The LIBOR Scandal:
A Comparison of Banks Involved Concerning the Impact of Disclosure and the Imposition of Fines on Stock Prices.

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1. Introduction

1.1. An Overview

Among other factors, the functioning of today's global financial system strongly depends on trust (Tonkiss, 2009, p. 196). Over the recent years a number of scandals has repeatedly challenged this trust of consumers in banks and other financial institutions. A prominent representative of these scandals during and in the aftermath of the financial crisis involving the London Interbank Offered Rate (Libor) will be examined on the following pages in part I of this thesis. At the heart of part II will then be the question, whether banks or rather shareholders are negatively affected by fines imposed by regulatory authorities.

In part I the thesis therefore first gives a detailed overview of what the Libor actually is. This serves as a foundation to understand how and why it was manipulated. It will concentrate on the misconduct and the financial penalties of individual banks that have been fined as of May 2018. Therefore, the matter of Barclays plc, the first bank to settle the claim, will be discussed in greater detail before following the timeline of events until with Citigroup Inc. the last bank was fined in 2016. Being familiar with the misconduct and the fines of the banks it will be shortly examined on what dates the market was informed about the ongoing investigations into the banks that received a financial penalty later on. For this a research based on the daily press will reveal when this information went public.

In the second part of the paper, as a component of an event study, several statistical as well as economic models to estimate returns in the absence of the event of interest will be introduced. The procedure aims at calculating the abnormal return (AR), which is the stock price movement attributable to the event of interest only. In advance two points in time have been thought of providing abnormal returns in the context of the scandal.
First, following the semistrong-form of the efficient market hypothesis, the study will focus on a two-day period when the market was informed about investigations against single companies. The second point in time will be a two-day period, when the banks were finally fined.
Due to the limited results from this, a promising third point in time will be identified and analyzed. Next, the AR is set in context of the market capitalization of the banks. As this sheds new light on the previous results, some additional reasoning is provided to explain the findings.

1.2. The Libor and Its Importance

The London Interbank Offered Rate, commonly known as Libor, is in many articles referred to as the world's most important number (Talley and Strimling, 2013). It primarily indicates the rate at which banks can borrow at an unsecure basis from each another ranging from extremely short-term periods such as overnight up to time spans of 12 months (Hou and Skeie, 2014, p. 1). In fact, however, it is far more than that. The Libor also serves as an important reference rate and has as such implications on many loans, bonds, mortgages, derivative securities and other products in the financial market (Needham, 2012, p. 1). The London Interbank Offered Rate gives contracting parties the possibility to build on interest rates that automatically adjusts to the funding costs of large banks in the inter-banking market. An example of how this benchmark rate frequently serves to the public sphere is given by looking at the loan market. Loans at times have an interest rate that is partly fixed and partly reflecting current Libor rates. By adding this fixed margin of a few percent to the London Interbank Offered Rate one can account for the risk premium of a private loan compared to the relatively secure inter-banking short term borrowing rate itself (MacKenzie, 2008). Contracting parties now have the possibility to pass on interest rate changes in accordance with the changes of the Libor. Needham 2012 states, that loans'

interest costs linked to Libor make up as much as $10 trillion. According to estimations of the British Financial Service Authority from 2012, the value of such and other contracts that are depended on the Libor sum up to a range of $300 trillion to $800 trillion (Wheatley, 2012, p. 76). The size of the number becomes clear if it is compared to the combined GDP of all OECD countries in the same year 2012, which was roughly $47 trillion (data.oecd.org, 2018). One can already guess that minor shifts to the Libor due to manipulation can have a huge impact on the market in absolute terms.

Part I – The Libor Scandal

2. History and Calculation of the Libor

The London Interbank Offered Rate was created during the 1980s to primarily serve the loan market (Wheatley, 2012, p. 75). The first administer of the Libor however, was the British Bankers' Association (BBA), responsible for the rate setting process, after banks have experienced an incentive to underreport borrowing costs (Hou and Skeie, 2014, p. 1). Later, the administration of the Libor was transferred to the Intercontinental Exchange (ICE) Benchmark Administration (IBA) in 2014 in the aftermath of the manipulation of the interest rate benchmark (ICE, 2014, p. 1).

To understand how the Libor was manipulated it is important to know how it is calculated. Under both the BBA (Hou and Skeie, 2014, p. 1) as well as the IBA (thomsonreuters.com, 2014) administration Thomson Reuters has been responsible for the actual calculation of the Libor. To do so, Reuters daily asks a number of panel banks the following question. "At what rate could you borrow funds, were you to do so by asking for and then accepting inter-bank offers in a reasonable market size just prior to 11 am?" (ICE, 2017, p. 1) As depicted in table I.1 the current panels of banks answering vary with the currencies the Libor is calculated for. The number of currencies has repeatedly changed over time with the Libor being previously computed for as much as 10 different currencies (Wheatley, 2012, p. 76) of which the following five remained:

BANK/CCY	USD	GBP	EUR	CHF	JPY
Lloyds Bank plc	*	*	*	*	*
MUFG Bank, Ltd	*	*	*	*	*
Barclays Bank plc	*	*	*	*	*
Mizuho Bank, Ltd.		*	*		*
Citibank N.A. (London Branch)	*	*	*	*	
Cooperatieve Rabobank U.A.	*	*	*		
Credit Suisse AG (London Branch)	*		*	*	
Royal Bank of Canada	*	*	*		
HSBC Bank plc	*	*	*	*	*
Santander UK Plc		*	*		
Bank of America N.A. (London Branch)	*				
BNP Paribas SA, London Branch		*			
Crédit Agricole Corporate & Investment Bank	*	*			
Deutsche Bank AG (London Branch)	*	*	*	*	*
JPMorgan Chase Bank, N.A. London Branch	*	*	*	*	*
Société Générale (London Branch)		*	*	*	*
Sumitomo Mitsui Banking Corporation Europe Limited	*				*
The Norinchukin Bank	*				*
The Royal Bank of Scotland plc	*	*	*	*	*
UBS AG	*	*	*	*	*

Table I.1
(theice.com, 2018)

In total there are 20 major banks of which some are part of just one panel as for example the Bank of America. Most credit instituts however, are part of many panels at once such as i.e. Lloyds. The prerequisite for becoming a major bank that can participate in setting the rates is a "relevant market activity, expertise and reputation" (ICE, 2014, p. 9). Each bank that is part of a panel has to provide the answer to the above given question with respect to seven different maturities ranging from overnight, over a few months up to a year (Hou and Skeie, 2014, p. 2). Prior to 2013 there were 15 different

maturities this resulted in a combined amount of 10 currencies times 15 maturities = 150 different Libors (Wheatley, 2012, p. 76). The reduction in the number of currencies and maturities the Libor has been calculated for was part of the recommendations of the so-called Wheatley Review (Wheatley, 2012, p. 37), the UK regulators' response to the manipulations with a strong impact on the reforms of the Libor in the aftermath of the crisis (ICE, 2014, p. 1).

The current administrator of the Libor, the Intercontinental Exchange (2017), provides a detailed overview about how the Libor is calculated today. Once Thomson Reuters receives the estimated rates from the corresponding banks each day around 11 o'clock, they identify the 25% highest and lowest rates in each panel to exclude it from further considerations. The exact number of excluded responses depends on the size of the groups of banks in the specific panel. In the next step the arithmetic mean is calculated from the other 50% responses. This mean is then published at the same day usually at around 11:55 am British Standard Time as the London Interbank Offered Rate of a certain currency and tenor for that day (ICE, 2017, p. 2).

3. Reasons for Banks to Manipulate the Libor

The reasons for manipulation are twofold.

Firstly, a bank might engage in a large contract with a third party that is based on the Libor. Hence, it would be in the banks interest to manipulate the rate to gain from an advantageous movement of the benchmark (Hou and Skeie, 2014, p. 7). Just one example for such a contract with a link to the London Interbank Offered Rate provided by Bodie and Kane (2014, p. 821) is an interest rate swap. Company A would i.e. want to set on increasing future interest rates or to be more precise on an increasing Libor, which often serves as a reference for such contracts. Company A is currently holding a large position with a fixed interest rate. The bank might not believe in interest rates to rise and so it offers to pay Company A the interest of an equally large position according to the Libor in exchange for Company A's fixed interest. The Bank's payoff then is the Company's fixed interest minus the interest it has to pay according to Libor. To maximize its payoff the bank therefore has an incentive to keep the responses it provides to Reuters lower than it actually would. Depending on the position the bank takes in such a deal it might also want to manipulate its answer in the upward direction.

Secondly, evoked by the financial crisis, there was another incentive to provide consistently lower rates according to Hou and Skeie (2014, p. 7). One feature of the Libor was that the individual responses of the banks were publicly available (Wheatley, 2012, p. 37). The idea behind this mechanism had been that banks would not dare to manipulate rates that are under constant public surveillance. However, at the same time this feature has put banks under pressure not to reveal their true costs of borrowing as not to be identified as having liquidity problems during the peak of the financial crisis (Hou and Skeie, 2014, p.7). Therefore, banks had a management driven incentive to manipulate responses submitted to Reuters in the downward direction.

4. The Scandal

4.1. Timeline of the Scandal

Although many banks have been involved into the scandal from an early stage, this section will first provide a more detailed overview about the sequence of events at Barclays plc only, the bank that was fined first for manipulating the Libor. Then, due to the partial similarity to the misconduct at the other banks it will be given a shorter overview of Barclays's competitors on which further penalties have been imposed. Although not part of the later following analyses the section also provides an overview of the crucial roles brokers played in the scandal to facilitate the manipulation for some banks.
Not matter of this thesis however are any private Libor related lawsuits.

