



Resistance, recovery and resilience in the industrial sector: Catalonia and Emilia-Romagna compared, 1970s-2020s

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Resistance, recovery and resilience in the industrial sector: Catalonia and Emilia-Romagna compared, 1970s-2020s

Abstract

This paper contributes to the expanding literature on regional resilience by comparing two southern European regions. Through an analysis of fluctuations in industrial value added and industrial employment in Catalonia and Emilia-Romagna, we assess the extent to which their industrial sectors were similarly affected by the major economic crises of the past fifty years—from the 1973 oil shock to the Covid-19 pandemic. Furthermore, we examine the capacity of each region's industrial sector to recover following these shocks. Across the six major crises experienced by Western economies, our findings reveal notable regional dif-

ferences in resistance, depending on whether value added or employment is used as the primary indicator. We also find that, since the early 2000s, Emilia-Romagna has consistently exhibited stronger recovery performance from shock-induced losses than Catalonia, reversing the pattern observed during the 1980s and 1990s. We also offer several hypotheses to account for this divergent trajectory in industrial resilience.

Key words: Regional resilience, Industrial performance, Economic crises, Employment dynamics, Southern Europe

Resistència, recuperació i resiliència en el sector industrial: Catalunya i Emília-Romanya comparades, anys 1970-2020

Resum

Aquest article contribueix a la creixent literatura sobre la resiliència regional mitjançant la comparació de dues regions del sud d'Europa. A través d'una anàlisi de les fluctuacions del valor afegit industrial i de l'ocupació industrial a Catalunya i a Emília-Romanya, avaluem fins a quin punt els seus sectors industrials es van veure afectats de manera similar per les principals crisis econòmiques dels darrers cinquanta anys —des del xoc del petroli de 1973 fins a la pandèmia de la Covid-19. A més, examinem la capacitat del sector industrial de cada regió per recuperar-se després d'aquests xocs. Al llarg de les sis grans crisis experimentades per les economies occidentals, els nostres resul-

tats revelen diferències regionals notables en la resistència, en funció de si s'utilitza el valor afegit o l'ocupació com a indicador principal. També observem que, des de principis dels anys 2000, Emília-Romanya ha mostrat de manera consistent un millor rendiment en la recuperació de les pèrdues provocades pels xocs que Catalunya, invertint el patró observat durant les dècades de 1980 i 1990. Finalment, proposem diverses hipòtesis per explicar aquesta trajectòria divergent en la resiliència industrial.

Paraules clau: resiliència regional, rendiment industrial, crisis econòmiques, dinàmiques d'ocupació, sud d'Europa

Resistencia, recuperación y resiliencia en el sector industrial: Cataluña y Emilia-Romana comparadas, años 1970-2020

Resumen

Este artículo contribuye a la creciente literatura sobre la resiliencia regional mediante la comparación de dos regiones del sur de Europa. A través de un análisis de las fluctuaciones del valor añadido industrial y del empleo industrial en Cataluña y en Emilia-Romana, evaluamos hasta qué punto sus sectores industriales se vieron afectados de manera similar por las principales crisis económicas de los últimos cincuenta años —desde el shock del petróleo de 1973 hasta la pandemia de la Covid-19. Asimismo, examinamos la capacidad del sector industrial de cada región para recuperarse tras estos shocks. A lo largo de las seis grandes crisis experimentadas por las economías occidentales, nuestros resultados revelan notables diferencias regionales en la resisten-

cia, dependiendo de si se utiliza el valor añadido o el empleo como indicador principal. También observamos que, desde principios de los años 2000, Emilia-Romana ha mostrado de forma consistente un mejor desempeño en la recuperación de las pérdidas provocadas por los shocks que Cataluña, invirtiendo el patrón observado durante las décadas de 1980 y 1990. Finalmente, proponemos varias hipótesis para explicar esta trayectoria divergente en la resiliencia industrial.

Palabras clave: resiliencia regional, desempeño industrial, crisis económicas, dinámicas de empleo, sur de Europa

Introduction

Resilience is a concept that has been interpreted and defined in various ways across disciplines. Although not extensively, in recent years economic historians dealing with business history have increasingly adopted the definition used in evolutionary economic regional geography (Ramon-Muñoz, Molema, and Evenhuis 2024). Accordingly, economic resilience is generally understood as the capacity of economies to withstand disruptions, the mechanisms these economies employ to cope with such shocks, and their ability to adapt, renew, and reconfigure in response (Martin and Sunley 2015).

Building on this definition, several works on business history have examined the evolution and adaptation of specific industries and firms within a given country or region (Valdaliso 2020, Miranda and Roldán 2022, Semeraro and Miranda 2023, Amdam, Bjarnar and Berge 2024, Davids 2024, Plantinga 2024, Semeraro 2024, Etxaniz 2025, Antuña 2025), as well as the long-term resilience of certain regions (Bianchi et al. 2024). However, cross-regional comparisons, especially those spanning different countries, remain less common; and when such studies do exist, they often focus on a single industry or sector.

To help address this gap, and as part of a broader research project, we compare industrial performance in Catalonia and Emilia-Romagna over the past fifty years. The selection of these two regions merits explanation. Located in southern Europe, northeastern Spain and northern Italy, respectively, both regions had achieved significant levels of industrialization by the early 1970s. With industrial employment accounting for between 40% and 50% of total employment, they ranked among the most industrialized regions of Spain and Italy, respectively. In fact, Catalonia being was the second most industrialized of Spain's 17 regions (after the Basque Country), while Emilia-Romagna ranked fifth out of Italy's 20 regions, following Lombardy, Piedmont, Tuscany, and Veneto (Rosés and Wolf 2020).

The industrial orientation of these regions is particularly relevant. Comparing their industrial trajectories can contribute to a better understanding of a phenomenon that has become central to the European policy agenda: the relative and absolute decline of industry and the resurgence of industrial policy (Aiginger and Rodrik 2020, Juhász, Lane and Rodrik 2024, Mazzucato and Rodrik 2023, Mazzucato, Doyle and von Burgsdorff 2024).

Beyond their strong industrial bases, Catalonia and Emilia-Romagna shared other structural similarities that make this comparison especially compelling. By the 1970s and early 1980s, both regions were characterized by a predominance of small and medium-sized enterprises, many of which were embedded in industrial districts and clusters (e.g. Brusco 1982, Costa 1988, 1990, and Catalan, Miranda, and Ramon-Muñoz 2011, for a review). Moreover, in both regions, the metal-mechanical and textile sectors were the most significant industrial branches, together accounting for two-thirds of total industrial value added (Ortega Galán 1974, Rinaldi 2013).

Naturally, there were also significant differences between these regions, particularly in terms of political and institutional frameworks, although a convergence process also took place. In the early 1970s, Emilia-Romagna was part of democratic Italy, a founding member of the European Economic Community (EEC). The region had a strong trade union presence, particularly in large firms, and was governed by the Communist Party at both the regional and local levels (Ferri and White 1999). The combination of a predominance of small and medium-sized enterprises, on the one hand, and the aforementioned institutional specificities, on the other, gave rise to what Sebastiano Brusco (1982), one of the leading Italian scholars in industrial districts and regional development, termed as "the Emilian model", a model that, nevertheless, has evolved over time (Rinaldi 2005, Mosconi 2011, Rinaldi and Solinas 2023).

In contrast, by around 1970, Catalonia remained under Franco's dictatorial regime, with no regional autonomy, restricted individual freedoms, and the prohibition of non-official trade unions and free political competition. Yet, from 1975 onwards, following Franco's death and initial attempts to preserve the former regime, Spain underwent a political and institutional transition towards democracy. This process culminated in the establishment of democratically elected governments in 1977, the restoration of the Catalan government (*Generalitat de Catalunya*) that same year, and Spain's accession to the EEC in 1986 (Molinero and Ysás 2018, Núñez Peñas 2020).

Despite their similarities and the institutional convergence that took place from the mid-1970s onwards, the two regions may have displayed different levels of resistance and recovery in response to economic shocks, highlighting the need for further research into their commonalities and differences. In particular, we

explore whether the industrial sectors of Catalonia and Emilia-Romagna were similarly affected by major crises over the past fifty years, from the 1973 oil shock to the COVID-19 pandemic. Additionally, we assess the extent to which each region's industrial sector demonstrated the capacity to recover following these shocks.

The remainder of this article is structured as follows. Section 2 provides an overview of long-term industrial trends. Section 3 discusses concepts and methodology, detailing how we measure two key dimensions commonly analyzed in evolutionary economic geography: resistance and recovery. Section 4 presents cross-regional evidence on the different capacity of Catalonia's and Emilia-Romagna's industrial sectors to withstand economic shocks and its potential determinants. Section 5 is devoted to comparing recoveries from previous shocks across regions, discussing the resistance and recovery nexus. Finally, Section 6 offers concluding remarks.

Comparing the long-term trends of industry: an overview

In the final quarter of the 20th century, following more than two decades of strong economic expansion, Western Europe and other developed areas entered a new phase marked by slower growth and heightened instability. Economic deceleration had already begun in the late 1960s as key drivers of post-war catch-up, such as institutional arrangements, labor supply and the technological diffusion from the Second Industrial Revolution, became increasingly exhausted (e.g. Glyn et al 1992, Eichengreen 1996, 2007, Temin 1997). The collapse of the Bretton Woods system in 1971 introduced further economic challenges (Eichengreen 1993), and the oil crises of 1973 and 1979 dealt severe

blows to the growth prospects of Western economies, marking the onset of a broader period of crisis (Barsky and Kilian 2004). Since then, per capita gross domestic product (GDP) growth rates have never returned to the levels seen during the so-called *Golden Age* (Crafts and Toniolo 1996).

Catalonia and Emilia-Romagna were no exception to this broader trend, although they exhibited certain regional specificities. Table 1 presents long-term growth rates for industry in terms of both value added and employment, the latter reflecting the number of jobs in the sector. For the purposes of this analysis, the term industry encompasses manufacturing, mining and quarrying, and activities related to water and energy supply. Growth rates are calculated using compound trend annual growth rates, which incorporate all available data points to provide a more accurate estimate of long-term trends. The original data are drawn from several sources, including De la Fuente and Ruiz Aguirre (2024), the Centro Ricerche Economiche Nord Sud, the Istituto Nazionale di Statistica (ISTAT, Italian Institute of Statistics), and the European Commission's Directorate-General for Regional and Urban Policy.

By integrating these sources, we have constructed long-term annual series on industrial value added at 2015 constant prices, as well as population and industrial employment for Catalonia and Emilia-Romagna, ensuring the highest possible degree of consistency.

These results confirm the exceptional nature of post-World War II industrial growth and the pronounced slowdown that followed in subsequent decades. The decline was particularly severe in terms of industrial employment, with a substantial loss of industrial jobs in both regions over the nearly half-century following 1975, more pronounced in Catalonia than in Emilia-Romagna. This pattern was not unique to these two regions; it was part of a broader struc-

TABLE 1: LONG-TERM ANNUAL GROWTH RATES OF THE INDUSTRIAL SECTOR IN CATALUNYA AND EMILIA-ROMAGNA, 1960-2021(%)

Variables	Catalonia		Emilia-Romagna	
	1960-1975	1975-2023	1960-1975	1975-2023
Industrial value added	8.9	1.4	6.8	1.6
Industrial employment	1.5	-1.0	1.4	-0.2
Total population	2.5	0.7	0.5	0.3
Industrial value added per capita	6.5	0.6	6.3	1.3
Industrial value added per employee	7.4	2.4	5.4	1.8

Sources and notes: Authors' elaboration. The data for the period 2021–2023 are provisional in the original sources and subject to revision. See Table A.1 (Appendix) and the main text for further details.

tural shift in many advanced economies commonly identified as deindustrialization (e.g. Rowthorn and Ramaswamy 1997, and for Catalonia, Solà, Sàez, and Termes 2012).

A particularly noteworthy finding from Table 1 is that, over the long run, industrial value added in Catalonia and Emilia-Romagna grew at relatively similar rates between the mid-1970s and the early 2020s—1.4% and 1.6% per year, respectively, though Emilia-Romagna maintained a slight advantage. However, population growth was substantially higher in Catalonia, which inevitably dampened its per capita growth in industrial value added relative to Emilia-Romagna (0.6% versus 1.3% per year). At the same time, because industrial employment declined more sharply in Catalonia, value added per employee increased at a faster rate in the northeastern Iberian region than in its northern Italian counterpart. This indicates that, as had already been the case between 1960 and 1975, labor productivity growth was stronger in Catalonia. Since the 1970s, rapid labor productivity growth possibly reflects Catalonia's industrial sector's intense adaptation to intensifying global competition through efficiency gains and technological upgrading (e.g. Bentolila and Blanchart 1990, Oliver 2009).

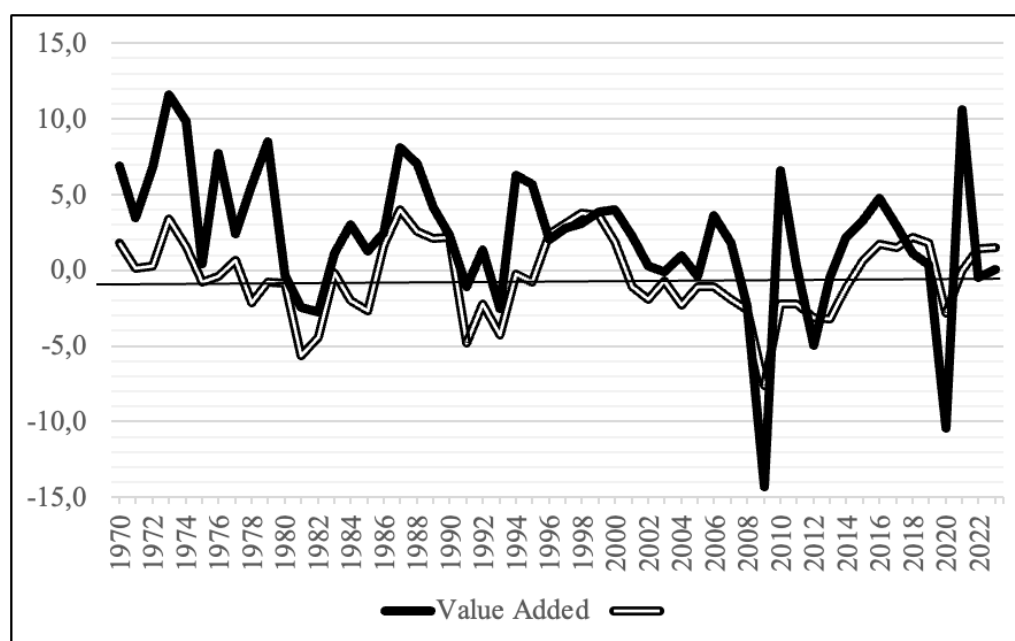
While these findings provide valuable insights, a detailed exploration of how these regions adapted

to structural economic impacts and changes, such as accelerated technological transformation and globalization, falls beyond the scope of this paper. Indeed, resilience to structural shocks is one of the three types of disturbances identified in the literature on regional economic resilience. The other two are sudden shocks, such as natural disasters, and macroeconomic shocks, such as major economic crises, which typically follow the business cycle (Ramon-Muñoz, Molema, and Evenhuis 2024).

