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Original Paper

European manufacturing reshuffling within the scope of spatial-temporal data

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ABSTRACT

The paper comprehensively evaluates ongoing structural changes in the manufacturing sector across EU NUTS2 regions in the period from 2000 to 2021. The paper's objective aims on critical evaluation of ongoing structural changes in manufacturing industry with causal significance between changes in output and employment in the manufacturing sector on EU NUTS 3 level. For the purpose of the study analysis of categorical variables and two-way ANOVA model was employed. The findings reveal a significant spatial reshuffling of manufacturing across the EU, with substantial declines in sectoral employment observed in Western, Northern, and Southern regions, contrasted by notable employment growth in Central and Eastern Europe. The findings show a statistically significant spatial polarisation, with manufacturing output and employment increasingly concentrated in the EU Central and East, underscoring the emergence of a two-speed Europe. Furthermore, the analysis highlights a cause-and-effect relationship between manufacturing downsizing and increased unemployment rates in several EU regions, reflecting the socio-economic implications of industrial decline. In effect, the study identifies consistent patterns linking manufacturing employment changes, structural unemployment deepening, and regional economic growth, offering robust evidence of the interconnected dynamics. Despite inherent limitations, the findings critically question the effectiveness of the EU's flagship industrial policies, emphasising the role of deep structural factors in shaping the uneven trajectories of the EU manufacturing landscape.

KEYWORDS: deindustrialisation, manufacturing reshuffling, manufacturing employment, structural changes, regional growth, industrial policy

JEL CLASSIFICATION: R11, O14

INTRODUCTION

On 10 March 2020, the European Commission presented 'A New Industrial Strategy for Europe' – a comprehensive plan aiming to shore up flagging European competitiveness towards the

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main non-European competitors, like the US and China. The EU also observes such a plan as an opportunity for the EU's world-leading industry to lead twin green and digital transitions against the backdrop of other pressing issues like climate change and the phasing out of Russian fossil fuels [10], [11].

Such an initiative is nothing new. Even in 2014, the European Commission, in its communication, challenged the EU's commitment to 'For a European Industrial Renaissance,' citing the industry's outsize role in the EU economy. EC reported that the EU industry accounts for over 80% of Europe's exports and 80% of private research and innovation [12].

In its report, Enrico Letta [28] cites several factors which are eroding the EU's position on the world stage. 1) The global demographic and economic landscape: over the past three decades, the EU's share of the global economy has diminished in favour of rising Asian economies. The leading cause is the shrinking and ageing European population; 2) The rule-based international order: wars and trade conflicts increasingly undermine the principles of a rule-based international system; 3) The perimeter of the Single Market: there are still sectors kept outside of the integration process, like finance, electronic communication and energy. Initially designed to protect domestic industries, national markets now represent a significant brake to growth and innovation in sectors where global competition has become increasingly important.

In another flagship report, Mario Draghi [6] highlighted slowing EU productivity growth and failure to close the innovation gap with the US and China, especially in advanced technologies. Among the essential causes, the report cites a static European industrial structure with few new companies rising to develop new growth engines. The EU generally lags well behind the US in R&D spending, translating innovation into commercialisation in overseas markets, hence propping up the EU trade competitors.

IMD [23] shows an extending difference between the US and EU labour productivity from 1990 – 2023 in an increasingly competitive global landscape. However, the EU is closely trailing the US GDP growth per capita. Other competitors like China, India, Brazil, Indonesia, and Turkey have experienced rapid growth in past decades and have become essential players in trade, investment, innovation, and geopolitics.

The paper's main objective is to provide evidence about the ongoing trend of industrial development in the EU against the backdrop of chosen proxy indicators. In the study, we look at evidence of the industrial structural changes in manufacturing output, a shift of jobs to other sectors, or even contribution to a general unemployment increase. The research sample consists of the EU regional NUTS 2 level observed over 2000-2021. Specifically, methods of spatial and econometric analysis are deployed to assess:

- potential trade-off relation between manufacturing output increase and employment decline,
- potential cause-and-effect between the decline in manufacturing employment and an increase in general unemployment,
- effects of manufacturing and unemployment on regional growth.

