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THE EFFECT OF BREXIT ON THE FINANCIAL INTEGRATION BETWEEN THE UNITED KINGDOM AND THE EUROPEAN UNION

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PREFACE AND ACKNOWLEDGEMENTS

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ABSTRACT

This paper investigates the change in the degree of financial integration, between the United Kingdom and the European Union after the Brexit event, represented by the referendum held on 23 June 2016. To guide the research, we developed six different hypotheses to focus on specific countries and sectors. The main findings do not show a clear effect of Brexit on the change in the integration score, especially in the whole period in exam, from April 2013 to August 2023. Restricting the period until COVID hit helped find more significant, negative, effects of the referendum. That also helped to show that COVID was a great driver of the change in the integration score, opening new possibilities for research.

Keywords: Brexit, Financial Integration, UK, Stock Market, COVID

JEL Classification: F36, G14, G15

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CHAPTER 1 Introduction

Integration was a keyword in the process of creating the European Union, as the main goal was to create a market with free movement of goods, people, and capital. This was a long and always-in-development process, characterized by crises that showed the need for better instruments and higher levels of integration. For this reason, the European Monetary Union (EMU) was formed (1999), followed by a Banking Union (2014) and a Capital Market Union (CMU) in 2015. Differently from the first two, the CMU was created to focus on all EU countries, not only those in the Euro area, and has the main purpose to develop and integrate capital markets rather than providing more uniform policies and rules (Allen & Pástor, 2018). All these new ways to assure a more stable and integrated market were the response to crises, especially the sovereign debt crisis that hit Europe in 2012. Despite these difficulties, the level of integration between the countries has increased during the evolution of the EU, especially during those crises, and then stabilized or slightly decreased (Nardo et al. 2022). Comparable results were found by Bekaert et al. (2017), which highlighted how in the period 2008-2016 the levels of integration were lower compared to pre-crisis periods. These results open questions about the increase of home country bias behaviour of EU countries and scepticism.

The main outcome of this sentiment was the UK referendum over the decision to leave the European Union, finally held on 23 June 2016. The well-known result established a victory for the "Leave" side, thanks to 51.89% of citizens that decided to break up with the EU. This result came after a long period of political campaigns and debates between the two sides, which gave reasonings and motivations for why the UK should, or should not, continue to be part of the European Union. Clarke et al. (2017) found that the main drivers of the decision over the vote were economic costs and benefits evaluation, national identity, and heuristics in forming opinions over the EU. The first factor was mainly stressed by the "Remain" side, which tried to convince the population that breaking up with the EU would have meant losing potential benefits, especially considering the large trades between the two sides, mainly in the case of a "Hard Brexit". Ciuriak et al. (2015) estimated a loss in GDP of 2.8% by 2030 in case of the UK shifting to WTO default rules, while a "Soft" Brexit would cost 1.03% of GDP by 2030. The second factor was exploited by the "Leave" side, which focused mainly on immigration control and security implications (Hobolt, 2016). Given the result, social identity was felt more relevant over economic costs, mainly by voters with lower educational levels and vulnerable positions in the labour market, since they were also more concerned about immigration (Hobolt, 2016).

Given the relevant importance of Brexit and its unprecedented effects, this research aims to investigate the level of financial integration, through capital markets, between the UK and the EU with the following research question:

Has Brexit lowered the degree of financial integration between the UK and the Eurozone?

This question is important for several reasons. First, it adds valuable insights into capital markets integration effects, especially in the case of a reduction of the level and its results on economic growth and other significant variables. European Union's further integration will bring positive effects on risk sharing, improving European stability, and economic growth, thanks to a greater effect of equity financing on real GDP growth (Orlowski, 2020).
Leaving this context and experiencing lower levels of integration could cause the opposite effects. Second, analysing this particular event, Brexit, will give unprecedented conclusions about a big country such as the UK leaving one of the most important economic areas, such as the European Union. This will also help to understand what other countries could face if they decide to follow the same path and what are the implications of that. Third, this research focuses on the capital (i.e. the stock market integration, not the bond market integration) market integration of the UK with the EU, and not mainly on economic effects as most of the literature does. As Dhingra and Sampson (2022) highlight, most of the financial markets' Brexit effects focus on the sterling drop and stock market loss after the Brexit vote. The same authors break down a series of literature results on the consequences of the Leave vote, from where it appears that the main areas of research were, together with financial markets, prices, labour market, output, investment, and trade. A capital market level of integration, as this paper proposes, is not intensively researched.

For these reasons, this thesis research will be beneficial in giving insight into the longer-term implications of Brexit, which can be further analysed focusing on specific periods in the long deal process with the EU, especially before and after the signing of the Withdrawal Agreement. Furthermore, as briefly anticipated, it could give an understanding of the implications of leaving a big economic area and the economic effects of a reduction, if found, of the degree of integration between the markets, helping to understand whether Brexit was a good or bad idea for both British and European citizens.

The main finding of this thesis, for the overall period in analysis, is that Brexit was not a clear driver of the change in the integration score after the referendum. By dividing into subperiods and decomposing the two big events that occurred, namely Brexit and COVID, we had a more complete understanding of the event study. We found significance for some countries regarding the Brexit effect until COVID hit globally, but the main unexpected result was to find repeatedly the significance of the COVID event on the increase in the integration score.

The remainder of the thesis will be as follows: the next chapter will present the literature connected to the research question and the Brexit effects in the UK, concluding with the hypotheses that will guide us in the analysis. The third chapter explains the dataset used to test the hypotheses. The methodology is fully explained in chapter four. The fifth chapter presents the results of the analysis and the last chapter summarises the conclusions and limitations of this thesis.

CHAPTER 2 Literature Review

This chapter will examine the existing literature on financial integration both considering definitions and measures and the effects of it especially on the UK before and after Brexit. The chapter is then divided into subsections that analyse integration measures to better understand how financial integration can be calculated, the UK integration in the EU and the benefits of it, Brexit, and its effect on both the UK economy and its integration by dividing into specific drivers and the shift or financial services to other EU countries. The last section concludes with the hypotheses that will be analysed in this thesis.

2.1 Financial globalization and integration measures

The concept of financial integration has often been put together with the term globalization or liberalization. This is because they all refer to developments in the market towards a more common and linked environment, whether it is through capital markets or international trade. Despite this, there is not a fixed definition of financial integration, and different literature refers to it as "international financial integration", "financial openness" or simply "financial liberalization". The ECB (2023) defines financial integration as a situation in which common rules are applicable and present in all countries that use the same currency, namely the euro. This is crucial for the transmission of the monetary policy in all the euro area countries. Lake et al. (2022) define international financial integration as a process of increasing linkages of financial markets. Finally, Taghizadeh-Hesary et al. (2019) see integration as the degree of restriction on capital and current account transactions of the countries.

The first signs of financial integration and its effects go back to the 19th century. Schularick and Steger (2010) consider 1880 the starting point of an "early" era of financial globalization, in their purpose to find evidence of a relationship between integration and economic growth. This window stops in 1914, right before World War I when the process of liberalization and globalization suddenly stopped. The majority of the literature on financial integration focuses mostly on the same question the two authors mentioned tried to answer: *is there any relation between financial integration and growth?* To analyse and try to solve this inquiry it is necessary first to define how to properly measure integration, to investigate and quantitatively solve this problem.

Given its tight link to globalization, to measure it, the great majority of the literature focused on quantities and effects capable of incorporating and showing a change in the integration of the market, mainly in the direction of freer flows of capital and in the decrease, if not total elimination, of potential barriers and constraints. This is why the main measures can be divided into restricting and capital flow measures.

This same distinction is made by Edison et al. (2002) when they attempted to solve the contradicting result that previous literature found on the relationship between financial integration and growth. They

analysed up to 57 countries in a period of 20-25 years with traditional measures, dividing them into the two categories mentioned earlier, namely restricting and capital flows measures, while adding two more measures, examining institutional factors that could positively influence growth and controlling for biases. As restricting measures, they used the IMF-Restriction measure from the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) and its improved measure developed by Quinn (1997). To implement capital flows measures they mainly focused on FDI and portfolio inflows and outflows related to GDP, to analyse the stock and both inflows, outflows and total net capital flows (inflows plus outflows) to assess openness. Moreover, they added new indicators from Lane and Milesi-Ferretti's (2002) analysis of the accumulated stock of foreign assets and liabilities of different countries. This has helped to overcome some limitations of previous measures, mainly short-term fluctuations in capital flows that are not related to financial integration. They conclude that there is an association between international financial integration and economic success, but the data is not sufficient to prove that financial integration stimulates economic growth. Despite this, they pointed out that more improvements in measures for countries' barriers and constraints would be beneficial for further investigation of this subject.

Quinn et al. (2011) reviewed the main indicators of openness and integration, to help future researchers in understanding which measure can best fit the research they want to develop. They divided them into three categories: de jure, de facto and hybrid (a combination of the previous two). Most of them rely on the already mentioned IMF's AREAER Annual Report, which generates de jure indicators with a further distinction into table-based and text-based indicators. They describe a relevant number of measures from each category, also analysing their relationship with one another. Their key conclusion is that all the measures, except IF Heritage, give information that is related to economic outcomes. Conclusions over the single indicators and their relations advise future researchers in the decision of which measure to use in their research.

Indicators of capital flow to measure integration were used in Kraay's (1998) analysis of possible reasons why findings on the effect of liberalization on countries' macroeconomic measures have been so difficult to assess. The author considers two possible explanations: the effect of an increase in volatility following liberalization and the need for already strong institutions and policies in the countries to be able to exploit the benefits of integration. Using data on capital inflows and outflows he found little evidence for both explanations, meaning that volatility is not that relevant in reducing the effects of liberalization, while better institutions and policy factors have little effect in helping the transition from openness to a better macroeconomic scenario.

By looking at more European-related studies, it is clear the particular situation in which countries are connected, thanks to the creation of different projects and levels of integration, such as the distinction between the European Union and the Euro Area. For these reasons, even the indicators of integration

can differ a little between those mentioned, mainly due to the almost complete absence of barriers to capital movements. Some literature focuses on asset valuations and prices.

A broad analysis of different types of measures is carried on by Baele et al. (2004) in which they explicitly focus on developing accurate indicators to measure financial integration in the euro area that are consistent with their definition of financial integration in Europe. To do this, they divide the measures into three main categories: 1) *Price-based measures*, which reflect the differences in prices or returns on assets due to the different geographical allocations of the assets themselves. An example can be a beta convergence measure, which helps quantify the speed at which the integration takes place. 2) *News-based measures*, exploiting the theory behind market efficiency and the spread of news in integrated markets. Their view is that global news, which reflects more integration, would have a greater impact on prices compared to regional ones. 3) *Quantity-based measures* that allow statistics on the ease of market access or on cross-border holdings that can reflect home biases. They conclude that, by focusing on the five most relevant euro area markets, each of them has experienced a different level of integration, with the money market showing the biggest degree among the others.

Similar objectives and distinctions are made by Hoffman et al. (2020) in their attempt to quantify the degree, and its development, of financial integration within the monetary union in the euro area. Their measures are also divided into price-based and quantity-based, with the first producing ten cross-country measures of the standard deviation of interest rates, while the latter consists of five measures of cross-border asset holdings relative to the total euro area asset holdings. They conclude that both indicators show an increase in financial integration after the creation of the Euro, with a decrease during the financial crises and the sovereign debt crisis, followed by a bigger integration, mainly helped by the creation of the banking union and new tools such as the OMT program. Moreover, they find a positive relation between intra-euro area integration and economic growth among the common currency union.

2.2 UK integration in the European Union and its benefits

The United Kingdom's path to join the European Union, first known as the European Economic Community (EEC), was long and difficult. After the Second World War, some European countries, mainly France and West Germany, started negotiations to create a more integrated Europe both economically and politically to face the challenges of the future and prevent any other sentiment of war. This effort led to the creation of first a European Coal and Steel Community (ECSC) in 1951 and then the European Economic Community (EEC) in 1957. The members of both communities at first were Belgium, France, Italy, Luxembourg, the Netherlands, and West Germany. The UK had different debates regarding the decision to be part of the ESCS, first and then the EEC, until it formally requested to join the latter first in 1961 and then in 1967, but both times France, due to Charles de Gaulle's beliefs,

vetoed. The UK finally joined the EEC in 1973 after the negotiations started in 1970 when a new prime minister, Edward Heat, was elected and Pompidou succeeded de Gaulle in France.

The reason behind the decision was mainly economic, due to the decline of its economy. Troitiño (2014) highlighted that economic development, political power and international influence were considered more important than losing some sovereignty. The latter feeling was very crucial in the UK debate also after the integration into the EEC, considering the later decision of the country to not join the eurozone or the Schengen Agreements.
Campos and Coricelli (2017) find proof of the economic decline of the UK compared with the six early members of the EEC. The ratio of the UK's GDP per capita to the EEC founding members started to decline at the end of the war from almost 1.3 in 1950 to 0.9 in 1973, suggesting that being part of the community was beneficial for those countries and the UK was struggling behind and losing its status as a great economic power country. Furthermore, the same authors also registered a loss in productivity compared to the founding members by showing the relative Total Factor Productivity (TFP) in each country compared to the US. The figure for the UK is a flat line until the 1970s, while the other EEC countries experienced significant growth.

These results prove that the UK was struggling to keep pace with the EEC countries, suggesting that the integration that was happening in Europe was leaving the United Kingdom behind. What this suggests, and that is relevant to this research, is that the integration is beneficial and that the following benefits gained by the UK after joining the EEC can highlight a deeper level of integration with the EU.

