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Exploring EU-UK trade and investment four years after Brexit

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Contents

1 Abstract

This paper looks at how Brexit has affected trade and foreign direct investment (FDI) between the United Kingdom and the EU. In 2020 the United Kingdom and the EU signed the Trade and Cooperation Agreement (TCA)[1], establishing the post-Brexit relationship and, in particular, a tariff-free area for goods produced in either of the two economies. However, non-tariff barriers to the trading of goods and services have emerged. Moreover, the United Kingdom's departure from the EU has affected its attractiveness as an investment target.

We analyse recent developments in UK imports and exports with the EU and the rest of the world, in both goods and services, including financial services and tourism. Our estimates suggest that, after the Brexit transition period, UK exports to the EU contracted by almost 40%, due to the emergence of non-tariff barriers with the EU, and the fact that no significant UK trade flows were redirected to other partners. Finally, the analysis of product-level data on German, French, Italian and Spanish exports to the United Kingdom has confirmed the significant negative impact of Brexit, especially for goods highly exposed or highly sensitive to increases in trade costs.

The FDI analysis begins with a conjunctural assessment that includes recent trends in EU-UK FDI at a broad level (including sectoral and geographical details), a breakdown of foreign affiliates and an investigation of new FDI projects and jobs in the United Kingdom. The analysis continues with developments in the UK financial sector in terms of the real economy, FDI flows, banks, insurance companies and pension funds, and the evolving status of the United Kingdom as a leading global financial centre. Finally, our analysis also provides an econometric investigation into the potential impact of Brexit on EU-UK FDI, using a gravity model approach. We find that Brexit contributed to a decline in EU FDI flows between the EU and the United Kingdom of around 4%, but business relocations involving temporary capital flows attenuated the overall FDI retreat. Large FDI flows among major European financial centres and the United Kingdom could potentially indicate some decoupling of London from the EU, marking the significant challenge that the departure of the United Kingdom from the EU posed for the financial sector.

JEL codes: F14, F15, F21

Keywords: Brexit, trade, global value chains, FDI

[1] Trade and Cooperation Agreement between the European Union and the European Atomic Energy Community, of the one part, and the United Kingdom of Great Britain and Northern Ireland, of the other part (OJ L 149, 30.04.2021, p. 10).

2 Non-technical summary

The Withdrawal Agreement (WA)[2] between the United Kingdom and the European Union provided for a transition period, during which the existing arrangements (including the United Kingdom's participation in the Single Market) would continue until the end of 2020. In December 2020 the EU and the United Kingdom concluded the EU-UK TCA, establishing a tariff-free area for goods produced in the two economies, and avoiding the reversion of trade relations to most favoured nation (MFN) terms. The agreement was signed on 30 December 2020 and provisionally applied from 1 January 2021. It entered into force on 1 May 2021.

In this paper, we investigate the impact of these Brexit milestones on the economic relationship between the United Kingdom and the EU, in terms of both trade and FDI links.

We first analyse EU-UK relations with respect to trade. Despite the conclusion of the EU-UK TCA, the end of the Brexit transition period on 31 December 2020 led to the emergence of permanent non-tariff barriers on EU-UK trade in goods, as well as in services. For goods, these took the form of customs controls, and for services, the loss of authorisation and mutual recognition (known as passporting rights[3] for financial services).

According to Eurostat data, UK imports of goods from the EU fell sharply over the first few months of 2021, while imports from non-EU countries rose. UK exports to EU countries also declined significantly in the same period. They subsequently recovered, and are now aligned with exports to non-EU economies. For the United Kingdom, trade in services has been much stronger than trade in goods, despite a steep decline during the COVID-19 pandemic. From 2019 the United Kingdom's trade in services with the rest of the world exceeded its trade with the EU, particularly in financial services, while tourism inflows from the United Kingdom to the EU increased, probably motivated by the fear of future travel restrictions due to the end of the free movement of people.

The impact of the end of the transition period on UK imports and exports of goods can be estimated using a difference-in-differences model, comparing trade with EU Member States and trade with a control group of advanced and emerging economies. According to this analysis, UK exports to the EU have fallen significantly and steadily, while there seems to have been little effect, on average, on UK imports from the EU.

A synthetic control analysis examines whether the introduction of customs controls on the trade of EU-UK goods resulted in a redirection of UK trade, compared with continued EU membership. We find that UK imports from most EU Member States

2 Agreement on the withdrawal of the United Kingdom of Great Britain and Northern Ireland from the European Union and the European Energy Committee, (OJ L 29, 31.1.2020, p. 7).

3 "Passporting" is a technical term referring to the system of free movement of financial products and services between Member States.

and large advanced economies have fallen significantly compared with the counterfactual, and that the United Kingdom has increased its imports from some small non-EU economies. However, this is not enough to offset the redirection of trade flows from the EU and other advanced economies.

Using product-level data on German, French, Italian and Spanish exports to the United Kingdom, we confirm that Brexit had a significant negative impact on bilateral trade, as non-tariff barriers increased relative trade costs. Indeed, products highly exposed or highly sensitive to an increase in trade costs (e.g. food or global value chain (GVC)-related products) fell significantly.

On FDI, the analysis finds that the flows between the EU and the United Kingdom declined after the referendum, but have partially recovered in the past few years. The volatility of EU-UK FDI peaked in early 2017, mainly driven by debt instruments, before gradually decreasing again until the end of the transition period, when business relocations may have caused sharp increases in UK equity investments in the EU. FDI flows were concentrated in only a few EU countries, and a notable share of transactions related to financial services. The EU invested in mining, electricity, and services (excluding financial, real estate as well as professional, scientific and technical activities) sub-sectors in the United Kingdom, but withdrew from financial activities and manufacturing. At the same time, UK investments in the EU increased in manufacturing, but contracted in financial activities. The main data sources were the European Union Statistical Office (Eurostat), the Organisation for Economic Cooperation and Development (OECD) and the UK Office for National Statistics (ONS). Significant differences between the Eurostat and ONS data underline the key role played by methodologies in calculating FDI flows.

The number of new FDI projects per year in the UK economy has decreased since 2017, in both expansions and mergers and acquisitions (M&A), with the main funding sources originating from the EU. Moreover, the number of jobs created by these new projects in the UK economy also followed a downward path in the period from 2015-2016 until the end of the COVID-19 pandemic. The UK industries attracting new FDI projects were software and computer services, wholesale services and financial services. In particular, in the case of the UK financial services sector, new FDI projects temporarily increased in 2023.

The United Kingdom is a major global financial centre, and its financial sector is an important growth driver for the UK economy. In the context of Brexit, the UK financial sector was hit particularly hard. Real gross value-added in the financial sector increased at a slower pace than in the overall services sector in the United Kingdom. In comparison, real gross value-added in the euro area financial sector has been less volatile and slightly stronger since the end of the transition period. The number of jobs in the UK financial industry remained relatively close to the long-term trend, but some fluctuations occurred in the context of the jobs relocated from UK firms to the EU after Brexit.

One of the main Brexit-related issues for the UK financial sector is the fact that UK financial firms have not been able to passport into the EU since the end of the transition period. As a result, the number of UK financial institutions with affiliates in

the EU has grown since Brexit, particularly the number of non-banking groups such as insurance corporations, partly due to differences in the equivalences granted by the two geographical areas. Meanwhile, the number of EU financial institutions with affiliates in the United Kingdom has been relatively stable. London remains one of the world's leading financial centres, but has lost some ground to New York. Since Brexit, the Global Financial Centres Index ratings of some competing European financial centres (e.g. Amsterdam, Paris, Madrid and Dublin) have improved.

A gravity-type modelling approach with synthetic difference-in-differences (see Arkhangelsky et al., 2021) was performed to estimate changes in EU-UK bilateral FDI flows and stocks following the United Kingdom's decision to leave the EU. This difference-in-differences technique tests whether the EU countries adopted different investment strategies for the United Kingdom from those applied to the other EU countries after the referendum. The analysis controlled for other FDI determinants, such as GDP growth, labour cost, trade openness and global factors (e.g. the COVID-19 pandemic, Russia's invasion of Ukraine), in order to isolate the impact of Brexit on EU-UK FDI. We found a slight negative impact of Brexit on total EU-UK FDI, but particularly large FDI outflows between the United Kingdom and major EU financial centres could indicate some decoupling from the EU of London as a major global financial centre after Brexit. Temporary business relocations supported FDI transactions, but it is still too early to determine the long-term level of EU-UK FDI within the new relationship framework between the EU and the United Kingdom that started in January 2021.

3 Foreword

The ECB and the national central banks of the European System of Central Banks (ESCB) established a Brexit Task Force (BTF) reporting to the International Relations Committee, with the specific purpose of monitoring and reviewing the process of the withdrawal of the United Kingdom from the EU from a holistic point of view, working closely with other ESCB committees.

In 2020, before the conclusion of the negotiations on a trade agreement between the EU and the United Kingdom, the BTF published a paper summarising the economic analyses conducted by its members on the potential impact of Brexit on the United Kingdom, EU and euro area.

When the BTF's mandate expired, its members formed a network in order to continue to exchange economic analyses on selected aspects of the evolving relationship between the EU and the United Kingdom. This paper showcases the work produced, focusing on trade and FDI. Other aspects, such as any economic impact of changes in migration flows, were not further developed, but this is not to imply that they are any less important.

We would like to thank the authors of the analyses in this publication for their contributions, and Filippo Vergara Caffarelli, Ana M. Almeida and Horatiu Lovin in particular, for coordinating the analyses and compiling this Occasional Paper.

Last but not least, we would like to extend our wholehearted thanks to Hans Geeroms, who co-chaired the BTF and the EU/UK Network until his retirement from the National Bank of Belgium in summer 2024. His knowledge, leadership, vision and enthusiasm were extremely valuable during this endeavour.

Gilles Noblet (European Central Bank)

Chair of the EU-UK Network of the International Relations Committee of the ESCB

4 Introduction: the institutional context for the analysis of trade and FDI between the EU and the United Kingdom

This introductory chapter briefly sets out the institutional context for the analysis of trade and FDI in the rest of this Occasional Paper. It complements the introductory chapter of the 2020 Occasional Paper[4], which provided an overview of institutional and political developments, starting from the Brexit referendum, covering the process of negotiating, renegotiating and ratifying the WA, and the uncertainty throughout that process, and setting out the various scenarios available in terms of trade at various points in the process.

The basis for the current trade relations was fixed in 2020.

The WA was ratified in January 2020, covering financial arrangements and citizens' rights. Under the WA, the United Kingdom exited the EU on 1 February 2020. The Protocol on Ireland and Northern Ireland (the Northern Ireland Protocol)[5] provided that Northern Ireland would remain within the EU Single Market for goods.

The WA did not yet include an agreement on trade relations. However, in a Political Declaration (PD) the EU and the United Kingdom agreed to work on "a comprehensive and balanced Free Trade Agreement". In the interim, the WA provided for a transition period during which the existing arrangements (including the United Kingdom's participation in the Single Market) would continue. This transition period would end irrevocably on 31 December 2020. In the event of a failure to reach a free trade agreement before the end of the transition period, trade would revert to MFN terms.

In December 2020 the EU and the United Kingdom concluded the EU-UK TCA. The agreement was signed on 30 December 2020 and applied provisionally as of 1 January 2021. It entered into force on 1 May 2021.

In terms of trade in goods and services, Brexit resulted in the United Kingdom leaving the Single Market, with its four freedoms, i.e. the free movement of goods, capital, services and people. From that starting point, in the TCA, the EU and the United Kingdom sought to establish clear and mutually advantageous rules governing their trade and investment.

In particular, the TCA provides for zero tariffs and zero quotas for trade in goods between the EU and the United Kingdom, for goods that satisfy the rules of origin. For trade in goods between the EU and Northern Ireland, the Northern Ireland Protocol included in the WA applies.

4 L'Hotellerie-Fallois et al. (2020).

5 The Protocol on Ireland/Northern Ireland.

The TCA also includes commitments in the area of trade in services, but in practice, market access depends on the nature of the service and the mode of supply.

For financial services, the EU and the United Kingdom agreed a Memorandum of Understanding[6] and established a Joint EU-UK Financial Regulatory Forum. However, in terms of market access, UK service providers no longer benefit from passporting rights, service providers are subject to local rules and the EU and the United Kingdom retain their regulatory autonomy (the "prudential carveout").

The EU and the United Kingdom have agreed on level playing field guarantees in areas such as environmental protection, carbon pricing, social and labour rights, tax transparency and State aid.

In early 2023 the EU and the United Kingdom agreed the Windsor Framework. Under the Framework, as under the Northern Ireland Protocol before it, Northern Ireland remains part of the EU Single Market for goods, with the border for customs checks in the Irish Sea. However, the Framework introduced administrative streamlining for trade between Great Britain and Northern Ireland, and a mechanism to scrutinise the application of new EU Single Market rules (the Stormont brake).

To oversee the implementation of the TCA, the EU and the United Kingdom meet in the context of a "Partnership Council" and a series of specialised committees that cover various aspects of trade and other issues.

An overview of the activities of the Partnership Council and these committees is provided every year in the European Commission's report[7] on the implementation of the TCA. This report also summarises the progress made in areas within the remit of the TCA.

The European Commission has noted that the sectoral implementation of the TCA worked well in 2023, that the trade-related arrangements in particular had worked very well, and that there were no significant implementation problems in the areas of services and investment, digital trade, intellectual property, public procurement and small and medium-sized enterprises.

The Commission noted significant concerns in the EU raised by the late publication of the United Kingdom's final Border Target Operating Model for border checks on imports from the EU, and the lack of detail on many of its provisions, together with delays in introducing electronic certification by the United Kingdom. There have been further delays since then.

At their summit on 19 May 2025, the EU and the United Kingdom agreed on a new Strategic Partnership, built on the foundation of the WA (including the Windsor Framework), the TCA and their full implementation. In addition to the geopolitical focus of the summit, the EU and the United Kingdom agreed on a Common

6 Memorandum of Understanding establishing a framework for financial services regulatory cooperation between the European Union and the United Kingdom of Great Britain and Northern Ireland.

7 REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL on the implementation and application of the Trade and Cooperation Agreement between the European Union and the United Kingdom of Great Britain and Northern Ireland, 1 January – 31 December 2023.

Understanding for a renewed agenda for EU-UK cooperation, also covering economic cooperation.

Today, more than eight years after the Brexit referendum, the way the EU and the United Kingdom organise their trade relationship continues to be crucial for our analysis. At the same time, the external environment has changed in ways that are difficult to control for. For example, throughout our analysis, we need to be mindful of the impacts of the COVID-19 pandemic on world trade, and of increased geopolitical tensions, such as the war following the Russian invasion of Ukraine, which has had a significant impact on energy and food prices.

5 EU-UK trade after Brexit

5.1 Introduction

By Filippo Vergara Caffarelli (Banca d'Italia).

Brexit is one of the most significant political events of the past decade, and the progress of institutional negotiations has significantly affected economic developments in the EU and the United Kingdom. The United Kingdom's membership of the EU was terminated on 31 January 2020, when the WA agreement, signed on 24 January 2020, entered into force. However, nothing in the relationship between the two economies changed until the end of the 11-month transition period provided for in the WA. After a month of uncertain negotiations, the TCA, establishing the terms of the future EU-UK relationship, was concluded on 30 December 2020 and entered into effect on 1 January 2021; for most economic instances, this is the actual date of Brexit. The TCA provided for zero tariffs and zero quotas on all goods produced in the two economies, but non-tariff barriers to trade nevertheless emerged.[8] In fact, the EU immediately set up customs controls on trade with the United Kingdom, while the United Kingdom did not impose corresponding checks. EU imports from the United Kingdom therefore underwent the full range of EU customs checks, while EU exports to the United Kingdom were subject to only a few, relating in particular to VAT and other taxes. Goods entering the United Kingdom from the EU and goods exiting the United Kingdom to the EU were not subject to checks.

This chapter presents five studies on the impact of Brexit on EU-UK trade in goods and services.

The work on these studies was completed in 2024. More specific information about the time series used is provided, where relevant.

To set the stage, Section 1 presents the development of trade between the United Kingdom and the EU. On the imports side, there was a striking decline in UK goods imports from the EU in the first few months of 2021, contrasting with a rise in imports from non-EU countries. On the exports side, UK exports of goods to EU countries fell sharply immediately after the end of the transition period. Subsequently, UK goods exports to the EU recovered and have since moved broadly in line with exports to non-EU partners.

In Section 2, the impact of the end of the Brexit transition period on UK imports and exports is estimated by means of a difference-in-difference model, comparing trade with the EU Member States and trade with a control group of advanced and emerging market economies. After the transition period, UK exports to the EU

[8] Non-tariff barriers include checks on rules of origin requirements, sanitary and phytosanitary regulations, labelling, certification and other technical barriers to trade, and VAT and other tax regulations.

decreased significantly and steadily, while there were few effects on UK imports from the EU.

In Section 3, the synthetic control method is used to investigate whether the introduction of customs controls by the EU on EU-UK trade on 1 January 2021 resulted in a redirection of trade for the United Kingdom compared with hypothetical continuing EU membership. Compared with the counterfactual scenario, while UK imports from most EU Member States and the major advanced economies (United States, Japan, Canada and Australia) contracted significantly, the United Kingdom increased its imports from small non-EU economies. However, this was not sufficient to offset the redirection of trade flows from the EU and other advanced economies.

In Section 4, product-level data for exports of Germany, France, Italy and Spain to the United Kingdom are used to show the substantial negative impact of Brexit on bilateral trade. Non-tariff barriers and customs procedures raised relative trade costs. Trade in products highly exposed or highly sensitive to increases in trade costs, such as food products or GVC products, declined significantly, confirming this general pattern.

Section 5 provides an in-depth analysis of the United Kingdom's trade in services, which has been much stronger than its trade in goods, notwithstanding the sharp drop during the COVID-19 pandemic. Since 2019 UK trade in services with the rest of the world has surpassed its trade with the EU, especially in financial services. This is consistent with the political developments of the WA and the TCA. Box 1 focuses on the effects of Brexit on visits by UK residents and their spending. Overall, there seems to have been a subdued but positive impact on tourism inflows from the United Kingdom to the EU, probably motivated by the fear of travel restrictions to come.

The economic implications of Brexit on UK trade have already been extensively analysed, as Britain's exit from the EU marked a significant shift in economic and trade relations. This decision led to the reintroduction of trade barriers, regulatory divergence and increased uncertainty, which have had notable repercussions on trade with the EU and other global partners.

Early studies by UK institutions, such as the National Institute of Economic and Social Research (NIESR) and the Centre for Economic Performance at the London School of Economics, indicated that Brexit would substantially reduce the United Kingdom's trade volume and alter its trade patterns. Policy briefs and studies (often published on VoxEU) also indicated that the reintroduction of non-tariff barriers, customs checks and rules of origin requirements would reduce UK-EU trade integration by approximately 15-20% (NIESR, 2016; Dhingra et al., 2017; Vandenbussche et al., 2022; Dinghra & Sampson, 2022). These disruptions were expected to be especially severe for industries that rely on just-in-time supply chains, such as automotive and food processing, which would face increased logistical costs and delays. A general review of the analysis of the potential impact of Brexit is presented in L'Hotellerie-Fallois et al. (2020).

The outcome of the Brexit referendum was itself extremely uncertain, and its consequences at the time were unclear. EU-UK negotiations on both the withdrawal and the future relationship were not easy, and the outcome was uncertain. All this prompted research into Brexit uncertainty (Crowley et al., 2018; Douch and Edwards, 2022; Graziano et al., 2020; Gutiérrez, Lacuesta, & Martín, 2021; Martin, Martinez & Méjean, 2019), showing that Brexit would adversely affect UK exports and trigger a reorientation of exports for EU Member States, such as France and Spain, away from the United Kingdom. Other works (Pisani and Vergara Caffarelli, 2018; Cappariello, et al., 2018; Berthou et al., 2019; Cappariello, et al., 2020) concentrated on the possible consequences of the various post-Brexit trading arrangements between the EU and the United Kingdom and the impact of tariff and non-tariff barriers, also taking into account the global value chains linking EU and UK firms. The results confirmed the intuitive assumption that higher barriers to trade would affect growth and trade, especially in the United Kingdom.

5.2 EU-UK trade developments

By Katrin Forster van Aerssen (European Central Bank).

EU-UK trade developments in recent years have not only been affected by Brexit. The global recession and subsequent recovery in the wake of the pandemic, together with disruptions to global supply chains and the Ukraine conflict, have generally increased trade volatility globally in recent years. For the United Kingdom, the extensive and drawn-out negotiations on the withdrawal arrangements and on the future trading relationship generated even greater uncertainty, making it difficult to disentangle the Brexit effect.

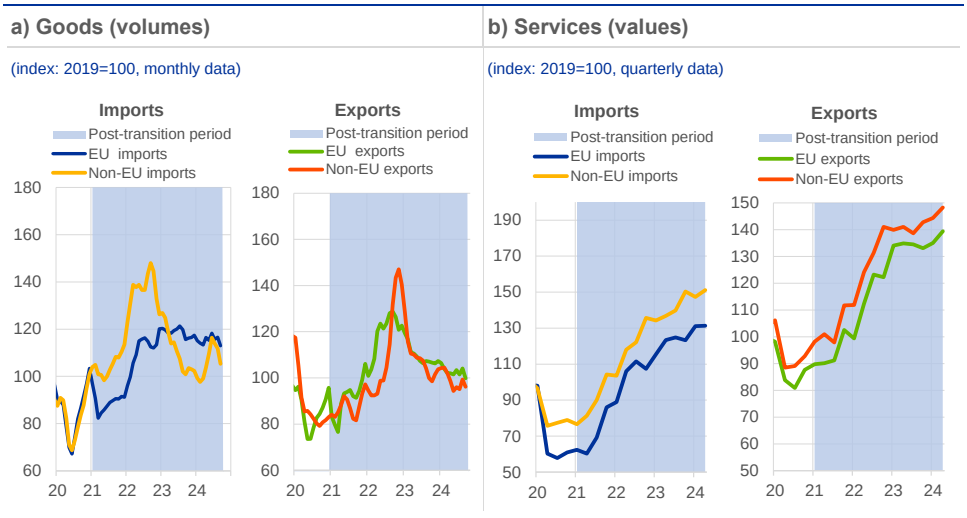
Focusing on the period from January 2021, trade volumes of UK goods with the EU initially fell significantly, remaining below their pre-pandemic level until early 2022. On the imports side, despite the delay in the application of TCA provisions on the part of the United Kingdom, there was a striking decline in UK imports from the EU in the first few months of 2021, contrasting with a rise in goods imports from non-EU countries (Chart 1, panel a). This could point to some substitution between EU and non-EU imports, with goods being redirected away from transits via EU countries. However, different cyclical conditions during the pandemic (owing to differences in case numbers and restrictions) and different exposures to global supply bottlenecks may also have played a major role. Since these trends between imports from EU and non-EU partners have reversed over the last two years, the impact of all these factors appears to have been rather short-lived. On the exports side, UK exports of goods to EU countries fell sharply immediately after the end of the transition period, as many exporters struggled to meet the new paperwork requirements for documenting compliance with EU standards. Subsequently, UK goods exports to the EU recovered and have since moved broadly in line with exports to non-EU partners, although they remain relatively subdued compared with pre-Brexit trends.

Trade in services with the EU has remained somewhat weaker than trade with non-EU partners (Chart 1, panel b). Most of the initially stronger decline in services trade

with the EU appeared to be pandemic-related, particularly given that the travel and transportation industries make up a higher proportion of EU trade than non-EU trade, and given the travel restrictions during the pandemic. Together with the recovery in tourism, UK trade in services has bounced back, well exceeding pre-pandemic levels. This also reflects the post-pandemic increase in travel prices. Other important categories of services exports to the EU, such as financial services, contracted more than, or failed to grow as much as, exports to the rest of the world until the end of 2021, and have remained below their pre-pandemic levels. Brexit thus appears to have played some role, possibly also owing to the lack of agreements covering trade in services. Overall, the importance of the EU as a UK trading partner in services has declined since Brexit, with the EU accounting for 36% of total UK services exports in 2023, compared with more than 38% in the 2010-19 period (Box 1).

Chart 1

UK trade in goods and services with EU and non-EU countries



Source: ONS.
Notes: The decomposition of services trade into exports to the EU and non-EU partners and imports from the EU and non-EU partners is only available in terms of values. The latest observations are for September 2024 for goods volumes and the second quarter of 2024 for services.

5.3 An estimation of the impact on trade of the end of the Brexit transition period

By Katrin Forster van Aerssen (European Central Bank) and Filippo Vergara Caffarelli (Banca d'Italia).

5.3.1 Introduction

UK goods trading volumes with the EU fell significantly after the implementation of the EU-UK TCA, but not all of this can be attributed to Brexit, as the COVID-19 pandemic was a confounding factor. We attempt to isolate the impact on EU-UK trade of the introduction of customs controls by the EU at the end of the Brexit transition period by means of difference-in-difference (diff-in-diff) estimation

techniques. We use these techniques to analyse UK exports and imports of goods vis-à-vis the EU Member States and a set of third countries that we use as a control group between 2000 and 2024.

In line with other studies, we find a significant negative and persistent impact on UK exports to the EU and a non-significant impact on UK imports from the EU. This is fully consistent with the fact that the EU immediately set up customs controls on trade with the United Kingdom, while the latter did not set up such controls.

5.3.2 Data and methodology

We consider UK monthly real exports and imports of goods with a balanced panel of 50 countries, i.e. the 27 (current) EU Member States and 23 advanced and emerging economies, from January 2000 to April 2024.[9] Exports and imports in real terms are calculated using bilateral trade flows in value terms and the implied deflators of UK total exports and imports, respectively. We perform a diff-in-diff analysis, taking the EU Member States as the treated group, with third countries as the control group. Our treatment is the introduction of EU customs controls on EU-UK trade on 1 January 2021. Although the EU-UK TCA establishes a post-Brexit free trade area for goods produced within the European Union and the United Kingdom and stipulates that no tariffs or quantitative restrictions will be applied to trade between the EU and United Kingdom, non-tariff barriers were erected on the European side from the first day, affecting UK exports to the EU and, to a lesser extent, UK imports from the EU. At the same time, the UK Government decided to postpone the implementation of customs controls on trade with the EU.[10] UK trade with non-EU countries was not affected, as it had been subject to customs controls both before and after the end of the transition period.

Adopting a "gravity-like" approach[11], the diff-in-diff regressions include some controls for the United Kingdom and its trading partners, namely the Index of Industrial Production, to control for economic activity, and the Oxford Stringency Index, to account for the developments in the COVID-19 pandemic that affected trade and economic activity in the years around the end of the transition period. We also include the bilateral exchange rate of UK trading partners' national currencies with the pound, to control for the competitiveness of the UK economy.[12]

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9 The control group consists of Argentina, Australia, Brazil, Canada, China, Hong Kong, Iceland, India, Indonesia, Japan, Mexico, New Zealand, North Macedonia, Norway, Saudi Arabia, Serbia, Singapore, South Africa, South Korea, Switzerland, Taiwan, Turkey and the United States. Russia is excluded, due to the implementation of sanctions by the United Kingdom after the attack on Ukraine on February 2022, after which UK-Russia bilateral trade almost completely shut down.

10 The United Kingdom repeatedly delayed the introduction of customs controls on EU-UK trade, finally implementing them on 31 October 2024.

11 For a thorough review in the literature on the topic of gravity estimations, see Baldwin and Taglioni (2007).

12 Santos and Temreyro (2006) show that estimations of gravity equations should be performed using Poisson pseudo-maximum-likelihood, in particular to take into account the distorting effect of zeros in the trade flows. In our dataset, while we start with the full trade matrix of the United Kingdom's monthly trade flows, which indeed contains zero trade flows, when we restrict the sample to the years and the countries for which we have data on industrial production and the stringency index, the zeros disappear from the dataset. We can then safely proceed with a standard diff-in-diff estimation.

In formulae:

$$\ln\left(X_{i,t}^{UK}\right) = \alpha_i + \beta_1 \ln\left(IP_{i,t}\right) + \beta_2 \ln\left(IP_{UK,t}\right) + \beta_3 S_{i,t} + \beta_4 S_{UK,t} + \beta_5 e_{i,t}^{UK} + \gamma_t + \delta B_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$\ln\left(M_{i,t}^{UK}\right) = \alpha'_i + \beta'_1 \ln\left(IP_{i,t}\right) + \beta'_2 \ln\left(IP_{UK,t}\right) + \beta'_3 S_{i,t} + \beta'_4 S_{UK,t} + \beta'_5 e_{i,t}^{UK} + \gamma'_t + \delta' B_{i,t} + \varepsilon'_{i,t} \quad (2)$$

where $X_{i,t}^{UK}$ $\left(M_{i,t}^{UK}\right)$ is UK exports to (imports from) country i at time t, calculated on data from the ONS, and $IP_{i,t}$ $\left(IP_{UK,t}\right)$ is country i's (United Kingdom's) industrial production index at time t, from the World Trade Monitor of the CPB Netherlands Bureau for Economic Policy Analysis. $S_{i,t}$ and $S_{UK,t}$ are the COVID-19 Government Response Tracker Index of the University of Oxford for country i and the United Kingdom, respectively. $e_{i,t}^{UK}$ is the bilateral exchange rate with the pound, from the International Monetary Fund. The model also includes the end of the transition period dummy, $B_{i,t}$, which is equal to one for the EU Member States from January 2021 onwards, and zero otherwise, and country and time-fixed effects. Table 1 sets out the summary statistics of all the variables.