Investigating these four interrelated dimensions represents the novelty and added value of the paper. The evidence also emphasises a rising regional divide in manufacturing at the regional NUTS 2 level, providing further insights into the topic. Such emphasis on the spatial reshuffling of manufacturing activities across EU regions adds a novel perspective to understanding the geographical reorganisation of industry over the two decades.

The evolution and importance of the industry in a global economy

There is a common consensus about industrialisation's role in a nation's economic development. Proponents often cite manufacturing's productivity advantage over the other sectors and the higher externalities that can arise from manufacturing growth [20].

Manufacturing growth is often linked with economic growth [15], [16]. One of the foremost theories about this relation provides Kaldor's law as a set of empirical relationships between manufacturing growth and overall economic growth. In its scope, manufacturing is observed as the driver of economic growth, with significant spillover potential for the broader economy, despite some evidence about the shift of the economic weight of modern economies towards knowledge-based services at the expense of the industry, which has not resulted in slower economic growth. Hence, it may be considered that Kaldor's principles are still valid [25], [33], [38].

Manufacturing is often at the forefront of industrialisation. It has played an essential role in shaping industrialisation and the working class in its origin countries, Europe, North America, and Japan. Manufacturing capacity and employment are highly unevenly distributed around the world. Four major areas account for approximately 80% of the world's manufacturing: North America, Europe, Western Russia and Ukraine, and parts of East Asia, notably Japan, South Korea, and China [40].

We may identify three major waves of industrialisation in Europe. The first wave began in Britain around 1760 and was highly localised because the industry needed to be near mineral resources and waterpower. The nuclei of industrialisation in Great Britain developed in north Cornwall, eastern Shropshire, south Staffordshire, north Wales, upland Derbyshire, south Lancashire, the West Riding of Yorkshire, Tyneside, Wearside and parts of the Lowlands of Scotland. During the second wave, industrialisation expanded to continental Europe based on coal, steel, heavy engineering, steam power, and railways. Initially, from around 1850, industrialisation was concentrated in the Sambre-Meuse region of Belgium and the valley of the Scheldt in Belgium and France. Subsequent phases saw the spread of industrialisation to the Aachen area, the right bank of the river Rhine around Solingen and Remscheid, and the Ruhr in Germany; to Alsace, Normandy and the upper Loire valley in France; and the Swiss industrial district between Basel and Glarus. Finally, the third wave of industrialisation included other European regions like the Netherlands, southern Scandinavia, northern Italy, eastern Austria, and Catalonia in northeastern Spain [27].

Compared to other industrial powers, North American manufacturing is concentrated mainly in the northeastern and midwestern United States and southeastern Canada. The belt extends from the northeast seaboard along the Great Lakes to Milwaukee, which turns south to St. Louis, then extends from the northeastern along the Ohio River valley to Washington.

Asia's most dynamic industrial development experience countries lie in the 'Pacific belt', including Japan, Singapore, Korea and Taiwan. Secondly, India and China are the prominent industrial giants of south and southeastern Asia. Their common feature is that the industrial fabrics of these countries are rather atomised, predominantly concentrated around the most prominent cities. India has a sizeable industrial base located near cities like Calcutta and Mumbai. In China, the manufacturing base is concentrated on the eastern coastline. The main centres are in cities like Shanghai, Beijing and Hong Kong [7], [21].

Global value chain (GVC) developments significantly impact industrial manufacturing expansion, location and global trade, manufacturing has linked the world to the nexus of goods and service exchange relations [26]. Global Value Chains (GVCs) have decentralised production, allowing different manufacturing stages in various countries based on comparative advantages like labour cost, skills or resource availability. It has helped to create industrial fabrics in many developing countries by allowing them to integrate into global markets without establishing complete domestic supply chains. GVCs account for almost 50% of global trade today. Evidence from 1995-2011 highlights that all sectors, except textiles, increased their GVC participation [48].

Among the key economic trends that the manufacturing sector is currently experiencing is digital transformation. There are at least four base digital technologies which are predominantly occupied: 1) Internet of Things (IoT), 2) Cloud computing, and 3) Big Data and Analytics (e.g. Business intelligence and Artificial intelligence). These technologies can significantly enhance the intelligence and autonomy of systems that operate machinery, equipment, and final products [46]. In a broader perspective, Deloitte in its survey, highlights the following essential trends in manufacturing: 1) Managing uncertainty; 2) Tackling workforce shortages; 3) Driving supply chain resiliency; 4) Scaling smart factory initiative to the metaverse and 5) Sustainability development [5].