2.2.1 UK benefits from integration

The precedent paragraph showed a difficult decision taken by the UK, driven mainly by the desire to secure economic growth by following the path of EEC members. The following section will give the effects of the decision to join the EU to show the increasing level of integration that these benefits brought to the country.
The already mentioned authors, Campos and Coricelli (2017) analysed also the effects following 1973. They find a turning point around 1969 in both the ratio of per capita GDP of the UK to the funding members and also the relative TFP compared to the US. This suggests that once the negotiations started, the UK began to benefit from the integration at an economic level. Productivity in particular is a key factor, as the same authors point out because it shows a higher level of integration compared to GDP measures. This means that the UK was receiving help from joining an open market that enhances competition and innovation, the two main drivers of productivity. Another key indicator of integration is the level of trade. The authors calculated an increase of roughly 15% in trade openness between 1973 and 2010, driven especially by intra-industry trade that saw growth from less than 50% in the 1960s to more than 70% after the 1970s. Lastly, Campos and Coricelli (2017) focused on the financial sector,

showing how joining the EU and the Single Market helped finance to experience a Gross Value Added growth higher than the overall economy (3.8% against 2.4% respectively) between 1970 and 2008, such that the UK became a leading financial centre with a 40% share of the foreign exchange transactions in the world since the 1990s.

Similar economic results were found by Campos et al. (2014) who found that per capita GDP would have been 8.5% lower ten years after joining the EU, or 4.8% lower after five years if the UK didn't become a member in 1973.

Despite these economic results one of the arguments against a UK membership of the EU was the contributions that the country had to give to the community to be part of it. A first renegotiation of the term of accession took place in 1974-75 in which great importance was given to try to limit budget contributions, and a second request was made in 1979 after the election of Margaret Thatcher at the Dublin European Council.

Crafts (2016) resolves these fears by showing how the benefits from a per capita GDP growth thanks to participation in the EU are above the costs of participation, calculated as a membership fee that takes into consideration net budgetary contribution and net costs of regulation.

This analysis of the benefits of integration was focused on economic variables, trade, investments, and the financial sector. This same structure is used in the following sections to analyse the effect of Brexit on the level of integration measured through these channels and its changes as a financial centre.

2.3. Brexit effects

As anticipated, the following section analyses the economic, investment, and trade effects of Brexit. This is used to show how the level of integration can be derived through the results already found in the literature and gives information on what is missing. It also presents an analysis of the UK financial sector to highlight differences and shift toward other European Countries.

2.3.1 Economic effects

One of the first elements to look at when trying to calculate the degree of financial integration is the economic growth of the country compared to others. A similar level of growth in the GDP or productivity can show higher integration due to the open market and a higher level of competition that makes the country more and more integrated and therefore its potential growth is shared with the other participants in the same market.

De Lyon and Dhingra (2019) reported a drop in the UK's growth rate from before the referendum to 2018, making it become the last G7 country in terms of growth rate from being the first before the vote. Also, productivity, calculated as GDP per worker, has been stagnant after the referendum and this widened the gap with the other OECD countries, showing a slower growth rate and possibly a loss in competitiveness.

A loss in productivity by 2% to 5% is also registered by Bloom et al. (2019) over the three years after the referendum, together with a reduction in total investment of 11%. Regarding the latter, they also expect FDI to be lower, especially from the European market as a consequence of leaving the Single Market and Customs Union.

As already mentioned, FDIs are one of the best ways to measure the level of cross-border activity that can reflect a change in the degree of financial integration due to lower cooperation between the countries and a harder and possibly more costly possibility to trade as a result of leaving a big and highly regulated open market.

2.3.2 FDI effects

Financial integration, globalization or liberalization has always been correlated with a higher level of cooperation in a free market, with the simplest result being an increase in cross-border investments through financial markets or export platforms.

As anticipated by Bloom et al. (2019), a lower degree of FDIs is expected from Brexit, in fact, Dhingra et al. (2016) implied a reduction in FDI inflows in the UK by around 22%. The same level is found by Bruno et al. (2017) who by looking at the benefit of being part of the EU in terms of FDI inflows, estimated a reduction by the same amount (22%) on the hypothesis of one country leaving it. This also gives proof of the relationship between integration and FDI and the benefits of it. They calculated an increase by 30% in FDI inflows as a result of being integrated into the European Union.

These were estimates done very close to the referendum date, so due to uncertainty the actual results can be different. From a more recent analysis, Breinlich et al. (2020) calculated an actual reduction in EU investment projects in the UK by 9%, corresponding to a £13.1 billion loss in potential investments. On the other hand, they show an increase of FDI from UK firms towards the EU of 17%. This is led by the service sector, mainly businesses and financial services.

2.3.3 Trade effects

Very similar to FDIs, trade is the other main variable and consequence of the level of integration and cooperation between the markets, especially in the case of the biggest open market such as that resulting from the EU. Import and export are highly dependent on the level of costs associated with these operations and one of the first and easier results from Brexit has been an increase in the costs and uncertainty associated with trade after leaving the EU single market.

Specifically due to higher uncertainty, Crowley et al. (2018) estimated for the year 2016 over 5200 firms that decided to not export to the EU, while around 4000 exited from exporting goods to EU countries. This fear over uncertainty prevented 5.1% higher entry and 4.3% lower exit from exporting to the EU. This shows how simply an implication of less clarity over policies and costs associated with trade right after the referendum affected the export towards EU countries, which would lead to higher levels of home country bias on closeness.

Considering that the process of Brexit has been long and characterised by constant negotiations and changes in terms and requests from both sides, the effects of it can be different from the expectations, which were highly affected by uncertainty over the final agreement between the UK and the EU. Finally, a Trade and Cooperation Agreement (TCA) was signed on 30 December 2020 and entered into force on 1 May 2021. This gave more reliable information on the relationship between the two sides, especially regarding trade activities. In this final document, trade in goods and services benefits from preferential arrangements between the UK and the EU, setting more favourable rules and laws than the ones expected right after the referendum. As a result, even though the relationship will not be the same as before, the effects of Brexit could be less hard than the ones feared after the vote.

For this reason, to understand the actual and future trade relationship between the UK and the EU it is reasonable to look at the expectations of short-term effects of the new agreement. Freeman et al. (2022) analysed the export from the UK after the implementation of the TCA, finding a small decline mainly driven by small exporters that were affected the most by an increase in fixed costs. A higher effect is found in the level of import from the EU, which declined by 25%, more than the import from the rest of the world.

A deeper analysis of the dynamics of export was made by Dhingra and Sampson (2022), which found a sharp decrease by 45% in January 2021 compared to December 2020, followed by a rapid recovery so they do not find evidence of a persistent decline of UK exports in the EU compared to non-EU countries. Finally, similar to the previous authors they calculated a higher effect on the UK import, resulting in a decline by around 20% in the first 9 months of 2021.
Both articles then suggest that the TCA, meaning the new rules under which the relationship between the UK and the EU will be regulated, has affected mostly the UK's import. This can result in lower levels of competitiveness and innovation that could lead to lower economic growth and productivity, also affecting real wages.

2.3.4 Financial Market effects

One of the most researched and documented effects of the referendum on Brexit was the subsequent reaction of the financial market. This is because it can be easily analysed and gives a straightforward image of the feelings of the investors and whether they were expecting such a result or not. This also gives information about what could happen in similar circumstances, with that level of uncertainty and unprecedented decision.

The biggest reaction was found in the foreign exchange market, where the pound depreciated by 8.1% against the US dollar and by 5.8% against the Euro, as calculated by Breinlich et al. (2022). The same authors tracked the performance of the exchange rate over time, finding a fluctuation of around 10%

below the pre-vote level over the two years after the referendum. This led to an increase in consumer price by 2.9% which eroded the real wage growth. Also, the stock market, measured by the FTSE 100 index, fell by 3.9% the day after the referendum.
Breinlich et al. (2018) in analysing the rationale behind this movement found that investors were mainly concerned about an economic slowdown in the UK and the effect of the sterling depreciation, which could have affected firms' export.

Since the depreciation was one of the biggest, unexpected reactions, it is interesting to understand its effects on other variables, specifically those mostly mentioned in this research to also link this financial market reaction to future changes in the degree of integration.
Costa et al. (2022) highlight higher import costs associated with the depreciation as a result of higher import prices that were not offset by higher exports, since the same firms experiencing revenue gains from export were facing the higher cost of import. In the end, these additional shocks were absorbed by the labour force, which experienced lower real wages.

It is clear then that also the financial market changed, more indirectly, the level of integration of the UK, affecting especially the trade of goods through the depreciation of the sterling. This also gives an idea of the high degree of financial integration and globalisation as everything is interconnected and how a decision, such as Brexit, can affect directly and indirectly the country in many different ways.

The last aspect missing in this financial market analysis is a look into the different sectors and how they reacted to the referendum vote. This will be useful in finding the most affected sectors to improve the analysis in the rest of this thesis.
As expected, the financial sector was the most affected. Ramiah et al. (2017) find that the banking and travel and leisure sectors experienced the lowest cumulative abnormal return (CAR), with the former experiencing a -15.37%. Similar results were found by Schierek et al. (2016), which found that EU banks were the most affected, with a CAR of -21% compared to non-EU banks which registered a -7%. These results show how the big financial system was hit hard by Brexit in the financial market, especially the EU banks. This opens questions on the future role of the UK as a leading financial centre. For this reason, the final subsection examines the consequences of Brexit on the financial system and if there is a shift to other European countries.

2.3.5 Financial Services Shift

Once Brexit was announced, it was unclear what the new relationship would have been and how the role of London as a big financial centre would have changed.
Once it was clear that a "Hard Brexit" was more possible, the debate in other EU countries focused also on the decision between cooperation, that would enable the cross-border coalition to secure as much

access to the market as possible, and a "battle" to attract financial businesses from the UK and aim to become the next financial centre (FC) in Europe (Howart and Quaglia, 2018).
To understand whether the actions of EU member states were to cooperate or collide, Howart and Quaglia (2018) examined both arguments and concluded that the latter was what happened after Brexit. This was because the financial sector was not able to secure protection in the negotiations from the government, and also because different players had different visions for the future. The authors found that the services more affected by Brexit would have been investment banking and clearinghouses active especially for euro-denominated assets. Moreover, non-EU banks, especially US banks were affected considering their use of London to access the EU single market using UK-based subsidiaries.
From this view, it is clear that all these services and actors would be damaged by staying in the UK, and competition between European countries to attract businesses, seems the right moment for them to relocate activities to other Financial Centres (FCs) to keep their position in the single market.

This view of a "battle" between EU countries is also confirmed by Panitz & Glückler (2022), who considered three different possible scenarios for the reorganization of financial services after Brexit. They found evidence of two possibilities, namely the "least necessary relocation" and the "selective relocation". Both would create a shift from London to EU countries, with the first view being that this would affect most businesses that have to meet regulatory requirements so London would remain the major FC, while the second possibility would create relocations based on specific expertise in different countries, creating a more fragmented market around Europe based on existing specialization.

These views, then confirm a possible relocation of financial services around Europe, so the final step would be to analyse where the specifications are, and which countries have benefited the most.
Donnelly (2023) resumes the theory of a "battle" between EU countries and examines the major Financial Centres that tried to attract businesses from the UK. He found that Germany, specifically through Frankfurt, captured 60% of the shift of investment banking from London. The Netherlands gained most of the trading activity, especially in stocks, bonds and sovereign debt swaps that resulted in 6.5 billion euros in daily trading from London to Amsterdam. Ireland and Luxemburg attracted asset management services, with the first specifically focused on hedge funds and fintech. Finally, Paris obtained other banking services that didn't shift mainly to Frankfurt. Next to single cities obtaining pieces of business, there was an action by the Euronext to create a big European alternative to the London market, done by acquisitions started in 2017 that resulted in obtaining the Irish Stock Exchange, Luxemburg Stock Exchange, Oslo Stock Exchange, Norwegian Nord Pool (spot energy trading), Lisbon Stock Exchange and Borsa Italiana.

This concludes the section on the results of Brexit in the UK which gave important information on the post-referendum effects and enables us to have an idea of the level of integration of the UK market with

the EU one. It is clear that most of the drivers analysed in this section suffered from the vote and this is clear evidence of the issues related to leaving an important open market and having to face uncertainty and the new rules applied by the EU.

2.4. Hypotheses

The preceding sections are going to be crucial for the following hypotheses that this thesis aims to test. As already said in the introduction, the research question focuses on the degree of financial integration in the stock market between the UK and EU, so the following hypotheses will deeply answer this question by trying also to have a broader look at the problem.

Directly following the research question, the first hypothesis is as follows:
Hypothesis 1: The degree of financial integration between the UK and the EU, measured by stock market integration scores, has significantly decreased following Brexit.

This is the first and main hypothesis to be tested, which answers directly to the research question and gives a general view of the changes in the financial integration between the United Kingdom and the European Union. Considering the literature examined, a lower level of integration is expected, and it will be beneficial to have a clear score that gives an easy-to-understand measure of financial integration.

Despite this being the most straightforward test of the research question, a deeper look into the integration with some countries that, considering their economy, can better represent the EU than a broader index on Europe is necessary. This allows for specific consideration on the level and the evolution of the integration between those countries and solves minor issues in testing the first hypothesis, as will be better explained in the next chapter. For these reasons, first, we will focus on three big EU countries, giving the following hypothesis:
Hypothesis 2: The level of stock market integration between the UK and three Large-EU countries has decreased following Brexit, as shown by integration scores.

From this follows the third one, which will research the integration with Mid-EU countries, always in terms of the size of the economy measured by the GDP:
Hypothesis 3: The level of stock market integration measured by specific integration scores, between the UK and three Mid-EU countries has decreased following Brexit.

This concludes the part of the hypotheses more focused on the research question, which allows us to have an image and complete understanding of the development of the integration during the period considered, its current level and if it has been affected by the referendum in 2016. The next hypotheses

will try to test in detail specific segments of the stock market, following both the literature and interesting considerations.

