European productivity from a regional perspective

The Draghi report is flooded, even in its preamble, with references to the persistent productivity gap with the US, the low productivity growth in the EU, and the need to boost it in a context of a rapidly ageing population.[1] Thus, a sustained and higher increase in productivity has become a top priority for the European economy, as it would simultaneously allow for an improvement in citizens' purchasing power, help mitigate the effects of the demographic transition – including the sustainability of public finances –[2] as well as help maintain a minimum level of economic relevance in the new global geopolitical scenario. In this Dossier, we explore recent dynamics in the EU's productivity, focusing on its territorial dispersion and the differentiating factors between the best and worst performing regions. We begin with some context by outlining the main trends.

EU: productivity

Annual change (%)

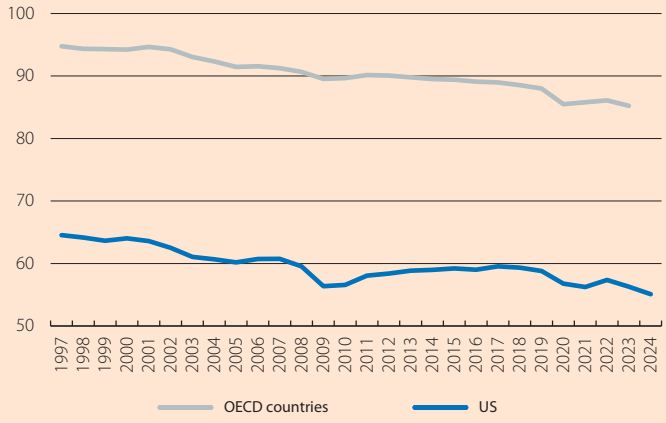
Notes: *Forecasts from 2024 onwards. The dashed lines correspond to the annual average of real GDP per hour worked during the periods 1996-2007 and 2008-2023.*
Source: *CaixaBank Research, based on data from AMECO.*

A broadly unfavourable diagnosis, from any perspective

The debate around what productivity is and how to measure it would probably fill an entire Dossier, so it is worth specifying from the outset which metrics we will use as a reference here and in the following articles. We opt to use GDP per hour worked, as it is considered a relatively uniform measure of production capacity (value added generation) per unit of working time. It is also less sensitive to the cycle than productivity per employee – as seen during COVID-19 – and is easily observable compared to the complications involved in estimating total factor productivity (TFP).[3] Moreover, GDP per hour worked is the metric which, according to the Draghi report, goes further in explaining the differences in per capita income between the European economy and the US. As for its measurement, we use statistics in real terms to analyse its evolution over time and abstract from the impact of prices, and when making a cross-sectional snapshot between EU Member States or regions, we adjust the nominal values for differences in purchasing power parity in each territory. In this way, our goal is to achieve the best possible approximation to a tangible idea – such as physical goods or services provided – rather than one based on monetary concepts or productivity.

EU: real GDP per hour worked

(% of the reference economy)



Note: *Calculated based on constant 2020 dollar values adjusted for purchasing power parity.*
Source: *CaixaBank Research, based on data from the OECD.*

The debate around metrics quickly takes a back seat when we find that they all lead us to a similar diagnosis and, more importantly, one that is not favourable for the aggregate productivity of the European economy. Thus, real GDP growth per hour worked in the EU has shown a notable slowdown over the past 30 years, decreasing from an annual average of 1.7% in the period 1996-2007 to 0.8% in 2008-2023, and falling below 0.5% since COVID-19 (see first graph). Productivity growth since the Great Recession is also less than half of that observed in the previous decade if we look at the figures in terms of GDP per employee or TFP. The comparison with other developed economies does not reflect well on European productivity either (see second chart). According to OECD estimates, GDP per hour worked in the EU would today be equivalent to 85% of the value for this group of economies, compared to 95% in

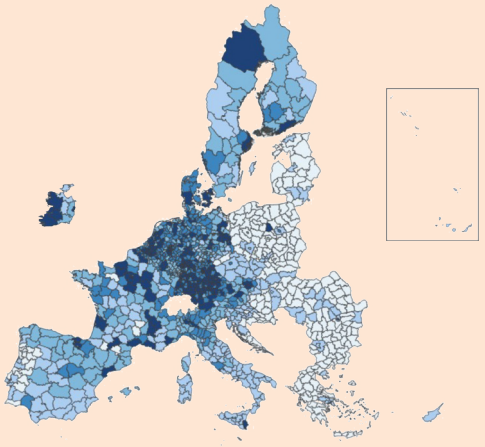
1. European Commission (2024), «The future of European competitiveness».
2. See the Dossier «Challenges and policies in the age of longevity» in the MR09/2025.
3. Changes in total factor productivity measure the variation in production in an economy that is not explained by increases in factors of production (capital and labour) – e.g. through a more efficient use of these factors.

1995. Moreover, it would have followed a similar trend relative to the country considered to be the technological frontier, the US, decreasing from 65% to 55% in the same period.[4]

Wide geographical disparity that is slowly narrowing

The data for the EU as a whole, or even within the Member States, conceal highly disparate realities between territories.[5] As a starting point for the more in-depth analyses presented in other articles of this Dossier, we introduce here a general overview of the regional differences in productivity levels and the recent dynamics. We take as a reference the most detailed territorial division defined by Eurostat, known as NUTS3, which covers approximately 1,165 territorial units across the 27 countries that make up the EU. In the case of Spain, this corresponds to the provinces and autonomous cities.

EU: GDP per hour worked by region
(2023)

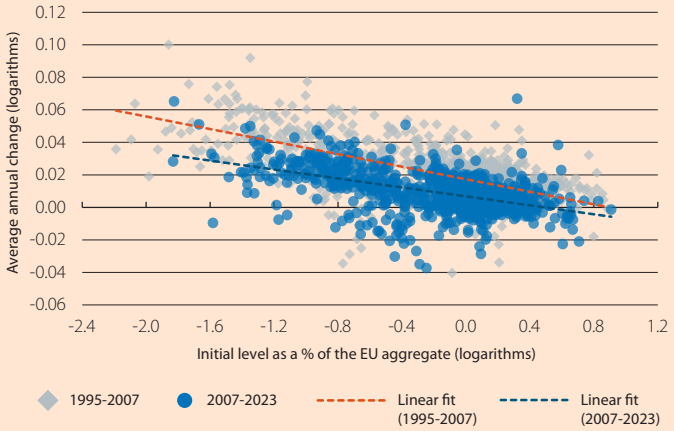


Notes: *Regions at the NUTS3 level (2024 definition). Level adjusted for purchasing power parity. Colour grading by quintile, ranging from light blue (lower productivity) to dark blue (higher productivity). The inset shows the Azores, Madeira and the Canary Islands.*
Source: *CaixaBank Research, based on data from the European Commission (ARDECO).*

With data for 2023, the geographical distribution shows a concentration of territories with higher productivity in the central and northern areas of the EU, while the lowest values are recorded in countries in the east and south (see map). Specifically, among the NUTS3 divisions where GDP per hour worked is at least 25% higher than the EU average, a significant number of regions are found in Ireland, Denmark, Germany, Belgium, France, and Austria. Conversely, among those with productivity at least 25% below the average, we find a majority of territories in Bulgaria, Greece, Poland, Portugal, Croatia, Hungary and the Baltic republics.

In light of this snapshot of differences in productivity levels, which confirms the persistence of significant territorial disparities within the EU, it is worth assessing the extent to which there has been convergence between regions of lower and higher productivity. Based on the two periods previously identified either side of the Great Recession, we compared the GDP per hour worked in the first year of each period with the average annual change (see third chart). From this exercise, we can draw three conclusions. The first, already noted above in aggregate terms and clearly visible in the chart due to the downward slope revealed by the scatter chart, is that productivity growth has been lower on average since 2008, with a greater number of regions with declines in GDP per hour worked. The second, reflected in a greater number of points located away from the dashed line marking the average pattern, is that the degree of dispersion in productivity change appears to have increased significantly for the same starting level; this would suggest a greater role of more idiosyncratic factors in the evolution of the different regions. The third conclusion, illustrated by the change in the slope of the dashed lines, is that the rate of convergence has also significantly decreased in the second period; i.e. the regions with lower productivity continue to grow faster than the rest, but to a lesser extent.