It is important to consider that banks and brokers have in the following cases not solely been fined for manipulating Libor, but also for the misconduct in the context of other benchmark submissions such as EURIBOR. EURIBOR is administrated by the European Banking Federation and similar in terms of structure and usage to the London Interbank Offered Rate (FCA, 2012a, pp. 5-8). Although fines were meant to cover the misconduct often relating to several benchmarks, the thesis just concentrates on the wrongdoing in the Libor context and assumes the fines to be fully based on the Libor manipulation.

The summary orientates at the sequence of settlements of parties involved and is based on the detailed investigation of regulatory authorities from all over the world. Thanks to a wide range of publicly available orders, agreements, final notices and statements of facts published by these financial authorities, it is possible to retrace the scandal in great detail. As evident from the following summary the British Financial Service Authority (FSA), the American Commodity and Futures Trading Commission (CFTC), United States Department of Justice (DoJ) and the European Commission (EC) are the most important financial regulators in the scandal.

4.1.1. The Matter of Barclays plc

It was revealed that following the findings of the US Department of Justice (2012a, p. 5), the manipulation of the Libor started as early as 2005 with the large British bank Barclays plc regularly manipulating the Libor to gain from derivative transactions until around 2009. The Financial Service Authority (2012a, p. 10) states that to do so, nearly every day in this period, individuals at the derivative department influenced another department responsible for the submission of the perceived costs of borrowing verbally, via e-mail or through instant messenger. During this period, it was primarily the US-Dollar but also the Yen Libor that was affected the most (FSA, 2012a, p. 11). The notice of the British FSA also provides evidence by citing numerous conversations between derivative traders and submitters who gave positive responses to the inquiries of traders to alter rates. The following shows a conversation via e-mail from 13 March 2006 as reported by the FSA (2012a, p. 12). The submitter's expression proves, that he is well aware of the fact that his conduct is not in accordance with law and order:

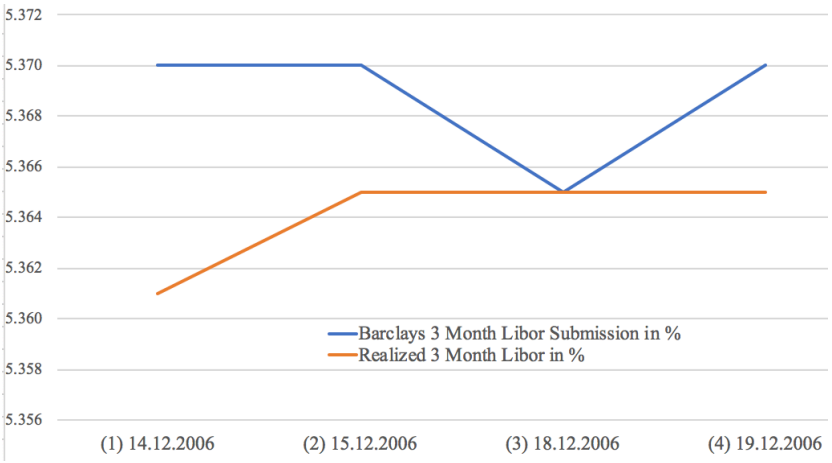
Trader C: "The big day [has] arrived... My NYK are screaming at me about an unchanged 3m libor. As always, any help wd be greatly appreciated. What do you think you'll go for 3m?"

Submitter: "I am going 90 altho 91 is what I should be posting".

Trader C: "[...] when I retire and write a book about this business your name will be written in golden letters [...]".

Submitter: "I would prefer this [to] not be in any book!"

Additionally, the FSA (2012a, p. 12) also provides examples of calendar reminder set by submitters as not to forget to manipulate the rates in accordance with the agreements made with traders. This reveals the routine of the manipulation. An example of how requests of trader were taken into account by submitters is given by citing an 18 December 2006 incident, were a calendar entry of a submitter stated "USD 3mth LIBOR DOWN" (FSA, 2012a, p. 15). According to the British authority it is evident that the submitters frequently followed the instructions received from the traders and adapted their Libor submissions. This can be seen by looking at the submission of the day, the calendar entry above related to:

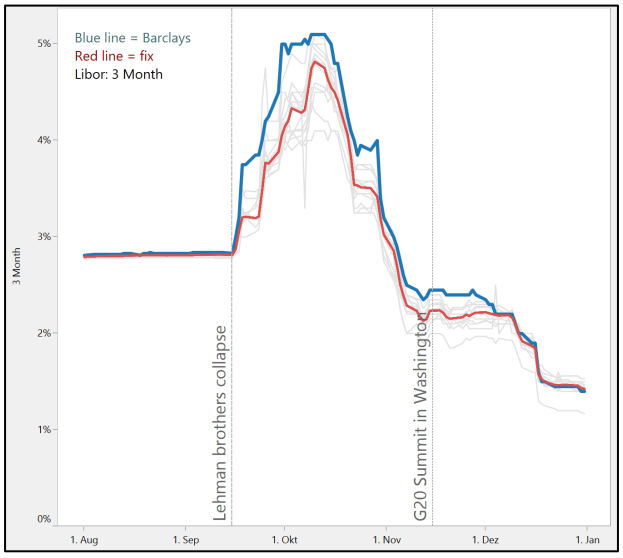


Graph IV.1 (FSA, 2012a, p. 12)

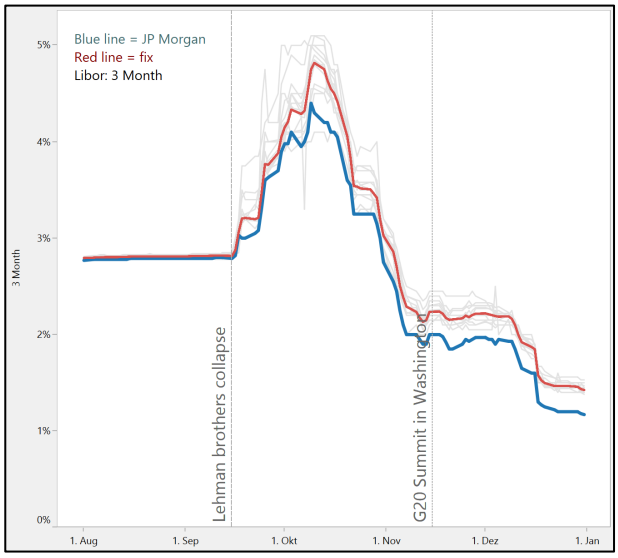
The downwards manipulation appears very obvious in this case and perfectly coincides with the submitter's reminder in his calendar. US-Dollar and Sterling Libor submitters at Barclays were furthermore asked by external traders from other banks to take their trading positions into account. Submitters of US-Dollar Libor followed such requests (FSA, 2012a, p. 19). The FSA (2012a, p. 19) cites the answer of the external trader who thanked by offering an expensive champagne in exchange. Further, Barclays's employees are also reported to have attempted to influence submitters at other banks (FSA, 2012a, pp. 22, 23).

As already mentioned there was a second reason for manipulating the Libor that was not primarily profit driven. According to the FSA's notice (2012a, p. 23) this type of manipulation at Barclays lasted from 2007 to 2009. Following the explanation of the Federal Reserve Bank of New York (2012a, p. 1) with the beginning of the financial crisis in 2007 fewer funds were available at the market and the cost of borrowing was therefore harder to determine. Barclays found itself soon among the highest submitters (FSA, 2012a, p. 24). In summer 2007 however, media began to question Barclays high perceived costs of acquiring money from the market. The FSA as well as the CFTC (2012a, p. 19) both quote a Bloomberg article, were the author asked, "what the hell is happening at Barclays […] to charge […] premium interest". Concerned about media attention that might raise public perceptions of liquidity problems senior management at Barclay's told submitters to lower the rates (FSA, 2012a, p. 23). The idea was to lower them by as much as not to be one of the highest submitters (FSA, 2012a, p. 25). Graphic II.2 and II.3 show the submissions of Barclays and of JP Morgan, the average lowest submitter

during the peaks of the financial crisis. The red line is the 3 month US-Dollar Libor in the period of 01. August 2008 to 01. January 2009.[1]



Graph IV.2
(theguardian.com, 2012)



Graph IV.3

Barclays had the concern that other banks were not stating their true costs of borrowing and thus contacted a number of authorities including with the FSA, the Bank of England, the Federal Reserve Bank of New York and the BBA (FSA, 2012a, p. 23). The Federal Reserve Bank of New York (2007, p. 1) provides several e-mails from Barclays to authorities from as early as 27 August 2007, where an employee at Barclays first mentioned unrealistically low rates of peers. Apart from several other e-mails, there are also transcripts of phone calls to the New York Federal Reserve Bank available. In a phone call of 11 April 2008 for example, an employee openly admits rate manipulation at Barclays und unveils concerns of media attention if not participating at submitting unrealistically low rates.

"[…] there was um, an article in the Financial Times, charting our LIBOR contributions and comparing it with other banks and inferring that this meant that we had a problem raising cash in the interbank market […] And um, our share price went down. […] And so we just fit in with the rest of the crowd, […] if we didn't do it […] It draws, um, unwanted attention on ourselves." (Fed NY, 2008, p. 6)

Going on in the sequence of events, the Wall Street Journal was first to raise public concerns about possible manipulations of the Libor on 16 April 2008 (Mollenkamp, 2008). Earlier newspaper articles already questioned the low Libor fixing, but the WSJ was first to clearly mention possible manipulative conduct (Hou and Skeie, 2014, p. 7).