Thanks to the literature review of sectors most affected by Brexit, especially in the stock market, it is clear that the financial sector was the most negatively influenced one (Ramiah et al. 2017; Schierek et al. 2016), and also experienced many businesses that left the UK to relocate in other EU countries (Panitz & Glückler 2022; Donnelly 2023). For this reason, a more detailed analysis of its integration with the EU can be interesting to give a more complete view of the effects of Brexit on the financial sector in the UK, through the following hypothesis:
Hypothesis 4: The integration of the UK's financial sector with the EU has decreased after Brexit, as shown by stock market integration scores.

This is also particularly relevant from a stock market perspective since the financial sector is the most represented in the UK's stock exchange, as shown by the FTSE All-Share Index which captures 98% of the UK's market capitalization. In this index, the financial sector is the most weighted, 22.29%, counting 254 constituents of the 579 total.

Finally, another relevant stock market characteristic is the dimension of the firms, with the typical distinction into high, mid, and low capitalization companies. Since most of the indexes that cover entirely a stock market usually comprehend mid-high cap stocks, it is relevant to make a comparison and distinction by looking at the behaviour of small-cap companies. This is interesting also considering the nature of these firms, usually more volatile and for this reason investors are more long-term oriented and accept short-term fluctuations.

Lee and Howlett (2021) give another reason why testing Small-Cap integration can be valuable in this research. First, they found that UK Small-Cap stocks' return one year after the referendum was 22.3%, the highest compared to other major indexes such as the FTSE 100 Index or FTSE 250 Index, which showed a performance of 17.4% and 13.4% respectively.
This suggests that UK Small Stocks are driven more by firm-specific factors rather than global events, and this can result in lower integration with the EU specifically after the vote. More interestingly, the authors studied the causal relationship between the UK and other EU Small Stocks before and after the referendum. They found that the level of the causal relationship between the two decreased after the vote, from four to only three. This result is relevant to this research because it reports that the co-movement between UK Small-Cap Stocks and EU ones has decreased since the referendum.
For these reasons, the following hypothesis is tested:
Hypothesis 5: The level of stock market integration between UK Small-Cap Stocks and EU ones has decreased following the referendum over Brexit.

The final test that will be conducted goes beyond the European market and answers questions on the new positioning of the United Kingdom regarding the rest of the world. In particular, its new relationship with the other biggest commercial and historical partners such as the USA. Measuring the level of integration between these two countries allows for consideration on the potential shift of the UK towards the American market and if the financial integration has changed as a consequence of Brexit, maybe to gain back the possible loss in integration with the EU. Following these considerations, the last hypothesis is tested:

Hypothesis 6: The level of stock market integration, measured by stock market integration scores, between the UK and the US has increased following Brexit.

This concludes the analysis of the different hypotheses and the motivation behind them, opening the possibility to structure the remainder of the research based on these six hypotheses, to ensure clarity.

CHAPTER 3 Data

Considering the purpose of this study, an analysis of the Stock Market integration between the United Kingdom, the European Union, and the United States after the decision to leave the EU, the data relevant for this research consists of equity indices representing the three economies, for a timeframe that covers the "before" and "after" of the Brexit referendum.

For these reasons, stock indices data are retrieved from Refinitiv Eikon. To remain consistent during the six different hypotheses and the main research question, all the indices are retrieved from Morgan Stanley Investment International (MSCI), an investment research firm that provides investment data relevant to investors. The indices are all euro-denominated and represent monthly observations of the net returns in the UK and EU markets, covering a period from 28/02/2013 to 31/08/2023, to analyse the effect of the referendum on the level of stock market integration. This leaves us with 127 observations per index, which will be used to test each hypothesis.
Throughout the tests, different sub-periods are considered to have a more comprehensive and complete analysis of the phenomenon.
In the following subsections, the indices considered are specified per hypothesis, to introduce the background needed for the method used which will be explained in the next chapter.

3.1. H1: Integration between the UK and EU

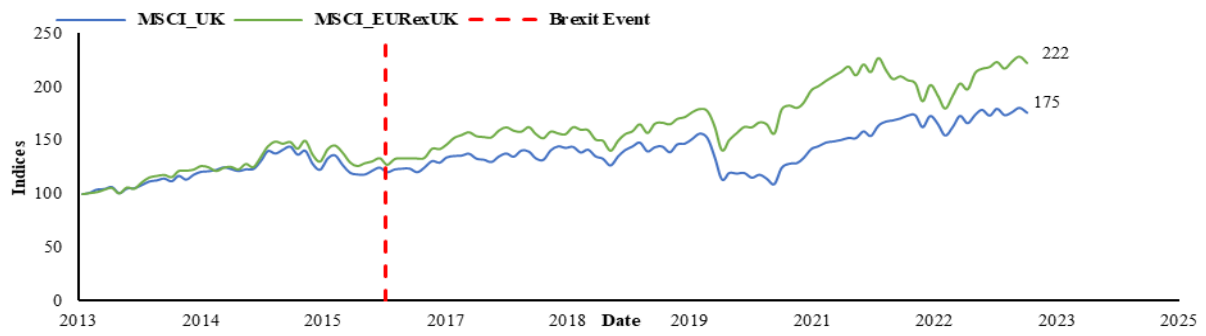
The first hypothesis: *The degree of financial integration between the UK and the EU, measured by stock market integration scores, has significantly decreased following Brexit*, is the main question of this research, testing the level of integration between the two sides, giving us both an understanding of the degree itself and its relationship with the referendum.

The data to test it are the two main indices representing the UK and the EU: the MSCI United Kingdom Net Index (Eikon code: .dMIGB00000NEU) and the MSCI Europe Ex United Kingdom Net Index (Eikon code: .dMIUG00000NUS) respectively. Both are a market-capitalization coverage of the publicly listed companies of both markets. As already mentioned, the indices are monthly observations of the euro-denominated net returns, from the end of February 2013 to August 2023 to show the most recent integration score. Below, a graph of the normalised returns of both indices is plotted, to give a clear visual representation of the relationship between the two indices, also regarding the movements of each of them as a consequence of the Brexit event, which is indicated by the vertical line.

Figure 1

H1 Normalised Returns

This graph represents the normalised return for the two indices used for H1. The starting point is set at 100.



3.2. H2: Large EU countries

Alongside the first hypothesis, data representing 3 Large-EU countries is retrieved to test the second hypothesis: *The level of stock market integration between the UK and three Large-EU countries has decreased following Brexit, as shown by integration scores.*

This is because the mentioned index for the EU also contains companies from countries outside the EU, such as Norway and Switzerland, so that by examining specific countries representing large economies we can have a more comprehensive and complete understanding of the integration score and the new relationship with the EU.

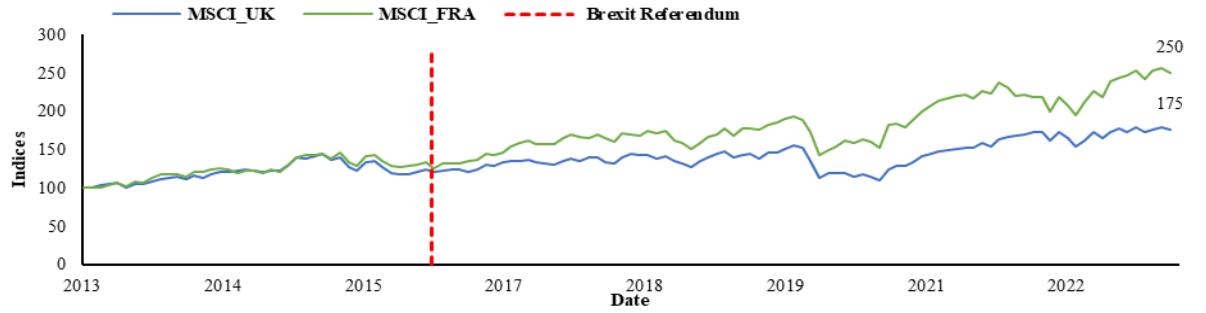
The three large-economy countries are Germany, France, and Italy, represented by the MSCI Germany Net Index (Eikon code: .dMIDE00000NEU), MSCI France Net Index (Eikon code: .MIFR00000NEU) and the MSCI Italy Net Index (Eikon code: .MIIT00000NEU) respectively.

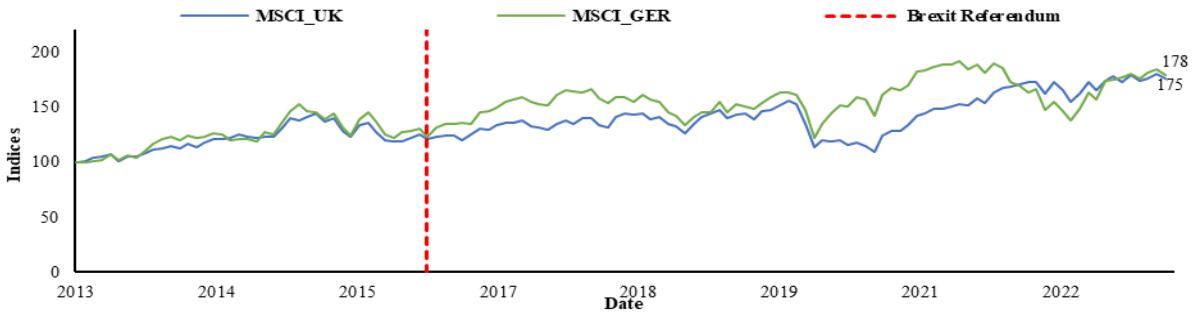
This choice is based on the latest information on the GDP of the European Union and its countries, retrieved from Eurostat, the main database with statistics and information regarding Europe. Considering the end of 2022, these three countries represent 53.24% of the total EU 27 economy, giving already a great covering of the European Union.

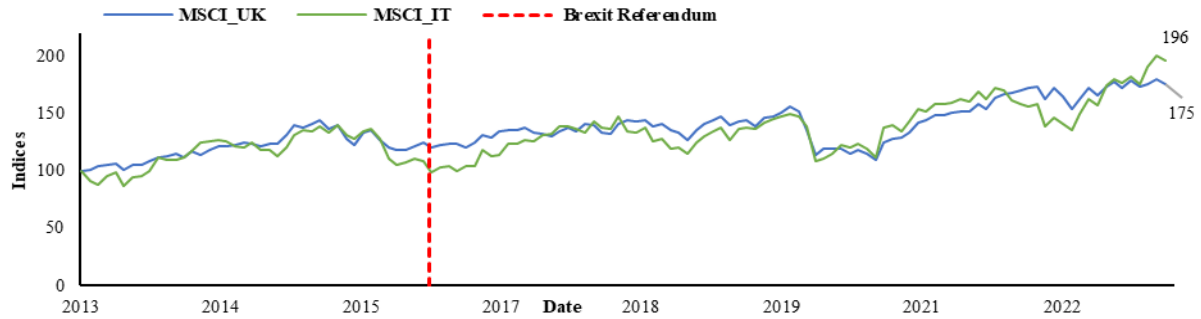
Figure 2

H2 Normalised Returns

These graphs represent the normalised returns of the three indices (FRA, GER, ITA) compared to the MSCI_UK. The baseline is set at 100.







3.3. H3: Mid-EU countries

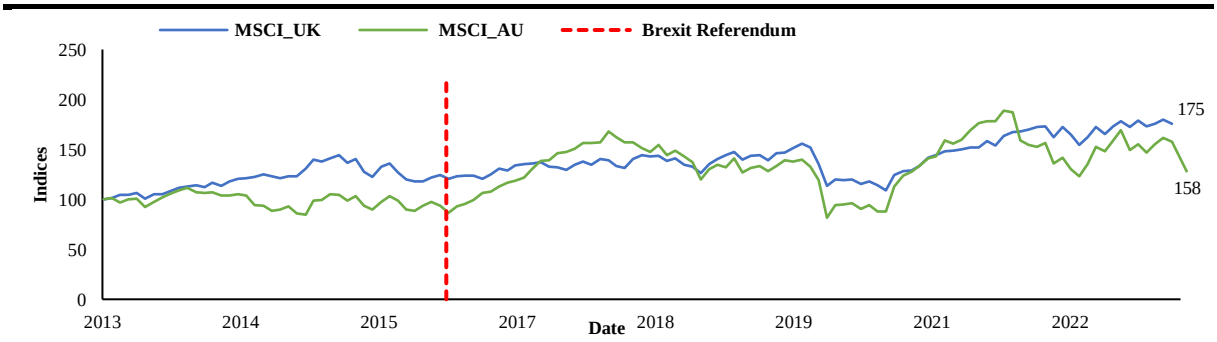
Using the same reasoning given in the previous subsection, data for the third hypothesis is obtained. The other three Mid-EU countries and their relative indices are Austria with the MSCI Austria Net Index (Eikon code: .MIAT00000NEU), Belgium with the MSCI Belgium Investable Net Index (Eikon code:. MIBE000I0NEU) and Poland with the MSCI Poland Net Index (Eikon code: .MIPL00000NPL).

