sciendo
STUDIA UNIVERSITATIS ECONOMICS SERIES
"Vasile Goldiş" Western University of Arad
SUES
2025 - 35(2) DOI: 10.2478/sues-2025-0007

THE IMPACT OF BREXIT ON UNEMPLOYMENT IN THE UNITED KINGDOM USING SYNTHETIC CONTROL METHOD

Mihaela Simionescu*
Faculty of Business and Administration, University of Bucharest, Bucharest, Romania
Institute for Economic Forecasting, Romanian Academy, Bucharest, Romania
E-mail: mihaela_mb1@yahoo.com, mihaela.simionescu@faa.unibuc.ro

Wadim Strielkowski
Faculty of Economics and Management, Czech University of Life Sciences Prague, Czech Republic
Department of Agricultural and Resource Economics, University of California, Berkeley, Berkeley, United States
E-mail: strielkowski@pef.czu.cz, strielkowski@berkeley.edu

(Received: December 2024; Accepted: February 2025; Published: April 2025)

Abstract: The withdrawal of the United Kingdom (UK) from the European Union (EU) (known as "Brexit") represented a challenge for labor markets on both sides. Hence, the aim of our paper is to assess the impact of this event on the unemployment rate in the UK. Specifically, the paper assesses the difference between unemployment in the UK after Brexit and unemployment in the UK in case the UK would have remained in the EU. Moreover, it identifies economic factors that influenced the monthly unemployment in the UK in the long and short run since the official Brexit happened in February 2020. The paper applies the synthetic control method for the data from the period 1995-2022 under three types of donor pools: a sample that includes all the Old EU Member States (EU Member States prior to the 2004 Enlargement), a similar sample that excludes Spain and Greece and a pool based only on the EU neighbors of the UK. The sample based only on the EU neighbors provides the most accurate results and indicates a lower, but non-significant unemployment in the absence of Brexit compared to the real situation. On the other hand, there is a long-run relationship from inflation and economic growth to unemployment in the period between February 2020 and December 2022, while inflation acts as a factor that reduces unemployment.

Keywords: Brexit; unemployment; inflation; synthetic control method; vector error correction model.

---

* Corresponding author: Mihaela Simionescu. *E-mail: mihaela_mb1@yahoo.com, mihaela.simionescu@faa.unibuc.ro*

JEL Codes: C51, C53, J64.

1. Introduction

On the 23rd of June 2016, the United Kingdom (UK) European Union (EU) membership referendum ended with a surprising (and quite close) result of 51.9% of British voters choosing to "leave" and marked the beginning of the country's withdrawal from the EU (commonly known as "Brexit") which formally happened five years ago, in February 2020. Even though nowadays most Britons would not have supported Brexit (according to YouGov (2025), 55% of UK citizens stated it was wrong for the UK to leave the EU), back then the results of the national referendum had been binding and the process of leaving EU had to be launched.

The first attempts to study Brexit and its consequences by the researchers that faced the reality of Brexit were aimed at understanding the reasons behind this decision. The existing research suggests a link between Brexit and regional discontent, with some areas feeling left behind economically (Dijkstra et al., 2020; McCann, 2020; Heath and Goodwin, 2017). This dissatisfaction may be linked to demographics like education, homeownership, social status, and age, which have been associated with voting patterns. Besides demographics, the analysis through the lens of economic geography suggests Brexit's causes are multifaceted, encompassing educational attainment, populist sentiment, national identity, historical ties, regional disparities, and economic unevenness (Bachmann and Sidaway, 2016; Glückler and Wójcik, 2023; Vysochan et al., 2023). While variations in national identity also played a role, economic factors remain crucial in understanding Brexit voting patterns, which is essential in understanding future policy responses (Rudkin et al., 2024).

The voters in favor of Brexit anticipated lower unemployment due to a reduction in immigration and wider job opportunities for British nationals. Within this context, Simionescu (2018) anticipated the creation of new jobs based on FDI projects. On the other hand, many scenarios created in 2016 about the impact of Brexit on the labor market indicated a loss of jobs which determined a rise in unemployment, at least in the short run (Bailey et al., 2019; Javorcik et al., 2020). Moreover, unemployment might be influenced by the relocation intentions of companies within the UK. Sohns and Wójcik (2023) examine the potential impact of Brexit on the relocation intentions of companies within the UK's FinTech industry. Their research aligns with the broader goal, shared by the government, financial sector, and Bank of England of solidifying London's position as a global FinTech hub and a regulatory model (Dymski et al., 2023). Sohns and Wójcik (2020) revealed a significant prevalence of relocation intentions among FinTech managers. These intentions were influenced by factors like the perceived economic consequences of Brexit, the companies' level of integration within the UK (territorial embeddedness), and the nationality of the managers themselves.

However, empirical evidence might be needed after the official withdrawal of the UK from the EU in 2020. According to the data provided by the Office for National Statistics in the UK, in the period from February to December 2020 (corresponding to the transition period to Brexit) about 828,000 workers lost their jobs in the UK alone. The hospitality sector was the most affected one in 2020 which was worsened by the context of the COVID-19 pandemic.

Apart from this incipient statistical analysis, the UK unemployment facing the Brexit challenge should be deeply analyzed from the two perspectives that determine the following research questions:

1) What is the difference between UK unemployment after Brexit and the unemployment that would have been registered in case the UK remained in the EU?
2) What are the economic factors that influenced the monthly unemployment in the UK in the long and short run since the official Brexit that occurred in February 2020?

The two research questions converge to the aim of the paper which considers the evaluation of the effect of Brexit on unemployment. The first research question could be treated by employing the synthetic control method that constitutes a comparative analysis with a control group of countries that have not withdrawn from the EU. The second research question employs a time series approach based on cointegrating regression and vector error correction model (VECM). The section on methodology focuses more on synthetic control methods for conducting a comparative analysis of unemployment in the presence and absence of Brexit. By introducing this background, we establish the objective of the paper referring to a deep description of the impact of Brexit on unemployment by making comparisons with unemployment in the absence of Brexit and identifying the factors with significant influence on the labor market in the post-Brexit period.

The anticipated results should indicate whether the actual unemployment in the UK is higher or not than the value that would have been registered in case Brexit never materialized. Moreover, some economic indicators such as inflation or GDP would have a direct or indirect impact on unemployment and the control of these variables would inevitably influence unemployment.

2. Literature review

The links between Brexit and unemployment in the United Kingdom have long been at the center of attention of many researchers who applied a whole range of tools for analyzing this conundrum, including synthetic control methods or vector error correction models. In general terms, the research literature suggests that Brexit had both subtle and meticulous impacts on the UK's labor market, with variations across different sectors and regions. While some studies report minimal direct effects of

Brexit on UK unemployment rates, others highlight significant regional and sectoral disparities stemming from Brexit. This is in accord with the recent trends observed in the labor markets worldwide (Stryzhak, 2023).

The study by Papyrakis et al. (2022) shows that the UK unemployment rate after the referendum followed a comparable path to that of synthetic control, indicating that Brexit had a limited effect on unemployment levels overall (Papyrakis et al., 2022). In addition, as for the manufacturing sector, however, employment had fallen an average of 1.7% per quarter in the three years after Brexit, even if some industries had been hit harder than others (Farid, 2021).