Table 1
Summary statistics

Variable	Num. obs.	Mean	St. dev.	Min.	Max.
$X_{i,t}^{UK}$	14,600	4,709,492	7,730,229	12,150.67	69,607,650
$M_{i,t}^{UK}$	14,600	6,248,745	9,741,822	10,845.99	63,773,150
$IP_{i,t}$	14,600	105.32	24.72	24.50	340.63
$IP_{UK,t}$	14,600	102.13	8.24	77.70	114.30
$S_{i,t}$	1,900	39.65	25.16	0.00	98.64
$S_{UK,t}$	1,836	43.11	27.32	2.24	98.64
$e_{i,t}^{UK}$	14,600	403.06	2,399.64	0.59	22,106.53

Note: The summary statistics for the Oxford Stringency Index are calculated only for the period COVID-19-related restrictions were in place (i.e. the index was consistently different from zero): for S_(i,t) this is from January 2020 to February 2023, and for S_(UK,t) from January 2020 to December 2022.

Equations (1) and (2) are estimated in two ways. The first method is the standard diff-in-diff, comparing the pre-treatment values with all post-treatment values for both the treated and the control groups (Ashenfelter and Card, 1985; Angrist and Pischke, 2008). We refer to the impact estimated in this way as the "average" impact. The second estimation approach follows Campos et al. (2022): we construct a "rolling" estimation interval, comprising the whole pre-treatment period and each post-treatment month separately, and then combine the results to show the month-by-month evolution of the impact of the end of the transition period and the subsequent introduction of EU customs controls. In both cases, we follow the advice of Bertrand et al. (2004) and cluster the standard errors at the country level.

5.3.3 Estimation results

In our estimations, we find that Brexit had a (statistically) negative impact on UK exports to the EU, amounting to -0.39, indicating that, due to Brexit, UK exports to

the EU in the period from January 2021 to April 2024 were 32% lower. By contrast, we do not find any significant impact of Brexit on UK imports from EU partners.

Table 2 presents the average impact of the end of the transition period.[13]

Table 2
Diff-in-diff estimation results

Variable	$\ln(X_{i,t}^{UK})$	$\ln(M_{i,t}^{UK})$
$B_{i,t}$	-.39***	0.06
	(.12)	(.10)
$IP_{i,t}$	.72***	.56***
	(.13)	(.17)
$IP_{UK,t}$	-1.21***	-1.71***
	(.60)	(.51)
$S_{i,t}$	-.01	.00
	(.01)	(.00)
$S_{UK,t}$	.06***	.00
	(.02)	(.01)
$e_{i,t}^{UK}$	-.00***	-.00***
	(.00)	(.00)

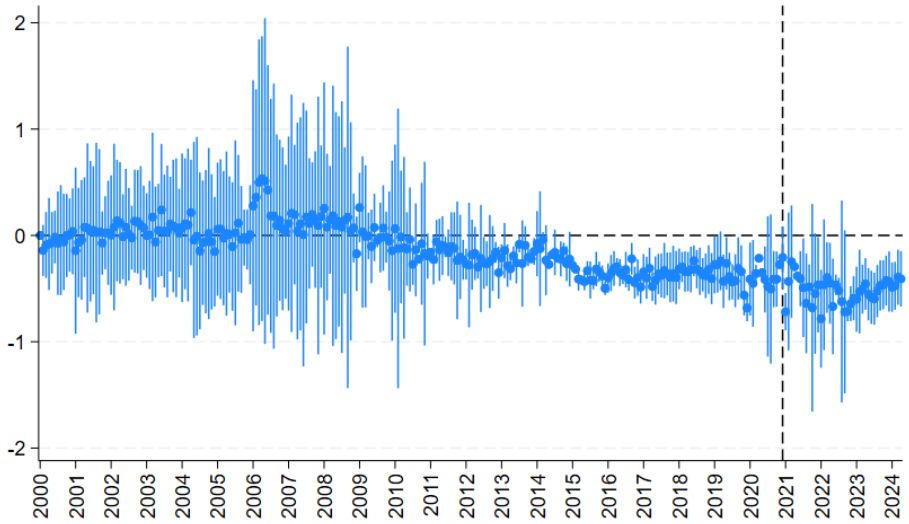
Notes: *** Significant at 1% level. Standard errors, clustered at the country level, in parentheses.

Difference-in-differences analysis substantially relies on the assumption that before the treatment, the trends of the treated and control groups are parallel, i.e. that there was no significant difference in the outcomes. Otherwise, no causal inference can be drawn, as the post-treatment difference cannot be safely attributed to the treatment. The test accepts the parallel trend assumption for equation (2) on imports ($F_{1.49}$ =.04, p-value =.84), while it rejects it for equation (1) on exports ($F_{1.49}$ = 4.87, p-value = 0.03). To investigate further, we regress UK exports on the interactions of the treated group indicator, i.e. the EU Member State dummy, and the controls with the time dummies, and check whether EU membership has a significant effect over time. Chart 2 plots the estimated coefficient for EU membership: it is not significantly different from zero up to mid-2014, with divergence in the trends of the treated and control groups only emerging from 2015.

13 We tried several alternative specifications to confirm the robustness of the results.

Chart 2

Effect of EU membership on UK exports over time



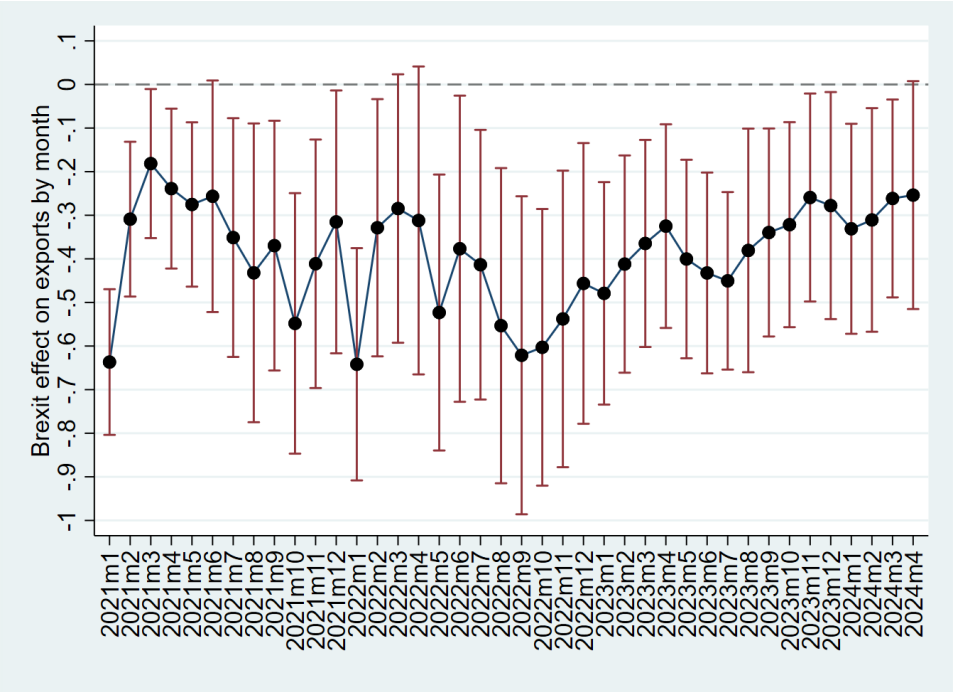
Note: The bars indicate the 5% confidence interval.

We now turn to the month-by-month estimation of the impact of the introduction of EU customs controls on UK trade. Chart 3 presents the average treatment effect on UK exports for each month, together with the 5% confidence interval boundaries. This analysis indicates that the negative impact on exports has been very persistent, also in terms of magnitude. This contrasts with the results of the month-by-month estimation results for UK imports. While UK imports from the EU appear to have initially been negatively affected after the end of the transition period, Chart 4 suggests that the impact was short-lived, with the effect turning positive from the beginning of 2022.[14]

[14] The results for imports should be interpreted with caution, as they may be affected by statistical factors. Data on goods imports from the EU were inflated in the first half of 2022 by delayed customs declarations from the second half of 2021. In January 2022 HM Revenue and Customs implemented a data collection change affecting data on imports from the EU into the United Kingdom. This followed a similar data collection change in January 2021 for data on exports of goods to the EU from the United Kingdom. The ONS applied adjustments to 2021 EU imports in order to compare import and export statistics on a like-for-like basis. The full time series for imports from the EU still contains a discontinuity from January 2021.

Chart 3

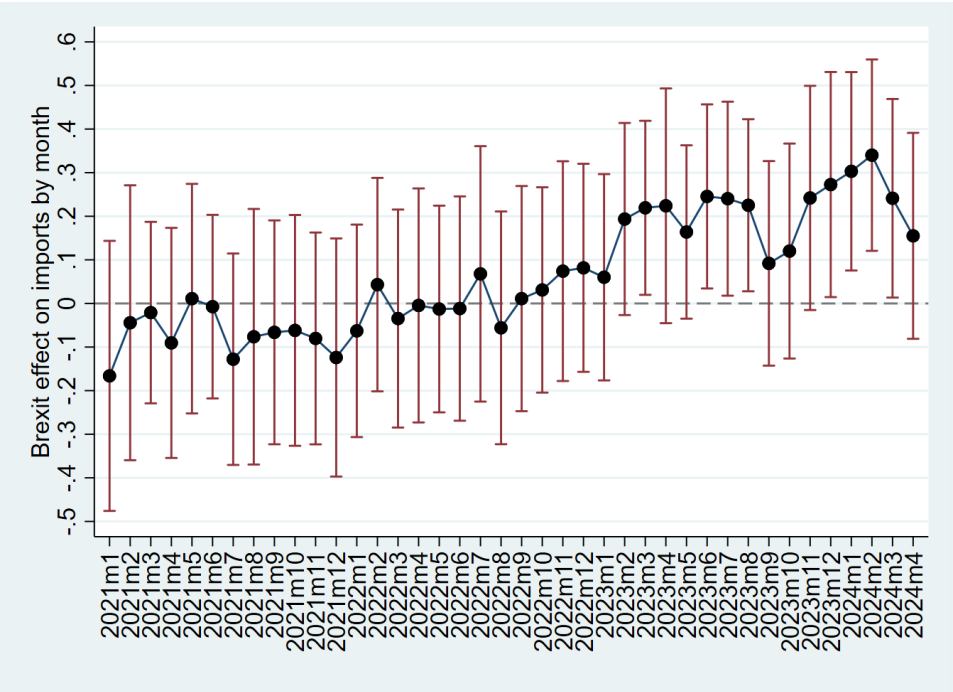
Month-by-month effect of customs controls on UK exports



Note: The bars indicate the 5% confidence interval.

Chart 4

Month-by-month effect of customs controls on UK imports



Note: The bars indicate the 5% confidence interval.

Comparing our results with those of other studies, it is noteworthy that the findings differ widely. Our results are very similar to those found by Du et al. (2022), who only consider the period to the first quarter of 2022, and find that the United Kingdom experienced a 22.9% fall in exports to the EU compared with the rest of the world. The initially negative impact on UK imports was also subsiding. Others, by contrast, either find significant dampening of both UK exports and imports (De Lucio et al., 2024, Kren and Lawless, 2022 and Du and Shepotylo, 2022) or show that the TCA reduced UK trade with the EU asymmetrically for exports and imports, with a stronger impact on imports (Gasiorek and Tamberi, 2023 and Freeman et al., 2022). Apart from differences in the reference country or methodologies[15],a large part of the contradictory results, particularly relating to the adverse impacts on UK imports, can be explained by differences in the length of the periods analysed, consistent with our results for the development of the month-on-month effects over time.[16]

5.3.4 Concluding remarks

Overall, the analysis suggests that Brexit has been a persistent dampening factor for UK goods exports. This is in line with evidence from a recent survey by the British Chambers of Commerce (2023) of more than 700 businesses to mark three years since the TCA was signed. Of the firms trading with the EU, 60% said the deal was not helping them to increase sales or grow their businesses. Two-fifths of the firms reported difficulties in adapting to the new rules for exporting goods (35% for services).

5.4 Post-Brexit redirection of trade

By Gabriele Cappadona, Kevin Pallara, and Filippo Vergara Caffarelli (all Banca d'Italia).[17]

5.4.1 Introduction

In this section, the synthetic control method (SCM) is used to examine the impact of the EU's introduction of customs controls on EU-UK trade on 1 January 2021. Specifically, it assesses whether the emergence of non-tariff barriers resulted in

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15 De Lucio et al. (2024), for instance, focus on the trade between the UK and Spain, finding that both Spanish imports and exports from and to the UK significantly decreased after the end of the transition period. This is not inconsistent with our findings as we measure the average effect of the TCA on UK trade with all EU Member States. Springford (2022a, 2022b) follows an alternative approach, providing several updates of estimates of Brexit impacts using a "doppelgänger" method, in which an algorithm selects countries whose economic performance closely matches that of the United Kingdom before Brexit.

16 Gasiorek and Tamberi (2023) consider a much shorter sample than ours, from January 2017 to December 2022, only covering the period between the Brexit referendum and the end of the first year of application of the TCA. When estimating our diff-in-diff model over the same time span, we find a much weaker impact on exports than in the full sample.

17 The authors gratefully acknowledge comments and suggestions from Paolo Conteduca, Michele Mancini and Alessandro Borin.

trade redirection[18] for the United Kingdom, and the major or most exposed EU Member States, compared with a scenario of the United Kingdom's continued EU membership.[19] The SCM has been widely applied in international trade analysis, including studies on the effects of policy changes, such as joining trade blocs, implementing new trade agreements, imposing international sanctions, or, as in this case, Brexit.

Our findings indicate that UK imports from most EU Member States contracted significantly compared with the counterfactual, as did imports from major advanced economies, including the United States, Japan, Canada and Australia. In contrast, UK imports from China remained largely unaffected, though there was notable sectoral variation. While UK imports from smaller non-EU economies increased compared with the no-Brexit hypothesis, this was insufficient to offset the decline in trade flows with the EU and other advanced economies.

The economic implications of Brexit for UK trade have been extensively studied, as Britain's departure from the EU marked a major shift in trade policy. This discussion focuses on research utilising the SCM. For example, Douch and Edwards (2022) constructed a synthetic United Kingdom, and found that UK exports to the EU fell by up to 25% even before formal barriers were implemented, suggesting that firms had anticipated disruptions early on. Similarly, Du et al. (2023) used the SCM to analyse the EU-UK TCA and observed a sustained decline in UK exports, particularly in product diversity. Regulatory changes posed significant barriers to market entry and retention, causing many small firms to cease exporting altogether.

Additional studies, such as those by Papyrakis et al. (2022) on employment and Saia (2017) on the costs of non-participation in the euro, highlight the SCM's versatility in evaluating policy impacts. While these works do not focus on trade flows, they demonstrate the method's capacity to create robust counterfactuals, which are critical for capturing Brexit's multifaceted economic effects. Collectively, this research reveals that Brexit has not only reduced trade volumes but has also fundamentally reshaped the structure and scope of UK exports, particularly with the EU.

5.4.2 Methodology and data

The SCM (Abadie and Gardeazabal, 2003; Abadie, Diamond and Hainmueller, 2010) is a statistical, quasi-experimental approach designed to simulate a randomised controlled experiment in observational settings. It is particularly effective for evaluating the causal impact of policy interventions (the treatment) on a single unit, such as a country or region, by constructing a control group of "donor units". These donor units are selected based on their pre-treatment similarity to the treated unit. In

[18] We define trade redirection as the shift in imports from one origin country to another (after the introduction of EU customs controls in EU-UK trade). It is akin, but not exactly identical, to trade diversion, which usually refers to the shift that occurs after the establishment of a free trade agreement, from the most efficient producer to a source enjoying preferential treatment.

[19] The EU and the United Kingdom signed the TCA, (provisionally) applied from 1 January 2021, which established a tariff-free area between the two economies. However, non-tariff barriers, such as rules of origin, sanitary and phytosanitary regulations, labelling, certification and tax regulations, were immediately introduced by the EU, while the United Kingdom temporarily waived them.

this study, the treatment is the EU's introduction of customs controls on exports to the United Kingdom on 1 January 2021. To analyse the impact of Brexit, we follow the methodology developed by Borin, Mancini and Conteduca (2022), who used the SCM to evaluate the effects of sanctions on Russian imports after the invasion of Ukraine, focusing on subsequent trade disruptions.

In this context, we construct the counterfactual for monthly UK imports by selecting an appropriate combination of export flows for each exporting country to the United Kingdom. For a given export flow from an origin country to the United Kingdom, the counterfactual is based on a convex combination of exports to other countries from the same origin, with weights optimised to minimise the distance between counterfactual and observed export flows before the TCA. Key predictors include bilateral average trade flows, export shares of the most significant sectors in UK imports, the GDP of trading partners and multilateral resistance between trading partners. Additionally, we conduct separate analyses for the largest EU Member States and those most exposed to UK trade (Belgium, Ireland and the Netherlands). Both the United Kingdom and the EU Member States are treated as affected and are, therefore, excluded from the donor pool.

Our analysis uses a panel of monthly bilateral and sectoral import flows between the United Kingdom, the EU Member States and 89 advanced and developing economies (the donor pool) from January 2018 to October 2023, with the post-treatment period spanning January 2021 to October 2023. The data are seasonally adjusted. Predictors for the SCM analysis include 2015-19 average GDP, Baier and Bergstrand's (2009) multilateral resistance, 2018-20 average bilateral trade flows, average sectoral import shares and a preferential trade agreement dummy.[20] These variables are calculated using the Dynamic Gravity Dataset (Gurevich and Herman, 2018).

5.4.3 Results

In this section, we present the results of our SCM analysis, starting with the findings for the United Kingdom, followed by those for the largest EU Member States (France, Germany and Italy). We then examine the outcomes for the EU Member States typically considered most affected by Brexit (Belgium, Ireland and the Netherlands).

5.4.3.1 United Kingdom

Our analysis finds no evidence that introducing EU customs controls caused any significant trade redirection for the United Kingdom. The synthetic UK total imports consistently exceed the actual (treated) imports from the global market (the total loss of UK imports amounts to -14.8%), the EU (-15.2%) and the rest of the world (-

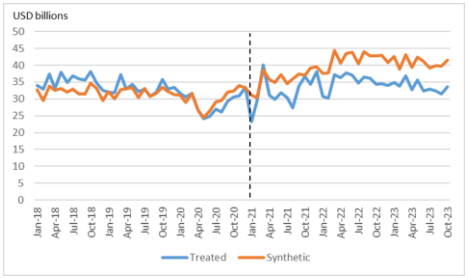
[20] COVID-19 was a pandemic and hit all countries in the world, albeit with some (slight) differences in timing and severity. Hence, we let the SCM approximate the COVID-19 shock without introducing specific controls.

14.3%; Chart 5). This impact is both substantial and sustained throughout the entire post-treatment period.

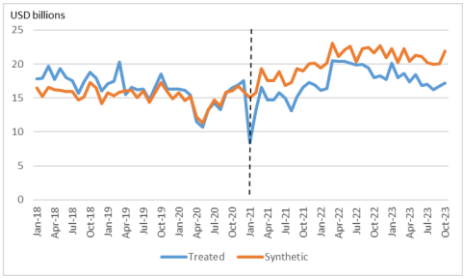
Chart 5

UK imports, actual and synthetic, by origin

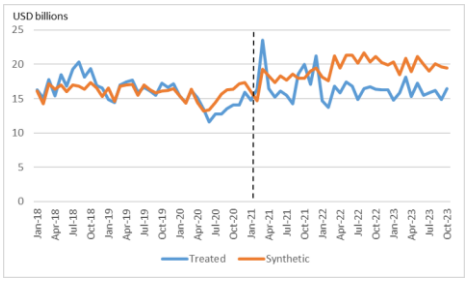
a) Total imports



b) Imports from the EU



c) Imports from the rest of the world



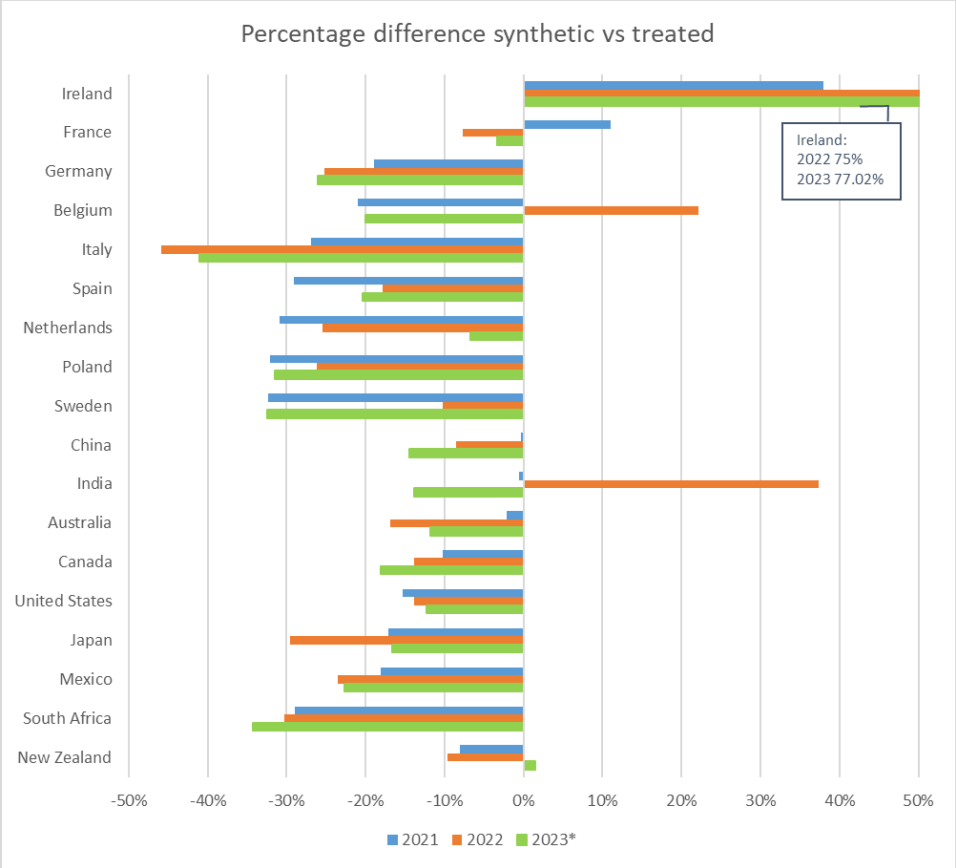
Source: Authors' estimation.

The country-level breakdown indicates that UK imports from the nine largest EU Member States were significantly affected by Brexit. Import volumes from most countries showed a negative gap between the actual and the counterfactual data for all years (Chart 6). For Germany and Italy, the gap grew between 2021 and 2023, while it narrowed for some countries, including the Netherlands and Spain. The decrease in the gap between 2021 and 2023 for Poland and Belgium, and the increase for Sweden, appear insignificant. Imports from France increased in 2021 compared with the counterfactual: however, the gap then became negative, although it was narrow. Notably, UK imports from Ireland increased, both immediately and progressively over time.[21] Imports from the rest of the world declined, with the notable exceptions of India in 2022 and New Zealand in 2023. At the country level, evidence of trade redirection remains minimal and, in any case, insufficient to offset the significant loss of imports from the EU.

[21] It should be noted, however, that the SCM leads to weak results for UK imports from Ireland. Its geographic proximity and the strong economic and cultural ties with the United Kingdom are difficult to replicate once the other EU Member States are excluded from the donor pool, as in our analysis.

Chart 6

UK imports, actual and synthetic, by country



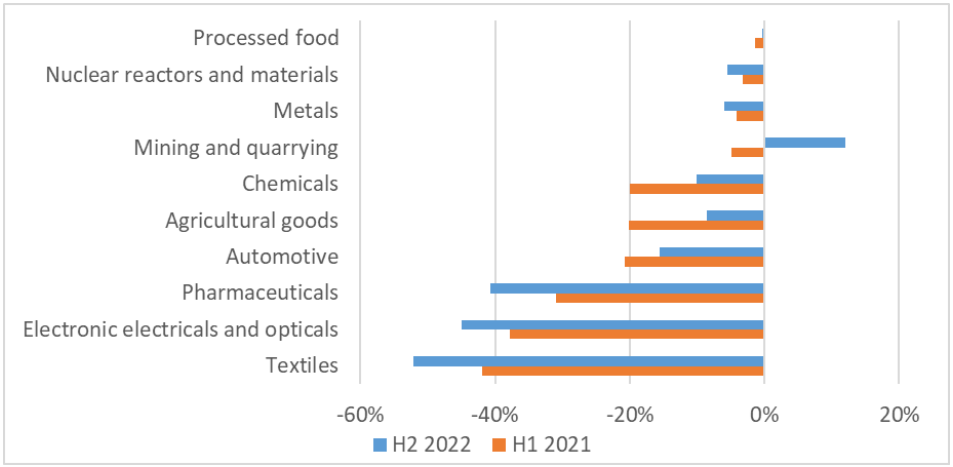
Source: Authors' estimation.
Notes: * 2023 comprises January to October only. For Ireland, see footnote 3.

We now shift to sector-level analysis. Following the introduction of EU customs controls, UK imports from the EU declined across all sectors and remained below the counterfactual throughout the second half of 2021, with recovery observed only in the mining and quarrying sector (Chart 7). Imports from the rest of the world were initially lower than the counterfactual across all sectors, except for textiles and metals. By the second half of 2022 imports of agricultural products aligned with the counterfactual, while metals imports remained slightly below it, and textiles imports showed a notable increase.

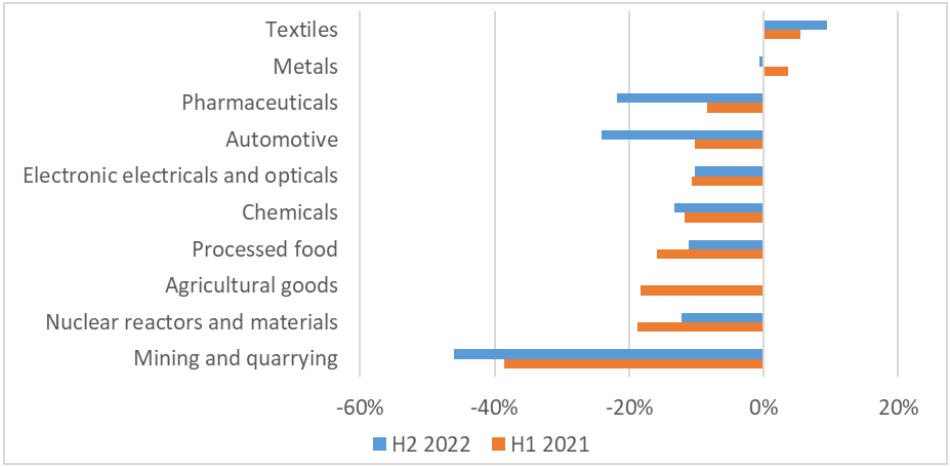
Chart 7

UK imports, actual and synthetic, by sector and origin

a) Imports from EU



b) Imports from the rest of the world



Source: Authors' estimation.

5.4.3.2 EU Member States

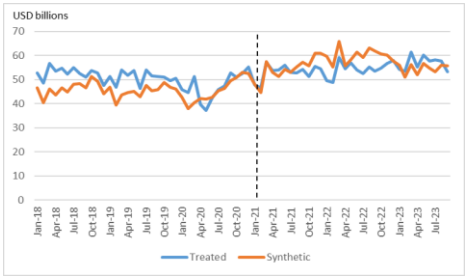
The impact of Brexit on German imports is minimal (-3.2%; Chart 8), primarily driven by a decline in imports from the United Kingdom (-27.9%), while imports from the rest of the world[22] remain consistent with the counterfactual, with a slight increase of 1.1%. A closer look at the post-treatment period shows that overall import volumes were initially below the counterfactual from mid-2021 to the end of 2022. However, in 2023 actual import volumes began to exceed the counterfactual, partially offsetting the losses incurred during the previous two years. Additionally, a significant increase in German imports from the United States and – to a lesser extent – from China is observed.

[22] In this section, trade with the rest of world excludes trade with the (rest of the) European Union, to prevent mixing treated and untreated countries.

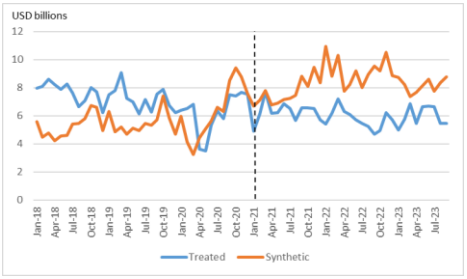
Chart 8

Germany's imports, actual and synthetic, by origin

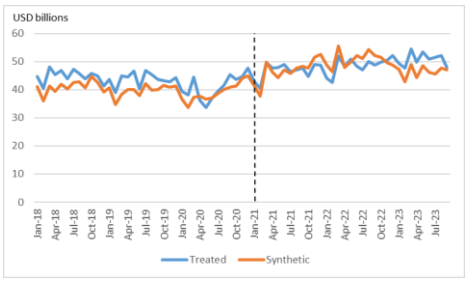
a) Total imports



b) Imports from the United Kingdom



c) Imports from the rest of the world (excluding EU)

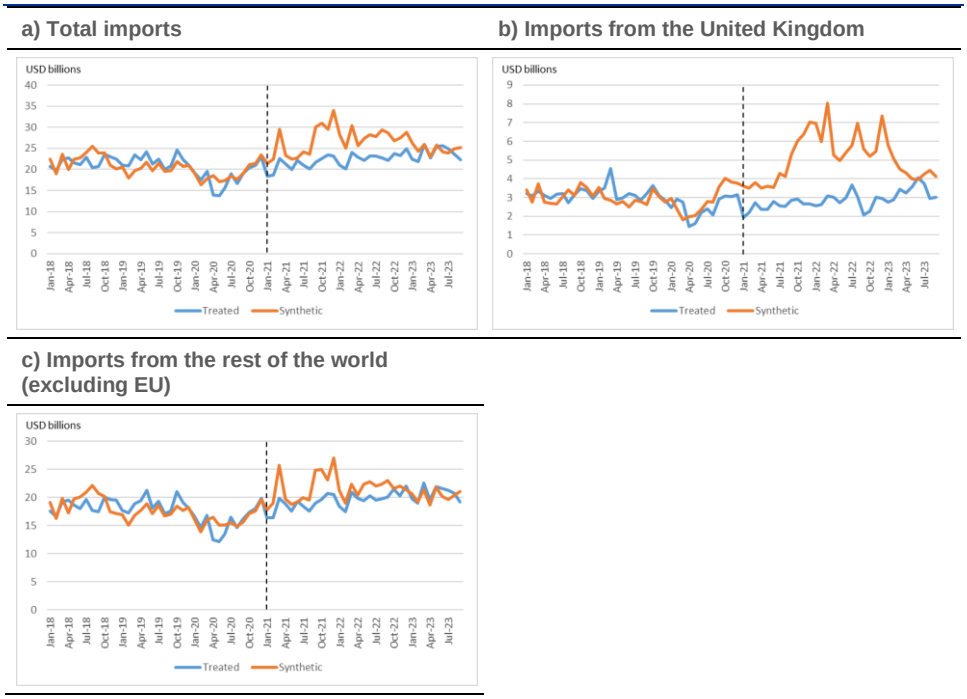


Source: Authors' estimation.