Following the publication of the article, the BBA contacted Barclays on two occasions on the 17 April and 2 May 2008 to speak about the reporting of low rates due to fears of media attention according to the FSA's notice (2012a, p. 29). On 10 June 2008 a report and on 5 August 2008 a feedback statement as well as a guideline on Libor submission for the banks was published by the BBA. Although Barclays was one of the banks to respond to the BBA´s report, its feedback statement concluded that the banks submit true Libor rates (FSA, 2012a, pp. 29, 30). Here a major problem with the BBA being the administrator of the Libor became recognizable. Its lack of authority (Kohn, 2014, p. 474). The BBA acknowledged the problem of possible media attention but rejected to change the Libor calculation for

[1] Similar graphs for other panel banks important to this thesis are attached: Graphs A.1-A.5

the sake of transparency (BBA, 2008, p. 9). According to the FSA (2012a, p. 30), Barclays manipulation of the rate continued even after Lehman Brother went bankrupt in autumn 2008. Authorities furthermore criticized Barclays failure to provide an adequate level of controls and to adapt the submission process of Libor even after the receipt of the report of the British Bankers' Association (FSA, 2012a, pp. 31, 32). But how was compliance involved into the events regarding Libor submission during the financial crisis? Although it was informed about the conflict of interest relating to the submission process in late 2007, it did not take any steps to address the issue (FSA, 2012a, pp. 36, 37).

As already mentioned not just the British, but also the American authorities investigated in the matter of Barclays. Those authorities included The Commodity Futures Trading Commission (CFTC) and the United States Department of Justice (DoJ). Published in an order of the CFTC (2012a) and in a statement of facts that is part of an agreement of the US Department of Justice (2012a) on the same date as the FSA's notice, allegations are similar to that of the FSA with both regulators first concentrating on derivative-based manipulation and later on manipulation due to fears of media attention.

The investigations of the FSA, CFTC and the US Department of Justice ended on 27 June 2012. As a consequence of the misconduct at Barclays plc, the bank was fined of 59.5 million Pound (FSA, 2012a, p. 1), 200 million US-Dollar (CFTC, 2012a, p. 30) and 160 million US-Dollar (DoJ, 2012b, p. 3) respectively by the before mentioned authorities.

After these findings were published, Martin Wheatley who was managing director of the FSA was instructed by the UK government to prepare a report on the Libor. The final draft of his report was released in September 2012 (Wheatley, 2012, p. 5). He made a number of suggestions to adapt the Libor including, among others, the following points that were probably most important. Wheatley recommends reducing of the amount of currencies and tenors restricted to those that are actively traded. He further suggests delaying the publication of banks' submissions for 3 months to avoid the risk of negative media attention and searching for a new administrator for the Libor other than the BBA (Wheatley, 2012, p. 8). With this he laid the foundation to the now current form of the interest rate benchmark.

4.1.2. Other Banks Involved

UBS was the second bank to be fined on 19 December 2012 for manipulating the benchmark interest rate Libor. The fine imposed by the CFTC, the United States Department of Justice and the FSA were 700 million US-Dollar (CFTC, 2012b, p. 59), 500 million US-Dollar (DoJ, 2012c, p. 5), 160 million Pound (FSA, 2012b, p. 1) respectively. Additionally, another Swiss authority, the Eidgenössiche Finanzaufsicht FINMA, imposed a fine of 59 million CHF (FINMA, 2012, p. 12). The amount that UBS AG had to pay was therefore well above that of Barclays plc. All four authorities identified the same two reasons for Libor manipulation as at Barclays. Just the periods of accused misconduct vary among the authorities. Still, the time spans are comparable to the misconduct at Barclays plc with the CFTC estimating the period of manipulation with the motive of gaining from derivative trading from January 2005 to June 2010 and the manipulation to avoid media attention from August 2007 to mid 2009. Differently to Barclays, UBS mainly manipulated the Libor submissions of the currencies of Japan, Switzerland, the UK, and from the euro area. Another dissimilarity is that authorities identified among others a single individual, a UBS Yen derivative trade, who routinely and methodically over a period of several years manipulated the Yen Libor (CFTC, 2012b, pp. 3, 4). Through the whole scandal this person will be referred to as the key person of misconduct in relation to Libor. He established a network of collusively operating individuals, who often affected Libor postings. The trader achieved this by manipulating UBS's own submissions, by making use of affiliations to former colleagues, who worked

at other banks and by spreading wrong information in the market to affect panel banks' submissions to his favor (CFTC, 2012b, pp. 3, 4). The FSA (2012b, p. 12) provides evidence, that this trader even offered compensations to external corrupt brokers for manipulating their submission such as in this case for the 6-month JPY Libor "if you keep 6s unchanged today […] I'll pay you, you know, 50,000 dollars, 100,000 dollars". According to the United States Department of Justice (2012d, p. 24), this Yen trader made a profit of $40 million in 2007, $80 million in 2008 and around $116 million till September in 2009 for UBS before he changed the employer. Other derivative traders at UBS continued with their manipulation even after investigation of the CFTC had started in October 2008 (CFTC, 2012b, p. 4, 5).

The next bank to settle was Royal Bank of Scotland (RBS). Again, it was the institutional triangle of CFTC, DoJ and FSA that imposed heavy fines on the bank. The FSA demanded 87.5 million Pounds (FSA, 2013a, p. 1), the CFTC 325 million US-Dollar (CFTC, 2013a, p. 39) and the United States Department of Justice 150 million US-Dollar (DoJ, 2013a, p. 8) all on 6 February 2013. Individuals at RBS mainly manipulated the Libor submissions of the Yen, Swiss Franc and US-Dollar (FSA, 2013a, p. 1). Other as at Barclays, the FSA does not accuse RBS of manipulating the Libor to avoid media attention. But, apart from influencing Libor to benefit from derivative trading from October 2006 to November 2010, the FSA identified a strong influence of the bank's money market traders on the submission process (FSA, 2013a, p. 20). As a consequence of an internal reform at RBS, the money market and the derivative department were merged in early 2006 to enhance communication according to the Financial Service Authority (2013a, p. 10). Submitters did have information about the activities of money market traders and were able to borrow and lend funds from and to the market themselves. With money market transactions depended on the Libor, submitters sought for strategies to profit from rate manipulation benefiting their own and the money market traders' positions. Additionally, those positions had to be hedged by using derivatives, which at times were linked to Libor as well (FSA, 2013a, p. 10, 11). Submitters were motivated to do so as their bonuses were dependent on the performance of the department that was in charge of the money market transactions (FSA, 2013a, p. 20). Furthermore, the bank sought to influence corrupt broker firms by generating trades with other banks that i.e. nullified each other but generated fees for these brokers to reward them for their attempts to manipulate Yen Libor submissions (FSA, 2013a, p. 17, 18). Also, RBS made further collusive attempts to influence JPY Libor by adapting its Libor submissions on external requests of other panel banks and brokers and by themselves making similar requests to externals as well (FSA, 2013a, p. 15-17).

Following the sentence against RBS, there were two institutional changes surrounding the setting and the regulation of the London Interbank Offered Rate. Firstly, at the beginning of April 2013 the UK regulator Financial Services Authority (FSA) was dissolved and replaced by two new institutions the Prudential Regulation Authority (PRA) and the Financial Conduct Authority (FCA) (Masters, 2013). Secondly, NYSE Euronext was selected on 09 July 2013 to purchase the Libor administration from the BBA and was itself bought by its competitor InternationalExchange, the current administrator of the Libor (Ridley, 2013). Therefore, the former BBA Libor was turned into the ICE Libor in the first months of 2014.

The first fine imposed by the newly founded FCA in the context of the Libor scandal was, again in cooperation with the CFTC, against ICAP Europe Ltd (IEL) on 25 September 2013. With IEL, a broker that facilitates over the counter operations linked to Libor (CFTC, 2013b, p. 2), it was also first that regulators fined a company that was not part of the Libor panels. According to the FCA (2013b, p. 1) IEL was involved in Libor manipulation for as long as from October 2006 to November 2010 and therefore had to pay 14 million Pound to the FCA and 65 Million US-Dollar to the CFTC (2013b, p. 46). ICAP Europe Ltd was convicted to influence Yen Libor submissions of panel banks in accordance

with the wishes of traders at UBS AG, one of their major clients. The Yen trader at UBS AG that was mentioned earlier played a key role in this relationship (CFTC, 2013b, p. 4). The CFTC (2013b, p. 3) explains that IEL used to provide panel banks with information regarding market transactions. Especially during the financial crisis, when interbank lending became less, this information was vital for Libor submitters of several panel banks to estimate how much it would cost to borrow in the market (CFTC, 2013b, p. 6, 7). Being aware of the importance of the data, the broker responsible for submitting it is reported to have called himself "Lord Libor" according to both, the FCA (2013b, p. 9) and the CFTC (2013b, p. 2). The Commodity and Futures Trading Commission (2013b, p.3) found that those brokers on the one hand side manipulated this market data before distributing it among panel banks and on the other hand side tried to directly influence certain submitters at panel banks.

Just one month later on 29 October 2013, Coöperatieve Centrale Raiffeisen-Boerenleenbank B.A, better known as Rabobank, was fined 105 million Pound by the FCA (2013c, p. 1), 475 million US-Dollar by the CFTC (2013c, p. 52), 325 million US-Dollar by the United States Department of Justice (2013b, p. 10) and another 70 million Euro by the Dutch Openbaar Ministerie (2013). Next to EURIBOR submissions, Rabobank primarily tried to manipulate JPY, GBP and USD Libor during a period from May 2005 to November 2010 according to the FCA (2013c, p. 2). Other as in the case of Barclays the authorities did not identify manipulation of the Libor and EURIBOR due to avoiding media attention during the crisis. Rabobank's motive for manipulation was to make profit form derivative transactions (FCA, 2013c, p. 4). Derivative traders therefore influenced submitters on a regular basis. Also, submitters adapted submissions to better suit the money market positions they had taken (FCA, 2013c, p. 9). The British authority (2013c, pp. 12, 13) found that Rabobank also set submissions in accordance with requests from external brokers and other panel banks mainly concerning Yen Libor submissions. Other as at Barclays, Rabobank also made a wrong attestation to the FSA concerning the status of the revision of the Libor submission process (FSA, 2013c, p. 16). All in all, accusations against Rabobank are very similar to those against the Royal Bank of Scotland.