In this paper, we focus on the latter, aligning with evolutionary economic geography scholars who have emphasized that major economic disruptions can shape the long-term trajectory of regional economies (e.g. Martin, 2012, 2). Specifically, we examine the impact of the major crises of the Western World on the industrial sectors of Catalonia and Emilia-Romagna. This does not mean to neglect mentioning structural factors where necessary, as sometimes acted in connection with short-term shocks. Rather, we recognize that structural factors often operate in tandem with short-term shocks, and that their interplay can be crucial to understanding regional economic outcomes.

Figure 1 shows the annual percentage changes in aggregate industrial value added (a measure of output) and industrial employment for Catalonia and Emilia-Romagna. The data reveal declines around 1973

FIGURE 1: ANNUAL PERCENTAGE CHANGE IN AGGREGATE INDUSTRIAL VALUE ADDED AND INDUSTRIAL EMPLOYMENT IN CATALONIA AND EMILIA-ROMAGNA AGGREGATED, 1970-2021 (%)



Sources and notes: Authors' elaboration. See Table 1 and the main text

and 1979, reflecting the impact of the 1970s oil crises. A slowdown is also evident in the early 1990s, likely linked to the recession affecting Western economies at the beginning of that decade, which was driven in part by a new oil shock in 1990 and the implementation of restrictive monetary policies. The figure further documents a downturn in the early 2000s, partly associated with the bursting of the dot-com bubble in 2000, but also to the Exchange Rate Mechanism (ERM) crisis of 2002 and the broader economic repercussions following the September 11, 2001, terrorist attacks in the United States. Finally, two sharp declines appear in the 21st century, attributable to the 2007-08 financial crisis and to the COVID-19 pandemic and the subsequent lockdown. In general, and as might be expected, in all these shocks value added experienced more pronounced fluctuations compared to employment, which tended to lag behind changes in output. Even so, the number of years in which employment growth remained negative exceeded those for value added, aligning with the trends presented in Table 1. Moreover, both variables show that the most intense crises were those that occurred around 1979, in the early 1990s, in 2008 and in 2019 when measured in terms of annual percentage decline.

Additionally, the data in Figure 1 allow for the identification of the traditional phases of a business cycle: expansion, peak, contraction, depression, trough, and recovery, with the troughs aligning closely with the aforementioned crises. Our objective is to assess the resilience of the industrial sectors of Catalonia and Emilia-Romagna by analyzing not only the extent to which these shocks affected industrial output and employment but also the capacity of each region to recover.

Concepts, methods and measurement

The previous discussion leads to three key and interrelated points. The first concerns the concept of resilience itself and how resistance and recovery fit within this framework. The second involves properly identifying business cycles and their relevance for regional economic resilience. The third pertains to the measurement of resilience and the selection of appropriate metrics. The following section explores these topics in more detail.

In a highly cited article on recessions and regional resilience, Martin (2012) argued that in analyzing

regions' responses to recessionary shocks, four dimensions should be considered. These were as follows: first, resistance, defined as the degree of vulnerability, sensitivity, or resilience of a regional economy to a negative impact; second, recovery, the speed, degree, or extent to which a regional economy rebounds from a previous recessionary shock; third, re-orientation, referring to the pace of adaptation and structural re-orientation of the regional economy following the contraction; and fourth, and finally, renewal, the extent to which the regional economy resumes its pre-shock growth trajectory or transitions to a new growth path.

Ron Martin and his co-authors revised and further developed these four dimensions of resilience in subsequent publications (e.g. Martin and Sunley 2015, Martin et al. 2016). For instance, Martin et al. (2016) introduced a prior dimension they termed "risk", placed before resistance. This refers to the risk (or vulnerability) "*of a region's firms, industries, workers and institutions to shocks*" (Martin et al. 2016, 564). This additional dimension was, in fact, closely linked to the evidence that regional resilience to recessions depends on the pre-shock growth trajectory of the regional economy, as well as on several underlying determinants of that trajectory, such as the region's economic structure and the influence of national institutions and policies.

Building upon this conceptual framework, and with the aim of comparing regional resistance to and recovery from recessionary shocks, several studies on regional economic resilience have sought to operationalize these concepts. This has involved the development of metrics and methodologies to measure regional economic resilience, or at least some of its dimensions. Among the four dimensions originally outlined by Martin (2012), particular attention has been devoted to the measurement of regional resistance and recovery.

Resistance is sometimes measured as the percentage change from peak to trough, while recovery is measured as the percentage change from trough to peak across the cycle. When this measurement is applied in cross-regional analyses within the same country, national downturns and upswings, rather than regional ones, are commonly used as reference points (Martin et al. 2016, 565). In addition, regional contractions and expansions in the variable of interest are typically compared to either national contractions and expansions or to the region's pre-shock trend in that variable (e.g. Martin et al. 2016, Han and Goetz

2015, 2019, Faggian et al. 2018). The core principle behind these approaches is the establishment of a counterfactual or benchmark to estimate what would have occurred in the absence of a shock. Deviations from this benchmark, whether relative to the national average or the pre-recession trend, are then used to quantify the extent of recession and recovery.

These methods for assessing regional resistance and recovery have primarily been applied to comparisons between regions within the same country. Our study, however, aims to compare two regions located in different countries across several industrial cycles. This introduces challenges in defining a common benchmark against which to measure industrial fluctuations in both cases. Moreover, our interest lies more in absolute declines and subsequent increases following a shock, rather than in deviations from multiple regional pre-shock trend growth rates. In this respect, we consider that absolute changes more accurately capture what we intend to measure: the sensitivity of Catalonia and Emilia-Romagna to economic shocks and their capacity to recover from them (Sensier, Bristow, and Healy 2016, 135).

Given these considerations, we have adopted a straightforward approach to measuring resistance and recoverability. To assess and compare these two dimensions of resilience in the industrial activity of Catalonia and Emilia-Romagna, we define simple and intuitive indicators that effectively capture both downturns and recoveries. Our calculations are based on the long-term series we constructed for industrial value added (in constant 2015 euros) and industrial employment in Section 2.

Regarding resistance, we measure industrial resistance to a shock as the annual percentage change in industrial value added and industrial employment between the observed peak and trough values of our series; specifically, between the maximum and minimum values within a given cycle. Unlike in Figure 1, where evidence was presented in terms of annual percentage changes, we now derive peaks and troughs by considering value added and employment in levels, as is common in several analyses of regional economic resilience (e.g. Martin 2012, Martin et al. 2016, Sensier and Artis 2014, Sensier, Bristow and Healy 2016). In our calculation, the greater the decline from peak to trough, the lower the resistance of the region.

Each region is considered independently. This means that Catalonia and Emilia-Romagna may reach their respective peaks and troughs in different years,

and the duration between turning points, from expansion to contraction and vice versa, may not necessarily coincide across regions, a phenomenon that is also common among regions within the same country (Duran and Fratesi 2023).

We estimate resistance using the following formula:

$$\text{Resistance}_{RC} = ([\text{Trough Value}_{RC} - \text{Peak Value}_{RC}] / \text{Peak Value}_{RC}) \times 100$$

where the subscripts R and C denote region R over cycle C.

Additionally, we define a cycle as the period extending from one peak to the next, passing through a trough. By definition, this second peak must exceed the values immediately before and after it, although it does not necessarily have to surpass the previous peak. We also consider the minimum duration of a cycle (from peak to peak) to be three years, encompassing a maximum value, a minimum (trough), and a subsequent maximum relative to the trough. This approach adopts a turning-point perspective. As Kulish and Pagan (2021, 1002) note, we are aware "that turning points can exist in a series without there being a representative oscillation of interest to business cycle analysts."

The decision to follow a turning-point approach also implies that, within the same recessionary period, we may identify multiple consecutive cycles. For instance, a cycle may begin with a maximum value in year t_0 , followed by a minimum in t_0+1 , and then a new maximum in t_0+2 , even if this second peak remains below the initial one (t_0), followed by another decline in t_0+3 . This pattern corresponds to a double-dip recession, and we treat it as two distinct cycles, since we are tracking turning points rather than overall levels. However, double-dip, and even triple-dip, recessions are, in our case, generally linked to a single originating shock, and this continuity must also be accounted for in the interpretation of economic downturns.

Finally, duration also plays a critical role in assessing the severity of recessions. The number of consecutive years during which an economy contracts constitutes a significant additional dimension of analysis. For this reason, we also calculate the duration, in years, between peaks and troughs for both single- and multiple-dip recessions, thereby incorporating into our analysis both the depth and the temporal extent of each contraction.

As for recovery, we follow the same measurement logic used for resistance but now we consider percentage changes in value added and employment

levels from trough to peak. Accordingly, recovery is calculated as follows (with the subscripts R and C referring to region R over cycle C):

$$\text{Recovery}_{RC} = ((\text{Peak Value}_{RC} - \text{Trough Value}_{RC}) / \text{Trough Value}_{RC}) \times 100$$

However, it must be acknowledged that recovery is not always defined this way in the literature on economic resilience. In their analysis of Italian regions between 1999 and 2020, Duran and Fratesi (2023) define recovery as the time elapsed until the economy returns to its pre-shock (peak) level, while the growth rate between the trough and the most recent peak is referred to as adaptability. It is indeed logical to consider the time needed to regain the pre-crisis peak. Nevertheless, this introduces a conceptual challenge when viewed through the lens of evolutionary regional economic geography. It implies the existence of a stationary or stable state to which an economy ought to return, an idea more aligned with engineering resilience than with the evolutionary perspective (see Ramon-Muñoz, Molema, and Evenhuis 2024). In addition, we encounter an empirical challenge that complicates the analysis: in several instances, the time series, either at the beginning or mid-way through the period under study, do not always return to their pre-crisis levels following a recessionary shock.

That said, as with recessions, we also calculate the time required for each region to return to its pre-shock level of industrial activity. This allows for a more nuanced understanding of regional resistance and recovery capacity in response to economic shocks (Sensier, Bristow, and Healy 2016). The corresponding data are presented in the Appendix of this paper (Tables A.5 and A.6).

Resistance to recessionary shocks

Was Catalonia's industry more resistant than Emilia-Romagna's to the recessionary shocks it faced since 1973, or was it the opposite? The answer depends on both the period under consideration and the variable employed; therefore, it is preferable to proceed step by step. First, we focus on value added while considering the various negative economic shocks that have characterized the Western world since 1973. We then turn to employment, also analyzing its evolution during recessionary episodes.

Table 2 presents the core data on industrial value added, highlighting both similarities and differences between Catalonia and Emilia-Romagna. In both regions, the number of turning points from peaks to

TABLE 2: PEAK TROUGH PERCENTAGE CHANGES IN THE INDUSTRIAL VALUE ADDED OF CATALONIA AND EMILIA-ROMAGNA, 1973-2023 (%)

Shock	Catalonia			Emilia-Romagna		
	Period	No. Years	Change (%)	Period	No. Years	Change (%)
1973 oil crisis	1976-1977	1	-0.4	1974-1975	1	-8.4
1979 oil crisis	1980-1982	2	-6.9	1979-1980	1	-3.3
				1981-1983	2	-4.4
Early 1990s recession	1992-1993	1	-4.1	1990-1991	1	-3.8
				1992-1993	1	-0.5
Early 2000s recession	2001-2002	1	-1.2	2000-2001	1	-0.5
				2002-2003	1	-1.1
				2004-2005	1	-0.6
2007-8 Great Recession	2007-2009	2	-11.4	2007-2009	2	-22.1
	2010-2013	3	-11.5	2011-2012	1	-4.1
	2017-2018	1	-0.2			
Covid-19 crisis	2019-2020	1	-10.9	2019-2020	1	-10.1
	2021-2022	1	-0.3	2021-2023	2	-2.4

Sources and notes: Authors' elaboration. See Table 1 and the main text.

troughs and the number of years in which industrial value added declined relative to the preceding peak were broadly similar, and these generally coincided with major economic crises in the Western world. However, Emilia-Romagna experienced a slightly higher number of recessions (12 compared to 10 in Catalonia) and a marginally greater number of contraction years (15 versus 14). Conversely, over the 1970–2023 period Catalonia spent a modestly longer time in total drawdown, 27 years operating below a previously established peak, compared to 25 years in Emilia-Romagna. Moreover, turning points did not always occur in the same year across regions, nor were they evenly distributed; recessionary episodes often took different forms, appearing as single-dip downturns in one region and as double or even triple-dip events in the other. Finally, in both cases, the most severe contractions were associated with the 2007–2008 Great Recession, followed by the Covid-19 crisis. However, while the third most significant decline in Catalonia was linked to the 1979 oil shock, in Emilia-Romagna it corresponded to the 1973 oil crisis.