A similar pattern is evident for France, where the overall impact (-14.7%) is primarily attributed to a decrease in imports from the United Kingdom (-43.9%; Chart 9). The total gap compared with the counterfactual was substantial in 2021 and 2022 but narrowed in 2023, driven by a relative increase in imports from the rest of the world, notwithstanding a decrease in imports from the United States.

Chart 9

France's imports, actual and synthetic, by origin



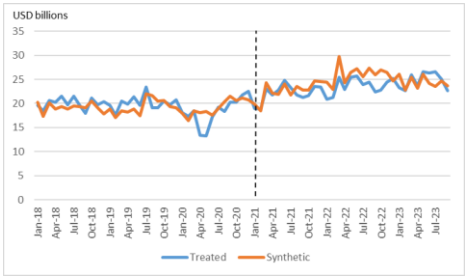
Source: Authors' estimation.

Italy is the least affected among the major EU economies (total imports decrease by -3.7%; Chart 10). It experienced only a small decline in imports from the United Kingdom following Brexit (-11.0%), while imports from the rest of the world showed a minimal overall impact (-2.8%), with an increase in imports from the United States.

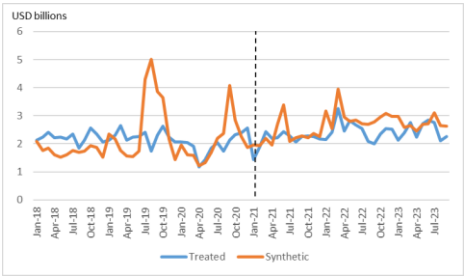
Chart 10

Italy's imports, actual and synthetic, by origin

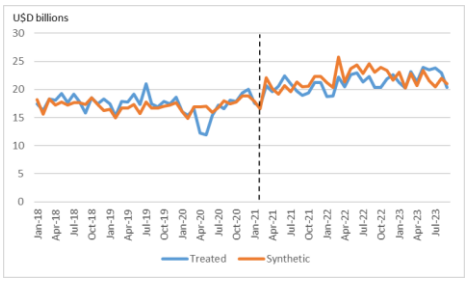
a) Total imports



b) Imports from the United Kingdom



c) Imports from the rest of the world (excluding EU)



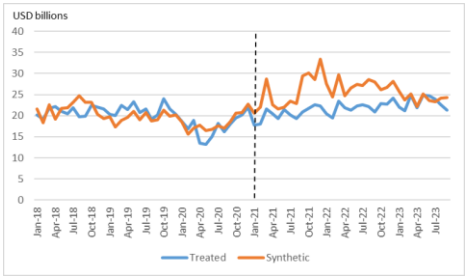
Source: Authors' estimation.

In Ireland's case, the impact of Brexit on import volumes is more pronounced (-15.4% overall, and -43.9% from the United Kingdom), due to the country's greater reliance on trade with the United Kingdom (Chart 11). Additionally, there is a negative effect on imports from the rest of the world (-8.4%), likely stemming from Ireland's historical use of the United Kingdom as a "land bridge" for its trade routes.

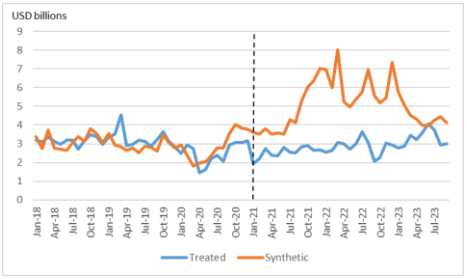
Chart 11

Ireland's imports, actual and synthetic, by origin

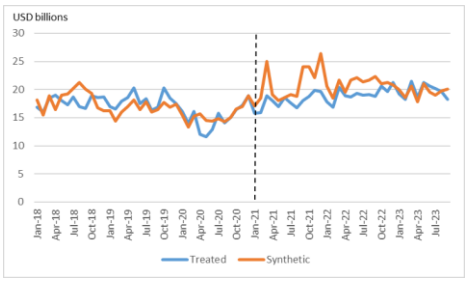
a) Total imports



b) Imports from the United Kingdom



c) Imports from the rest of the world (excluding EU)



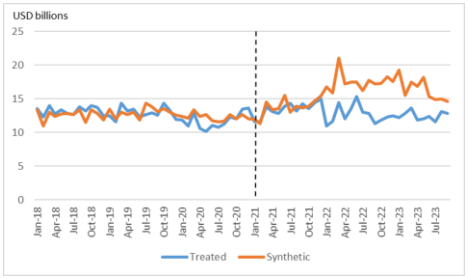
Source: Authors' estimation.

Similarly, in the Netherlands, the impact of Brexit on imports is significant (-18.5% overall and -52.5% from the United Kingdom), reflecting the importance of the United Kingdom's pre-treatment share in the country's trade (Chart 12). However, imports from the rest of the world remained unaffected by Brexit, with actual volumes closely aligning with the counterfactual levels.

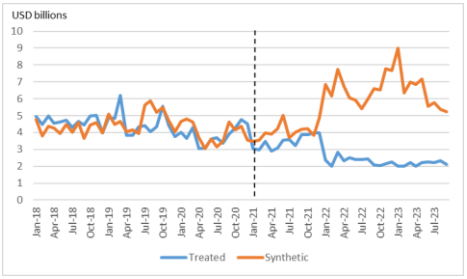
Chart 12

Netherlands' imports, actual and synthetic, by origin

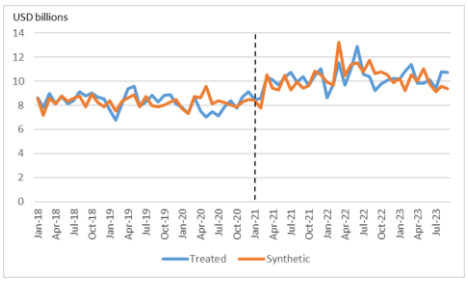
a) Total imports



b) Imports from the United Kingdom



c) Imports from the rest of the world (excluding EU)

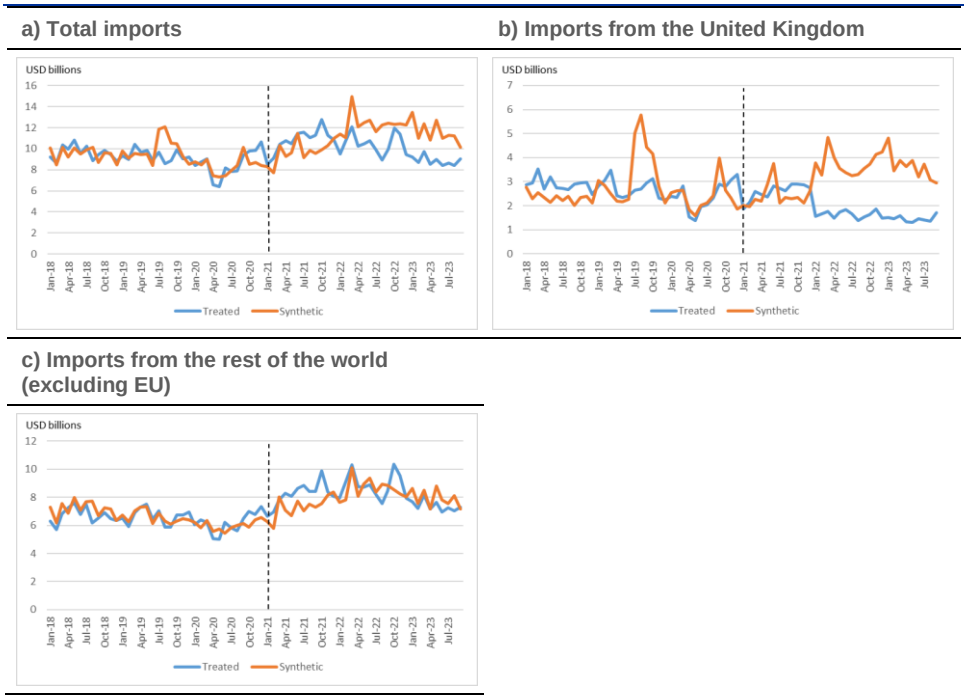


Source: Authors' estimation.

For Belgium (Chart 13), actual imports are lower than the counterfactual (-9.2%), primarily due to a significant reduction in imports from the United Kingdom (-40.1%). Imports from the rest of the world, however, are higher than the counterfactual levels (by 3.3%).

Chart 13

Belgium's imports, actual and synthetic, by origin



Source: Authors' estimation.

5.4.4 Concluding remarks

This study evaluates the impact of the EU's implementation of customs controls on EU-UK trade on 1 January 2021, using the synthetic control method. The analysis seeks to determine whether Brexit, which introduced non-tariff barriers to EU-UK trade, led to a redirection of trade flows for the United Kingdom. The findings reveal a significant decline, compared with a scenario of the United Kingdom's continued EU membership, in UK imports from most EU Member States, as well as from other developed economies, including the United States, Japan, Canada and Australia. In contrast, imports from China remained largely unaffected, though there is evidence of considerable sectoral variation. While the United Kingdom saw a modest increase in imports from smaller non-EU economies compared with the counterfactual, this was insufficient to offset the loss of trade with the EU and other advanced nations.

5.5 The impact of Brexit on European exports to the United Kingdom

By Juan Carluccio and Lionel Fontagné (Banque de France), and Makram Khalil (Deutsche Bundesbank).

5.5.1 Setting the stage

While the outcome of the 2016 Brexit referendum came as a surprise, the broad outlines of the TCA between the EU and the United Kingdom were widely expected, even if its actual conclusion was uncertain until the very end of the transition period. As a result, when the TCA came into effect in January 2021, the shock had been anticipated, despite margins of uncertainty about the operational details. In terms of trade in goods, the TCA established a zero-tariff free trade agreement, while imposing the wide range of European non-tariff measures (NTMs) applicable to imports from third countries, in addition to customs procedures.

While the depreciation of the pound after the Brexit referendum is a confounding factor[23], there were two exogenous shocks in addition to the TCA: the trade disruptions related to the COVID-19 pandemic; and the very sharp increase in freight rates that followed. Thus, the impact of Brexit might be confounded by a combination of several factors. The costs associated with the operational details of the United Kingdom's exit from the EU and its uncertainty costs, the depreciation of the pound and the two exogenous shocks obviously make it difficult to quantify what exactly falls under the Brexit heading.[24]

The first expected impact on trade patterns is therefore uncertainty: uncertainty before the vote on the outcome of the referendum, and uncertainty after the vote on the exact processes of the separation agreement. These two elements are expected to have played a role before the TCA entered into force.

In addition to such uncertainty, Brexit can be seen as a permanent increase in relative trade costs between the two sides of the Channel. Because of the NTMs and customs procedures, the United Kingdom has moved "further away" from the EU and "closer", in relative terms, to its other trading partners. The extent of the expected reorientation of trade depends on the scale of the additional costs imposed by the TCA, the elasticity of trade flows with respect to these additional costs, and the direction of the flows: the United Kingdom is a small partner for the EU, and it may be easier for the EU to find substitutes for UK products than vice versa.

In the absence of an easily defined counterfactual, one important question is with which control group the changing patterns of UK-EU trade should be compared. The other OECD countries are probably a potential control group; one could also compare trade with the EU27 with trade with the rest of the world, or, lastly, isolate the United Kingdom's traditional partners (the United States, Canada, Germany, France, Italy and Spain). None of these solutions is perfect, but comparing the results helps us to understand what ultimately occurred. We will proceed using monthly trade data.

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[23] Broadbent (2019) predicted that depreciation in the pound would temporarily boost UK exports. Ayele and Winters (2020) document that this was not the case.

[24] The introduction of the TCA in 2021 may also have amplified pandemic-induced bottlenecks in international trade, thereby hampering the recovery from the pandemic of exports to the UK in 2021. However, such interactions between the effects of the pandemic and Brexit have probably been less relevant more recently, as the pandemic-induced bottlenecks in international trade have disappeared.

In this section, we contribute to the strand of literature focusing on ex post outcomes of Brexit. In doing so, we focus on exports of the large EU economies to the United Kingdom. Moreover, we study not only nominal but also price-adjusted trade flows. This is important because the post-Brexit era overlapped with exceptionally high inflation at differing levels across trading partners.

Other studies confirm that the NTMs emerging from Brexit significantly reduced EU-UK trade, at least in the aggregate, after the TCA entered into effect. Freeman et al. (2022) conduct a difference-in-differences event study that benchmarks the evolution of UK trade with the EU against that of UK trade with the rest of the world. They absorb unobserved product-time and product-region shocks with fixed effects. In so doing, they control for confounding factors in terms of supply from exporters and demand from importers. The result is clear-cut: UK imports from the EU recorded a permanent 25% drop after the TCA, as opposed to UK exports to the EU, which suffered only a limited and transitory drop.[25] Using a control group comprising non-EU OECD origins and destinations plus BRICs, Gasiorek & Tamberi (2023) confirm that UK exports to the EU recovered rapidly after the sudden drop following the inception of the TCA, while EU exports to the United Kingdom did not recover, posting a 25% drop. The synthetic control method yields similar results.

As opposed to most of the literature, we have used the continental Europe perspective (e.g. German exports to the United Kingdom), rather than the UK perspective. We have focused on exports (rather than imports), mainly because they are directly relevant for a country's GDP.[26]

5.5.2 Data and methodology

We have used Trade Data Monitor, which provided HS6 monthly trade data for the four largest countries in the EU: Germany (DEU), France (FRA), Italy (ITA) and Spain (ESP), with a focus on these countries' exports. We created three country groups: United Kingdom, WEST (North America and the four largest EU Member States, i.e. Canada, France, Germany, Italy, Spain and the United States, excluding the country under analysis), and rest of the world (RoW) (the remaining trade partners). We selected product categories that were traded at least once in the 2010-15 period, excluding Harmonized System (HS) categories introduced after December 2015.

Two sub-categories of goods are of particular interest: those falling under HS01-HS24, loosely referred to as "food" (i.e. live animals, animal products, vegetable products, vegetable fats, prepared foodstuffs, beverages, spirits, vinegar and tobacco) and those involved in global value chains, referred to as "GVC goods". The latter are defined as products classified in the UN Broad Economic Categories

[25] As well as these aggregate figures, Freeman et al. (2022) find evidence of a negative impact of the TCA on the extensive margin of products exported from the United Kingdom to the EU, suggesting that small exporters (or small flows) had been forced out by the increase in the fixed costs of exporting to the EU.

[26] Of course, the import channel is also relevant for a country's GDP. Intermediate inputs are one major channel, as intermediate import flow distributions have adverse consequences for downstream production: see Khalil and Weber (2022).

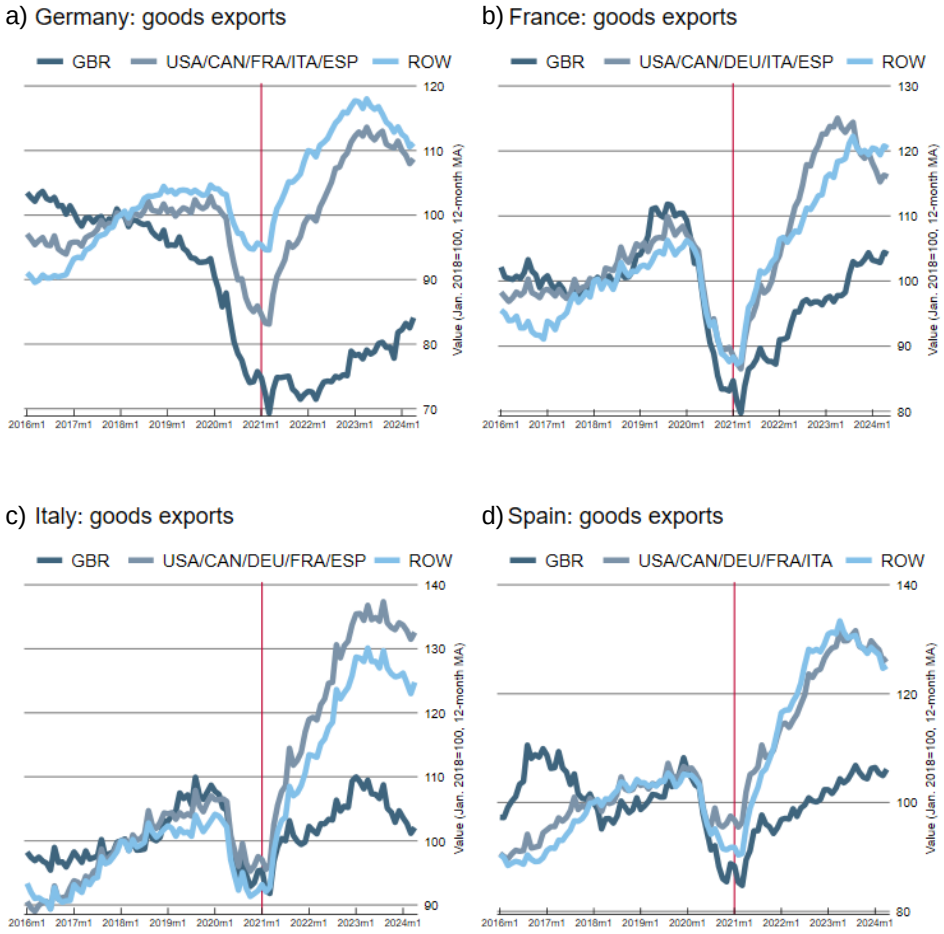
classification as intermediate, processed and specific products (the latter being processed goods that are only absorbed in certain industries).

For each month, we use 12-month-averages of bilateral exports. We consider both the value and the number of (HS6) products traded. The data covers the period from January 2015 to April 2024. We chose to use January 2018 as the base period, on the basis that at least the potential valuation effects of the steep depreciation in the pound in 2016 should have diminished by then.

5.5.3 Results: substantial lag in exports to the United Kingdom

We begin by reporting the evolution of overall trade values across the three trading partner groups. Chart 14 shows export flows in the largest four EU countries by export destination.

Chart 14
Export values by destination (all goods)



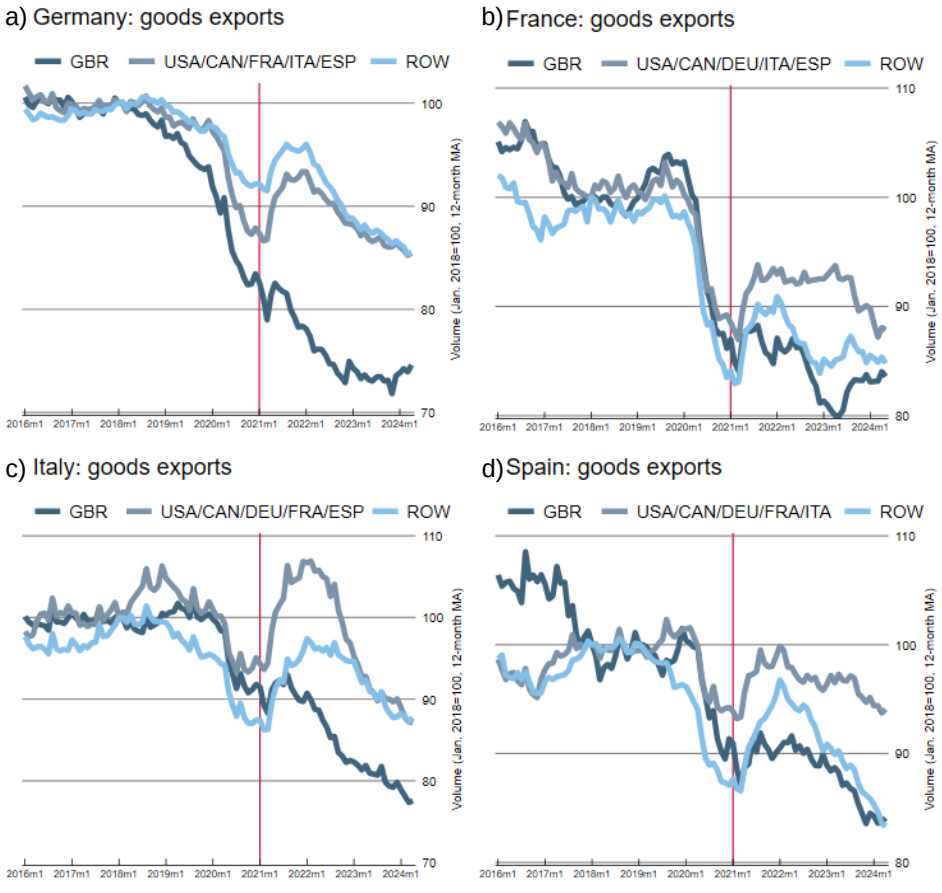
Source: Authors' calculations based on data from Trade Data Monitor.
Note: The red line marks January 2021, when the TCA came into effect.

The 2021-22 inflation surge shaped the evolution of nominal export flows. Nevertheless, nominal export flows to the United Kingdom remained remarkably subdued. For all four countries, exports to the United Kingdom in 2024 were not far from, or even below, 2018 levels, whereas exports to other regions grew considerably. This indicates that exports to the United Kingdom have been lagging behind substantially in recent years.

To control for the effects of shifts in the price level – which could vary across the three groups – we generated a Fisher price index for each group (UK, WEST, RoW) and used it to generate trade volume indices.[27] Chart 15 shows the resulting evolution of real export flows. The price-adjusted flows show that exports to the United Kingdom also fall behind exports to other regions in real terms, particularly exports to the WEST group.

Chart 15

Real exports by destination (all goods)



Source: Authors' calculations based on data from Trade Data Monitor.
Note: The red line marks January 2021, when the TCA came into effect.

[27] Our sample is subject to substantial adjustments in the extensive margin. To avoid spurious results due to shifts in the import composition when computing Fisher price indices (in early 2020, for instance) we compute the index based on products that are available over the whole time span. Moreover, we exclude products with a price change variance in the top percentile. This probably differs from the price adjustment procedures of statistical offices. However, for our main purpose of comparing different groups, it is sufficient to adjust for prices consistently across different groups.

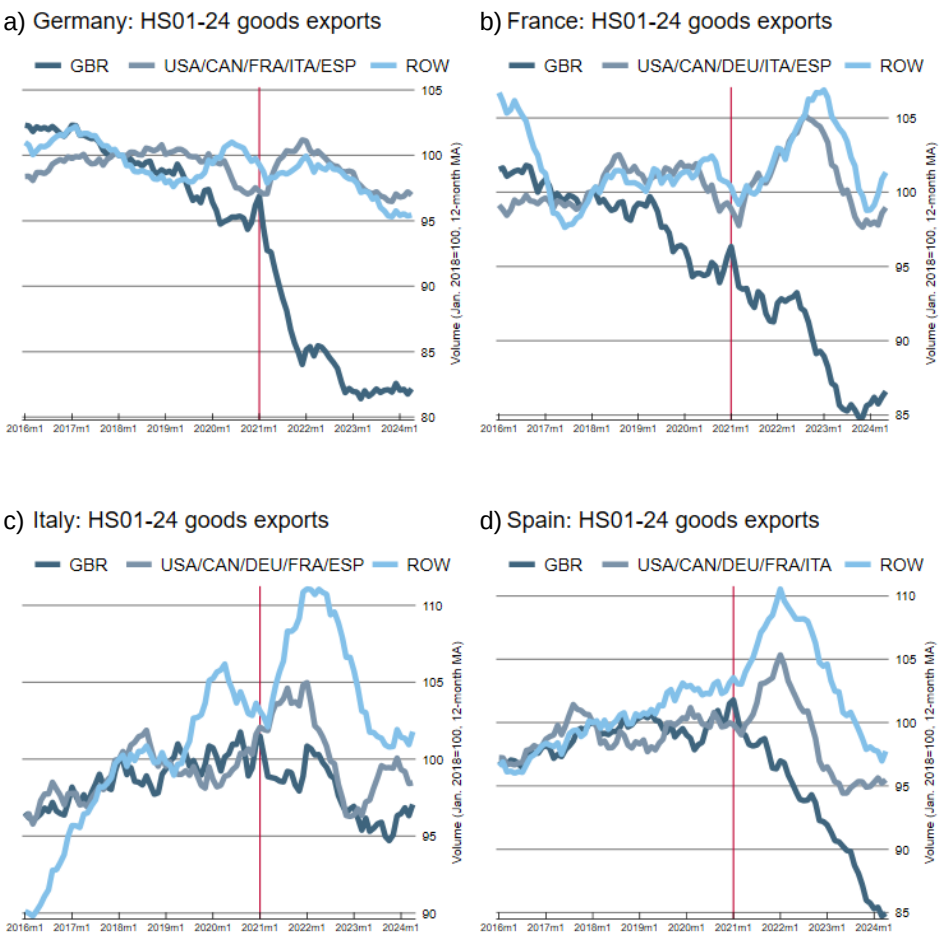
5.5.4 New trade barriers affect food exports…

The new trade regime between the EU and United Kingdom requires stricter border controls and creates additional bureaucratic hurdles for exporters. This has resulted in high costs for exporters and imposes new barriers to trade.

Products that are potentially greatly affected by such barriers are food-related products (HS01-24), as they are less durable and rely heavily on transport between the two jurisdictions. Chart 16 indeed shows a substantial decline in real exports to the United Kingdom of such goods in recent years. For Germany, France and Spain, exports to the United Kingdom are 15% to 20% below the 2018 level; for Italy, the corresponding drop is slightly less significant. This decline followed the implementation of the EU/UK trade agreement in 2021.

Chart 16

Real exports by destination (food and related products, HS01-24)

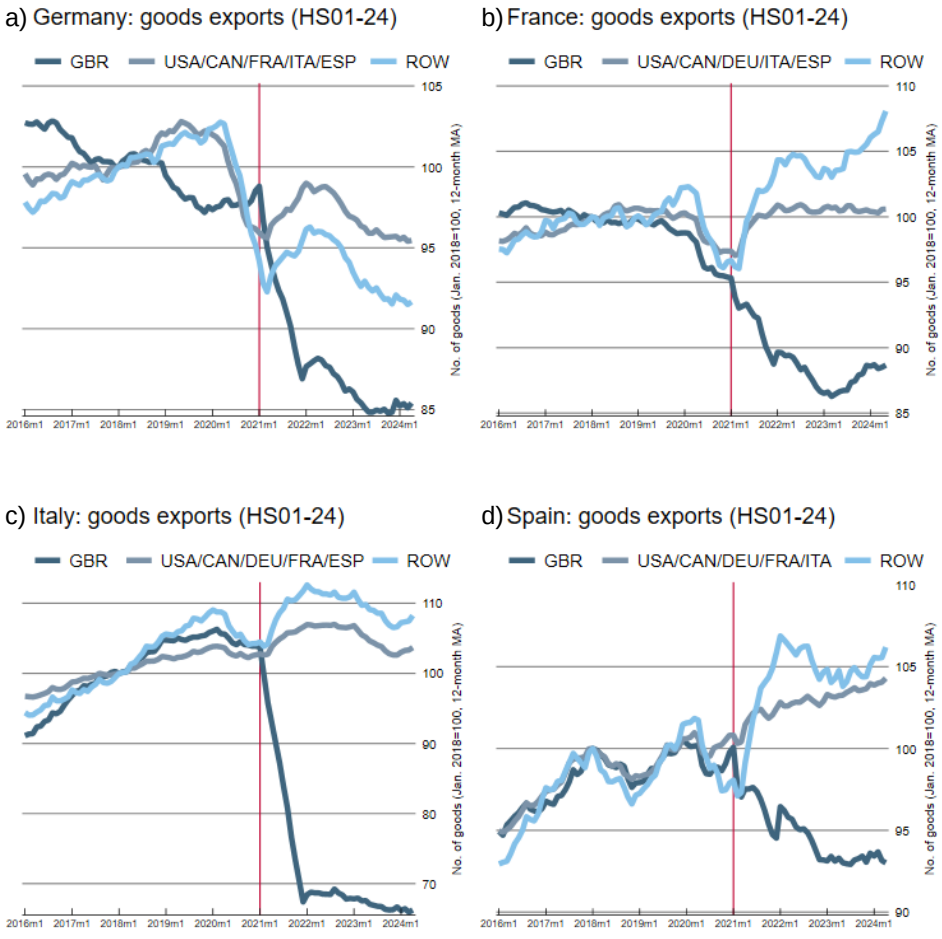


Source: Authors' calculations based on data from Trade Data Monitor.
Note: The red line marks January 2021, when the TCA came into effect.

In addition, we find that the number of food products exported to the United Kingdom – i.e. the extensive margin – has declined substantially for all four countries (Chart 17).[28]

Chart 17

GER, FRA, ITA, ESP: exports by destination: number of products (food and related products, HS01-24)



Sources: Trade Data Monitor and authors' construction.
Note: The red line marks January 2021, when the TCA came into effect.