Globally, industry represented 21.4% of gross domestic product (GDP) in 2022. Manufacturing accounted for 78.5% of value-added within the industry, while the remaining 21.5% originated in the combined mining and utilities sector. The three most competitive industrial economies are presently Germany, China and Ireland. Furthermore, the top ten industrial economies include Japan, Taiwan, the US, Korea and other European economies (IT, CH, FR, NL) [43].

Industrial economies currently account for 91% of global manufacturing value added. Mapping the recent development trends, disaggregated data has recently shown declining manufacturing activity in high-income industrial economies. On the other hand, the group of middle-income industrial economies (including China) records stable incremental growth in manufacturing. Industrialising economies account for a lower share of global manufacturing production. However, the group's production has gradually increased over the past few years, leaving behind industrial economies, which have reported stagnating production [44].

Causes and effects of deindustrialisation in global economics

Deindustrialisation may be described as a falling share of value-added and employment in manufacturing in the total GDP and jobs, respectively [29]. The basic idea of deindustrialisation emerged throughout the development of the three-sector hypothesis, and this political-economic theory is a particular case. Fisher (1935) and Clark (1940) promoted the hypothesis, which was further elaborated by Fourastié (1940); according to the hypothesis on a low level of development, the primary sector (agriculture) dominates, later the secondary sector (industry) and finally, the tertiary sector (services) (see in [34]). A different hypothesis was highlighted by Rowthorn and Ramaswamy [36], who argued that deindustrialisation is a consequence of higher productivity growth in the industrial sector instead of the service sector. Hence, fewer workers are needed to maintain the same level of output.

Studies have highlighted external factors in addition to the internal causes of deindustrialisation. International trade development and global FDI reallocation are often cited as primary culprits in industrial deterioration in developed countries [1].

Since World War II, the global economy has undergone three phases: 1) the Recovery phase - marked by rapid economic expansion driven by the industry and services sector; 2) the Critical period in 70. and 80. years – the structural crises emerged, pooling the energy, materials and food crises together. One of its most visible effects in advanced economies was deindustrialisation, the decline in manufacturing capacity that is typically reflected in the loss of manufacturing jobs; 3) The beginning of 90-ties – a collapse of the Soviet Union and transition of Central and Eastern European economies from the centrally planned economies to market ones. After this, world economics became almost market-based, propelled by technological development and competitiveness [24], [29]. Undergoing structural changes had profoundly shaped industrial development on a global stage.

Nevertheless, Felipe and Mehta [16], in their study of the 1970-2010 period, highlight that manufacturing's share in global employment and output did not decline. The reason could be that the manufacturing decline in developed countries was counterbalanced by a shift in manufacturing jobs towards lower-productivity economies. Nevertheless, across the OECD, manufacturing employment has declined by some 30% since 1980, particularly in low-technology sectors. For instance, the US experienced a steep decline in manufacturing, from about 28 to 16% of its total civilian workforce, and the EU-15 followed a similar trajectory as manufacturing employment fell from a high of around 30% in 1970 to 20% in 1994 [2].

The EU has been hit particularly hard by manufacturing downsizing. Russu [37] and Mucha-Leszko [31] show that the pace of deindustrialisation in the euro area increased from 2000 to 2015 but varied between countries. The share of manufacturing in GVA in 1995 was 19.9%; in 2015, it fell to 16.3%. In terms of jobs, the retreat was even more complex. The share of employment in manufacturing declined from 18.7% in 1995 to 13.8% in 2015. Since the crisis, the EU industrial production has become increasingly polarised. Among the EU countries, Germany, Austria, and the Netherlands were able to return to pre-crisis levels. However, most Northern and Central European EU countries failed to recover – France, the UK, Sweden, Denmark, and Finland posted losses. Southern Europe experienced a dramatic loss of industrial production, contributing to the further polarisation of the Southern 'periphery' [3]. Christova-Balkanska [22] points to the further reallocation of many EU companies, followed by the manufacturing output slump and job loss in the EU heavy industries. Slow EU adaptation to those structural changes, rapid acceleration of productivity growth and competition from the Asian economies put the EU into a tough spot.