While similarities and differences abound throughout the period under study, the most marked divergence in terms of the magnitude of industrial contraction occurred during the 1973 oil crisis. Emilia-Romagna experienced a significantly sharper decline in industrial value added (-8.4%) compared to Catalonia (-0.4%), a decline partly shaped by central government decisions. Following the 1973 oil crisis, the Italian government implemented monetary and financial restrictions that contributed to a deep recession in 1975, as evidenced by the sharp drop in industrial value added between 1974 and 1975 (Ventresca 2023, 185). A report by the Organization for Economic Co-operation and Development (OECD) underscored this dynamic. It contended that the restrictive policies adopted by Italian authorities, amid declining demand across several major OECD economies, culminated in 1975 in “the deepest recession in Italy since the early 1950s” (OECD 1976, 5).

In contrast to Emilia-Romagna, Catalonia’s industrial sector exhibited greater resistance in the initial phases of the crisis. This aligns with historical evidence suggesting that the Spanish dictatorship at the time adopted policies aimed at delaying the full impact of the oil shock. These included maintaining artificially low energy prices and deferring structural adjustments, measures that might temporarily have cushioned the immediate economic impact but ultimately fueled in-

flation, fiscal deficits, and external imbalances, creating further problems in the subsequent years (e.g. Sudrià 1988, 2013, Catalan 1991, Lluch 1996, Prados de la Escosura and Sanz 1996).

Although such expansionary policies remained largely in place until 1977, other indicators reveal that Catalonia’s industrial economy did not escape unscathed. For example, car production declined continuously from 1974 to 1981, while per capita industrial production growth stalled in 1972, thereafter fluctuating around this baseline level with no sustained upward trajectory between 1973 and 1977 (Catalan 2013, 386, Catalan 2016–17, 244–246). Additionally, significant job losses occurred after 1974, as will be further detailed below.

Leaving aside these discrepancies, what is crucial to stress is that, despite its moderate scale, the drop in industrial value added in 1976–1977 (Table 2), coincided with a decisive shift in economic policy following Spain’s first democratic elections and the signing of the Moncloa Agreements. This shift introduced more restrictive monetary policies aimed at inflation control and implied rising interest rates (Trullén 1993, Cabrera 2015). For example, the Bank of Spain’s nominal discount rate for commercial loans increased from 8.8% in 1976 to 10.0% in 1977, while interbank deposit rates rose from 10.5% to 14.4% over the same period (Martín-Aceña and Pons 2005, 701, Table A.7, Appendix).

This evidence highlights not only the timing and magnitude of regional divergences, but also the importance that State policy frameworks may have in shaping the regional impact of global economic disturbances. Similar dynamics can be observed in the context of other major recessionary episodes in Western economies.

If, alongside magnitude, we also consider the duration and structure of the shocks, we observe dissimilarities between Catalonia and Emilia-Romagna during the 1979 oil crisis and the 2007–2008 Great Recession. In the case of the second oil crisis, the impact on Catalonia was more severe than during the first oil shock. However, the difference in the magnitude of contraction between the two regions was far less divergent than the gap observed in 1973. Industrial value added declined by a total of 6.9% in a single, continuous drop in Catalonia. By contrast, the duration and structure of the recession revealed more significant regional disparities. While Catalonia experienced a relatively brief, U-shaped downturn and

had stabilized by 1982, Emilia-Romagna underwent a prolonged, double-dip recession, experiencing successive contractions of 3.3% (1979-1980) and 4.4% (1981-1983). This structural difference indicates a more persistent and ultimately more severe shock in the Italian region, stretching across four years.

Were these differing oscillations in value added partially shaped by the monetary policies implemented by central governments? A definitive answer remains elusive. By the end of the 1970s, both Spain and Italy had begun transitioning toward tighter monetary regimes. However, the Bank of Spain's nominal discount rate for commercial loans remained largely stable until the mid-1980s. In contrast, real interest rates underwent a significant transformation. After a sharp rise between 1979 and 1980, they turned positive (Table A.7, Appendix), a shift that might have contributed to the short-term decline in industrial value added observed in Catalonia between 1980 and 1982.

Italy's case was somewhat different. Its entry into the European Monetary System in December 1978 reinforced, or at least provided justification for, the adoption of more restrictive macroeconomic policies (e.g. Frieden 2001, Ventresca 2023). Within this framework, the Bank of Italy's discount rate rose steadily from 10.5% in 1978 to a peak of 19.0% in 1981, before easing slightly to 17% by 1983. Real interest rates, however, followed a different pattern: after trending downward between 1978 and 1980, during which we observe a first drop in industrial value added, they increased in 1980 and turned positive in 1981 (Table A.7, Appendix). This shift coincided with the

onset of a two-year contraction in Emilia-Romagna's industrial value added

Differences between Catalonia and Emilia-Romagna are also observed in the period 2007–2013. During the Great Recession of 2007–2008, both regions were severely affected; however, Emilia-Romagna's industrial sector contracted more sharply in the initial phase (-22.1% compared to -11.4%). In the following years, Catalonia experienced a further decline of 11.5%, surpassing Emilia-Romagna's additional contraction of 4.1%. These differences in the timing and intensity of the contractions likely reflect divergent economic policy responses. Initially, the Spanish government adopted expansionary fiscal measures. An expansionary policy was also followed by the Catalan government. However, these policies were subsequently abandoned in favor of austerity programs, notably including, among others, reductions in public sector wages (Maluquer de Motes 2013, Fernández-Albertos 2014, Catalan 2015, Catalan 2016-17). While the initial shock was significantly steeper in Emilia-Romagna, the recession ultimately proved to be more persistent in Catalonia. This is due to the longer duration and the continuous fall or stagnation of industrial value added across six consecutive years, resulting in two separate, severe double-digit drops of -11.4% and -11.5%, and indicating Catalonia's lower level of resistance to the prolonged effects of the Great Recession.

For the remaining recessionary shocks, the data presented in Table 2 suggest higher levels of similarity in terms of peak-to-trough percentage changes, the duration of the recession, and its shape. The ear-

TABLE 3: PEAK TO TROUGH PERCENTAGE CHANGES IN THE INDUSTRIAL EMPLOYMENT OF CATALONIA AND EMILIA ROMAGNA, 1973-2023 (%)

Shock	Catalonia			Emilia-Romagna		
	Period	No. Years	Change (%)	Period	No. Years	Change (%)
1973 oil crisis	1974-1982	8	-26.5	1977-1978	1	-0.6
1979 oil crisis	1983-1985	2	-7.3	1980-1986	6	-6.3
Early 1990s recession	1990-1995	5	-13.3	1989-1993	4	-11.7
				1995-1996	1	-0.6
Early 2000s recession	2000-2016	16	-39.6	2003-2004	1	-3.7
2007-08 Great Recession				2007-2010	3	-4.4
				2011-2015	4	-4.5
Covid-19 crisis	2019-2020	1	-3.7	2019-2021	2	-2.1

Sources and notes: Authors' elaboration. See Table 1 and the main text.

ly 1990s recession reached Catalonia slightly later, possibly due to the short-term economic stimulus generated by the 1992 Barcelona Olympic Games (Brunet 1995). In terms of magnitude, the downturn was somewhat more pronounced in Catalonia, potentially as a result of central government policies that combined fiscal expansion with restrictive monetary measures (Trigo, Tremosa, and Guillem 2003, 73). However, the recession was also shorter in Catalonia, whereas Emilia-Romagna experienced a double-dip contraction. The early 2000s and COVID-19 crises show very comparable patterns in both regions, although the initial decline was marginally steeper in Catalonia.

What if we shift the focus from value added to employment? Based on the data shown in Figure 1 (Section 1), which tracks the annual percentage change in industrial value added and employment, one might expect similar regional patterns. Yet the reality differs markedly. Table 3 reveals a very different story in terms of cross-regional resistance to shocks. While both Catalonia and Emilia-Romagna experienced industrial employment losses during major recessions, the magnitude and duration of these contractions varied significantly. A consistent pattern emerges: Catalonia typically suffered steeper and more prolonged employment declines, especially during drawn-out crises, while Emilia-Romagna generally experienced more contained losses over shorter periods, with the notable exception of the early 1980s.

The most striking disparities emerge during the 1973 oil crisis and the early and late 2000s recessions, shocks that warrant particular attention. In sharp contrast to value-added data, following the 1973 crisis, Catalonia experienced a dramatic employment decline of -26.5% over eight years, while Emilia-Romagna's drop was comparatively negligible (-0.6%). This suggests that the Spanish government's initial efforts to shield the country from the oil shock (by not passing on oil price increases to the economy) ultimately resulted in massive job losses (Sanromà 1990, 89). The delayed effects of the 1973 crisis were later compounded by the 1979 oil shock. Thus, with the sole exception of 1983, employment in Catalonia's industrial sector declined continuously from the mid-1970s to the mid-1980s, marking an extraordinarily prolonged recessionary period (Flos, Gasòliba, and Serra 1978, Santacana 1983, Col·legi d'Economistes de Catalunya 1985, Petitbó and Bosch 1990, Catalan 2016-17).

Several potential factors may help explain the sharp decline in employment in Catalonia. To begin with, it can be argued that the sectoral composition of the Catalan economy may have exacerbated the impact of the oil shocks (Sudrià 1988, 254–55, 257–260). The rationale for this explanation is that, alongside the energy crises, these years also witnessed the emergence of new international competitors in Latin America and Southeast Asia in key branches of Catalan industry, such as textiles. Indeed, in 1973, almost 30% of industrial employment in Catalonia was concentrated in textiles, compared with 20% in Emilia-Romagna. Most notably, between 1973 and 1987, nearly 60% of all industrial jobs lost in Catalonia were in the textile sector (Banco Bilbao Vizcaya 1999).

While international competition negatively affected Catalonia's textile industry, this was not the case in Emilia-Romagna, where employment in the textile sector remained relatively stable, suggesting that sectoral composition alone does not fully explain the divergent cross-regional employment trends. In addition, in Emilia-Romagna, larger final firms in textiles chose both offshoring and quality upgrading (moving to higher market segments) to withstand international competition. Following the offshoring of the larger end-client companies and the difficulties faced by micro and small end-client enterprises, a portion of the subcontracting firms turned towards clients outside the region, working with highly visible brands and labels, including luxury brands, thereby preserving at least part of employment in the region (Bigarelli and Solinas 2024).

Labor legislation enacted at the central government level has often been regarded as an impediment to labor market adjustment. In Spain, labor markets were indeed subject to considerable overregulation during the 1970s, partly as a legacy of the Francoist dictatorship, and partly due to the new legal framework introduced by the first government of the Monarchy through the 1976 Labor Relations Act. Overregulation has been identified as a contributing factor to rising unemployment. As Prados de la Escosura and Sanz (1996, 375) argued, during the crises of the 1970s, aggregate demand contracted and, "given institutional constraints, quantity and not price (wage) adjustments took place, resulting in high unemployment". The passage of the Workers' Statute in 1980 marked a shift towards greater hiring flexibility (Pedreño Muñoz 1990, 417, Herrero 1991, 376–382).

In Italy, labor markets were also subject to a high degree of regulation, a condition that appears to have persisted longer than in Spain. For example, Crafts and Magnani (2013) argued that between the 1970s and the 1990s, "Italy was notable in this period for a very high level of employment protection". In this regard, it is worth noting that the Workers' Statute, enacted in 1970 in response to the 1969 "Hot Autumn", introduced significant reforms that made dismissal procedures more complex and costly, even though these provisions did not apply to small firms with fewer than 16 employees, while also strengthening the role of the major trade unions, namely, the General Italian Confederation of Labor (CGIL), the Italian Confederation of Workers' Trade Unions (CISL), and the Italian Labor Union (UIL).

With Italian labor market regulations more explicitly geared towards preserving employment than those in Spain, adjustment mechanisms during the crises of the 1970s may have followed different paths, although this may have introduced other challenges to the Italian economy. As noted by Rossi and Toniolo (1996, 447), after the first oil crisis, "fragile governments under heavy social pressure resorted to inflation and devaluation, as lesser evils than unemployment". Attempts to introduce labor market flexibility occurred between 1977 and 1983, and more seriously between 1983 and 1984, but substantive reforms did not begin until 1991–1992. According to some authors, this prolonged rigidity contributed to higher unemployment rates (Christofides 1996, Hijzen, Mondauto, and Scarpetta 2013).

The fact that job losses between the mid-1970s and mid-1980s were greater in Catalonia than in Emilia-Romagna may suggest that the nature of labor market regulation differed in the two regions, or that other institutional arrangements played a critical role, an issue to which we shall return.

In connection with labor markets, the role of wages, particularly in combination with other factors, has attracted considerable attention. For example, for Spain, Bentolila and Blanchard (1990, 262) concluded that a combination of wage inflation after the early 1970s, followed by a monetary contraction after 1977, led to a profit squeeze and a reduction in capital accumulation. This, along with industrial restructuring that included the closure of inefficient firms, layoffs, and a transformation of the industrial structure, initially led to rising unemployment in Spain.

For Catalonia, Catalan (2013) argued that, in a context of declining business confidence caused by political uncertainty and social unrest, which peaked in the late 1970s, labor disputes led to a sharp rise in real wages. This, in turn, contributed to declining profitability and investment. Simultaneously, the adoption of a restrictive monetary policy and rising interest rates after 1977 triggered a wave of payment suspensions, leading to further unemployment. Catalan also contends that the abandonment of industrial policy further exacerbated difficulties by removing protections from sectors with high potential for long-term growth, such as the car and motorbike industries, machinery manufacturing, and household appliances. Finally, he notes "the insolvency of some banking groups that had played an important role in industrial promotion during Franco's development only hardened the Catalan depression in the early 1980s." (Catalan 2013, 377)

Italy also experienced political instability, substantial increases in real wages, and intense social pressure until the late 1970s (Lubitz 1978, Rossi and Toniolo 1996). Much like Spain during its transition to democracy, the country was also afflicted by both right- and left-wing terrorism, known as the Anni di Piombo (Years of Lead) (e.g. Baby 2021). Emilia-Romagna was affected by these general developments and the broader socio-political climate. However, the areas that are most relevant to economic performance and unemployment appear to have remained comparatively insulated from these disruptions, especially when contrasted with Catalonia, likely due to institutional factors.