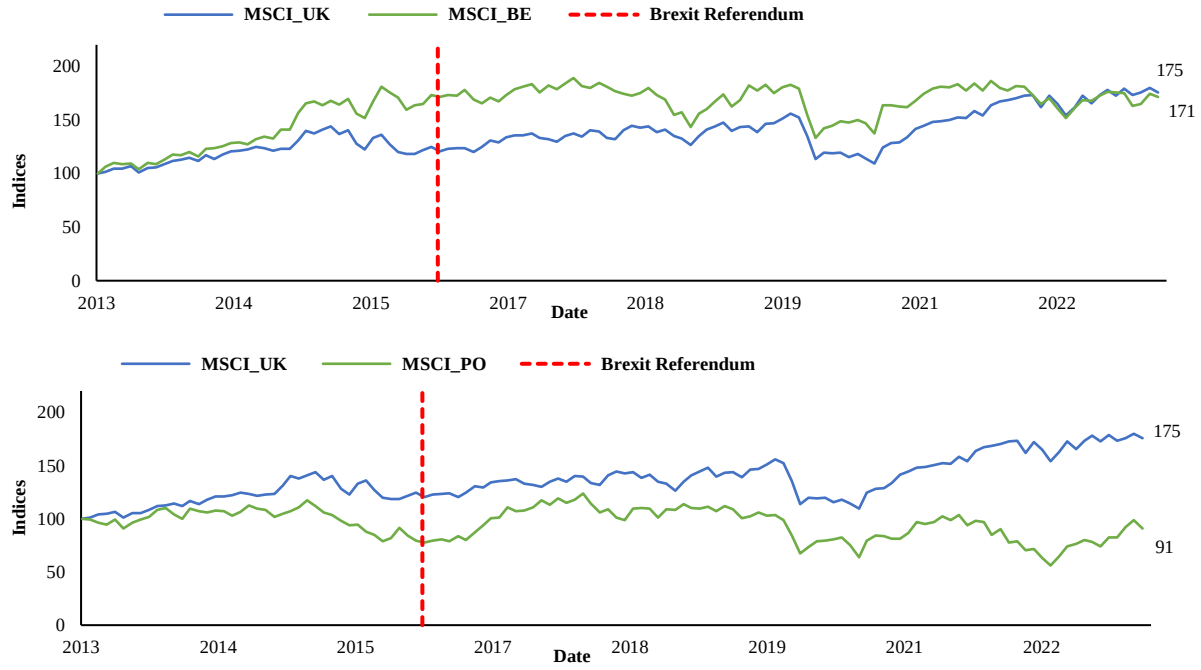
These are also considered following Eurostat statistics, which show how these three countries represent 10.46% of the EU 27 economy. Together with the earlier Large-EU countries, these two hypotheses cover 64% of the EU 27 economy.

Figure 3

H3 Normalised Returns

These graphs represent the normalised returns of the three indices (AU, BE, PO) compared to the MSCI_UK. The baseline is set at 100.





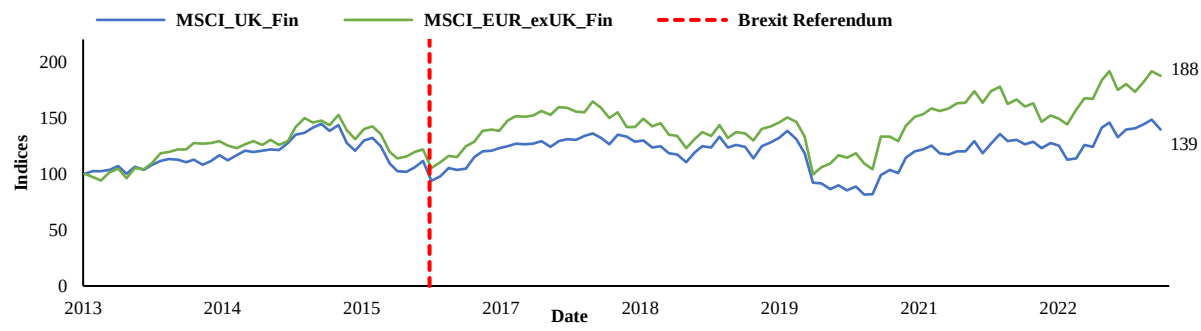
3.4. H4: The financial sector

This hypothesis focuses on the financial sector, considered one of the most affected by the referendum. Following the same main indices for the first hypothesis, the two indices used in this test are the MSCI United Kingdom Financials Sector Net Index (Eikon code: .dMIGB0FN00NUS) and the MSCI Europe Ex UK Financials Net Index (Eikon code: .dMIUG0FN00NUS). These indices give a broad representation of this sector, following the Global Industry Classification Standard (GICS) in the methodology. Specifically, this means that in the Financials industry (code 40), banks, financial services, and insurance are included.

Figure 4

H4 Normalised Returns

This graph represents the normalised return for the two indices used for H1. The starting point is set at 100.



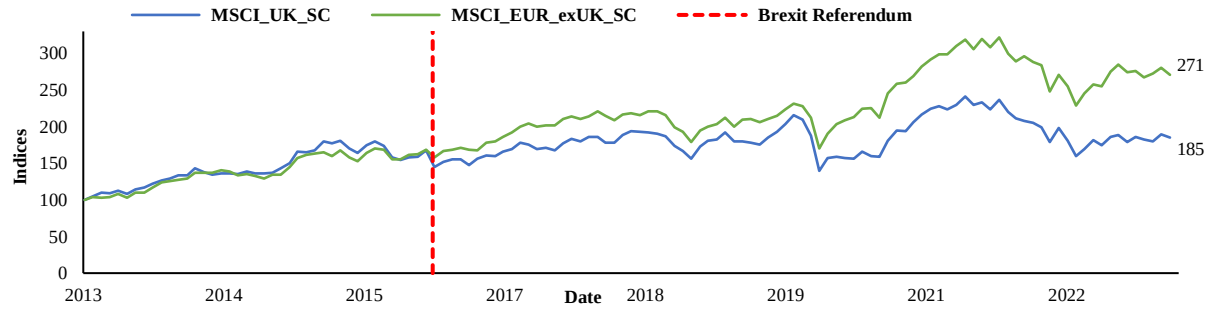
3.5. H5: Small Cap Stocks

The fifth hypothesis has the goal to understand if there is a different level of integration specifically in Small Cap Stocks. To do so the MSCI United Kingdom Small Net Index (Eikon code: .MIGB000S0NGB) and the MSCI Europe Ex United Kingdom Small Cap Net Index (Eikon code: .dMIUG000S0NUS) are used. These indices cover lower capitalization companies in all markets in both the UK and Europe, enabling an analysis of the integration scores in this specific fragment of the market, usually more volatile.

Figure 5

H5 Normalised Returns

This graph represents the normalised return for the two indices used for H1. The starting point is set at 100.



3.6. H6: The integration with the US

Lastly, to have the most comprehensive possible understanding of the integration of the UK with two of the biggest markets, data for the US stocks are collected, to test the last hypothesis. This gives us the last index for this research, which is the MSCI United States Net Index (Eikon code: .MIUS00000NUS), converted in Euro with Refinitiv Eikon.

This concludes all the data on the indices to test the hypotheses. The next chapter explains the method and how these indices are used.

Figure 6

H6 Normalised Returns

This graph represents the normalised return for the two indices used for H1. The starting point is set at 100.

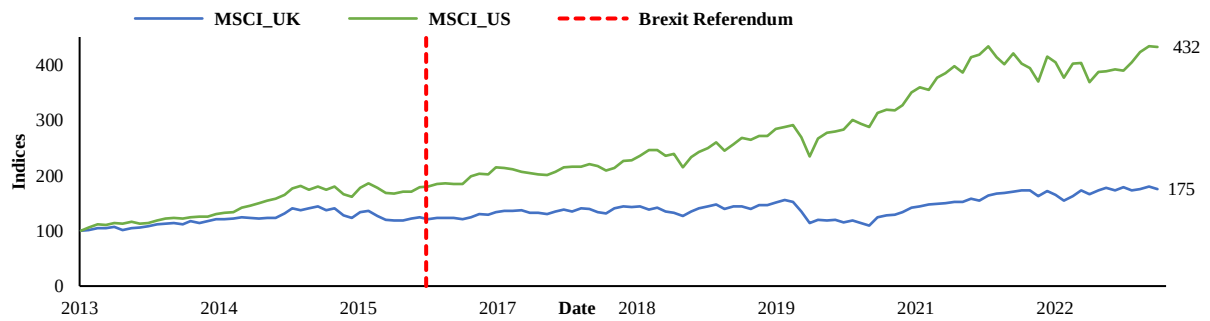


Table 1

Summary Statistics

This table summarizes the main statistics for all the indices used to test each hypothesis. Each number is calculated from monthly returns.

	Obs	Mean	Median	Min	Max	St.Dev	Skew	Kurt
MSCI_UK	127	0.52%	1.01%	-15.88%	13.72%	4.02%	-0.56	5.05
MSCI_EUR_exUK	127	0.72%	1.02%	-13.97%	14.33%	4.13%	-0.24	4.00
MSCI_FRA	127	0.83%	1.11%	-17.61%	19.71%	4.60%	-0.02	5.72
MSCI_GER	127	0.58%	0.64%	16.94%	14.09%	4.89%	-0.23	3.81
MSCI_ITA	127	0.70%	0.91%	-22.45%	23.50%	5.90%	-0.12	5.41
MSCI_AU	127	0.60%	1.30%	-31.60%	28.60%	6.88%	-0.39	7.64
MSCI_BE	127	0.53%	0.81%	-13.99%	18.76%	4.57%	0.03	5.13
MSCI_PO	127	0.16%	0.06%	-19.93%	24.62%	6.82%	0.08	3.89
MSCI_UK_Fin	127	0.43%	1.20%	-22.05%	21.10%	5.84%	-0.31	5.13
MSCI_EUR_exUK_Fin	127	0.68%	1.33%	-25.28%	27.38%	6.06%	0.19	7.06
MSCI_UK_SC	127	0.54%	0.66%	-25.74%	13.98%	5.45%	-0.98	6.62
MSCI_EUR_exUK_SC	127	0.90%	1.43%	-19.50%	15.96%	4.78%	-0.65	5.46
MSCI_US	127	1.25%	1.47%	-12.76%	13.88%	4.20%	-0.32	4.11

Chapter 4 Method

This research aims to quantify the degree of financial integration, measured through the stock market, between the United Kingdom and the European Union, and its relationship with the event of Brexit, represented by the referendum held on 23 June 2016. To do so, a quantitative approach is adopted to calculate an integration score and test its interrelationship with Brexit.

The method follows the research conducted by Akdogan (1996;1997) and Barari (2004), who applied event studies and regression analysis to investigate stock market integration. In particular, Akdogan (1996), by suggesting that international fund managers should invest in foreign countries based on the level of market segmentation from a benchmark market, proposed a new measure of market segmentation based on a risk decomposition model. The idea behind it is the so-called law of one price, which suggests that in integrated markets the risk is priced the same, not allowing for risk premium differentials. It follows that a measure for integration is a country's systematic risk contribution to the benchmark portfolio.

This study directly follows the risk decomposition model, in which the contribution of the UK's systematic risk to the EU's systematic risk is calculated, resulting in an integration score. The lower the contribution, the lower the integration between the two markets. To measure this, we use the UK's domestic Capital Asset Pricing Model (CAPM), and a weighted average CAPM of the EU, based on market capitalization.

The model is based on a rolling regression to dynamically evaluate the evolution of the stock market integration over time, specifically from January 2013 to May 2023. Following Akdogan (1996;1997), the single-index return generating process for the UK is calculated as:

$$R_i = \alpha_i + \beta_i R_j + \varepsilon_i \tag{1}$$

where:

R_i is the return of the UK index *i* associated with each hypothesis;

R_j is the return of the benchmark index *j* associated with each hypothesis;

α_i represent the constant of the regression model, showing what would be the UK's *i* index return if R_j was zero;

β_i is the beta of UK vis-à-vis the benchmark, calculated as the $Cov(R_i, R_j)/Var(R_j)$;

ε_i represent the random error with $E(\varepsilon_i) = 0$.

Equation (1) will be then specified for each hypothesis in the following sub-sections, saying the relevant indices for both the UK and the benchmark.

Since the key part of the method is to decompose the risk factor and evaluate the contribution of the UK's systematic risk to the EU's one, from equation (1) we can derive the value of the variance of R_i and write it as a sum of the systematic and idiosyncratic risk:

$$R_i = \alpha_i + \beta_i R_j + \varepsilon_i \quad (1)$$

where:

R_i is the return of the UK index *i* associated with each hypothesis;

R_j is the return of the benchmark index *j* associated with each hypothesis;

α_i represent the constant of the regression model, showing what would be the UK's *i* index return if R_j was zero;

β_i is the beta of UK vis-à-vis the benchmark, calculated as the $Cov(R_i, R_j)/Var(R_j)$;

ε_i represent the random error with $E(\varepsilon_i) = 0$.

Equation (1) will be then specified for each hypothesis in the following sub-sections, stating the relevant indices for both the UK and the benchmark.

Since the key part of the method is to decompose the risk factor and evaluate the contribution of the UK's systematic risk to the EU's one, from equation (1) we can derive the value of the variance of R_i and write it as a sum of the systematic and idiosyncratic risk:

$$Var(R_i) = \beta_i^2 Var(R_j) + Var(\varepsilon_i) \quad (2)$$

The left side of the equation is the total variance, hence risk, of R_i that it is decomposed into its systematic component, $\beta_i^2 Var(R_j)$, and the unsystematic one $Var(\varepsilon_{UK})$. As mentioned earlier, the first part of the right side is what is needed to measure the integration and calculate a relative score. To do so, it is essential to express equation (2) in relative terms to the $Var(\varepsilon_i)$:

$$\frac{\beta_i^2 Var(R_j)}{Var(R_i)} + \frac{Var(\varepsilon_i)}{Var(R_i)} = 1 \quad (3)$$

Following Akdogan (1996) $\frac{\beta_i^2 Var(R_j)}{Var(R_i)} = p_i$, while $\frac{Var(\varepsilon_i)}{Var(R_i)} = q_i$, with *i* reflecting the different integration scores associated with each hypothesis and corresponding indices to test it. What is crucial for our analysis is p_i, which is the integration score which will be calculated separately for each hypothesis to reflect the specific relationship being tested. Higher levels of p_i show higher degrees of integration between the UK and the EU because the UK market risk contributes to most of the EU market risk.