5.5.5 …and distort GVC trade

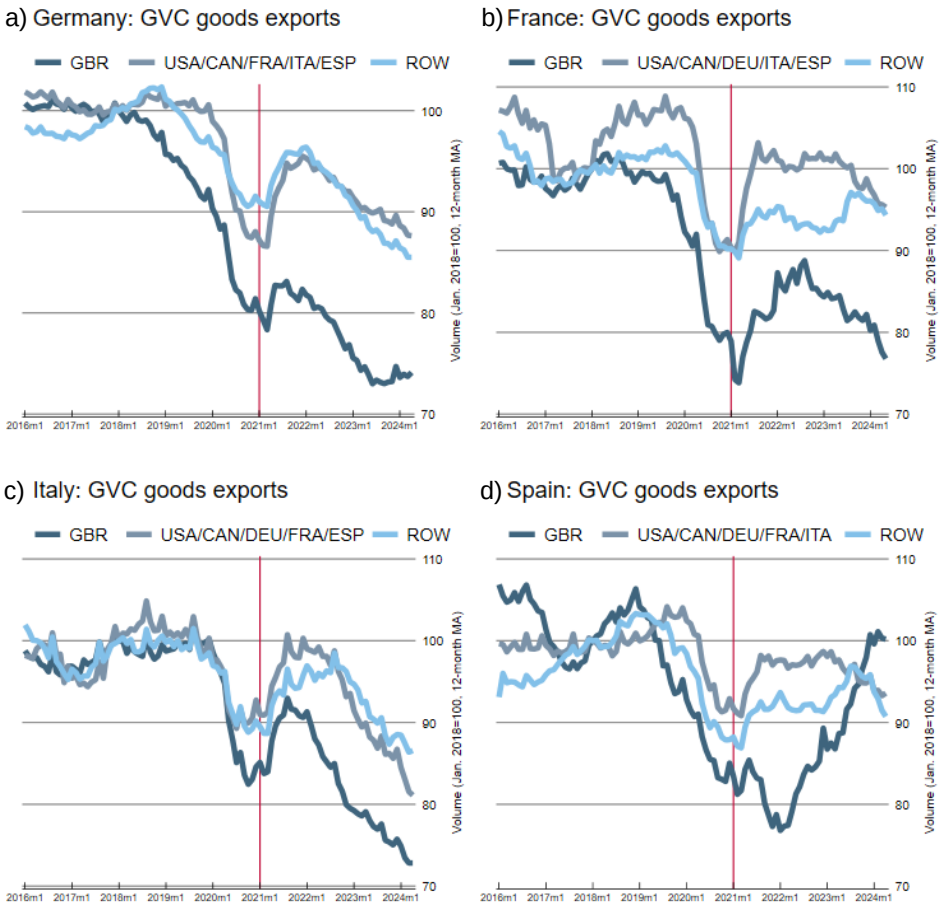
Our granular trade data allows us to focus on trade flows within cross-border value chains. In particular, we have used the broad economic categories (BEC) to classify

[28] Charts 16 and 17 indicate that the extensive margin is not the main driver behind the decline in real exports due to Brexit. For instance, according to Figure D, for Italy, the number of product exports to the UK declined steeply when the TCA went into effect, but real exports to the UK did not fall to the same degree. This mainly reflects the fact that products that exited after 2021m1 only accounted for a very small fraction of overall exports to the UK before the TCA came into force.

GVC-related goods. Chart 18 shows that the volume of value chain trade was clearly interrupted by Brexit. In the largest EU economies – Germany, France and Italy – GVC trade was between 20% and 30% below its level at the beginning of 2018. Moreover, exports to the United Kingdom are clearly below the comparison groups. Spain is an exception, as real exports are close to its 2018 level and stand above exports to other countries.[29]

Chart 18

Real exports by destination (GVC goods)



Source: Authors' calculations based on data from Trade Data Monitor.
Note: The red line marks January 2021, when the TCA came into effect.

5.5.6 Conclusion

Overall, we find that Brexit had a substantial impact on exports to the United Kingdom, especially after 2021, when new non-tariff barriers and customs procedures resulted in a permanent increase in relative trade costs between the United Kingdom and countries in the EU. The decline in trade in products highly

[29] However, in nominal terms, Spanish exports to the UK also fell behind exports to other regions.

exposed or highly sensitive to an increase in trade costs, such as food products or GVC products, confirms this general pattern.

5.6 Recent developments in EU-UK trade in services after Brexit

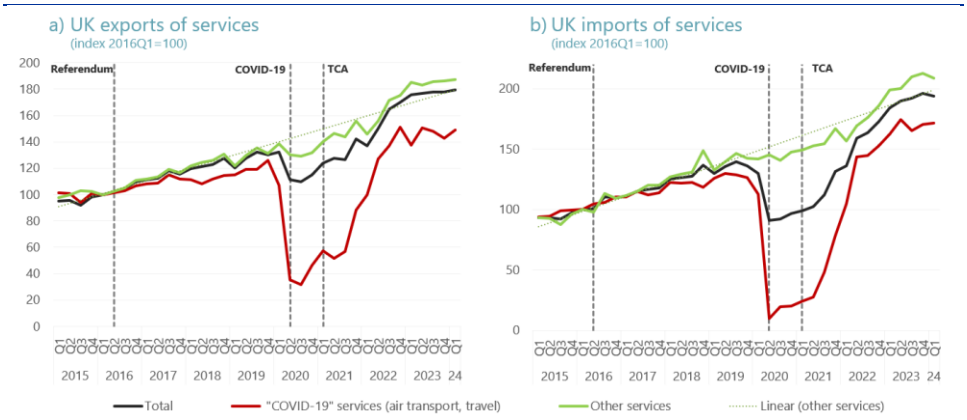
By Sarah El Joueidi (National Bank of Belgium).

In this section, we turn our attention to trade in services to investigate in detail how its developments were shaped by the end of the transition period, sector by sector.

The United Kingdom's recent trade performance in services has been much stronger than in goods. The service sector has generally grown steadily in recent years. Both exports and imports of services increased consistently until 2020, when the COVID-19 pandemic caused a sharp decline, particularly in air transport and travel categorised as "COVID-19" services (Chart 19). While most service areas rebounded strongly, surpassing pre-pandemic levels by 2022, travel-related services have recovered more slowly. Overall, the service sector – especially outside air transport and travel – has shown robust post-pandemic growth in both exports and imports, with Brexit's impact on UK trade in services appearing relatively limited.

Chart 19

UK trade in services with the EU



Source: ONS.
Note: Data breakdown by account, seasonally adjusted and in current prices.

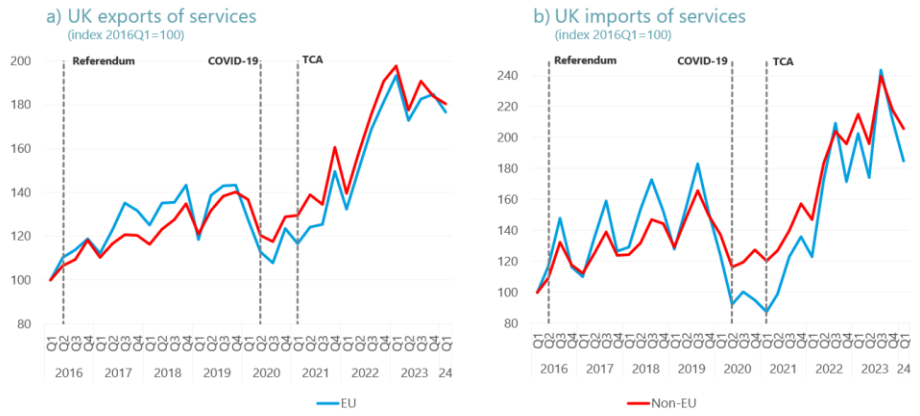
A key recent development in UK trade in services is the shifting balance between trade with EU and non-EU countries. In 2023 the United Kingdom exported GBP 171 billion in services to the EU and GBP 299 billion to non-EU countries, while imports reached GBP 147 billion from the EU and GBP 170 billion from non-EU countries.[30] Trade with the EU has grown more slowly since Brexit and the COVID-19 pandemic compared with trade with the RoW. As shown in Chart 20, both exports and imports of services with EU and non-EU countries grew steadily before declining sharply in 2020, due to the pandemic. Following this drop, service exports and imports

[30] Source: ONS, Balance of payments; data in current prices, non-seasonally adjusted.

rebounded strongly in 2022. However, from late 2019 the non-EU exports index started to surpass that of EU exports. At the same time, imports from non-EU countries have also grown slightly faster than imports from the EU. Between 2019 and 2023 the United Kingdom's index of service exports (in value, not adjusted for seasonality and in current prices) to the EU grew by 34.9%, while the non-EU exports index increased by 41.1%, signalling stronger growth with non-EU markets. Similarly, the index for service imports from the EU rose by 34.8%, while the non-EU imports index records a higher growth rate of 46.6%. These figures underscore that over this period, non-EU trade, in both exports and imports, experienced faster growth than EU trade.

Chart 20

UK trade in services with the EU and the RoW



Source: ONS.
Note: Data not adjusted for seasonality and in current prices.

In air transport and travel services, the index of exports to non-EU countries has consistently outpaced the index of exports to the EU since 2020 (Chart 21). This trend emerged during the COVID-19 pandemic and has since stabilised. EU citizens appear to be travelling less to the United Kingdom since Brexit and the COVID-19 pandemic. In financial services, a gap appeared between exports to the EU and exports to non-EU countries in around 2020, with the non-EU exports index significantly outperforming the EU exports index. However, this gap has narrowed in recent years (2022-24), as UK exports to the EU have gradually recovered, likely influenced by the TCA.

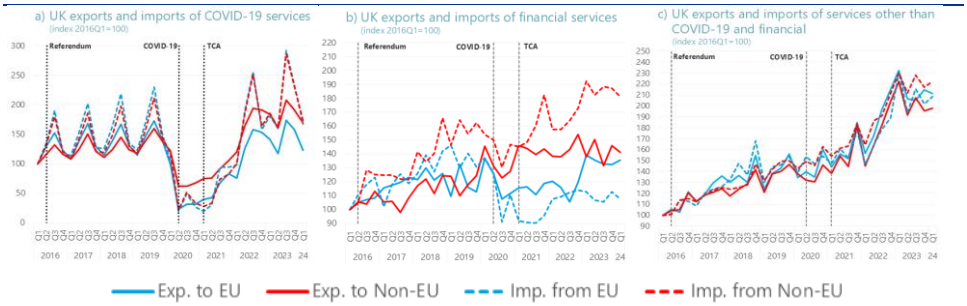
Imports of financial services from non-EU countries have increased significantly, particularly following the TCA (2021), while imports from the EU have either stagnated or grown more slowly. Indeed, UK imports of financial services from the EU have remained relatively low since Brexit and the COVID-19 pandemic, with the TCA seemingly having little impact on narrowing this gap.

For other services (excluding COVID-19-related and financial services), both EU and non-EU regions recorded growth, with the non-EU exports index slightly outpacing the EU exports index after 2021. Similarly, imports of other services from non-EU countries have outperformed those from the EU. Since Brexit and the pandemic, UK

trade has increasingly shifted towards non-EU countries, reflecting a shift in trade dominance.

Chart 21

UK trade in services with the EU, by category



Source: ONS.

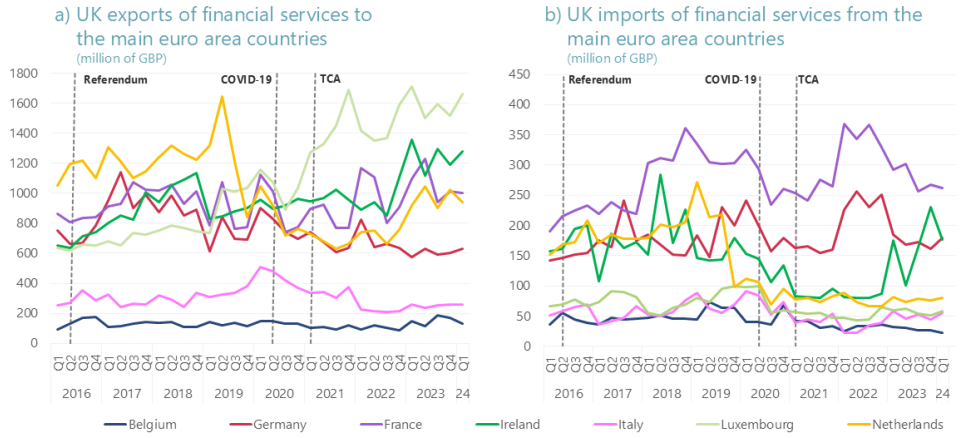
Notes: COVID-19 services include air transport and travel services. Data not adjusted for seasonality and in current prices.

The change in UK trade dominance between EU and non-EU countries is particularly important in financial services. Trade patterns with EU countries have evolved in distinct directions, showing notable heterogeneity in financial services trade between the United Kingdom and individual EU countries. Chart 22 illustrates UK exports and imports of financial services with some euro area countries from 2016 to 2024. On the exports side (panel a), UK exports of financial services to Luxembourg showed significant growth, starting in 2020 and continuing to rise following the TCA, making Luxembourg the largest recipient. Ireland also experienced substantial growth post-TCA. France registered steady growth, though with some fluctuations, while exports to Germany remained relatively stable. Exports to the Netherlands dropped sharply from 2019 but have shown signs of recovery since 2022. Exports to Belgium and Italy remained consistently lower throughout the period.

On the imports side (panel b), France emerged as the leading source of financial services imports, with volumes increasing post-TCA, after a decline during the pandemic. Imports from Germany remained stable, apart from a slight dip during the COVID-19 period. Ireland showed some fluctuations but recorded a marked increase in 2023. Conversely, imports from the Netherlands declined significantly after 2019 and have yet to recover. Imports from Italy and Belgium remained consistently low throughout the period.

Chart 22

UK trade in financial services with selected euro area countries



Source: ONS.
Note: Data not adjusted for seasonality and in current prices.

Box 1

The effect of Brexit on UK citizens travelling abroad

By St. Panagiotou and M. Vasardani (Bank of Greece).

Following the Brexit referendum on 23 June 2016 and the triggering of Article 50 of the Treaty on European Union (TEU)[31] on 29 March 2017, the United Kingdom entered into lengthy and cumbersome negotiations with the EU over the WA. The uncertainty caused by the Brexit referendum and the several subsequent delays in the Brexit process may have influenced the United Kingdom's trade relations in goods and services, including tourism. The formal departure of the United Kingdom from the EU took place in January 2020, followed by a transition period that ended on 31 December 2020.

The aim of the analysis is to investigate whether Brexit affected outbound tourism from the United Kingdom in the post-referendum period and whether this effect was uneven between EU and non-EU destinations, namely North America, which en bloc represents the EU's main competitor in the provision of travel services to UK residents. Tourism is an important component of tradable services, and therefore aggregate economic activity in several EU countries, with the United Kingdom being one of the top origin countries. The nature of Brexit uncertainty differed substantially from that of a typical uncertainty shock, due to its length, breadth and political complexity. Such a persistent shock could create significant volatility in travel flows and expenditure. Brexit could also shift expectations about future income and wealth, which, compounded with heightened policy uncertainty, could affect the UK economy even before the actual change in policy occurred.

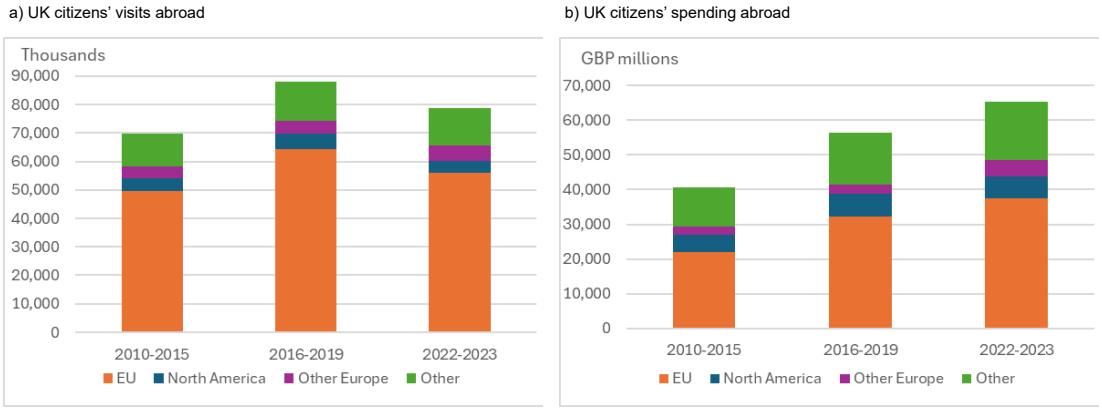
However, after the Brexit referendum in June 2016 there was an increase in both visits by UK citizens to the EU and their expenditure while there. Comparing the period before the Brexit referendum (2010-2015) with the period following the referendum and before the pandemic (2016-2019), the proportion of UK citizens' visits to the EU and their spending increased slightly, reaching roughly 70% of total visits and 57% of total tourist expenditure in the EU.

[31] Consolidated version of the Treaty on European Union (OJ C 326, 26.10.2012, p. 13).

The increase in expenditure primarily reflected a rise in the number of visits, as well as the spending amount per night, as the number of nights spent abroad remained almost unchanged. Meanwhile, the increase in the number of visits to the new EU Member States (post-2004) was greater than in visits to the EU-15. By contrast, in North America, the increase in both visits and expenditure by UK citizens was smaller than that experienced by the EU, resulting in a decrease in the corresponding percentages (Chart A).

Chart A

UK tourism indicators



Source: ONS.

To get a clearer view of the effect of Brexit uncertainty on UK tourism flows and expenditure, we use the autoregressive distributed lag (ARDL) bounds testing methodology (Pesaran, Shin and Smith, 2001), as it has a number of advantages that make it suitable for this empirical work, namely the better small-sample properties and the single equation set-up.

The estimated model is:

$$TOURISM_t = f(RGDP_t, RER_t, BREXIT_t) \quad (1)$$

where $TOURISM_t$ indicates either the visits or expenditure of the UK residents abroad, $RGDP_t$ is UK real GDP, RER_t is the real exchange rate of the pound (nominal exchange rate adjusted by the relative prices in the United Kingdom and the destination), and $BREXIT_t$ is a dummy variable, equal to that of the second quarter of 2016. The data are quarterly and seasonally adjusted, where needed, and sourced from the UK ONS, except for the exchange rates (ECB). The period of analysis is from the second quarter of 2004 to the second quarter of 2019.[32]

Our analysis indicates that the Brexit referendum had a positive effect on the visits of UK citizens abroad to both the EU and North America.[33] However, the effect on expenditure was ambiguous: it was positive for travel to the EU, but not statistically significant for travel to North America (Table A).

[32] The model was not estimated post-2019, as it was not feasible to disentangle the effects of COVID-19 from those of Brexit. In a more recent analysis, Forster-van Aerssen and Spital (2023) argue that most of the initially stronger decline in UK services trade with the EU appeared to be pandemic-related, particularly given that travel and transportation make up a higher proportion of EU trade than non-EU trade, and in view of the travel restrictions during the pandemic. Together with the recovery in tourism, UK services trade has bounced back, amply exceeding pre-pandemic levels.

[33] In an alternative specification, the Economic Policy Uncertainty Index was also included, but did not seem to contribute to the explanatory power of the model.

Table A

Empirical results

Dependent	UK visits to:		UK spending in:	
	EU	North America	EU	North America
Constant	-4.63**	-0.59	-19.01**	-5.84
	(-3.75)	(-0.16)	(-3.17)	(-1.07)
log(UK GDP)	1.63**	0.57**	2.06**	0.95*
	(6.63)	(2.06)	(4.54)	(2.29)
log(RER)	-0.45**	-0.41**	-2.05**	-1.15**
	(-3.74)	(-2.79)	(-10.29)	(-4.81)
Brexit dummy	0.07**	0.12**	0.05*	0.05
	(2.76)	(2.83)	(2.63)	(1.23)
Based on conditional ECM				
Cointegration coefficient (1)	-0.55**	-0.71*	-0.43**	-0.62

Notes: ** and * indicate significance at 1% and 5%, t-values in parenthesis; (1) significance is determined on the bases of the bounds t-statistic estimated by Pesaran et al. (2001). The model passes all χ^2 diagnostics tests for the hypotheses of absence of serial correlation (LM test up to four lags), homoscedasticity (Breusch-Pagan-Godfrey test), and normal distribution of residuals (Jarque-Bera test).

Although one would expect the heightened economic policy uncertainty caused by Brexit to temporarily dampen UK travel outflows post-referendum, the positive effect of Brexit on these flows could reflect the fear of possible future barriers to travel between the EU and the United Kingdom, resulting in the frontloading of demand for travel services. Our results are in line with several studies in the literature. For example, Douch and Edwards (2021), using the synthetic control method, found that the UK tourism sector had experienced a positive shock. Earlier work from Perles-Ribes et al. (2019) also confirms that Brexit did not produce any initial negative effect on the arrival of British tourists or on their spending in Spain.

In sum, Brexit seems to have had a muted and positive impact on tourism inflows from the United Kingdom to the EU. Our analysis indicates that the Brexit shock did not cause protracted disruptions to the travel preferences and patterns of UK residents. This also suggests that the "drop-rebound-overshoot" (Bloom, 2009) hypothesis of an economic policy uncertainty shock did not hold for the Brexit episode. After the pandemic, in the period 2022-23, the total expenditure of UK citizens in the EU continued to increase, due to the changes in spending amount per night and in nights per visit, despite the decrease in the number of visits and the post-pandemic increase in travel prices. The EU continued to outperform North America in attracting UK tourists.

6 Monitoring EU-UK FDI links following Brexit

Prepared within the remit of the International Relations Committee EU-UK Network by Ana M. de Almeida (Banco de Portugal), Graeme Walsh (Central Bank of Ireland), Horatiu Lovin (Banca Naţională a României), Marek Benda (Česká národní banka), and Wilko Bolt (De Nederlandsche Bank).

6.1 Introduction

This section provides an in-depth analysis of developments in EU-UK FDI links after Brexit, using available data up to the end of 2024.

Section 2 includes a comprehensive overview of trends in FDI flows between the EU and the United Kingdom since Brexit, and includes a detailed look at new FDI projects created in the United Kingdom, as well as the new jobs associated with them. The main sources used in this section are the FDI databases of the European Union Statistical Office (Eurostat)/OECD and of the UK ONS. The relevant period starts in May 2015, when the United Kingdom decided to hold a referendum on its EU membership, covers its accomplishment in June 2016 and the subsequent beginning of the new EU-UK relationship in January 2021, which overlapped with the COVID-19 pandemic, and ends in 2023. Countries of origin/destination, sectors of economic activity, FDI income and the activities of foreign affiliates are also presented. The data on FDI new projects and jobs created in the United Kingdom are from the UK Department for Business and Trade (DBT) and the Ernst & Young European Investment Monitor (E&Y EIM). EU-UK FDI stocks data are also disclosed.

Since the second quarter of 2016 net FDI flows between the EU and the United Kingdom decreased gradually, according to Eurostat data, in both directions. By the end of the transition period in the fourth quarter of 2020 there were steep increases in UK equity investments in the EU, potentially indicating business relocations from the United Kingdom to the EU. About 50% of EU investments in the United Kingdom originated from the Netherlands, Germany and Belgium, while 60% of UK investments in the EU went to the Netherlands and Germany. Large disinvestments also occurred between Luxembourg and the United Kingdom in the period to the fourth quarter of 2022, potentially for tax reasons. In terms of sectors of economic activity, in the period 2017-22, the EU invested in UK mining and other services, while making disinvestments from manufacturing, and particularly financial activities. Conversely, the largest UK investments were registered in the EU manufacturing sector and largest disinvestments were recorded in financial activities. The number of new FDI projects in the United Kingdom fell, according to the UK DBT, from almost 2,300 in 2016-17 to over 1,550 in 2023-24. According to Eurostat, the activity of EU foreign affiliates in the United Kingdom has been declining in the financial sector since at least 2020. The contribution of the United Kingdom’s foreign affiliates

in the EU remained sizeable, but the turnover of rest of the world foreign affiliates in the financial sector was much higher in 2021 than that of affiliates from the United Kingdom, indicating some UK FDI decoupling from the EU in that sector.

Section 3 looks at recent trends in the UK financial sector since Brexit, beginning with a conjunctural analysis of real economic activity, including output and jobs, before turning to FDI flows. We also provide the latest trends from a variety of financial sector datasets related to FDI, such as the ESCB, the Register of Institutions and Affiliates Database (RIAD), the European Insurance and Occupational Pensions Authority (EIOPA), the Global Financial Centre Index and the European Securities and Markets Authority (ESMA). Lastly, a concluding comment is provided to help interpret recent trends in the sector.

UK financial services jobs have been volatile since the end of the transition period, with, according to ONS, fewer than 3,000 jobs created. At the same time, almost 500 financial firms have relocated from the United Kingdom to the EU, moving jobs, setting up hubs and/or transferring assets. The main destinations for relocation are Frankfurt, Paris, Amsterdam, Dublin and Luxembourg. Financial sector UK FDI inflows from the EU surged in 2016, 2019 and 2021, particularly from the Netherlands, which suggests potential Brexit-related activity in the sector. This compares with an average below historical levels. For financial sector UK FDI outflows to the EU, there were negative outflows or disinvestments following the global financial crisis, and this pattern was reversed in 2017 and 2020, when positive outflows were recorded, potentially indicating Brexit-related activity in the sector. In 2021 there was again a financial sector disinvestment to the EU. The number of EU members of UK financial groups, according to the ECB, increased from 100 in the fourth quarter of 2015 to 246 in the fourth quarter of 2023, mainly driven by non-banking groups, primarily insurance corporations. The increase actually observed by the EIOPA in UK participations in the EU insurance corporations and pension funds sector may be due to the loss of passporting after the end of the transition period in the fourth quarter of 2020 and to differences in equivalence granted by the two geographical areas.

Section 4 uses a gravity-type modelling approach with synthetic difference-in-differences to identify changes in the relationship of bilateral FDI flows and stocks between the EU and the United Kingdom after the latter's decision to leave the EU. This difference-in-differences technique tests whether EU countries adopted different investment strategies for the United Kingdom from those applied to other EU countries after the referendum.

The gravity model results showed that, from the time of the Brexit referendum until 2023, EU FDI flows in the United Kingdom declined by 3.9%, and UK FDI flows in the EU also decreased by 4.0%, compared with the pre-referendum period starting in 2010. When very large transactions, most taking place after the beginning of the new EU-UK relationship in January 2021, were excluded from the estimation, these coefficients turned into increases of 5.5% and 5.6% respectively, suggesting an increase in FDI flows in both directions in that period. Particularly large FDI outflows between the United Kingdom and major EU financial centres, such as Luxembourg and the Netherlands, could potentially indicate some decoupling from the EU of

London as a major global financial centre since the Brexit referendum, highlighting the significant challenge posed by the United Kingdom's exit from the EU, particularly to the financial sector.

Section 5 summarises the main findings.

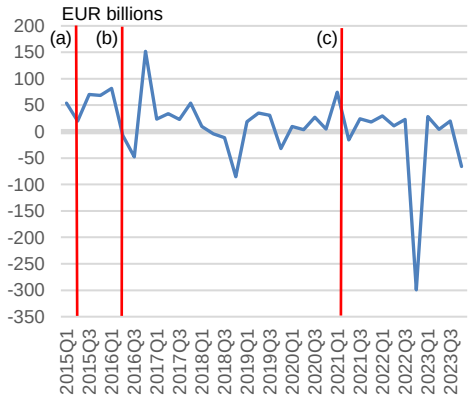
6.2 Recent developments in EU-UK FDI since 2016

6.2.1 FDI descriptive analysis

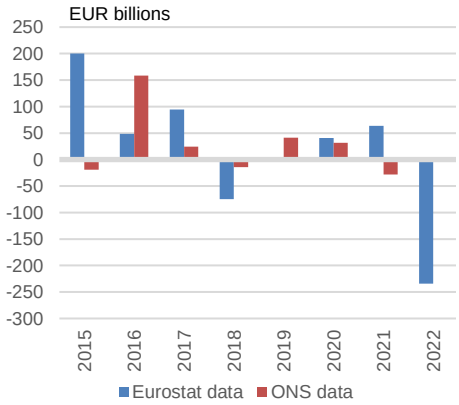
EU-UK FDI flows declined after the referendum, but have partially recovered since 2021. The United Kingdom's decision, in May 2015, to organise a referendum on EU membership, and the referendum outcome in June 2016, resulted, according to Eurostat data, in a temporary increase of FDI flows from EU countries to the United Kingdom, along with greater volatility. FDI flows record the value of cross-border transactions related to direct investment during a given period, usually a quarter or a year. After the referendum, FDI flows stabilised below the pre-referendum level, while the effects of the COVID-19 pandemic and the beginning of the new EU-UK relationship in 2021 had no sizeable impact on EU-UK FDI flows. The partial recovery of EU FDI in the United Kingdom from 2019 was, for the most part, a consequence of more stable flows following disinvestments by EU companies. The EU resumed investments in the United Kingdom at the beginning of the new EU-UK relationship in 2021, but net FDI flows remained at 25% of the pre-referendum level. Nevertheless, sizeable withdrawals between Luxembourg and the United Kingdom took place in the fourth quarter of 2022 (Figure 1, panel a).