Indeed, a final, and perhaps more decisive, factor may help explain the divergent unemployment trends during and after the 1970s oil crises: institutional arrangements. A highly influential article by Sebastiano Brusco concluded that during the 1970s, Emilia-Romagna outperformed other Italian regions and proved "more resilient to crisis" (Brusco 1982, 167). He argued that, rather than significantly different sectoral specialization, what truly distinguished Emilia-Romagna was its concentration of small firms organized into industrial districts. This form of organization allowed for a more flexible use of labor, the rapid adoption of innovations, and the nurturing of entrepreneurial skills and local business leadership. Brusco (1982) conceptualized this distinctive industrial structure as the "Emilian model," which he viewed as a key factor in the region's superior performance and its capacity

“to resist foreign competition, in particular that of Third World countries” (Brusco 1982, 178).

Beyond industrial organization, additional elements contributed to Emilia-Romagna’s resistance. The model promoted strong social cohesion and political consensus. While the central state played a limited role, local institutions, under Communist Party leadership, proved highly effective. Trade unions were also active and influential, although they represented only about half the labor force, thereby maintaining a balance between workers’ rights and economic flexibility. More specifically, strong unions operated within a ‘primary’ industrial sector composed of larger, innovative firms able to support high wages and avoid mass layoffs. At the same time, a ‘secondary’ sector of smaller, dynamic firms benefited from a more flexible labor market. Moreover, a ‘putting-out’ system extended production to other regions, providing further flexibility to firms.

While some of the characteristics highlighted by Brusco were also present in Catalonia’s industrial sector, others were notably weaker or altogether absent, especially at the institutional level. Catalonia had an industrial structure dominated by small and medium-sized firms, often organized into industrial districts. However, the level of social cohesion and political consensus described by Brusco in Emilia-Romagna was much less evident in Catalonia, particularly during the 1970s. Similarly, the influence of leftist parties in Catalonia did not match the strength or organizational depth of the Italian Communist Party in Emilia-Romagna. Nor did they possess the capacity to foster the same number and variety of organizations and associations, ranging from credit co-operatives to business associations, through which the party “promoted co-operation, enforced social norms of fair play and stimulated economic growth” (Rinaldi 2005, 245).

In Catalonia, political parties and trade unions were not legalized until 1977, the same year in which the *Generalitat de Catalunya* was restored. The first elections to the Catalan Parliament were subsequently held in 1980. Although leftist parties collectively received more than half of the votes, the winning party was *Convergència i Unió*, a centre-right Catalan nationalist coalition, which obtained 28% of the popular vote and 43 out of 135 seats. Its leader, Jordi Pujol, was elected President of the *Generalitat de Catalunya* with the support of his coalition and two additional parties. He would remain in office until 2003. In 2010, *Con-*

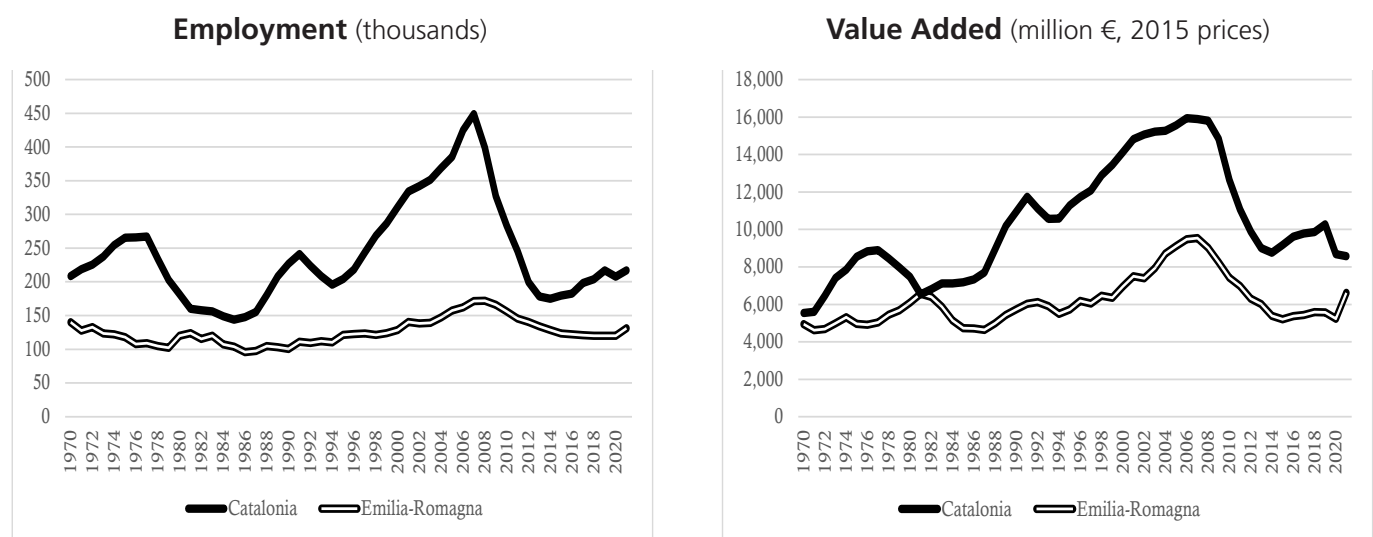
vergència i Unió returned to power, this time under the leadership of Artur Mas, who served as President of the Catalan Government from 2010 to 2016.

Alongside the 1970s, the 2000s stand out as the period in which the most striking disparities in job losses between Catalonia and Emilia-Romagna emerged. During the early 2000s downturn, Catalonia once again exhibited weaker resistance, with industrial employment falling by nearly 40% over a span of sixteen years—an exceptionally prolonged and severe contraction. Emilia-Romagna, by contrast, experienced a modest decline of just 3.7%, and this only over a single year. As will be further elaborated, one point appears certain: in the case of Catalonia, this outcome cannot be fully explained by the typical determinants of economic downturns in the early 2000s, such as the bursting of the dot-com bubble in 2000 or the aftermath of the September 11, 2001, terrorist attacks in the United States.

Catalonia’s employment decline in the early 2000s was further exacerbated by the 2008 Great Recession. Although no distinct trough is recorded immediately after 2000, since no new employment minimum was observed until 2016, the estimated percentage decline in industrial employment between 2008 and 2016 was -25.1% (a sub-component of the broader 39.6% contraction shown in Table 3). This contraction far exceeds the successive losses of 4.4% and 4.5% registered in Emilia-Romagna between 2007 and 2015.

Globalization is a key factor to explain the prolonged employment decline that Catalonia has experienced since the early 2000s. The integration of global markets offered new opportunities for Catalan firms to access foreign supply chains and consumer bases, yet it also exposed them to intensified international competition (Catalan 2016-17). This duality manifested most starkly in the textile, clothing, leather, and footwear sectors, which were disproportionately affected by cheap imports from low-cost Asian countries, particularly following China’s accession to the World Trade Organization (WTO) (Catalan and Ramon-Muñoz 2013). Between 2001 and 2007, these industries experienced a 15% drop in the number of establishments and a staggering 40% decline in employment, far exceeding the 15% reduction observed across the broader industrial sector.

At the same time, the early 2000s saw a significant wave of delocalization (Myro, Fernández-Otheo, and Ruíz Céspedes 2006), partly coinciding with the

FIGURE 2: EMPLOYMENT AND VALUE ADDED IN CONSTRUCTION IN CATALONIA AND EMILIA-ROMAGNA, 1970–2021

Sources and notes: Authors' elaboration. See Table A.2 (Appendix).

historic enlargement of the European Union towards Eastern Europe in 2004 (Gual 2004). During this period, numerous multinational and domestic firms relocated production facilities from Catalonia to lower-cost destinations in Eastern Europe, Asia, and North Africa. Portugal also attracted some factories, while others moved to Western Europe due to the “home effect.” Major examples include Hewlett-Packard’s closure of its Catalan plant in 2000, with production shifting to Singapore and Hungary, and the automotive components manufacturer Lear, which moved operations to Poland in 2002, resulting in the loss of nearly 1,000 jobs (Ramon-Muñoz 2016). Further closures followed in subsequent years, involving companies such as Valeo (2003), Samsung Electronics (2004), Celestia (2005), Braun (2006), Durex (2007), and others, spanning sectors from electronics to textiles and automotive parts. These relocations further eroded the region’s industrial employment base, a process that continued after 2008 and throughout the 2010s (Rovira, Gutiérrez, and Marly 2020).

While Catalan industry grappled with these challenges, macroeconomic conditions further exacerbated its industrial decline. Although some authors have argued that Catalonia benefited more than other Spanish regions from European monetary unification, at least initially (Costa and Tremosa 2003), Spain’s

entry into the Eurozone eliminated the possibility of currency devaluation as a tool to restore competitiveness (Catalan and Sánchez 2013). At the same time, the early 2000s were characterized by a sense of economic prosperity, driven by easy credit and a booming construction sector, which led to a property bubble (See Figure 2).¹ When the global financial crisis hit in 2007–08, the Spanish economy entered a sharp downturn (Maluquer de Motes 2013, Catalan 2017): bankruptcies increased, the credit system froze, the public sector faced a debt crisis and finally adopted restrictive fiscal policies, demand collapsed both domestically and internationally, and unemployment surged.

In contrast, Emilia-Romagna, although also subject to external shocks such as globalization, China’s accession to the WTO, and the constraints of the euro, demonstrated greater resistance in maintaining industrial employment. While this observation requires further empirical substantiation, national labor policies

1 Certainly, employment and value added in the construction sector in Catalonia have followed broadly similar cyclical trajectories to those observed in Emilia-Romagna. In both regions, the sector expanded steadily until the mid-2000s, peaking around 2007 before contracting sharply in the aftermath of the global financial crisis. The intensity and timing of these cycles, however, differ somewhat. According to the available data, Catalonia appears to have experienced a more pronounced boom-and-bust pattern, with employment and value-added rising rapidly during the pre-crisis years and falling steeply thereafter, likely reflecting its greater exposure to speculative real estate dynamics.

and cross-regional institutional arrangements do not appear to have played as pivotal a role as they did during the 1970s. By the early 2000s, labor markets in both regions had undergone processes of deregulation and flexibilization, which continued shortly after the Great Recession of 2007–2008. In the Italian region, two major changes marked the adaptation of industrial structure to globalization and helped to retain manufacturing employment much more than in Catalonia (Bianchi et al. 2024).

The first one is the rise of lead firms within Emilian industrial districts. These firms, contrary to “canonical” district firms which tend to remain small while the whole production system grows, pursue size growth and extend their markets, often acquiring other firms both within and outside their industrial district of origin. Many lead firms experienced an export boom following the devaluation of the lira in 1992. After significantly increasing their sales in foreign markets, such firms moved to control distribution networks abroad by establishing commercial subsidiaries, partnerships and dealerships, first in the largest EU countries and North America and then also in East Asia. Some lead firms also established production facilities overseas, but these investments were mostly market-seeking, i.e., aiming to serve the American and the Chinese markets, and did not replace production for the European market that largely continued to be made in the region.

The second change is inward foreign direct investment by foreign multinationals. Foreign investors have primarily been attracted by Emilian technology-intensive industries (i.e., biomedical equipment, machinery and industrial equipment, and automotive) and the possibility to develop synergies with local firms. They generate intense intra-group exchanges that enhance inflows and outflows of goods and services to and from the regional territory. MNEs came to Emilia-Romagna essentially to have access to the regional pool of localized knowledge and the qualified networks of subcontractors. In many cases local firms acquired by multinationals retained strong links with their Emilian industrial districts and this helped to retain manufacturing employment in the region.

Investments by lead firms and multinationals in the region benefited from funding from both national and regional industrial policy, i.e., Lamborghini (in Sant’Agata Bolognese) with its new SUV model; Elettric 80 (in Reggio Emilia), with a new generation of handling and navigation systems; and the multinational company AVL Italia (in Cavriago) with its new research center

for the analysis of big data applied to industry (Rinaldi and Solinas 2023).

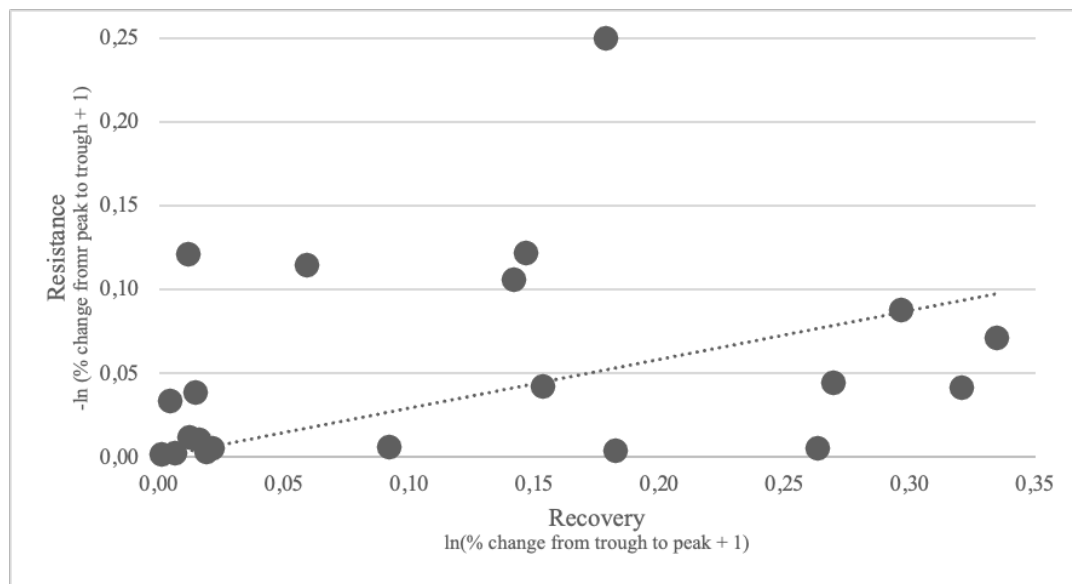
Recovery from recessionary shocks

In the analysis of regional resilience, quantifying the impact of recessionary shocks is important not only for assessing resistance capacity but also because it may partly determine a region’s ability to recover. If a shock is sufficiently severe and destructive to erode the regional economic base, its effects may become permanent, hindering recovery and negatively affecting post-shock growth over both the short and long term (e.g. Martin 2012). The literature, however, has not reached a conclusive consensus on this issue. While some studies suggest a link between lower resistance and more modest recovery, many emphasize significant heterogeneity in this relationship depending on the nature of the shock (e.g. Doran and Fingleton 2014). In some instances, recovery appears relatively uniform across regions within the same country and only weakly related to the severity of the initial downturn (e.g. Fingleton, Garrese, and Martin 2012, Cellini and Torrisi 2014).