Portes (2024) discusses the wider impacts of Brexit on the economy and shows that while GDP growth lags, the number of people out of work does not as he notes that there is only a statistical correlation between the two variables and consequently one is not a measure of the other.

While UK employment levels remained resilient, Brexit also led to an increasing divergence of the economy and further regional inequalities worsened by uncertainties in policymaking and changes in the labor market (Fetzer and Wang, 2020). In addition, due to this inward shift of the Beveridge Curve, a decline in labor market inefficiency occurs later to reflect post-referendum enabling changes in vacancies to lower the UK unemployment rate (Amuedo-Dorantes and Begen, 2023).

Table 1 that follows summarizes the methods and main results from similar research papers and studies focusing on impacts on the UK and EU labor markets following Brexit and using similar methods as those applied in our work.

Table 1 Overview of papers on Brexit and unemployment

Paper	Methods	Main results
Papyrakis et al. (2022)	Utilize a synthetic control method to assess Brexit's impact on UK unemployment up to January 2020 and find minimal effects by comparing actual unemployment trends with a synthetic control indicator.	- The Brexit referendum had little effect on the UK unemployment and employment rate. - UK unemployment rate declined and employment increased after the referendum.
Portes (2024)	Focuses on GDP growth, trade, migration, and investment changes post-Brexit, indicating overall negative economic impacts.	- UK trade and investment have significantly declined post-Brexit - GDP growth underperformed by about 5% since the referendum.

Farid (2020)	Focuses on labor productivity and its components, showing a decline post-Brexit.	- The Brexit vote decreased UK labor productivity by 2.24% annually. - Real GDP lost $133.3 billion from 2016 to 2019.
Farid (2021)	Analyzes Brexit's impact on UK manufacturing employment using synthetic control methodology, revealing a 1.7% average quarterly decrease in employment post-referendum.	- UK total manufacturing sector's employment decreased by 1.7% per quarter. - Two manufacturing divisions benefited, eight were negatively affected, and six were unaffected.
Hall and Heneghan (2023)	Focus specifically on financial services employment and the phenomenon of 'missing' jobs in that sector post-Brexit.	- Brexit caused lower job relocations than initially estimated. - 'Missing' jobs linked to Brexit and changing financial work nature.
Amuedo-Dorantes and Begen (2023)	Investigate Brexit's impact on labour market efficiency focusing on shifts in the Beveridge Curve and job vacancy rates relative to other EU countries post-Brexit.	- Inward shift of the Beveridge Curve after Brexit. - Increased labor market efficiency after the Brexit referendum.
Gupta et al. (2023)	Analyze unemployment trends, indicating a downward trajectory until 2020, followed by a spike in 2021, with significant impacts observed in England and Scotland.	- The unemployment rate decreased until 2020 and spiked in 2021. - Trade experienced a significant decline after Brexit and COVID-19.
Fetzer and Wang (2020)	Study the output loss across districts, indicating that Brexit has not led to productivity increases, which may affect future labor market adjustments.	- Significant economic costs of Brexit are unevenly distributed across UK regions. - About 168 districts lost an average of 8.54 percentage points of output.
Fingleton (2022)	Estimates the impact of Brexit on employment, indicating a job shortfall in the UK due to longer journey times.	- Job shortfall expected in UK and EU regions. - Outcomes might vary considerably across different regions.

Hu and Guo (2022)	Indicate that Brexit led to an increase in the unemployment rate in the UK.	- Brexit negatively affected UK imports, exports, and GDP. - The unemployment rate increased and currency depreciated.
Portes and Springford (2023)	Examine how overall labor force growth in the UK has differed between sectors, both overall and in terms of the extent to which this growth was driven by migrant workers, both from the EU and from outside the EU after Brexit and before the pandemic.	- The post-Brexit migration system has reduced labor supply in some sectors. - Visa issuance has increased in higher-skilled sectors.
Fingleton (2020)	Focuses on job shortfalls across post-Brexit UK and EU regions using dynamic spatial panel models.	- Estimates the possible job shortfall across UK and EU regions. - Heightened barriers to trade will cause job shortfalls in the UK and across the EU.
Jafari and Britz (2020)	Study welfare losses, trade, immigration, and foreign direct investment consequences of Brexit.	- Welfare losses of approximately 1000 EUR per UK citizen are predicted. - Reduced labor force due to reduced immigration has the greatest welfare impact.
Douch and Edwards (2021)	Assess the impact of Brexit on UK services exports using synthetic control methods.	- Exports dropped 7% post-referendum compared to counterfactual. - Divergence in services exports began in early 2015.

Source: Own compilations

Overall, it appears that although Brexit's direct effects on unemployment rates might seem marginal, its wider economic ramifications, such as trade challenges and regional disparities, indicate a complex set of factors shaping the UK labor market. It also highlights the impact of the ongoing transition period and how adjustments in immigration and trade agreements are affecting the UK economy as it moves forward. In the post-Brexit UK, employment rates might remain poised to decrease or increase again in the future based on the current and possible market conditions and opportunities emerging for the British economy.

3. Methodology and empirical data

As a rule, to evaluate the impact of an event or policy intervention on a certain indicator assuming that the particular indicator is determined by various factors, case studies are applied. In this paper, the event is represented by Brexit and the comparison is based on two types of units (countries): the UK is the unit exposed to Brexit (it gave up to the EU membership) and other Old EU Member States (i.e. EU Members prior to the 2004 Enlargement) that are unexposed units (they remained in the EU). The treatment represents the event of Brexit.

In this type of comparative study, synthetic control methods could be employed. Let us start with a number of *J+1* countries. If only one country (the UK) is exposed to the event, then the rest of the countries (J units) are potential controls and represent the donor pool in the matching approach. Moreover, let us assume that the UK is uninterruptedly exposed to this intervention.

The outcome that is observed in any country i at time t without any existence of intervention is represented by unemployment: u_{it}^{N}, where i is the index for country (i=1, 2, …, J+1) and t is the index for year (t=1, 2, …, T).

Furthermore, let us consider a number of T_0 periods before the event (Brexit), where $1 \leq T_0 \leq T$. The unemployment that would be observed for country i at time t if unit i is subject to event or intervention I in the next periods (from $T_0 + 1$ to T) is denoted by u_{it}^{I}. The event has no impact on unemployment before intervention. Therefore, $u_{it}^{I} = u_{it}^{T}$, for i=1, 2, …, N and t= 1, 2, …, T_0.

In many cases, the event may have an effect before it takes place because of anticipation effects. In this situation, T_0 is redefined to be the first year when unemployment is affected by future intervention. This study is based on the assumption that unemployment in the countries from the donor pool is not influenced by Brexit.

The effect of the event in the case of country i at time t is given by $\alpha_{it} = u_{it}^{I} - u_{it}^{N}$. A dummy variable is considered to indicate if a country is exposed to intervention at a certain moment. This variable $D_{it} = 1$, if country i is exposed to treatment at time t and $D_{it} = 0$, otherwise. The observed unemployment for country i in the year t is calculated as follows:

$$u_{it} = u_{it}^{N} + \alpha_{it} D_{it}.$$

Since only the first country (UK) is exposed to the intervention (it left the EU) after period T_0, where $1 \leq T_0 \leq T$, then the dummy variables take the values: $D_{it} = 1$, if i=1 and $t > T_0$ and $D_{it} = 0$, otherwise.