EU: productivity convergence between regions
Level of and change in real GDP per hour worked



Notes: *Regions at the NUTS3 level (2024 definition). Initial level in euros adjusted for purchasing power parity. Change in constant 2020 euros.*
Source: *CaixaBank Research, based on data from the European Commission (ARDECO).*

4. Calculated using constant 2020 USD values adjusted for purchasing power parity.
5. O. Aspachs and E. Solé (2024), «Evolución de la productividad en Europa: una mirada regional», Cercle d'Economia.

Greater convergence is needed in order to close the gap with the US

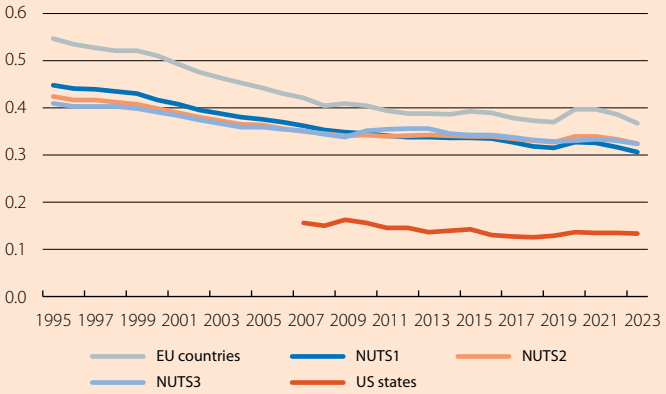
Parallels are often drawn between the EU and the federal structure across the Atlantic. Productivity is no exception, and better understanding its territorial differences can give us clues about which levers to activate in the European economy in order to close the persistent gap with the US. When comparing the dispersion between countries and regions of the EU with that of the US states, we find that the territorial map of productivity is much more even in the latter (see fourth chart). This diagnosis is robust to the use of different territorial units in the EU and would even hold if we used figures not adjusted for differences in price levels between US states.

The result of this greater dispersion among European regions, along with a lower average productivity than in the US, suggests that a significant number of territories must be far from the technological frontier. This conclusion is confirmed when we compare the levels of GDP per hour worked in US states with those of the most similar territorial units in the EU, the so-called NUTS1 divisions (large socio-economic regions with between 3 and 7 million inhabitants, or entire countries where applicable). Thus, while among the 25 territories with the highest productivity – out of a combined total of 143 – we find a relatively equitable distribution between both economic areas (something that is replicated in the middle part of the distribution), the 25 lowest records correspond to European regions, mainly in the east and south of the EU.

Understanding how we can accelerate convergence between EU territories – learning from the regions that show better performance and what would allow us to reduce the gap with the US – is precisely what we dedicate the following articles of this Dossier to.

Territorial dispersion of productivity in the EU and US

(Standard deviation over the average)

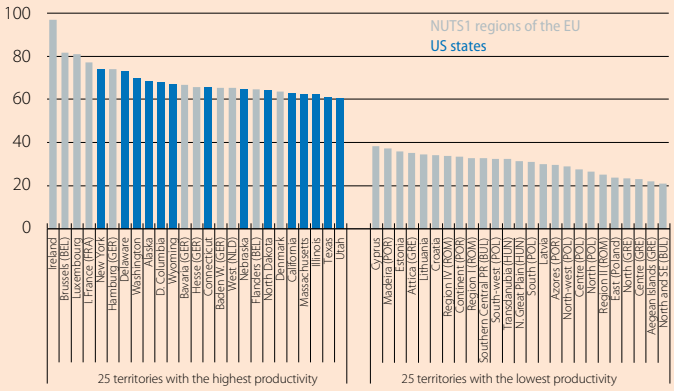


Notas: *Simple dispersion, not weighted by population. Productivity measured as GDP per hour worked at constant 2020 prices adjusted for purchasing power parity. Calculated for the US on the gross value added in the non-primary private sector.*

Source: *CaixaBank Research, based on data from the European Commission (ARDECO), the Bureau of Labor Statistics and the BEA.*

GDP per hour worked in EU and US territories

(2023)



Notes: *EUR thousands adjusted for purchasing power parity. Calculated for the US on the gross value added in the non-primary private sector. NUTS1 regions for the EU (2024 definition).*

Source: *CaixaBank Research, based on data from the European Commission, the Bureau of Labor Statistics, the BEA and the IMF.*

Oriol Aspachs, Javier Garcia-Arenas and David Martínez Turégano
(with excellent research support across all articles in the Dossier from Catalina Becu and Anna Bahí)

Factors shaping regional productivity disparities in Europe

Productivity is the ultimate driver of sustainable economic growth and long-term well-being. However, as we have seen in the first article of this Dossier («European productivity from a regional perspective»), neither its level nor its evolution over time are uniform across different territories, as they depend on multiple structural factors. In this article, we review a broad set of variables covering institutional, geographical and technological aspects, as well as others linked to the economy's productive structure, in order to distinguish the different groups of European regions according to their productivity level. This framework serves as a prelude to the third article,[1] in which we quantify their explanatory capacity relative to the dynamics observed over the last 20 years, seeking to understand why some regions have seen an acceleration in their productivity while others have stagnated.

The usual suspects explaining the geographical productivity gap

This section provides a brief overview of the aspects most frequently cited in the economic literature to explain territorial productivity differences and the transmission channels.

Firstly, institutional quality plays a crucial role. Regions with better governance tend to exhibit higher productivity and even enhance the returns of other factors such as training and innovation through regulatory efficiency, protection of property rights and the confidence of economic agents.[2] Conversely, weak institutions constrain the development of human capital and R&D expenditure, as well as for their translation into efficiency gains. Institutional reforms can be slow, but they are crucial for development.

Secondly, geographical aspects have a significant impact. Densely populated and urbanised regions are conducive to agglomeration economies that boost productivity.[3] The concentration of firms and workers facilitates specialisation, mutual learning, and more efficient services, while a high proportion of the population living in metropolitan areas tends to correlate with higher GDP per worker due to better access to markets and knowledge. Furthermore, neighbouring high-productivity regions increase the likelihood of a territory improving its relative position compared to others with a similar level of productivity.[4]

Thirdly, the structure of the regional productive fabric is a determining factor. A greater relative weight of the manufacturing sector tends to be associated with higher productivity and long-term growth, as it is in their industries – especially those with high technological complexity – where most innovation and efficiency gains are generated. Recent studies indicate that the relative decline of the manufacturing sector in European regions has been accompanied by a slowdown in productivity growth.[5] Similarly, business size plays an important role. Regions where a significant portion of employment is in medium-sized and large firms – with greater capital, technology, and economies of scale – tend to be more productive than those dominated by microenterprises.[6]

Finally, technological factors are decisive in the regional productivity gap. A higher share of jobs in high-tech sectors (both in industry and in services) is associated with higher levels of productivity, as activities such as computing or electronics tend to provide high value added per worker. Similarly, R&D intensity has a positive impact by boosting efficiency and generating spillover effects that benefit the entire productive fabric of the economy. Several analyses have indicated that part of Europe's low productivity growth in recent decades is due to a technological deficit compared to other advanced economies, including lower private investment in R&D, a lower dissemination of cutting-edge technologies and slower adoption of digitalisation.[7]

It is worth noting that these factors do not act in isolation but interact with each other. For example, good institutions enhance the positive effect of urban agglomeration or technological innovation. Similarly, skilled human capital is less likely to emigrate if the region offers a dynamic environment with attractive cities, cutting-edge sectors and good governance. The most prosperous European regions typically combine these ingredients virtuously, which explains much of the dispersion in productivity observed between territories.