Despite this being a straightforward measure of integration, it is still advisable to consider another variable that can help explain better the degree of segmentation and evaluate its importance. This can

be done by expressing the integration score in relation to the market size of the UK and the EU. This is the extension of Barari (2004), who expressed p_i as

$$Adjusted\ p_i = \frac{\frac{\beta_i^2 Var(R_j)}{Var(R_i)}}{\frac{W_{UK}}{EU}} = \frac{p_z}{\frac{W_{UK}}{EU}} \quad (4)$$

where $W_{UK/EU} = \frac{Market\ Capitalization_{UK}}{Market\ Capitalization_{EU}}$. In this setting, the effect of the size of the UK market is considered, to avoid issues related to countries with higher integration but a small size compared to the overall market, which would lower the effect and relevance of the higher degree of integration.

Another point stated by Barari (2004) over the Akdogan (1996) research was the choice of cutting the sample period in two, resulting in two integration scores, one per period. This makes the integration score sensitive to the cutoff period and does not take into account the time-varying nature of integration. We follow this consideration in our empirical framework, by implementing a rolling regression that allows us to plot the integration score over different time windows and dynamically analyse its evolution during the sample period.

The result of the regression will be different values of β_i that are necessary to measure p_z using equation (3). Similarly, this will produce multiple integration scores that will be needed both to analyse the changing in the integration over time, thanks to the different time windows, but also to prepare the test of the different hypotheses to link the evolution in the integration between the UK and the EU to the Brexit referendum in 2016.

The following subsections will then present the theoretical framework used to test each of the hypotheses, giving the regression equation, stating the null and alternative hypothesis, and expressing the expected results.

4.1. Hypothesis 1

The first hypothesis can be considered the main one, saying the following:

Hypothesis 1: The degree of financial integration between the UK and the EU, measured by stock market integration scores, has significantly decreased following Brexit.

The starting point, which will be the same for each hypothesis, is the integration score found with the mentioned methodology.

It is worth noting here that the integration scores will be calculated until August 2023 with different periods and subperiods, to allow for further considerations regarding the degree of integration nowadays and trying to divide the possible COVID effect from the Brexit one. This will give a complete image of the situation and allow for further considerations and research into these values.

For this reason, the test of the hypotheses will be conducted from 2013 to 2023, with the critical point of June 2016 as the reference for the Brexit event.

This first setting considers the relationship between the UK and the EU in general, by looking at the two main indices. For this reason, equation (1) can be written as:

$$R_{UK} = \alpha_{UK} + \beta_{UK} R_{EU} + \varepsilon_{UK} \quad (5)$$

where R_{UK} is the return of the MSCI United Kingdom Net Index while R_{EU} the return of the MSCI Europe Ex United Kingdom Net Index. The other variables are explained in the same way as previously mentioned with equation (1), with the specification that they refer to the corresponding UK and Europe index.

The integration score found is named p_{UK-EU}, to refer to the integration between the MSCI United Kingdom Net Index and the MSCI Europe Ex United Kingdom Net Index. This gives us the following regression to test the hypothesis:

$$p_{UK-EU,t} = \alpha + \beta Brexit + \varepsilon_t \quad (6)$$

The left side of the equation is the integration score between the UK and the EU for a specific time period (*t*), with *t* that goes from 2013 to 2023. On the right side, α is the intercept of the regression equation, representing0 the baseline level of integration score before accounting for the impact of Brexit ($\beta = 0$). β is the beta of the adjusted integration score vis-à-vis the Brexit variable. $Brexit$ is the independent variable, representing the referendum event. Specifically, is a dummy variable that takes values of 0 for the pre-Brexit period (before June 2016) and 1 for the post-Brexit period. In this way, we can test the significance of the referendum vote on the changes in the integration score. Finally, ε_t is the residual of the regression equation, accounting for the changes in the adjusted integration score not explained by either the Brexit event or α.

Following this regression, the null and alternative hypotheses will be:

H0: The occurrence of Brexit has no significant effect on the adjusted integration score between the UK and the Eurozone ($\beta = 0$).

H1: The event of Brexit has a significant effect on the adjusted integration score between the UK and the Eurozone, leading to a decrease in integration ($\beta < 0$).

Rejecting the null hypothesis, with statistically significant levels, would mean that the referendum had an impact on the degree of integration score between the UK and the EU. Negative values of the beta suggest a decrease in the dependent variable vis-à-vis the independent one, confirming our hypothesis.

4.2. Hypothesis 2

The second hypothesis is necessary to have a more comprehensive image of the degree of integration between the UK and the EU.

Hypothesis 2: The level of stock market integration between the UK and three Large-EU countries has decreased following Brexit, as shown by integration scores.

This is done by analysing three large EU countries, namely Germany, France and Italy.

Without reporting each equation for each country, since they would follow the previous section with differences only to specify the different indices used, it will be told the name of the integration scores associated with the relevant index. This gives us the following structure:

p_{UK-GE} refers to the integration score resulting from the rolling regression between the MSCI United Kingdom Net Index and the MSCI Germany Net Index. The corresponding regression equation will be:

$$p_{UK-GE,t} = \alpha + \beta Brexit + \varepsilon_t \quad (7)$$

p_{UK-FR} represent the integration score as a result of the rolling regression between the MSCI United Kingdom Net Index and the MSCI France Net Index. The corresponding regression equation will be:

$$p_{UK-FR,t} = \alpha + \beta Brexit + \varepsilon_t \quad (8)$$

p_{UK-IT} is the integration score following the rolling regression between the MSCI United Kingdom Net Index and the MSCI Italy Net Index. The corresponding regression equation will be:

$$p_{UK-IT,t} = \alpha + \beta Brexit + \varepsilon_t \quad (9)$$

Each equation can be interpreted the same as equation (6), with *t* representing the specific time period, β the relevant beta of the equation, $Brexit$ the dummy variable representing the referendum event and ε_t the residual of the regression. What changes is the adjusted integration score, to reflect each different relationship considered.

4.3. Hypothesis 3

Following the same considerations made in the previous subsection, here the analysis is focused on mid-economy EU countries to try to represent most of the Eurozone.

Hypothesis 3: The level of stock market integration measured by specific integration scores, between the UK and three Mid-EU countries has decreased following Brexit.

The corresponding integration scores and equations are as follows:

p_{UK-AU} is the integration score resulting from the rolling regression using the MSCI United Kingdom Net Index and the MSCI Austria Net Index. The corresponding regression equation will be:

$$p_{UK-AU,t} = \alpha + \beta Brexit + \varepsilon_t \quad (10)$$

p_{UK-BE} is the integration score as a result of the rolling regression using the MSCI United Kingdom Net Index and the MSCI Belgium Investable Net Index. The corresponding regression equation will be:

$$p_{UK-BE,t} = \alpha + \beta Brexit + \varepsilon_t \quad (11)$$

p_{UK-PO} refers to the integration score resulting from the rolling regression using the MSCI United Kingdom Net Index and the MSCI Poland Net Index. The corresponding regression equation will be:

$$p_{UK-PO,t} = \alpha + \beta Brexit + \varepsilon_t \quad (12)$$

Same as before, the interpretation and the meaning of each variable are the same as mentioned for equation (6), with the only difference in the adjusted integration score to reflect each relationship.
Each equation from (7) to (12) will be tested as equation (6), with the same criteria for the null and alternative hypotheses, meaning looking at the value of the beta and its significance to clearly state that the changes in the integration scores can be explained by the Brexit event. The result of the tests on each country considered in these three sections will give us a complete image of the integration between the UK and the EU and will help us to better understand the results found with the main hypothesis stated in 4.1.

4.4. Hypothesis 4

The fourth hypothesis focuses on the financial sector:
Hypothesis 4: The integration of the UK's financial sector with the EU has decreased after Brexit, as shown by stock market integration scores.

The corresponding rolling regression will be:

$$R_{UKFS} = \alpha_{UKFS} + \beta_{UKFS} R_{EUFS} + \varepsilon_{UKFS} \quad (13)$$

with R_{UKFS} representing the return of the MSCI United Kingdom Financials Sector Net Index while R_{EUFS} refers to the return of the MSCI Europe Ex UK Financials Net Index. α_{UKFS} is the intercept of the regression, β_{UKFS} the beta representing the relationship between the two indices and ε_{UKFS} the residual term.
This will generate an integration score associated with this hypothesis that will be called p_{FSIS}, with FSIS meaning Financial Sector Integration Score. Thanks to this variable, we can test the hypothesis with the usual equation, specifically referred to the previous integration score:

$$p_{FSIS,t} = \alpha + \beta Brexit + \varepsilon_t \quad (14)$$

As usual, $p_{FSIS,t}$ represent the integration score for a specific time period (*t*), and the rest of the variables are the same as the equation testing the previous hypotheses.

From this we can derive the null and alternative hypotheses:

H0: Brexit does not have a significant effect on the integration score between the financial sector of the UK and the EU ($\beta = 0$).

H1: Brexit has a significant impact on the integration score between the financial sector of the UK and the EU, leading to a decrease in financial integration ($\beta < 0$).

Equally, as for H1, the beta of this regression, and its significance, will provide the needed information to be able to quantify the importance of Brexit in the evolution of the integration in this particular sector. This can better explain current or future behaviour in the financial sector, such as the shift of the services towards different EU cities analysed in the second chapter.

4.5. Hypothesis 5

The fifth hypothesis aims to show the Brexit effect on integration in the Small Cap segment of the market.

Hypothesis 5: The level of stock market integration between UK Small-Cap Stocks and EU ones has decreased following the referendum over Brexit.

The starting point of this analysis is the rolling regression, which as before changes only to consider the indices associated with this particular hypothesis:

$$R_{UKSC} = \alpha_{UKSC} + \beta_{UKSC} R_{EUSC} + \varepsilon_{UKSC} \tag{15}$$

UKSM and EUSM refer to the United Kingdom Small Cap and Europe Small Cap respectively, so that R_{UKSC} represent the return of the MSCI United Kingdom Small Net Index and R_{EUSC} the return of the MSCI Europe Ex United Kingdom Small Cap Net Index. As always, α_{UKSC} is the intercept, β_{UKSC} is the beta and ε_{UKSC} is the residual of this regression equation.

The integration score related to this hypothesis is named Small Cap Integration Score (SMIS), so it will be referred to as p_{SCIS}. This variable will enable us to test the hypothesis using the following regression:

$$p_{SMIS,t} = \alpha + \beta Brexit + \varepsilon_t \tag{16}$$

where the integration score p_{SCIS} is considered for a specific period of time indicated by *t*.

Equation (16) gives us the methodology to test the following null and alternative hypotheses:

H0: The event of Brexit has no significant effect on the integration score between the Small Cap firms of the UK and the EU ($\beta = 0$).

H1: The event of Brexit has a significant effect on the integration score between the Small Cap firms of the UK and EU, reducing the degree of financial integration ($\beta < 0$).

Rejecting the null hypothesis with significant levels of the beta and finding negative values would confirm the alternative hypothesis and show the impact of the referendum on the stock market integration of the Small Cap firms, confirming previous findings on the reduction of the co-movement between UK Small-Cap Stocks and EU ones (Lee and Howlett, 2021), and adding information regarding the behaviour of these particular stocks in the occasion of international shocks such as Brexit.

4.6. Hypothesis 6

The last hypothesis has a broader look and tries to understand if following the event of Brexit, the UK has increased the level of stock market integration with the other big partner such as the US.

Hypothesis 6: The level of stock market integration, measured by stock market integration scores, between the UK and the US has increased following Brexit.

To keep clarity and coherence first will be expressed the rolling regression associated with this hypothesis:

$$R_{UK} = \alpha_{UK} + \beta_{UK} R_{US} + \varepsilon_{UK} \tag{17}$$

Here, R_{UK} represent the return of the MSCI United Kingdom Net Index, R_{US} is the return of the MSCI US Net Index, α_{UK} the intercept, β_{UK} the beta and ε_{UK} the residual of the regression equation.

The method is the same as the previous hypothesis, in particular, is the same as H1 when looking in general at the UK and the EU, with the difference that the MSCI US Index is used.

p_{USIS} is then the integration score between the UK and the US, which will be the dependent variable in the usual regression equation:

$$p_{USIS,t} = \alpha + \beta Brexit + \varepsilon_t \tag{18}$$

The beta, β, is the relevant coefficient as it enables us to accept or reject the following null and alternative hypotheses:

H0: Brexit has no significant effect on the integration scores between the UK and the US ($\beta = 0$).

H1: Brexit has a significant effect on the integration scores between the UK and the US, leading to an increase in the degree of financial integration between these two countries ($\beta > 0$).

Similarly to the previous section, a level of beta significantly different from zero would mean rejecting the null hypothesis, meaning that Brexit affects the integration between the UK and the US. The sign of the beta will show if the effect is positive or negative, so if there is more integration or segmentation.

This concludes the method chapter consisting of relevant regression equations and definitions of coefficients that will be analysed in the following section that tests these hypotheses.

CHAPTER 5 Results

This chapter examines the results of the tests conducted to give an answer to the research question stated at the beginning of the thesis:
Has Brexit lowered the degree of financial integration between the UK and the Eurozone?

In order to do so, we developed six different hypotheses to cover multiple countries and stock market sectors to have a clearer and most comprehensive understanding of the phenomenon of the Brexit referendum and its impact on the relationship between the UK, the EU and lastly the US.
The overall expectation on the effects of Brexit was that this event impacted the financial integration of the UK and led to a lower degree of integration between these two big economies, namely the United Kingdom and the European Union.