Studia Universitatis "Vasile Goldis" Arad. Economics Series Vol 35 Issue 2/2025
ISSN: 1584-2339; (online) ISSN: 2285 – 3065
Web: publicatii.uvvg.ro/index.php/studiaeconomia. Pages 38-64

The objective is to estimate the elements of vector $\left(\alpha_{1T_0+1}, \dots, \alpha_{1T}\right)$. If $t > T_0$, then $\alpha_{1t} = u_{1t}^I - u_{1t}^N = u_{1t} - u_{1t}^N$. Since u_{1t}^I is known, u_{1t}^N should be estimated. Let us consider a factor model to determine u_{1t}^N:

$u_{1t}^N = \delta_t + \theta_t Z_i + \lambda_t \mu_i + \varepsilon_{it}$ (1)

δ_t- unknown common factor having constant factor loadings across countries

μ_i- vector of unknown factor loadings (*F* x 1 dimension)

λ_t- vector of unobserved common factors (1 x *F* dimension)

θ_t- vector of parameters (1 x *r* dimension)

Z_i- vector for observed covariates (*r* x 1 dimension) that is not influenced by the event

ε_{it}- shocks of null average that are transitory and not observed at country level

Equation (1) makes the generalization of the difference-in-differences (fixed-effects) model. For constant λ_t and any *t*, the equation (1) becomes the usual difference-in-differences (fixed-effects) model. The factor model allows for the variation in time of confounding unobserved properties.

Let us denote the vector of weights by W (*J* x 1 dimension): $W = (w_2, \dots, w_{J+1})'$, $w_j \geq 0$, for *j*=2, 3, …, *J*+1 and $w_2 + w_3 + \cdots + w_{J+1} = 1$. Each value of this vector of weights represents a potential synthetic control and it is computed as a weighted mean of control countries. The value of unemployment for each synthetic control is indexed by *W*:

$$\sum_{j=2}^{J+1} w_j u_{jt} = \delta_t + \theta_t \sum_{j=2}^{J+1} w_j Z_j + \lambda_t \sum_{j=2}^{J+1} w_j \mu_j + \sum_{j=2}^{J+1} w_j \varepsilon_{jt}$$

Now, let us choose $(w_j^*, \dots, w_{J+1}^*)$, where:

$$\sum_{j=2}^{J+1} w_j^* u_{j1} = u_{11}$$

$$\sum_{j=2}^{J+1} w_j^* u_{j2} = u_{12}$$

…………….

$$\sum_{j=2}^{J+1} w_j^* u_{jT_0} = u_{1T_0}$$

$$\sum_{j=2}^{J+1} w_j^* Z_j = Z_1$$

$\sum_{t=1}^{T_0} \lambda'_t \lambda_t$ is non-singular and $u_{1t}^N - \sum_{j=2}^{J+1} w_j^* u_{jt} = \sum_{j=2}^{J+1} w_j^* \sum_{s=1}^{T_0} \lambda_t \left(\sum_{n=1}^{T_0} \lambda'_n \lambda_n\right)^{-1} \lambda'_s (\varepsilon_{js} - \varepsilon_{1s}) - \sum_{j=2}^{J+1} w_j^* (\varepsilon_{jt} - \varepsilon_{1t})$ (3)

In equation (3), the average calculated for the right-hand side is null for a higher number of pre-intervention periods compared to the scale associated with transitory shocks. The estimator of α_{1t} is:

$\hat{\alpha}_{1t} = u_{1t} - \sum_{j=2}^{J+1} w_j^* u_{jt}$, if $t > T_0$

The equation (2) holds exactly when $(u_{11}, \dots, u_{1T_0}, Z'_1)$ belongs to convex hull of $\{(u_{21}, \dots, u_{2T_0}, Z'_2), \dots, (u_{J+1\,1}, \dots, u_{J+1\,T_0}, Z'_{j+1})\}$.

The implementation of the synthetic control method using our data is explained below. Even if the synthetic controls are convex combinations of control countries, weights that are higher than 1 or negative are utilized to permit extrapolation.

The unemployment rate in the country where the event happened (UK) at time t is u_{1t}, while the same indicator in the countries from the donor pool at the same moment is u_{jt}, j=2, …, J+1. Knowing the vector K (T_0 x 1 dimension): $K = (k_1, \dots, k_{T_0})'$, we can define the linear combination of values before the Brexit moment: $\bar{u}_i^K = \sum_{s=1}^{T_0} k_s u_{is}$.

In the case of M linear combination based on the vectors K_1, ..., K_M. For the UK, we will define the vector of characteristics before Brexit (k x 1): $X_1 = (Z'_1, \bar{u}_1^{K_1}, \dots, \bar{u}_1^{K_M})'$, where $k = r + M$.

X_0 represents a matrix (k x J dimension) that includes the indicator for countries in the donor pool. The j^{th} column of this matrix is: $(Z'_j, \bar{u}_j^{K_1}, \dots, \bar{u}_j^{K_M})'$. The selection of the vector W^* is made to minimize the distance between X_1 and $X_0 W$, $\|X_1 - X_0 W\|$, where the weights are non-negative and the sum of weights is 1.

A positive semi-definite and symmetric matrix denoted by V (k x k) is used to measure the distance: $\|X_1 - X_0 W\|_V = \sqrt{(X_1 - X_0 W)' V (X_1 - X_0 W)}$.

V attributes weights to covariates:

$$V = \begin{pmatrix} v_1 & & & \\ & v_2 & & \\ & & \dots & \\ & & & v_k \end{pmatrix}$$

V is chosen to minimize the root mean squared prediction error (RMSPE) of unemployment in the years before Brexit.

Apart from this approach based on panel data, the paper proposes some time series models to explain the evolution of monthly unemployment since the official data of

Brexit: vector error correction model (VECM) and cointegrating regression based on fully modified least squares (FMOLS) estimators. These models are proposed due to the cointegration relationship between time series for monthly unemployment, inflation, and GDP. FMOLS approach takes into account the endogeneity and serial correlation effects (Phillips and Hansen, 1990).

The VECM equation that includes the long-run disequilibrium from the cointegrating equation is:

$$\Delta Y_t = \mu + \beta_1 \Delta X_t - (1 - \alpha_1)(Y_{t-1} - \hat{a}_0 - \hat{a}_1 X_{t-1}) + \eta_t$$

The coefficient ($1-\alpha_1$) provides information on the speed of adjustment. The VECM approach is different from SCM and it provides a commentary analysis to understand better how the UK unemployment rate evolved given the evolutions of GDP and inflation.

The paper is based on annual panel data for a sample of countries, including the UK, and on time series for the UK. The approach based on panel data uses synthetic method control. After the referendum on 23 June 2016, the UK government made an official announcement of Brexit in March 2017. However, the country officially left the EU on the 31st of January 2020, followed by a transition period until the 31st of December 2020. The sample period starts in 1995 to includes all the Old EU Member States. It ends in 2022, the last year for which data are available.