1. See the article «Key factors driving productivity improvements at the European regional level» in this same Dossier.
2. A. Rodríguez-Pose, and R. Ganau (2022), «Institutions and the productivity challenge for European regions», Journal of Economic Geography, 22(1), 1-25.
3. A. Ciccone (2002), «Agglomeration effects in Europe», European Economic Review, 46(2), 213-227, and A. Gómez-Tello, M.J. Murgui-García and M.T. Sanchis-Llopis (2025), «Labour productivity disparities in European regions: the impact of agglomeration effects», Annals of Regional Science, 74(1), 123-146.
4. O. Aspachs Bracons, and E. Solé Vives (2024), «Evolución de la productividad en Europa: una mirada regional», Cercle d'Economia.
5. R. Capello and S. Cerisola (2023), «Regional reindustrialization patterns and productivity growth in Europe», Regional Studies, 57(1), 1-12.
6. See the Focus «Firm size and productivity gaps in the EU» in the MR10/2025.
7. IMF (2025), «Europe's Productivity Weakness: Firm-Level Roots and Remedies», IMF Working Paper nº 2025/040 and R. Veugelers (2018), «Are European Firms Falling Behind in the Global Corporate Research Race?», Bruegel Policy Contribution nº 6.

Characterisation of the most and least productive European regions

On the basis of the aspects identified in the previous section as relevant for explaining differences in productivity levels, we will now group Europe's regions into productivity quintiles, differentiating them according to the value of the variables that represent institutional, geographical and technological aspects and those linked to the productive fabric (see the table for a description of the variables used and their sources).[8]

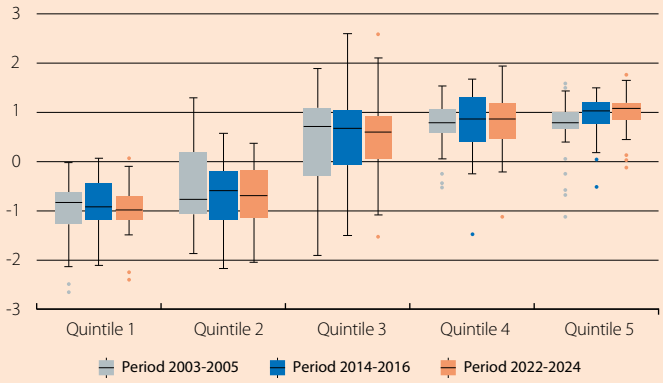
Database: main variables relevant to the analysis to explain differences in productivity

Variable and description	Sphere represented	Source
Productivity per hour worked *Adjusted for purchasing power parity in constant terms*	–	Eurostat
Productivity of bordering regions *Weighted by population*	Geographical factors	Eurostat
Density *Population per km²*	Geographical factors	Eurostat
Share of the population in the metropolitan area *% of the population living in the functional urban area**	Geographical factors	Eurostat
EQI *European Quality of Government Index ***	Institutional framework	University of Gothenburg
Total R&D expenditure *% of GDP*	Innovation & human capital	Eurostat
% of employment in high-tech sectors ***	Innovation & human capital	Eurostat
% of the population with secondary or higher education	Innovation & human capital	Eurostat
% of employment in firms with >10 employees	Productive & sectoral structure	Eurostat
% of hours worked in industry	Productive & sectoral structure	Eurostat

Notes: *Out of a total of 244 NUTS2 regions. * Defined as a territory comprising a main city and the area from which people regularly commute to work in that city. ** The EQI measures the perception of corruption and the quality and impartiality of public services in the EU. *** High-tech sectors include pharmaceutical and electronic manufacturing and knowledge-intensive services such as ICT and R&D.*
Source: *CaixaBank Research.*

In the institutional sphere, we use the European Quality of Government Index (EQI) developed by the University of Gothenburg, which has been published every three years since 2010[9] and includes aspects related to the quality of public services and the perception of corruption. We observe that the most productive regions tend to exhibit significantly superior institutional quality, with good governance and effective public services (see first chart). This advantage has remained relatively stable over time, while the less productive regions show very limited improvements.

European Quality of Government Index (EQI)*
Distribution by productivity quintile



Notes: *The boxes represent the interquartile range IQR = Q3 - Q1, where Q1 is the 25th percentile and Q3 the 75th percentile; the central line is the median, and the outer lines show the values within the normal range [Q1 - 1.5x IQR; Q3 + 1.5x IQR]; the points correspond to observations that fall outside this range (outlier values). * Standard deviation from the European average, mean = 0.*
Source: *CaixaBank Research, based on data from the University of Gothenburg.*

For the geographical dimension, we use three variables: population density, measured as the number of inhabitants per square kilometre published by Eurostat; the share of the region's population living in metropolitan areas, defined as functional urban areas;[10] and the productivity of neighbouring regions, which we construct as a population-weighted average. The most productive regions coincide with large metropolitan centres, and this trend is reinforced over time. In less productive regions, urban growth is more limited, which hinders the generation of agglomeration effects. Something similar is observed in the case of density: it is higher in the regions that make up the most productive quintile. Finally, neighbouring regions can influence the productivity of each region through proximity to other markets, the possibility of cross-border cooperation, technological diffusion and access to shared infrastructure. The most productive European regions are also surrounded by highly productive regions (see second chart). In contrast, in less productive regions, the productivity of their bordering regions is also low. Throughout the three periods, a progressive improvement is observed in the upper quintiles, especially in those with the highest productivity (quintile 5),

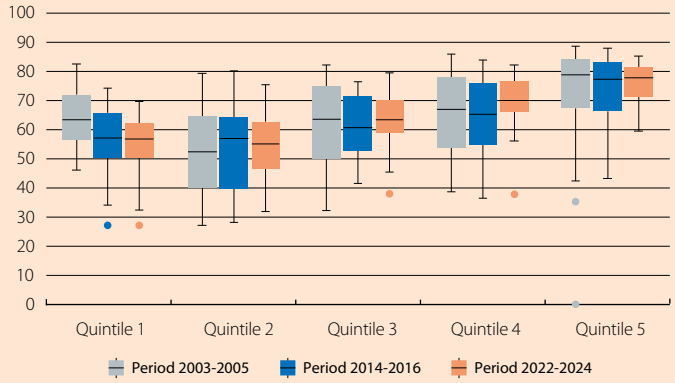
8. In this article and those that follow, the European regions correspond to the NUTS2 territorial analysis units according to Eurostat (autonomous communities in the case of Spain).
9. For 2003-2005, we take the value of 2010.
10. A functional urban area is a zone comprising a main city and nearby municipalities that are connected to it, primarily on the basis of daily commutes, such as people going to work or to study; it is characterised by an urban centre, with high population and employment density, and a peri-urban crown, where people who work or study in the centre live. This concept is used by bodies such as Eurostat and the OECD to understand how cities and their surroundings are really organised, beyond administrative boundaries, and it helps in planning public policies, transport, housing, etc.

where the productivity of the bordering regions intensifies. This could reflect better economic integration, the utilisation of European networks and greater business dynamism. In the middle quintiles, the progress is more moderate, while in the lower quintiles there are hardly any advances, indicating persistent structural barriers.