On 04 December 2013, in a settlement with a number of banks, the European Commission (EC, 2013) imposed a fine of combined 1.49 billion Euro for cartel agreements. The bank Société Générale SA failed to provide correct data on the value of sales in the first place, therefore the fine was reduced from an initial 1.7 billion Euros in 2016 (EC). By imposing these fines, the EU Commission did unlike other authorities primarily concentrate on the collusion among panel banks and brokers in the context of Yen Libor and EURIBOR setting, rather than on the misconduct of single banks. Taking into account the reduction of the penalty, approximately 670 million Euro were imposed due to the Yen Libor and 820 million Euro due to EURIBOR manipulation in a combined fine. Of the total penalty Deutsche Bank payed 726 million Euro, Royal Bank of Scotland 391 million Euro, Société Générale 228 million Euro, JP Morgan 80 million Euro, Citigroup (Citi) 70 million Euro and the broker RP Martin 0.247 million Euro. The original fine of Citigroup was partly remitted by 55 Million Euro. UBS AG, the bank, that employed the main perpetrator in the cartel of Yen Libor manipulation would have payed a fine of 2.5 Billion Euros if the EC had not granted full remission for revealing the cartel to the commission (EC, 2013).

On 15 May 2014, RP Martin, another broker involved in the Libor scandal was fined by the FCA and by the CFTC for manipulating the Yen Libor. Partly, due to the bad financial situation of the broker, the fine was reduced by the FCA (2014a, p. 1) down to 630,000 Pound. The CFTC (2014a, p. 29) demanded another 1.2 million USD. Similar to IEL, RP Martin had an intermediary role in the interbank money market. Panel banks were relying on the assessment of these brokers for costs of borrowing. Therefore, RP Martin was in the position to indirectly influence the Libor by for example sending misleading information to panel banks (CFTC, 2014a, p. 6) by directly asking submitters of panel banks to

manipulate their submissions (CFTC, 2014a, p. 10) and by placing faked cash bids in the market to alter submitters perception of borrowing opportunities (CFTC, 2014a, p. 14). Motivation for RP Martins' employees were corrupt payments made by the Yen derivative trader at UBS AG to the brokerage house totaling in sum at around 412.000 US-Dollar (CFTC, 2014a, p. 15).

In summer on 27 July 2014, Lloyds Banking Group, another panel bank was fined for its entanglement into to scandal from late spring 2006 to early summer 2009 (FCA, 2014b, p. 3). Lloyds Banking Group consists of Lloyds Bank plc and Bank of Scotland plc, that had been two individual Libor panel banks during most of the time of the scandal (FCA, 2014b, p. 11) until Lloyds TSB acquired HBOS, mother company of the Bank of Scotland, in early 2009 (CFTC, 2014b, p. 4). The FCA (2014b, p. 2) has convicted the Banking Group of Libor and repo rate manipulation. According to the authority (2014b, pp. 2, 3), the latter offence affected fees the bank had to pay to the Bank of England due to borrowing during the crisis and was an attempt of manipulating a benchmark as well. The combined fine of 105 million Pound imposed by the FCA (2014b, p. 1) was this time higher than the single fines of American authorities. The CFTC (2014b, p. 24) demanded 105 million US-Dollar and the United States Department of Justice (2014) another 86 million US-Dollar with sole focus on Libor manipulation. Prior to the acquisition the authorities identified that money market traders at Lloyds TSB that were in charge of providing the Libor submissions for the Pound (CFTC, 2014, p. 6) and for the US-Dollar (CFTC, 2014, p. 10) sought to alter Libor to benefit from their trading position. According to the CFTC (2014, pp. 7, 10) HBOS did the same also concerning the submission of the Sterling and the US-Dollar Libor. It is not surprising however that the manipulation of the Sterling Libor went on even after the acquisition took place (CFTC, 2014b, pp. 7, 10). In Addition, the CFTC has found numerous collusive agreements between Lloyds TSB and Rabobank in the context of Yen Libor submissions. By agreeing on rates, the employees at both banks hoped to increase the gains from positions they had taken (CFTC, 2014b, p. 11). Furthermore, because of HBOS's bad finical situation that was ultimately solved through the acquisition by Lloyds TSB, the bank reduced its Libor submissions to avoid negative market reactions (CFTC, 2014b, p. 14). Finally, in 2006, submitters at both banks tried to affect other banks' Libor submissions by placing higher than usual bids in the cash market to alter other submitters' perception of costs of borrowing again to gain from certain trading positions (CFTC, 2014, p.17).

Further, on 21 October 2014, JP Morgan (JPM) was fined by the EU-Commission for cartel agreements with RBS in the context of Swiss Franc Libor setting (EC, 2014). RBS however, was granted full leniency for revealing the cartel to the commission. JP Morgan had to pay a 61.6 million Euro fine to the Commission.

Unlike several banks that decided to settle with the European Commission on 04 December 2013, ICAP denied wrongdoing and was therefore fined 14.9 million Euro on 04 February 2015 by the EC (2015) for collusion with UBS, Deutsche Bank, Citi and RBS. The fine however was annulled on 10 November 2017 by the General Court of the European Union (2017) claiming that it was not sufficiently justified.

Just a few months later, another prominent player Deutsche Bank AG was punished by the British and American authorities with a series of unprecedentedly high fines on 23 April 2015. The CFTC (2015a) demanded a payment of 800 million US-Dollar, the largest fine in the authority's history according to its press release. The US Department of Justice furthermore asked for 625 million US-Dollar from Deutsche Bank AG (DoJ, 2015a, p. 11) and another 150 million US-Dollar from its subsidiary Deutsche Bank Group Services UK Limited (DoJ, 2015b, p. 11). With 226.8 million Pound the FCA (2015, p. 1) as well imposed its largest ever fine in relation to the Libor scandal so far. This time another authority, the New York State Department of Financial Services (NYDFS), also joined in imposing monetary penalties of an additional 600 million US-Dollar on Deutsche Bank AG (NYDFS, 2015, p. 17)

The order of CFTC as well as the other authorities' summaries concerning the entanglement of Deutsche Bank into the scandal list a number of reasons that have led to this record-breaking fine.
With the motivation of increasing trading gains, a senior manager at Deutsche Bank promoted communication among EURIBOR and Libor submitters of several currencies and derivative traders on a routine basis (CFTC, 2015b, p. 8). Submitters were sometimes also taking own derivative positions into account when submitting Libor quotes to Reuters (CFTC, 2015b, p. 9). The Commodity and Futures Trading Commission (CFTC, 2015b, p. 10) found, that especially during the financial crisis Deutsche Bank generated massive revenues from following a certain manipulative strategy concerning Libor and EURIBOR related derivatives. The CFTC consequently states, that the department turnover was at 1.9 billion Euros in 2008 which was as much as 14.27% of the banks total turnover in that year, coming up from 399 billion in 2007. There is also evidence that employees of the bank tried to influence other banks' Libor submissions with the help of brokers (CFTC, 2015b, p. 14). The Commodity Future Trading Commission (2015b, pp. 25, 26) furthermore provides numerous examples of collusive agreements between an employee at Deutsche Bank and the Yen trader working at UBS AG known from the previous mentioning of the massive Yen Libor manipulation.
In the context of Swiss Franc Libor manipulation, submitters continued to manipulate rates even until one year after investigations had started (CFTC, 2015b, p. 34).

So far, the fine may not be plausible if misconduct at Deutsche Bank is compared to that of competitors that have settled earlier. The British Financial Conduct Authority however, gives a clear reason for imposing a fine that exceeds pervious financial penalties regarding Libor by far. According to the authority's final notice, the German Bundesanstalt für Finanzdienstleitungsaufsicht (BaFin) conducted a report concerning the entanglement of the Deutsche Bank into the Libor and EURIBOR scandal. As Deutsche Bank disagreed with some aspects of this report it sought for a way of preventing further distribution of the findings (FCA, 2015, p. 26). The Bank therefore wrongfully stated towards the FCA, that BaFin had forbidden further distribution of the report, which was clearly not the case (FCA, 2015, pp. 27, 28). Also, Deutsche Bank AG wrongly claimed that it had a sufficient level of controls in place regarding Libor submission after it had been asked by the BBA (FCA, 2015, p. 29). On top of that there were several problems during the investigation process of the FCA including slow responses from Deutsche Bank (FCA, 2015, p. 33) or the destruction of several hundred tapes relevant to the investigation (FCA, 2014, p. 34).

On 25 May 2016 with Citibank the CFTC (2016, p. 25) in a solo action charged a 175 million US-Dollar fine against another global bank for its involvement in Yen Libor and and Euroyen Tibor manipulation. Euroyen Tibor is a benchmark for Yen rates in the money market outside Japan (CFTC, 2016, p. 5). It is again the Yen trader that was referred to before in numerous occasion that played the key role here. After he left UBS AG in 2009 (CFTC, 2012, p. 37), he started working at Citibank in late 2009 (CFTC, 2016, pp. 5, 6), where he continued with the same techniques he used before at UBS AG to manipulate benchmarks (CFTC, 2016, p. 8). During his time at Citibank that lasted until August 2010, the Yen trader especially relied on former colleagues at UBS AG and his contacts to Deutsche Bank AG (CFTC, 2016, pp. 9, 10). Due to the trader's attempts to influence Citibank's Yen Libor submissions, Citi finally dismissed him and contacted the CTFC (2016, p. 13).
In Addition, similar to Barclays plc, the bank manipulated its USD Libor submissions during the financial crisis to avoid further negative attention (CFTC, 2016, p.14).

By now it became more and more clear, why the European Commission has sentenced several brokerage houses and panel banks for their collusive behavior. The scandal that first came to light due to Barclays perception of too low Libor rates and its own involvement in Libor manipulation has unveiled a full-fledged network of numerous actors that systematically manipulated the Libor to make profit. The most

sophisticated network of misconduct has established around a single aggressive Yen derivative trader working at UBS AG. This trader made a revenue of more than 230 Million US-Dollar in less than 3 years for the company (DoJ, 2012d, p. 24).