The synthetic UK denoted by the synthetic control unit is built as a weighted mean based on potential control countries. The weights are chosen to have synthetic UK that best reproduces the values associated with predictors on unemployment in the UK before official Brexit in 2020. The synthetic UK has the role of reproducing the unemployment rate that would have been registered if the UK had not exited the EU. Three donor pools are considered in this research. The first pool includes all the Old EU Member States that are the current remaining EU Members: Austria, Belgium, Germany, France, Italy, Spain, Greece, Portugal, Netherlands, Sweden, Finland, Denmark, Luxembourg, and Ireland. The second donor pool in the analysis excludes Greece and Spain since these countries registered high levels of unemployment in the context of the previous global economic crisis. The third pool reduces only to the UK neighbors that are also among the Old EU Member States: Ireland (land border) and the countries with maritime borders, namely France, Belgium, Germany, the Netherlands, and Denmark.

The dependent variable is represented by the unemployment rate (ILO estimate in % of total labor force from the World Bank). The predictors of unemployment are gross domestic product per capita (GDP per capita) in constant 2015 US $ from the World Bank, inflation rate (annual inflation in %) taken from the World Bank database, and number of immigrants from Eurostat. The synthetic UK has to show the values of the predictors of the UK unemployment rate before Brexit which took place in 2020. According to Figure 1, excepting Spain and Greece, the other EU countries in the sample provide a suitable group for comparison. There are no significant differences between unemployment rates in the control group and the UK before Spain and Finland. In the period 1995-2001, unemployment decreased in the UK from one year to another. A sudden increase was observed in 2009 by almost 35% compared to the level in 2008. This significant increase is explained by the world economic crisis that started in 2008-2009. Since 2012, UK unemployment has followed a descending trend, but in 2020 an increase of almost 20% compared to value in 2019 was observed in the context of Brexit.

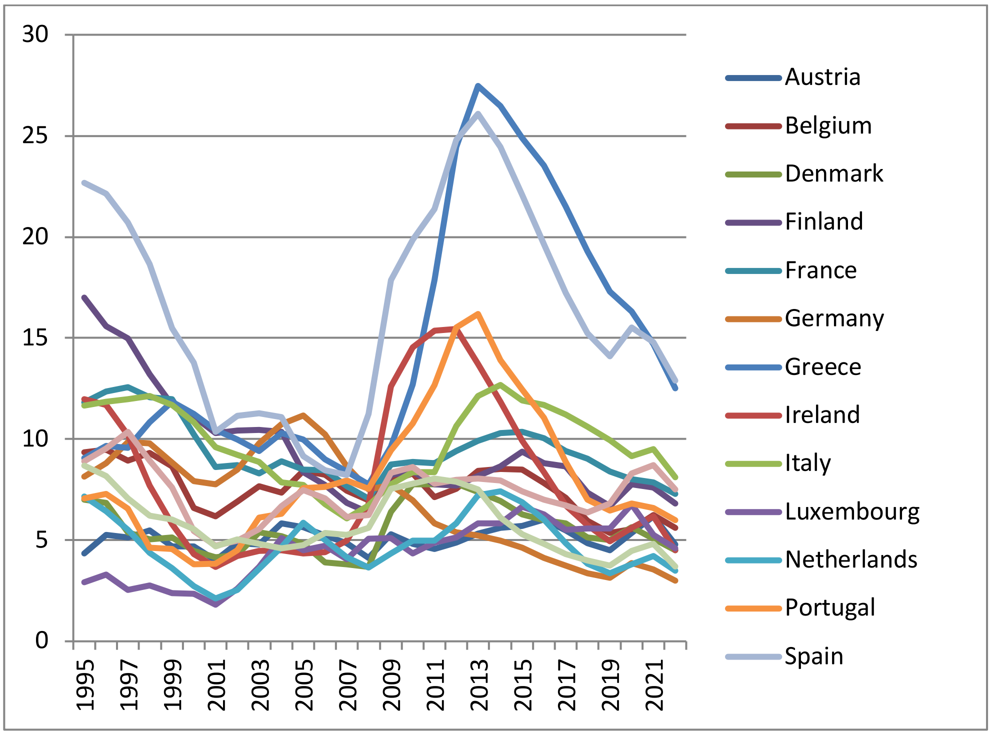


Figure 1 Unemployment rate (%) in the UK and Old EU Member States in the period 1995-2022
Source: authors' graph

4. Empirical results

The effect of Brexit on unemployment is assessed by evaluating the potential evolution of this indicator if the UK would have remained the EU Member State. This counterfactual is estimated by employing the synthetic control method.

The synthetic UK is a convex combination of countries in the donor pool that are very close to the UK in terms of values of unemployment before Brexit. Table 1 makes a comparison of characteristics of the actual UK before Brexit with the synthetic UK based on the population-weighted mean for the countries in each donor pool. The averages of the indicators corresponding to donor pools are computed for the period 1995-2019, before official Brexit. The results in Table 2 and Figure 2 suggest that the control groups are suitable for the UK in terms of economic growth and inflation. Prior to Brexit, the average number of immigrants was significantly lower in the donor pools compared to the UK. On the other hand, the synthetic UK reproduces better the values that unemployment and its predictors had in the UK before Brexit.

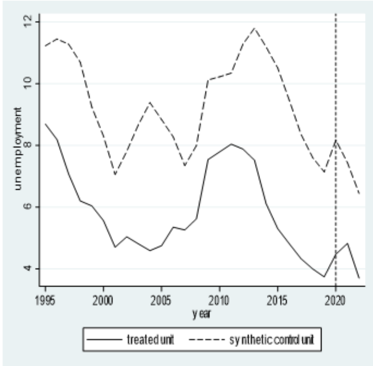
Table 2 Real and synthetic UK

Indicator	**Donor pool: all the Old EU member states**			**Donor pool: the Old EU member states, except Greece and Spain**			**Donor pool: the UK neighbors (Ireland, Germany, France, Denmark, the Netherlands)**		
	Treated	Synthetic	Average in the control group	Treated	Synthetic	Average in the control group	Treated	Synthetic	Average in the control group
Immigrants	483663.5	383102.7	381458.8	483663.5	383821.1	368992.7	483663.5	367018.1	348534.7
Inflation	2.05	1.78	1.82	2.05	1.70	1.71	2.05	1.72	1.70
ln(GDP per capita)	10.63	10.60	10.53	10.63	10.64	10.62	10.64	10.62	10.63
Root Mean Squared Prediction Error (RMSPE)	3.616468			2.323123			1.004394		

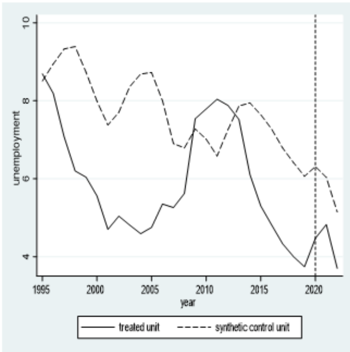
Source: Own calculations in Stata 15

The method shows the affinity between the UK and its synthetic counterpart, that is the weighted average of countries from the donor pool. Therefore, the synthetic control method does not provide counterfactuals outside the convex hull of the data (Abadie et al., 2021). According to RMSPE values, the donor pool composed of the EU neighbors of the UK is the most suitable. Like many European countries, including its neighbors, the UK experienced a rise in unemployment following the

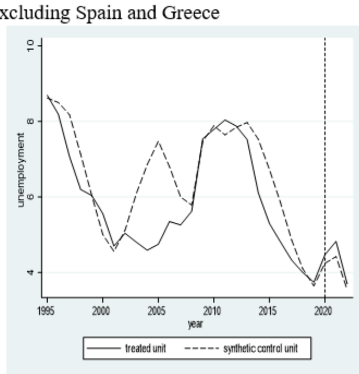
2008 financial crisis, a subsequent decline, and then another increase due to the COVID-19 pandemic. The migration between these countries contributed to a reduction in labor market pressures in all of them.