If we focus on the dimensions related to the business structure, the results are also noteworthy. Regarding the share of employment in industry, it is observed that this is higher for regions in the lowest quintile and then shows no clear pattern as the regions become more productive. This characterisation reflects the fact that Eastern Europe – with a good number of its regions at the lower end of the distribution – plays a significant role in Central European industrial value chains. On the other hand, the sector's role in the economy has steadily decreased over time, reflecting the progressive shift towards a service-based economy consistent with countries' more

Employment in firms with >10 employees (%)

Distribution by productivity quintile



Note: *The boxes represent the interquartile range IQR = Q3 - Q1, where Q1 is the 25th percentile and Q3 the 75th percentile; the central line is the median, and the outer lines show the values within the normal range [Q1 - 1.5x IQR; Q3 + 1.5x IQR]; the points correspond to observations that fall outside this range (outlier values).*

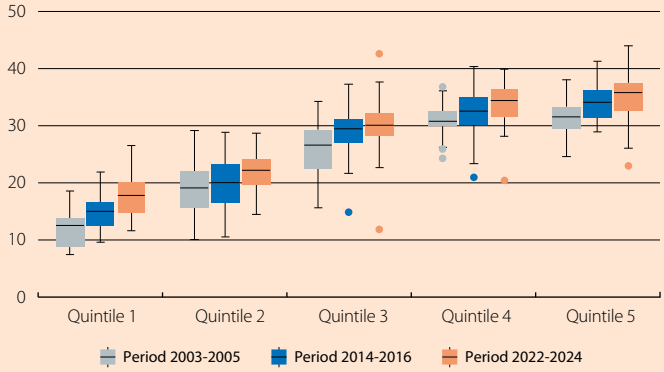
Source: *CaixaBank Research, based on data from Eurostat.*

is observed that the most productive regions allocate a significantly larger proportion of their GDP to research activities, which enhances their capacity to generate endogenous innovation (see fourth chart). In contrast, the lower quintiles exhibit much lower levels, which limits their potential for technological convergence. This structural gap persists over time. A similar pattern is observed for the share of employment in high-tech jobs, as this share increases when we move towards more productive regions.

The visual evidence suggests that institutional quality, urbanisation and density, the productivity of the neighbouring environment, sectoral and business structure, human capital, and R&D intensity may be key determining factors of regional productivity in Europe. In the following article, we analyse to what extent the quantitative estimates confirm this hypothesis.

*Productivity index of bordering regions**

Distribution by productivity quintile



Notes: *The boxes represent the interquartile range IQR = Q3 - Q1, where Q1 is the 25th percentile and Q3 the 75th percentile; the central line is the median, and the outer lines show the values within the normal range [Q1 - 1.5x IQR; Q3 + 1.5x IQR]; the points correspond to observations that fall outside this range (outlier values). * GDP per hour worked of neighbouring regions weighted according to the population of those regions.*

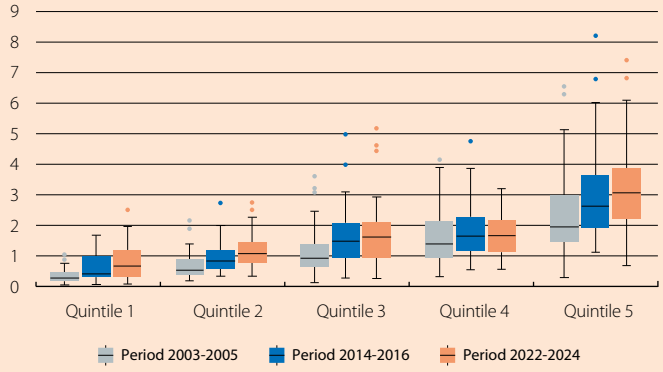
Source: *CaixaBank Research, based on data from Eurostat.*

advanced economic development. Also, the regions with higher productivity have a business structure that is made up of larger firms, specifically with a higher share of employment in firms of more than 10 workers; this suggests that more scalable firms have higher productivity, as has been empirically documented in the economic literature (see third chart). This difference persists over time, although the intermediate quintiles show some improvement. In less productive regions, employment in microenterprises predominates, which limits the ability to scale.

If we look at the variables of innovation and human capital, the relationship also goes in the expected direction. In all regions, the share of people with higher education has increased over the last 20 years, but it is in the most productive regions where this share is highest (the same applies to both secondary and higher education). Also, from the first period, it

*Total R&D expenditure**

Distribution by productivity quintile



Notes: *The boxes represent the interquartile range IQR = Q3 - Q1, where Q1 is the 25th percentile and Q3 the 75th percentile; the central line is the median, and the outer lines show the values within the normal range [Q1 - 1.5x IQR; Q3 + 1.5x IQR]; the points correspond to observations that fall outside this range (outlier values). * % of GDP.*

Source: *CaixaBank Research, based on data from Eurostat.*

Oriol Aspachs, Javier Garcia-Arenas and David Martínez Turégano
(with excellent research support across all articles in the Dossier from Catalina Becu and Anna Bahí)

Key factors driving productivity improvements at the European regional level

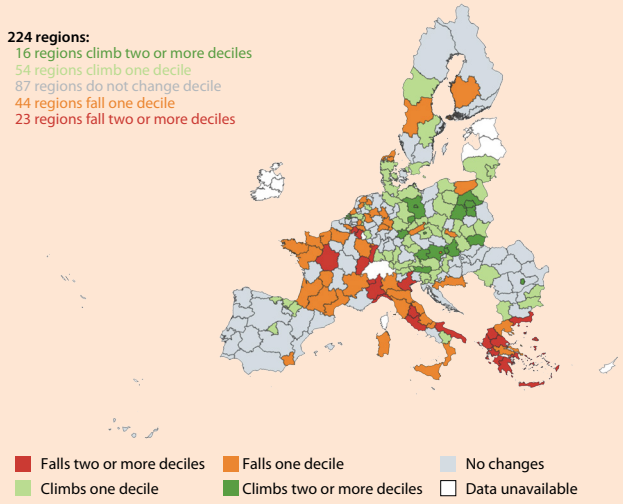
In this article, we conduct an in-depth analysis of the key economic factors driving productivity at the European regional level and their quantitative contribution. After confirming in the previous article that there are notable differences in the evolution of the main variables related to productivity,[1] it is now time to identify which ones have the most significant positive impact.

How to achieve a jump in productivity? An initial descriptive approximation

The aim of this article is to characterise the patterns exhibited by the most successful European regions (outperformers), understood as those that have shown better performance than their counterparts with a similar starting point, which has allowed them to improve their position in the productivity ranking of European regions over the last 20 years. We conduct a similar analysis in the following article, focusing on changes between deciles of the Spanish regions.[2]

In order to analyse the movements among European regions in recent years, we grouped them into 10 deciles, from lowest to highest productivity.[3] Between 2004 and 2023,[4] 61% of European regions (137 out of 224) have changed decile. Of these, 70 have risen and 67 have fallen.[5] Among those that have improved, Germany stands out (17 out of its 38 regions have moved up from their starting decile, including all 8 regions in the East of the country), Austria (7 out of 9), Poland (11 out of 17) and Denmark (3 out of 5). In contrast, France has recorded no improvements, and Italy only 2 (out of 21 regions). Among the regions that have fallen back, Greece stands out, with all of its 13 regions dropping by at least one decile and 11 of them by more than 1; and Italy, with 16 setbacks (76% of its regions), particularly in the South of the country (Mezzogiorno), where 6 out of 8 regions have seen their position deteriorate. France also stands out negatively, with 14 regions falling from their starting decile (out of 21).[6]

Change in productivity decile in Europe between 2004 and 2023 (NUTS 2 territories)



Notes: *The regions in white are those that do not appear in the final sample due to a lack of data in relevant explanatory variables. Final sample of 224 regions.*
Source: *CaixaBank Research.*

We begin with a descriptive analysis that helps provide visual evidence of the main variables in our sample[7] for which a good (bad) relative starting position in 2004 is particularly relevant for moving up (down) a decile between 2004 and 2023.[8,9] In the case of the regions that have climbed deciles, the main variables in which they initially outperform regions with similar productivity are primarily geographical components and those related to human capital and innovation:[10] population density,

