



Expertise
and insight
for the future

Jevgeni Maiorov

Can Brexit Damage the European Derivative Market?

Metropolia University of Applied Sciences

Bachelor of Business Administration

European Business Administration

Bachelor's Thesis

18.04.2019

Author Title	Jevgeni Maiorov Can Brexit Damage European Derivative Market?
Number of Pages Date	44 pages 18 April 2019
Degree	Bachelor of Business Administration
Degree Programme	European Business Administration
Instructor/Tutor	Patrik Pehrsson, Senior Lecturer
<p>Brexit is a media term, referred to Britain leaving European Union. His process has been initiated in March 2017 is still in progress. This research paper looks into financial consequences of Brexit, particularly the possible damage Brexit may cause to European Derivative Market.</p> <p>Current research has been done with support of secondary qualitative data acquired from various resources e.g. Internet articles, books, other researches; and practical analysis of expected probabilities for different Brexit scenarios to happen. Research has aimed to help businesses and private investors to make a better financial decision concerning their risk management strategy involving derivatives on the basis of the current research paper.</p> <p>The results have shown, that at the moment there is only 15,4% risk for European Derivative Market to be directly impacted by Brexit consequences. This is substantially smaller risk exposure compared to one that was associated with Brexit event even a year ago. ESMA decision to protect financial stability has greatly contributed to the potential risk reduction by mitigating the largest risk in case of no-deal Brexit scenario.</p> <p>Current research has proven that at the moment European Derivative Market is relatively safe and probably will not suffer any direct damage from Brexit, however, Brexit is still active event and its consequences and expected outcome can be altered by the final Brexit day.</p>	
Keywords	Brexit, United Kingdom, Financial Market, Derivatives, Derivative Market, Scenarios, Probabilities, Risk

Contents

Glossary

1	Introduction	1
2	Literature Summary	2
3	Theory	3
3.1	BREXIT	3
3.1.1	Possible Outcomes	3
3.1.2	Legal Overview	5
3.2	Market of Derivatives	5
3.2.1	Financial Derivatives	5
3.2.2	Risk Exposure	6
3.2.3	Risk level	7
3.3	Hypothesis	9
4	Methods	10
4.1	Potential Impact	10
4.2	Market Size	11
4.3	Vulnerability	11
4.4	Consequences	11
5	Results	13
5.1	Brexit Scenarios	13
5.2	Brexit outcome probabilities	17
5.2.1	The Economist Intelligence Unit	18
5.2.2	J.P. Morgan	19
5.2.3	EY	20
5.3	Influence on Derivative Market	21
5.3.1	No-Deal Brexit	21
5.3.2	Norway Plus option	22
5.3.3	No Brexit	23
5.3.4	May's Deal	24

5.3.5	New Deal	24
5.3.6	Second Referendum	25
6	Analysis and Discussion	28
7	Conclusion	31
	References	34

List of Figures

Figure 1:	Derivative workload distribution among different countries.	8
Figure 2:	Brexit options after the extension.	14
Figure 3:	Opinion poll results.	25
Figure 4:	Opinion poll results in table view.	26
Figure 5:	Weighted Average Outcome probabilities.	28

Glossary

Derivative	<p>a financial instrument that value is wholly dependant on the value of an asset it is based on. Essentially, derivatives are contracts that tie together two or more parties. Their underlying asset could be one or a group of financial instruments. Some of the common underlying financial assets for derivatives include interest rates and bonds. One can compare a derivative contract with the insurance contract. Depending on the behaviour of the underlying asset, the outstanding balance is being created every day, which one party has to pay to another (Investopedia 2019).</p>
CCP	<p>Clearing House or Central Clearing Counterpart – the link between two parties of the derivative contract, that has to ensure the security of both parties and make sure the derivative contract is being done accordingly with regulations. The clearing house has been licensed and authorized by the government to conduct a clearing process. In European Union CCPs are operating under the supervision of ESMA accordingly to EMIR regulations (Investopedia 2019).</p>
Clearing	<p>the process that ensures market stability and security. The volatility on the underlying asset market, causing the price fluctuation in the underlying asset directly affects the derivative contract, constantly creating an outstanding amount that one party have to pay to another. In order to make sure both contract parties have a sufficient amount of funds to cover the derivative price fluctuations during the given period, the marginal accounts for both parties are established. Therefore, clearing is referred to as the process of clearing an outstanding balance for the given period by the means of marginal accounts (Investopedia 2019).</p>

ESMA	European Securities and Markets Authority is an institution that aims to regulate the European securities market, including derivatives. It supervises every transaction in EU involving derivatives and issues licenses for CCPs to operate in the European Union. At the moment, ESMA has no direct control over third-country originated CCPs that operate within EU e.g. Japan or U.S.A. (Demary 2017).
EMIR	European Market Infrastructure Regulation that is intended to regulate and control transactions involving over-the-counter derivatives. Namely, EMIR regulates Clearing, Reporting and Risk management processes. ESMA regulates CCPs operations accordingly to EMIR legislation (European Commission 2019).
MiFID	Markets in Financial Instruments Directive regulates derivative processes in within EEA area and is working towards achieving transparency in EU financial market by standardizing the regulation across different financial markets (Investopedia 2019).
MiFID II	an updated regulation, that allows states outside of EEA area to apply for MiFID passport to operate in the EEA area (Investopedia 2019).
MiFID passport	a document, that gives a state, that has the authority and license for investment activities and derivative bearing operations within MiFID area, the right to provide the same service in another MiFID area state (Financial Conduct Authority 2018).

1 Introduction

BREXIT is a widely debated topic and is expected to remain for several years to come. In March 2017 Britain's prime minister – Theresa May initiated process of leaving the EU, i.e. Article 50 of European law. According to Article 50, Brexit was to last exactly two years but many experts think it can take much longer and have a very substantial impact on the world economy during this time (Hunt and Wheeler 2018).

The purpose of this research is to get acquainted with existing Brexit information and to determine the possible damage the entire process can inflict to the global economy and primarily to the European Derivative Market.

Publications such as Financial Times, Wall Street Journal and BBC covered Brexit from various perspectives. Many of them have a separate category devoted entirely to articles related to BREXIT. Most of the articles currently available look into possible financial implications for the UK economy, focusing primarily on the foreign exchange and stock market. While there are clear warnings of threat that cannot be ignored, the European Derivative Market is a less prominent topic of conversation. Therefore, this paper aims solely at the derivative market.

Similar studies already exist and are accessible to the public. BREXIT, however, is still an active process and will stay at least until early April 2019.

The paper outlines the most vital sources on the subject matter but also general information about Europe's Derivative Market, along with the explanation on the subject of derivatives, how are they constructed and what is their purpose.

2 Literature Summary

This paper aims at researching a potential damage Brexit may inflict to European Derivative Market. A lot of EU based derivative contracts are being processed through Britain. Current derivative market, as well as European Financial Market, depend on Brexit terms and conditions Britain will be able to negotiate with the European Union. Initially, Brexit has been scheduled to happen on March 29th, 2019 but due to the complicated negotiating process, it has been postponed to April 12th. At the moment Brexit is a major event not only in European but in Global Economy and therefore, there is an active academic discussion on the matter. Current research reflects only a specific part of the whole topic of Brexit (Hunt and Wheeler 2018).

The common topics of discussion surrounding the topic of Brexit touch upon the British economy during and after Brexit, the potential volatility of British Pound Sterling in the foreign exchange market and the future changes that Britain based corporations will have to face due to Brexit. There is a notably quiet discussion around the topic of derivatives, taking into consideration the scope of potential threat. The author has purposefully decided to choose the given area of research in order to bring more awareness to the issue at hand and attempt to contribute to the existing discussion.

The challenge that the author has to overcome is that Brexit is still active event. The conversation between Britain and the European Union is very active and the situation changes very rapidly. There is a lot of speculation around the Brexit scenarios but there is no way to know in advance the final result. This challenge should not prevent researches to look into the problem. Derivatives are first and foremost the instruments of risk management. They are designed to help entities to mitigate risks associated with their activities and therefore they are being heavily relied on. Thus, it is crucial to provide these organizations with detailed research to base their financial decisions.