The Old EU member states excluding Spain and Greece



The UK neighbors from the EU



All the Old EU member states

Figure 2 Treated and synthetic control units

Source: own graphs in Stata 15

Table 3 that follows presents the weights of each control country in the synthetic UK. The results vary across the donor pool. For example, if the comparison is made with all the Old EU Member States, unemployment trends in the UK before Brexit are a combination of all states, except Portugal. If Greece and Spain are excluded from the donor pool, then unemployment is better reproduced by the values in Germany, Italy, and Luxembourg. If the donor pool is represented by the UK neighbors, the UK unemployment trends before Brexit are a combination of values in the Netherlands, Germany, and Ireland.

Certain countries have high weights in all donor pools. For instance, Luxembourg and the UK have important and successful financial services sectors. Germany is a big economy (like the UK) with a similarly diverse industrial base - although many German engineering-based sectors, i.e. machine tools and industrial equipment, are in much better shape. A long-standing Common Travel Area agreement allows citizens of the UK and Ireland to live and work freely in either country. This has led to significant migration flows and interconnected labor markets. The UK and Netherlands economies place a strong emphasis on skilled labor, with a focus on education and vocational training. This results in a workforce that is generally well-educated and adaptable to the demands of a modern economy. Italy and the UK have significant service sectors, including finance, tourism, and retail, which employ a large proportion of the workforce.

Table 3 Country weights in the synthetic UK

State	Weights for donor pool		
	All the Old EU member states	The Old EU member states, except Spain and Greece	The UK neighbors
Austria	0.001	0	-
Belgium	0.001	0	0
Denmark	0.001	0	0
Finland	0.001	0	-
France	0.001	0	0
Germany	0.435	0.457	0.369
Greece	0.006	-	-
Ireland	0.001	0	0.227
Italy	0.002	0.365	-
Luxembourg	0.246	0.178	-
Netherlands	0.001	0	0.404
Portugal	0	0	-
Spain	0.3	-	-
Sweden	0.001	0	-

Source: own calculations in Stata 15

The synthetic UK provides a sensitive approximation of the unemployment rate that would have been registered in the period 2020-2022 if the UK had remained in the EU. Figure 1 presents the values of unemployment considering the three types of donor pools. If the comparison is made with all the Old EU Member States or with these countries except Greece and Spain, the unemployment rate, if the UK had remained in the EU, would have been higher than the effective unemployment. On the other hand, if the comparison is made only with the EU neighbors, then the unemployment rate in the absence of Brexit would have been lower than the registered values. However, the difference is not high; the largest gap was observed in 2021, immediately after the transition period.

The results are in accord with those of Papyrakis et al. (2022) who applied the same method but used another group of control (27 OECD countries), another intervention period (June 2016), and other predictors: unemployment in the previous year, labor productivity, part-time employment and temporary contracts, average personnel cost in manufacturing, general state gross debt. The authors showed that the unemployment rate in the synthetic UK is lower than in the real UK, but the difference is not statistically significant.

Apart from this panel data approach that employs the synthetic control method, a deeper analysis of monthly unemployment is made using a time series approach. This variable is explained in the period February: 2020- December: 2022 using a vector error correction model (VECM). All the data series are considered in natural logarithm form and refer to the following variables with monthly frequency provided by the Office for National Statistics from the UK.

First, unit root tests are applied for the all-time series. The Dickey-Pantula strategy is used to check for unit roots based on Enders and Lee Fourier's (2012) ADF test that considers structural breaks. Table 4 indicates that the data series in the natural logarithm are I(1) for inflation rate and unemployment rate and I(2) for GDP.

Table 4 The results of Enders and Lee Fourier's (2012) ADF test

Indicator (in ln)	Type of data series	Stat.	p-value
unemployment rate	Data series in the second difference (model with trend and intercept)	-5.448509	0.0007
	Data series in the first difference (model without trend and intercept)	-3.198889	0.0023
	Data series in level (model with trend and intercept)	-2.424585	0.3612
GDP	Data series in the second difference (model without trend and intercept)	-9.793124	0.0000

	Data series in the first difference (model with trend and intercept)	-2.970231	0.1595
	Data series in level (model with intercept)	-1.901043	0.3279
inflation rate	Data series in the second difference (model without trend and intercept)	-10.42667	0.0000
	Data series in the first difference (model without trend and intercept)	-6.127232	0.0000
	Data series in level (model with trend and intercept)	-3.418858	0.0656

Source: own calculations in EViews.

The cointegration is checked for time series associated with unemployment, inflation, and GDP in the first difference using the Johansen test. Table 5 that follows indicates the existence of cointegration between data series at a 5% significance level.

Table 5 The number of cointegrating relations by the model at a 5% significance level

Data Trend:	**None**	**None**	**Linear**	**Linear**	**Quadratic**
Test Type	No Intercept	Intercept	Intercept	Intercept	Intercept
	No Trend	No Trend	No Trend	Trend	Trend
Trace	1	2	2	2	3
Max-Eig	1	2	2	2	3

Source: own calculations in EViews

A VECM(1) model is constructed and the results of estimations are presented in Appendix 1. The errors are homoscedastic, independent, and normally distributed at a 1% significance level. There is a long-run relationship of causality from inflation and variation in GDP growth to unemployment at a 1% significance level. On the other hand, there is a short-run causality from variation in GDP growth to unemployment. One shock in inflation generates a negative response to unemployment after one period and a negative response to GDP variation after two periods.

Moreover, a regression based on Fully Modified Least Squares (FMOLS) is built. Table 6 suggests a negative impact of inflation and a positive influence of variation in GDP on unemployment.

Table 6 FMOLS estimations

Variable	Coefficient	Std. Error	t-Statistic	p-value	Centered variance inflation factor
ln(inflation)	-0.122119***	0.010694	-11.41942	0.0000	1
Δ ln(GDP)	0.462840*	0.231735	1.997285	0.0549	1
Constant	1.550565	0.014792	104.8257	0.0000	-
R-square	0.774650				
Adjusted R-square	0.759627				

Source: own calculations in EViews
Note: * significance at 10% level and *** significance at 1% level.

A higher increase in growth is associated with higher unemployment, while higher inflation determines less unemployment. The results based on Okun's law are contrary to expectations and with previous findings for the 128 UK regions in the period 1983-2009 (Palombi et al., 2015) or for Jordan in the period 1991-2019 (Hjazeen et al., 2021). Since there are sectors that are less labor-intensive than others, for the same quantity of output some sectors require less labor force than others.
The indirect relationship between inflation and unemployment is confirmed by economic theory and by previous studies for the UK (Chen et al. (2010) in the period 1961-2005; Simionescu et al. (2020) in the period June 2016–March 2019).