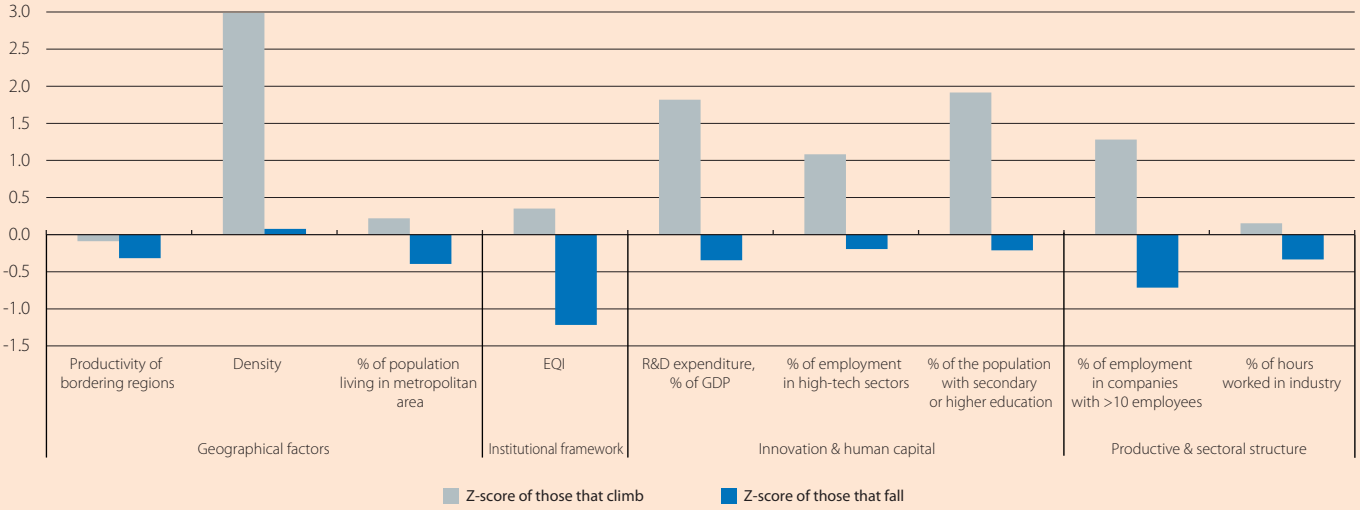
1. See the article «Factors shaping regional productivity disparities in Europe» in this same Dossier.
2. See the article «The key ingredients for Spain's regions to boost productivity» in this same Dossier.
3. The 10% of regions with the lowest level of productivity form the first decile, the next 10% comprise the second decile, and so on, successively. Finally, the 10% of European regions with the highest level of productivity correspond to the 10th decile.
4. In reality, we use the periods 2003-2005 and 2022-2024, taking, for each one, the average productivity and explanatory variables of the available years. For simplicity, in the remainder of the article we will refer to these periods simply as 2004 and 2023, respectively.
5. Although the total number of upward and downward movements between 2004 and 2023 is the same, this does not necessarily mean that the number of regions that have improved matches the number of regions that have deteriorated. This is because some regions have experienced more than one rise or decline over the period. Moreover, not all movements are of a single decile; in some cases, there has been a jump of several deciles. Therefore, from a strictly mathematical point of view, the number of regions that have risen may not necessarily match the number of regions that have fallen, even though the total number of movements is balanced.
6. The data from Spain are discussed in detail in the article «The key ingredients for Spain's regions to boost productivity» in this same Dossier.
7. These variables are explained in detail in the article «Factors shaping regional productivity disparities in Europe» in this same Dossier.
8. In general, these upward movements involve climbing from one decile to the next, although there are some cases (16 out of 70) in which, after 20 years, a region ends up two or more deciles higher than where it started.
9. Specifically, the normalised difference, or «Z-score», is calculated (normalising allows us to compare magnitudes for the different variables) in 2004 of the average determining variables of productivity between European regions that climb/fall between deciles between 2003-2005 and 2022-2024 and those that do not change decile, for each decile. Finally, this score is weighted taking into account how many regions climb deciles in each decile with respect to the total in the sample.
10. We make this comparison by decile and then weigh the result according to the number of regions that have improved in each decile with respect to the total number of regions that improve in the whole sample.

the percentage of employment in high-tech sectors, the percentage of the population with secondary or higher education, and investment in R&D. Additionally, having a larger business size than other regions with similar productivity levels will help a European region to subsequently climb the productivity ranking. Conversely, one of the two main factors that predict subsequent declines between deciles is insufficient institutional quality, which highlights the importance of healthy institutions that ensure a level playing field in order to prevent a region from falling down the ranking. The other factor is a low percentage of employment in companies with more than 10 employees.

This analysis, by considering the entire productivity distribution, may conceal significant variations in the factors which initially distinguish the regions that progress from those that stagnate, depending on the initial level of productivity. In deciles 1-3, it is notable that the regions which have moved up a decile in the last 20 years initially had a much higher density. In contrast, in deciles 8-10, the most notable differences between regions that progress and those that stagnate are observed in education and, to a lesser extent, institutional quality and the productivity of neighbouring regions. Finally, in deciles 3-7, where Spain's autonomous communities are located, the regions that have managed to climb deciles stand out for having higher density and relatively larger metropolitan areas, a higher percentage of the population with secondary or higher education, higher percentages of hours worked in industry, and higher institutional quality. The importance of geographical constraints in these intermediate deciles suggests that, in the depopulated areas of Spain, the absence of agglomeration effects represents a significant obstacle to climbing the European productivity ranking.

Determining factors of productivity: initial differences by decile between European regions that move up/down deciles between 2004 and 2023 and those that do not change decile

*Weighted Z-score**



Note: $Global\ indicator = \sum_{j=1}^{10} (Weight_j \times Z\text{-}score_j) = \sum_{j=1}^{10} \left(\frac{No.\ of\ regions\ that\ climb\ in\ decile\ j}{Total\ no.\ of\ regions\ that\ climb} \times \frac{Average_{climb,j}^{2004} - Average_{stagnant,j}^{2004}}{Standard\ dev._{stagnant,j}^{2004}} \right)$

Source: *CaixaBank Research, based on data from Eurostat and Ardeco.*

The key ingredients for progress: geography, institutions, and human capital and innovation

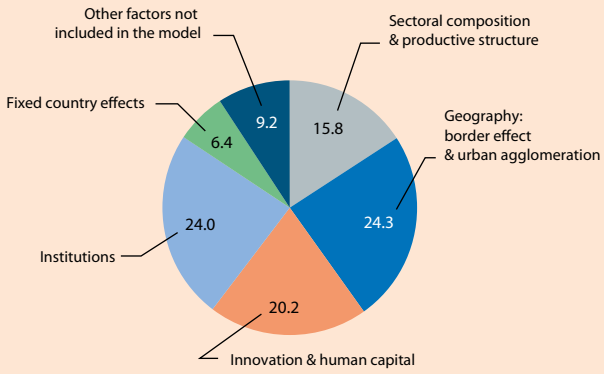
In this second part of the article we proceed to characterise, using more sophisticated econometric techniques, what the most successful regions – or outperformers – are like. These regions have managed to stand out due to a greater improvement in productivity relative to their counterparts at the starting point. To characterise them, we estimate a multiple linear regression with the regions that have improved their relative position using their productivity growth between 2004 and 2023 as the dependent variable, compared to the average productivity growth of those regions that have stagnated but were in the same decile in 2004 (we will henceforth refer to this variable as differential productivity growth). Subsequently, we use the decomposition of the variance to study the relative weight of factors related to demographics,[11] institutional quality,[12]

11. Density, percentage of the population living in metropolitan areas (defined as functional urban areas), percentage of the population living in urban areas and cities, and the productivity of bordering regions.
12. The European Quality of Government Index (EQI).

technology and human capital[13] and productive structure,[14] presented in the previous article, in order to explain the differential productivity growth for the regions that have improved their relative position.[15]

The results (see last chart) show that the four categories of variables included in our analysis play a very important role in explaining why some regions have managed to «take off» over the last 20 years in terms of productivity and grow more than other regions that had a similar starting position. Specifically, these four categories together account for almost 85%[16] of the differential productivity growth of the outperformers.

Explanatory factors of productivity growth in 2004-2023 for European regions that have moved up a decile compared to the average growth of those that have stagnated having started from the same decile in 2004
(% of the total change)



Source: *CaixaBank Research.*

Geographical conditions and institutions appear to play a particularly key role. Specifically, geographical factors account for around a quarter of the differential productivity growth. When we examine which variables in this sphere are statistically significant for differential productivity growth, having an initially high density and the growth in the percentage of the region's population living in urban areas stand out. This suggests the importance of economies of agglomeration, a concept coined by economists to emphasise that the physical proximity of people, workers, companies, etc. enriches us.[17] Hence the importance of public policies that help to create vibrant and dynamic urban centres.