Figure 1
FDI flows from EU countries to the United Kingdom

a) EU FDI in the United Kingdom, net (balance of payments-asset/liability principle)



b) EU FDI in the United Kingdom, net (directional principle)

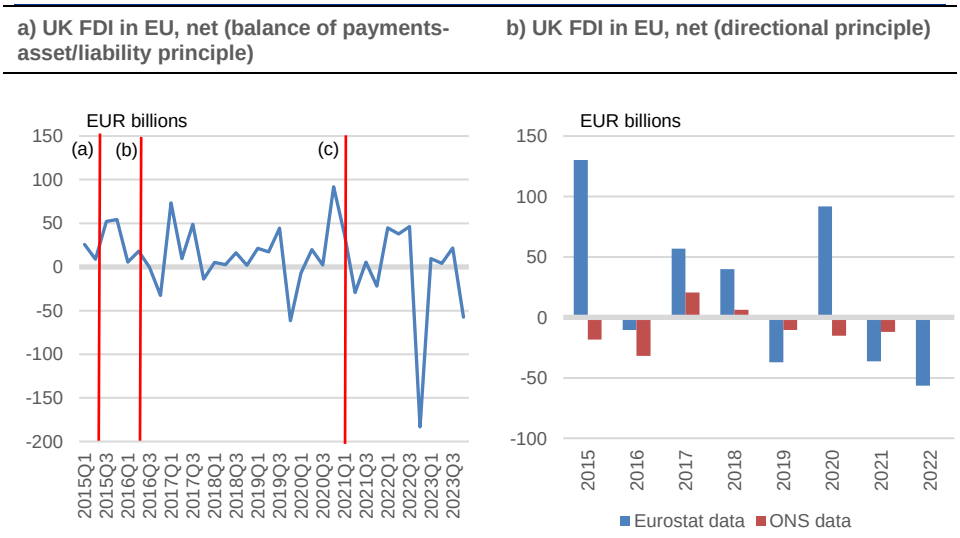


Source: Eurostat.
Notes: (a) In May 2015 the European Union Referendum Act 2015 was introduced to the House of Commons. (b) In June 2016 the UK-EU membership referendum took place. (c) In January 2021 the new relationship between the EU and the United Kingdom began. Quarterly data compiled based on balance of payments-asset/liability principle; annual data compiled based on directional-inward/outward principle.

Statistical differences between Eurostat and the ONS emphasise how important the methodology is in measuring FDI flows. The data published by Eurostat and the ONS do not align fully, but the overall trend in FDI flows between the EU countries and the United Kingdom is confirmed by both data sources (Figure 1, panel b). The discrepancies between the series can be explained by differences in the methodologies used by Eurostat and the ONS when compiling the statistics (Annex I).

The volatility of EU-UK FDI flows was moderate after the referendum, but sensitive to an episode of very large outflows. For UK FDI in the EU countries, according to Eurostat data, the volatility of FDI flows temporarily increased in the aftermath of the UK-EU membership referendum, and re-emerged in the 2019-20 period. After 2021, when the new relationship between the EU and the United Kingdom began, net EU-UK FDI flows declined, but surged in the first quarter of 2022. Moreover, in the fourth quarter of 2022 there was a symmetrical retreat from UK investments in Luxembourg, which was the largest quarterly FDI outflow between the United Kingdom and an EU country in the period in question (Figure 2).

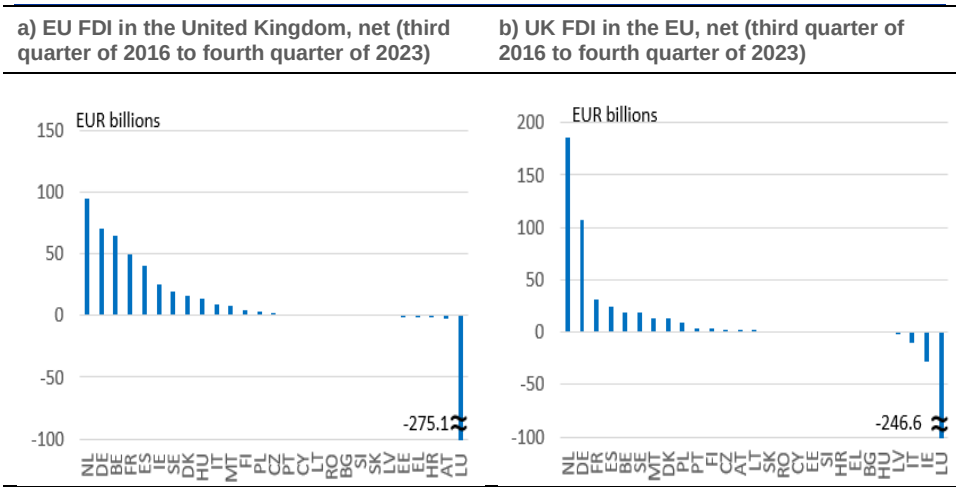
Figure 2
FDI flows from the United Kingdom to EU countries



Source: Eurostat.
Notes: (a) In May 2015 the European Union Referendum Act 2015 was introduced to the House of Commons. (b) In June 2016 the UK-EU membership referendum took place. (c) In January 2021 the new relationship between the EU and the United Kingdom began. Quarterly data compiled based on balance of payments-asset/liability principle; annual data compiled based on directional-inward/outward principle.

Most EU-UK FDI flows have been carried out by a very few EU countries. The concentration of EU-UK FDI flows by country after the UK-EU membership referendum was significant. About 50% of EU investments in the United Kingdom originated from the Netherlands, Germany and Belgium, while over 60% of UK investments in the EU went to the Netherlands and Germany. Large disinvestments also occurred between the United Kingdom and Luxembourg in the fourth quarter of 2022, potentially for tax reasons (Figure 3 and Boxes 2 and 3).

Figure 3
EU-UK FDI flows by country after the UK-EU membership referendum



Source: Eurostat.
Note: Data compiled based on balance of payments-asset/liability principle.

Box 2
FDI flows between the Netherlands and the United Kingdom

In addition to the substantial trade flows between the United Kingdom and the Netherlands, bilateral NL-UK FDI flows were also significant, further underscoring the strong interdependence of the UK and Dutch economies.

By investing in foreign subsidiaries, firms and enterprises can benefit from both production scale-up and locally available production factors. In this way, FDI boosts productivity and capital allocation, while improving competition and technology transfer. However, some enterprises may also be active abroad for other reasons, especially tax and legal motives that drive (re)location decisions. In this context, the Netherlands has played a central role in attracting holding companies and so-called special financial institutions (SFIs). These location and relocation decisions of holding companies and SFIs have caused considerable volatility in FDI flows during recent years. Generally, this type of foreign investment, which exists solely "on paper", does not add much economic value, as these (large) holding companies usually have few employees – many of them with no physical presence in the Netherlands – and any trading activity mainly consists of intra-concern financial activities (Statistics Netherlands, 2024). Nevertheless, correcting for the presence of these "channelling entities", the Netherlands remains one of the largest players worldwide. In 2023 the Netherlands ranked second (after the United States) in terms of outward FDI, with €1,565 billion (excl. holdings and SFIs), and fourth for inward FDI (after the United States, China and the United Kingdom) with €1,262 billion (excl. holdings and SFIs).[34]

Bilateral direct investments between the Netherlands and United Kingdom have also traditionally been important. The top destination for UK FDI in 2022 was the United States (accounting for 26.9% of total UK outward FDI stock), followed by the Netherlands (15.8%) and Luxembourg (6.3%).[35] For inward FDI, the top investor in the United Kingdom was the United States (34.0%), followed by Jersey (10.5%) and the Netherlands (6.8%). In 2023, for the Netherlands, the United

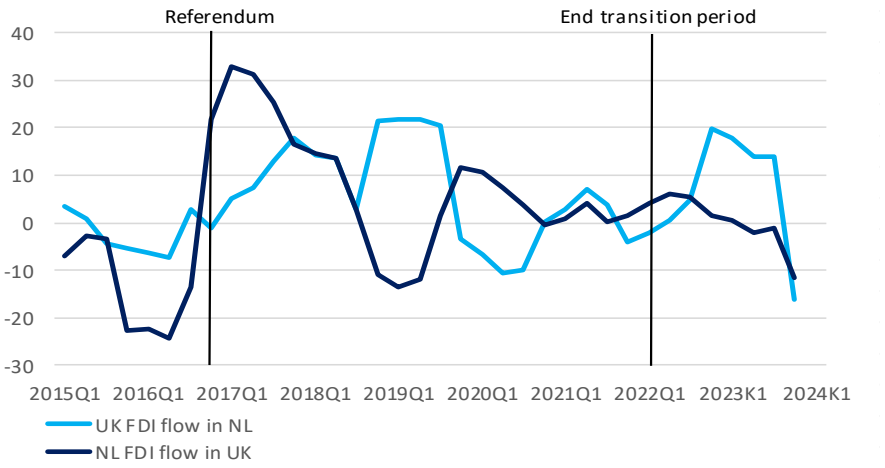
[34] Excl. holdings and SFIs. Sources: DNB and the OECD.
[35] More recent data for the UK are not yet available.

Kingdom (14.4%) was ranked the top destination for outward NL FDI (followed by the United States with 10.1% and Switzerland with 7.5%), while the United Kingdom (16.7%) was the second-largest investor (after the United States, with 20.6%, and followed by Germany, with 9.8%) for inward NL FDI.[36] Partly due to some recent relocations of Dutch-British multinationals after Brexit, NL-UK FDI flows have shown a volatile pattern (Chart B). In particular, the recent relocations by Unilever and Shell from the Netherlands to the United Kingdom have caused some substantial increases in UK direct investment in the Netherlands, because business units that are still located in the Netherlands now have foreign owners. A decreasing trend in FDI was observed after the referendum, until 2020, but seems to have stabilised, particularly from the Netherlands to the United Kingdom. However, more data analysis will shed light on whether Brexit has caused any critical changes in the direct investment relationship between the Netherlands and the United Kingdom.

Chart B

Direct investment transactions between the Netherlands and the United Kingdom

EUR billions (one-year moving average)



Source: DNB statistics.
Note: Data based on assets/liabilities principle.

Box 3

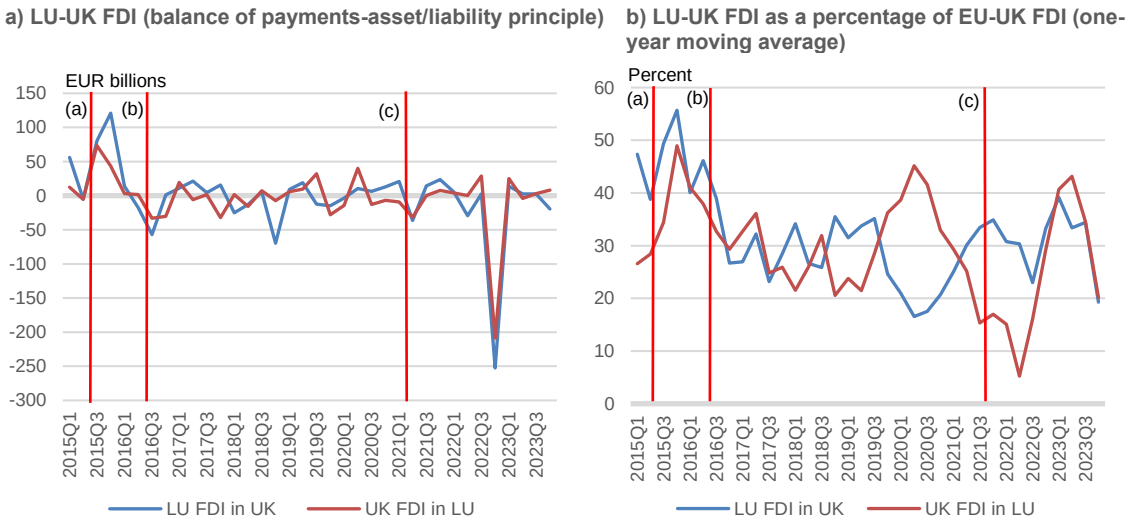
FDI flows between Luxembourg and the United Kingdom

Luxembourg has been the United Kingdom's largest EU counterpart in terms of FDI disinvestment flows. Average quarterly FDI flows between Luxembourg and the United Kingdom remained above €20 billion, roughly 30% of total EU-UK FDI flows, from the first quarter of 2015 to the fourth quarter of 2023. As the two countries are major global business and financial centres, these FDI flows might be connected to investment vehicles, also suggested by alternating inflows and outflows. After the Brexit referendum was announced in May 2015 there was a sharp but short-lived increase in LU-UK FDI in both directions. In the subsequent period, between the Brexit referendum (June 2016) and the beginning of the new EU-UK relationship (January 2021), LU-UK FDI fluctuated with no major deviations.

[36] For the Netherlands, excl. SFIs. Sources: DNB and the UK Office for National Statistics.

Chart C

FDI flows between Luxembourg and the United Kingdom



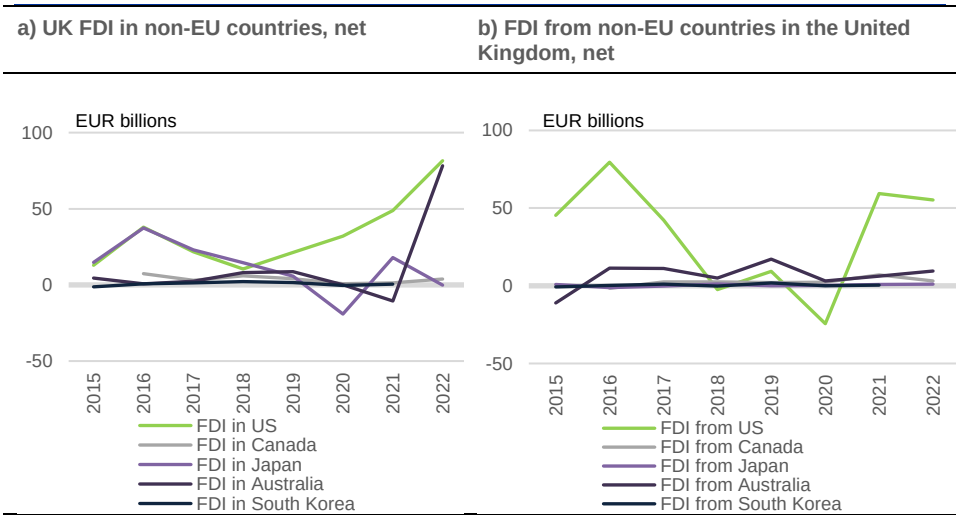
Source: Eurostat.
Notes: (a) In May 2015 the European Union Referendum Act 2015 was introduced to the House of Commons. (b) In June 2016 the UK-EU membership referendum took place. (c) In January 2021 the new relationship between the EU and the United Kingdom began.

Although large LU-UK FDI flows were frequently observed, historic disinvestments were carried out in the fourth quarter of 2022 (-€253 billion of LU FDI in the United Kingdom and -€209 billion of UK FDI in Luxembourg). One explanation for these extraordinarily large outflows could lie in the Convention signed in June 2022 by Luxembourg and the United Kingdom for the elimination of double taxation with respect to taxes on income and on capital, and the prevention of tax evasion and avoidance. The Convention was ratified by the parliaments of the two countries and entered into force in 2024. The scope of the Convention includes property-related capital gains taxes, dividend tax and withholding tax on royalties, as well as the treatment of pension funds and the taxation of collective investment vehicles. Despite the substantial disinvestments in 2022, the proportion of LU-UK FDI flows returned to a significant 20% of total EU-UK FDI in the fourth quarter of 2023 (Chart C).

Investments between the EU countries and the United Kingdom were not strongly correlated across the EU Member States. The long-term co-movement among the EU countries in relation to FDI flows with the United Kingdom can be measured by the correlation distance between pairs of EU countries. The level of correlation declined after the referendum, but partially reversed in the wake of the COVID-19 pandemic and the Russian aggression to Ukraine (Box 4).

The United Kingdom maintained strong relations with its non-EU investment partners. With respect to UK FDI with countries in the world other than EU countries, according to the OECD, the United States was both the main investing and investee country (please see the note under the figure below). Another important UK FDI partner among non-EU OECD member countries was Australia, from 2020 (Figure 4).

Figure 4
FDI flows between the United Kingdom and non-EU countries



Source: OECD.
Note: Since ONS data for 2022 was not available when this article was finished, the two panels include only OECD member countries and no other countries, including Asian countries such as China and India, which could have had substantial FDI flows with the United Kingdom from 2020.

Box 4
Mapping correlation (multi-dimensional scaling)

One way to assess the effect of Brexit on EU-UK FDI flows is by measuring the homogeneity of FDI flows among the EU countries. As the data shows, the United Kingdom has important investment relations with certain EU Members States, but is not a major partner for other EU countries.

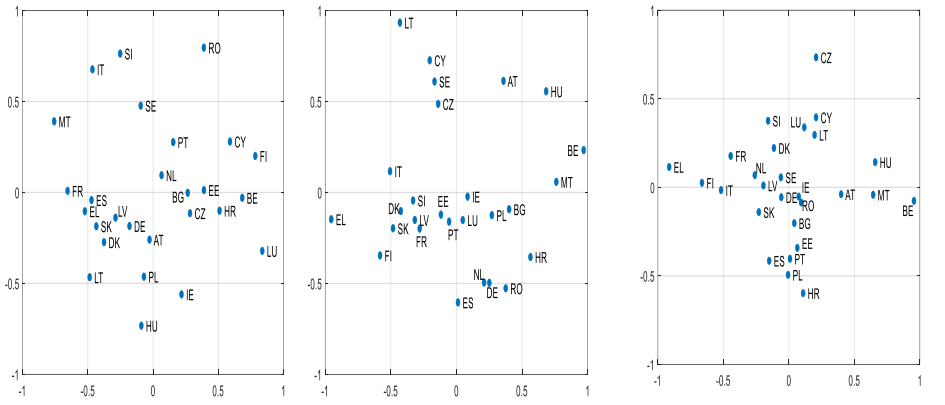
One option would be to compute the correlation between EU Member States with respect to their FDI flows with the United Kingdom, before and after the UK-EU membership referendum, and visualise the correlation in two dimensions (Cartesian system). An increase in correlation after Brexit could indicate a change in the same direction of FDI flows with the United Kingdom for all or most of the EU countries (e.g. a decrease of FDI due to risk aversion or an increase of FDI due to business relocations), while a decline in correlation may indicate that Brexit affected various EU countries differently.

The matrix of the correlations between each pair of EU countries is transformed into a low-dimension matrix by multi-dimensional scaling, as follows:

- *Step 1*: Compute the correlation distance between pairs of time series: $d_{ij} = 1 - \frac{(x_i - \bar{x}_i)(x_j - \bar{x}_j)'}{\sqrt{(x_i - \bar{x}_i)(x_i - \bar{x}_i)'}\sqrt{(x_j - \bar{x}_j)(x_j - \bar{x}_j)'}}$, where x_i refers to FDI flows between EU country i and the United Kingdom;
- *Step 2*: Build the matrix $D = (d_{ij})$, of dimension n x n, where n is the number of EU countries;
- *Step 3*: Transform matrix D into a new matrix N (n x p) of vectors $y_1, y_2, \ldots, y_p$, where p<n (p is the number of positive eigenvalues of N*N'), such that $\|y_i - y_j\| \approx \text{sqrt}(1 - d_{ij})$;
- *Step 4*: Select the first two vectors y_1, y_2 of matrix N (corresponding to the largest eigenvalues of N*N') and plot them.

Chart D
Mapping the correlation between EU FDI in the United Kingdom

a) Before the referendum (first quarter of 2013 to second quarter of 2016)	b) After the referendum, excluding the COVID-19 pandemic and the Russian aggression to Ukraine (third quarter of 2016 to fourth quarter of 2019)	c) After the referendum (third quarter of 2016 to fourth quarter of 2023)

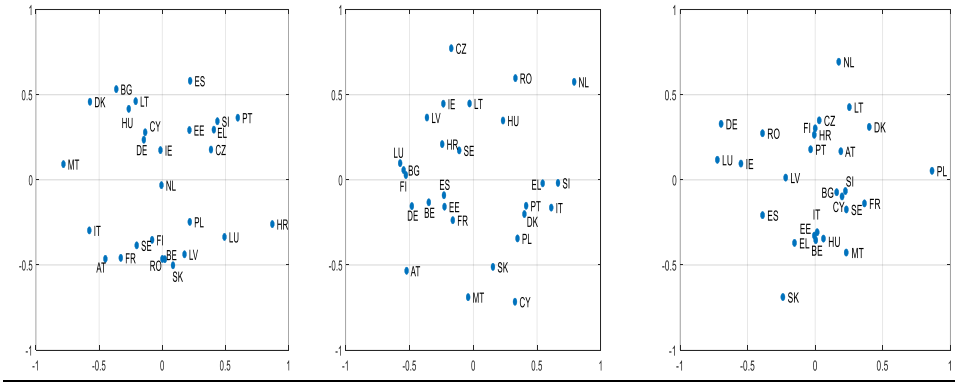


Source: Authors' calculations.

Before the referendum, the correlation between the EU Member States was lower, resulting in a high degree of heterogeneity across EU countries. The scatter plot indicates various levels and paths of investment linkages with the United Kingdom among the EU countries. FDI heterogeneity increased even further in the aftermath of the UK-EU membership referendum. Distances between pairs of EU countries began to increase as EU FDI in the United Kingdom became more divergent at a country level. However, the diminished FDI flows in the context of the COVID-19 pandemic caused the short-term correlation between the EU members to increase slightly (Chart D).

Chart E
Mapping the correlation between UK FDI in the EU

a) Before the referendum (first quarter of 2013 to second quarter of 2016)	b) After the referendum, excluding the COVID-19 pandemic and the Russian aggression to Ukraine (third quarter of 2016 to fourth quarter of 2019)	c) After the referendum, (third quarter of 2016 to fourth quarter of 2023)

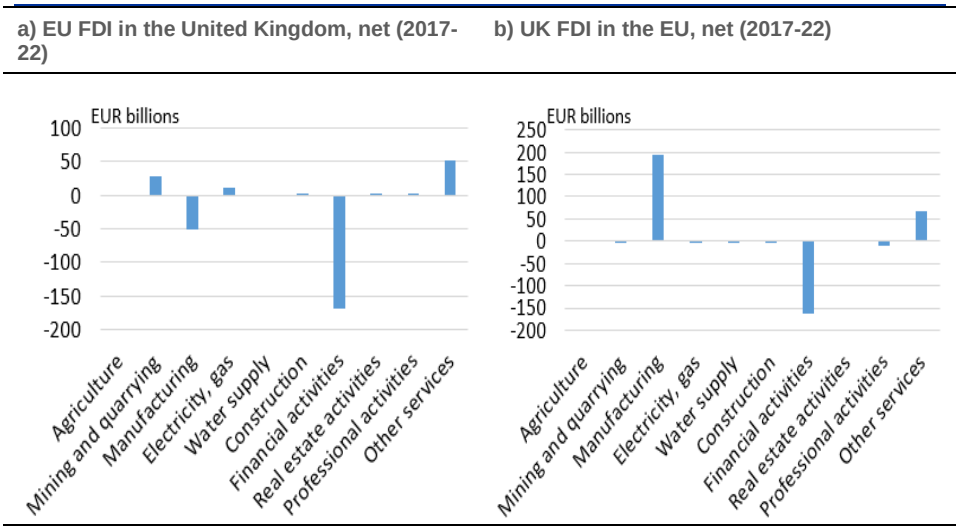


Source: Authors' calculations.

A comparable evolution of correlation has been observed for UK FDI in the EU. Heterogeneity across EU Member States increased in the wake of the referendum, but the pandemic led to more co-movement between UK investments in the individual EU countries (Chart E).

Substantial disinvestments have occurred in financial services between the EU and the United Kingdom since 2017. The EU invested in the United Kingdom's mining, electricity and other service sectors of economic activity in 2017-22, but at the same time disinvested from manufacturing, and particularly from financial activities. UK investments in the EU increased significantly in manufacturing, but declined in financial activities. Given that the largest disinvestments occurred in the financial sector in the fourth quarter of 2022, it may be concluded that Brexit had the biggest effect on the financial activities sector (Figure 5).

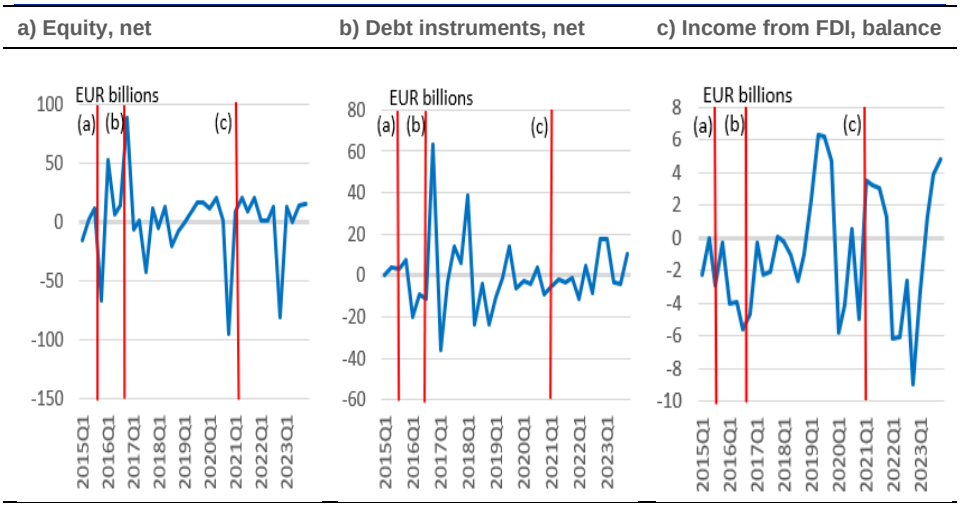
Figure 5
EU-UK FDI flows by economic activity sector after the UK-EU membership referendum



Source: Eurostat.
Notes: Data compiled based on directional-inward/outward principle. Professional activities include professional, scientific and technical activities.

Business relocations and the rapid increase of interest rates after the Russian invasion of Ukraine affected EU-UK FDI. Substantial UK equity investments were made in the EU before the beginning of the new EU-UK relationship in 2021, potentially indicating business relocations from the United Kingdom to the EU. Moreover, the volatility of FDI debt instruments jumped after the referendum, but its impact gradually faded. Income from FDI reflects fluctuations in net flows, as well as the rapid increase in interest rates in the aftermath of the Russian aggression to Ukraine (Figure 6).

Figure 6
Type of instrument flows and income from EU-UK FDI



Source: Eurostat.
Notes: Quarterly data compiled based on balance of payments-asset/liability principle; annual data compiled based on directional-inward/outward principle. (a) In May 2015 the European Union Referendum Act 2015 was introduced to the House of Commons. (b) In June 2016 the UK-EU membership referendum took place. (c) In January 2021 the new relationship between the EU and the United Kingdom began.

The activity of companies owned or controlled by foreign investors is relevant to the benefits of FDI. The Foreign Affiliates Statistics (FATS) of Eurostat provide data on the activity abroad of an economy's resident companies' foreign affiliates (outward) and the activity in the economy of non-resident companies' foreign affiliates (inward). The information supplements data on FDI flows by offering a broader perspective on the effective contribution of FDI to the EU and foreign economies, adding data on turnover, numbers of enterprises and numbers of employees (Box 5).

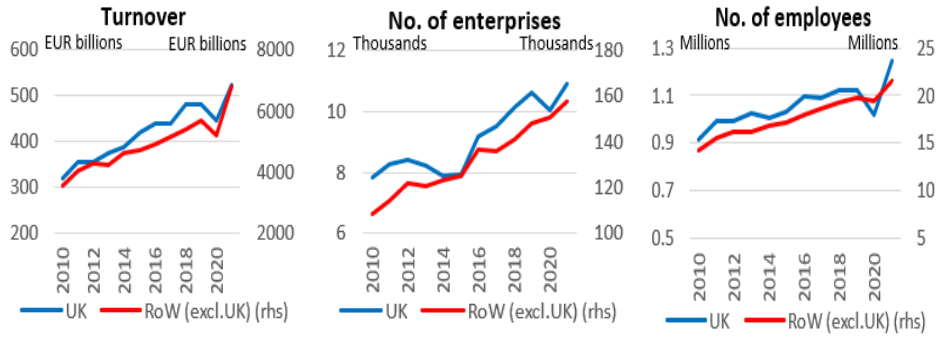
Box 5
Foreign affiliates of EU and UK enterprises

When foreign investors control or own the local companies in which they invest, the local companies are known as the foreign affiliates of these investors. The activities of foreign affiliates allow us to measure the benefits of FDI for the local economy. Eurostat publishes data on the number, turnover and number of employees of foreign affiliates.

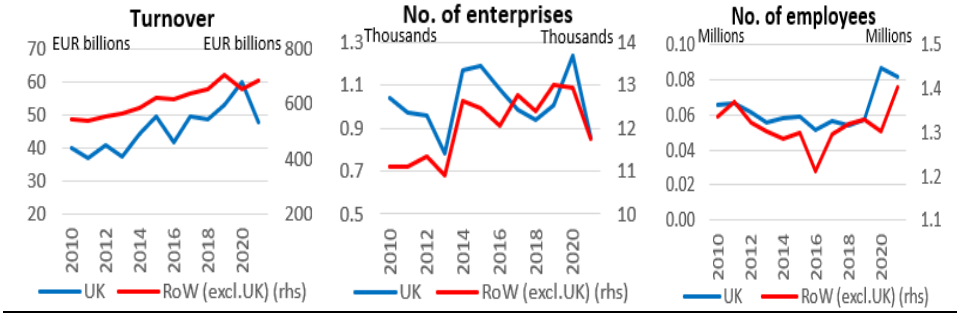
The data for the foreign affiliates of EU companies operating in the United Kingdom and in the RoW show that for over a decade, EU FDI abroad has followed an overall upward trend across the whole economy, except for financial and insurance activities, which contracted slightly during the COVID-19 pandemic. In the case of the financial sector, the foreign affiliates of EU enterprises in the United Kingdom have undergone a contraction in all three indicators of turnover, number of enterprises and number of employees, at least since 2020, while in the RoW, the evolution was mixed (Chart F).