3 Theory

3.1 BREXIT

Brexit is the media term which refers to the process of Great Britain Exiting the European Union. It has originated after the referendum conducted in Great Britain on June 23rd, 2016 where the population had to vote in support or against exiting the European Union. As a result, the majority – 51.89 per cent of those who voted have voted for Great Britain to leave the EU. On March 29th, 2017 Theresa May – Prime Minister of Great Britain has officially confirmed the initiation of Article 50, which is European Union regulation for the member state to exit the union. Article 50 states, that from the day it is initiated the “exit” process takes exactly two years. During this time leaving member has to negotiate the exit terms and conditions with the European Union and create a future economic strategy. Even though the regulation is in place, there is no prior experience of EU member state leaving the union, thus, the whole process is associated with uncertainty. Moreover, Great Britain and particularly London has very close interconnection with the European Union. London is known to be the major financial hub in Europe – meaning that major share of financial transactions in European Union both internal and external, regardless of an underlying currency be it British Pound or Euro are being facilitated, conducted and legally tied to London. Therefore, any mistake done in the Brexit process will have a great, potentially negative financial and economic impact on both parties (Hunt and Wheeler 2018).

3.1.1 Possible Outcomes

Since Brexit is an on-going event without any clear result yet – there is no definite knowledge as to what will happen after Brexit. Different decisions and Brexit terms could mean very different economic outcome for both Great Britain and the European Union. Since there is no certainty it is important to take into consideration all realistically possible scenarios of how Brexit could happen. The period right after March 29th, 2019 is known to be a “standstill” or “transitional” period which has been initially scheduled to last up until December 2020. The transitional period will allow Britain and EU gradually make the Brexit consequences as painless as possible for both parties (BBC 2018).

Even though Britain is to leave the European Union, it still has a variety of ways to save the relationship with the EU. As of today, Britain doesn't have membership in either Schengen or Eurozone, but it may change before the final Brexit terms are set. It is also unknown if Britain will join the Single Market or not (Pearson 2018).

There are countries like Switzerland, Norway, Iceland and Lichtenstein that do not belong to the EU but still receive similar benefits by being a part of the European Economic Area (Sheffield 2016).

In case if Britain would like to receive special quotas on trading product and services with the EU, they could join EFTA (European Free Trade Association). EFTA consists of 4 above mentioned states: Switzerland, Iceland, Norway and Lichtenstein. The idea behind EFTA is to allow a free trade area between its members' states, EU and other countries in the world. Taking into consideration that EU member states are the major export destination for British goods and services the option of joining EFTA would make a lot of sense to Britain (EFTA 2019).

Moreover, the European Customs Union allows member states trading goods and services with other member states without any additional taxes or tariffs. However, in light of current thesis Customs Union option does not have much value, because of a very little effect it has on the financial market (The Economist 2018).

Media has outlined two major scenarios of Brexit – "hard" and "soft". These terms are hardly scientific and are not exactly defined. Soft Brexit means Britain is going to leave EU, but still remain part of either Customs union or EFTA. The so-called Hard Brexit stands for Britain leaving the European Union and ultimately remaining a separate state like U.S.A or New Zealand. Britain could negotiate a deal somewhere in between these two options, which is the most likely scenario. Apart from that, there is also a "no-deal" scenario which will happen if Britain will fail to come to an agreement with European Union by the departure date (Hunt and Wheeler 2018).

Various possible Brexit outcomes will be discussed in detail in the further chapter. Different scenarios would affect derivative markets very differently and therefore all the most likely to happen scenarios should be considered to achieve the most accurate result

possible. It is important to notice, that at the moment this paper is being written there is yet no clear information regarding the Brexit terms and conditions, and the paper conclusion may vary from the actual Brexit end result.

3.1.2 Legal Overview

At the moment Britain, as EU member state has to comply with EU legislation, but the moment Brexit occurs all the EU laws will not affect Britain anymore. In order to make this transition as smooth as possible and avoid risk and danger of changing the whole legislation overnight, the Great Repeal Bill has been introduced. It will implement the whole EU legislation at once in British law so that it can be updated (BBC 2017).

3.2 Market of Derivatives

3.2.1 Financial Derivatives

Derivatives are commonly used by entities and private investors all over the world to manage their exposure to financial risk through the process called hedging. This process could be roughly compared to the insurance concept. If you own a house – you can buy house insurance, which will protect you in case if your house will be damaged in exchange for monthly payments. Derivatives work in a similar way but could be designed for more complex uses (International Monetary Fund 1998).

An implementation of derivatives vastly varies. Through the process of Financial Engineering, one could build a simple interest rate swap derivative contract, that has the interest rate as an underlying asset, or one could also make much more complex construction with very sophisticated underlying assets. An example of such complex derivative contracts may be Collateralized mortgage obligations (CMOs) and Collateralized debt obligations (CDOs) which both have different combinations of various debt contracts as an underlying asset. The more complex is the structure, the less transparent is the actual work mechanics of the derivative contract and the more risk it represents for an investor (Galitz 1995).

Since there is no limit as of how many derivative contracts can be done on the same underlying asset, this results in derivative market being significantly larger than the market of its underlying assets, thereafter even an insignificant fluctuation in an underlying asset may have a strong impact on derivative market. The extent to which derivative bearing transactions are being controlled and regulated is caused by the level of risk a potential minor mistake may cause to the stability of the whole financial market (Mobius 2011).

For comparison, the European Bond Market size is estimated to be over 7,5 trillion euro (Statista 2018). European Derivative Markets value is estimated at 450 trillion euro (ESMA 2017). Moreover, the nature of derivative contracts is tightly associated with high financial leverages, which multiplies both potential return or loss and therefore is considered very risky instrument, that has to be regulated and overviewed (Mobius 2011).

The majority of EU based derivative contracts are being cleared in Britain by British CCPs – Brexit will cause British CCPs to lose their current license. In order to operate with EU based derivatives, Britain will have to stay in the EEA zone and apply for MiFID passport. During the application time, CCPs will not be authorized to operate with EU based derivative contracts and therefore, these contracts will have to be either moved elsewhere or voided (Martin 2018).

Scarpetta and Booth (2016) have estimated that the application period takes roughly from two and a half to four years to get authorized by ESMA and thus, it is highly unlikely that British CCPs will be able to acquire ESMA license before Brexit (Batsaikhan, Kalcik and Schoenmaker 2017).

3.2.2 Risk Exposure

The majority of European derivative contracts are being cleared in British CCPs. This, however, doesn't mean that all of them are facing the danger of being voided.

Among all derivative contracts going through British Clearing Houses only 33 trillion-euro worth of contracts are being at risk and 15 trillion-euro worth of contracts will mature prior to March 29th. Therefore, only 18 trillion-euro worth of uncleared contracts is facing the Brexit threat (Bank of England 2018).

Cleared derivative contracts may oppose threat to financial stability in case if Britain will decide to leave EEA area or if EEA area will fail to authorize British CCPs in time. Approximately 43 trillion-euro worth of cleared derivative contracts will not mature before Brexit day (Bank of England 2018).

Therefore, the aggregated amount of derivatives going through British Clearing process that is subject to threat is worth 61 trillion euro.

3.2.3 Risk level

In hard Brexit scenario, Britain is to leave the European Union and not remain part of the EEA area and Customs Union. In this case, British CCPs will not be authorized to process EU based derivative contracts. In this case, all the existing derivative contract will be required to transfer from British CCPs to European based clearing houses (Bank of England 2018).

Currently, all the derivative contracts that go through British clearing process are distributed among four British CCPs: the London Clearing House, London Metal Exchange, CME Clear and ICE Clearing Europe. The London Clearing House (LCH Clearnet) does the largest amount of euro-denominated derivative contracts in Britain and is owned by London Stock Exchange (LSE) (Batsaikhan, Kalcik and Schoenmaker 2017).