To examine the relationship between the resistance and recovery dimensions of resilience, we first analyzed industrial value-added data, followed by employment metrics. Specifically, we estimated the percentage increase in value added from trough to peak in both Catalonia and Emilia-Romagna (Tables A.1 and A.4, Appendix). These recovery figures were then correlated with the corresponding percentage declines observed during recessions, as previously reported in Table 2 in Section 3.

The results of this bivariate correlation are illustrated in Figure 3. A preliminary methodological clarification is in order. We transformed the percentage data for both resistance and recovery into natural logarithms. For resistance, percentage changes from peak to trough, originally negative, were transformed using the negative natural logarithm of the ratio: Resistance = $-\ln([\% \text{ change from peak to trough}/100] + 1)$. With this transformation, the resulting positive values accurately scale so that higher numbers correspond to more severe downturns, and lower values to milder contractions. For recovery, the percentage increases from trough to peak, already positive, were simply transformed as $\ln([\% \text{ change from trough to peak}]/100] + 1)$. This method smooths the data, lin-

FIGURE 3: RELATIONSHIP BETWEEN RESISTANCE (PEAK-TO-TROUGH) AND RECOVERY (TROUGH-TO-PEAK) IN INDUSTRIAL VALUE ADDED IN CATALONIA (CAT) AND EMILIA-ROMAGNA (EMR), 1973–2023



Sources and notes: Authors' elaboration. See Tables 1, 2, A.1 and the main text. The periods plotted in the figure correspond to distinct phases of decline (peak to trough) and subsequent recovery (trough to peak), with the initial year indicating the peak preceding the downturn and the final year marking the peak following recovery.

earizes multiplicative effects, and ensures that equal magnitudes of resistance and recovery represent a return to the pre-shock baseline.

The results yield several noteworthy insights. In some instances, lower resistance to recession, represented by higher values on the vertical axis, is associated with weaker subsequent recovery, indicated by lower values on the horizontal axis. For example, in Emilia-Romagna during the 1979-1981 period, industrial value added declined by 3.3% between 1979 and 1980 but rebounded by only 0.5% over 1980-1981. A similar pattern is observed in Catalonia during 2007-2010, where industrial value added fell sharply by 11.4% between 2007 and 2009, yet recovered by only 1.2% between 2009 and 2010, illustrating that a severe downturn may result in only modest growth afterward.

However, many cases show the opposite pattern: the more intense the decline during the downturn, the stronger the rebound during the recovery, and vice versa. Although the relationship is not very strong ($R\text{-squared} = 0.36$), the positive trend line in Figure 3 indicates that, more often than not, severe contractions are followed by stronger recoveries.

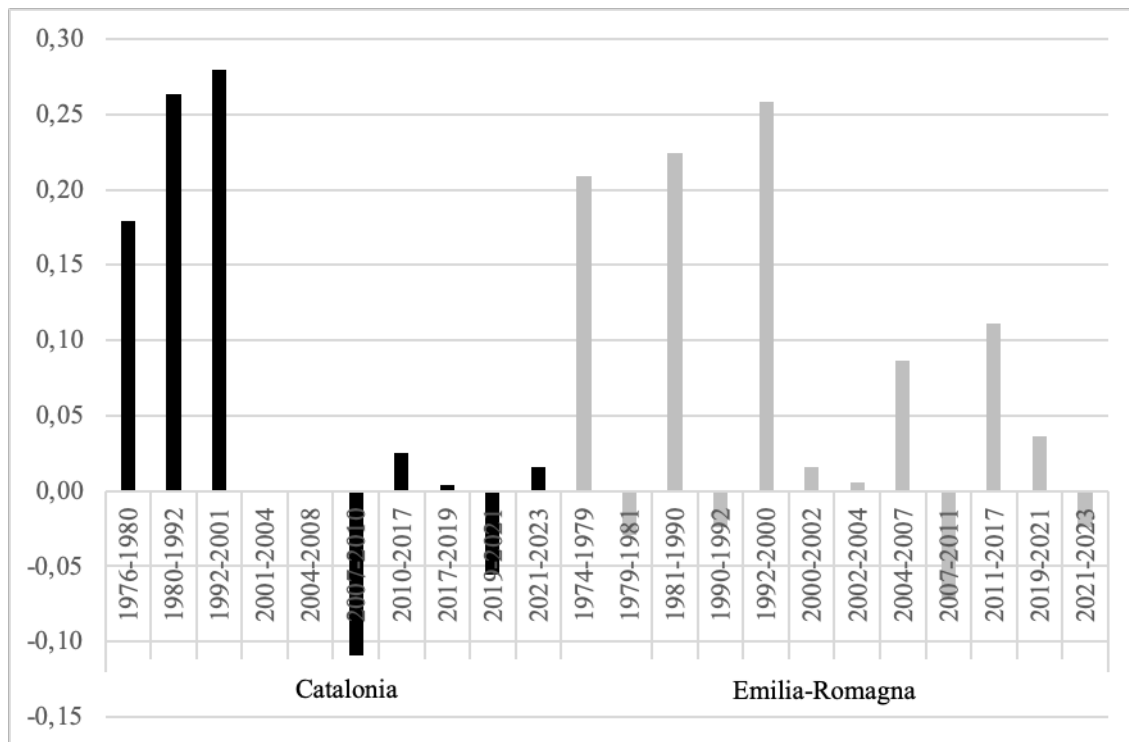
Furthermore, no significant differences in the direction of the resistance–recovery relationship are

observed between Catalonia and Emilia-Romagna, nor between the late 20th century and the first two decades of the 21st century. Instead, notable disparities appear in other respects. Figure 4 illustrates the net recovery balance, computed as the difference between the percentage decline during the recession (from peak to trough) and the subsequent percentage recovery (from trough to peak). Following the same methodology used in Figure 3, we calculated the percentage changes from peak to trough and from trough to peak, converted the declines into positive values, and applied a logarithmic transformation.² The results should be interpreted as follows: if the net recovery balance is above 0, the recovery exceeds the recession losses; if it equals 0, the recovery fully offsets the losses; and if it is below 0, the recovery has been insufficient to compensate for the downturn.

According to the calculations presented in Figure 4, recoveries relative to declines in both Catalonia and

² As an extension of what has already been noted the logarithmic transformation addresses the inherent asymmetry of percentage changes, where equal percentage gains and losses do not cancel out multiplicatively. For instance, a 20% decline (from 100 to 80) followed by a 20% increase (from 80 to 96) results in a net loss. By linearizing multiplicative effects, this approach ensures symmetry: a recession-recovery cycle returns to its original value if and only if Recovery minus Resistance equals zero.

FIGURE 4: NET RECOVERY BALANCE IN THE INDUSTRIAL VALUE ADDED OF CATALONIA AND EMILIA-ROMAGNA BY BUSINESS CYCLE TURNING POINTS, 1973–2023

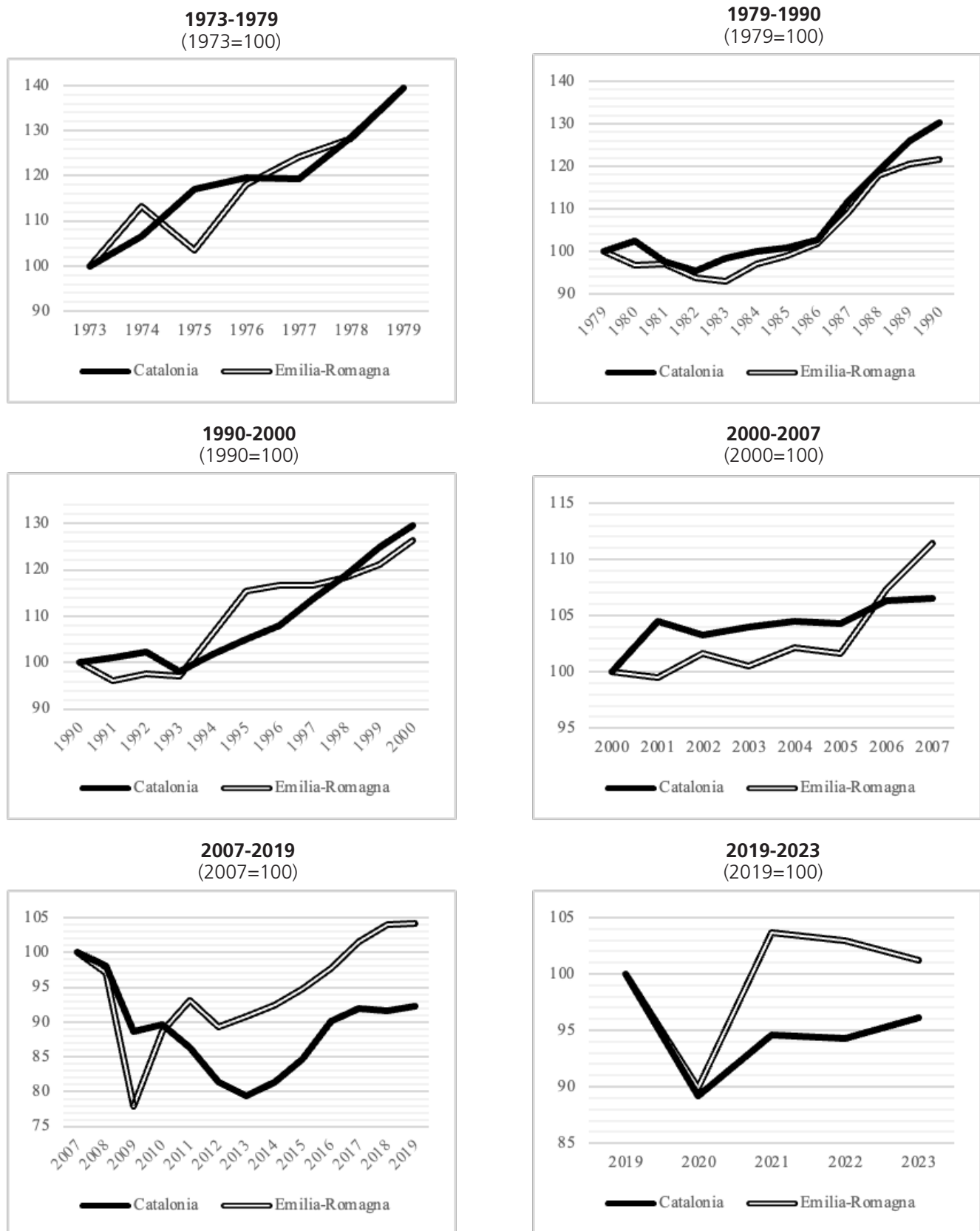


Sources and notes: Authors' elaboration. See Table 1, 2, A.1, Figure 3 and the main text.

Emilia-Romagna were stronger and generally exceeded the depth of recessionary shocks during the last quarter of the 20th century. In Catalonia, the strength of the rebound was particularly notable following the 1979 oil shock, when industrial output declined by 6.9% between 1980 and 1982, and after the early 1990s recession, which saw a 4.1% drop in value added between 1992 and 1993. In Emilia-Romagna, the recovery was insufficient to fully offset the losses incurred during the initial impact of the 1979 oil shock, which resulted in a 3.3% decline in industrial

value added between 1979 and 1980, as well as those stemming from the early 1990s recession, which led to an initial contraction of 3.8%. However, when the cumulative effect of the recessive cycles of 1973, 1979, and 1990 is considered, the net results remain clearly positive, although throughout the 1980s and 1990s, Emilia-Romagna exhibited lower resistance–recovery values than Catalonia.

FIGURE 5: RESISTANCE AND RECOVERY FOLLOWING ECONOMIC SHOCKS IN THE INDUSTRIAL VALUE ADDED OF CATALONIA AND EMILIA-ROMAGNA, 1973–2023



Sources and notes: Authors' elaboration. See Table 1 and the main text.

This picture changed significantly with the turn of the 21st century. Recovery capacity in terms of industrial value added became more unstable and generally weaker. Net recovery balances showed greater variability and were often lower, and at times even negative, particularly following the sharp downturns of the Great Recession, which in Emilia-Romagna led to a decline of 22.1% in 2007–2009, and the Covid-19 crisis, which caused a 10.1% drop between 2019 and 2020. Despite these challenges, Emilia-Romagna's industrial output maintained positive, though declining, net recovery values throughout the 2000s and 2010s. Importantly, the region successfully regained pre-shock levels from the troughs of 2001, 2003, 2005, 2009, 2012, and 2020 (Figure 5).