5. Conclusions

All in all, reducing unemployment after Brexit in the UK can be achieved through a combination of policies and strategies. Some potential measures could be implemented. Increasing public investment in infrastructure projects, such as transportation, housing, and renewable energy, can create new jobs and stimulate economic growth (Rosewell, 2017). Providing financial incentives, tax breaks, and simplified regulations for small and medium-sized enterprises (SMEs) can encourage entrepreneurship and job creation (Suckert, 2023).
Expanding vocational training and apprenticeship schemes can help equip individuals with the skills needed for available job opportunities, particularly in sectors that may experience growth post-Brexit (Calvert Jump and Michell, 2023). It is necessary to promote innovation and research and development (R&D). Encouraging investment in R&D can foster innovation, attract foreign direct investment, and create high-skilled jobs in emerging industries. Investing in digital

skills training and promoting digital literacy can ensure that the workforce is equipped for the changing demands of the job market in the digital era.

This paper contributes to the existing literature by providing an ex-post assessment of the impact of Brexit on unemployment using a combined methodology of the synthetic control method and vector error correction modeling. Unlike prior studies that focused on pre-Brexit predictions, our research offers empirical evidence based on actual post-Brexit data from February 2020 to December 2022. Our unique findings highlight that while Brexit did not lead to a significantly higher unemployment rate compared to a counterfactual scenario where the UK remained in the EU, inflation has emerged as a key factor inversely related to unemployment in the post-Brexit period.

The policy measures provided in this section are derived from our empirical findings. The study shows that inflation has acted as a mitigating factor for unemployment in the UK post-Brexit, which suggests that inflation-targeting policies must be balanced against potential labor market consequences. Moreover, GDP fluctuations are significantly associated with unemployment, reinforcing the need for economic stability measures tailored to the UK's current economic conditions. While some recommendations may appear broadly applicable, their relevance to the UK stems from Brexit-induced changes in trade relations, investment patterns, and labor market flexibility. Hence, these proposals are particularly pertinent to mitigating post-Brexit employment risks rather than serving as general labor market strategies. One key policy measure for the UK and any European economy is to strengthen regional development. Implementing policies that focus on balanced regional development can help reduce regional disparities in employment opportunities. This could include infrastructure investments, tax incentives, and business support tailored to specific regions (Nurse and Sykes, 2023). Priority should be assigned to support those industries mostly affected by Brexit. Offering targeted support to industries that may be adversely affected by Brexit, such as agriculture, manufacturing, and financial services, can help preserve jobs and facilitate a smoother transition (Brownlaw, 2023). It is vital to improve the access to finance. Enhancing access to finance for small businesses and startups through government-backed loan schemes or grants can enable them to expand and create jobs.

Implementing policies to attract FDI, such as offering tax incentives, streamlined regulations, and investment promotion campaigns, can bring in new businesses and create employment opportunities (Khan, 2023). Enhancing international trade agreements might also be a key policy measure to reduce unemployment in the post-Brexit period. Negotiating favorable trade agreements with other countries can open up new export markets, stimulate economic growth, and create employment opportunities for UK businesses (Clift and Rosamond, 2024).

Thence, it is important to note that the effectiveness of these policies will depend on various factors, including the overall economic climate, government commitment, stakeholder cooperation, and the ability to adapt to evolving circumstances post-Brexit.

Given the actual economic context when the UK faces hyperinflation and unemployment proved to be inversely correlated with inflation, the policies could be adapted. Striking the right balance between these policies is crucial. While tackling inflation is necessary, overly aggressive policies could push the economy into recession and increase unemployment (Breinlich et al., 2022). The Bank of England and the government need to work together to find a measured approach.

Tackling both inflation and unemployment requires a two-pronged approach. The Bank of England, the UK's central bank, is primarily responsible for controlling inflation. They can use tools like raising interest rates to make borrowing more expensive and slow down economic activity, ultimately reducing demand and inflationary pressures (Hobijn et al., 2021). The government can also play a role by controlling its spending and raising taxes strategically. This can help to reduce the amount of money circulating in the economy and dampen inflation.

Reducing unemployment without fueling inflation supposes investment in skills training and education, targeted wage subsidies, and infrastructure investment. Investing in programs that equip people with the skills needed for in-demand jobs can improve job placement rates and reduce structural unemployment. Temporary wage subsidies can incentivize businesses to hire new employees, particularly in sectors struggling with vacancies, without pushing up wages too quickly. Public investment in infrastructure projects can create jobs and boost economic activity without directly increasing inflation.

In the UK's post-Brexit context, specific labor market challenges emerge due to disrupted trade relationships, a changing migration landscape, and shifts in foreign direct investment. Given this, our policy recommendations should emphasize the targeted labor market programs for industries most affected by Brexit, such as manufacturing and financial services. In addition, they need to emphasize flexible migration policies to fill critical labor shortages post-Brexit, particularly in healthcare and agriculture. There should be trade facilitation measures to offset the loss of EU market access and encourage employment in export-dependent sectors. There also needs to be sector-specific job retention schemes to address structural unemployment caused by Brexit-related business relocations.

Overall, our results demonstrate that Brexit is a challenge for unemployment. Various scenarios made before effective Brexit have created a debate: unemployment rate might decrease because of lower inflows of immigrants or unemployment might increase because the economic growth might be affected. This paper makes an ex-post evaluation of the impact of Brexit on unemployment by employing synthetic control methods and time series models.

Additionally, our results suggest an increase in unemployment compared to a few years before Brexit, but there is not a significant difference between the unemployment rate that was registered after Brexit and the unemployment that would have been recorded if the UK had remained in the EU. High inflation which is an actual issue in the UK acts like a factor that reduces monthly unemployment.

Apart from the novelty of this research, it is also subjected to certain limitations related to the selection of a specific method or the use of a few predictors of unemployment. For robustness check, alternative approaches to synthetic control models should be employed (e.g. difference-in-differences approach, interactive fixed effects, and cointegration). The selection of donor pools in the synthetic control method, while carefully justified, remains an approximation that might not fully capture the complexity of macroeconomic interactions. Additionally, the study relies on a limited number of economic predictors, excluding potentially influential variables such as sector-specific employment trends, labor migration patterns, and trade dynamics post-Brexit. Future research could expand on these aspects to provide a more comprehensive understanding of the labor market effects of Brexit. More predictors of unemployment could be considered (export, general government debt, unemployment in the previous period, etc.). Moreover, other control groups might be considered such as the EU countries that have high trade relationships with the UK. Future research could build on these findings by employing alternative econometric techniques, such as difference-in-differences or interactive fixed-effects models, to enhance the robustness of results. Additionally, incorporating micro-level labor market data, such as firm-level employment decisions and wage adjustments, could provide deeper insights into Brexit's heterogeneous effects across industries. Another promising avenue for further research is to explore the long-term structural changes in the UK labor market, particularly in light of global economic uncertainties and shifts in trade relationships post-Brexit.

Acknowledgments

The authors thank the anonymous reviewers and editors for their valuable contributions.

Funding

This research received no external funding.

Author Contributions

Conceptualization, Mihaela Simionescu and Wadim Strielkowski; methodology, Mihaela Simionescu; software, Mihaela Simionescu; validation, Mihaela

Simionescu and Wadim Strielkowski; formal analysis, Mihaela Simionescu and Wadim Strielkowski; investigation, Mihaela Simionescu and Wadim Strielkowski; resources, Wadim Strielkowski; data curation, Mihaela Simionescu; writing—original draft preparation, Mihaela Simionescu and Wadim Strielkowski; writing—review and editing, Mihaela Simionescu and Wadim Strielkowski; visualization, Mihaela Simionescu; supervision, Mihaela Simionescu; project administration, Mihaela Simionescu and Wadim Strielkowski; funding acquisition, Wadim Strielkowski.