In the analysis of a similar period ([32], [41]) it is concluded that the main driving force of deindustrialisation in the EU was rising GDP per capita, followed by increasing trade volume and lastly, by productivity, which suggests that deindustrialisation in the EU is primarily caused by the natural process of gravitating toward the service sector, which is experienced by all advanced economies. Furthermore, other authors highlight the shift towards higher value-added and labour-saving activities and increasing 'servitisation' of the EU manufacturing sector [45].

The European manufacturing industry has been exposed to several supply-demand shocks recently. After the coronavirus pandemic shock, suppliers' dependencies became vulnerable, which has an impetus to restructuring supply and production processes along stretched-out international value-added chains [19]. In addition to the supply disruptions caused by the

pandemic, some European countries have been facing considerable problems in energy supply since spring 2022, depending on the respective national energy supply mix and the country's resource endowment. Furthermore, historically high intermediate inputs and raw materials costs occurred in 2021. The supply-side issues with energy and raw materials – mainly due to the war – have led to unprecedented cost shocks in many European economies [18].

The geography of the European industrial retreat is not homogenous. Significant differences exist between the EU15 and the other EU countries and among the technological manufacturing classes. The evidence pointed to partial industrial offshoring from the EU15 to the EU12, which helped the convergence of some economies but fostered the divergence of others [39]. In particular, there was rising importance of Eastern European countries as manufacturing producers, the strengthening of Germany and Switzerland as industrial poles, and the loss of influence of other traditional manufacturing powers, like the UK and Italy [35].

The general picture displays a significant degree of heterogeneity in the current manufacturing sector in Europe. Firstly, there are considerable differences in the importance of the industrial sector in European countries. In 2021, four European countries (Ireland, Germany, Slovenia and Hungary) had a manufacturing share of 20% or more. By contrast, four countries (Norway, Greece, United Kingdom and France) had 10% or less manufacturing shares. Different subsectors of manufacturing respond differently to changing energy prices. For instance, the energy-intensive industries include chemical, primary metal, coke/refined petroleum products, non-metallic and mineral products, and paper products, which account for 2% - 5% of the total gross value added of most European economies within the manufacturing, these industries account for 20% in average [17], [18].

MATERIAL AND METHODS

According to its scope, the paper investigates possible causal links between output and employment in the manufacturing sector, pointing to further ramifications such as the impact on regional growth and unemployment. The introduction outlines the general situation in the manufacturing sector on the national EU level.

Pearson's chi-squared coefficient of association was used to analyse potential causal links between employment change in the manufacturing sector and change in general unemployment in *n*-regions at the NUTS2 level; for this purpose, the variables of interest (manufacturing employment vs. unemployment) were turned to the categorical variables coded as follows: exposure variable – manufacturing employment frequency (YES – employment increased, NO – employment decreased); outcome variable – unemployment frequency (YES – unemployment increased, NO – unemployment decreased).

Table 1 The specimen of two-way table for measuring the association between the variables

	Outcome Yes	Outcome No
Exposure Yes		
Exposure No		

Source: own processing

The intensity of association is measured by the Cramer's V coefficient formally as

$$V = \sqrt{\frac{\chi^2}{N \cdot \min(R-1, C-1)}}, \tag{1.0}$$

where R is the number of rows, N is total number of observations, and C is the number of columns in the table (e.g. Table 1).

Finally, the mutual relations between manufacturing employment, unemployment, and economic growth are investigated using a two-way ANOVA model. The model for the dependent variable in a two-way ANOVA can be expressed as

$$Y_{ijk} = \mu + \alpha_i + \beta_i + \epsilon_{ijk}, \tag{1.1}$$

assuming no interaction between the independent variables.

In the model, the dependent variable Y_{ijk} represents the average economic growth of k-region, α_i represents the effect of i-th level of factor A (average manufacturing employment growth), β_i represents the effect of i-th level of factor B (average unemployment growth),and ϵ_{ijk} is a random error. The model helps investigate the effect of changes in independent variables on economic growth using the margin plots. Such a methodological approach would enable a comprehensive investigation of causal relations between regional growth and structural changes in the manufacturing sector and general unemployment.