Also, the institutional quality variable, EQI, accounts for around a quarter of the differential productivity growth in regions that have improved their relative position between 2004 and 2023, which underscores the importance of considering institutional variables when analysing the productivity growth of European regions. This result aligns with the economic literature, championed by the Nobel laureates Daron Acemoglu and James Robinson, which documents the importance for economic growth of strong institutions that respect property rights and stimulate investment and the flourishing of a broad middle class.

Next, the variables related to human capital and innovation explain around one-fifth of the differential productivity growth in regions that have improved their relative position between 2004 and 2023. More than two-thirds pertain to investment in R&D and employment in high-tech sectors.

Finally, the variables that make up the regions' productive structure account for slightly less than one fifth of the differential productivity growth in regions that have improved their relative position between 2004 and 2023.[18] Among the variables in this category, of particular note is a positive and statistically significant relationship between employment in large companies in 2004 and differential productivity growth. This should come as no surprise, given the abundant literature documenting a positive relationship between company size and productivity: large companies tend to last longer, export more, have more diversified sources of financing and are more innovative.[19]

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(with excellent research support across all articles in the Dossier from Catalina Becu and Anna Bahí)

13. Investment in R&D, the percentage of employment in high-tech jobs and the percentage of the population with secondary or higher education levels.
14. Hours worked in industry as a proportion of the total, hours worked in services as a proportion of the total, the stock of physical capital, as well as the percentage of workers in companies with more than 10 workers.
15. This method is also known as Shapley decomposition. Specifically, we use as regressors the levels in 2004 of the explanatory variables and interactions of their level in 2004 with their differential growth (i.e. for each region that has climbed deciles, their growth minus the average growth of those that have stagnated and started from the same initial decile) in order to incorporate convergence effects. The results are similar if instead of the initial level we take their initial level relative to the initial level of those that stagnated by decile.
16. We also include fixed country effects, for countries with more regions that climbed deciles, in order to capture idiosyncratic factors at the country level not absorbed into the rest of the variables. These fixed effects have a contribution of 6.4% to the total variance.
17. See the article «The urban factor of the labour market» in the Dossier of the MR06/2016.
18. 100% here includes 9.2% corresponding to other factors not included in our analysis, so the proportion is relative to the total of the explained variance (90.8%) and the unexplained variance (9.2%).
19. See the Focus «Sectoral specialisation penalises the productivity of the Spanish economy» in the MR11/2023.

The key ingredients for Spain's regions to boost productivity

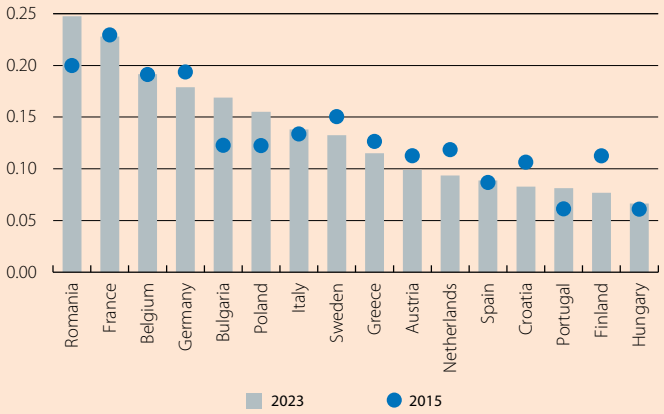
Studying productivity is essential for assessing the state and growth potential of any economy, but it is particularly relevant in the case of Spain. Our economy has long been characterised by relatively low productivity growth, and it is still unclear whether this has changed in recent years.

For instance, GDP growth per employee has increased by 0% between Q4 2019 and Q3 2025, a figure that falls short of the 0.3% shown between Q4 2014 and Q4 2019. GDP growth per hour worked has shown slightly more dynamism, averaging 0.4% between Q4 2019 and Q3 2025, a rate similar to the 0.5% observed in the period Q4 2014-Q4 2019. However, this result has been driven by the decline in the number of hours worked per employee –[1] a source of improvement with limited scope.

In order to identify the factors that hinder productivity growth in the Spanish economy, and those that could drive it, we focus on the evolution of productivity in the various autonomous community regions and on their defining traits relative to other European regions.

Regional productivity dispersion by EU country

(Standard deviation from the average)



Notes: *NUTS3 regions. Data adjusted for purchasing power parity, at constant 2020 prices. EU countries with 15 or more regions. Dispersion weighted according to population.*
Source: *CaixaBank Research, based on data from Eurostat.*

Relative position of Spain's autonomous communities in the European productivity ranking

In general, Spain's autonomous communities have a productivity level close to the European median.[2] In the ranking of European regional productivity, Spain's autonomous communities are predominantly found between deciles 4 and 6.[3] The Region of Murcia was the only one positioned a step below, in decile 3, while the Basque Country is slightly higher, in decile 7, closer to Europe's leading regions.[4] The disparity in productivity levels among Spain's various autonomous communities has slightly increased in recent decades. However, if we compare the dispersion of regional productivity in Spain with that of other EU countries, we observe that it is relatively low, clearly below that recorded by leading economies such as Germany, France and Italy (see first chart).

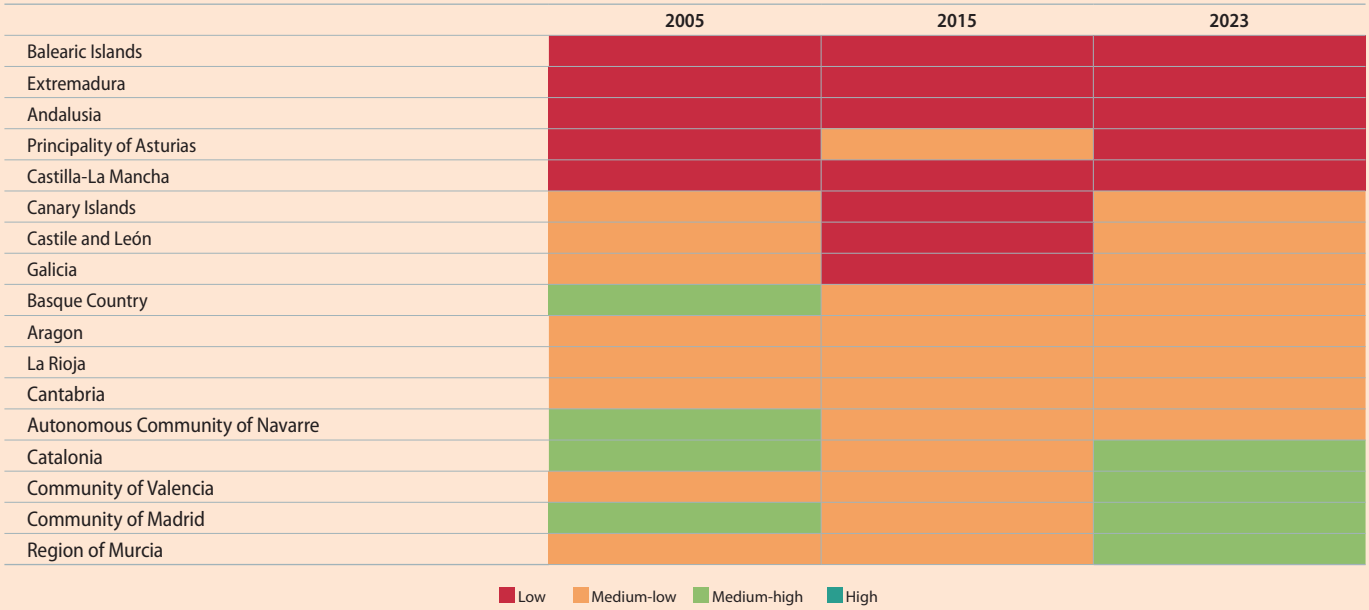
The relative position of the various autonomous communities in the European productivity ranking is quite similar to that of two decades ago, without significant changes. Only Cantabria, the Autonomous Community of Navarre, the Community of Madrid, and the Basque Country have moved up one position; conversely, the Region of Murcia has dropped one position. This stability contrasts with the dynamics observed in most European countries. In some countries – such as Germany, Austria and Denmark – their regions have recorded widespread rises in the ranking, while in others – such as France, Greece and Italy – a large number of regions have experienced a decline.