Disclosure Statement

The authors declare no conflict of interest.

References

1. Abadie, A., Cattaneo, M.D., (2021), Introduction to the Special Section on Synthetic Control Methods, Journal of the American Statistical Association, 116(536), 1713-1715. https://doi.org/10.1080/01621459.2021.2002600.
2. Amuedo-Dorantes, C., Begen, N., (2024), How did Brexit impact labor market efficiency in the UK?, Applied Economics Letters, 31(19), 2011-2015. https://doi.org/10.1080/13504851.2023.2208840.
3. Bachmann, V., Sidaway, J.D., (2016), Brexit geopolitics, Geoforum, 77, 47-50. https://doi.org/10.1016/j.geoforum.2016.10.001.
4. Bailey, D., Driffield, N., Kispeter, E., (2019), Brexit, foreign investment and employment: some implications for industrial policy?, Contemporary Social Science, 14(2), 174-188. https://doi.org/10.1080/21582041.2019.1566563.
5. Breinlich, H., Leromain, E., Novy, D., Sampson, T., (2022), The Brexit vote, inflation and UK living standards, International Economic Review, 63(1), 63-93. https://doi.org/10.1111/iere.12541.
6. Brownlow, G., (2023), Northern Ireland and the Economic Consequences of Brexit: taking back control or perpetuating underperformance?, Contemporary Social Science, 18(2), 168-184. https://doi.org/10.1080/21582041.2023.2190157.
7. Calvert Jump, R., Michell, J., (2023), Education and the geography of Brexit, Journal of Elections, Public Opinion and Parties, 33(1), 41-53. https://doi.org/10.1080/17457289.2020.1839471.
8. Chen, T., Gentle, P. F., Upadhyaya, K.P., (2010), The inflation-unemployment trade-off and the significance of the interest rate: some evidence from the United Kingdom, Banks and Bank Systems, 5(1), 87-91.
9. Clift, B., Rosamond, B., (2024), Technocratic reason in hard times: the mobilization of economic knowledge and the discursive politics of Brexit, New Political Economy, 1-14. https://doi.org/10.1080/13563467.2024.2359972.
10. Dijkstra, L., Poelman, H., Rodríguez-Pose, A., (2020), The geography of EU discontent. Regional Studies, 54(6), 737-753. https://doi.org/10.1080/00343404.2019.1654603.

11. Douch, M., Edwards, T.H., (2021), The Brexit policy shock: Were UK services exports affected, and when?, Journal of Economic Behavior & Organization, 182, 248-263. https://doi.org/10.1016/j.jebo.2020.12.025.
12. Dymski, G., Gavris, M., Huaccha, G., (2023), Viewing the impact of Brexit on Britain's financial center through a historical lens: Can there be a third reinvention of the City of London?, ZFW–Advances in Economic Geography, 67(2-3), 76-91. https://doi.org/10.1515/zfw-2021-0041.
13. Enders, W., Lee, J., (2012), A unit root test using a Fourier series to approximate smooth breaks, Oxford Bulletin of Economics and Statistics, 74(4), 574-599. https://doi.org/10.1111/j.1468-0084.2011.00662.x.
14. Farid, M., (2020), The Effect of Brexit on United Kingdom Productivity: Synthetic Control Analysis, Journal of Applied Economic Sciences (JAES), 15(70), 791-800. https://doi.org/10.57017/jaes.v15.4(70).07.
15. Farid, M., (2021), The Winners and Losers of Brexit: A UK Manufacturing Sector Analysis. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3765122, Accessed on 28 January 2025.
16. Fetzer, T., Wang, S., (2020), Measuring the regional economic cost of Brexit: Evidence up to 2019. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3661394, Accessed on 29 January 2025.
17. Fingleton, B., (2020), Exploring Brexit with dynamic spatial panel models: some possible outcomes for employment across the EU regions, The Annals of Regional Science, 64(2), 455-491. https://doi.org/10.1007/s00168-019-00913-2.
18. Fingleton, B., (2022), Exploring Brexit implications: the impact of longer journey times, International Journal of Computational Economics and Econometrics, 12(1-2), 174-196. https://doi.org/10.1504/ijcee.2022.120496.
19. Glückler, J., Wójcik, D., (2023), Seven years of Brexit: Economic geographies of regional de-and recoupling, ZFW–Advances in Economic Geography, 67(2-3), 67-75. https://doi.org/10.1515/zfw-2023-0046.
20. Gupta, R., Hasan, M.M., Islam, S.Z., Yasmin, T., Uddin, J., (2023), Evaluating the Brexit and COVID-19's influence on the UK economy: a data analysis, Plos One, 18(6), e0287342, https://doi.org/10.1371/journal.pone.0287342.
21. Hall, S., Heneghan, M., (2023), Brexit and 'missing' financial services jobs in the United Kingdom, Contemporary Social Science, 18(2), 235-249. https://doi.org/10.1080/21582041.2023.2189294.
22. Heath, O., Goodwin, M., (2017), The 2017 general election, Brexit and the return to two-party politics: An aggregate-level analysis of the result, The Political Quarterly, 88(3), 345-358. https://doi.org/10.1111/1467-923x.12405.
23. Hjazeen, H., Seraj, M., Ozdeser, H., (2021), The nexus between economic growth and unemployment in Jordan, Future Business Journal, 7(1), 1-8. https://doi.org/10.1186/s43093-021-00088-3.
24. Hobijn, B., Nechio, F., Shapiro, A. H., (2021), Using Brexit to identify the nature of price rigidities, Journal of International Economics, 130, 103448. https://doi.org/10.1016/j.jinteco.2021.103448.