RESULTS

The following essential issue concerns investigating the relations between structural changes in the manufacturing sector and potential links to economic and unemployment growth in the EU over the observed period. It would help us to understand how structural changes may contribute to the overall expansion of the economy, either by shifting the excess employment from the manufacturing sector to services or if employment cuts contributed to structural unemployment growth in the economy. The statistical analysis of categorical variables further examines the links between manufacturing employment, economic growth, and unemployment growth.

Firstly, the association between employment and unemployment is investigated. For this purpose, relative changes in quantitative variables – manufacturing employment and general unemployment were turned into categorical variables and examined as specified in the paper methodology.

Table 2 shows the result of the measured association between the EU regions showing either positive change in manufacturing employment (increase - coded as YES) or negative (decline - coded as NO), and the same approach is applied in case of unemployment changes. Notice that the Pearson $chi - squared = 21.53$, $p < 0.001$, so the results are highly significant. Moreover, we see that Cramér's V is 0.2995. The values above the $V > 0.3$ indicates a strong association.

Table 2 Results of Chi-squared test analysis of categorical variables

Manufacturing employment change	Unemployment change		
	No	Yes	Total
No	88	93	181
	48.62	51.38	100.00
Yes	49	10	59
	83.05	16.95	100.00
Total	137	103	240
	57.08	42.92	100.00
Pearson Chi2 = 21.53, Prob = 0.0000, Cramér's V = 0.2995			

Source: own research

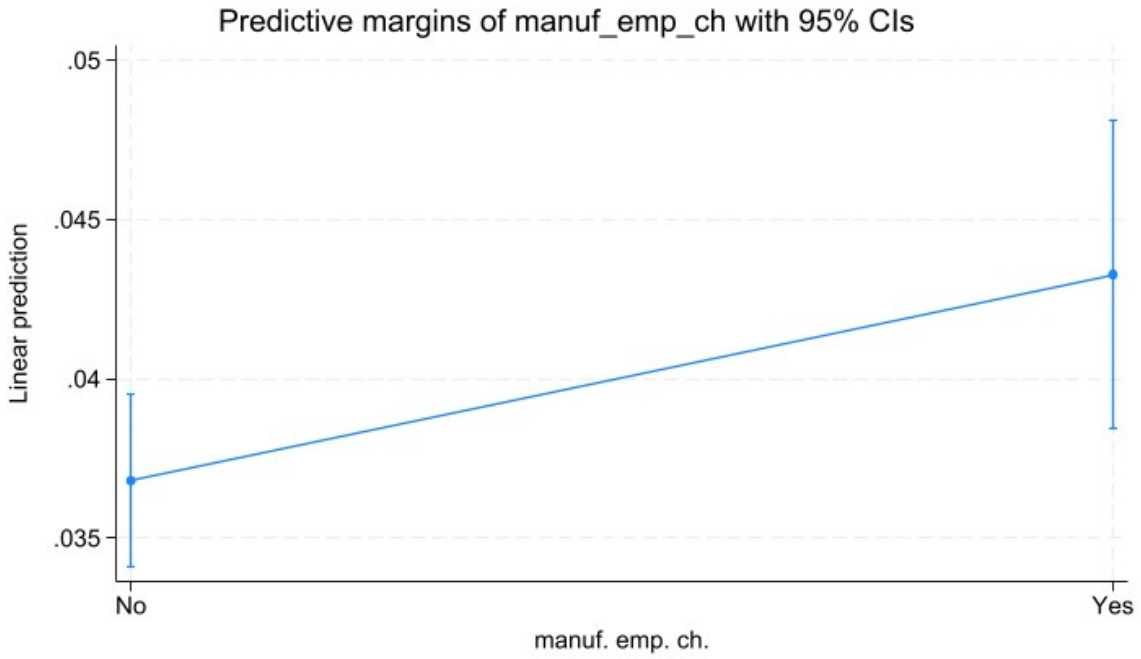
Table 3 presents the results of the two-way ANOVA analysis using GDP growth as the dependent variable and two predictor categorical variables - manufacturing employment changes and unemployment changes. Both, *Manuf. empl. ch.*, $F(1, 240) = 5.11, p < 0.05$, and *Unempl. ch.*, $F(1, 240) = 23.42,\ p < 0.001$, are statistically significant. Results suggest that both predictors are related to regional economic growth on the NUTS 2 level. Such results do not come as a surprise, but in the case of the manufacturing sector, it seems that manufacturing has a considerable effect on regional growth. The effect magnitude is demonstrated by the margins plot showing the positive link between economic growth and employment increase in manufacturing and vice versa.