Chart F
Foreign affiliates of EU enterprises – EU outward FATS (2008-21)

a) Whole economy, except financial and insurance activities



b) Financial and insurance activities

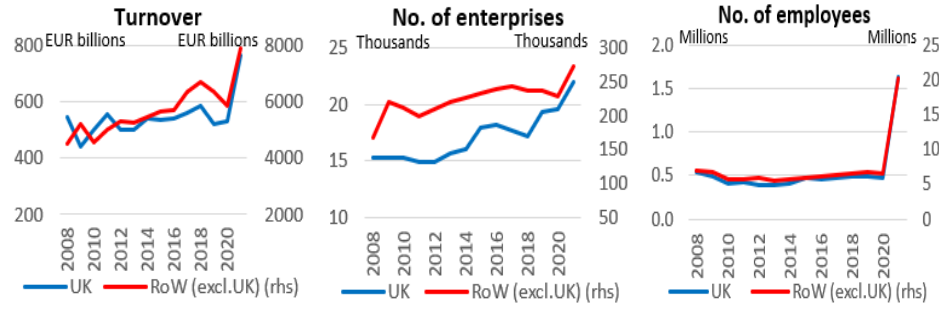


Source: Eurostat.

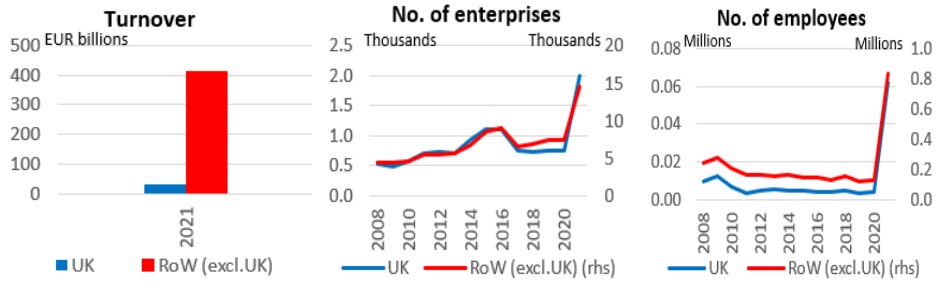
The contribution of the UK foreign affiliates to the EU's total economy remained significant, except for financial and insurance activities, while the turnover of RoW foreign affiliates came in highest, particularly after the Brexit referendum, indicating a potential slight EU decoupling from the UK perspective. Since 2020 the UK foreign affiliates in the EU have gained ground on the RoW in all three indicators. In the financial sector, the turnover of the RoW affiliates in the EU was much higher than those in the United Kingdom in 2021, but in the other indicators both origins remained broadly unchanged in that year (Chart G).

Chart G
Foreign affiliates of UK enterprises – EU inward FATS (2008-21)

a) Whole economy, except financial and insurance activities



b) Financial and insurance activities



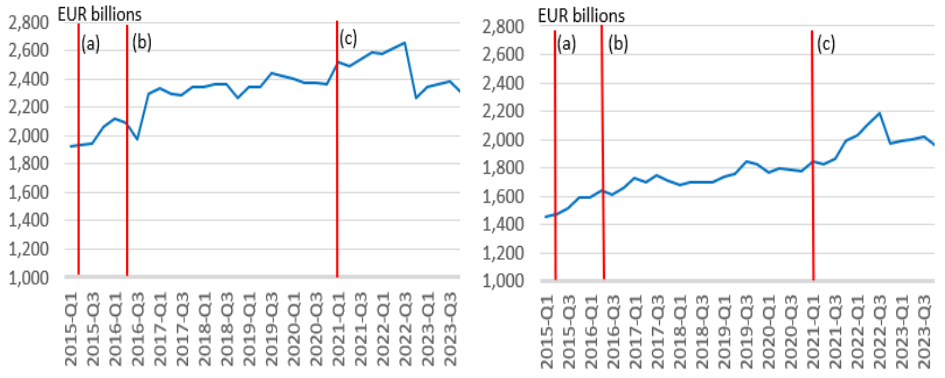
Source: Eurostat.
Note: Turnover data for financial and insurance activities are available only for the year 2021.

EU FDI in the United Kingdom has outpaced UK FDI in the EU in terms of stocks. FDI stocks measure the total level of foreign direct investment at a given point in time, usually the end of a quarter or of a year. EU countries were net investors in the United Kingdom at the end of 2023, when the difference between EU FDI stocks in the United Kingdom and UK FDI stocks in the EU amounted to €346 billion. EU-UK FDI stocks stabilised after the Brexit referendum and resumed growth after the beginning of the new relationship in 2021. The substantial FDI outflows between Luxembourg and the United Kingdom in the fourth quarter of 2022 led to a significant reduction in EU-UK FDI stocks (Figure 7).

Figure 7
EU and UK FDI stocks

a) EU FDI stocks in the United Kingdom, net (b.o.p.-asset/liability principle)

b) UK FDI stocks in the EU, net (b.o.p.-asset/liability principle)



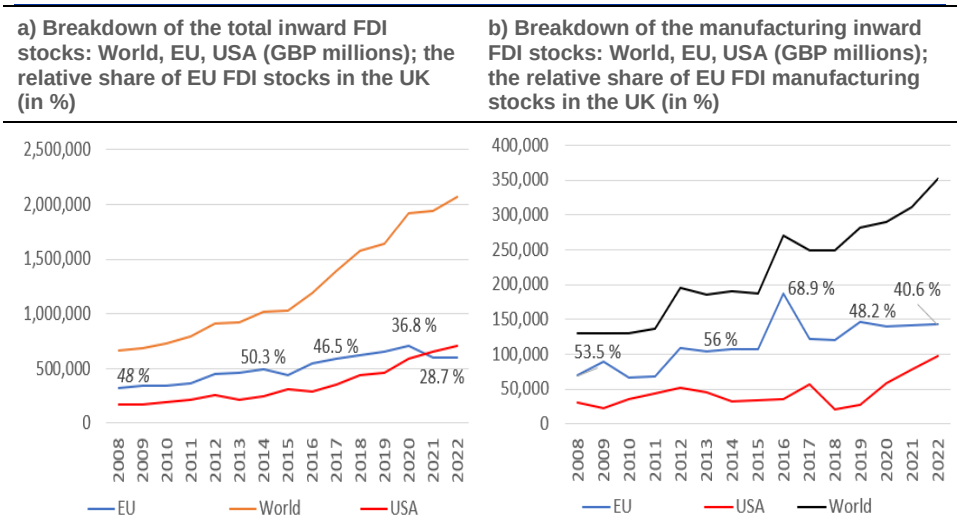
Sources: Eurostat and ONS.
Notes: Quarterly data compiled based on balance of payments-asset/liability principle; annual data compiled based on directional-inward/outward principle. (a) In May 2015 the European Union Referendum Act 2015 was introduced to the House of Commons. (b) In June 2016 the UK-EU membership referendum took place. (c) In January 2021 the new relationship between the EU and the United Kingdom began.

The relative importance of UK FDI stocks, both inward and outward, vis-à-vis the EU has decreased since Brexit, according to the ONS, unlike UK FDI stocks vis-à-vis the rest of the world (Box 6).

Box 6
FDI stocks and manufacturing FDI

While, in absolute terms, inward UK FDI stocks from the world (incl. the EU) tripled between 2008 and 2022, the relative dependency of the UK economy on EU FDI has significantly decreased since 2013. In 2022 the EU accounted for less than 29% of total UK inward FDI stocks, compared with almost half in 2008, slightly over half in 2013, 46.5% in 2016 (the year of the Brexit referendum) and almost 37% in 2020, as the United Kingdom withdrew from the EU. In addition, the proportion of UK inward FDI stocks originating in the United States surpassed FDI stocks from the EU in 2021 for the first time since 1998 (considering the ONS historical data) and has been growing ever since (Chart H, panel a).

Chart H
Inward FDI stocks in the United Kingdom



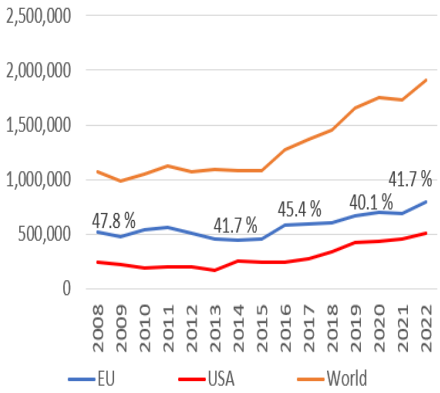
Sources: ONS and own calculations.
Notes: Certain US FDI manufacturing investments have been undisclosed since 2018.

The relative proportion of EU investments in all UK manufacturing FDI stocks declined after 2016, when there was a temporary sharp hike, and declined to around 40% in 2022 (Chart H, panel b). The development in 2016 was primarily influenced by several big FDI projects, such as the takeover of the UK-listed brewer, SABMiller, by its Netherlands-listed rival, Anheuser-Busch InBev.

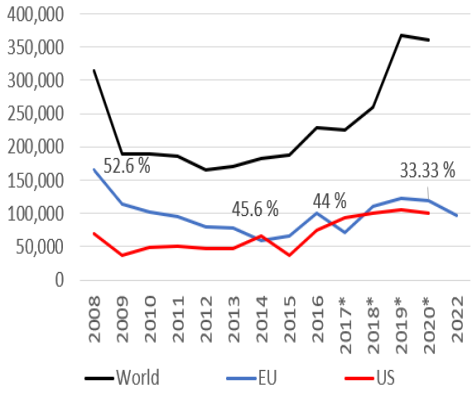
A similar trend occurred in UK outward FDI stocks, i.e. the proportion of UK outward stocks in the EU has been in relative decline since the first five years of the 2010s. Although the EU remains an important market for UK investors, with growing absolute FDI stocks even after the Brexit referendum, the EU decreased as an investment destination for outward UK FDI stocks from 45% in 2016 to 40% in 2021 (Chart I, panel a).

Chart I
Outward FDI stocks of the United Kingdom

a) Breakdown of the total outward FDI stocks: World, EU, USA (GBP millions); the relative share of UK FDI stocks in the EU (in %)



b) Breakdown of the manufacturing outward FDI stocks: World, EU, USA (GBP millions); the relative share of UK FDI stocks in the EU (in %)

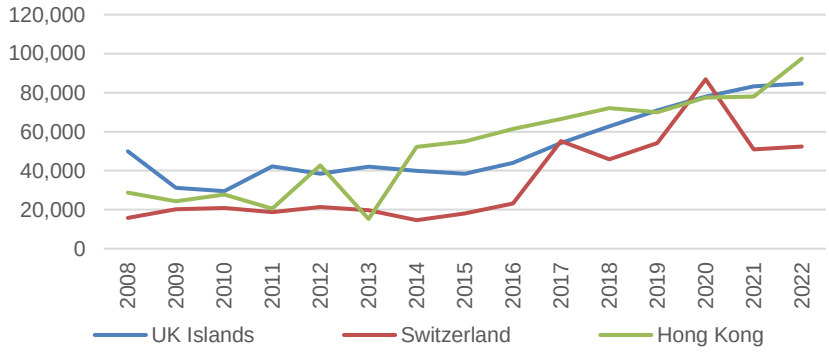


Sources: ONS and own calculations.
Notes: Certain data for EU and/or USA are still undisclosed.

Processes between the United Kingdom and the EU have also been disentangled with respect to outward FDI manufacturing stocks (Chart I, panel b). While in 2008 outward UK FDI stocks in the EU accounted for nearly 53% of all UK FDI stocks worldwide, this proportion was only slightly more than one-third in 2020. Meanwhile, the impact of the global financial crisis on UK outward FDI manufacturing stocks in the rest of the world seemed more significant and long-lasting than on UK inward FDI, with the former declining sharply from 2009 and only returning to its pre-crisis level ten years later in the context of Brexit.

In contrast, a remarkable increase in outward UK FDI stocks occurred in non-EU destinations, including the Channel Islands, Switzerland and Hong Kong (Chart J). UK FDI stocks in these jurisdictions doubled or even tripled from 2016 to 2020. A large part of those FDI stocks related to the financial sector.

Chart J
Total outward FDI stocks of the United Kingdom: remarkable surges (GBP millions)



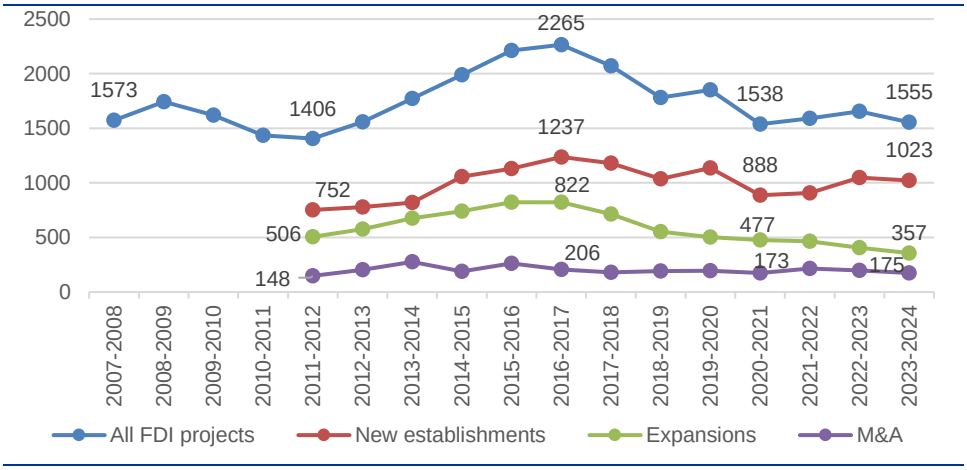
Source: ONS.

6.2.2 New FDI projects and resulting jobs in the United Kingdom

This section focuses on new FDI projects and new jobs generated in the United Kingdom, and the respective breakdowns according to sectors of economic activity and countries/regions of origin. Two sources were used: the UK DBT and the Ernst & Young European Investment Monitor (E&Y EIM) (Box 7) (for the methodological framework, see Annex II).

According to the UK DBT, new FDI projects have been decreasing since 2017. This is particularly evident in both expansions and M&A (Figure 8). The number of new FDI projects rose to 1,654 in 2022-23, although it remained considerably below the measured peak of 2,265 projects in 2016-17. However, in the financial year 2023-24 the number of new FDI projects fell again to 1,555 projects, a 12-year low (a lower figure of 1,406 projects was recorded in the aftermath of the global financial crisis (GFC) in 2011-12). New establishments took a dominant share in new FDI projects, with 1,023 undertakings in 2023-24. This represented a decline of 25 projects compared with the previous financial year, but nevertheless an increase of 135 projects compared with the post-Brexit low in 2020-21.

Figure 8
FDI projects in the United Kingdom

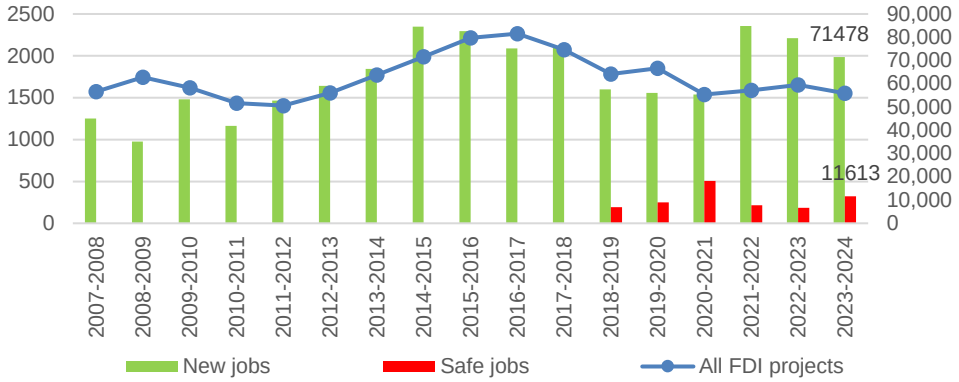


Source: UK DBT.

The new jobs created by these new FDI projects in the United Kingdom started to decrease from 2015-16 until the end of the COVID-19 pandemic. As the COVID-19 pandemic restrictions were lifted, the recorded figures again began to rise, reaching a peak of around 85,000 in 2021-22, and even surpassing the pre-Brexit high of 2014-15 (Figure 9). More than 79,000 new jobs were also recorded in the following financial year of 2022-23. In 2023-24, however, the number of new jobs decreased to fewer than 71,500 positions (but the number of already existing jobs safeguarded by new FDI projects almost doubled year on year, to 11,613 positions in the same financial year). The most dynamic sectors in terms of new job creations were software and computer services (with 22% of the jobs created by new FDI projects), wholesale (14%) and financial services (11%).

Figure 9

New FDI projects (y) and new (safeguarded) jobs (z)



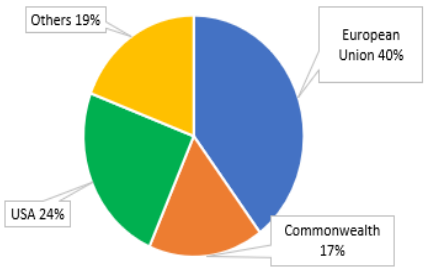
Source: UK DBT.

With respect to the individual countries of origin of new FDI projects in the United Kingdom, the United States remained the largest investor, with a 24% share of new projects and a 27% share of new job creations. However, six of the top ten countries of origin of FDI new projects in the United Kingdom were EU countries (Germany, France, the Netherlands, Spain, Italy and Sweden). Seven EU countries also ranked among the top ten in terms of new job creations (Germany, France, Sweden, Italy, Spain, the Netherlands and Denmark).

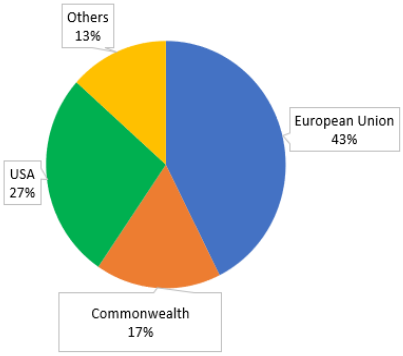
In addition, most of the new FDI projects in the United Kingdom in 2023-24 still came from the EU as a whole (40%, see Figure 10, panel a). New FDI projects from the EU were also more numerous than projects from Commonwealth countries (17%). Stronger economic ties with these countries, one of the goals of Brexit supporters during and after the referendum, have apparently not (yet) materialised in terms of new FDI projects. Moreover, the relative proportion of inward FDI projects from the Commonwealth countries has decreased by 1% since the previous financial year 2022-23. For new jobs created by FDI in the United Kingdom, the United States surpassed the EU as the biggest investor country in 2021-22, with a share of 32%. However, EU investors bounced back in the following financial year 2022-23, restoring the EU to its position as the largest direct investor in the United Kingdom also in terms of job creations, with a share of 39%. In 2023-24, the lead of EU investors increased further, to 43% of new jobs created by their new FDI projects in the United Kingdom (Figure 10, panel b).

Figure 10
Origin and new generated jobs of FDI projects in the United Kingdom in 2023-24

a) Origin of FDI projects in the UK in 2023-24 (1,555 projects)



b) New jobs generated in the UK by the respective FDI projects in 2023-24 (71,478 jobs)



Source: UK DBT.

Box 7
Selected data from Ernst & Young European Investment Monitor

Ernst & Young European Investment Monitor (E&Y EIM) analysts collect data on FDI projects using slightly different criteria and methodology from those of the UK DBT.[37] In particular, FDI projects in the area of M&A are not included at all, unless they create new facilities or jobs. E&Y's definition of FDI projects[38] is thus not far from the category of "new investment" used by the UK DBT[39]. In addition, the focus of E&Y researchers is on developments within a calendar year, unlike the UK DBT, which uses UK financial years (i.e. from April 6 to April 5) as the periods for their data analyses.

The latest data confirm a steady increase in FDI projects in France since the post-COVID-19 recovery. In 2023 France recorded 1,194 projects, despite the uncertainties resulting from the energy crisis and inflationary headwinds, building up its pole position among the most attractive European destinations for new FDI projects since 2019 (see Chart K, panel a on Europe's top three destinations for FDI). However, E&Y analysts add that most new FDI projects in France are extensions of already existing projects, whereas only 36% of new FDI projects are greenfield investments (compared with 77% in Germany and 75% in the United Kingdom). New FDI activity

37 The latest data published in: Amid global competition for investment, what more can Europe do?", EY Attractiveness Survey, Europe, June 2024; more data for the UK in: Stability and growth, EY UK Attractiveness Survey, July 2024.

38 **New FDI projects as defined by E&Y** are projects that have resulted in the creation of new facilities and jobs. The following are NOT included: M&A (w/o new facilities/jobs); portfolio investments; licence agreements; retail and leisure, hotel, real estate utilities and extraction investments (unless a headquarters/distribution centre is created); machinery and production replacements (w/o new jobs); and non-profit organisation activities.

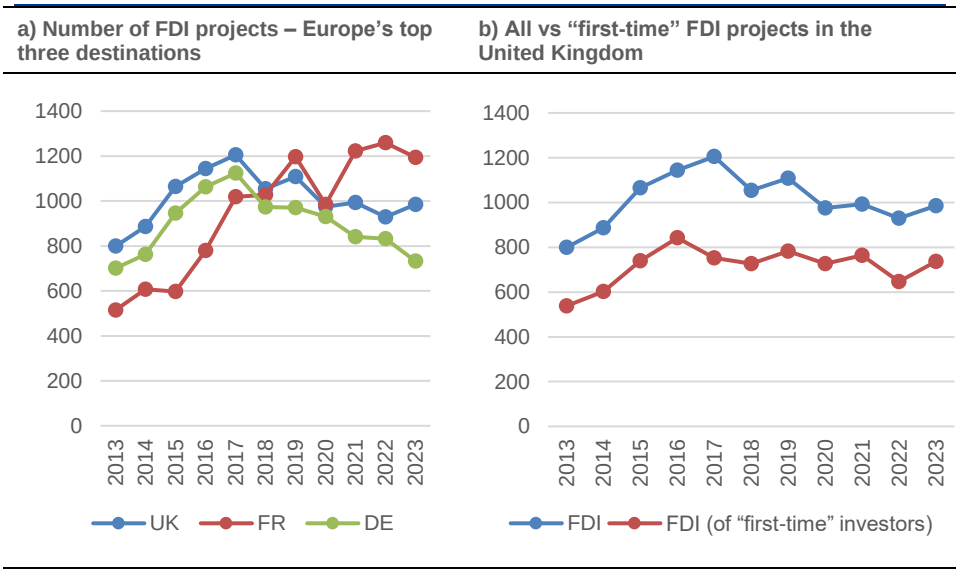
39 **New investment as defined by UK DBT** involves establishing a new entity and setting up new offices, building, production or operational facilities in the UK, creating one or more permanent jobs. The following are NOT included: M&A, expansions + short-term projects (less than three years), contract agreements (excl. R&D), franchise contracts and real estate w/o additional businesses and jobs. In Figure 8, the category of "new investment" is referred to as "new establishments".

has grown in manufacturing projects, such as the automotive, aeronautics, electronics and consumer industries.

As for the United Kingdom, annual FDI projects increased by 6% to 985 in 2023 compared with 2022 (Chart K, panel b). Nevertheless, new FDI in the United Kingdom created more jobs (52,211) compared with the EU countries (42,450 jobs in Spain, 39,773 in France, 22,378 in Poland, 18,259 in Portugal and only 14,261 in Germany). However, the figure for the United Kingdom represents only a partial recovery from a substantial year-on-year drop of 33% in 2022, after a record year in 2021 for newly created jobs (70,022). This trend is also mirrored in the UK DBT database for the respective financial years (see Section 2.2). Among the countries observed by E&Y, the United Kingdom retains the leading position in the technology sector, with 255 projects, and is also first in the financial services sector, with 108 projects announced in 2023 (i.e. one-third of all 329 European financial services projects in 2023). One of the reasons for the United Kingdom's relative success among its European peers might be the persisting attractiveness of London as a financial centre, as the UK capital alone accounted for 81 FDI financial services projects in 2023 (up from 46 projects in 2022). Greater London is also the best-performing region in Europe in terms of FDI projects (accounting for 359 projects in 2023 and again pushing "Greater Paris", the Île-de-France region, to second place). In manufacturing, however, the United Kingdom's performance worsened by almost 15% to 150 projects, lagging considerably behind the peak of 217 recorded in 2017.

The number of projects in Germany decreased to 733 in 2023 (down by 12% compared with 2022). As E&Y analysts argue, Germany's lack-lustre performance might relate to tight labour market conditions, high wage costs and an unfavourable and costly energy model.

Chart K
FDI projects in Europe and the United Kingdom according to the Ernst & Young European Investment Monitor



Source: E&Y.

E&Y also collects data on the number of FDI projects conducted by new investors in the country ("first-time" FDI projects). As regards the United Kingdom, one quite remarkable observation is that, despite Brexit woes, its share of those FDI projects remains steady and at a high level of between 70% and 80% of all new FDI projects over the years (excluding 2017, when it fell slightly, to 62%).

In terms of absolute figures, in 2023 the United Kingdom even recorded the highest number of FDI projects (736) by first-time investors of all the European economies observed by E&Y. This may imply that the UK Government has been quite successful in attracting new companies into the United Kingdom and promoting the country as a promising FDI destination, even though the overall conditions and outlook have deteriorated, such as the end of the United Kingdom's access to the EU Common Market or the health situation in 2020. However, the E&Y data indicate a decline and a trend reversal in the number of FDI projects in the United Kingdom since the Brexit referendum in 2016, as do the UK DBT data collected for the respective financial years.

6.3 The case for the UK financial sector

The United Kingdom is one of the world's leading financial centres, and the financial sector is an important source of growth for the UK economy.[40] For example, the financial sector accounts for about 8% of total economic output, making it the fifth-largest sector in the United Kingdom. It also provides about 1.2 million jobs (about 3% of all jobs). Specifically, London is a world-leading financial centre and accounts for about half of the output of the United Kingdom's financial sector.[41]

6.3.1 Recent trends in the real economy and FDI

Real gross value-added in the financial sector was more volatile during Brexit compared with the broader UK economy. In the post-transition period, the UK economy has grown by 4.5%, while the financial sector contracted by 1.9%. Figure 11 shows real gross value-added for the UK financial sector from the first quarter of 2015 to the fourth quarter of 2023. Following the referendum, financial sector output grew by 12.6%, before going into a period of decline in 2018 and 2019. During the peak COVID-19 period, UK financial sector output fell by 3.9%, compared with 21.6% for the economy as a whole. The UK economy rebounded from COVID-19 in the second quarter of 2021, with growth of 8.0% and 25.7% in the financial sector and the overall economy, respectively. While the UK economy has continued to grow in the post-transition period at an average rate of around 4.5%, real gross value-added (GVA) in the financial sector has contracted on average by 1.9% (Figure 11).[42]

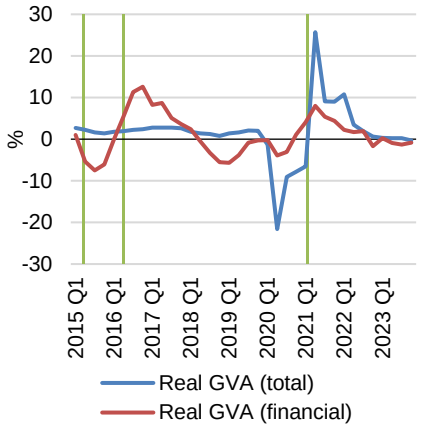
40 In this section, the "financial sector" refers to NACE sector "K: Financial and insurance activities".

41 "Financial services: contribution to the UK economy", Commons Library Research Briefing, 1 September 2022.

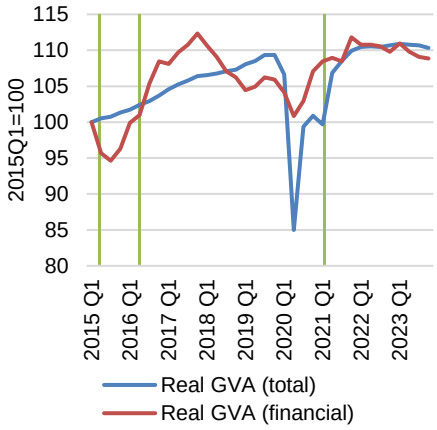
42 The three vertical lines indicate a set of reference periods: (i) the introduction of the EU Referendum Act 2015 to the House of Commons in the second quarter of 2015; (ii) the UK-EU membership referendum in 2016Q2; and (iii) the end of the transition period in the fourth quarter of 2020.

Figure 11
UK financial sector output

a) Financial sector output, annual % change, first quarter of 2015 to fourth quarter of 2023



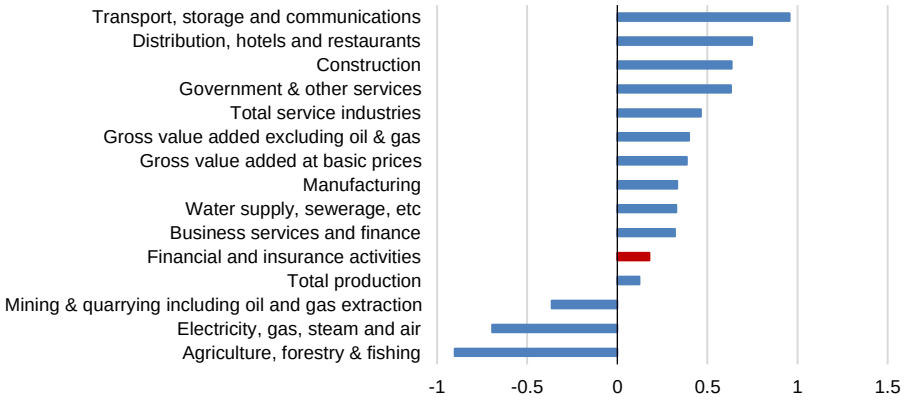
b) Financial sector output, (2015=100), first quarter of 2015 to fourth quarter of 2023



Source: ONS.