Throughout the remainder of this chapter each hypothesis will be analysed in a separate section, and its results discussed to ensure clarity and coherence.

5.1. Hypothesis 1

The beginning of the analysis of the effect of the Brexit event tries to give an overall view of the level of financial integration between the UK and the EU and it can be considered the main hypothesis that gives important insights into the effects of the referendum held in 2016 on the stock market integration between the two economies.
The hypothesis stated the following:
The degree of financial integration between the UK and the EU, measured by stock market integration scores, has significantly decreased following Brexit.

As explained in the method chapter, to test this hypothesis the first step was to calculate the beta between the UK stock market index and the European one, namely the MSCI United Kingdom Net Index EUR and the MSCI Europe Ex United Kingdom Net Index, to further be able to get the integration scores.

A rolling regression with a window of three months has been used to get multiple betas over that same period. The integration scores follow this setting, so we are able to have an image and a clear representation of the development of the stock market integration between the UK and the EU starting at the end of April 2013.

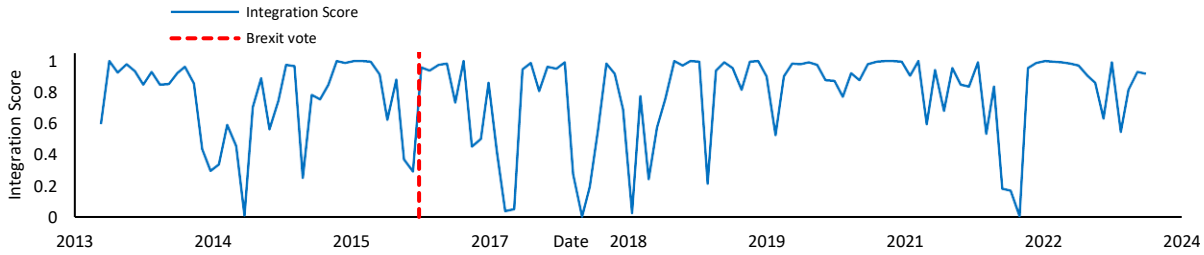
As it is visible from Figure 7, the degree of financial integration, represented by the integration score, changes often during the period in exam, with picks going both to 1 and 0, the two boundaries into which the score can fluctuate. In the chart is shown also the Brexit referendum, our event study, to give a clear visual representation of the two periods examined: before and after Brexit.

From this figure we can see how the integration score rapidly and repeatedly goes towards zero, showing a great, sometimes extreme, level of disaggregation. In the months right after the referendum the score drops towards zero, and until 2019, we can see a discontinuous behaviour with sharp ups and downs, indicating a period of great instability.

Figure 7

H1: Integration Score

This figure is the graphical representation of the level of the Integration Score during the full period in exam (30/04/2013 – 31/08/2023).



The graph also shows, on the other hand, a difficulty in depicting a clear sign of a trend, contrary to what was hoped in the premises of this research. Despite the drop following the event that can be consistent with the first sharp reaction of the market to the result of the referendum and the uncertainty that was present during those months, in the remaining period the score doesn't stay at a lower level, or interval, compared to the before Brexit window that could indicate a clear sign of direct effect of the event in study.

The only more stable period can be detected during COVID-19, until 2022. It can be the case that this event had an impact on the level of integration since it hit all countries internationally.
To sustain this graphical view, average integration scores are calculated during specific periods to have a summary of the degree of integration decomposed into critical events.

Table 2

H1: Average Integration Scores

This table is the average Integration Score over the different sub-periods of the overall timeframe. In brackets is specified the interval with the exact date of start and end of the calculations.

Period	Average Integration Score
Overall (30/04/2013 – 31/08/2023)	0.77
Pre Brexit (30/04/2013 – 30/06/2016)	0.75
Post Brexit (31/07/2016 – 31/12/2019)	0.71
COVID (31/01/2020 – 31/08/2023)	0.84
1 Year Post Brexit (31/07/2016 – 31/07/2017)	0.68

As you can see from the table above, the average integration score decreased, from 0.75 to 0.71, after the Brexit vote until COVID-19 hit at the beginning of 2020. This gives a clearer view of that period, which on average resulted in a lower integration score, also compared to the overall mean of 0.77. To further sustain the impact of COVID, during that event the average integration score found is 0.84, higher than both the pre and post Brexit vote. These three events divide the entire period into three relevant windows show the development of the integration score and add key details and clearness to Figure 7. The last period covered is the year after the referendum, which resulted in the lowest average integration score calculated at 0.68.

But this is not sufficient to prove a clear effect of the Brexit vote. We need to regress the integration score versus variables indicating the event, to show the statistical relevance of the referendum and the sign of the possible effects. In particular, we developed 4 dummy variables reflecting the same sub-periods mentioned in Table 2 and regressed them against the Integration Score using single simple regressions.

We tested the null hypothesis, together with a t-test to verify the significance of the results in order to be able to reject the hypothesis and assess the significance of the effects of the Brexit referendum on the integration score calculated before, over the different sub-periods.

Table 3

H1: Coefficients Summary

This table shows the results from the single regressions carried using each dummy variable mentioned below. *General_Dummy* takes the value of 1 from 31/07/2016 to 31/08/2023 and 0 elsewhere. *Post_Dmmy* takes the value of 1 from 31/07/2016 to 31/12/2019 and 0 elsewhere. *COVID_Dummy* takes the value of 1 from 31/01/2020 to 31/08/2023 and 0 elsewhere. *ST_Dummy* takes the value of 1 from 31/07/2016 to 31/07/2017 and 0 elsewhere. The coefficients are shown with the values of the t-Stat in brackets and *, **, *** represent the significance at 99%, 95% and 90% level respectively. Negative values of the t-Stat derive from negative coefficients.

Variables	Coefficients
General_Dummy	0.028 (0.509)
Post_Dummy	-0.088 (-1.646)
COVID_Dummy	0.112 (2.142) **
ST_Dummy	-0.097 (-1.171)

The results of our study are summarised in the table above. By dividing the period into sub-periods and creating corresponding variables, we are able to decompose the change in the integration score and understand the underlying drivers. In fact, the only positive statistically significant coefficient different from zero, 0.112, is the one connected with the COVID event. All the other variables show coefficients

that are not statistically significantly different from zero, therefore it is not possible to establish a precise effect of the Brexit referendum on the change in the integration score.

This means that we cannot reject the null hypothesis described in Chapter 4, despite the sign of the *Post_Dummy* and the *ST_Dummy* variables being slightly negative.

5.2. Hypothesis 2

We present here the results of the second hypothesis:
The level of stock market integration between the UK and three Large-EU countries has decreased following Brexit, as shown by integration scores.

This opens the decomposition of the analysis on a country level, by showing the event study conducted on three large EU countries.

The following table summarizes the average integration scores over the four subperiods mentioned in the previous section about hypothesis one. All the results from the single economies are incorporated in the same table below for a quick comparison.

Table 4

H2 Average Integration Scores

This table shows the average Integration Score calculated per country over different sub-periods of the overall timeframe. In brackets is specified the interval with the exact date of start and end of the calculations.

	Average Integration Score		
Period	GER	FRA	ITA
Overall (30/04/2013 – 31/08/2023)	0.69	0.77	0.72
Pre Brexit (30/04/2013 – 30/06/2016)	0.65	0.82	0.67
Post Brexit (31/07/2016 – 31/12/2019)	0.61	0.68	0.63
COVID (31/01/2020 – 31/08/2023)	0.78	0.82	0.86
1 Year Post Brexit (31/07/2016 – 31/07/2017)	0.52	0.64	0.49

The first thing to notice here is that both periods after Brexit, until COVID, show lower integration scores compared to overall and the pre-Brexit period, for all countries. The second trend common to all countries is that the highest average integration score is related to the COVID event, while the lowest is found one year after Brexit, with Italy showing the lowest integration score among all countries of 0.49. The biggest difference between the pre and post Brexit average integration score is found in France (0.14), while in the other two countries the difference is minimal (0.04). Again, we can see a weak

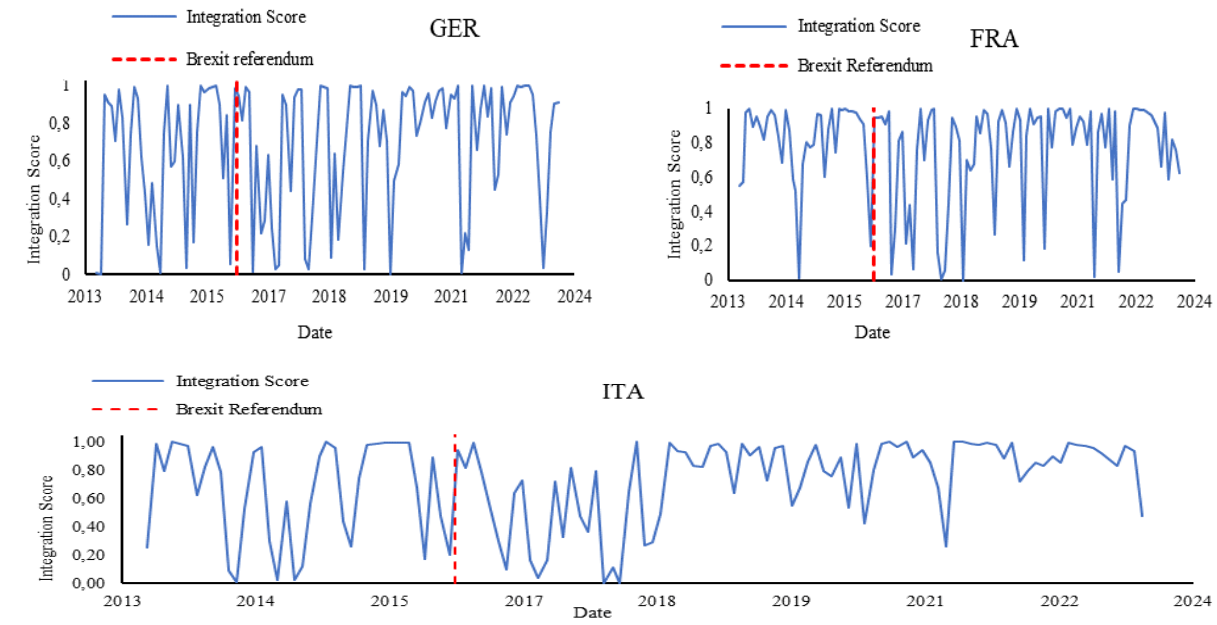
decrease in the integration score following the referendum and an increase following the COVID event, apart from France where it stayed the same at 0.82.

Thanks to Table 4 we can now look at the graphical representation of each integration score per country and be able to look behind the big fluctuations of the score for all countries and see better the trends.

Figure 8

H2 Integration Score

This figure shows the Integration Score over the period considered (30/04/2013 – 31/08/2023) for the three countries: Germany (GER), France (FRA) and Italy (ITA)



As always now we will present the results from the test of the significance of the Brexit event on the change in the integration score. Table 5 summarises the output of the regressions made to test the significance of the event study.

The first thing to notice, in line with hypothesis one, is that the *General_Dummy* variable is not statistically significant in any country. This means that the Brexit event was not the driver of the change in the integration score over the whole period in exam. Moreover, even if slightly, the sign of the coefficient is positive for Italy and Germany, while only for France is negative as expected. But this coefficient, considered the value of the t-statistic, can't be considered different from zero.

Excluding the COVID event, we see significant negative coefficients for all countries. France shows the most significant coefficient for the *Post_Dummy*, (-0.14) indicating a negative impact of the Brexit

referendum on the integration score previous to the widespread of COVID-19 in Europe, while Italy shows the biggest short-term effect with a coefficient of -0.265. This means that removing the COVID event from the analysis allows finding better and more significant results. In fact, the COVID-related dummy is positive and significant for both Germany and Italy.

Table 5

H2 Coefficients Summary

This table shows the results from the single regressions carried using each dummy variable mentioned below. *General_Dummy* takes the value of 1 from 31/07/2016 to 31/08/2023 and 0 elsewhere. *Post_Dmmy* takes the value of 1 from 31/07/2016 to 31/12/2019 and 0 elsewhere. *COVID_Dummy* takes the value of 1 from 31/01/2020 to 31/08/2023 and 0 elsewhere. *ST_Dummy* takes the value of 1 from 31/07/2016 to 31/07/2017 and 0 elsewhere. The coefficients are shown with the values of the t-Stat in brackets and *, **, *** represent the significance at 99%, 95% and 90% level respectively. Negative values of the t-Stat derive from negative coefficients.

	Coefficients		
Variables	GER	FRA	ITA
General_Dummy	0.046 (0.708)	-0.065 (-1.181)	0.083 (1.405)
Post_Dummy	-0.11 (-1.724) *	-0.14 (-2.66) ***	-0.141 (-2.489) **
COVID_Dummy	0.151 (2.427) **	0.076 (1.43)	0.216 (3.99) ***
ST_Dummy	-0.185 (-1.879) *	-0.15 (-1.806) *	-0.265 (3.047) ***

5.3. Hypothesis 3

The analysis now shifts to three mid-EU countries, to complete the focus on single EU economies. The hypothesis here is the following:

The level of stock market integration measured by specific integration scores, between the UK and three Mid-EU countries has decreased following Brexit.

Following the same setting as the previous section first we present in Table 6 the average integration score and see if any trend can be found, and then to complete the analysis of the integration score behaviour we show the graphical representation of the scores per country.

In Belgium (BE) and especially in Poland (PO), the average integration score decreased compared to the Pre-Brexit period and the overall average score, with the lowest value of 0.32 in Poland in the short-term period after the event. What is particular here is the behaviour of the integration score in Austria (AU), where the average score increases after the event for all periods, showing a higher integration score in the short-term (0.63) compared to the Post Brexit until COVID (0.61). This never happened before.