As mentioned in the introduction to this section, private lawsuits such as putative class actions were not considered in the timeline of the scandal. This is despite the fact, that plaintiffs have reached enormous sums in settlements especially when looking at the most recent decisions. According to Reuters Barclays plc had to pay another $120 million in 2015, Citigroup, mother company of Citibank, $130 million in 2017 and Deutsche Bank $240 million in 2018 to investors active in the OTC market (Stempel, 2018). Again, in 2016 Barclays had to pay another $100 million and Deutsche Bank $ 220 million in 2017 to other parties affected by the scandal (Stempel, 2017). Also, in 2017, Citigroup, Deutsche Bank and HSBC consented to a settlement with future traders to pay a combined amount of $132 million (Pierson, 2017). And still, according to the 2017 annual report of UBS AG (2017, p. 382), several agencies and authorities form a range of countries are further investigating the entanglement of banks into the scandal. Also, several private lawsuits are pending in the case of UBS AG (2017, p. 32) as of end 2017.

4.1.3. Public Notice of the Banks's Active Involvement in Investigation

As mentioned in the introduction, the later following event study will initially concentrate on two points in time when abnormal returns are expected to occur. As the event in this thesis, one might primarily understand the moment, when a fine is imposed. Therefore, a two-day event window will be constructed on and following the dates of the imposition of the fines. But actually, investors should immediately account for the future movement of a stock once they receive the information of an upcoming event, that affects future profits. The following section provides an explanation of how exactly this second moment of importance to the study was determined. Two aspects have to be considered.

4.1.3.1. Efficient Market Hypothesis

Firstly, a certain point in time has to be defined when stock prices are expected to reflect new information. According to the efficient market hypothesis that provides different explanations of when and how news affect stock prices, there are three different theories ranging from the weak-form efficiency to the strong-form efficiency (Body, Kane, Marcus and Rain, 2014, p. 357). The same authors state (2014, p. 358), that according to the strong-form efficiency, already the existence of private information on an issue should affect the price of a stock. A good example in context of the scandal could be the e-mails sent by a Barclays employee to several authorities in late August 2007. As stated above these e-mails contain allusions that other banks' Libor submissions were too low. Although this information is not public yet and only known to few people, that were not expected to spread the information, the assumptions of the strong-form approach however would be that stock prices immediately reflect the consequences of potential manipulation. This does not seem to be realistic as broad movements in the market would then have to be triggered by the trading of only a few insiders. The weak-form efficiency in contrast simply states that the market reflects past stock price movements (Brealey, Myers and Allen, 2017, p.332) and does not comment on information processing. Alternatively, one could also assume no market efficiency at all. In the context of the Libor scandal even news on a financial penalty that would put a bank at the edge of financial distress would not affect the value of a stock. This theory does not seem to be very convincing either. A mixture of these theories, the semistrong-form efficiency suggests that only information available to the public affect prices of stocks (Body, Kane, Marcus and Rain, 2014, p. 358). Publicly available means that any information channel in any language that is potentially accessible to the public has to report about the news. Certainly, the theory also has shortcomings assuming that any (potential) stock trader or people who

could influence them has immediately read all information out there that somehow relate to future earnings of a company. Although this may not be the case, it is still a good approximation with information being normally priced in within a couple of minutes. Since the following analysis will concentrate on daily stock price movements, there is enough time for new information to be considered by the market. Therefore, this analysis will follow the semistrong efficiency hypothesis. To do so LexisNexis, a databank of international newspaper articles, will help to identify when involvement of banks into the scandal became known to the public.

Secondly, it is important to clarify what information to look for. Does the assumption that was raised in the media in September 2007 by i.e. the Financial Times that Libor may not mirror true borrowing costs of banks already affect stock prices (Tett, 2007)? At this early stage investors can probably not yet infer that deviations from true cost of borrowing are caused by manipulation of the benchmark. Hence, this Point in time might be too early to expect stock price movements. On 16 April 2008 the Wall Street Journal was first to mention manipulation as a reason for the deviations of the benchmark from the banks' true costs of borrowing (Mollenkamp, 2008). The WSJ article still leaves open the question of which banks are involved and what consequences to expect. Therefore, it is still difficult to draw a link between manipulation and potentially arising penalties reducing future dividends to investors. The next step of the analysis though concentrates on looking for information that suggest active involvement of the banks, such as for example the receipt of a subpoena or an individual mentioning by the press.

4.1.3.2. Point in Time When Banks were Associated with the Scandal

The first hint that authorities have started their investigation into the scandal was given in the annual report of the Swiss bank UBS published on 15 March 2011. Here the bank states that authorities from the US issued a summons on the bank and that Japanese institutions requested information concerning potential Libor manipulation by UBS on its own or together with competitors (UBS, 2011a, p. 318). The 15 March 2011 is therefore the day when investigations at UBS were made public. On the same day, the Financial times quotes insiders by mentioning that all of the US-Dollar Libor panel banks have been asked for information by investigators (Masters, Jenkins and Baer, 2011b). This however does not allow a conclusion which of the panel banks is suspected of rate manipulation. Just one day later the Financial Times published an article in which it mentions Bank of America, Citigroup and Barclays to have also been subpoenaed by regulators now also including the British FSA according to a secret source. Banks as well as authorities did not want to comment on these assertions (Masters, Jenkins and Baer, 2011a). On 24 March 2011 it is again the Financial Times that referring to insider states that Barclays is becoming more and more the prime suspect (Masters and Murphy, 2011). On 18.04.2011 the first lawsuit in relation to Libor became public. According to Bloomberg a number of banks including Bank of America, Barclays, Citigroup, Credit Suisse, Deutsche Bank, HSBC, JPMorgan Chase, Lloyds Bank, Norinchukin Bank, Royal Bank of Scotland, UBS and West LB were accused by several investment funds of Libor manipulation (Milford, 2011). A private company filing of a lawsuit however, does imply investigations and can therefore be seen as the point in time when all of those banks have actively been involved into the Libor scandal first. Additionally, a number of banks confirmed involvement in the now following weeks. Barclays plc (2011, p.7) confessed on 27 April 2011 in a management statement that it was under investigation by UK and US authorities. RBS (2011, p.86) admitted entanglement into the investigations a couple of days later, also through its first quarter management statement, released on 06.05.2018. Lloyds followed on Monday, the 16.05.2011 as stated by the Telegraph (Wilson, 2011).

Except of Société Générale and Rabobank, all of the banks that have been fined later on were associated with the investigations in spring 2011. One reason for Société Générale and Rabobank for not being

mentioned so far was that at first investigation focused on the US-Dollar Libor manipulation. Société Générale however is not part of the US-Dollar Libor panel as table I.1 reveals. It did not take long until regulators from all over the world, now also including the EU (Masters, Murphy and Binham, 2011), expanded their enquiry into the field of Yen Libor submission as first mentioned in the second quarter financial report of UBS AG from 26 July 2011 (UBS AG, 2011b, p. 86). But it took half a year until both banks were ensnared into investigations by the Swiss Competition Commission COMCO (2012), that revealed the beginning of own investigations into Yen Libor related misconduct on 03 February 2012.

By now a number of important dates regarding the Libor scandal have been identified. Primary motivation for this thesis is the question if the announcement of Libor related investigation or the publication of a Libor scandal related financial penalty imposed by regulators affect banks' stock prices. The second part of the thesis is devoted to this question.

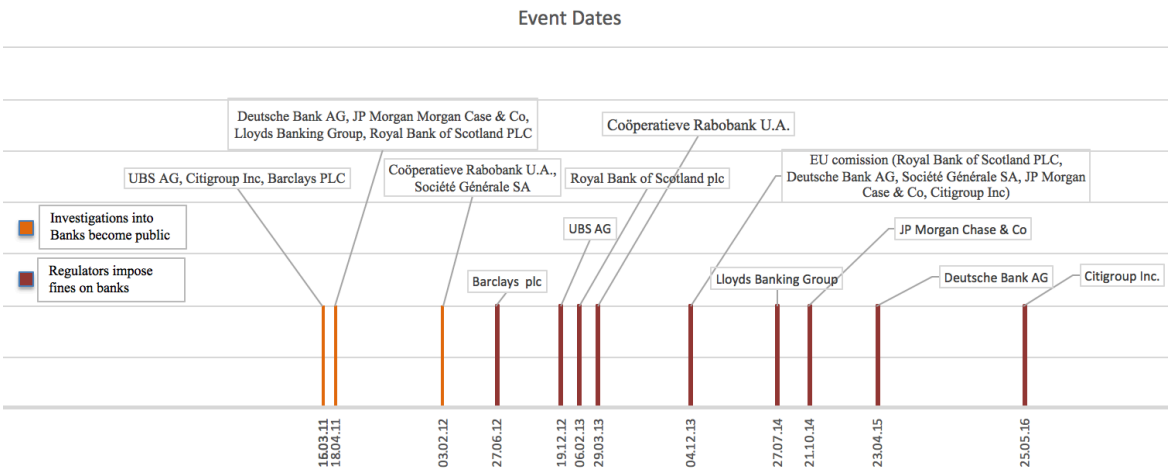
Part II – An Event Study Regarding the Impact of Financial Penalties

5. Effects on Stock Prices

To answer the previous question an event study is conducted, that first estimates the expected return, the company $i's$ stock performance $\widehat{r_{it}}$ that would have prevailed in absence of the event. In a second step this estimation is then compared to actual market data r_{it} to determine the abnormal returns AR_{it} (Benninga, 2014, p. 331)

(i) $$AR_{it} = \widehat{r_{it}} - r_{it}$$ [2]

The difference between both figures is considered to be the abnormal return (AR) that results from the event on previously specified dates. Graph V.1 summarizes the event dates of interest:



Graph V.1

[2] Originally, Benninga (2012, p. 334) refers to the formula as: $AR_{it} = r_{it} - (\alpha_i + \beta_i r_{MT})$ with the substrahend being the "Return predicted by the stocks' α, β and the market return"

The analysis will concentrate on changes in daily stock prices. Therefore, daily closing prices from the New York Stock Exchange, retrieved through Thomson Reuters Eikon, will be considered. Société Générale SA however, which is not listed in New York will be excluded from further consideration. Also, Coöperatieve Rabobank U.A, which as a cooperative bank does not have outstanding shares will not be analyzed either. Furthermore, the combined penalty imposed by the EU-commission on 04. December 2013 will not be considered, as all of the banks fined in the combined procedure also settled separately with other authorities. The event period examined will be the event date and the consecutive trading day to make sure that even events which occur after the closing of the market are priced in. This conduct appears especially rational, if time zone differences are considered. American authorities, that operate close to the east coast follow Eastern Standard Time (EST), that is lagged by 5 hours compared to the British Standard Time (timeanddate.com, 2018).