25. Hu, X., Guo, Y., (2022), How UK Exit from EU Influences UK's Economy. In 7th International Conference on Financial Innovation and Economic Development (ICFIED 2022), pp. 2070-2077. Amsterdam: Atlantis Press.
26. Jafari, Y., Britz, W., (2020), Brexit: an economy-wide impact assessment on trade, immigration, and foreign direct investment, Empirica, 47(1), 17-52. https://doi.org/10.1007/s10663-018-9418-6.
27. Javorcik, B., Stapleton, K., Kett, B., O'Kane, L., (2020), Unraveling deep integration: Local labor market effects of the Brexit vote. Oxford Discussion Paper.
28. Khan, E., (2023), The post-Brexit paradigm: investigating the effects of foreign direct investment on economic growth in the United Kingdom, Archives of the Social Sciences: A Journal of Collaborative Memory, 2(1), 94-110.
29. McCann, P., (2019), Perceptions of regional inequality and the geography of discontent: Insights from the UK, Regional Studies, 54(2), 256-267. https://doi.org/10.1080/00343404.2019.1619928.
30. Nurse, A., Sykes, O., (2023), Levelling Up and the privileging of sub-national governance in England in the inter-Brexit space, ZFW–Advances in Economic Geography, 67(2-3), 161-171. https://doi.org/10.1515/zfw-2023-0048.
31. Palombi, S., Perman, R., Tavéra, C., (2015), Regional growth and unemployment in the medium run: asymmetric cointegrated Okun's Law for UK regions, Applied Economics, 47(57), 6228-6238. https://doi.org/10.1080/00036846.2015.1068922.
32. Papyrakis, E., Pellegrini, L., Tasciotti, L., (2022), Impacts of the Brexit referendum on UK employment: a synthetic control method approach, Applied Economics Letters, 1-4. https://doi.org/10.1080/13504851.2022.2056567.
33. Papyrakis, E., Pellegrini, L., Tasciotti, L., (2023), Impacts of the Brexit referendum on UK employment: a synthetic control method approach, Applied Economics Letters, 30(11), 1407-1410. https://doi.org/10.1080/13504851.2022.2056567.
34. Phillips, P.C., Hansen, B.E., (1990), Statistical inference in instrumental variables regression with I (1) processes, The Review of Economic Studies, 57(1), 99-125. https://doi.org/10.2307/2297545.
35. Portes, J., (2023), The impact of Brexit. Available at: https://oxfordre.com/economics/economics/display/10.1093/acrefore/9780190625979.001.0001, Accessed on 30 January 2025.
36. Portes, J., Springford, J., (2023), The impact of the post-Brexit migration system on the UK labor market, Contemporary Social Science, 18(2), 132-149. https://doi.org/10.1080/21582041.2023.2192516.
37. Rosewell, B., (2017), Infrastructure, policy, and Brexit, Oxford Review of Economic Policy, 33(suppl_1), S113-S123. https://doi.org/10.1093/oxrep/grx016.
38. Rudkin, S., Barros, L., Dłotko, P., Qiu, W., (2024), An economic topology of the Brexit vote, Regional Studies, 58(3), 601-618. https://doi.org/10.1080/00343404.2023.2204123.
39. Simionescu, M., (2018), The impact of Brexit on the UK inwards FDI. Economics, Management and Sustainability, 3(1), 6-20. https://doi.org/10.14254/jems.2018.3-1.1.
40. Simionescu, M., Streimikiene, D., Strielkowski, W., (2020), What does Google Trends tell us about the impact of Brexit on the unemployment rate in the UK?, Sustainability, 12(3), 1011. https://doi.org/10.3390/su12031011.

41. Sohns, F., Wójcik, D., (2020), The impact of Brexit on London's entrepreneurial ecosystem: The case of the FinTech industry, Environment and Planning A: Economy and Space, 52(8), 1539-1559. https://doi.org/10.1177/0308518x20925820.
42. Sohns, F., Wójcik, D., (2023), Do they do as they say? Analyzing the impact of Brexit on relocation intentions in the UK's FinTech industry, ZFW–Advances in Economic Geography, 67(2-3), 105-126. https://doi.org/10.1515/zfw-2021-0049.
43. Stryzhak, O., (2023), Analysis of Labor Market Transformation in the Context of Industry 4.0., Studia Universitatis Vasile Goldiş, Arad-Seria Ştiinţe Economice, 33(4), 23-44. https://doi.org/10.2478/sues-2023-0017.
44. Suckert, L., (2023), Economic nostalgia: the salience of economic identity for the Brexit campaign, Socio-Economic Review, 21(3), 1721-1750. https://doi.org/10.1093/ser/mwac037.
45. Vysochan, S., Hyk, V., Mykytyuk, N., Vysochan, O.O., (2023), Taxonomy of Financial Reporting in the Context of Digitalization of the Economy: Domestic and International Analysis Scientific Research, Studia Universitatis Vasile Goldiș Arad, Seria Științe Economice, 33(2), 49-70. https://doi.org/10.2478/sues-2023-0008.
46. YouGov, (2025), How do Britons feel about Brexit five years on?. Available at: https://yougov.co.uk/politics/articles/51484-how-do-britons-feel-about-brexit-five-years-on, Accessed on 30 January 2025.

Appendix

VECM(1) model
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1		
LN_U(-1)	1.000000		
LN_I(-1)	0.143281 (0.00721) [19.8725]		
D_LN_GDP(-1)	2.935535 (0.20685) [14.1918]		
C	-1.584294		
Error Correction:	D(LN_U)	D(LN_I)	D(D_LN_GDP)
CointEq1	-0.038530	0.464536	-0.306087

	(0.03545)	(0.33647)	(0.01927)
	[-10.8676]	[1.38063]	[-15.8842]
D(LN_U(-1))	0.559075	-1.971786	-0.015769
	(0.14984)	(1.42203)	(0.08144)
	[3.73108]	[-1.38659]	[-0.19362]
D(LN_I(-1))	-0.001598	-0.388304	0.016411
	(0.02125)	(0.20163)	(0.01155)
	[-0.07521]	[-1.92579]	[1.42112]
D(D_LN_GDP(-1))	0.213036	0.638640	0.022320
	(0.08369)	(0.79422)	(0.04549)
	[2.54559]	[0.80411]	[0.49071]
C	-0.001826	0.086951	0.006076
	(0.00464)	(0.04404)	(0.00252)
	[-0.39349]	[1.97447]	[2.40903]
R-squared	0.427505	0.193439	0.937146
Adj. R-squared	0.342691	0.073948	0.927834
Sum sq. resids	0.017287	1.556950	0.005107
S.E. equation	0.025303	0.240135	0.013753
F-statistic	5.040504	1.618860	100.6412
Log-likelihood	74.97036	2.962084	94.48061
Akaike AIC	-4.373148	0.127370	-5.592538
Schwarz SC	-4.144127	0.356391	-5.363517
Mean dependent	-0.003208	0.072643	0.007115
S.D. dependent	0.031210	0.249539	0.051195

D(LN_U) = - 0.0385300792052*(LN_U(-1) + 0.143280844744*LN_I(-1) + 2.93553535577*D_LN_GDP(-1) - 1.58429403702) + 0.559074604157*D(LN_U(-1)) - 0.00159801127315*D(LN_I(-1)) + 0.213035634589*D(D_LN_GDP(-1)) - 0.00182591362514

D(LN_I) = 0.464535877074*(LN_U(-1) + 0.143280844744*LN_I(-1) + 2.93553535577*D_LN_GDP(-1) - 1.58429403702) - 1.97178591123*D(LN_U(-1)) - 0.388304387266*D(LN_I(-1)) + 0.638639801693*D(D_LN_GDP(-1)) + 0.0869506735298

D(D_LN_GDP) = - 0.306087232276*(LN_U(-1) + 0.143280844744*LN_I(-1) + 2.93553535577*D_LN_GDP(-1) - 1.58429403702) - 0.0157685047488*D(LN_U(-1)) +

0.016410890422*D(LN_I(-1)) + 0.022320313064*D(D_LN_GDP(-1)) + 0.00607578829209

VEC Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Sample: 2020M02 2022M12
Included observations: 32

Lags	LM-Stat	Prob
1	12.16044	0.2044
2	15.83438	0.0704
3	5.946156	0.7453
4	8.929402	0.4438
5	9.311245	0.4091
6	9.018968	0.4355
7	10.92441	0.2809
8	4.831393	0.8488
9	4.458285	0.8787
10	10.47865	0.3131

Probs from chi-square with 9 df.

VEC Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)
Sample: 2020M02 2022M12
Included observations: 32

Joint test:

Chi-sq	df	Prob.
44.58836	48	0.6134

Component	Jarque-Bera	df	Prob.
1	0.246375	2	0.8841
2	1.921266	2	0.3827
3	12.59926	2	0.0018

Joint	14.76690	6	0.0221