Panel A April 2013	France		Germany		United Kingdom		United States		Total
	Amount	Share of total, %	Amount	Share of total, %	Amount	Share of total, %	Amount	Share of total, %	Amount
Euro	141,245	10.6%	88,125	6.6%	927,840	69.4%	27,090	2.0%	1,336,075
Pound	4,746	2.3%	4,728	2.3%	189,802	91.9%	3,162	1.5%	206,643
US Dollar	52,080	6.7%	6,205	0.8%	110,235	14.2%	546,268	70.4%	776,268
<i>Total</i>	<i>202,210</i>	<i>7.3%</i>	<i>101,347</i>	<i>3.7%</i>	<i>1,347,749</i>	<i>48.9%</i>	<i>628,153</i>	<i>22.8%</i>	<i>2,758,583</i>

Panel B April 2016	France		Germany		United Kingdom		United States		Total
	Amount	Share of total, %	Amount	Share of total, %	Amount	Share of total, %	Amount	Share of total, %	Amount
Euro	100,648	13.2%	16,562	2.2%	573,664	75.2%	6,832	0.9%	762,494
Pound	6,648	2.5%	506	0.2%	247,489	94.8%	2,333	0.9%	261,113
US Dollar	26,833	1.8%	2,455	0.2%	215,157	14.4%	1,167,958	78.0%	1,497,627
<i>Total</i>	<i>141,215</i>	<i>4.7%</i>	<i>31,311</i>	<i>1.0%</i>	<i>1,180,246</i>	<i>39.0%</i>	<i>1,240,774</i>	<i>41.0%</i>	<i>3,028,031</i>

Figure 1. Derivative workload distribution among different countries. Adopted from Batsaikhan, et al. (2017).

Figure 1 shows the total Global OTC single currency interest rate derivatives turnover by country. This comparison shows, that the majority of euro-denominated derivative contracts are being processed in the United Kingdom.

In euro-area, there is no one CCP able to process the derivative contract volume as large as LCH Clearnet. In case derivative contracts will have to be moved to EU based CCPs they will have to be distributed among four major cities: Frankfurt, Paris, Dublin and Amsterdam (Batsaikhan, Kalcik and Schoenmaker 2017).

This way derivative contract clearing would be repositioned to another CCPs which will be associated with a lot of logistical and resource-oriented issues and this procedure will cause short term damage to the market (Jones 2018).

One possible way to solve the problem by changing the legislation regarding derivative contract clearing allowing ESMA to supervise CCPs that originate from outside of EU and EEA countries but still have a direct impact on European Derivative Market (Demary 2017).

In case Britain will be able to negotiate a soft Brexit and leave the European Union but stay as EEA member, British clearing houses will have a right to continue operations with

accordance of EMIR by the supervision of ESMA. This scenario should not cause any threat to the derivative market (Investopedia 2019).

There is also an option to revoke Article 50 and cancel the whole Brexit procedure. Britain has a right to revoke Article 50 at any stage of the negotiating process even without a consent from EU 27 members if the revoking is done in good faith (Stone 2018).

3.3 Hypothesis

On the basis of the literature review the author has defined the hypothesis for current research – Brexit will damage European Derivative Market.

4 Methods

This chapter gives more detailed insight into the method the necessary data is going to be retrieved and analyzed.

Taking into consideration, that there is no clearly decided Brexit terms and conditions, current research has to look into different probable Brexit outcome scenarios and evaluate their probabilities as well as their individual consequences. Therefore, it is not possible to focus precisely on the potential impact but to involve the Brexit overview and different scenarios in the research as well. In previous chapters, an overview and general information about both Brexit and European Derivative Market have been provided. The following chapters will focus on Brexit various scenarios, their probabilities and potential damage to European Derivative Market.

To determine the potential damage Brexit will cause to the derivative market it is essential to:

1. identify the amount of potential impact by assessing various Brexit scenarios and their consequences on the derivative market.
2. get an estimation of European Derivative Market size and the share of it being in danger.
3. identify the level of derivative market vulnerability against Brexit – only a part of derivative contracts is reliant on Britain
4. estimate an average effect Brexit may cause to European Derivative Market.

4.1 Potential Impact

Through researching available information on the subject of Brexit it is possible to compute several different possible Brexit scenarios. There is a number of articles written on the subject of possible outcomes as well as simulations done by trusted entities. It is

crucial not to try and predict every possible scenario, but to think in broad economic terms. The understanding of how derivatives work and how they are constructed will also help to distinguish scenarios that present potential for great danger from those which may not affect the financial market at all.

4.2 Market Size

The total size of the European Derivative Market has to be determined. ESMA (The European Securities and Markets Authority) website presents a yearly updated number of different European derivative contracts outstanding.

4.3 Vulnerability

In order to establish the accurate amount of derivatives exposed to the danger, this research has to get an understanding of the nature of derivatives themselves. What are they constructed from and how do they operate? For instance, a part of derivative contracts being tied in the UK are set to mature prior the Brexit deadline. This has to be accounted for in the current research.

4.4 Consequences

Before an actual Brexit day the best estimation of Brexit outcome would be the weighted average of different scenarios happening. There are several computations done on this matter by The Economist Intelligence Unit, J.P. Morgan and EY which results are publicly available. After allocating the probabilities it is possible to match them with their possible effects and conclude the weighted average damage that Brexit may cause to European Derivative Market.

The analytical approach to analyse the data depends greatly on the method used to acquire the information. The methods are described in the previous chapter. After the point of retrieving the data, it has to be analysed and interpreted in order to gain only

relevant information for the topic at hand. Due to the specifics of the topic, the major sources of information are various publications. Even though the research is mostly concentrated on the most trusted publications, still, it is crucial to look out for controversial information and be aware of possible biases to avoid them. After, the gathered information has to be critically assessed, analysed and synthesized in order to conclude the topic.

5 Results

5.1 Brexit Scenarios

Key world economists and analysts consider various scenarios of Brexit outcome and process. The information changes relatively fast because of the common unawareness and long-time extension of Brexit till October 31st. The possible outcomes, actions and statistics are explained in the present chapter.

March 29th was the appointed date for the UK to leave the European Union. However, it didn't happen that day and even on the first shifted date – April 12th. After the long negotiations, EU leaders agreed to the six-month delay for the UK to leave the union (Financial Times 2019). During the extension period, the UK government will still try to leave the bloc with a deal promptly. However, if there will be no compromise agreement, various outcomes can be generated. Moreover, the UK must participate in European elections on May 23rd, in case the country will not – it would have to leave the European Union on June 1st. Figure 2 shows the scheme of possible Brexit options.

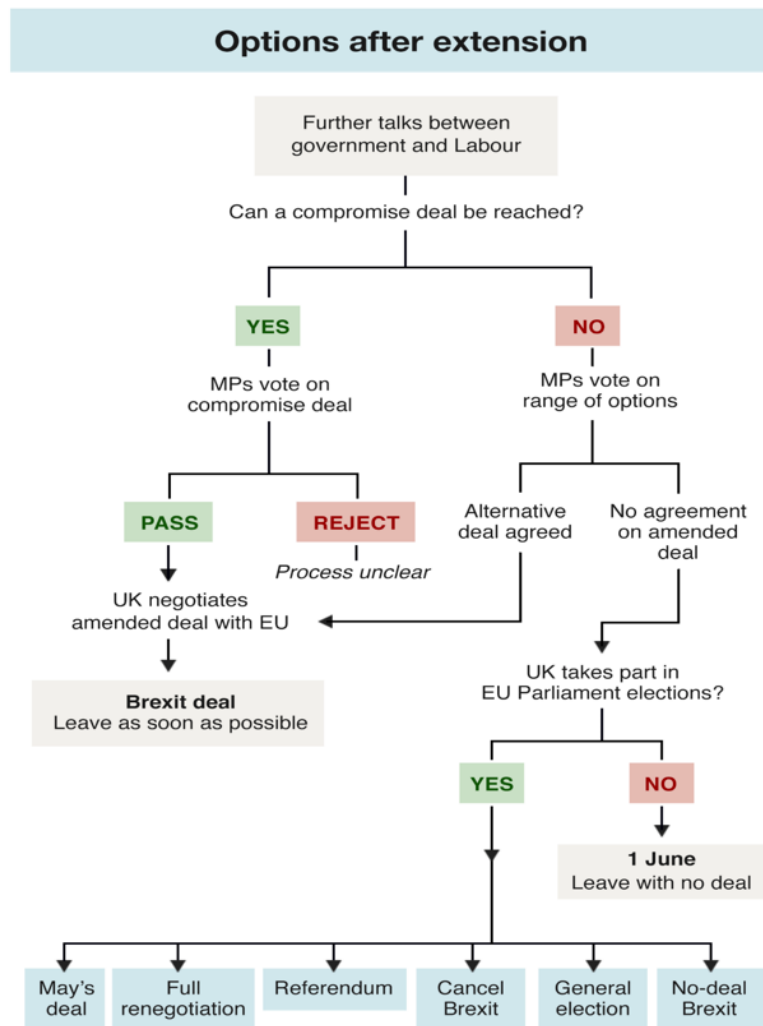


Figure 2. Brexit options after the extension till the end of October. Adopted from Barnes (2019).