Compared with other sectors in the United Kingdom, since 2015 real GVA in the financial sector has grown at a slower rate than in the broader service industries (Figure 12). Since the first quarter of 2015 the financial sector has grown at an average quarterly rate of 0.2% while the production sector and total services sector have grown by 0.1% and 0.5%, respectively. Since the end of the transition period, financial sector output has grown by 1.9%, compared with 4.5% for the overall economy.

Figure 12
UK real GVA by sector since 2015, average quarterly growth rate, first quarter of 2015 to fourth quarter of 2023

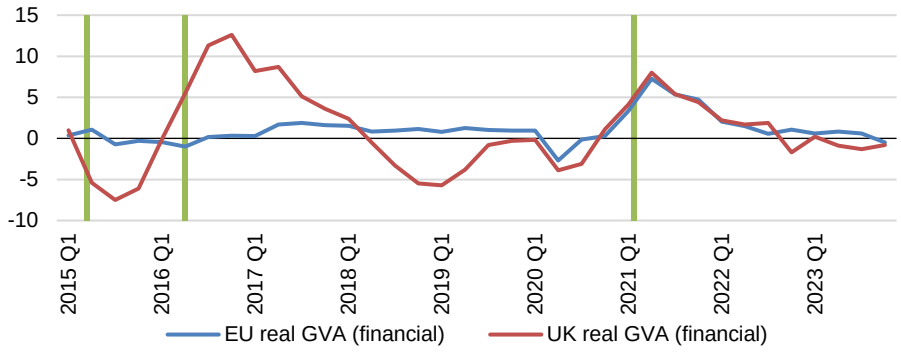


Source: ONS.

Real GVA growth in the euro area (EA) financial sector has been less volatile and slightly stronger since the end of transition period compared with the United Kingdom (Figure 13). Since the first quarter of 2021 real GVA in the EU financial sector has grown by 2.3%, compared with 1.9% in the United Kingdom.

Figure 13

Financial sector output, annual % change, first quarter of 2015 to fourth quarter of 2023

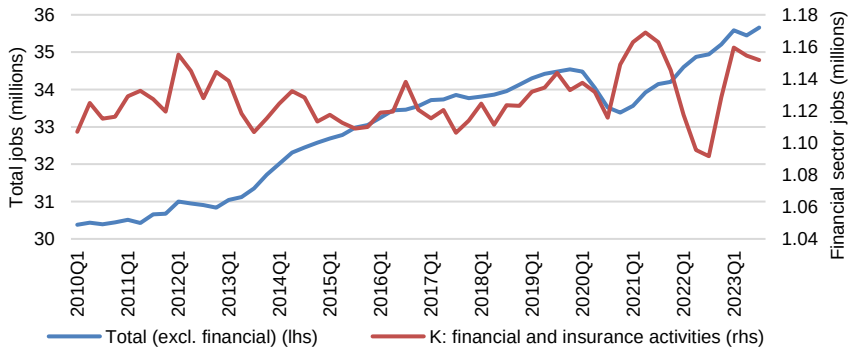


Sources: ONS and Eurostat.

The number of jobs in the UK financial sector fluctuated after the end of the transition period, but remained in line with the long-run historical trend of around 1.1 million jobs. Broadly speaking, the number of jobs in the UK financial sector has remained steady at around 1.1 million jobs over the past decade. Since the end of the transition period, the number of financial sector jobs has fluctuated, with around 3,000 more jobs in the third quarter of 2023 compared with the fourth quarter of 2020. At the same time, the number of jobs in the broader economy has also increased (Figure 14). Caution should be exercised when interpreting these numbers, as the period includes not only the Brexit transition, but also the transition of the United Kingdom into the post-COVID, high inflation and higher interest rate environment.

Figure 14

Number of jobs in the UK financial services sector, first quarter of 2010 to third quarter of 2023



Source: ONS.

Since the end of the transition period, the number of financial sector jobs in England and Scotland has declined by around 7,000 jobs, with around 15,000 financial sector jobs lost in London. Table 1 shows a breakdown of the number of financial sector jobs in the United Kingdom by region. Since December 2020 the number of financial sector jobs has fallen in London (14,772), England (4,797) and Scotland (2,233). The number of jobs has increased in Wales (9,232) and Northern Ireland (664).

Table 1

Number of financial sector jobs in the United Kingdom by region since 2016

	Jun 2016	Dec 2020	Sep 2023	Change since Dec 2020
United Kingdom	1,119,545	1,148,848	1,151,714	2,866
England	980,576	1,010,347	1,005,550	-4,797
Wales	33,392	32,090	41,322	9,232
Scotland	84,924	87,164	84,931	-2,233
Northern Ireland	20,653	19,247	19,911	664
North East	26,505	25,777	28,064	2,287
North West	104,198	100,734	85,452	-15,282
Yorkshire and The Humber	74,409	73,302	88,702	15,400
East Midlands	34,972	40,751	43,618	2,867
West Midlands	63,253	65,323	64,676	-647
East	71,112	73,113	71,049	-2,064
London	392,081	427,317	412,545	-14,772
South East	130,033	133,410	122,353	-11,057
South West	84,013	70,620	89,091	18,471

Source: ONS – Nomis.

The observed number of UK financial sector job losses is at the lower end of the predicted estimates. As a basis for comparison, "Brexit-relocation" estimates from New Financial (Hamre and Wright, 2021[43]) and Ernest & Young were in the range of 7,400 and 7,600 financial sector jobs, respectively. Early predictions of financial sector job losses due to Brexit included estimates of 10,000, 45,000 and even 75,000 jobs.[44] More recently, the Lord Mayor of London has reported that 40,000 financial sector jobs have been lost.[45] Again, caution is in order, as a cursory analysis of the data does not allow the Brexit effect on financial sector jobs to be identified.

The EU financial centres (e.g. Dublin, Paris, Luxembourg, Frankfurt and Amsterdam) are expected to benefit from jobs relocated from UK firms after Brexit. New Financial identified the European financial centres to which UK firms would be most likely to relocate jobs after Brexit. The financial centre's area of specialty would be one impact factor influencing this decision. For example, Dublin would be a leading candidate for jobs in asset management firms; Frankfurt would likely attract banks and Amsterdam would be conducive to jobs in trading platforms, exchanges, and broking firms. Table 2 shows the top five EU financial centres competing with the United Kingdom, the specialty of each centre and the estimated number of firms that have responded to Brexit by relocating there. The New Financial report finds that the total number of firms relocating from the United Kingdom to the EU in some way (e.g. moving jobs, setting up hubs and transferring assets) is 440 firms. However, the report says that this number is likely to be an underestimate. In the longer term, the report expects Frankfurt and Paris to receive the most relocations of assets and jobs,

43 Hamre, E.F. and Wright, W. (2021), "Brexit and The City: The Impact So Far", New Financial, April.

44 Ahmed, K. (2017), "Bank of England believes Brexit could cost 75,000 finance jobs", BBC News, 31 October.

45 O'Donnell, J., Martinuzzi, E. and Bruce, A. (2024), "Brexit 'disaster' cost London 40,000 finance jobs, City chief says", Reuters, 16 October.

respectively. More recent estimates suggest that Dublin has gained 10,000 financial sector jobs since Brexit, with Milan, Paris and Amsterdam also benefiting from jobs migrated from London to the EU.[46]

Table 2

Top five EU financial centres and number of firm relocations

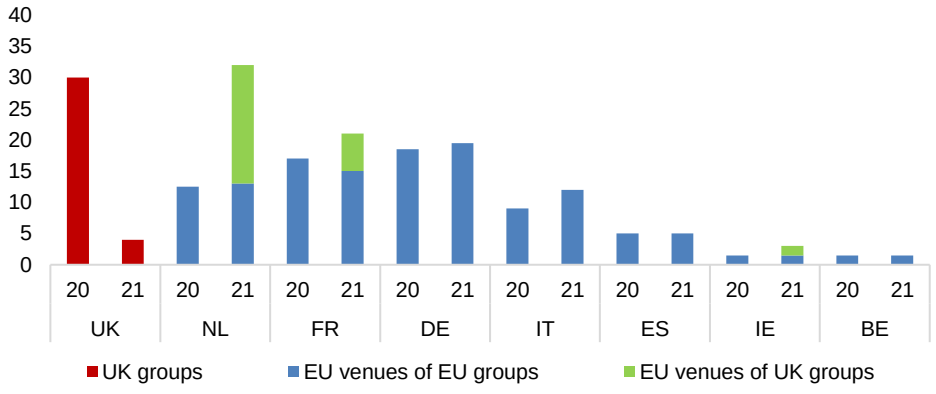
Financial centre	Centre specialty.	No. of UK firms relocating
Dublin	Asset management firms, hedge funds, private equity and diversified financials.	135
Paris	Banks, hedge funds and private equity.	102
Luxembourg	Asset management firms, hedge funds, private equity and insurance firms.	95
Frankfurt	Banks.	63
Amsterdam	Trading firms and market infrastructure providers.	48

Source: Hamre, E.F. and Wright, W. (2021), "Brexit and The City: The Impact So Far", New Financial, April.

There has been a change in market trading dynamics since the end of the transition period. The ESMA Annual Statistics report for 2022 provides evidence of a shift in share trading volumes from the United Kingdom to the Netherlands in 2021, following the end of the Brexit transition period (Figure 15). A more recent ESMA article finds a few other key shifts in market dynamics over the 2019-22 period; namely, a sharp decrease in trading volumes (since many European Economic Area (EEA) shares were traded in the United Kingdom), a reshuffling of share trading across market types and countries, a relocation of domestic trading (from around 40% to 60%) and increased specialisation of trading venues.[47]

Figure 15

Share trading by country



Sources: CBOE and ESMA.
Notes: Notional trading volumes on shares making up EEA30 national indices as a percentage of the total location of the venue and ownership for selected EEA30 venues. UK venues represent venues located in the United Kingdom after 31/12/2021. EU venues of UK groups are venues newly created in the EU by UK groups, and EU venues of EU groups represent pre-existing EU venues. "20" provides data on Sep-Dec 2020 and "21" provides data for the first few days of 2021.

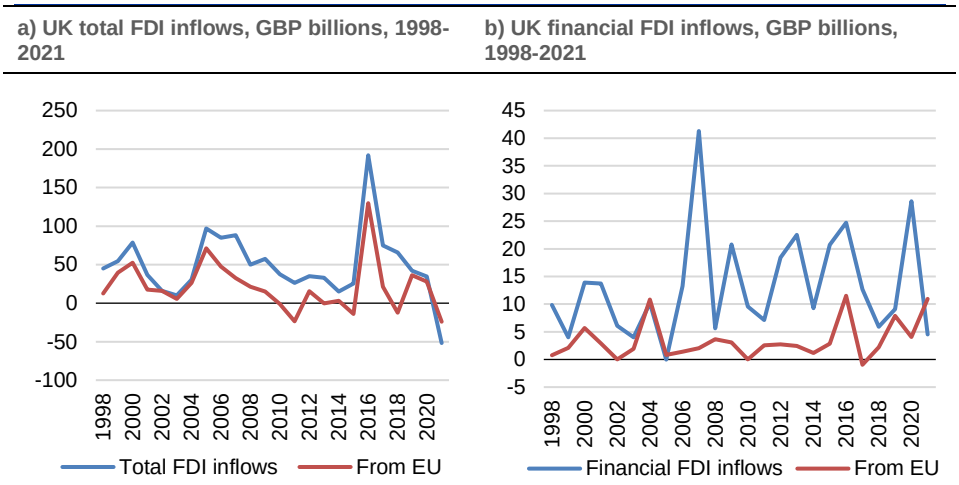
UK financial sector FDI inflows from the EU have increased since 2016. In the 2011-15 period, according to the ONS, UK total FDI inflows amounted to GBP 27 billion on

46 ibid.

47 Danieli, L. and Le Moign, C. (2023), "Evolution of EEA share market structure since MiFID II", ESMA TRV Risk Analysis, ESMA, 30 October.

average.[48] In 2016 total FDI inflows increased by over 600%, reaching GBP 192 billion. One key driver of this increase were inflows from the EU (Figure 16, panel a). The latest data show that in 2021 there were negative FDI inflows to the United Kingdom amounting to GBP 51.7 billion, including GBP 24 billion from the EU. UK financial sector FDI inflows typically represent about 40% of total FDI inflows, and the EU accounts for about 25% of financial sector FDI inflows. While financial sector FDI inflows increased in 2016, they represented only 12.9% of total FDI inflows for that year. Financial sector FDI inflows from the EU jumped in 2016 and 2019 (particularly from the Netherlands) to GBP 11.5 billion and GBP 7.8 billion, respectively, and this compares with a historical average of less than GBP 3 billion (Figure 16, panel b). In 2017 there were negative FDI inflows from the EU (particularly from France and Luxembourg), indicating disinvestment from the United Kingdom and a potential consequence of Brexit. The latest data show that in 2021 there were financial sector FDI inflows of GBP 4.5 billion, with inflows from the EU of GBP 10.9 billion.

Figure 16
UK FDI inflows

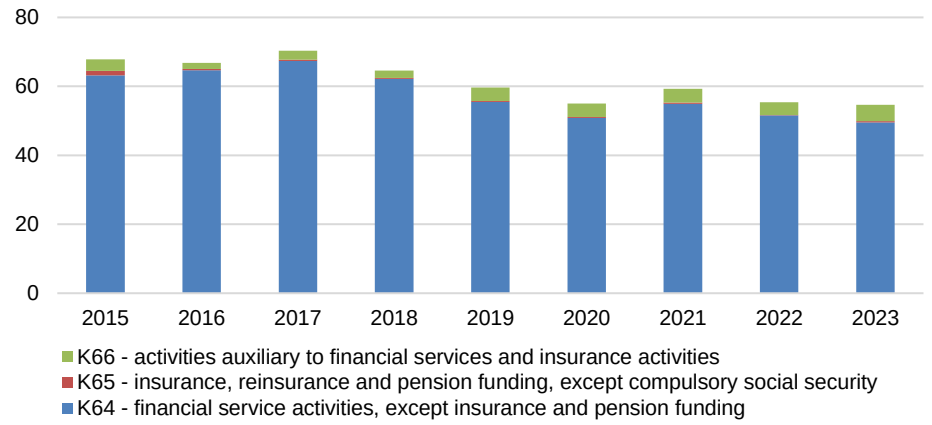


Source: ONS.

However, alternative data suggest that financial sector FDI from the EU to the United Kingdom has decreased. Additional FDI data, made available by the ECB and European banking supervision, show that financial sector FDI from the EU to the United Kingdom has fallen by €13.2 billion, or 20.4%, since 2015 (Figure 17).

[48] The FDI data quoted here are net flows measured on a directional principle basis.

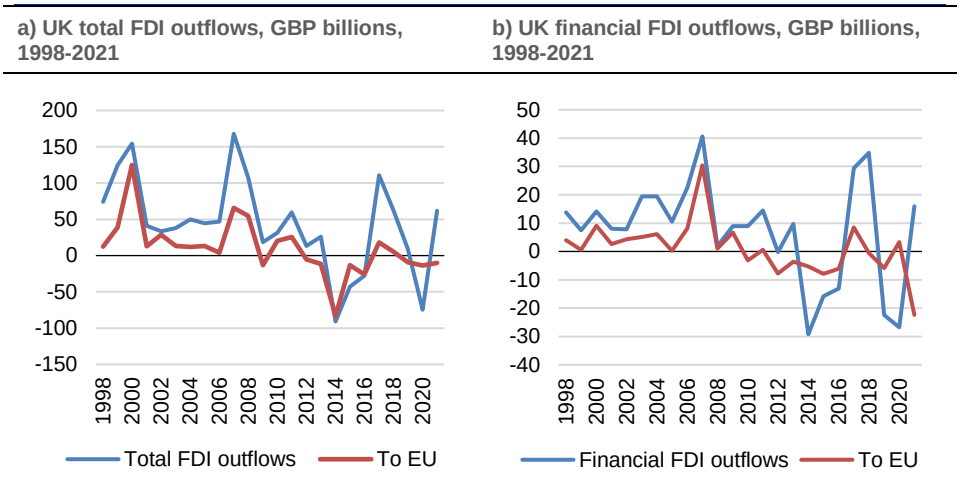
Figure 17
Financial sector FDI from the EU to the United Kingdom (equity ownership >=10%), EUR billions, 2015-23



Sources: ECB and European banking supervision.

UK financial sector FDI outflows have been volatile since 2016, with short periods of positive and negative outflows. UK total FDI outflows were negative over the 2014-16 period, before reaching GBP 110 billion in 2017, the largest outflow in the post-2008 period (Figure 18, panel a). Financial sector FDI outflows typically represent about 25% of total UK FDI outflows. Financial sector FDI outflows were negative over the 2012-16 period, before averaging GBP 32 billion in the following two years. UK financial sector FDI outflows to the EU amounted to GDP 8.4 billion in 2017, the first positive outflows to the EU since 2011 (Figure 18, panel b), and were also positive in 2020 (particularly to Ireland) to the tune of GDP 3.3 billion. In 2021 total FDI outflows from the United Kingdom came to GDP 61.7 billion, with financial sector outflows of GDP 22.4 billion. At the same time, there was a negative outflow (disinvestment) of GDP 15.9 billion to the EU.

Figure 18
UK FDI outflows



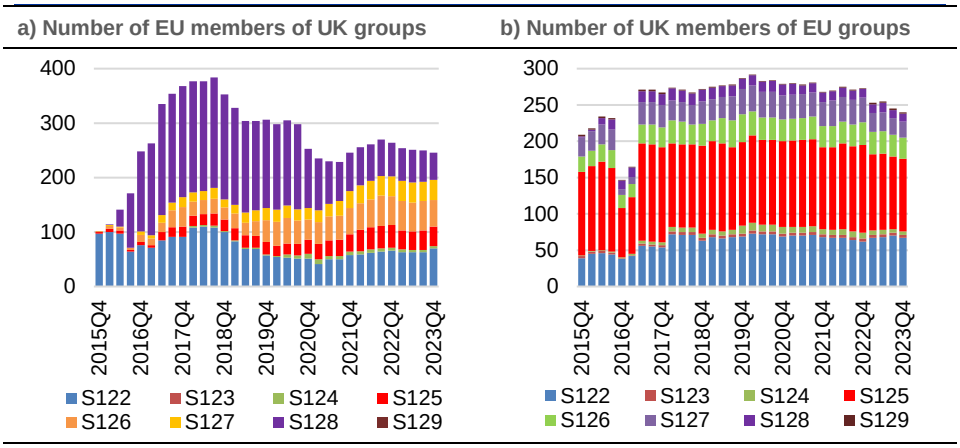
Source: ONS.

6.3.2 Banks, insurance corporations and pension funds and financial centres

The ESCB'S RIAD is used to maintain lists of financial institutions, including monetary financial institutions (MFIs), investment funds (IFs), financial vehicle corporations (FVCs), insurance corporations (ICs) and payments statistics relevant institutions (PSRIs). RIAD contains information on entities and relationships. An entity is a financial institution resident in a particular country, and its relationships are with the branches or subsidiaries of this entity located in a different country. RIAD can provide information about the number of UK financial institutions, particularly banks, with affiliates in the EU (i.e. EU members of UK groups).

Since Brexit, the number of UK financial institutions with affiliates in the EU has grown, particularly the number of non-banking groups, such as insurance corporations. Figure 19, panel a shows that the number of EU members of UK groups increased from 100 in the fourth quarter of 2015 to 246 in the fourth quarter of 2023. This growth in relationships in the EU (which has declined since 2018) was driven by non-banking groups (primarily insurance corporations (S128)), which increased from 0 to 240 over the period. The number of banking groups (S122) declined from 100 to 70.

Figure 19
UK and EU financial institutions and affiliates



Sources: RIAD and ESCB.

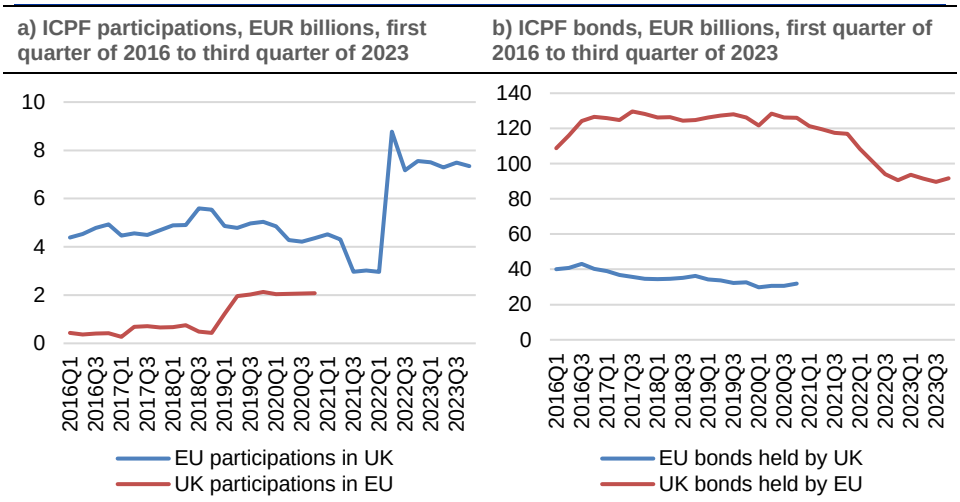
Since Brexit, the number of EU financial institutions with affiliates in the United Kingdom has been broadly stable. Figure 19, panel b shows that the number of UK members of EU groups has been relatively stable in recent years, increasing from 200 in the fourth quarter of 2015 to 240 in the fourth quarter of 2023. The two-quarter blip from the fourth quarter of 2016 to the first quarter of 2017 can be explained by a data quality issue and is likely to be unrelated to Brexit developments. Most of the EU groups present in the United Kingdom are banking groups. It is worth noting that the proportion of EU entities in UK groups is around 50%, while the proportion of UK entities in EU groups is below 5%.

EIOPA provides statistical data on insurance undertakings and groups in the EU and the EEA. Focusing on the asset side of balance sheets and considering the value of

participations and bonds between the EU and the United Kingdom, insurance corporations and pension funds hold investment portfolios that include equities and bonds. Equity investments that meet certain criteria, such as the 20% holding threshold from Solvency II reporting, are considered a participation.

The value of EU participations in the United Kingdom increased significantly in 2022, while the number of UK bonds held by the EU declined. The value of UK insurance corporation and pension fund (ICPF) participations in the EU jumped from €0.5 billion in 2016 to €2 billion in 2019 (Figure 20, panel a). The value of EU participations in the United Kingdom was relatively stable, at around €4.5 billion, until the second half of 2021, subsequently falling below €3 billion. The increase in UK participations in the EU may be due to the loss of passporting due to Brexit. On the EU side, there is no corresponding jump in the data, and this may relate to the differences in the equivalence granted by the two areas. For example, the United Kingdom granted equivalence to the EU in financial services (in 28 out of 32 areas), while the EU, in return, granted only two equivalence decisions for financial services, both of which were time limited and one of which has since expired.[49] The underlying data show that Ireland and Luxembourg account for most of the value of UK participations in the EU, as well as the increase in 2019. The value of bonds held by the United Kingdom in the EU (and vice versa) remained stable in the sample period from the first quarter of 2016 (Figure 20, panel b): however, the value of UK bonds held by the EU declined from 2022, from around €120 billion to close to €90 billion.[50]

Figure 20
ICPF participations and bonds



Source: EIOPA.

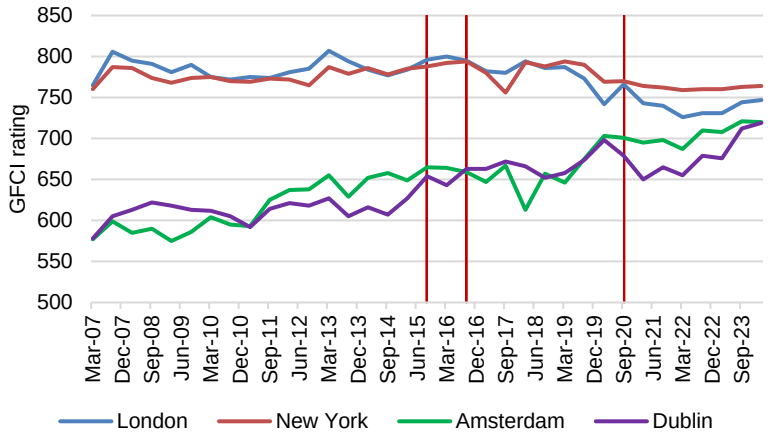
London remains one of the world's leading financial centres, but has lost some ground to New York. Since Brexit, the Global Financial Centres Index (GFCI) rating of some competing European financial centres (e.g. Amsterdam, Paris, Madrid and Dublin) have improved. The GFCI, published by Z/Yen Partners in collaboration with

[49] See UK Parliament (2022), "New UK-EU financial services inquiry launched", News Article, February.

[50] Note that 2022 marks the beginning of rising interest rates in the euro area and the United Kingdom.

the China Development Institute, provides a measure of the competitiveness of the world's leading financial centres.[51] The latest GFCI shows that New York has been in first place in recent years, with London pushed into second place. London continues to lead in western Europe, but lost 14 points in the latest ratings, the biggest drop among the top 20 centres. Since 2015 London's GFCI rating has fallen enough to leave New York firmly in first place as the top ranked global financial centre (Figure 21). While London's rating has fallen, it remains in second place globally and in first place in western Europe. The ratings of some competing financial centres in Europe, such as Amsterdam, Paris, Madrid and Dublin, and in Asia, such as Hong Kong and Singapore, improved over the Brexit period.

Figure 21
Global Financial Centre Index



Sources: Z/Yen Partners and China Development Institute.

6.3.3 Comment on the UK financial sector

This section has shown that the UK financial sector has been one of the worst performing sectors in the UK economy since Brexit, as measured by growth in real gross value-added. There were historically large FDI inflows from the EU to the United Kingdom in 2016 and 2019, which may suggest Brexit-related activity in the sector. In 2017 and 2021 there were negative FDI inflows from the EU, indicating disinvestments in the United Kingdom. In 2020 FDI inflows from the EU were lower than the historical average, an early indication of a possible reduction in EU FDI in the UK financial sector. For UK FDI outflows to the EU, there were negative outflows (disinvestments) following the global financial crisis, and this pattern reversed in 2017 and 2020, when positive outflows were recorded. These positive outflows to the EU may indicate Brexit-related activity. The potential for Brexit-driven trends, or relocating activities, is also evident in data from RIAD, ICPF participations, New Financial and ESMA reports.

[51] For more information, including the methodology, see the Global Financial Centres Index.

One of the main challenges for the UK financial sector due to Brexit is the fact that the TCA contains only limited provisions on the trade in financial services between the United Kingdom and the EU. While UK financial firms were once able to passport into the EU, this has no longer been the case since the end of the transition period in the fourth quarter of 2020.

One potential way around the loss of passporting financial services into the EU is so-called equivalence; however, this would be only a partial solution, and, crucially, it depends on the United Kingdom and the EU adopting similar equivalence decisions, which is not the case. While the United Kingdom has granted equivalence to EEA Member States in 28 of the 32 areas identified for the equivalence process, the EU has, in return, only granted the United Kingdom two equivalence decisions for financial services (both of which are time limited, and one has since expired). The implication of this outcome is that UK financial services firms have had to restructure and relocate operations, staff and assets to the EU in order to maintain access to customers there.

Some of the main destinations for relocation are Frankfurt, Paris, Amsterdam, Dublin and Luxembourg. Some financial services firms publicly announced details of their relocation plan due to Brexit (i.e. how many staff and to where), but it is otherwise not easy to determine from the data how much of recent movement can be attributed to a “Brexit effect”. During the period under consideration, there were also other shocks to the economy, including COVID-19, the war in Ukraine, the environment of high inflation and rising interesting rates, etc. It is also likely that “Brexit effects” will only fully unfold in the long term. For these reasons, caution is required when interpreting any of the above data.

6.4 Estimating the impact of Brexit on EU-UK FDI – a gravity model approach

6.4.1 The model

In this section, we use a gravity model approach to determine the potential impact of Brexit on FDI flows and stocks between the EU and the United Kingdom, comparing trends in EU-UK FDI with EU-EU (one EU country with other EU countries) FDI, before and after the Brexit referendum. The referendum date of June 2016, as well as the beginning of the new EU-UK relationship in January 2021, were chosen in the model as the key Brexit events. The volatility of EU-UK FDI temporarily soared after the referendum, and the behaviour of large investors became more heterogeneous. The beginning of the new EU-UK relationship in January 2021 was already marked by high levels of uncertainty, and partially overlapped with the COVID-19 pandemic.

The difference-in-differences technique tests whether EU countries adopted different investment strategies for the United Kingdom from those adopted for other EU countries after the referendum. The “treated units” are the FDI between individual EU countries and the United Kingdom, while the “control units” are the FDI between

individual EU countries and the rest of the EU. The counterfactual scenario was that, in the absence of Brexit, the EU-UK FDI would have been higher.

The scenario is strengthened by assigning weights to the control units and the treated units, in order to build parallel trends between the two categories before the Brexit referendum. This synthetic difference-in-differences (SDID) methodology was developed by Arkhangelsky et al. (2021) and Clarke et al. (2023). Consequently, the counterfactual scenario creates the conditions for detecting causality, rather than correlation only.

We control for GDP growth, which is strongly correlated with the FDI trend (Pegkas, 2015), unit labour costs and trade openness (Dellis et al., 2017), and try to estimate the coefficient of a Brexit dummy, representing the impact on EU-UK FDI flows. Temporary common shocks with a similar impact on the EU countries, heterogeneity among the EU countries and interactive effects (temporary common shocks with heterogeneous effects across the EU countries) are also included in the model (Bai, 2009). The dependent variable with one lag corrects for the potential serial correlation of residuals.