Table 6

H3 Average Integration Scores

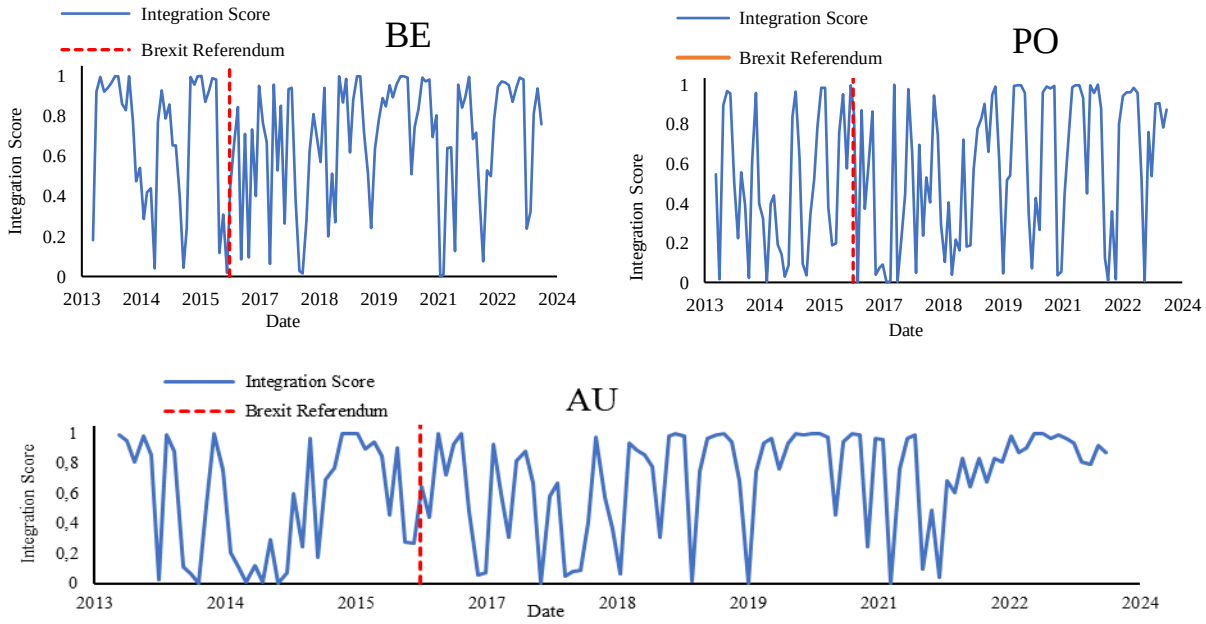
This table shows the average Integration Score calculated per country over different sub-periods of the overall timeframe. In brackets is specified the interval with the exact date of start and end of the calculations.

Period	Average Integration Score		
	AU	BE	PO
Overall (30/04/2013 – 31/08/2023)	0.66	0.68	0.55
Pre Brexit (30/04/2013 – 30/06/2016)	0.55	0.68	0.51
Post Brexit (31/07/2016 – 31/12/2019)	0.61	0.62	0.45
COVID (31/01/2020 – 31/08/2023)	0.80	0.74	0.69
1 Year Post Brexit (31/07/2016 – 31/07/2017)	0.63	0.57	0.32

Figure 9

H3 Integration Score

This figure shows the Integration Score over the period considered (30/04/2013 – 31/08/2023) for the three countries: Germany (GER), France (FRA) and Italy (ITA)



By looking at the graphs we can understand why Austria experienced a higher average integration score after Brexit compared to the period before the referendum: in 2014 there was a longer period of extremely low integration scores, which decreased the average level, resulting in a higher degree in the period after Brexit.

The event study, whose results are summarized in Table 7, confirms the view of a higher integration score in Austria after Brexit, with the positive coefficient (0.16) of the *General_Dummy*, significant at the 95% confidence level. Despite the sign being the opposite compared to the expectations, it is the first time that we see a coefficient significantly different from zero, even if slightly, for the *General_Dummy*. Both Austria and Poland's *COVID_Dummy* coefficients show high significance, showing a positive, but small, effect of COVID-19 on the integration score. Surprisingly, none of the coefficients for Belgium are significant. Lastly, Poland also shows a negative significant coefficient for the *Post_Dummy*, -0.153, and the *ST_Dummy*, -0.262, so for the period excluding COVID we can affirm that the Brexit event had a negative, significant, impact on the integration score, confirming our hypothesis.

Table 7

H3 Coefficients Summary

This table shows the results from the single regressions carried using each dummy variable mentioned below. *General_Dummy* takes the value of 1 from 31/07/2016 to 31/08/2023 and 0 elsewhere. *Post_Dmmy* takes the value of 1 from 31/07/2016 to 31/12/2019 and 0 elsewhere. *COVID_Dummy* takes the value of 1 from 31/01/2020 to 31/08/2023 and 0 elsewhere. *ST_Dummy* takes the value of 1 from 31/07/2016 to 31/07/2017 and 0 elsewhere. The coefficients are shown with the values of the t-Stat in brackets and *, **, *** represent the significance at 99%, 95% and 90% level respectively. Negative values of the t-Stat derive from negative coefficients.

	Coefficients		
Variables	AU	BE	PO
General_Dummy	0.159 (2.379) **	0.00 (0.003)	0.068 (0.975)
Post_Dummy	-0.075 (-1.125)	-0.096 (-1.631)	-0.153 (-2.276) **
COVID_Dummy	0.223 (3.53) ***	0.094 (1.615)	0.213 (3.282) ***
ST_Dummy	-0.028 (-0.274)	-0.118 (-1.295)	-0.262 (-2.539) **

5.4. Hypothesis 4

The fourth hypothesis opens the analysis of a specific stock market segment, namely the financial sector, with the following hypothesis:

The integration of the UK's financial sector with the EU has decreased after Brexit, as shown by stock market integration scores.

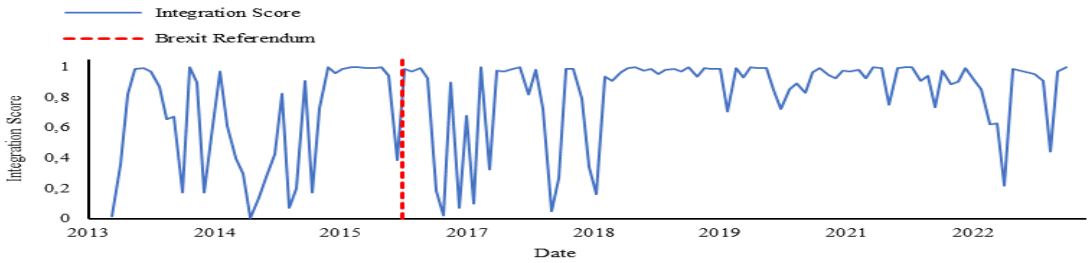
From the chart in Figure 10, we can immediately see an extended period of constant high integration scores between the end of 2018 and 2022, most probably due to a big effect of COVID. For this reason, the graph presents fewer extreme fluctuations of the score compared to the earlier analysis, but still, we can't depict a specific trend or effect of the event highlighted. Contrarily to what we have seen in the other analysis, short before and after the referendum we do not see a sharp decline in the score, if

anything it decreases a little and then comes back higher especially on the event date, for then decline after a few months.

Figure 10

H4: Integration Score

This figure is the graphical representation of the level of the Integration Score during the full period in exam (30/04/2013 – 31/08/2023).



The analysis of the average integration score in different subperiods shown in the table below confirms this view: the average integration score Post Brexit, and during COVID, is very high, 0.77 and 0.89 respectively. Comparing these numbers with the Pre Brexit period we can already suspect an increase in the score, in contrast with our expectations. The score slightly decreases only in the short-term period after Brexit (0.62).

Table 8

H4 Average Integration Scores

This table shows the average Integration Score over the different sub-periods of the overall timeframe. In brackets is specified the interval with the exact date of start and end of the calculations.

Period	Average Integration Score
Overall (30/04/2013 – 31/08/2023)	0.78
Pre Brexit (30/04/2013 – 30/06/2016)	0.65
Post Brexit (31/07/2016 – 31/12/2019)	0.77
COVID (31/01/2020 – 31/08/2023)	0.89
1 Year Post Brexit (31/07/2016 – 31/07/2017)	0.62

To confirm this suspect, we now show the results of the event study conducted for this specific hypothesis.

Table 9

H4 Coefficients Summary

This table shows the results from the single regressions carried using each dummy variable mentioned below. *General_Dummy* takes the value of 1 from 31/07/2016 to 31/08/2023 and 0 elsewhere. *Post_Dmmy* takes the value of 1 from 31/07/2016 to 31/12/2019 and 0 elsewhere. *COVID_Dummy* takes the value of 1 from 31/01/2020 to 31/08/2023 and 0 elsewhere. *ST_Dummy* takes the value of 1 from 31/07/2016 to 31/07/2017 and 0 elsewhere. The coefficients are shown with the values of the t-Stat in brackets and *, **, *** represent the significance at 99%, 95% and 90% level respectively. Negative values of the t-Stat derive from negative coefficients.

Variables	Coefficients
General_Dummy	0.18 (3.162) ***
Post_Dummy	-0.07 (-0.117)
COVID_Dummy	0.176 (3.191) ***
ST_Dummy	-0.172 (-1.936) *

The results confirm the expectations, from both the graph and the average scores, that after the event the integration score has increased with both the referendum and COVID-19 playing a role, even if minimal, in this phenomenon. In particular, we observe statistically significant coefficients at the 99% confidence level for both the *General_Dummy* and the *COVID_Dummy*. It is worth mentioning that in the short-term period after Brexit, the coefficient is negative and almost significant at the 95% confidence level (p-value found of 0.055). Due to these results, we have to reject the hypothesis.

5.5. Hypothesis 5

The second stock market focus is on the Small-Cap stocks between the UK and Europe, with the fifth hypothesis saying the following:

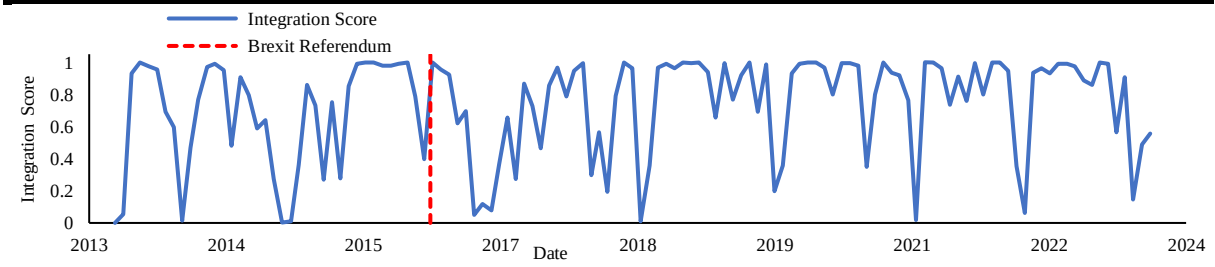
The level of stock market integration between UK Small-Cap Stocks and EU ones has decreased following the referendum over Brexit.

The behaviour of the integration score over time is summarised in the chart below. The fluctuation of the score is very similar to what we have seen so far, so it is not possible to establish a specific trend, but we can observe a decline in the score right after the referendum until the beginning of 2017.

Figure 11

H5 Integration Score

This figure is the graphical representation of the level of the Integration Score during the full period in exam (30/04/2013 – 31/08/2023).



From the summary of the average integration score, as always, we have a clearer picture of the changes in the score, and we can understand better the possible trends and implications.

Table 10

H5 Average Integration Scores

This table is the average Integration Score over the different sub-periods of the overall timeframe. In brackets is specified the interval with the exact date of start and end of the calculations.

Period	Average Integration Score
Overall (30/04/2013 – 31/08/2023)	0.73
Pre Brexit (30/04/2013 – 30/06/2016)	0.67
Post Brexit (31/07/2016 – 31/12/2019)	0.69
COVID (31/01/2020 – 31/08/2023)	0.82
1 Year Post Brexit (31/07/2016 – 31/07/2017)	0.52

As suspected, the lowest integration score is in the immediate months after the referendum, with a 1-year average of 0.52. Between the pre and post Brexit the change is minimal (0.02), but it increases instead of decreasing. The COVID period gives the highest score of 0.82.

From the event study, we can understand if the short-term decrease is caused by the referendum and if COVID has indeed had an impact on the increase in the integration.

Table 11

H5 Coefficients Summary

This table shows the results from the single regressions carried using each dummy variable mentioned below. *General_Dummy* takes the value of 1 from 31/07/2016 to 31/08/2023 and 0 elsewhere. *Post_Dmmy* takes the value of 1 from 31/07/2016 to 31/12/2019 and 0 elsewhere. *COVID_Dummy* takes the value of 1 from 31/01/2020 to 31/08/2023 and 0 elsewhere. *ST_Dummy* takes the value of 1 from 31/07/2016 to 31/07/2017 and 0 elsewhere.
The coefficients are shown with the values of the t-Stat in brackets and *, **, *** represent the significance at 99%, 95% and 90% level respectively. Negative values of the t-Stat derive from negative coefficients.

Variables	Coefficients
General_Dummy	0.083 (1.362)
Post_Dummy	-0.63 (-1.053)
COVID_Dummy	0.14 (2.402) **
ST_Dummy	-0.232 (-2.559) **

We can see, indeed, that the only statistically significant coefficients are found for the *COVID_Dummy* and the *ST_Dummy*, both at 95% confidence level, showing a positive and negative effect, respectively. Again, the absolute value of the coefficients is remarkably close to zero, so the effect is very minimal.