No Deal Brexit

No deal Brexit means the UK leaves the European Union with no withdrawal agreement¹. It implies there will be no transition period for businesses, UK people working outside of the country and other consequences – because in this case, the UK will need to leave immediately. It may affect the lives of ordinary people, businesses, number of industries and future relationship of the UK and European Union (BBC 2019).

There are the positive and negative sides of such a scenario. On the one hand, the political uncertainties will be immediately clarified. On the other hand, the economic situation and unawareness of future events will be tough. It will affect the businesses

¹ ¹ Withdrawal Agreement – the document stating how the UK leaves the European Union (BBC 2018). In some media sources it is also called May's Deal.

and companies dramatically, lead to the shortages in labour and cancel some legal and commercial agreements (The Economist Intelligence Unit 2019).

Thus, if the Members of Parliament can't agree on the deal as soon as possible and the UK simultaneously will not participate in the European Elections on May 23rd – the no deal Brexit will take place on the 1st of June. If the UK takes part in the Elections – no deal Brexit may become one of the scenarios on October 31st (Barnes 2019).

Norway Option

Some of British Members of Parliament support the so-called Norway Brexit option, meaning for the UK to leave European Union, but joining The European Free Trade Association (EFTA) and becoming the member of European Economic Area (EEA). Meaning the UK will retain the same access to the single market of EU, which will allow companies to continue trade and will be least harmful for the country. The freedom of movement will also resume. However, the Norway option implies, the UK will remain to contribute to the European Union's budget and follow some regulations without refuting them. From this side, for pro-Brexit defenders, it will be the inferior option because EEA members are required to accept the free movement of people and goods condition, which was the biggest incentive for Brexit to occur (Payne 2018).

Second Referendum

As it is already known, the European Union agreed for a long extension for the UK till October 31st. It means the UK government may recall the second Brexit Referendum in order to allow the electorate to choose whether to leave EU or stay, to go for "no deal" or "Mrs May's Brexit deal". However, during the current period of time there is no parliament support for this kind of scenario. The second referendum will give the British government a mandate and support from the public to choose the Brexit further actions. On the other side, the second referendum is a difficult and long process to organize, which will continue the uncertainty for businesses and markets. It may also bring the deeper division and contradictions between "leavers" and "remainers" (The Economist Intelligence Unit 2019).

No Brexit

There is an option, even though being relatively unlikely, that British government would decide to revoke an Article 50 unilaterally and stop Brexit process. This option would resolve the current economic issues surrounding Brexit but would put the trust into the first referendum and British democracy at stake. It is clear, that UK doesn't need an agreement from other EU 27 states for this option, but it is still unclear what should be the procedures and who would have the authority to initiate the revocation process (The Economist Intelligence Unit 2019).

There is a public petition registered at the UK parliament website in progress to revoke Article 50. Since its inception to this date, it has gathered over 5.7 million signatures. It has long passed the threshold of 100,000 signatures required for the petition to be debated in Parliament. Even though thousands of signatures have been removed from the petition after the discovery of automated bots' usage, it is still considered to represent people's opinion. After the petition has passed 2 million signatures, Theresa May has commented, that she respects the initial referendum's results and is set to deliver on people's decision to leave European Union (BBC News 2019).

Withdrawal Agreement (May's Deal)

After getting the six-months period extension of Brexit process, Mrs May hopes the Withdrawal Agreement will be approved even before May 23rd. This scenario will mean the 2-year transition period for businesses and eliminate political volatility. Moreover, it is sure to some extent will strengthen Mrs May's position. In opposition, even in case of the acceptance of the Withdrawal Agreement, there is still the place for uncertainty about the new economic and political relationship between the UK and the European Union (BBC UK 2019).

New Deal

If UK Parliament does not support an existing Withdrawal agreement, an alternative option for UK Prime Minister could be to renegotiate a completely new Withdrawal agreement, preferably taking into consideration the Parliament's notes on the existing agreement. However, the complete renegotiation would require a considerable amount of time to design and put together in writing. It is important to take into consideration the fact, that the EU might refuse to renegotiate another agreement, and, in this case, Britain will be left out with the current choice (Barnes 2019).

There is another alternative deal, which is gaining signatures in petition – since any Brexit outcome may be seen as a lose-lose situation for both EU and the UK the possible alternative option proposes the EU to offer the UK a deal which would imply Britain to remain in the EU, but allow Britain more autonomy specifically with regards to immigration – the single most important factor for Brexit (Henkel, et al. 2019).

This alternative option would probably result in Brexit being revoked, but it is extremely unlikely to happen because such a resolution would provoke other EU members to request such an exclusive autonomy and therefore would weaken the relationship inside the union.

5.2 Brexit outcome probabilities

For the purpose of estimating an average expected Brexit outcome likelihood three major financial publications have been analysed: The Economist Intelligence Unit, J.P. Morgan and EY (Ernst & Young). These sources have a proven track record of market analysis – and they are considered to be well known and respected in the industry. All three sources have published their estimated probabilities of different Brexit scenarios to happen, however, each has their similarities and differences. Since there is no way to know for the fact the Brexit outcome all three publications have presented different expectations. Even though some probabilities substantially differ from one another, it is still vital to consider all three opinions. In order to provide the most accurate result possible the

average will be taken based on probabilities from different sources. The published likelihood estimations are listed below.

5.2.1 The Economist Intelligence Unit

On January 14th The Economist has published an article considering the possible Brexit outcome probabilities and the reasoning behind them. The publication has successfully predicted the Brexit deadline to be postponed. The Economist has argued that taking into consideration the fact that Parliament is unlikely to vote in support of May's withdrawal agreement in January and will not be in favour of no-deal Brexit scenario, Prime Minister would most likely request the Brexit day to be postponed. This would provide more time for Theresa May and the British Parliament to negotiate the new terms. With the deadline being delayed, The Economist has listed their outcome expectations as follows:

- Withdrawal Agreement (May's Deal) – 40% likelihood

Theresa May is expected to stick to her version of a withdrawal agreement and eventually get it approved by the Parliament.

- Second Referendum – 30% likelihood

In case Parliament will not support Prime Minister's deal and European Union will not agree to adjust the terms in British favour the second referendum is more likely to take place in order to resolve political "deadlock".

- Norway Plus – 15% likelihood

Even though, being a viable option for Britain, The Economist assigns only 15% likelihood to this scenario justifying it so that The Parliament will avoid supporting the deal that includes free movement of people – the issue, that sparked the initial idea for Brexit.

- General Election – 10% likelihood

The probability of general election takes place, that would replace the current Parliament and Prime Minister. Since this option implies, that the new government would still face the same Brexit options the current option bears no value for the research at hand.

- No Deal – 5% likelihood

Since being the riskiest and the least attractive option for both Britain and EU, The Economist assigns only 5% probability to this event.

Since the article has been published on January 14th it is important to keep in mind, that since that date important events have happened and that today the expected probabilities report could look different (The Economist Intelligence Unit 2019).

5.2.2 J.P. Morgan

On February 28th J.P. Morgan has reported their analysis results and the expectations on the Brexit outcome:

- Withdrawal Agreement (May's Deal) – 45% likelihood

J.P. Morgan analysts are standing on their best guess assumption that Parliament would eventually accept the current Withdrawal Agreement.

- Article 50 long extension – 20% likelihood

The bank has expected the long delay of the Brexit to happen with 20% probability – the event that actually took place. For the purpose of current research, this probability doesn't add value.

- Second Referendum – 15% likelihood

According to J.P Morgan, there is a 15% chance of the second referendum happening in the future.

- No Deal – 10% likelihood

The bank finds no-deal option to be a less probable scenario and assigns only 10% probability to this option.

- General Election – 10% likelihood

J.P. Morgan doesn't forecast General election to be a probable scenario, but still acknowledges its possibility in their expectation report. Since General election doesn't have any direct impact on the derivative market and cannot be the Brexit resolve on its own its probability should not be taken into consideration during this research.