In order to assess each autonomous community's current situation and evaluate to what extent it can improve its position, we analyse in more detail the main factors determining their productivity. For this, we rely on the factors already mentioned in the other articles of the Dossier: geographical and institutional factors, the productive structure, and the capacity to innovate of each region. Specifically, we developed a statistical model to estimate the probability of each autonomous community changing its productivity decile, given the state of these determining factors.[5] Our model shows good predictive capability: we find that 50% of the European regions that were in the medium-high and high probability quartiles of moving up the deciles in 2004 have indeed climbed declines over these 20 years. Similarly, 90% of the European regions that have moved up at least one decile were situated 20 years ago in the two quartiles with medium-high and high probabilities of doing so.

1. Comparison of the main determining factors of productivity in the autonomous community regions versus the average of the top 25% of European regions with the highest probability of moving up from each decile.
2. Following the methodology used in the rest of the articles of this Dossier, the measure of productivity used is GDP per hour actually worked.
3. Data referring to 2022-2024, the latest data available for comparing between European regions. As in the other articles of this Dossier, three representative periods of relative normality are analysed: pre-Great Recession (2003-2005), pre-COVID (2014-2016) and the recent period (2022-2024). For each one, the average of the available years is taken, which for simplicity we will refer to as 2004, 2015 and 2023, respectively, in the remainder of this article.
4. Refer to the charts at the end of the article to see in detail in which decile each autonomous community lies.
5. Specifically, we estimate a probit model for all European regions, where the dependent variable indicates whether or not the region has climbed productivity deciles between 2004 and 2023. The explanatory variables include factors related to geography, institutions, productive structure, investment in innovation and human capital, in addition to the initial productivity decile from which each region started in 2004.

As the table below shows, most Spanish regions have a relatively low probability of moving up the deciles.[6] Only four of them present a high probability: Catalonia, the Community of Madrid, the Community of Valencia and the Region of Murcia. In the past, this group also included the Autonomous Community of Navarre and the Basque Country, but both have moved up a position in recent decades and today are in a productivity decile more in line with the state of their determining variables.

Probability of climbing positions in the European regional productivity ranking



Note: *A probit model is estimated to determine the probability of climbing the European productivity ranking. The dependent variable indicates whether the region has climbed productivity deciles between 2004 and 2023. The explanatory variables include factors related to geography, institutions, productive structure, investment in innovation, and human capital, in addition to the productivity decile in which each region started in 2004. The estimated coefficients are applied to the values of the regressors observed in 2004, 2015 and 2023 in order to analyse the probability of improvement over time. «Low» refers to the estimated probability being below the lowest 25% mark in the probability distribution, medium-low between 25% and 50%, medium-high between 50% and 75%, and high above 75%.*
Source: *CaixaBank Research.*

What should the autonomous communities do to improve their position in the European productivity ranking?

Finally, in order to better understand in which spheres each autonomous community excels and which factors hinder its progress in the European productivity ranking, we compare the state of the various determining variables of productivity with that of the top 25% of European regions that are most likely to move up a decile. For example, let us take the autonomous communities positioned in the 4th productivity decile and compare them with equivalent European regions within that decile, such as the regions of Zagreb (Croatia), Vilnius (Lithuania) or Wrocław (Poland). In this case, the Community of Valencia and Castilla-La Mancha benefit from being located close to other more productive regions, such as Catalonia and Madrid, respectively. On the contrary, the main elements hindering progress in the European productivity ranking are those related to the productive structure (for example, the small average size of companies), certain geographical factors (such as the percentage of the population residing in metropolitan areas) and the level of human capital (particularly, the percentage of the population with secondary or higher education).

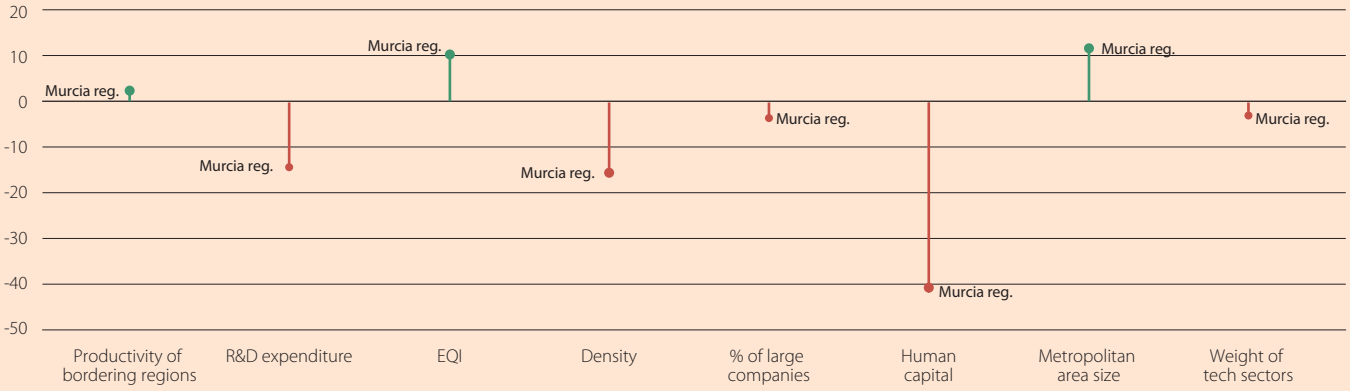
Similarly, the autonomous communities located in the 5th decile are compared with equivalent regions such as Mecklenburg-Vorpommern (Germany), Chemnitz (Germany) and Friesland (Netherlands). For many of the autonomous communities within this decile, their geographical factors stand out as being particularly positive, such as the size of their metropolitan area and their population density. These aspects, as observed in previous articles of this Dossier, are closely correlated with the progress of the most productive regions. Catalonia stands out in this group for having R&D expenditure greater than the top 25% of the European regions most likely to move up a decile. However, the institutional quality of all the autonomous communities within this decile is clearly inferior compared to the regions of reference. This factor also weighs down those positioned higher up the ranking, in deciles 6 and 7, such as the Autonomous Community of Navarre, the Community of Madrid and the Basque Country. In the case of the Community of Madrid, the high population density and the extent of its metropolitan area stand out as particularly positive factors, along with the fact that it has a relatively large business network. In the Basque Country, meanwhile, investment in R&D stands out.

6. According to the distribution of probabilities predicted by the probit model, most of Spain's autonomous communities are in quartiles 1 and 2.

Comparison of the main determining factors of productivity in the autonomous community regions versus the average of the top 25% of European regions with the highest probability of moving up from each decile

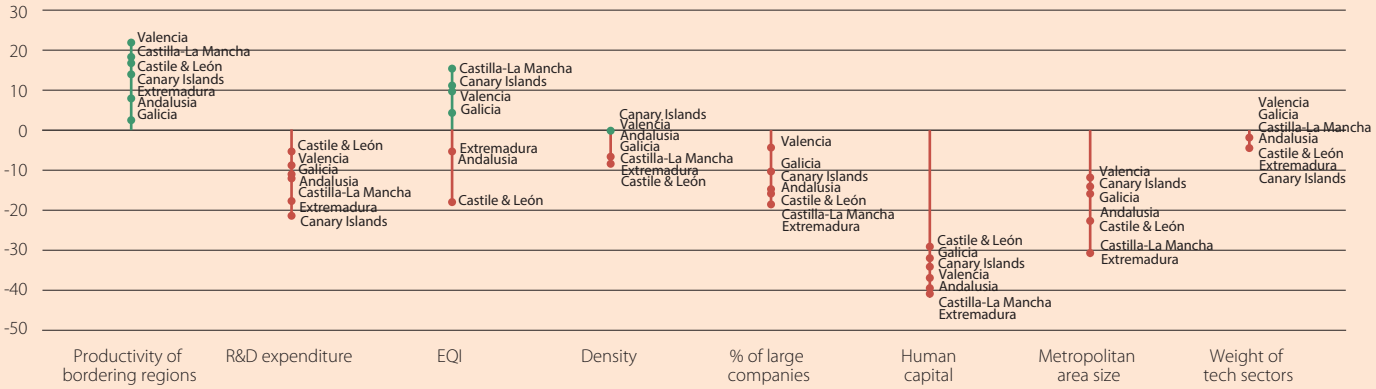
Decile 3: difference versus the average of the top 25%