This was not the case for Catalonia, where industrial recovery offset the relatively mild recessions of 2001–2002 (–1.2%) and 2004–2005 (–0.2%), but was insufficient to compensate for the much deeper declines of the 2007–2008 Great Recession and the 2019–2020 pandemic. The more modest recovery capacity of Catalonia had a final consequence: by 2023, Catalonia's industrial value added, measured in constant 2015 euros, remained below both its 2007 and 2000 levels. In contrast, Emilia-Romagna's output

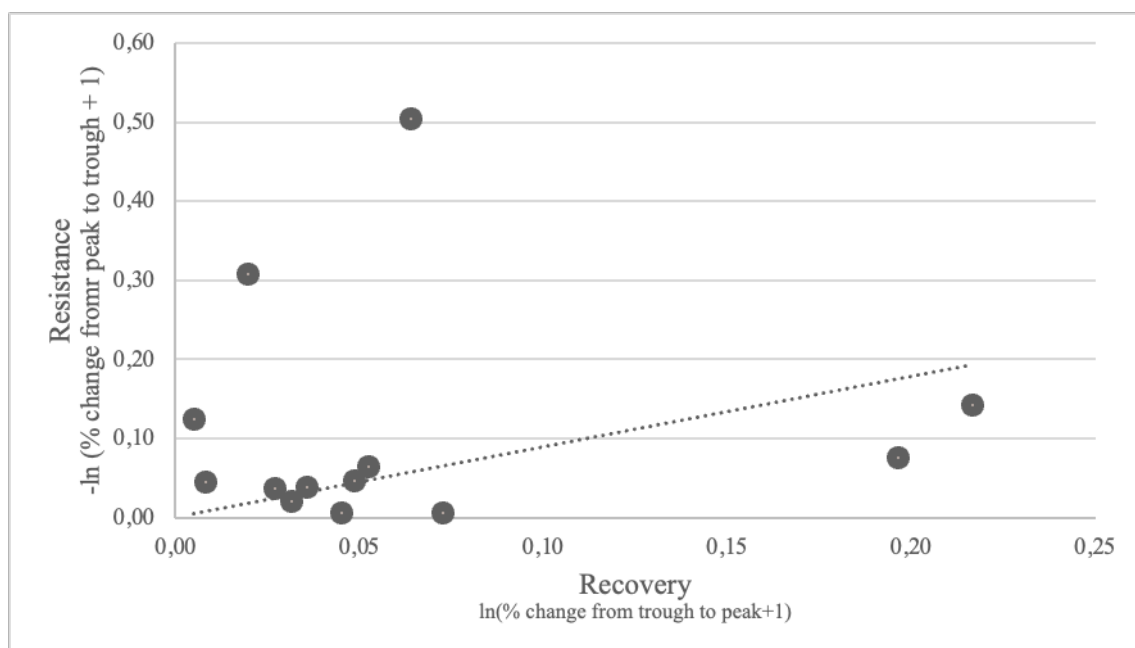
in 2023 was 17% higher than in 2000 and 5% above the 2007 level (Table A.6, Appendix, and Figure 5).

What about when the focus is on employment? Building on the evidence presented in Section 3 on resistance, we hypothesize that employment data may exhibit a different recovery pattern from that observed for value added. There is an additional structural factor that supports this hypothesis: between 1973 and 2023, the value-added series in both regions displayed a fluctuating yet overall upward trend. In contrast, industrial employment in both Catalonia and Emilia-Romagna also fluctuated, but around a generally declining trend since the 1970s.

As previously, we begin by analyzing the resistance–recovery relationship in employment. We then assess whether post-shock recoveries were sufficient to offset the losses incurred during recessions, using the net recovery balance as our primary indicator.

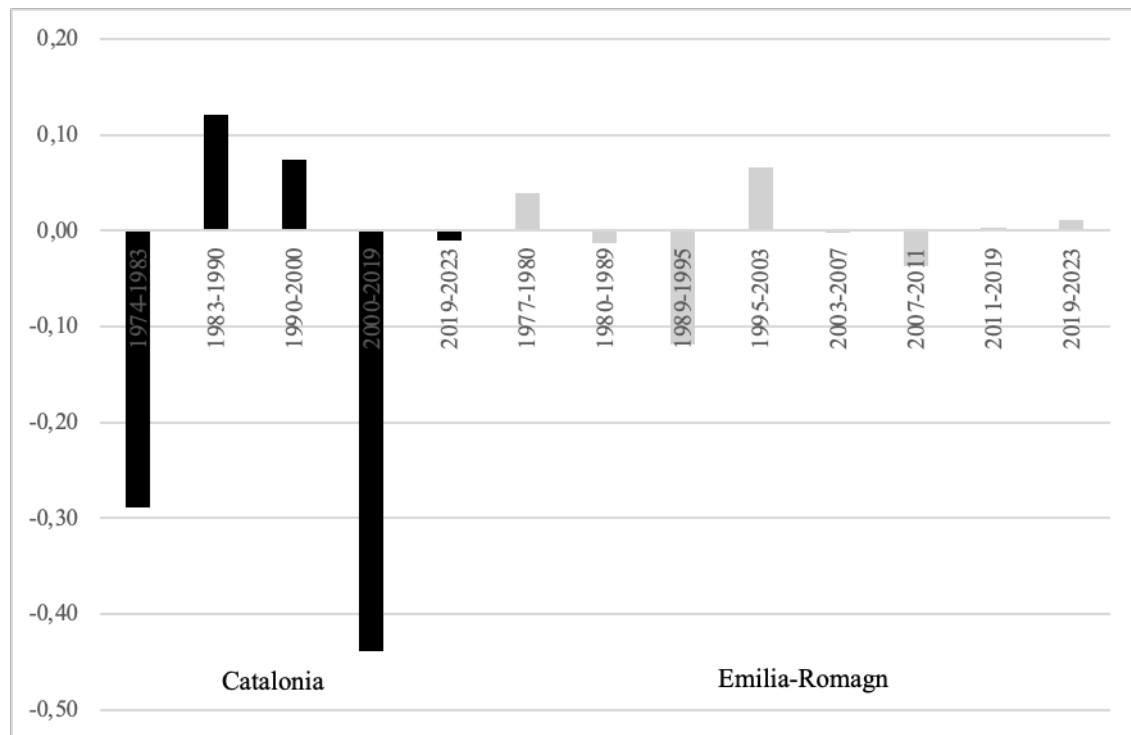
Regarding the resistance–recovery nexus, a weaker pattern emerges for employment than for added in the resistance–recovery nexus. While value added exhibited an imperfect but overall positive relationship between the severity of shocks and the strength of subsequent recoveries, suggesting that more severe shocks could elicit more intense rebounds, this dynamic

FIGURE 6: RELATIONSHIP BETWEEN RESISTANCE (PEAK-TO-TROUGH) AND RECOVERY (TROUGH-TO-PEAK) IN INDUSTRIAL EMPLOYMENT IN CATALONIA (CAT) AND EMILIA-ROMAGNA (EMR), 1973–2023



Sources and notes: Authors' elaboration. See Table 1, 3, A.4, Figure 3 and the main text.

FIGURE 7: NET RECOVERY BALANCE IN THE INDUSTRIAL EMPLOYMENT OF CATALONIA AND EMILIA-ROMAGNA BY BUSINESS CYCLE TURNING POINTS, 1973–2023



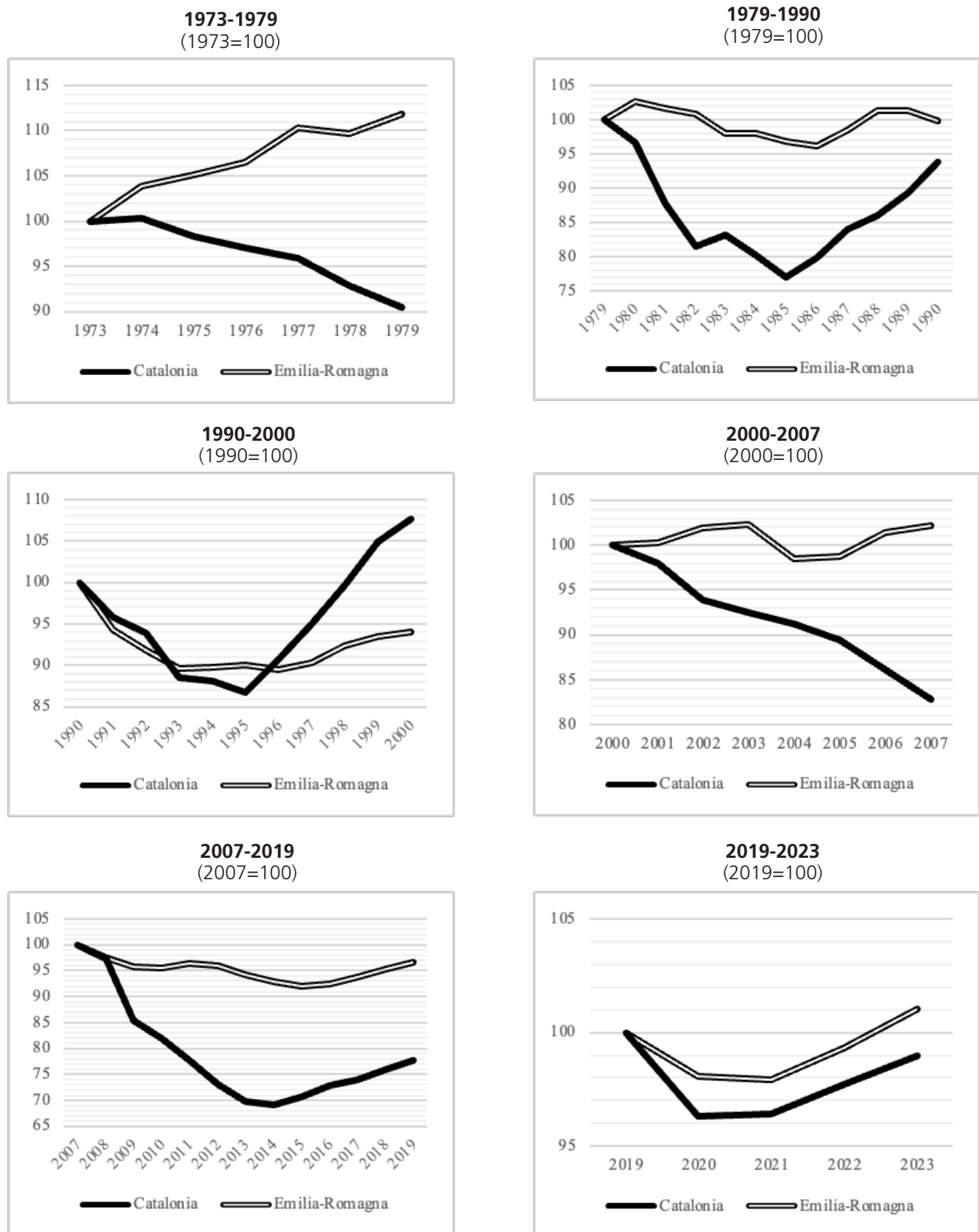
Sources and notes: Authors' elaboration. See Table 1, 3, A.4, Figure 3 and the main text.

is less evident for employment. As shown in Figure 6, the relationship between resistance and recovery is weak, with a R-squared value of 0.21.

Similarities between the two regions become more apparent when we calculate the net recovery balance in industrial employment for Catalonia and Emilia-Romagna by business cycle turning points (Figure 7). As with value added, two distinct phases can be identified by examining the net recovery balance, defined as the difference between recovery and recession. The first phase corresponds to the last quarter

of the 20th century, during which the net recovery balance appears slightly more favorable to Catalonia, largely due to strong rebounds following the 1979 oil shock (which reduced employment by 7% between 1983 and 1985) and the early 1990s recession (with a 13% decline between 1990 and 1995). In contrast, Emilia-Romagna underperformed during the 1990s, particularly because the losses during the recessionary years from 1989 to 1993, which were similar in scale to those in Catalonia, exceeded subsequent employment gains during the recovery.

FIGURE 8: RESISTANCE AND RECOVERY FOLLOWING ECONOMIC SHOCKS IN THE INDUSTRIAL EMPLOYMENT OF CATALONIA AND EMILIA-ROMAGNA, 1973–2023



Sources and notes: Authors' elaboration. See Table 1 and the main text.

Although the employment recoveries observed in Catalonia during the second half of the 1980s and the late 1990s were significant (Figure 8), they were not sufficient to offset the steep decline that occurred between 1974 and 1982, when industrial employment fell by 26.5% (Table A.6 Appendix). In comparison, Emilia-Romagna experienced a negligible decline of less than 1% over the same period. By the peak year of 2000, Catalonia's industrial workforce had reached approximately 775,000, still below the 850,000 recorded in 1974.

The second phase in industrial employment recovery began with the early 2000s recession and extends to the present. Relative to shock-induced losses, recoveries were generally weak in both regions, resulting in overall negative net recovery balances. This marks a notable divergence from the trajectory of value added, especially in Emilia-Romagna, where output recovery was more robust. Nevertheless, in terms of employment, as with value added, Catalonia underperformed Emilia-Romagna during the 21st century. This outcome is attributable to the prolonged recession that began in the early 2000s and intensified after 2007, coupled with a brief and insufficient recovery period between 2014 and 2019, which was interrupted by a new shock in 2020.

In short, our hypothesis that employment data may exhibit a different recovery pattern from that observed for value added is confirmed when analyzing the resistance–recovery nexus: stronger rebounds were less clearly associated with more intense shocks than in the case of value added. Greater convergence emerges when considering the net recovery balance. Both indicators point to relatively stronger recovery dynamics in the late 20th century and a clear weakening of recovery capacity in the 21st century for Catalonia. They also show that, relative to this latter region, Emilia-Romagna was a weaker performer in the 1980s and 1990s but a stronger one in the early decades of the 21st century. One important point remains: across the entire period, recovery in employment was consistently weaker than in value added.

How can these distinctive patterns be explained? Regarding the last quarter of the twentieth century, the recovery capacity displayed by Catalonia from the mid-1980s to the end of the millennium is difficult to understand without reference to Spain's accession to the European Economic Community in 1986, and, consequently, the integration of Catalan firms into this broader market. A first and obvious consequence

of this milestone was the removal of tariffs on trade in Catalan products, which facilitated access to new markets for Catalan industrial firms. This trend was further reinforced by the establishment of the European Single Market in 1993, the successive devaluations of the Spanish currency between 1992 and 1995, and the initial stages of monetary union that took place in 1999 (Costa and Tremosa 2003). By 2005, more than 70% of Catalan exports were directed to the European Union, with France accounting for 20%, Germany for 12%, Italy for 10%, and Portugal for 9%. Total merchandise trade as a share of GDP rose from 40% in 1985 to 65.1% in 2005 (Amarelo 2007, 21, 19), with export growth outpacing that of imports over the two decades following Spain's accession in 1986. This trend points to an improvement in the competitive capacity of Catalan industry and, to some extent, reflects structural transformation and productivity gains (Oliver 2009).