It should be noted, that J.P. Morgan protects its internal information and there is no extended article on their Brexit outcome expectations available to the general public (Faulconbridge 2019).

5.2.3 EY

Mats Persson – EY consultant and a former Special Advisor to UK Prime Minister David Cameron on EU affairs has reported the Brexit outcome expectation list from the EY point of view:

- WTO i.e., No Deal – 15% likelihood

EY has reported a reduction in the likelihood of no-deal Brexit, but still assigned it 15% probability, justifying it by the soon to come Brexit deadline (March 29th).

- FTA (Withdrawal Agreement) – 15% likelihood

Without major support from the UK Parliament, this option has a very low likelihood to happen.

- Hybrid (New Deal) – 40% likelihood

EY analysts argue that this option is at the moment being the most likely to happen Brexit scenario. They expect it to happen either during 4th motion vote from UK Prime Minister or then during an extension period.

- Single Market / Norway Plus – 15% likelihood

Consultant refers to this option as “dark horse”. It may gain momentum, taking into consideration the unsupportive Parliament towards May’s deal.

- Second Referendum – 15% likelihood

EY expects, that a long Article 50 extension will increase the likelihood of the second referendum, even though it has been turned down by the Parliament once.

EY expectation report is the most recent one among the three sources and therefore could be argued to be the most relevant. Nevertheless, it is crucial to compare its expectations with other sources to mitigate the risk of various biases (Persson 2019).

5.3 Influence on Derivative Market

This chapter will go into a discussion on how various Brexit outcomes may influence the European Derivative Market.

5.3.1 No-Deal Brexit

Presently, this is default option either if UK doesn’t agree to take part in EU elections by May 1st or in case both parties fail to agree about Brexit terms by the new deadline on October 31st. Either case means Britain leaves the EU and lose all existing trade agreements with the EU (Barnes 2019).

Until recent events, this option would mean all the existing EU based derivative contracts being cleared in British CCPs being voided. However, on February 18th ESMA has officially

confirmed authorizing three British CCPs (LCH Limited, ICE Clear Europe Limited and LME Clear Limited) 12-month long license to continue their operations with EU based derivatives in case no-deal Brexit scenario would happen on March 29th. The decision has been reapproved with regard to Brexit deadline shifting to April 12th and eventually to October 31st. Hereby, ESMA attempts to protect the financial stability of the market in case no-deal Brexit will happen (ESMA 2019).

Even though the license has only been provided for the duration of 12 month and further future is unclear, this decision has mitigated the immediate risk and has provided some short-term certainty. The time provided should be enough to decide on the future problem resolution (Bailey 2019).

Therefore, in case no-deal Brexit takes place there will be no immediate direct damage to European Derivative Market. It may still occur, depending on the decision for the proceeding made during the 12-month period after no-deal Brexit scenario for example, if the decision on relocation of clearing from Britain to EU 27 will be made. Alternatively, the possible Brexit impact on the broader financial sector including businesses and forex exchange may have an eventual indirect impact on the derivatives market.

However, there is a strong opinion, that London will remain to be the main financial hub even in the post-Brexit period. Christopher Giancarlo – the chair of the U.S. Commodity Futures Trading Commission, says: "London is and will remain a key global centre for global derivatives trading and clearing for a long time to come" (Partington 2019).

5.3.2 Norway Plus option

In case Britain will choose to proceed with so-called Norway plus option they would still be a part of EEA which would provide Britain with an opportunity to continue clearing EEA area based derivative contracts under EMIR regulation in accordance with MiFID passporting regulation. This way, the clearing process should not sustain any substantial damage from Brexit (Investopedia 2019).

This case would allow Britain to shape its own financial sector. Through the lobbying process, Britain would be able to push their interests in creating EU legislation, that affects EEA and EFTA member states. Furthermore, since the EU is obliged to consult with all the EEA and EFTA member states on implementation of new legislation Britain would receive a voting power in EEA Joint Committee to be able to choose whether to implement new EU legislation in EEA or not. Moreover, the British parliament would have to vote to allow the new EEA legislation in Britain. This gives Britain another level of control over their financial situation (Morgan 2019).

There is, however, a possible threat for the British derivative clearing business. While receiving a vote and an influence in EEA legislation, Britain loses all the power of EU legislation, including regulation of euro-denominated and EU based derivative contracts. In this case, Britain will have no voting power if the decision on relocation of clearing processes from Britain to EU 27 would be made. After Brexit British interests will be of a secondary nature for EU lawmakers (Gleeson 2019).

Relocation of clearing business is associated with logistical issues, long preparation process and high costs. Financial costs of relocation for EU are estimated at around 20 billion euro – said the governor of the Bank of England – Mark Carney (Partington 2019). Such a scenario may hurt British Clearing business and will cost EU money and time, however, doesn't imply any major risk for the European Derivative Market itself, such as contract voiding.

5.3.3 No Brexit

If Britain would eventually decide to revoke Article 50 and remain in European Union, it could have an effect, most probably positive, on British pound on Foreign exchange and corporations, but would not affect the existing derivative market. This option implies the least amount of risk and potential damage because essentially it doesn't change anything.

5.3.4 May's Deal

Current Withdrawal Agreement, commonly known as May's deal, doesn't have a section regarding the financial sector or derivative market, and therefore it is hard to predict how this scenario would affect European Derivative Market (Atoz Tax Advisers 2018).

It does include, however, a section regarding the transition period which is agreed to last for the period of 21 months and if need be could be extended for one or two years. Over the whole duration of the transition period, Britain will have an opportunity to adjust their business, financial and other sectors. During the set amount of time, the regulations will remain the same as they were during the EU 28 time (Atoz Tax Advisers 2018).

After the transition period, Britain becomes a separate state from the European Union, leaving both the Single Market and Customs Union. In this case, British CCPs should lose an opportunity to continue clearing EU related derivative contracts. Although, both EU and UK legislation regarding derivatives and its regulation may adjust within the transitional period. For the purpose of protecting the market's stability, in case of no-deal Brexit, ESMA has granted British CCPs 12-month long license, which could be extended if needed. There is no reason to believe they would not do the same in May's deal case after the transition period if the situation would present a potential risk for the European financial sector.

Taking all the points mentioned above into consideration, the author assumes that Withdrawal agreement does not present any immediate direct negative effect on European Derivative Market.

5.3.5 New Deal

There is a chance that Britain will have to renegotiate the whole new Brexit deal and write a new withdrawal agreement seeking support from both EU and the British parliament. Since there is no way to predict the terms of a possible new deal – it is not feasible to adequately measure and estimate a possible impact this option may have on derivative market (Barnes 2019).

By default, the new option should be referred to as an uncertain event, until the time there would be more information available on this matter. In the financial context, uncertainty represents risk and therefore – threat. At the current stage, it is safe to assume that new deal scenario represents an unknown risk to European Derivative Market (Investopedia 2019).

5.3.6 Second Referendum

The chance of the second Referendum is slowly growing and with Brexit deadline extension, it is now a viable Brexit scenario which is important to take into consideration. Essentially, the second referendum can result only in two ways: population of Britain to vote against the Brexit or in support of it – the first option would prompt the “no Brexit” scenario to happen and second would lead back to one of other four scenarios take place. There is no value in assessing possible implications of the second referendum on the derivative market without information regarding people’s current opinion status.

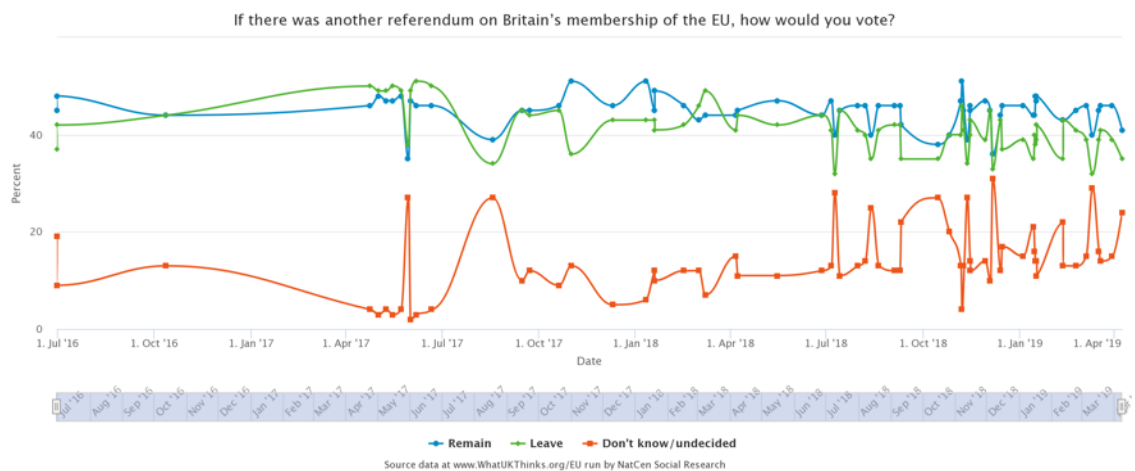


Figure 3. Opinion poll results over the period of almost three years. Adopted from What UK Thinks (2019).