(pps)



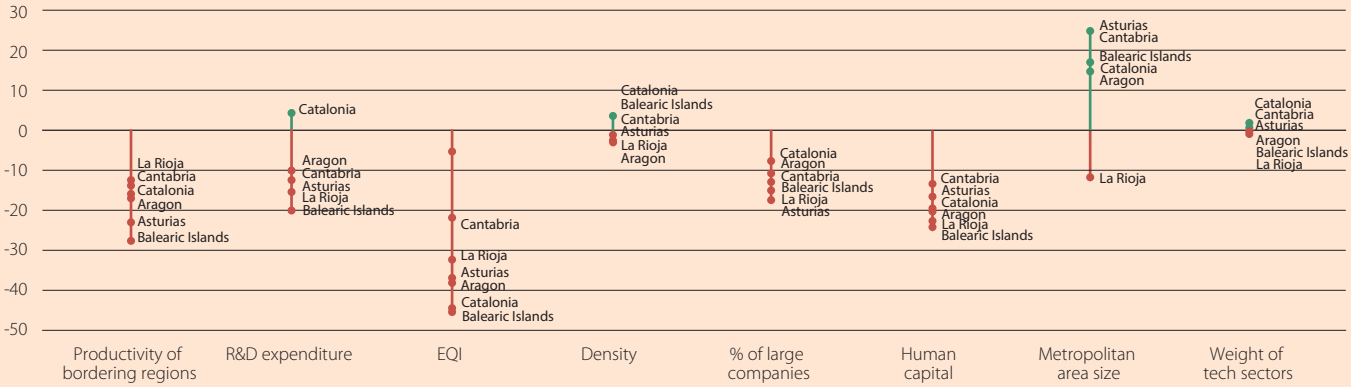
Decile 4: difference versus the average of the top 25%

(pps)

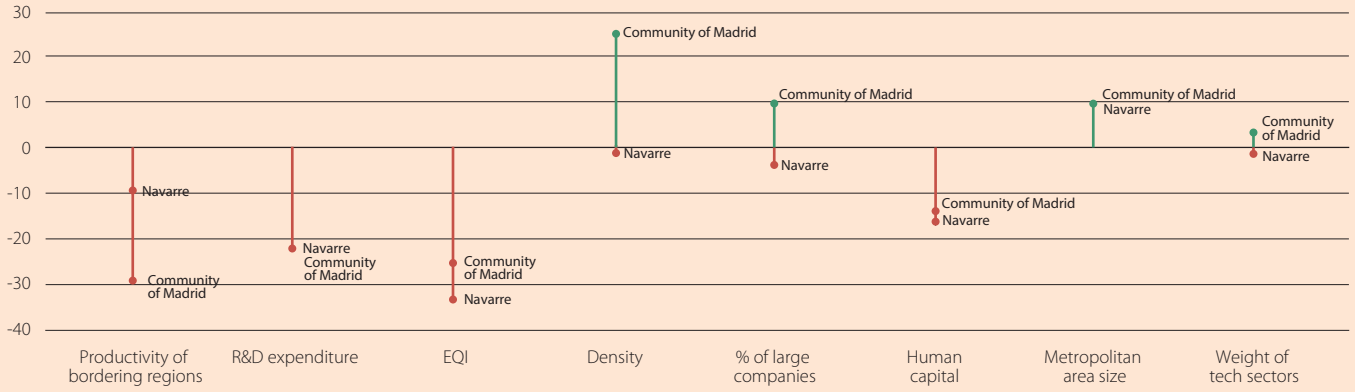


Decile 5: difference versus the average of the top 25%

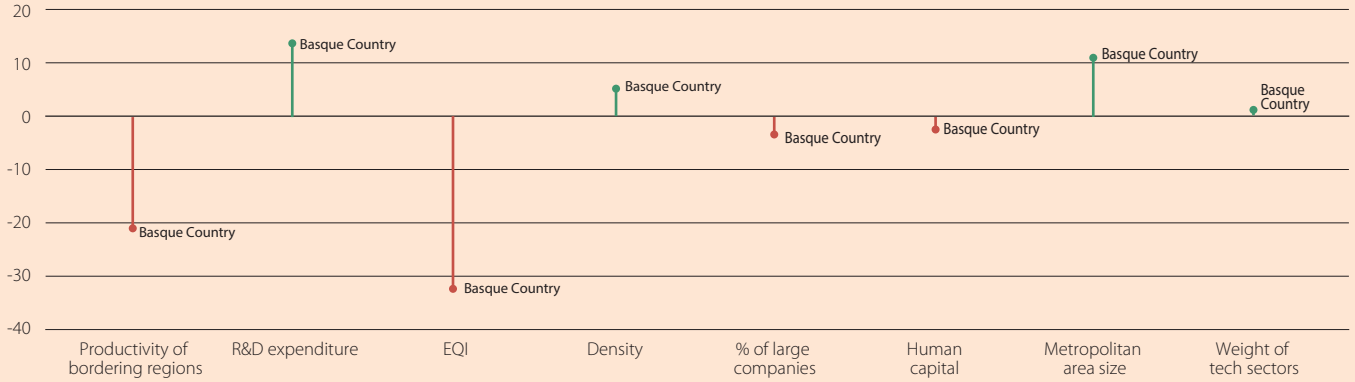
(pps)



Decile 6: difference versus the average of the top 25%
(pps)



Decile 7: difference versus the average of the top 25%
(pps)



Higher than the top 25% Lower than the top 25%

Notes: *(1)* ***Productivity of bordering regions*** *refers to the productivity of neighbouring regions weighted according to their population;* ***total R&D expenditure*** *refers to investment in R&D as a % of GDP;* ***EQI*** *refers to the European Quality of Government Index produced by the University of Gothenburg;* ***Density*** *to the number of inhabitants/square km;* ***% of large companies*** *to the percentage of employment that is in companies with more than 10 workers;* ***Human capital*** *to the percentage of the population with secondary or higher education;* ***Metropolitan area size*** *to the percentage of the population living in functional urban areas and* ***Weight of tech sectors*** *to the percentage of employment in high-tech jobs. (2) As our starting point, we use a probit model for all European regions, where the dependent variable indicates whether or not the region has climbed productivity deciles between 2004 and 2023. The explanatory variables include factors related to geography, institutions, productive structure, investment in innovation, and human capital, in addition to the productivity decile in which each region started in 2004. The coefficients estimated in the historical model are applied to the observed values of the regressors in 2023 to obtain the most current probability of moving up a decile. In each productivity decile, the top 25% of regions with the highest probability of moving up a decile, according to the probit model, are selected. For each explanatory variable, the gap of each Autonomous Community (AC) is calculated as the difference relative to the average of the top 25%, after normalising the variables on a scale of 0-100 (to do this, a robust range is defined using the 2nd and 98th percentiles, avoiding the influence of extreme values):*

$$Gap\ (pps) = X_{\%}^{ACs} - X_{\%}^{top25}$$

Source: *CaixaBank Research.*

Ultimately, all of Spain's autonomous communities have certain elements they can rely on to continue improving their productivity, and some areas where they face a certain disadvantage. None of them are insurmountable. If corrected, the growth capacity of their economy will improve. The study also highlights the importance of geographical factors. Therefore, if the effort is shared among all the autonomous communities, then the probability of success will be even greater.

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