39             | Industry                                    | 29,68  | 30,8   | 31,37  | 32,11  | 32,71  | 33,79  | 35,43  | 36,91  | 36,94  | 37,69  |
| De 10 a 33            | Manufacturing Industry                      | 25,41  | 26,35  | 26,75  | 27,31  | 27,73  | 28,59  | 30,06  | 31,28  | 30,8   | 31,48  |
| 41-43                 | Construction                                | 23,14  | 22,64  | 22,17  | 21,66  | 20,97  | 20,31  | 19,73  | 18,97  | 21,1   | 24,68  |
| 45-56                 | Trade, Hospitality and Transport            | 22,72  | 22,59  | 22,23  | 21,89  | 21,6   | 21,37  | 21,15  | 20,86  | 20,38  | 20,76  |
| 58-63                 | Information and Communication               | 34,51  | 35,85  | 36,37  | 37,85  | 37,9   | 38,55  | 37,83  | 39,93  | 39,59  | 39,49  |
| 64-66                 | Financial Activities                        | 49,01  | 54,03  | 56,15  | 58,09  | 63,32  | 69,38  | 75,27  | 79,23  | 81,52  | 78,29  |
| 68                    | Real Estate Activities                      | 309,87 | 301,72 | 309,39 | 297,87 | 295,88 | 288,04 | 271,02 | 288,55 | 278,45 | 318,83 |
| 69-82                 | Professional Activities                     | 26,96  | 24,22  | 22,62  | 21,91  | 20,97  | 20,81  | 20,85  | 21,36  | 20,22  | 20,28  |
| 84-88                 | Public Administration, Education and Health | 28,85  | 28,99  | 29,1   | 29,15  | 29,47  | 29,27  | 28,87  | 29,53  | 29,53  | 29,14  |
| 90-98                 | Artistic and Recreational Activities        | 17,65  | 17,95  | 17,96  | 17,58  | 17,54  | 17,47  | 17,24  | 17,43  | 17,53  | 17,64  |

| Divisiones CNAE rev.2 |                                             | 2011   | 2012  | 2013  | 2014   | 2015   | 2016  | 2017   | 2018   | 2019   | 2020   |
|-----------------------|---------------------------------------------|--------|-------|-------|--------|--------|-------|--------|--------|--------|--------|
| GDP                   | GDP                                         | 32,91  | 33,54 | 34,04 | 34,14  | 34,41  | 34,57 | 34,87  | 34,79  | 34,99  | 34,92  |
| De 1 a 3              | Agriculture and Fishing                     | 18,44  | 17,18 | 19,94 | 19,68  | 20,61  | 20,74 | 19,52  | 21,25  | 20,46  | 21,32  |
| De 5 a 39             | Industry                                    | 41,39  | 42,47 | 42,94 | 44,06  | 44,36  | 44,63 | 45,35  | 44,6   | 44,2   | 42,68  |
| De 10 a 33            | Manufacturing Industry                      | 33,43  | 34,37 | 35,93 | 37,17  | 37,9   | 37,42 | 38,49  | 37,41  | 36,73  | 34,27  |
| 41-43                 | Construction                                | 24,43  | 27,18 | 27,68 | 27,68  | 26,9   | 27,43 | 26,66  | 25,43  | 24,46  | 23,95  |
| 45-56                 | Trade, Hospitality and Transport            | 21,64  | 22,08 | 22,3  | 22,29  | 22,91  | 22,99 | 23,49  | 23,55  | 23,79  | 22,29  |
| 58-63                 | Information and Communication               | 39,83  | 42,15 | 44,09 | 46,83  | 46,54  | 46,86 | 47,46  | 47,44  | 48,63  | 46,91  |
| 64-66                 | Financial Activities                        | 75,65  | 72,42 | 68,51 | 66,9   | 64,09  | 64,92 | 65,55  | 69,76  | 65,17  | 68,62  |
| 68                    | Real Estate Activities                      | 346,76 | 375   | 417,4 | 386,51 | 361,23 | 345,1 | 330,96 | 308,87 | 301,86 | 319,18 |
| 69-82                 | Professional Activities                     | 21,35  | 21,38 | 21,67 | 21,97  | 22,29  | 22,64 | 22,88  | 23,26  | 23,95  | 23,43  |
| 84-88                 | Public Administration, Education and Health | 29,47  | 29,4  | 29,44 | 28,73  | 28,71  | 28,66 | 29,26  | 28,99  | 29,81  | 29,63  |
| 90-98                 | Artistic and Recreational Activities        | 18,5   | 18,21 | 18,62 | 19     | 19,81  | 19,74 | 20,18  | 19,84  | 20,67  | 19,09  |

Source: INE.

Note: Own elaboration based on INE data.