Figure 3 represents the opinion pull within the United Kingdom on the matter "If there was another referendum on Britain's membership of the EU, how would you vote?". The figure shows, that even though the opinions divide roughly equally, the vote to remain in EU distinctively leads the opinion poll most of the time (What UK Thinks 2019).

Fieldwork End Date / Pollster	30 June 2016	30 June 2016	12 October 2016	24 April 2017	2 May 2017	9 May 2017	15 May 2017	23 May 2017	30 May 2017	1 June 2017	7 June 2017
Remain	55 %	53 %	50 %	48 %	49 %	49 %	48 %	49 %	48 %	49 %	47 %
Leave	45 %	47 %	50 %	52 %	51 %	51 %	52 %	51 %	52 %	51 %	53 %

Fieldwork End Date / Pollster	21 June 2017	18 August 2017	15 September 2017	22 September 2017	20 October 2017	1 November 2017	10 December 2017	11 January 2018	19 January 2018	19 January 2018	16 February 2018
Remain	48 %	53 %	50 %	51 %	51 %	59 %	52 %	54 %	51 %	54 %	52 %
Leave	52 %	47 %	50 %	49 %	49 %	41 %	48 %	46 %	49 %	46 %	48 %

Fieldwork End Date / Pollster	2 March 2018	8 March 2018	6 April 2018	8 April 2018	16 May 2018	27 June 2018	6 July 2018	9 July 2018	14 July 2018	31 July 2018	7 August 2018
Remain	48 %	47 %	52 %	51 %	53 %	50 %	53 %	56 %	50 %	53 %	53 %
Leave	52 %	53 %	48 %	49 %	47 %	50 %	47 %	44 %	50 %	47 %	47 %

Fieldwork End Date / Pollster	13 August 2018	20 August 2018	4 September 2018	9 September 2018	10 September 2018	15 October 2018	26 October 2018	6 November 2018	7 November 2018	9 November 2018	12 November 2018
Remain	53 %	53 %	52 %	52 %	55 %	52 %	50 %	54 %	53 %	52 %	53 %
Leave	47 %	47 %	48 %	48 %	45 %	48 %	50 %	46 %	47 %	48 %	47 %

Fieldwork End Date / Pollster	15 November 2018	15 November 2018	29 November 2018	4 December 2018	6 December 2018	14 December 2018	15 December 2018	4 January 2019	14 January 2019	15 January 2019	16 January 2019
Remain	53 %	51 %	55 %	50 %	52 %	51 %	55 %	54 %	56 %	52 %	56 %
Leave	47 %	49 %	45 %	50 %	48 %	49 %	45 %	46 %	44 %	48 %	44 %

Fieldwork End Date / Pollster	17 January 2019	17 January 2019	11 February 2019	11 February 2019	23 February 2019	5 March 2019	11 March 2019	17 March 2019	19 March 2019	30 March 2019	8 April 2019
Remain	55 %	53 %	55 %	50 %	52 %	54 %	56 %	54 %	53 %	54 %	54 %
Leave	45 %	47 %	45 %	50 %	48 %	46 %	44 %	46 %	47 %	46 %	46 %

Figure 4. Opinion poll results in table view. Adopted from What UK Thinks (2019).

Figure 4 provides the opinion poll data in excel format. The average opinion distribution could be found below.

Note: "Undecided" opinion results have been left out from the calculation since this result provides no value for the current research.

The average opinion poll result:

- Remain – 52%
- Leave – 48%

Even though the “second referendum” by itself provides no value for estimating the possible risk for derivative market, the expected result of the second referendum, based on the trusted opinion poll would help to provide more accurate end result. The calculated averages for opinion poll result shows, that if the second referendum would take place, the expected results would yield 52% vote for revoking Article 50 and Britain to stay in the European Union. Therefore, this scenario would contribute to “no Brexit” option – no substantial impact on European Derivative Market.

6 Analysis and Discussion

This chapter is intended to analyze all the gathered data in order to draw a thesis conclusion and test the provided hypothesis. In previous chapters, the author has presented the list of possible Brexit outcome scenarios as well as their probabilities based on different sources. Besides, every outcome option has been analyzed in terms of the possible danger to derivatives. In order to come up with a single answer, it is vital to weight different scenarios consequences according to their probabilities.

Deal	Publication & Predictions			Analysis	
	The Economist	J.P. Morgan	EY	Average	Adjusted
<i>May's Deal</i>	40%	45%	15%	33,3%	38,4%
<i>No Deal</i>	5%	10%	15%	10,0%	11,5%
<i>Second Referendum</i>	30%	15%	15%	20,0%	23,1%
<i>Norway plus</i>	15%	0%	15%	10,0%	11,5%
<i>New deal</i>	0%	0%	40%	13,3%	15,4%
<i>Other (non-relevant)</i>	10%	30%	0%	13,3%	-
<i>Total</i>	100%	100%	100%	100%	100%

Figure 5. Weighted Average Outcome probabilities. Developed by the author on basis of results from chapter 5.2.

Figure 5 represents the Excel-based calculation of Weighted Average Impact Outcome. Firstly, all the probable Brexit outcomes have been imputed in the table based on their source. Thereafter, an average of three different points of views has been taken. Finally, non-relevant outcome probabilities e.g. General Election and deadline extension have been taken out of the proportion and therefore the probabilities had to be adjusted accordingly. The final average probabilities for different Brexit scenarios are outlined as follows:

- Withdrawal Agreement (May's Deal) – 38,4% probability
- Second Referendum – 23,1% probability
- New Deal – 15,4% probability
- Norway Plus – 11,5% probability

- No Deal – 11,5% probability

The numbers are based on three separate trusted sources and therefore represent the accurate, reliable and diversified average outcome.

Based on the analysis outcome, the most likely Brexit option is one way or another – the current Withdrawal agreement. There is 38,4% likelihood that after Brexit day Britain would enter a Transition period, during which potential financial risk would be mitigated or otherwise ESMA would grant British CCPs an extended license in order to protect the market stability.

The second most probable Brexit outcome is Second Referendum. The analysis shows, that there is 23,1% chance of Second Referendum taking place in 2019 and, based on the data from official opinion poll, the most likely Referendum result, as of the day of the current research, would be for Britain to remain an EU member state and revoke Article 50. In this event, British CCPs would be welcome to continue their present operation and no substantial negative impact is expected on the European Derivative Market.

The third most likely scenario to unveil, even though being assigned a relatively low probability, is the renegotiation of a completely new Withdrawal Agreement. This option is associated with the most amount of uncertainty and therefore is considered to be risky and to present a potential danger to European Derivative Market.

There is 11,5% chance that Britain would choose Norway Plus scenario. This event presents a direct danger to British Derivative Clearing Business and potentially high relocation costs for EU, but ultimately, this option does not expose European Derivative Market to any negative impact.

The final expected British outcome is “No Deal” scenario. This option has been assigned an 11,5% probability chance. As discussed earlier this event does not put European Derivative Market at any direct risk, however, there might be an indirect danger following the possible disruption of British general Financial Sector, which is very closely related to EU financial market and therefore – European Derivative Market.

In summary, only one Brexit scenario possess a possible direct impact on European Derivative Market – New Withdrawal agreement negotiation (New Deal) which has a 15,4% probability chance.