5.6. Hypothesis 6

The sixth hypothesis concludes the analysis, with a focus on another country, the US. The hypothesis was the following:

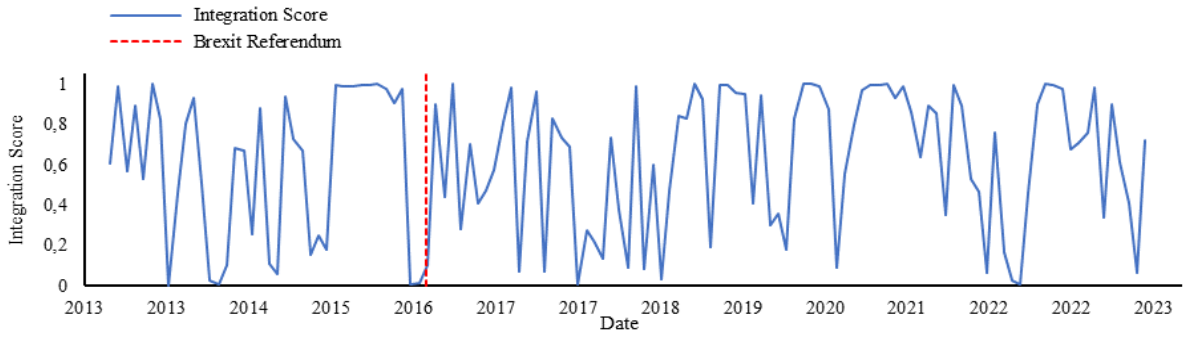
The level of stock market integration, measured by stock market integration scores, between the UK and the US has increased following Brexit.

From a first look at Figure 12, we can observe how the behaviour of the score is very irregular, and no specific trend can be found, not even in the very short-term period after Brexit, where usually we found a clear and sharp decrease in the score, even if for a few months. What is also particular is that the movements of the integration score before and after the event until COVID hit seem quite symmetrical. In fact, as it is clear in Table 12, the average integration score stayed the same.

Figure 12

H6 Integration Score

This figure is the graphical representation of the level of the Integration Score during the full period in exam (30/04/2013 – 31/08/2023).



We present here the table, where it is clear that the average integration score is low compared to the numbers found in the earlier analysis, already showing a less integrated market. As we said earlier, the average before and after the referendum stayed the same (0.58). The score increased after the vote both during COVID and in the few months after the referendum, as we expected earlier from the graphical analysis.

Table 12

H6 Average Integration Scores

This table shows the average Integration Score over the different sub-periods of the overall timeframe. In brackets is specified the interval with the exact date of start and end of the calculations.

Period	Average Integration Score
Overall (30/04/2013 – 31/08/2023)	0.62
Pre Brexit (30/04/2013 – 30/06/2016)	0.58
Post Brexit (31/07/2016 – 31/12/2019)	0.58
COVID (31/01/2020 – 31/08/2023)	0.69
1 Year Post Brexit (31/07/2016 – 31/07/2017)	0.64

We conclude our analysis with the event study and by presenting the coefficients for the variables in the analysis. The table below summarises the results and helps us in the exhibition of the results. As suspected, the *General_Dummy*, the *COVID_Dummy* and the *ST_Dummy* present positive coefficients, showing an increase in the integration after the event, even if only the second one is statistically significant at the 90% confidence level. Again, the COVID event is the only one that seems to have an effect on the score, even if minimal (0.105). Even though the *General_Dummy* coefficient is positive, we cannot confirm the hypothesis that the integration has increased due to the Brexit event since it is not statistically significant.

Table 13

H6 Coefficients Summary

This table shows the results from the single regressions carried using each dummy variable mentioned below. *General_Dummy* takes the value of 1 from 31/07/2016 to 31/08/2023 and 0 elsewhere. *Post_Dmmy* takes the value of 1 from 31/07/2016 to 31/12/2019 and 0 elsewhere. *COVID_Dummy* takes the value of 1 from 31/01/2020 to 31/08/2023 and 0 elsewhere. *ST_Dummy* takes the value of 1 from 31/07/2016 to 31/07/2017 and 0 elsewhere. The coefficients are shown with the values of the t-Stat in brackets and *, **, *** represent the significance at 99%, 95% and 90% level respectively. Negative values of the t-Stat derive from negative coefficients.

Variables	Coefficients
General_Dummy	0.051 (0.751)
Post_Dummy	-0.058 (-0.882)
COVID_Dummy	0.105 (1.613) *
ST_Dummy	0.023 (0.227)

5.7. Robust Checks

In this final section, we will present the results of the coefficients score of the same dummies examined in the previous section as a result of multiple regression. This will help us understand the relationship between the variables and verify if the results obtained with the single regressions are different from the ones found using multiple regressions. This could signal an interaction between specific variables that can change the considerations made earlier.

Since our analysis is focused on the effects of Brexit until the current days, multiple regressions will be carried out considering the *Post_Dummy* and the *COVID_Dummy*. It is already important here to notice how, by also adding the *General_Dummy* into the regression Stata omits that variable because of collinearity. This is understandable since the period they cover is the same until 2019, so the two variables take the same values almost entirely. What remains important is the relationship between the two dummies, namely *Post_Dummy* and *COVID_Dummy* in order to verify the accuracy of the previous results, especially considering the number of times we found the *COVID_Dummy* being statistically significant.

The equation used is the same for each hypothesis, so it is the name of the variables, used also in the previous analysis. The equation is the following:

$$IntScore = \alpha + \beta_1 Brexit + \beta_2 COVID + \varepsilon \quad (19)$$

where $Brexit$ and $COVID$ represent the *Post_Dummy* and *COVID_Dummy* respectively, as explained before and in the previous sections. β_1 is the beta associated with the first variable, while β_2 refers to the second variable. As always, by examining the value of the two betas and their significance we can assess the effect of the corresponding event on the overall integration score.

Table 14

Multiple Regression Coefficient Summary

DESCRIPTION						
	β_1			β_2		
H1	-0.039			0.092		
	FRA		**GER**		**ITA**	
	β_1	β_2	β_1	β_2	β_1	β_2
H2	-0.138 **	0.005	-0.041	0.13 *	-0.037	0.197 ***
	AU		**BE**		**PO**	
H3	β_1	β_2	β_1	β_2	β_1	β_2
	0.06	0.254 ***	-0.064	0.061	-0.055	0.185 **
	β_1			β_2		
H4	0.119			0.238 ***		
	β_1			β_2		
H5	0,015			0.148 **		
	β_1			β_2		
H6	-0.004			0.103		

Table 14 summarizes the results found, showing the value of each beta per hypothesis. By comparing these values with the one found earlier with single regressions we can observe the changes in either the sign of the coefficient and its level of significance.

Regarding hypothesis one, we observe no statistically significant coefficients, while in the single regression using the *COVID_Dummy*, we found a slightly positive coefficient, 0.112, significant at a

95% confidence level. By combining the two dummies we lose the significance of the COVID event and the sign of the *General_Dummy* becomes negative.

The analysis of the second hypothesis reveals for France a stronger statistically significant negative sign, -0.112 compared to -0.065, associated with the Brexit event, while *COVID* value is remarkably close to zero. This can indicate that the effect of Brexit was stronger when evaluated together with the COVID-19 effect. Interestingly, in Germany, we found an opposite sign compared to the previous test, as we expected at the beginning of the analysis. Despite this, it cannot be considered statistically significantly different from zero. The same applies to Italy, where the *General* coefficient becomes negative, while the *COVID* one remains positive and significant at a 99% confidence level.

In the third hypothesis can observe that Austria maintains a high significance of the *COVID* coefficient, while the *General* coefficient loses any significance and decreases to almost zero (0.06). This can reveal that the increase in the integration score is mainly driven by the COVID effect, while in the previous test with single regression we concluded that also Brexit had an effect. In Belgium, we still cannot find any significance, even if the sign of the *General* coefficient becomes negative. For Poland β_1 becomes negative as well, but not significant, while the *COVID* coefficient stays significant but at a 95% confidence level compared to the 99% of the previous setting.

In hypothesis four we found that the big effect of the increase in the integration score was mainly driven by the COVID event, since we no longer find any significance for the *General* coefficient, while we still observe a 99% level of significance for the *COVID* dummy.

In hypothesis 5 we don't find any changes, while the *COVID* coefficient in hypothesis 6 loses its significance so in this combined analysis it is not possible to find a stronger effect of one of the two events.

Regarding the last hypothesis, we still don't find any significance in the coefficient for the *General* variable and also the *COVID* variable loses any relevant significance compared to the previous analysis where it was found a positive effect significant at the 90% confidence level.

In conclusion, it has to be said that the analysis just discussed can be considered less reliable for our purpose to find an impact of the referendum vote on the change in the integration score after it. Therefore, we will rely more on the previous analysis, using these last considerations to better understand the phenomenon.

CHAPTER 6 Conclusion

The purpose of this thesis was to detect an effect of the Brexit event, represented by the referendum vote on 23/06/2016, on the stock market integration between the UK and the EU. This resulted in the following research question:
Has Brexit lowered the degree of financial integration between the UK and the Eurozone?

To answer this question, we developed and tested six different hypotheses, and in this chapter, we will give the conclusion for each of them separately and answer the main research question.
We end this chapter with limitations and recommendations for the reader.

6.1. Hypothesis 1

The first hypothesis stated the following:
The degree of financial integration between the UK and the EU, measured by stock market integration scores, has significantly decreased following Brexit.

Considering the results found in the previous chapter for the variables that can be reconducted to the Brexit event, we conclude that we cannot consider the effect of the event statistically different from zero, therefore the referendum, in our analysis, didn't have an impact on the stock market integration between the UK and the EU.

6.2. Hypothesis 2

Hypothesis two focused on three large EU countries, in order to have a more precise analysis of EU countries by stating the following:
The level of stock market integration between the UK and three Large-EU countries has decreased following Brexit, as shown by integration scores.

Specifically, the three chosen countries are France, Germany, and Italy. Following our test carried out, we conclude that, in Germany, Brexit cannot be considered a significant driver of the change in the integration score between the UK and each one of the two economies.
Regarding Italy, a significant effect is found from the single regression on the *Post*_Dummy variable, while in the multiple regression, this significance is no longer present. Therefore, we conclude that Brexit was a driver of the reduction in the integration score before COVID-19 hit, even if it does not explain the whole change.
Instead, we can consider in France a significant effect of the referendum on the change in the integration score, confirming our hypothesis thanks to a negative coefficient in both the single and multiple regression, -0.14, significant at the 99% and 95% respectively in each analysis.

6.3. Hypothesis 3

The third hypothesis concludes the consideration of different countries by looking at three medium economies through the following hypothesis:
The level of stock market integration measured by specific integration scores, between the UK and three Mid-EU countries has decreased following Brexit.

We conclude that only in Poland we can observe a negative significant impact on the integration score before the COVID event, thanks to a coefficient of -0.153. Therefore, we make the same conclusions as for Italy in the previous hypothesis and consider that the Brexit event had an effect previous to COVID, so it does not explain all the changes in the period, considering the value of the coefficient for the same variable in the multiple regression setting. For the other countries, we cannot confirm our hypothesis, considering both the coefficient and the significance of them.

6.4. Hypothesis 4

Hypothesis four states the following:
The integration of the UK's financial sector with the EU has decreased after Brexit, as shown by stock market integration scores.

We conclude that we cannot confirm the hypothesis, particularly considering that we found a statistically significant positive effect of the event in the whole period after Brexit (July 2016 – August 2023), while in the other two periods considered to assess the effect of the referendum, we found slightly negative coefficient only during the one year after the event, at the 90% confidence level.

6.5. Hypothesis 5

The fifth hypothesis focused on the Small Cap sector, specifically our hypothesis was:
The level of stock market integration between UK Small-Cap Stocks and EU ones has decreased following the referendum over Brexit.

We conclude that the Brexit event had a negative significant impact only in the short term, one year after the referendum. For that period, we can confirm our hypothesis, but in all other periods, we have to reject the starting hypothesis.

6.6. Hypothesis 6

Lastly, our analysis shifted to another big economy, the US, thanks to the following hypothesis:
The level of stock market integration, measured by stock market integration scores, between the UK and the US has increased following Brexit.

To conclude, also in this occasion we cannot confirm our hypothesis because the coefficients found are not significant, therefore the change in the integration score cannot be considered different from zero.

6.7. Final Considerations

In the previous sections, we summarized the conclusion regarding each one of the hypotheses, so we can now give a clear answer to the research question.
Having rejected all the hypotheses, despite for some countries or specific periods, and especially having rejected the first one, we cannot establish a clear effect of the Brexit event on the financial integration between the UK and the EU until the end of August 2023. Therefore, the answer to the research question cannot be clearly affirmative.

It has to be said that, as a final consideration, in our analysis, we found evidence of an effect of the COVID event in all the single regressions in each hypothesis and for most of the coefficients in our multiple regressions. The arrival of the global virus in 2020 affected most of the sectors and economies and for sure it had an effect on financial integration as well.

6.8. Limitation and Recommendations

We conclude with some recommendations and limitations of this thesis in order to help and allow further research on this same argument.
As has been said earlier, the first limitation was that considering a whole period with also the COVID effect has affected the possible effect of the Brexit referendum on the integration score. This is confirmed by the fact that the coefficients for the Post_*Dummy* and the *ST_Dummy* in most of the tests were negative and significant.
On the other hand, this also gives input for following research on the effect COVID had on the financial integration worldwide, to assess how a crisis with those specific characteristics can affect the stock market and the relationship between economies.

Another limitation is given by the fact that the integration score was not calculated taking into consideration the market capitalization of the two countries or economies that we were evaluating, therefore not adding the extension of Barari (2004) for an adjusted integration score explained in the fourth chapter. This is due to the fact that, for the indices used, that specific historical data was not publicly available.

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