The chemical, transport equipment, and food industries spearheaded the growth and transformation of Catalonia's industrial sector, although more mature industries also displayed significant dynamism (Fluvià, Gual, and Solà 1991, Trillo, Tremosa, and Guillem 2003). The expansion of the transport sector, including the automobile industry and household appliances, further stimulated the growth of auxiliary and supporting activities. This is a noteworthy point: in a study on Catalan firms in the global economy, it is argued that the industrial sector's resilience during the final decade of the twentieth century can largely be attributed to the investment by multinational corporations across key manufacturing sectors, including automotive, chemicals, electrical and electronic equipment, and agri-food (Trigo, Tremosa, and Guillem 2003). These investments occurred in a context of rapidly increasing foreign direct investment in Catalonia following Spain's accession to the EEC, which grew by 62.6% between 1986 and 1992, compared to 34.8% for Spain as a whole (Amarelo 2007, 25). Together, they contributed to the development of a robust network of small and medium-sized suppliers of materials and components, playing a crucial role in mitigating the effects of the severe industrial decline of the 1980s, particularly in Catalonia, where unemployment had reached nearly one-quarter of the labor force in the early years of the decade (Trigo, Tremosa, and Guillem 2003, 70).

Regarding the 21st century, when Emilia-Romagna outperformed Catalonia, we hypothesize that one of the possible explanations might lie in differences

TABLE 4: EMPLOYMENT AND VALUE ADDED IN MANUFACTURING INDUSTRY BY SECTOR IN CATALONIA AND EMILIA-ROMAGNA, 1970-2019 (PERCENTAGES)

Branches	Catalonia			Emilia-Romagna		
	Employment*					
	1971	1993	2019	1970	1995	2019
Food and Beverage	7.4	11.4	19.1	13.3	11.4	13.7
Textiles and Garment	31.9	21.8	7.6	21.1	14.6	7.4
Mechanical engineering	30.5	33.4	37.3	40.6	40.8	51.5
Others	30.3	33.4	36.1	24.9	33.2	27.3
<i>Of which non-metallic products</i>	5.6	4.1	2.6	10.1	13.5	10.3
Total manufacturing	100	100	100	100	100	100
(thousands)	(826)	(651)	(453)	(473)	(474)	(478)
	Value Added					
	1971	1993	2019	1970	1995	2019
Food and Beverage	8.3	14.5	17.1	15.4	10.8	12.9
Textiles and Garment	27.3	15.3	5.9	13.0	10.9	5.2
Mechanical engineering	32.9	33.7	36.0	40.8	43.0	54.7
Others	31.5	36.5	41.0	30.8	35.3	27.2
<i>Of which non-metallic products</i>	5.9	5.0	2.5	15.7	14.7	10.3
Total manufacturing	100	100	100	100	100	100
(million current euros)	(1,389)	(17,755)	(37,075)	(2,501)	(20,078)	(36,904)

(*): For Emilia-Romagna jobs refer to “posizioni lavorative” (individual employment positions), i.e. jobs held by workers, rather than the number of workers themselves. Note that the figures in total employment and value added consider only the manufacturing sector, not total industry, as in other sections of this article.

Sources: Authors’ elaboration based on the sources cited in Table A.1, Appendix, and, for Catalonia, Banco Bilbao Vizcaya (BBV) (1999) and Institut d’Estadística de Catalunya, Idescat (<https://www.idescat.cat>), accessed November 4, 2025.

in sectoral specialization within the manufacturing industry and in the potential for developing related variety,³ which has been shown to contribute to regional economic growth (Boschma and Iammarino 2009, Boschma, Minondo, and Navarro 2012).

Table 4 reports data on the evolution of sectoral specialization in Catalonia and Emilia-Romagna, concerning both employment and value added from 1970s to 2019 (the year prior to the Covid pandemic).

The sectoral specialization of Emilian manufacturing has changed since the 1970s. Low-tech industries

(textiles and garment and, with regard to value added, also food processing) have declined, while medium- and high-tech industries, especially mechanical engineering, have gained prominence. Mechanical engineering accounted for little more than 40 per cent of the region’s manufacturing value added and employment in 1970 and increased to more than 50% in 2019. This industry constitutes the “core” of Emilia-Romagna’s manufacture. Its specializations have become increasingly diversified and technologically sophisticated over time and now range from metalmaking to automotive, machinery and industrial equipment, and to mechatronics. Thus, in the face of changing competitive environment and sudden shocks, industrial structure in Emilia-Romagna was able to transform by shifting towards a more knowledge-intensive mix of sectors, thereby boosting the value added produced and retaining employment. The upgrade of mechanical engineering has powerfully contributed to

3 The concept of related variety has been defined in the evolutionary economic geography literature and indicates that regional development is positively influenced by regional sectoral diversification (rather than specialization on one or few sectors), especially if the different regional sectors have some complementarities, potential cross-fertilizations, such as mechanical engineering in the ER region producing machines for the other regional sectors. See Frenken, van Oort, and Verburg (2007), Neffke, Henning, and Boschma (2011) and Boschma, Minondo, and Navarro (2012).

the adaptability and upgrade of related variety of the whole regional industrial structure, producing engines, machines and equipment for many other industries in the region (Bianchi et al. 2024).

An exemplary case of the update of related variety in the region is the ceramic tile industrial district of Sassuolo. In the 20th century, resilience in this district was nurtured principally by the collaborative relationships that linked tile producers and machine producers. With a few exceptions, the ceramic tile firms did not invent new machines, or new methods of production. The demand for improvements and modifications to existing techniques of production sprang from them but was largely satisfied by local engineering firms specializing in building machines, or sometimes only a particular piece of a machine, for ceramic tile factories. Machine producers had daily contacts with tile producers, so that they constituted a sort of external technical staff of the tile firms. This allowed the latter to avoid the cost of an internal technical staff. On the other hand, engineering firms, instead of having laboratories for testing prototypes, used the ceramic firms to test how the new machinery actually worked. That is, innovation took place not only within each of the two groups of firms (those producing machines and those producing ceramic tiles) but also, and above all, between the two groups of firms, thereby exploiting the advantages of related variety (Russo 1985).

In recent years, the ceramic tile district triggered the emergence of the ICT sector in the region, representing a “new” related variety. A prominent example is Expert System, a firm which was founded in 1989 to meet the demand of software for materials analysis of the R&D labs of the largest ceramic tile producer, Marazzi. After a few years, Expert System diversified into semantic software and R&D in this field was funded from the revenues of the sale of software to the ceramic tile industry. In 1994, Expert System obtained a contract from Microsoft for the supply of the spelling and grammar corrector for the Italian version of Windows, since then semantic software development has become the core business of the company. Now, Expert System is a leader in artificial intelligence applied to text. At the same time, the materials analysis business unit started to develop software solutions also for industries technologically related to ceramics, such as glass, energy, and waste treatment (Giardino 2005).

Catalonia presents commonalities with Emilia-Romagna but a distinctive pattern regarding the industrial structure. As in Emilia-Romagna, the share of textiles and garments has been falling since the 1970s, accounting in both cases less than 8 per cent of employment and value added in 2019. Instead, in Catalonia food and beverages expanded significantly in relative terms, rising from around 7-8 per cent of employment and value added in the 1970s to 18-19 per cent in 2019. This has been a stronger increase than in Emilia-Romagna where the weight of this branch has remained relatively stationary in the long term.

There are two other remarkable differences in the industrial structure of these two regions. First, since the 1970s, Catalonia diversified into a broader set of manufacturing activities relative to Emilia-Romagna. Second, as in Emilia-Romagna, the relative importance of mechanical engineering, which has consolidated its leading role in the Catalan manufacturing sector, has increased in terms of both employment and value added. Nevertheless, in 2019 the share of mechanical engineering, which accounted for more than one-third of the Catalan manufacturing industry, is still lower than in Emilia-Romagna, where mechanical engineering surpassed 50% of both of the industrial employment and value added.

As in the Emilian case, Catalonia exhibits multiple instances of related variety within its mechanical engineering and other industrial sectors, often linked to Barcelona and its metropolitan area and anchored by leading firms or institutions. A particularly illustrative example is the Catalan mobility ecosystem, where related variety has recently driven industrial upgrading, catalyzed by the pivotal role of a major anchor firm such as SEAT (Volkswagen Group), a leading company within the historical Barcelona automotive cluster (Catalan 2017, see also Hernández Gascón, Fontrodona Francolí, and Pezzi 2005, Hernández Gascón, Pezzi, and Soy i Casals 2010 for an overview of the existing Catalan clusters between the 1990s and early 2000s). SEAT's progressive transformation toward electromobility fostered the foundation for a dynamic mobility hub, which integrates companies from distinct industrial traditions that have converged toward the electric vehicle value chain. For example, Ficosa, established in Barcelona in 1949, initially manufactured mechanical cables for the spare-parts market. However, in the early 2010s, the company strategically shifted toward products with higher electrical component content, culminating in the late 2010s with the launch of a

Battery Management System (BMS), which enables continuous monitoring of the status and charge level of batteries in electric vehicles. Ficosa's BMS integrated into cars of the Volkswagen Group and secured contracts for the Chinese market in 2018. Alongside BMS, the company now produces electrical boxes for power protection and distribution (BDU/eBOX) and battery charging devices (OBC).⁴ This evidence, along with other comparable cases, demonstrates that related variety has facilitated the cross-pollination of knowledge and technologies, specifically integrating the automotive, energy, and ICT sectors (Oficina Pública per a la Transformació de les Indústries de Mobilitat i Automoció, n.d., Berbel 2022).

Yet despite this and other examples of industrial relatedness, mechanical engineering is weaker in Catalonia. Consequently, the presence of a less dense network of interrelated industries might have limited the extent to which related variety could be exploited in the same way as in Emilia-Romagna. Unfortunately, we cannot go further in providing strong evidence on the connection between industrial structure, related variety, and industrial resilience. Confirmation of this hypothesis would require, first, the construction of homogeneous indicators of industry relatedness at the regional level; second, testing whether certain industrial structures and sectors are more prone than others to fostering relatedness; and, finally, assessing the actual impact of related variety on industrial resilience. These issues cannot be addressed within the scope of this study and, although they form part of a broader research agenda, the fact that they cannot be substantiated here certainly constitutes another limitation of this work.

Conclusions and further research

This article has compared two key dimensions of the resilience concept, resistance and recovery, in two Mediterranean regions, Catalonia and Emilia-Romagna, over the past half-century. Examining the six major economic shocks that affected Western economies during this period, our analysis reveals important

differences contingent on the variable under consideration, value added or employment. This distinction is crucial, as conclusions may vary depending on the preferred indicator. Some influential approaches to regional resilience focus primarily on employment, contending that workers bear the brunt of economic adjustment during downturns (e.g. Martin et al. 2016).

While this perspective is valid to a certain extent, it tends to overlook the significant role played by labor market institutions and employment protection legislation in shaping regional responses to economic shocks. Furthermore, neglecting changes in value added risks missing critical aspects of regional resilience, especially those related to technological upgrading and productivity gains. Since productivity is closely tied to value added, increases in the latter, even amid declining employment, may reflect structural adaptation. This is a point that future research will need to explore further, especially in terms of identifying appropriate indicators to capture the multidimensional nature of regional resilience (e.g. Evenhuis 2017).

A further contribution of this paper lies in challenging the tendency to treat regions as autonomous territorial units. Instead, our findings demonstrate how extra-regional decisions, particularly those related to economic policy at the State level, influence both resistance and recovery. This underscores the need for multi-scalar approaches to regional resilience that incorporate both regional and non-regional actors (e.g. Christopherson, Michie, and Tyler 2010).

At a more specific level, two key conclusions emerge from our analysis. First, while value-added losses from peak to trough do not reveal a consistent regional pattern, being occasionally more pronounced and prolonged in Emilia-Romagna, especially in the final quarter of the 20th century, employment contractions display a more regionally differentiated trend. Employment resistance during recessionary shocks diverges sharply between the two regions. In general, Catalonia performed worse than Emilia-Romagna in terms of the scale of job losses, particularly during the oil crises of the 1970s and again from the early 2000s. This pattern is even more pronounced when comparing employment losses to changes in value added. From the industrial employment peak in the 1970s to 2023, Catalonia lost approximately 360,000 industrial jobs, a 42% reduction, whereas Emilia-Romagna experienced a much smaller decline of around 26,000 jobs, or 5%. We hypothesize that part of these differences may be explained by divergent institutional

4 Information elaborated from Ficosa's official website, including *Our History*, "Ficosa Presents the First Battery Management System for the VW Electric Cars" (March 6, 2018), and *Ficosa in the Press*, accessed November 11, 2025, <https://www.ficosa.com/company/our-history>; <https://www.ficosa.com/news/ficosa-presents-the-first-battery-management-system-for-the-vw-electric-cars/>; <https://www.ficosa.com/ficosa-in-the-press/>.

arrangements at the regional level, although further research is needed to identify the underlying drivers of this distinctive behavior.

Second, our findings highlight a temporal shift in the resistance–recovery nexus. While Catalonia exhibited stronger performance during the final decades of the 20th century, particularly in terms of value added, this trend reversed around the early 2000s. From that point onwards, Emilia-Romagna outperformed Catalonia in terms of both value added and employment. We suggest that Catalonia's relatively strong performance in the late 20th century can be partly explained by improved access to European markets and a surge in foreign direct investment following Spain's accession to the European Economic Community in 1986. By contrast, the weakening of Catalonia's resistance–recovery nexus since the early 2000s may reflect, among other factors, historical differences in industrial structure and industry relatedness, potentially signaling the emergence of two distinct models of economic growth in these Mediterranean regions. These hypotheses, however, require further research and form part of a broader project comparing the resilience paths of Catalonia and Emilia-Romagna.