Table 3 Results of two-way ANOVA analysis

GDP growth	Coef.	St. Err.	t-value	p-value	[95% Conf.	Interval]	Sig
Manuf. empl. ch	.006	.003	2.26	.025	.001	.012	**
Unempl. ch.	-.012	.002	-4.84	0	-.017	-.007	***
Constant	.042	.002	22.53	0	.038	.046	***
Mean dependent var		0.038		SD dependent var			0.020
R-squared		0.140		Number of obs.			240
F-test		19.277		Prob > F			0.000
Akaike crit. (AIC)		-1238.527		Bayesian crit. (BIC)			-1228.085
*** p<.01, ** p<.05, * p<.1							

Source: own research

Figure 1 Predictive margins between manufacturing employment change and regional growth



Source: own research

DISCUSSION

The paper's main objective is to provide evidence about the spatial patterns related to manufacturing deindustrialisation in the regions of the EU at the NUTS2 level. For research purposes, relationships between manufacturing output, employment, economic growth, and unemployment were investigated within the chosen spatial-temporal dimension. The results reveal a complex nexus of relationships and possible 'trade-offs' and 'cause-and-effect' links among the studied variables.

At first, a substantial decline in manufacturing activity measured as the share of GVA of manufacturing on the national GDP of EU states was confirmed, which is in accord with earlier cited evidence [31], [37]. Showing the bivariate relationships using the choropleth map between the average relative change in manufacturing output and manufacturing employment over the 2000-2021 period reveals a two-way pattern of manufacturing reallocation in the EU.

Western Europe and the North-South European periphery exhibit declining employment and stagnating output in the manufacturing sector. Central and Eastern Europe, mainly V4 and Baltic countries, showed steady manufacturing output and employment growth. Subsequent spatial analysis has confirmed a statistically significant clustering pattern of high values predominantly in CEECs and low values in the West of Europe, including the North and South.

Earlier cited empirical sources pointed to the decline of manufacturing in terms of output and employment as the natural phenomena related to the structural changes in the economy when rising productivity in manufacturing frees the excess employment to other sectors of the economy, mainly the services [25], [32], [41]. Though, it should be noted that quantitatively, very few regions showed a decline in manufacturing output compared to 2000. However, their

pace of manufacturing expansion could not be sustained with the overall expansion of the economy in case of most regions, respectively.

The EU's focus on productivity growth has been within the scope of European policymakers in the long-term Europe 2020 [13], Green Deal Industrial Plan [10] and others. However, as discussed in the Draghi report [6], the EU is experiencing a slowdown in productivity growth and is further trailing behind its peers (mainly the US) regarding technological advancements. Such a trend has also been observed and evaluated on a global scale. WB Group [47] is reporting on the widening productivity gap between southern and northern EU member states since the early 2000s. Further elaborated, European productivity growth slowed sharply (along Central Asia) after the global finance crisis (GFC) period due to investment decline from pre-GFC levels amid financial system disruptions associated with the euro area debt crisis. To a lesser degree, the slowdown was experienced in East Asia, the Pacific region, and Sub-Saharan Africa [47]. However, it should be noted that since the post-GFC period, EU labour productivity has slowed markedly in all measures, such as output per person, output per hour worked, or in terms of TFP. Furthermore, the decline in euro labour area productivity is widespread at the sector level, reflecting a marked slowdown in within-sector rates rather than a shift in industrial structure towards sectors with low labour productivity [14].