After presenting three different ways of estimating expected returns, it will be searched for a pattern regarding the appearance of abnormal returns during the different points in time identified in Part I of this thesis. Just after finding such a pattern, the ARs of the banks will be multiplied with the then current market cap of the previous closing of the companies to compare the market value lost due to the penalty with the fine itself. This will then allow an answer to the question posted at the end of part I.

5.1. Expected Return Estimation

According to Benninga (2014, pp. 332, 333) the basis of an event study forms the so-called estimation window, a period of time of normally one trading year or 252 days prior to the event window when the abnormal return is expected to occur. To estimate the stock prices that would have been realized if the scandal had not been disclosed, several methods can be used. Bhagat and Romano (2001, pp. 6, 7) mention both statistical as well as economic models to approach the issue. At first statistical methods will be considered.

5.1.1. Two-Factor Model (Model 1)

For the estimation window a regression is carried out that considers the daily return of both the company i and a broad market index over the year (Benninga, 2014, p. 333):

(i) $$r_{it} = \alpha_i + \beta_i r_{Mt} + e_{it}$$ [3]

With the coefficients and the data of the market indices on the days of the event it is then possible to estimate the return of the banks' stocks in the absence of the event for that particular point in time as depicted by formula (i). The model can be improved by also taking an industry specific index into account (Benninga, 2014, p. 350). This two-factor model helps to predict stock price movements reflected through the whole market and additionally through industry specific drivers. Benninga (2014, p. 350) provides a multiple regression model:

(ii) $$r_{it} = \alpha_i + \beta_{iM} r_{Mt} + \beta_{iI} r_{It} + e_{it}$$ [4]

Many books including Benninga (2014, p. 334) suggest among others the usage of the S&P 500 as a market index. But with the Libor scandal, a broad range of international banks is affected. Therefore,

[3] Originally, Benninga (2012, p. 333) refers to the formula as: $r_{it} = \alpha_i + \beta_i r_{Mt}$

[4] Originally, Benninga (2012, p. 333) refers to the formula as: $r_{it} = \alpha_i + \beta_{i,Market} r_{Mt} + \beta_{i,Industry} r_{Industry,t} + e_{it}$

the analysis concentrates on the MSCI ACWI Index that is comprised of small-, mid- and large-cap companies from industrialized and emerging countries around the world (MSCI, 2018a, p.2). With this, the index much better covers the market as a whole than the S&P 500 does. As an industry benchmark the MSCI International World Index for Banks will be used. This benchmark comprises financial institutions from as much as 23 developed countries and does therefore serve well to reflect the industries' market conditions and serves as a good proxy to cover stock price movements of the international banking sector (MSCI, 2018b, pp. 1, 2).

5.1.2. The Capital Asset Pricing Model (CAPM/Model 2)

With the Capital Asset Pricing Model (CAPM), Bhagat and Romano (2001, p. 7) present an economic model to estimate expected returns. According to Brealey, Myers and Allen (2017, p. 201) the basic of the CAPM is, that the risk premium and the beta of a stock are proportional. The risk premium referred to is the excess return of the stock r_i over the risk-free rate r_f (Brealey, Myers and Allen, 2017, p. 199). Beta (β_i) expresses the stock's contribution to the market risk (Brealey, Myers and Allen, 2017, p. 201). The model therefore uses the tradeoff of risk and return to determine a fair return. Beta is calculated by dividing the covariance of a stock i and the market by the variance of the market (Brealey, Myers and Allen, 2017, p. 183):

(iii) $\beta_i = \frac{\sigma_{iM}}{\sigma_M^2}$ [5]

Beside the risk premium and the company's beta, the formula of the CAPM given by Bhagat and Romano (2001, p. 7) further includes the risk-free rate r_f:

(iv) $r_{it} = r_f + \beta_i(r_{Mt} - r_f) + e_{it}$ [6]

To better understand the formula, it makes sense to look at the return of a secure government bond and a high-risk stock. With everything else being fixed it is the covariance of the asset with the market what matters. The covariance is defined as the product of the market's times the stock's standard deviation times the correlation coefficient. In the case of the secure government bond one of the three factors, the standard deviation of the secure paper, is zero. Therefore, β_i is zero as well and the expected return of the secure bond is the risk-free rate. In contrast the high-risk stock is quite volatile and has a high standard deviation driving up β_i. $\beta_i(r_{Mt} - r_f)$ is the risk premium an investor would demand in excess of the risk-free rate.

The CAPM however, builds on several assumption and simplifications of which the most important ones are the following. Individuals are rational price takers with uniform expectations, who act in an environment without transaction costs. Further, these individuals hold duplicates of the market portfolio, which they can individually combine with investments into the risk-free asset (Bodie, Kane, Marcus and Jain, 2014, p.291). Albrecht and Maurer (2008, pp. 303, 309) add that the market is assumed to be in equilibrium and that a risk-free investment opportunity r_f exists and is constant over time.

Following Benninga's (2014, p. 333) approach, the time period to estimate β_i will also be 252 days or one trading year prior to the event. Also, as with the previous model, the MSCI ACWI Index is used to

[5] Originally, Brealey, Myers and Allen (2017) refer to the formula as: $\beta_i = \frac{\sigma_{im}}{\sigma_m^2}$

[6] Originally, Bhagat and Romano (2001) refer to the formula as Rit =Rf+ßi *(Rmt -Rf) +eit

represent daily market movements. In reality a proxy has to be found for the rate r_f, which is risk-free in theory. As suggested by Brealey, Myers and Allen (2017, p. 198), U.S. treasury bills can be considered as nearly without default risk and serve therefore as an adequate proxy for this rate. In our analysis the 1-month U.S. Treasury bill over the period of 252 trading days prior to the event will be averaged and used as r_f.

The CAPM however, does not come without criticism. Apart from several assumptions that had to be established first, the CAPM fails to convince in practice due to the non-existence of adequate proxies for the market portfolio (Bodie, Kane, Marcus and Jain, 2014, p. 308). Further, tests with historical data does not persuade, especially when looking at more recent time periods (Brealey, Myers and Allen, 2017, pp. 203-204). Therefore, the literature often refers to another model that includes additional factors to come up with a more precise estimation for expected returns. The Fama-French Three-Factor Model.

5.1.3. The Fama-French Three-Factor Modell (FF3FM/Model 3)

Fama and French have sought for additional factors that might improve predictions of the CAPM and found that small firms outperform larger peers. Also, firms with a higher book-to-market ratio seem to provide consistently superior returns on average (Brealey, Myers and Allen, 2017, p. 209). Bodie, Kane, Marcus and Jain (2014, p. 345) suggest that the factors might proxy other unknown sources of risk to the company. The two additional components included into the model besides a factor reflecting the broad market movement hence are Small Minus Big (SMB) and High Minus Low (HML) (Bodie, Kane, Marcus and Jain, 2014, p. 345). According to the authors, Small Minus Big refers to the return of the of small companies compared to the return of large companies in the market. High Minus Low in contrast is the difference in return of companies with high to low bock-to-market ratio. The resulting formula for the model is provided by Bodie, Kane, Marcus and Jain (2014, p. 345).

$$\text{(v)} \qquad r_{it} = \alpha_i + \beta_{iM} r_{Mt} + \beta_{iSMB} SMB_t + \beta_{iHML} HML_t + e_{it}$$

Fama and French (1993, pp. 8, 9) first sorted the stocks by size. Then two groups were formed that split sorted firms at the median in big and small according to their market capitalization. Also, three firm categories of the lower 30%, the medium 40% and the upper 30% regarding their book-to-market ratio were established. The two categories combined give six different groups as for example the high book-to-market/small size portfolio. Fama and French (1993, pp. 8, 9) took the company's book and market value from the end of the year t-1 to form the book-to-market ratio to make sure that the market knew about the book equity figure of the previous year and the size component from June in year t.

Following Fama and French (1993, p. 9) the return of the three big size categories are then averaged and subtracted from the average return of the small size portfolios to obtain SMB. The two aggregated size portfolios are therefore relatively similar in terms of book-to-market ratio, which enables to focus only on size differences. Similarly, to obtain HML, returns from both low book-to-market portfolios are again averaged and then subtracted from the average of high book-to-market ratio portfolios. Here, the focus is only on the differences in the ratio of the book value to the market value, with both portfolios being relatively similar in size. Fama and French (1993, p. 10) further proxy the market factor with the risk premium of the market. The latter is based on the aggregated value weighted performance of all stocks r_M in excess over the U.S. 1-month treasury bill, which represents the risk-free rate r_f.

Due to data availability, for this approach of expected return estimation, the proxy for the market is not as previously the MSCI ACWI Index. Luckily Kenneth R. French maintains a website where he provides

a large set of data for $(r_M - r_f)$, SMB and HML on a daily basis at mba.tuck.dartmouth.edu (2018). The underlying stocks are a combination of all NYSE, AMEX and NASDAQ firms that provide the necessary data of market and book equity (mba.tuck.dartmouth.edu, 2018). Again, the estimation window will be one trading year or 252 days.