However, the whole Brexit process is associated with a great deal of uncertainty – and therefore could be looked at as risky. This aspect may force people to panic and act impulsively, which may yield more risk and financial volatility in the market. This, even though is being a legitimate risk, is very subjective and arguable and therefore will not be taken into consideration for the purpose of the current research.

Even though, the majority of probable outcome does not represent any danger to European Derivative Market the probability calculation still adds tremendous value by allowing to isolate the potentially dangerous scenario and identify its probability – therefore overall risk level for European Derivative Market.

The hypothesis, this research attempts to test is “Brexit will damage European Derivative Market”. On the basis of researched data and conducted analysis it has been determined, that there is 15,4% probability chance that Brexit would have a direct negative influence on European Derivative Market – therefore the stated hypothesis has been approved by 15,4% and disapproved by 84,6%. Overall the hypothesis is considered to be disapproved.

7 Conclusion

The current research focuses on the possible disruption Brexit event can cause on European Derivative Market. Original Brexit deadline has been scheduled on March 29th, then it was postponed to April 12th and recently it has been granted an extension opportunity up to October 31st. There are several most probable scenarios to the Brexit outcome which are going to affect European Derivative Market differently – therefore it has been important to research every possible Brexit option and to define the amount of risk each option presents to the market.

One hypothesis has been developed for the research – Brexit will damage European Derivative Market. To test this hypothesis, the following method framework has been used:

1. potential danger Brexit presents to European Derivative Market has been identified by analyzing different Brexit scenarios using publicly available information e.g. Internet, published articles, scientific works, books, other research paperers;
2. the proportion of European Derivative Market contracts being under direct threat has been estimated and defined;
3. derivative market vulnerability has been defined;
4. the average level of risk to European Derivative Market has been calculated using various probabilities from diversified sources.

The research has identified six ways Brexit may result in. However, only five has proven to be probable events, based on prediction analysis done by different reliable sources. Research analysis results have been gathered from three main sources: The Economist Intelligence Unit, J.P. Morgan and EY. The list of probable Brexit scenarios with their average probability chance is distributed as follows: current Withdrawal agreement (May's Deal) – 38,4% likelihood; second Referendum – 23,1% likelihood; newly

renegotiated deal – 15,4% likelihood; Norway plus option – 11,5% likelihood; No-Deal Brexit – 11,5% likelihood.

The analysis has shown, that out of all possible options only one carries a potential danger to European Derivative Market – new renegotiated withdrawal agreement (15,4% probability). Brexit has the potential to bring a lot of disruption in the European Financial sector and possibly even global economy, therefore both EU and UK do everything possible to avoid the worst scenario. The fact that ESMA has officially confirmed that they are ready to provide British CCPs license to continue operating with EU based derivative contracts for the period of 12 months in case no deal Brexit happens has mitigated the largest risk for European Derivative Market. In any other scenario if there might occur financial danger for EU markets ESMA would be ready to act in order to protect EU financial stability.

There are several ways current research is limited and could be improved in the future. Unfortunately, these limitations have not been resolved by the author due to various constraints related to time and information access, however, it is crucial to acknowledge them in order to improve potential future work in this field.

First of all, Brexit is an ongoing event and, during the process of researching the topic the situation and Brexit status has changed frequently. At the moment the official Brexit deadline is October 31st, 2019, but it is possible that Brexit may happen earlier or even extended for a longer period of time. Therefore, this research, as many others on this topic may become outdated very quickly, however, this condition should not prevent the research of this topic.

Secondly, there could be more information regarding the topic not available for the general public. J.P. Morgan research details, for example, are only available for J.P. Morgan members who are only invited by other members – therefore there is very restricted access to the information gathered and analyzed by J.P. Morgan. It is possible that some of the information that the author could not access could have changed the research result.

Finally, the analysis of three different sources regarding the expected Brexit scenarios and their probabilities has shown, that the probabilities substantially vary from each other. This could be a result of the time difference in the researches or could point to the fact, that it is highly challenging to estimate Brexit probabilities at this point in time.

It is recommended, therefore, that any research on this topic done in the future should take into consideration the outlined limitations.

This research can become a foundation for the researches being done in a similar field. The possible topics could be "Brexit income on Global Financial Sector"; "Brexit impact on British Business and Pound Sterling"; "Brexit impact on Foreign Exchange market".

The research has proven the hypothesis to be wrong. Brexit will not affect European Derivative Market negatively. Even though, the hypothesis set by the author has been disapproved it still provides value for the research topic.

In conclusion, Brexit is a complex event, that is very difficult to predict. There is no way to be absolutely sure if Brexit is going to happen or will be revoked, but business entities and investors across Europe must make financial decisions today. This research has provided value for these people and enterprises to get familiar with the topic, become aware of the threat and hopefully make a better decision.

References

Ashurst, 2016. *Brexit: The Impact on Derivatives Regulation*. [online] Available at: <<https://www.ashurst.com/en/news-and-insights/insights/brexit-the-impact-on-derivatives-regulation/>> [Accessed 14 January 2019].

Atoz Tax Advisers, 2018. *European Union: Brexit: What Does The Withdrawal Agreement Mean For Financial Services?* [online] Available at: <<http://www.mondaq.com/x/760936/Financial+Services/Brexit+What+does+the+Withdrawal+Agreement+mean+for+financial+services>> [Accessed 28 January 2019].

Bailey, D., 2019. EU derivatives traders to get hard-Brexit reprieve, *Financial Times*, [online] Available at: <<https://www.ft.com/content/be6212a4-334b-11e9-bd3a-8b2a211d90d5>> [Accessed 23 March 2019].

Bank of England, 2018. *Financial Stability Report*. London: Bank of England.

Barnes, P., 2019. *Brexit: What happens now?* [online] Available at: <<https://www.bbc.com/news/uk-politics-46393399>> [Accessed 11 April 2019].

Batsaikhan, U., Kalcik, R. and Schoenmaker, D., 2017. *Brexit and the European financial system: mapping markets, players and jobs*. Brussels: Econstor.

BBC, 2019. *Brexit: Your simple guide to the UK leaving the EU*. [online] Available at: <<https://www.bbc.com/news/uk-46318565>> [Accessed 11 April 2019].

BBC, 2017. *EU Withdrawal Bill: A guide to the Brexit repeal legislation*. [online] Available at: <<https://www.bbc.co.uk/news/uk-politics-39266723>> [Accessed 21 February 2019].

BBC, 2018. *The UK and EU agree terms for Brexit transition period*. [online] Available at: <<https://www.bbc.com/news/uk-politics-43456502>> [Accessed 12 February 2019].

BBC News, 2019. *Brexit: Petition to revoke Article 50 passes 5.7m signatures*. [online] Available at: <<https://www.bbc.com/news/uk-politics-47665929>> [Accessed 12 April 2019].

BBC UK, 2019. *Brexit: What happens if Theresa May's deal is approved?* [online] Available at: <<https://www.bbc.co.uk/newsround/46838551>> [Accessed 12 April 2019].

Brühl, V., 2017. *Clearing of euro OTC derivatives post Brexit: An analysis of the present cost estimates*. Frankfurt a. M.: Goethe University.

Brühl, V., 2018. *The clearing of euro OTC derivatives post Brexit: Why a uniform regulation and supervision of CCPs is essential for European financial stability*. Frankfurt a. M.: Goethe University.

Brush, S., 2018. *U.K. Urges Fix for Brexit Threat to \$137 Trillion of Derivatives*. [online] Available at: <<https://www.bloomberg.com/news/articles/2018-04-19/u-k-urges-fix-for-brexit-threat-to-137-trillion-of-derivatives>> [Accessed 2 April 2019].

Demary, M., 2017. *The European Derivatives Market after Brexit*. [online] Available at: <<https://www.iwkoeln.de/studien/iw-kurzberichte/beitrag/httpswwwiwkoelndestudieniw-kurzberichtebeitragmarkus-demary-the-european-derivatives-market-after-brexit-329771.html>> [Accessed 10 March 2019].

Dickson, A., Cooper, C. and Baume, M., 2017. *9 ways Britain could stay in the European Union*. [online] Available at: <<https://www.politico.eu/article/9-ways-britain-could-stay-european-union-brexit/>> [Accessed 14 January 2019].

EFTA, 2019. *About EFTA*. [online] Available at: <<https://www.efta.int/about-efta/european-free-trade-association>> [Accessed 8 March 2019].