Hence, the first part of the model is as follows:

$$FDI_{it} = c + \alpha * GDPgrowth_{it} + \beta * LCI_{it} + \eta * logTrade\_openness_{it} + \mu_i + \tau_t + u_{it} \quad (1)$$

$$u_{it} = \delta_i F_t + \varepsilon_{it} \quad (2)$$

After estimating the factors, equation (1) was re-estimated with the factors included. The factors are computed using the principal component analysis, with first two selected (proxy for global and European factors). At the end, the dummy variables are considered in order to obtain the impact of Brexit on EU-UK FDI flows:

$$\varepsilon_{it} = \rho * UK_{it} + \sigma * Brexit_{it} + \theta * UK_{it} * Brexit_{it} + v_{it} \quad (3)$$

where FDI_{it} are the FDI flows or stocks over GDP between EU country i and the United Kingdom, at time t, or between EU country i and other EU countries, $GDPgrowth_{it}$ refers to the GDP growth rate (quarter-on-quarter) in EU country i, LCI_{it} is the quarterly change in the labour cost index, $logTrade\_openness_{it}$ is the total trade volume over GDP, expressed in logarithm, μ_i and τ_t are the unit-fixed and time-fixed effects, UK_{it} is a dummy variable (taking the value one for EU-UK FDI flows and zero for EU-non EU FDI flows) and $Brexit_{it}$ is a dummy variable for the UK-EU membership referendum (taking the value 1 since the third quarter of 2016 and 0 until the second quarter of 2016). F_t are time-variant common factors (the global evolution of FDI flows, including those channelled via the United Kingdom, the COVID-19 pandemic, etc.) and δ_i refers to the corresponding factor loadings (the heterogeneous impact of the common factors on the FDI carried out or received by the individual EU countries).

The Brexit dummy estimates the impact of the referendum and the beginning of the new EU-UK relationship on FDI carried out by EU countries in the Single Market. If one assumes that Brexit overlapped with broader, global developments, or simply

that Brexit affected EU FDI not only with the United Kingdom, but also with the rest of the EU, then the coefficient of the UK*Brexit dummy variable refers to the specific impact of the Brexit referendum on EU-UK FDI flows or stocks (for a detailed explanation of the modelling methodology, see Annex III).

6.4.2 COVID-19 pandemic effects

The period after the Brexit referendum overlapped, for approximately two years, with the COVID-19 pandemic, thus making it difficult to isolate the effect of Brexit on FDI. Additionally, the beginning of the new EU-UK relationship partially overlapped with the pandemic. Hence, the impact of the pandemic on FDI may be material, if we expect a strong correlation between economic activity and FDI.

In the model, the impact of the pandemic is captured by time-fixed effects (time-variant common shock) or interactive effects if the pandemic had heterogeneous effects on FDI flows across EU countries. Additionally, the impact of the pandemic on the data requires a specific estimator for the model. The historical volatility observed for GDP data during the pandemic could lead to heteroscedasticity. In that case, robust estimators, adjusted to handle heteroscedasticity, were applied.

6.4.3 Data

The database includes information on: (i) FDI flows and stocks (assets and liabilities) between individual EU countries and the United Kingdom, on the one hand, and between individual EU countries and other EU countries, on the other hand; (ii) GDP growth in the individual EU countries; (iii) the index of unit labour cost; (iv) total trade between individual EU countries with the rest of EU; and (v) GDP at current prices in the individual EU countries. FDI assets comprise FDI carried out by individual EU countries in the United Kingdom and in the rest of the EU. Implicitly, FDI liabilities comprise FDI received by individual EU countries from the United Kingdom and from the rest of the EU. FDI between EU countries and the United Kingdom is “treated”, in the sense that the United Kingdom has left the EU. The control units are the FDI between EU countries and the rest of the EU. The potential divergence between the treated and control units after the Brexit referendum or after the beginning of the new EU-UK relationship quantifies the impact of Brexit on FDI between the EU and the United Kingdom.

The data have quarterly frequency, cover the period from the first quarter of 2010 to the fourth quarter of 2023 and are extracted from Eurostat. FDI is normalised by GDP and further adjusted to remove heterogeneous fixed effects and common time effects. When estimating the model for the January 2021 benchmark of Brexit, the period between 2015 and 2023 is considered, to ensure that the data are relevant.

6.4.4 Estimation and results

In the model, for each EU country, FDI with the United Kingdom and FDI with other EU countries are considered. The rationale is that these two types of FDI were correlated before the referendum or the beginning of the new EU-UK relationship, but afterwards, the FDI of individual EU countries with the United Kingdom started to deviate from the FDI of individual EU countries with the rest of the EU. The analysis focuses on FDI flows, given their high sensitivity to changes in investor sentiment, while the impact of Brexit on FDI stocks, a more stable indicator, plays the role of a robustness check.

The coefficients shown in Table 3 should be interpreted as the overall trend in the FDI of each EU country with the United Kingdom, compared with the FDI of each EU country with the rest of the EU (coefficient of Dummy UK), the impact of Brexit on EU FDI flows with the rest of the world (coefficient of Dummy Brexit) and the impact of Brexit on EU-UK FDI (coefficient of Dummy UK*Dummy Brexit), the latter being of most interest for our analysis.

6.4.5 Results for FDI flows

The model detected an overall positive effect of the Brexit referendum on the FDI flows of EU countries in the United Kingdom of 5.5%, after filtering out the effects of the GDP growth, labour cost and trade openness of the EU countries, the particularities of the EU countries (unit-fixed effects) and time-fixed effects (temporary common shocks with a similar impact on the EU countries), as well as interactive effects (temporary common shocks with heterogeneous effects across the EU countries) (Table 3). Consequently, the figure isolates the Brexit effect from other factors driving EU FDI in the United Kingdom. The positive contribution of Brexit could be explained by business relocations from the EU to the United Kingdom involving temporary capital flows; therefore, the impact may fade away in the coming years if the United Kingdom continues to move away from the Single Market. For UK FDI flows in EU countries, since the Brexit referendum a symmetric positive contribution of 5.6% has been identified, with slightly more statistical significance than that registered for EU-UK FDI. Similarly, relocations from the United Kingdom to the EU could explain these trends.

Table 3
Estimation results (dependent variable: orthogonal FDI flows, estimator: OLS (Ordinary Least Squares))

	Benchmark for Brexit: June 2016 (referendum)		Benchmark for Brexit: January 2021	
Variable	FDI asset flows	FDI liability flows	FDI asset flows	FDI liability flows
Dummy UK	0.0287*	0.0153	0.0431**	0.0493***
	[1.9446]	[1.0937]	[2.5316]	[3.1360]
Dummy Brexit	-0.0466***	-0.0209	0.0016	0.0139
	[-3.3897]	[-1.6032]	[0.0667]	[0.6274]
Dummy UK * Dummy Brexit	0.0549**	0.0559**	-0.0287	-0.0045
	[2.2512]	[2.4123]	[-0.7524]	[-0.1292]
No. of countries (control)	27	27	27	27
No. of countries (treated)	27	27	27	27
No. of observations	3,024	3,024	1,944	1,944
Akaike information criterion	0.9606	0.8585	1.1682	1.0078

Source: Authors' calculations.
Note: ***/**/* indicates a 1%/5%/10% significance level; t-statistic in brackets.

So as not to endanger the model's statistical robustness and the accuracy of the results for most EU countries, very large FDI transactions between some EU countries (Luxembourg and the Netherlands) and the United Kingdom were treated as outliers and therefore omitted from the estimations.

However, to obtain a possible impact of Brexit on the very substantial EU-UK FDI flows, the model was re-estimated using all the data, naturally at a cost of higher variance. The gravity model results showed that, from the Brexit referendum until 2023, EU FDI flows in the United Kingdom declined by 3.9%, and UK FDI flows in the EU also decreased by 4.0%, when compared with the pre-referendum period, starting in 2010. The contraction of FDI was significant after January 2021, of 27% and of 24%, respectively (Table 4). The exceptional FDI withdrawals between Luxembourg and the United Kingdom in the fourth quarter of 2022, potentially linked to the Convention between the two parties on the elimination of double taxation of income and capital gains and the prevention of tax evasion and avoidance, signed in June 2022, may have prompted this estimated impact of Brexit.

Table 4
Simulation results with the very large EU-UK FDI transactions included in flows (dependent variable: orthogonal FDI flows, estimator: OLS)

	Benchmark for Brexit: June 2016 (referendum)		Benchmark for Brexit: January 2021	
Variable	FDI asset flows	FDI liability flows	FDI asset flows	FDI liability flows
Dummy UK	0.0175	0.0213	0.0525**	0.0541
	[0.8799]	[0.7749]	[2.1661]	[1.6127]
Dummy Brexit	0.0060	-0.0007	0.0811**	0.0462
	[0.3256]	[-0.0287]	[2.3662]	[0.9732]
Dummy UK * Dummy Brexit	-0.0394	-0.0404	-0.2669***	-0.2378***
	[-1.1961]	[-0.8862]	[-4.9268]	[-3.1677]
No. of countries (control)	27	27	27	27
No. of countries (treated)	27	27	27	27
No. of observations	3,024	3,024	1,944	1,944
Akaike information criterion	1.5628	2.2089	1.8729	2.5251

Source: Authors' calculations.
Note: ***/**/* indicates a 1%/5%/10% significance level; t-statistic in brackets.

6.4.6 Robustness check: results for FDI stocks

A robustness check of the model's results is conducted by referring to EU-UK FDI stocks. The estimation results confirm, to a significant extent, the effect of Brexit on EU-UK FDI (Table 5). The data on FDI stocks are more stable than the data on FDI flows: the results on FDI stocks are therefore less sensitive to short-term movements.

Table 5
Estimation results (dependent variable: orthogonal FDI stocks, estimator: OLS)

	Benchmark for Brexit: June 2016 (referendum)		Benchmark for Brexit: January 2021	
Variable	FDI asset stocks	FDI liability stocks	FDI asset stocks	FDI liability stocks
Dummy UK	0.7497***	0.6846***	0.8440***	0.0216
	[6.4313]	[6.6944]	[6.8317]	[0.3046]
Dummy Brexit	0.1602	-0.3249***	0.2655	0.2296**
	[1.4765]	[-3.4132]	[1.5197]	[2.2912]
Dummy UK * Dummy Brexit	0.0766	-0.1576	-0.0730	0.3611**
	[0.3976]	[-0.9320]	[-0.2642]	[2.2786]
No. of countries (control)	27	27	27	27
No. of countries (treated)	27	27	27	27
No. of observations	3,024	3,024	1,944	1,944
Akaike information criterion	5.0942	4.8324	5.1309	4.0194

Source: Authors' calculations.
Note: ***/**/* indicates a 1%/5%/10% significance level; t-statistic in brackets.

When including very substantial EU-UK FDI transactions in stocks, the results confirm an increase in EU FDI in the United Kingdom after the referendum, as well as a decline in UK FDI in the EU after the new EU-UK relationship began (Table 6).

Table 6
Simulation results with the very large EU-UK FDI transactions included in stocks (dependent variable: orthogonal FDI stocks, estimator: OLS)

	Benchmark for Brexit: June 2016 (referendum)		Benchmark for Brexit: January 2021	
Variable	FDI asset stocks	FDI liability stocks	FDI asset stocks	FDI liability stocks
Dummy UK	-0.0215	0.0098	-0.0311	-0.1468
	[-0.1269]	[0.0974]	[-0.1720]	[-1.2893]
Dummy Brexit	-0.0332	0.0560	-0.1105	-0.0700
	[-0.2110]	[0.5950]	[-0.4315]	[-0.4350]
Dummy UK * Dummy Brexit	0.0967	-0.0659	0.2230	0.5198**
	[0.3460]	[-0.3949]	[0.5680]	[2.0412]
No. of countries (control)	27	27	27	27
No. of countries (treated)	27	27	27	27
No. of observations	3,024	3,024	1,944	1,944
Akaike information criterion	5.8381	4.8076	5.8956	4.9680

Source: Authors' calculations.
Note: ***/**/* indicates a 1%/5%/10% significance level; t-statistic in brackets.

6.5 In summary

From the second quarter of 2016 net FDI flows between the EU and the United Kingdom decreased gradually in both directions, according to Eurostat data. The volatility of EU-UK FDI peaked in the first quarter of 2017, mainly driven by debt instruments, before gradually decreasing until the end of the transition period in the fourth quarter of 2020, when there were substantial surges in UK equity investments in the EU, potentially indicating business relocations from the United Kingdom to the EU. Record disinvestments were also registered in the fourth quarter of 2022. After the referendum, EU-UK FDI flows were concentrated in a few countries. About 50% of EU investments in the United Kingdom originated from the Netherlands, Germany and Belgium, while 60% of UK investments in the EU went to the Netherlands and Germany. Substantial disinvestments had also taken place between Luxembourg and the United Kingdom by the fourth quarter of 2022, potentially due to tax reasons.

With respect to UK FDI vis-à-vis countries in the world other than the EU, the United States was, according to OECD data, the country's main investor and investee, with one other major UK FDI counterpart among non-EU members of the OECD being Australia. In terms of sectors of economic activity, in the period 2017-22, the EU invested in UK mining and other services, according to Eurostat data, while making disinvestments in manufacturing, and particularly in financial activities. Conversely, the largest UK investments were registered in the EU manufacturing sector, and the largest disinvestments were recorded in financial activities.

The activity of EU foreign affiliates in the United Kingdom's financial sector has been declining since at 2020. The contribution of the United Kingdom's foreign affiliates in the EU remained sizeable, but the turnover of rest of the world foreign affiliates in the financial sector was much higher than the turnover of affiliates from the United Kingdom in 2021, indicating some UK FDI decoupling from the EU in that sector.

In terms of FDI stocks, EU countries were net investors in the United Kingdom at the end of 2023, when the difference between EU FDI stocks in the United Kingdom and UK FDI stocks in the EU was €346 billion. The relative importance of UK FDI stocks, both inward and outward, vis-à-vis the EU has decreased since Brexit, according to ONS data, unlike UK FDI stocks vis-à-vis the rest of the world.

The number of new FDI projects in the United Kingdom fell, according to the UK DBT, from almost 2,300 in 2016-17 to over 1,550 in 2023-24. The number of new jobs created by these FDI projects decreased in the 2016-20 period, before reaching a new record of almost 85,000 new jobs in 2021-22 and falling back again to 71,000 in 2023-24. The sectors creating most new jobs were software and computer services, accounting for 22% of total jobs created by new FDI projects, wholesale trade, with 14% and financial activities, with 11%. In 2023-24 the EU and the United States accounted for 40% and 24% respectively of new FDI projects in the United Kingdom. Within the EU, the main investors were Germany, France, Spain, Italy, Sweden and the Netherlands. Since Brexit, new FDI projects from the Commonwealth countries, with a relative share of 17%, have not increased significantly.

According to ONS data, the UK financial sector has been one of the worst performing sectors in the UK economy since Brexit, as measured by growth in real gross value-added. Financial services jobs have been volatile since the end of the transition period, with the creation of fewer than 3,000 jobs. At the same time, almost 500 financial firms have relocated from the United Kingdom to the EU, moving jobs and setting up hubs and/or transferring assets. The main destinations for relocation are Frankfurt, Paris, Amsterdam, Dublin and Luxembourg.

Financial sector UK FDI inflows from the EU surged in 2016, 2019 and 2021, particularly from the Netherlands, which suggests potential Brexit-related activity in the sector. This compares with an average below historical levels. For financial sector UK FDI outflows to the EU, there were negative outflows or disinvestments after the global financial crisis, with this pattern reversing somewhat in 2017 and 2020, when positive outflows were recorded, also potentially indicating Brexit-related activity in the sector. In 2021 there was more financial sector disinvestment from the EU. According to the ECB, the number of EU members of UK financial groups increased from 100 in the fourth quarter of 2015 to 246 in the fourth quarter of 2023, mainly driven by non-banking groups, primarily insurance corporations. The increase actually observed by the EIOPA in UK participations in the EU insurance corporations and pension funds sector may be due to the loss of passporting after the end of the transition period in the fourth quarter of 2020 and to the differences in the equivalence granted by the two geographical areas.

The gravity model results showed that from the Brexit referendum until 2023, EU FDI flows in the United Kingdom declined by 3.9%, while UK FDI flows in the EU also decreased, by 4.0%, compared with the pre-referendum period starting in 2010. This was mainly due to a few very substantial FDI outflows, some of them potentially due to tax reasons. When very substantial transactions, most taking place after the beginning of the new EU-UK relationship in January 2021, were excluded from the estimation, these coefficients turned into rises of 5.5% and 5.6% respectively,

suggesting an increase in FDI flows in both directions in the same period in the context of business relocations. Particularly large FDI outflows between the United Kingdom and major EU financial centres, such as Luxembourg and the Netherlands, could potentially indicate some decoupling from the EU of London as a major global financial centre since the Brexit referendum, marking the significant challenge that the United Kingdom's departure from the EU has posed, particularly to the financial sector.

Annex I: International Monetary Fund (IMF) and OECD methodological issues relating to FDI

According to the IMF "Balance of Payments and International Investment Position Manual" recommendations, which are consistent with those set out in the OECD "Benchmark Definition of Foreign Direct Investment", FDI is a type of international investment made by a resident of an economy in order to establish a permanent and lasting interest in an enterprise resident in another economy. A direct investment relationship arises when a resident direct investor makes an investment in a direct investment enterprise resident in another economy, allowing the former to have control (> 50% of the voting rights) or significant influence (between 10% and 50% of the voting rights) over the management of the latter. The control or influence may be held directly (through the direct holding of voting power) or indirectly (through the ownership of other companies that, in turn, hold voting rights). In the analytical use of the various presentations of FDI, the directional principle is a presentation of direct investment data, organised according to the direction of the direct investment relationship. It can be contrasted with the assets and liabilities presentation of aggregates, organised according to whether the investment relates to an asset or a liability.

According to the directional principle, direct investment is shown as either:

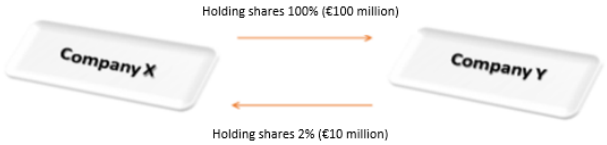
> Direct investment abroad, covering assets and liabilities between resident direct investors and their non-resident direct investment enterprises. Direct investment abroad is also called outward direct investment.
>
> Direct investment in the reporting economy, including all liabilities and assets between resident direct investment enterprises and their non-resident direct investors. Direct investment in the reporting economy is also called inward direct investment.

According to the directional principle, direct investment abroad and direct investment in the reporting economy include both assets and liabilities: negative values may therefore arise.

Data on both the asset/liability principle and the directional principle are useful for different kinds of analysis: while data on an assets and liabilities basis are consistent with monetary, financial and other balance sheet data, and thus facilitate comparison between the several datasets, data on a directional basis help to clarify the motivation for direct investment, taking account of control and influence.

The difference between the asset/liability and the directional presentations arises from differences in the treatment of reverse investment that emerge when a direct investment enterprise lends funds to or acquires equity in its immediate or indirect direct investor, if it does not own equity comprising 10% or more of the voting rights in the direct investor. To aid understanding, an example is shown below.

Example of FDI registered in the country of Company X:



Directional principle	Asset/liability principle
It records a net asset of Company X of €90 million (net asset of €90 million = €100 million - €10 million)	It records an asset of €100 million of Company X and a liability of €10 million of Company Y
Reflects the direction of the underlying original relation of direct investment.	Reflects the structure of external assets and liabilities, regardless of the direction of the original investment.

Annex II: FDI definitions and time periods used by the UK Department for Business and Trade and the Ernest & Young European Investment Monitor

UK Department for Business and Trade

1. DBT definition of FDI = a cross-border investment by a non-UK resident entity where the direct investor acquires at least 10% of the voting power or ownership.
2. All FDI projects = new investment, M&A (incl. joint ventures), expansions (incl. retentions) of already existing projects
    a. NOT included: short-term projects (less than three years), contract agreements (exc. R&D), franchise contracts, real estate w/o additional businesses and jobs
3. New investment = establishing a new entity, setting up new offices, building, production or operational facilities in the United Kingdom, creating one or more permanent jobs
    a. NOT included: M&A, expansions + short-term projects (less than three years), contract agreements (exc. R&D), franchise contracts, real estate w/o additional businesses and jobs
4. Period: UK financial year (April 6 – April 5)
5. Jobs: job figures are estimates made at the start of each investment project. New jobs capture total jobs likely to be created within three years from the start of the project. Safeguarded jobs include those jobs that were retained due to the additional/new inward investment.

Ernest & Young European Investment Monitor

1. E&Y EIM definition of FDI = an investment in a company in which the foreign investor acquires more than 10% of the company's equity and takes a role in its management. FDI includes equity capital, reinvested earnings and intra-company loans.
2. New FDI projects = projects that have resulted in the creation of new facilities and jobs
    a. NOT included: M&A (w/o new facilities/jobs); portfolio investments; licence agreements; retail and leisure, hotel, real estate utilities,

extraction investments (unless a headquarters/distribution centre is created); machinery and production replacements (w/o new jobs); non-profit organisation activities.

3. Period: calendar year.

Annex III: Methodology and results of the gravity model

The use of unit and time-fixed effects in the regression requires the imposition of restrictions to identify the model. Bai (2009) indicated that the sum of unit-fixed effects should equal zero, with the same applying for time-fixed effects:

$$\sum_{i=1}^{N} \mu_i = 0 \text{ and } \sum_{t=1}^{T} \tau_t = 0 \quad (4)$$

Moreover, both unit and time-fixed effects can be correlated with the independent variable (in our case, GDP growth and lagged FDI flows). Consequently, according to Bai (2009), the dependent variable (FDI flows normalised by GDP) is adjusted before running the estimations, as follows:

$$FDI_{it\ adj} = FDI_{it} - \overline{FDI}_{i\cdot} - \overline{FDI}_{\cdot t} + \overline{FDI}_{\cdot\cdot} \quad (5)$$

where $\overline{FDI}_{i\cdot} = \frac{1}{T}\sum_{t=1}^{T} FDI_{it}$, $\overline{FDI}_{\cdot t} = \frac{1}{N}\sum_{i=1}^{N} FDI_{it}$ and

$$\overline{FDI}_{\cdot\cdot} = \frac{1}{TN}\sum_{t=1}^{T}\sum_{i=1}^{N} FDI_{it} \quad (6)$$

Variable FDI_{it} is replaced with $FDI_{it\ adj}$ in equation (1). When the model includes time-variant covariates and factors, Arkhangelsky et al. (2021) recommend applying the SDID methodology for the dependent variable orthogonal of covariates (in our model, the variable $FDI^{orth}_{it\ adj}$). Therefore, the SDID method of Arkhangelsky et al. (2021), with unit weights, adjusted for the covariates and the other variables of our model, becomes:

$$(\hat{\gamma}, \hat{\theta}, \hat{\tau}) = arg\min_{\gamma,\theta,\tau}\{\sum_{i=1}^{N}\sum_{t=1}^{T}(FDI^{orth}_{it\ adj} - \gamma * UK_{it} - \theta * \textit{Brexit}_{it} - \tau * UK_{it} * \textit{Brexit}_{it})^2\, \omega^{sdid}\} \quad (7)$$

where:

$$FDI_{it\ adj} = c + \delta_i F_t + \alpha * GDPgrowth_{it\ adj} + \beta * LCI_{it\ adj} + \eta * logTrade\_openness_{it\ adj} + \varepsilon_{it} \quad (8)$$

and

$$FDI^{orth}_{it\ adj} = \widehat{\varepsilon_{it}} \quad (9)$$

The common factors (F_t) with heterogeneous effect across the FDI by individual EU countries are determined by principal component analysis (Bai, 2009, Bai and Ng, 2017). Briefly, equation (1) with the adjusted variables is first estimated with no interactive effects. Afterwards, the residuals are standardised and further decomposed with singular value decomposition (SVD), as follows:

$$SVD\ (residuals) = UDV' \quad (10)$$

Hence, the time-variant common factors are $F_t = \sqrt{T}U_r(D_r)^{1/2}$ (11)

where r represents the number of factors or the rank of residuals' matrix. Roughgarden and Valiant (2024) recommend a rule of thumb to determine the number of factors the sum of the largest k singular values is at least ten times the

sum of the remaining singular values. The excluded principal components are treated as “noise”. On the other hand, the sample size may impose further adjustments of r if the number of heterogeneous effects (δ_i) that must be estimated becomes too large. For example, Chernozhukov and Fernandez-Val (2017) concluded that adding too many control variables does not lead to a sizeable improvement in estimation results. Moreover, the heterogeneous effects lower the variation in data considerably, because principal components, with less power to explain the sample’s variance, could measure individual large shocks (Bai and Ng, 2019). Hence, to filter out the heterogeneous effects of common factors and also maintain the statistical significance of the estimation results, a low number of common factors is preferable, depending on the size of the dataset and the number of total units.

After computing and selecting the common factors (F_t) to be considered in the model, equation (1) is estimated again, this time with the complete specification.

Furthermore, weights are assigned to the dependent variable for each country to match parallel trends between treated and control units before the Brexit referendum, according to the SDID methodology developed by Arkhangelsky et al. (2021) and Clarke et al. (2023). The parallel trend facilitates building the counterfactual scenario and measuring, by differentiation, the impact of Brexit on FDI flows. Arkhangelsky et al. (2021) proposed the following equation to estimate the weights for control and treated units (adapted to our model):

$$\left(\widehat{\omega_0}, \widehat{\omega^{sdid}}\right) = arg \min_{\omega_0 \in R, \omega \in \Omega} \sum_{t=1}^{T_{pre}} (\omega_0 + \sum_{i=1}^{N_{CO}} \omega_i FDI_{it\ adj}^{orth} - \frac{1}{N_{tr}} \sum_{i=N_{CO}+1}^{N} FDI_{it\ adj}^{orth})^2 + \zeta^2 T_{pre} \|\omega\|_2^2 \quad (12)$$

$$\text{where } \Omega = \left\{\omega \in R_+^N : \sum_{i=1}^{N_{CO}} \omega_i = 1, \omega_i = \frac{1}{N_{tr}} \; for \; i = N_{CO}+1, \ldots, N\right\} \quad (13)$$

The weights are estimated using the data before treatment (before the Brexit referendum), but they apply for the entire period. In case of the control units (FDI between individual EU countries and the rest of the EU), the weights are positive, and their sum is one. For the treated units (FDI between individual EU countries and the United Kingdom), the weights are equal (1/no. of control units).

Arkhangelsky et al. (2021) indicated the regularisation parameter to be computed as follows (adapted to our model):

$$\zeta = (N_{tr} T_{post})^{1/4} \hat{\sigma}, \quad (14)$$

$$\text{with } \hat{\sigma}^2 = \frac{1}{N_{CO}(T_{pre}-1)} \sum_{i=1}^{N_{CO}} \sum_{t=1}^{T_{pre}-1} (\Delta_{it} - \bar{\Delta})^2, \quad (15)$$

$$\Delta_{it} = FDI_{i(t+1)\ adj}^{orth} - FDI_{it\ adj}^{orth} \quad \text{and} \quad (16)$$

$$\bar{\Delta} = \frac{1}{N_{CO}(T_{pre}-1)} \sum_{i=1}^{N_{CO}} \sum_{t=1}^{T_{pre}-1} \Delta_{it} \quad (17)$$

The regularisation parameter ζ should penalise the large weights by shrinking most of them close to zero, in order to reduce the risk of multicollinearity when estimating the weights and to ensure their uniqueness.

The objective is to run the equation (3) to obtain the coefficient of the UK*Brexit dummy variable, which measures the impact of Brexit on FDI flows. To this end, we need first to determine the FDI flows orthogonal to the covariates, unit-fixed effects, time-fixed effects and interactive effects, and second to estimate the synthetic weights.

To obtain the orthogonal FDI flows, equation (1) is estimated without the common factors that are not known at this stage and are extracted from the residuals by principal component analysis. In the case of FDI asset flows, the methodology of Roughgarden and Valiant (2024) leads to the selection of the first 18 principal components out of 53, the rest being labelled as “noise”. Similarly, 20 principal components for FDI liability flows were selected. Nevertheless, a number of 18/20 common factors means that a total of 972/1,080 heterogeneous effects must be estimated, while the sample size is 2,808 observations.

We have tested the informational benefits of including the common factors in the model. Given the presence of heteroscedasticity in the residuals, we used the GLM (Generalised Linear Model (normal distribution)) estimator - HAC (Heteroscedasticity and Autocorrelation Consistent) robust - to obtain a valid inference. The estimated coefficients are similar to those resulting with the OLS estimator, but the standard errors are correctly specified by considering the heteroscedasticity and potential autocorrelation in the residuals. The results indicate a modest improvement (a smaller decline in the Akaike information criterion and standard error of regression), also given the fact that most of the common factors were removed from the data when adjusted for unit and time-fixed effects. In this case, we decided to include in the regression only the first two principal components (54 heterogeneous effects), which is expected to filter the data for the heterogeneous effects of global and European factors. Otherwise, more than 108 control factors (heterogeneous effects) will decrease the number of degrees of freedom to such an extent that the variance will increase considerably. The statistical significance of the heterogeneous effects of the first principal component is rather weak, pointing to strong particularities across EU countries. Nevertheless, part of the heterogeneity is removed from the data, improving the efficiency of the estimated Brexit impact.

Further on, residuals from equation (3) become the orthogonal FDI flows, which are considered in equation (12) to compute the synthetic weights for control and treated units. With both orthogonal FDI and unit weights known, regression (7) is estimated to measure the impact of Brexit on FDI.

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