By now the thesis covered both, the event dates and the methods to investigate if abnormal returns have occurred. Further, the statistical significance of the abnormal returns is important. For this the thesis again orientates at Benninga's (2014, pp. 338, 339) approach described in his book Financial Modelling. Assuming a normal distribution in the residuals, he conducts a t-test to see if the single abnormal returns are significant. The thesis will do the same at a 5% level.

Further, it has to be mentioned, that With the MSCI ACWI, the MSCI International World Index for Banks and the combined market portfolio for the Fama-French-3-Factor-Model broad market indexes have been chosen. Due to the large amount of companies reflected by these indexes, the impact of stock price movements of banks on the indexes are expected to be minimal and are therefore neglected.

The following paragraphs focus on the abnormal return that resulted during the event windows. In this first step, there will not be a direct comparison between fines imposed and the market capitalization of the banks. Rather, the analysis first looks for consistent patterns regarding the ARs before conducting the comparison to the market capitalization in a second step. For this comparison, one has to consider some fundamental basics first. When buying a stock, the investor obtains the right to receive future dividend payments. The stock price therefore is the expected discounted value of these dividends (Brealey, Myers and Allen, 2017, p. 81). The money used to pay a regulatory fine cannot be given to the shareholders and should therefore curb all future dividend payments to investors by its own amount. Therefore, the company's market capitalization, the product of the share price times the number of shares outstanding (Brealey, Myers and Allen, 2017, p. 4) should decrease by as much as the fine. The thesis begins searching for ARs by concentrating on the event window when shareholders were informed about ongoing investigations against their banks.

5.2. Abnormal Returns When Investigations Became Public

The table below summarizes the findings of this section. Generally, information regarding the individual boxes can be found on the sides of the table. The box in the upper left corner for example belongs to an analysis of the UBS AG. For each company, there have been three separate estimations of abnormal returns following the models presented above. The 252 days estimation window has in all cases preceded the dates that can be found in Table V.1. The coefficients of determination relate to the models and the companies during the estimation window. The dates in the table mark the days t when the event occurred. The following trading day is referred to as t+1. Additionally, the table contains the realized returns of the companies on t and t+1 in the bottom and the market movement proxied by the MSCI ACWI in the upper right corner. Following Benninga, the level of significance is at a 5% level and is based on the residuals of the models over the estimation period. Table V.1,3,4,5 all follow a similar structure.

UBS AG	15.03.11	R^2	Abnormal Return t	Significance t/t+1	Abnormal Return t+1		t		t+1	Market index Return (ACWI)
	1. Two factor model	56.35%	1.24%	no/no	-0.27%	15.03.11	-2.25%	16.03.11	-0.75%	
	2. CAPM	53.49%	1.82%	no/no	-0.55%	16.03.11	-0.75%	17.03.11	1.28%	
	3. FF3FM	64.74%	-0.01%	no/no	1.25%	18.04.11	-1.59%	19.04.11	0.55%	
Barclays plc	16.03.11	R^2	Abnormal Return t	Significance t/t+1	Abnormal Return t+1	R^2	Abnormal Return t	Significance t/t+1	Abnormal Return t+1	Citigroup Inc.
	1. Two factor model	65.07%	-3.04%	no/no	-0.18%	65.07%	-3.04%	no/no	-0.18%	
	2. CAPM	59.13%	-3.72%	no/no	-1.08%	59.13%	-3.72%	no/no	-1.08%	
	3. FF3FM	66.4%	-1.31%	no/no	-1.27%	66.4%	-1.31%	no/no	-1.27%	
RBS plc	18.04.11	R^2	Abnormal Return t	Significance t/t+1	Abnormal Return t+1	R^2	Abnormal Return t	Significance t/t+1	Abnormal Return t+1	Deutsche Bank AG
	1. Two factor model	57.67%	0.91%	no/no	-1.01%	58.83%	-0.7%	no/no	-0.07%	
	2. CAPM	51.61%	0.96%	no/no	-1.63%	56.48%	-0.72%	no/no	-0.45%	
	3. FF3FM	58.67%	-0.13%	no/no	-1.49%	68.52%	-1.59%	no/no	-0.48%	
JP Morgan Chase & Co		R^2	Abnormal Return t	Significance t/t+1	Abnormal Return t+1	R^2	Abnormal Return t	Significance t/t+1	Abnormal Return t+1	Lloyds Banking Group
	1. Two factor model	38.45%	-0.29%	no/no	1.09%	55.5%	1.47%	no/no	-1.04%	
	2. CAPM	38.02%	-0.3%	no/no	0.96%	55.23%	1.53%	no/no	-1.58%	
	3. FF3FM	77.5%	-0.7%	no/no	1.19%	55.48%	0.5%	no/no	-1.52%	
Realized Returns	Date/Bank	UBS AG	Barclays PLC	Citigroup Inc.	RBS PLC	Deutsche Bank AG	JP Morgan Chase & Co		Lloyds Banking Group	
	t	-1.78%	-5.36%	-1.13%	-2.28%	-3.49%	-2.07%		-1.55%	
	t+1	-1.75%	1.72%	1.37%	-0.51%	0.51%	1.57%		-0.52%	

Table V.1

As Graph V.1 as well as the previous analysis suggests, the banks' active involvement into investigations was revealed on three different days with UBS AG being the first to mention a subpoena by regulators on 15 March 2011 (UBS AG, 2011a, p. 318). The two-factor model, the CAPM and the FF3FM manage to explain in excess of 50% of the variation of the Bank's stock price during the estimation period. By further looking at R^2, the FF3FM with nearly 65% of explained variation appears to be more precise than the other two models. Although, one might expect a highly negative abnormal return for UBS AG, being the first bank to be hit by the bad news, its realized return was with -1.78% only slightly negative on 15 March 2011. With that, UBS AG even outperformed the market that lost in excess of 2%. According to the CAPM and the two-factor model that solely build on market movements, the abnormal return of the bank was at 1.82% and 1.24% respectively. Only the FF3FM identifies a slightly negative abnormal return of -0.01%.

How can variation of ARs among the models be explained? Differences in the abnormal return come from divergent developments of the market proxies used. The ACWI Banking index and the ACWI MSCI lost -2.35% and -2.25% respectively. The solely US based market index of Fama and French in contrast just lost -1.05%. With all models assuming the banks stock price volatility to be stronger than the market volatility, they always predict higher absolute returns compared to the market. With the AR being the difference of this prediction and the realized return, the first two models provide positive abnormal returns. For model 3, this effect is mitigated due to a smaller absolute market change. Why did UBS's stock price not react stronger to the news? The media mentioned no other news published on this day that could have mitigated a more intense reaction. It is also unlikely that the market had already closed by the time the annual report containing the information was published. UBS AG is headquartered in central Europe and due to the time shift market closure in the United States is therefore in the late evening form a Swiss perspective. Divergent from the semistrong-form efficiency defined earlier, Investors might have needed some time to digest the information of involvement that was not easy to assess. But on the next trading day the situation did not change much. Again, UBS AG had a negative absolute stock price development of -1.75%. With the market performing better than on the previous day, the two factor-model and the CAPM now suggest a negative abnormal return of -0.27% and -0.55% respectively. The FF3FM model again diverges from the other models and prompts an 1,25% positive return, also due to market proxy differences. This first application of the semistrong-form efficiency hypothesis ends unsatisfactory with none of the abnormal returns being statistically significant on a 5% nor on a 10 % level.

On 16 March 2011, involvement of Citigroup Inc. and Barclays plc was published. In the case of Citigroup Inc., the R^2 for both the two-factor model and the CAPM go down to only 38%. SMB and HML seem to explain a great portion of the FF3FM model which remains at a relatively high 60% share of explained deviations to total deviation of stock price changes. Regarding potential abnormal returns, the picture again looks somewhat disappointing with none of the ARs of the models in t and t+1 even exceeding the absolute amount of 1% and not being significant either. In contrast, Barclays's performance on the 16. March 2011 seems to be more promising with a negative realized return of -5.36%. The models also manage to explain a greater part of the stock price deviation over the estimation period as previously for Citigroup. The CAPM has a R^2 of nearly 60% and the other two models even slightly exceed 65%. As the models account for the market movement, which has also been negative that day, the abnormal return melts to -3.04%, -3.72% and even a relatively mere -1.31% for the two-factor model, the CAPM and the FF3FM respectively. The differences among abnormal returns on day t are similar to those of UBS AG on day t+1, which also refer to 16 March 2011. The ARs of the first two models of Barclays plc are statistically significant at a 10 % level. But by looking at the daily press, it becomes clear that other factors than the scandal drove the drop in stock prices. According to the market report of the Press Association (PA), losses for Barclays are explained by Moody's lowering of the Portuguese debt rating, a market with strong exposure for Barclays plc (Williams and Crips, 2011). Interestingly on t+1, all of the models estimate a negative abnormal return ranging from -0.18% for model 1 over -1.08% for model 2 to -1.27% for model 3, although Barclays plc with 1.72% clearly outperformed the MSCI ACWI by 0.44% in realized terms. This might be a good opportunity to look deeper at Model 2 that only builds on the MSCI ACWI to understand what is going on. As mentioned earlier, the expected return estimation for this model results from the sum of the stock's risk premium and the average daily one-month-T-bill. The latter is very low due to the low-interest period and contributes just around 0.0008% to the expected returns of the companies in this part of the anlysis. More important is the risk premium $\beta_i(r_{Mt} - r_f)$. With a β_i of 1, the stock price estimation of the bank would always be the realized return of the market for model 2. For Barclays plc on t+1 AR would be 0 then. But with banks being normally considered as on average riskier than the market, β_i of banks is generally above 1. For this section β_i of the companies of interest ranges from 1.11 for JP Morgan up to 2.19 for Barclays, which implies that a Barclays investor should receive more than double the risk premium of the market for the risk they take. Therefore, according to model 2, the abnormal return is negative on t+1.