Next, the long-term links between relative changes in manufacturing employment and general unemployment were investigated. The evidence suggests a possible cause-and-effect link between the decline in manufacturing and an increase in general unemployment. Showing the bivariate relations on the choropleth map confirmed a decrease in manufacturing employment and an increase in general unemployment in regions located in the West and South of the EU (France, Italy, and Spain), albeit with a mixed pattern in the North (Germany, Belgium, Finland, and Sweden) and South-Eastern (Romania, Bulgaria) EU. On the other hand, Ireland, V4, and Baltic countries mostly showed an increase in employment and a decrease in unemployment.

Further, spatial analysis has confirmed a statistically significant clustered pattern of manufacturing employment growth and decline across the EU regions. Regions mostly afflicted by employment downsizing are located in the West and South EU periphery (France, Spain, Italy) and East (Romania), however, with a few exceptions (regions in France and Spain). Countries in the North (Finland, Sweden) and areas in Germany, Ireland, Italy, Bulgaria, Romania, and Greece did not show a statistically significant pattern. On the contrary, the Central and Eastern EU countries (V4 countries, Baltic countries) mostly showed increased employment.

Though the study showed a strong correlation but not causation, we may assume there could be a link between the decline in manufacturing jobs and an increase in general unemployment. The earlier evidence pointed to a decrease in manufacturing output as a share of the national GDP of EU states. Also, more than 75% of EU regions showed a decline in manufacturing jobs, and 42% of EU regions showed an increase in the general unemployment rate over the observed periods. The statistical analysis between the categorical variables revealed statistical significance between the decline in manufacturing employment and the increase in general unemployment on the regional NUTS2 level. Further analysis (two-way ANOVA) revealed links between regional growth, manufacturing employment, and general unemployment. Finally, margin plot showed the difference in regional growth rates between regions with expanding manufacturing bases and regions with manufacturing downsizing.

Hence, the cause-and-effect relation between manufacturing decline and subsequent unemployment increase cannot be ruled out. Labour markets in many regions seem to struggle to absorb additional workforce laid off from manufacturing. Other empirical sources may highlight similar trends and indirectly concede potential transitional unemployment.

CONCLUSIONS

The paper examines the spatial scale of manufacturing retreat on the regional NUTS2 EU level over the 2000-2021 period. Variables measuring manufacturing output, employment, regional growth, and unemployment became focal points in the study. Based on the evidence, we may speak instead about the manufacturing reshuffling in the EU because the CEE countries substantially increased or maintained their manufacturing base and sector employment. The manufacturing sector was hardest hit in Western-Europe countries, such as France, Spain, Italy, and North-Europe countries, such as Sweden, Finland, and others. While losing predominantly manufacturing jobs, most regions have retained the manufacturing output level. However, it did not keep pace with the overall expansion of the economy, and the share of output in total country GDP declined in most cases.

The overall spatial pattern of manufacturing arrangement in terms of output and employment is significantly clustering, showing cold spots (low values) predominantly on the West, North, and South of the EU and hot spots (high values) on the East of the EU. The manufacturing employment pattern became less spatially significant than the output pattern. Interestingly, Germany, the traditional manufacturing powerhouse of the EU, shows a mixed pattern with increasing weakness on the Western regional periphery.

Subsequent statistical analysis found a solid link between the regional frequencies coded as decline/increase in manufacturing employment and unemployment. Moreover, a statistically significant link was found between regional growth and two factors—manufacturing employment and unemployment (e.g., two-way ANOVA). Hence, the cause-and-effect between the manufacturing decline and the unemployment increase in many regions shall not be ruled out.

The study also has some limitations. The results and conclusions are based on aggregated data. This means the type of industry in terms of output and employment was not considered. There can be considerable variance between the GVA composition and labour intensity of the manufacturing sector in the regions. Also, studying more recent trends may reveal that the strong industrial position of the CEE countries is somewhat eroded (based on more recent data). The future scope may be narrow in research on cutting-edge industries and their regional presence or identification of the regional cores of manufacturing that are increasing or declining in terms of spatial analysis.

However, based on the evidence, it may be concluded that unemployment stemming from industrial decline proves challenging, and the EU flagship policy of the '*Industrial Renaissance*' is faltering yet delivering rather polarising results across the EU.

CONFLICT OF INTEREST

The authors declare no conflict of interests or competing interests.

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