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Appendix

TABLE A.1: INDUSTRIAL VALUE ADDED, INDUSTRIAL EMPLOYMENT, AND INDUSTRIAL VALUE ADDED PER EMPLOYEE IN CATALONIA AND EMILIA-ROMAGNA, 1970-2023

Year	Catalonia			Emilia-Romagna		
	Industrial value added	Industrial employment	Industrial value added per employee	Industrial value added	Industrial employment	Industrial value added per employee
	Millions of € (2015 prices)	Number (Thousands)	€ (2015 prices)	Millions of € (2015 prices)	Number (Thousands)	€ (2015 prices)
1970	15,287	816.5	18,722	11,366	459.5	24,737
1971	16,188	825.4	19,611	11,417	452.7	25,223
1972	16,682	829.6	20,109	12,759	452.0	28,227
1973	17,263	850.5	20,298	15,467	474.8	32,577
1974	18,413	853.3	21,578	17,493	492.9	35,493
1975	20,190	836.5	24,137	16,025	499.0	32,112
1976	20,663	824.8	25,052	18,249	505.6	36,093
1977	20,590	815.3	25,256	19,199	524.0	36,642
1978	22,203	789.8	28,112	19,852	521.0	38,105
1979	24,067	769.2	31,289	21,557	531.2	40,583
1980	24,709	744.0	33,210	20,840	545.0	38,239
1981	23,506	676.2	34,761	20,939	540.2	38,762
1982	23,009	627.0	36,697	20,222	535.2	37,783
1983	23,690	639.4	37,051	20,024	520.7	38,456
1984	24,088	616.8	39,054	20,939	520.3	40,245
1985	24,290	592.8	40,976	21,311	514.1	41,452
1986	24,789	614.1	40,367	21,943	510.8	42,958
1987	26,962	646.8	41,684	23,544	522.8	45,034
1988	28,668	661.7	43,324	25,400	538.1	47,203
1989	30,357	687.1	44,181	25,975	538.3	48,253
1990	31,413	721.6	43,533	26,214	530.5	49,413
1991	31,773	691.1	45,975	25,223	500.4	50,405
1992	32,152	677.4	47,464	25,600	487.3	52,534
1993	30,843	639.4	48,238	25,463	475.5	53,551
1994	31,985	636.2	50,274	27,870	476.1	58,538
1995	32,994	625.9	52,715	30,238	477.9	63,272
1996	33,916	655.2	51,764	30,592	474.9	64,418
1997	35,708	685.9	52,061	30,597	479.1	63,864
1998	37,325	718.8	51,926	31,029	490.4	63,273
1999	39,207	757.1	51,786	31,779	495.8	64,095
2000	40,680	777.3	52,335	33,133	499.0	66,399
2001	42,504	762.0	55,780	32,958	500.6	65,838
2002	42,002	729.7	57,561	33,672	508.6	66,205
2003	42,307	718.7	58,866	33,317	510.7	65,238
2004	42,514	709.1	59,955	33,858	491.7	68,858
2005	42,430	695.2	61,033	33,665	493.0	68,285
2006	43,266	669.5	64,624	35,573	506.1	70,288
2007	43,321	643.6	67,311	36,917	509.6	72,443
2008	42,489	626.3	67,841	35,865	496.7	72,206
2009	38,373	549.3	69,858	28,760	488.2	58,910
2010	38,832	527.0	73,685	32,732	487.3	67,171
2011	37,377	500.4	74,694	34,387	491.3	69,992
2012	35,242	470.9	74,839	32,967	489.4	67,361
2013	34,380	449.6	76,468	33,526	479.8	69,876
2014	35,264	445.1	79,227	34,128	473.4	72,091
2015	36,718	455.4	80,628	34,973	469.3	74,522
2016	39,031	469.2	83,187	36,085	471.3	76,565
2017	39,813	476.4	83,570	37,488	477.9	78,443
2018	39,722	488.9	81,248	38,417	486.1	79,031
2019	39,971	500.2	79,910	38,442	492.7	78,022
2020	35,632	481.8	73,956	34,576	483.1	71,571
2021	37,812	482.2	78,415	39,846	482.4	82,600
2022	37,690	488.8	77,107	39,593	489.4	80,901
2023	38,424	495.0	77,625	38,894	497.9	78,115

Sources: Authors' elaboration. See text.

TABLE A.2: VALUE ADDED AND EMPLOYMENT IN CONSTRUCTION, AND VALUE ADDED PER EMPLOYEE, IN CATALONIA AND EMILIA-ROMAGNA, 1970–2021

Year	Catalonia			Emilia-Romagna		
	Value added	Employment	Value added per employee	Value added	Employment	Value added per employee
	Millions of € (2015 prices)	Number (Thousands)	€ (2015 prices)	Millions of € (2015 prices)	Number (Thousands)	€ (2015 prices)
1970	5,544	208.4	26,601	4,944	139.9	35,331
1971	5,596	218.6	25,598	4,615	127.8	36,110
1972	6,454	225.5	28,621	4,688	132.8	35,294
1973	7,414	237.3	31,246	4,986	123.6	40,350
1974	7,860	254.2	30,915	5,314	122.2	43,503
1975	8,539	265.6	32,148	4,964	117.8	42,154
1976	8,833	266.0	33,207	4,915	107.6	45,682
1977	8,891	267.1	33,281	5,038	108.9	46,257
1978	8,448	233.9	36,119	5,442	104.5	52,079
1979	7,974	203.1	39,253	5,683	102.1	55,670
1980	7,471	181.6	41,153	6,093	120.2	50,691
1981	6,542	159.9	40,917	6,564	123.7	53,064
1982	6,807	157.7	43,161	6,397	115.2	55,530
1983	7,116	156.3	45,525	5,877	120.0	48,975
1984	7,122	149.0	47,794	5,140	107.3	47,903
1985	7,176	143.7	49,920	4,726	103.9	45,486
1986	7,339	147.6	49,715	4,711	95.8	49,175
1987	7,696	155.3	49,549	4,645	97.4	47,690
1988	8,936	180.5	49,500	4,994	104.6	47,744
1989	10,175	208.2	48,878	5,430	103.1	52,667
1990	10,961	226.6	48,361	5,743	100.5	57,144
1991	11,741	241.3	48,666	6,031	111.0	54,333
1992	11,118	223.6	49,718	6,125	109.4	55,987
1993	10,563	208.3	50,713	5,911	112.1	52,730
1994	10,572	195.7	54,014	5,502	110.3	49,882
1995	11,288	204.1	55,294	5,725	121.2	47,236
1996	11,729	218.1	53,787	6,184	122.4	50,526
1997	12,077	243.7	49,551	6,052	123.6	48,963
1998	12,893	268.5	48,024	6,458	121.1	53,326
1999	13,440	286.7	46,884	6,356	124.0	51,255
2000	14,123	311.2	45,389	6,953	128.5	54,111
2001	14,814	333.8	44,381	7,500	140.3	53,458
2002	15,071	342.3	44,035	7,392	138.1	53,527
2003	15,219	351.5	43,295	7,930	139.0	57,052
2004	15,268	368.9	41,386	8,714	147.2	59,195
2005	15,563	385.6	40,356	9,103	157.6	57,762
2006	15,945	424.8	37,534	9,482	162.1	58,492
2007	15,889	448.7	35,415	9,538	171.4	55,646
2008	15,797	398.9	39,600	9,014	172.1	52,375
2009	14,842	327.2	45,362	8,248	166.1	49,658
2010	12,651	283.8	44,582	7,430	156.2	47,566
2011	11,064	245.7	45,035	6,981	145.7	47,910
2012	9,897	199.4	49,633	6,313	140.6	44,901
2013	8,995	178.5	50,404	6,012	134.2	44,795
2014	8,762	174.7	50,161	5,388	128.5	41,926
2015	9,165	179.5	51,059	5,208	123.5	42,168
2016	9,619	182.4	52,734	5,371	122.2	43,948
2017	9,789	198.4	49,338	5,435	120.7	45,027
2018	9,853	203.9	48,324	5,591	120.1	46,555
2019	10,269	216.9	47,345	5,570	120.0	46,417
2020	8,675	207.5	41,809	5,240	119.8	43,739
2021	8,568	217.0	39,482	6,614	130.9	50,525

Sources: Authors' elaboration. The original data are drawn from several sources, including De la Fuente and Ruiz Aguirre (2024), for Catalonia, and the Centro Ricerche Economiche Nord Sud, and the Istituto Nazionale di Statistica (ISTAT, Italian Institute of Statistics), for Emilia-Romagna.

TABLE A.3: THROUGH TO PEAK PERCENTAGE CHANGES IN THE INDUSTRIAL VALUE ADDED OF CATALONIA AND EMILIA ROMAGNA, 1973-2023 (%)

Shock	Catalonia			Emilia-Romagna		
	<i>Period</i>	<i>No. Years</i>	<i>Change (%)</i>	<i>Period</i>	<i>No. Years</i>	<i>Change (%)</i>
1973 oil crisis	1977-1980	3	20.0	1975-1979	4	34.5
1979 oil crisis	1982-1992	10	39.7	1981-1982	1	0.5
				1983-1990	7	30.9
Early 1990s recession	1993-2001	8	37.8	1991-1992	1	1.5
				1993-2000	7	30.1
Early 2000s recession	2002-2004	2	1.2	2001-2002	1	2.2
	2005-2008	3	0.1	2003-2004	1	1.6
				2005-2007	2	9.7
2008 Great Recession	2009-2010	1	1.2	2009-2011	2	19.6
	2013-2017	4	15.8	2012-2019	5	16.6
	2018-2019	1	0.6			
Covid-19 crisis	2020-2021	1	6.1	2020-2021	1	15.2
	2022-2023	1	1.9			

Sources and notes: See main text.

TABLE A.4: THROUGH TO PEAK PERCENTAGE CHANGES IN THE EMPLOYMENT OF CATALONIA AND EMILIA ROMAGNA, 1973-2023 (%)

Shock	Catalonia			Emilia-Romagna		
	<i>Period</i>	<i>No. Years</i>	<i>Change (%)</i>	<i>Period</i>	<i>No. Years</i>	<i>Change (%)</i>
1973 oil crisis				1978-1980	2	4.6
1979 oil crisis	1982-1983	1	2.0	1986-1989	3	5.4
	1985-1990	5	21.7			
Early 1990s recession				1993-1995	2	0.5
	1995-2000	5	24.2	1996-2003	7	7.5
Early 2000s recession				2004-2007	3	3.6
2008 Great Recession				2010-2011	1	0.8
	2016-2019	3	6.6	2015-2019	4	5.0
Covid-19 crisis	2020-2023	3	2.7	2021-2023	2	3.2

Sources and notes: See main text.

TABLE A.5: DURATION OF THE RECOVERY OF INDUSTRIAL VALUE ADDED TO REACH THE PREVIOUS PEAK AFTER A TROUGH IN CATALONIA AND EMILIA-ROMAGNA, 1973–2023 (IN YEARS)

Shock	Catalonia			Emilia-Romagna		
	<i>Peak-Through</i>	<i>Year return</i>	<i>No. Years</i>	<i>Peak-Through</i>	<i>Year return</i>	<i>No. Years</i>
1973 oil crisis	1976-1977	1978	1	1974-1975	1976	1
1979 oil crisis	1980-1982	1986	4	1979-1980	1986	6
				1981-1983	1984	1
Early 1990s recession				1990-1991	1994	3
	1992-1993	1995	2	1992-1993	1994	1
Early 2000s recession	2001-2002	2004	2	2000-2001	2002	1
				2002-2003	2004	1
	2004-2005	2006	1	2004-2005	2006	1
2007-8 Great Recession	2007-2009	Not yet recovered		2007-2009	2017	8
	2010-2013	2016	3	2011-2012	2015	3
	2017-2018	2019	1			
Covid-19 crisis	2019-2020	Not yet recovered		2019-2020	2021	1
	2021-2022	2023	1	2021-2023	---	---

Sources and notes: See main text.

TABLE A.6: DURATION OF THE RECOVERY OF INDUSTRIAL EMPLOYMENT TO REACH THE PREVIOUS PEAK AFTER A TROUGH IN CATALONIA AND EMILIA-ROMAGNA, 1973–2023 (IN YEARS)

Shock	Catalonia			Emilia-Romagna		
	Peak-Through	Year return	No. Years	Peak-Through	Year return	No. Years
1973 oil crisis	1974-1982	Not yet recovered		1977-1978	1979	1
1979 oil crisis	1983-1985	1987	2	1980-1986	Not yet recovered	
Early 1990s recession	1990-1995	1999	4	1989-1993	Not yet recovered	
				1995-1996	1997	1
Early 2000s recession	2000-2016	Not yet recovered		2003-2004	Not yet recovered	
2007-8 Great Recession				2007-2010	Not yet recovered	
				2011-2015	2019	4
Covid-19 crisis	2019-2020	Not yet recovered		2019-2021	2023	2

Sources and notes: See main text.

TABLE A.7: NOMINAL AND REAL INTEREST RATES IN SPAIN AND ITALY, 1976-1986 (%)

Year	Spain			Italy		
	Nominal interest rate	Inflation rate	Real interest rate	Nominal interest rate	Inflation rate	Real interest rate
1976	10.5	17.6	-7.1	15.0	16.6	-1.6
1977	14.4	24.5	-10.1	11.5	17.1	-5.6
1978	20.2	19.8	0.4	10.5	12.1	-1.6
1979	15.1	15.7	-0.6	15.0	14.8	0.2
1980	15.2	15.6	-0.4	16.5	21.1	-4.6
1981	15.5	14.5	1.0	19.0	18.0	1.0
1982	15.8	14.4	1.4	18.0	16.5	1.5
1983	18.8	12.2	6.6	17.0	14.6	2.4
1984	15.3	11.3	4.0	16.5	10.8	5.7
1985	12.5	8.8	3.7	15.0	9.2	5.8
1986	11.7	8.8	2.9	12.0	5.8	6.2

Sources and notes: Interest rates: Spain: Interbank deposit market, Cost/yield of outstanding operations (total). Banco de España (1988). Italy: Interest rates for the Bank of Italy's main operations. Interest rates for ordinary advances. <https://infostat.bancaditalia.it>. Inflation: Consumer prices (annual %). <https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG>.