## Appendix 4 Real productivity per hour worked by branches of activity (€2016) in Spain

|                                                                   | 2000  | 2001  | 2002  | 2003  | 2004  | 2005  | 2006  | 2007  |
|-------------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Regional Aggregate                                                | 27,13 | 27,15 | 27,2  | 27,26 | 27,39 | 27,46 | 27,65 | 28,09 |
| Agriculture and Fishing                                           | 13,68 | 13,41 | 13,71 | 13,99 | 14,13 | 13,49 | 15,22 | 16,82 |
| Industry                                                          | 29,06 | 30,11 | 30,85 | 31,64 | 32,42 | 33,5  | 35,21 | 36,64 |
| Construction                                                      | 24,27 | 23,54 | 22,99 | 22,28 | 21,5  | 20,6  | 19,75 | 18,86 |
| Services                                                          | 28,57 | 28,46 | 28,41 | 28,39 | 28,51 | 28,64 | 28,59 | 29,12 |
|                                                                   |       |       |       |       |       |       |       |       |
| Sector V. Services excluding Health and Education                 | 28,94 | 28,71 | 28,57 | 28,45 | 28,45 | 28,59 | 28,57 | 28,91 |
| Sector VI. Public Services including Health and Education         | 27,53 | 27,74 | 27,93 | 28,2  | 28,69 | 28,77 | 28,66 | 29,78 |
| Sector Va. Financial and Insurance Services                       | 49,53 | 52,89 | 55,21 | 57,33 | 62,49 | 68,82 | 74,72 | 79,6  |
| Sector Vb. Trade, Hospitality, Transport and Communications       | 25,72 | 25,66 | 25,41 | 25,13 | 24,98 | 24,82 | 24,55 | 24,2  |
| Sector Vc. Other Market Services (excluding Health and Education) | 31,94 | 30,94 | 30,68 | 30,63 | 30,41 | 30,38 | 30,08 | 31,12 |

|                                                                   | 2008  | 2009  | 2010  | 2011  | 2012  | 2013  | 2014  |
|-------------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|
| Regional Aggregate                                                | 28,27 | 29,04 | 29,76 | 30,26 | 30,88 | 31,31 | 31,33 |
| Agriculture and Fishing                                           | 17,08 | 17,27 | 17,69 | 18,39 | 17,13 | 19,63 | 19,42 |
| Industry                                                          | 36,66 | 37,41 | 39,72 | 41,06 | 42,16 | 42,32 | 43,46 |
| Construction                                                      | 21,23 | 24,99 | 24,53 | 25,03 | 28,1  | 28,56 | 28,32 |
| Services                                                          | 28,65 | 28,9  | 29,46 | 29,76 | 30,19 | 30,57 | 30,48 |
|                                                                   |       |       |       |       |       |       |       |
| Sector V. Services excluding Health and Education                 | 28,16 | 28,57 | 29,16 | 29,69 | 30,31 | 30,82 | 30,96 |
| Sector VI. Public Services including Health and Education         | 30,25 | 29,91 | 30,37 | 29,99 | 29,88 | 29,86 | 29,12 |
| Sector Va. Financial and Insurance Services                       | 80,22 | 76,81 | 75,94 | 75,82 | 73,29 | 71,24 | 70,08 |
| Sector Vb. Trade, Hospitality, Transport and Communications       | 23,51 | 23,86 | 24,52 | 24,77 | 25,39 | 25,79 | 26,07 |
| Sector Vc. Other Market Services (excluding Health and Education) | 30,12 | 30,81 | 31,49 | 32,51 | 33,32 | 34,29 | 34,44 |

|                                                                   | 2015  | 2016  | 2017  | 2018  | 2019  | 2020  | 2021  | 2022  |
|-------------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Regional Aggregate                                                | 31,35 | 31,5  | 31,78 | 31,71 | 31,92 | 31,9  | 31,55 | 32,18 |
| Agriculture and Fishing                                           | 20,22 | 21,13 | 19,9  | 21,57 | 20,79 | 21,52 | 21,65 | 18,13 |
| Industry                                                          | 43,22 | 43,8  | 44,5  | 43,79 | 43,39 | 41,92 | 42,53 | 42,96 |
| Construction                                                      | 27,36 | 27,76 | 26,99 | 25,75 | 24,77 | 24,25 | 21,91 | 22,08 |
| Services                                                          | 30,58 | 30,58 | 30,99 | 31,04 | 31,51 | 31,71 | 31,44 | 32,34 |
|                                                                   |       |       |       |       |       |       |       |       |
| Sector V. Services excluding Health and Education                 | 31,1  | 31,11 | 31,49 | 31,64 | 31,98 | 32,38 | 32,3  | 33,69 |
| Sector VI. Public Services including Health and Education         | 29,08 | 29,06 | 29,53 | 29,27 | 30,1  | 29,95 | 29,08 | 28,53 |
| Sector Va. Financial and Insurance Services                       | 67,81 | 66,13 | 66,77 | 71,07 | 66,38 | 69,92 | 68,19 | 74,69 |
| Sector Vb. Trade, Hospitality, Transport and Communications       | 26,69 | 26,97 | 27,73 | 27,87 | 28,23 | 27,51 | 28,64 | 30,35 |
| Sector Vc. Other Market Services (excluding Health and Education) | 34,21 | 34    | 33,83 | 33,74 | 34,37 | 35,03 | 33,88 | 34,96 |

Source: FEDEA.

Note: Own elaboration based on FEDEA data.

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