ESMA, 2017. *ESMA PRODUCES FIRST OVERVIEW OF EU DERIVATIVE MARKETS SIZE*. [online] Available at: <<https://www.esma.europa.eu/press-news/esma-news/esma-produces-first-overview-eu-derivative-markets-size>> [Accessed 2 April 2019].

ESMA, 2019. *ESMA to recognise three UK CCPs in the event of a no-deal Brexit*. Paris: ESMA.

European Commission, 2019. *Derivatives / EMIR*. [online] Available at: <https://ec.europa.eu/info/business-economy-euro/banking-and-finance/financial-markets/post-trade-services/derivatives-emir_en> [Accessed 23 March 2019].

Faulconbridge, G., 2019. *J.P.Morgan's best guess on Brexit: 45 percent chance of exit with current deal*. [online] Available at: <<https://www.reuters.com/article/us-britain-eu-jpmorgan/j-p-morgans-best-guess-on-brexit-45-percent-chance-of-exit-with-current-deal-idUSKCN1QH1Q1>> [Accessed 6 March 2019].

Financial Conduct Authority, 2018. *Passporting*. [online] Available at: <<https://www.fca.org.uk/firms/passporting>> [Accessed 23 January 2019].

Financial Times, 2019. *EU leaders agree to six-month Brexit delay*. [online] Available at: <<https://www.ft.com/content/d4b4d80e-5bb7-11e9-939a-341f5ada9d40>> [Accessed 11 April 2019].

Galitz, L., 1995. *Financial Engineering: Tools and Techniques to Manage Financial Risk*. New York: McGraw-Hill.

Gleeson, C., 2019. *Brexit: EEA membership 'will not work' for UK financial services*. [online] Available at: <<https://www.irishtimes.com/business/economy/brexit-eea-membership-will-not-work-for-uk-financial-services-1.3757741>> [Accessed 5 February 2019].

Glover, J., 2018. *EU Needs to Prevent Brexit Threat to Derivative Contracts: BOE's Carney*. [online] Available at: <<https://www.insurancejournal.com/news/international/2018/06/27/493351.htm>> [Accessed 5 March 2019].

Gurman, M., 2016. *Brexit: UK 'will lose £440bn derivatives business' and global banks are already planning the move*. [online] Available at: <<https://www.independent.co.uk/news/business/news/brexit-uk-lose-derivatives-clearing-industry-banks-plan-move-france-germany-a7322166.html>> [Accessed 14 March 2019].

Henkel, H., Kühne, K., Weiss, H., Berger, R., Schneider, M. and Sinn, H., 2019. *The EU must offer a New Deal for Britain and the EU*. [online] Available at: <<https://new-deal-for-britain.de/a-new-deal-for-britain/>> [Accessed 28 March 2019].

Hunt, A. and Wheeler, B., 2018. *Brexit: All you need to know about the UK leaving the EU*. [online] Available at: <<https://www.bbc.com/news/uk-politics-32810887>> [Accessed 1 March 2019].

International Monetary Fund, 1998. *Financial Derivatives*. Washington, D.C: IMF.

Investopedia, 2019. *Derivative*. [online] Available at: <<https://www.investopedia.com/terms/d/derivative.asp>> [Accessed 24 March 2019].

Investopedia, 2019. *Financial Risk*. [online] Available at: <<https://www.investopedia.com/terms/f/financialrisk.asp>> [Accessed 24 February 2019].

Investopedia, 2019. *Markets In Financial Instruments Directive - MiFID*. [online] Available at: <<https://www.investopedia.com/terms/m/mifid.asp>> [Accessed 6 April 2019].

Jones, H., 2018. *It's Up to Insurers to Prevent Brexit Disruption of Policies, Warns EU Chief*. [online] Available at: <<https://www.insurancejournal.com/news/international/2018/05/17/489476.htm>> [Accessed 21 January 2019].

Martin, W., 2018. *A \$38 trillion financial crunch is looming on the horizon — and it could hit early next year*. [online] Available at: <<https://www.businessinsider.com/bank-of-england-warns-on-brexit-derivatives-crunch-2018-6?r=US&IR=T&IR=T>> [Accessed 23 January 2019].

Mobius, M., 2011. *High-Leverage Derivatives Have Turned The Stock Market Into A Minefield*. [online] Available at: <<https://www.businessinsider.com/the-problem-with-the-misuse-of-derivatives-2011-6?r=US&IR=T&IR=T>> [Accessed 22 March 2019].

Morgan, N., 2019. *Norway-style Brexit would allow UK to shape rules on finance*. [online] Available at: <<https://www.ft.com/content/5223fa04-1293-11e9-a168-d45595ad076d>> [Accessed 8 March 2019].

National Association of Pension Funds, 2013. *Derivatives and Risk Management Made Simple*. London: National Association of Pension Funds.

Partington, R., 2019. *UK and US agree post-Brexit derivatives trading deal*. [online] Available at: <<https://www.theguardian.com/business/2019/feb/25/uk-us-brexitderivatives-trading-deal-eu>> [Accessed 26 March 2019].

Payne, A., 2018. *The House of Lords voted for Theresa May to negotiate a Norway style Brexit — here's what that means*. [online] Available at: <<https://nordic.businessinsider.com/what-is-the-norway-model-brexit-2018-4?r=US&IR=T>> [Accessed 11 April 2019].

Pearson, A., 2018. *EU Customs Union, Single Market, Brexit — What you need to know*. [online] Available at: <<https://www.dw.com/en/eu-customs-union-single-market-brexit-what-you-need-to-know/a-42462951>> [Accessed 11 April 2019].

Persson, M., 2019. *Signals and developments*. [online] Available at: <<https://www.ey.com/uk/en/issues/business-environment/ey-brexit-probabilities-and-signals>> [Accessed 26 March 2019].

Sheffield, H., 2016. *What is the single market? How is it different from the EEA? Can the UK stay in after Brexit?* [online] Available at: <<https://www.independent.co.uk/news/business/news/single-market-what-is-it-brexit-eu-referendum-eea-boris-johnson-economy-effects-a7106066.html>> [Accessed 6 March 2019].

Statista, 2018. *Total size of bond markets in Europe as of 31st December 2016, by bond type (in billion euros)*. [online] Available at: <<https://www.statista.com/statistics/709633/size-of-bond-markets-europe/>> [Accessed 9 March 2019].

Stearns, J. and Wishart, I., 2018. *What is the Norway model, and can it solve Brexit?* [online] Available at: <<https://www.bloomberg.com/professional/blog/norway-model-can-solve-brexit/>> [Accessed 16 February 2019].

Stone, J., 2018. *UK can cancel Brexit by unilaterally revoking Article 50, European Court advocate general says*. [online] Available at: <<https://www.independent.co.uk/news/uk/politics/brexit-court-case-latest-article-50-cancel-overturn-european-justice-ruling-verdict-a8666016.html>> [Accessed 23 March 2019].

Stratfor, 2018. *The Future of Brexit in Six Scenarios*. [online] Available at: <<https://worldview.stratfor.com/article/brexit-six-scenarios-united-kingdom-britain-european-union-eu-uk>> [Accessed 14 March 2019].

The Economist Intelligence Unit, 2019. *UK will not leave EU on March 29th*. [online] Available at: <<http://country.eiu.com/article.aspx?articleid=547537438&Country=United%20Kingdom&topic=Politics&subtopic=Forecast&subsubtopic=International+relations&linkId=10000004665711>> [Accessed 27 February 2019].

The Economist Intelligence Unit, 2019. *What will happen after the March 12th Brexit vote?* [online] Available at: <<http://country.eiu.com/article.aspx?articleid=1997746583&Country=United%20Kingdom&topic=Politics&subtopic=Recent+developments>> [Accessed 11 April 2019].

The Economist, 2018. *What is the EU's customs union and why is it central to Brexit?* [online] Available at: <<https://www.economist.com/britain/2018/03/01/what-is-the-eus-customs-union-and-why-is-it-central-to-brexit>> [Accessed 2 April 2019].

What UK Thinks, 2019. *If there was another referendum on Britain's membership of the EU, how would you vote?* [online] Available at: <<https://whatukthinks.org/eu/questions/if-a-second-eu-referendum-were-held-today-how-would-you-vote/>> [Accessed 19 March 2019].