Further, during both days there was a high volatility in the Japanese market, driven by the earthquake on 11. March 2011 and the insecureness of the following days regarding the nuclear power plant Fukushima. The Business Times Singapore explains that Nikkei 225 Index fell by as much as 10.6 percent on 15 March 2011 (Quah, M., 2011). Williams and Crips (2011) mention that the Japanese Index went up by 6% the following day. This development in one of the world's biggest markets worried global investors. Fears of liquidity problems also strongly affected local operating banks (Quah, M., 2011). This might have diluted the results of the event study in the thesis for the two days with the banking sector being differently affected than the market as a whole.

Ongoing investigation into the remaining Banks important to this analysis, namely Deutsche Bank AG, JP Morgan Chase & Co, Lloyds Banking Group and Royal Bank of Scotland plc became publicly known on 18 April 2011, over one month after the catastrophe in Japan had commenced. But also, in the absence of this major event, no significant abnormal return occurred. Although all of the four banks lost between -1.6% and -3.5% in realized returns, most of this loss can be explained by broad market movements, which incurred a minus of -1.6% that day due to the first ever downgrade of the US by the rating company S&P (Agence France Presse, 2011a) and worries regarding Greece and Portugal in the context of the European debt crisis (Agence France Presse, 2011b). The industry index even went down by -

2.09% on that day. On day t however, abnormal returns ranged from a maximum of 1.53% for Lloyds Banking Group to a minimum of -1.59% for Deutsche Bank with none of the ARs being significant nor revealing a pattern in reactions to the involvement into investigations. If it were not for JPM, that incurred positive realized and abnormal returns, one could at the first glance assume that the investigations might have caused abnormal returns of the banks to be systematically negative on the following day. But with the US bank not following this pattern, stock price reactions of European banks were possibly rather due to the worsening of the European debt crisis.

Another interesting aspect however, can be found by taking a deeper look at the R^2. All of the European Banks have a R^2 in excess of 50% for each model. The American Bank's stock price movement however, can best be explained by the FF3FM with an astonishing R^2 of around 78% compared to relatively poor 38% for the other two models. This is reminiscent of what could be seen earlier in the case of Citigroup Inc.. Another explanation for the relative high R^2 of the FF3FM beside the size and the book-to-market factor takes into account that only American Banks show this anomaly. Probably stock price predication for US companies profits from the market proxy used. In the FF3FM model the market is represented by a combination of solely American stocks, whereas other models rely on a broader international market index. With the US banks being rather active in the North American market, movements of US indexes are closer to that of these large banks' stocks. Therefore, FF3FM may especially supports American stock price estimation.

This first part of the analysis casts doubts on the semistrong-form efficiency. Obviously, with ARs being positive on many occasion, the market did not immediately take the effects of Libor scandal involvement into account. At least it can be said, that no reliable pattern regarding the ARs could be identified so far. The analysis will therefore now concentrate on the days when the fines were imposed. The fines itself might come as a surprise to the investors, which could have triggered some abnormal losses for shareholders.

5.3. Abnormal Returns when Fines Became Public

The following table summarizes the fines imposed by both financial as well as cartel authorities that are interesting to the analysis. The calculated total of 8.5 billion US-Dollar includes fines against Rabobank, Société Générale and brokers as well as costs referring to the settlement of banks with the EU-Commission mentioned earlier. The single fines have been aggregated in USD following the historical exchange courses from XE Corporation (2018):

Financial Authority	Financial and Cartel Regulators/ Banks	Barclays plc	UBS AG	RBS plc	Lloyds Banking Group	Deutsche Bank AG	JP Morgan Chase & Co.	Citigroup Inc.
	Date	27.06.12	19.12.12	06.02.13	27.07.14	23.04.15		25.05.16
All Fines in Million USD	FSA/FCA	92.52	260.28	136.96	178.26	341.29	-	-
	CFTC	200	700	325	105	800	-	175
	DoJ	160	500	150	86	775	-	-
	Eidgenössiche Finanzaufsicht FINMA	-	64.69	-	-	-	-	-
	Openbaar Ministerie	-	-	-	-	-	-	-
	New York State Department of Financial Services	-	-	-	-	600	-	-
	European Commission	-	-	-	-	-	78.38	-
	Regulator's total fine	452.52	1524.97	611.96	369.26	2516.29	78.38	175
		Overall Total including Brokers, Rabobank, Societe Generale and the combined fine of the EU-Commission:						8966.82

Table V.2

On 27 June 2012 British and American regulators imposed their first fine in the context of the Libor scandal on Barclays plc. As depicted by Table V.2, which provides an overview of the banks and the financial authorities involved, the combined sum of the financial penalties levied on the bank was 452,5 million US-Dollar. As summarized by table V.3 below, the models used to explain expected returns all provide a relatively high R^2 of 71.87%, 68.83% and 75.22% for Model 1,2 and 3 respectively over the 252 trading days estimation period.

Barclays plc	27.06.12	R^2	Abnormal Return t	Significance t/t+1	Abnormal Return t+1		t		t+1	Market index Return (ACWI)
	1. Two factor model	71.87%	-1.82%	no/yes	-10.98%	27.06.12	0.92%	28.06.12	-0.22%	
	2. CAPM	68.83%	-1.13%	no/yes	-11.5%	19.12.12	0.15%	20.12.12	0.18%	
	3. FF3FM	75.22%	-1.28%	no/yes	-12.06%	06.02.13	0.15%	07.02.13	-0.45%	
UBS AG	19.12.12	R^2	Abnormal Return t	Significance t/t+1	Abnormal Return t+1	R^2	Abnormal Return t	Significance t/t+1	Abnormal Return t+1	RBS plc
	1. Two factor model	50.84%	-2.11%	no/no	-0.33%	50.96%	0.74%	no/no	-1.07%	
	2. CAPM	49.56%	-1.49%	no/no	-0.24%	43.7%	0.96%	no/no	-0.91%	06.02.13
	3. FF3FM	51.27%	-0.62%	no/no	-1.49%	41.82%	0.94%	no/no	-1.61%	
Realized Returns	Date/Bank	Barclays PLC		UBS AG		RBS PLC				
	t	1.31%		-1.19%		1.32%				
	t+1	-12.08%		0.12%		-1.95%				

Table V.3

On the day of the settlement the bank's stock first realized a positive return of 1.31%. Comparing the positive realized return of Barclays plc on day t with the expected return for this day however, Barclays plc had in fact a negative AR ranging from -1.13% to -1.82% depend on the model used. Considering the market benchmark return of 0.92% this result might be surprising but can again be explained by the CAPM-β of 2.7. The same logic can be applied to the models 1 and 3, that through their coefficients also account for the higher volatility of banks compared to the market. More interesting however, is the stock's performance on the following day. The stock plummeted by -12.08%. Also, when looking at the abnormal returns, the decrease in stock price of -10.98%, -11.5% and -12.06% is significant even at a 1% level for the Models 1, 2 and 3 respectively. Furthermore, no event occurred on that day that could have caused such a decrease in stock prices other than happenings in relation to the fine. By now one might assume that other banks that were to be fined by the financial regulators could incur similar losses. Interestingly, this does not prove to be true.

The next two banks to be sued for rate rigging were UBS AG on 19 December 2012 and the Royal Bank of Scotland on 06 February 2013. For both banks as depicted in table V.3 the fit of the models is not as good as in the case of Barclays plc. For UBS AG, all three approaches to expected return estimation exhibit an $R^2$of around 50%, for RBS only model 1 tackles the 50% threshold, whereas Model 2 and Model 3 have a lower R^2 of 43.7% and 41.82% respectively. The stock price loss for UBS AG on the day, the penalty was imposed was just -1.19%. The lowest abnormal returns estimated by the models is a minus of -2.11% provided by the two-factor model. Other as at Barclays, also in t+1 larger losses failed to materialize. In contrast, the realized stock price movement was even positive. Due to a slightly better market performance, the abnormal return was still negative ranging from -0.33% to -1.49%. RBS realized not only a return of 1.32% on the day of the settlement but also a positive AR of even close to 1% according to all models. With a minus of close to -2% on the following day, the stock price also turned negative similar to that of Barclays albeit by far not that significant. Also, abnormal returns were negative but similar to those of UBS AG not significant.

So why did RBS incur positive stock price movements after being fined by regulators? One reason could be that investors had initially expected the penalty to be higher. This view is supported by voices from the international press that assumes shareholder to be relieved after RBS received a far less severe penalty than UBS (Agence France Presse, 2013b). Table V.2 helps to compare the amounts the banks

had to pay. The fine of UBS AG totaled to 1.525 billion US-Dollar, whereas RBS were only fined 512 million US-Dollar. This however leaves one behind with another important question. When was the fine priced in that was expected to be higher? Obviously, there must have been a point in time other than those examined when shareholders considered effects of the scandal.

Graph V.1 reveals that after RBS has settled with the authorities, it would now be accounted for ARs of Rabobank and the combined fine of the EU-Commission if they had not been excluded from the analysis.[7] By now, there were only 4 parties left to settle with the American and British Financial regulators with the Lloyds Banking Group being the first one. As in the previous cases the following table depicts the findings:

Lloyds Banking Group	27.04.14	R^2	Abnormal Return t	Significance t/t+1	Abnormal Return t+1	R^2	Abnormal Return t	Significance t/t+1	Abnormal Return t+1	JP Morgan Chase & Co.
	1. Two factor model	29.84%	-0.01%	no/no	0.83%	41.67%	0.38%	no/no	-0.71%	
	2. CAPM	28.76%	-0.01%	no/no	0.92%	36.05%	0.52%	no/no	-0.63%	21.10.14
	3. FF3FM	35.26%	0.04%	no/no	1.36%	58.7%	-0.18%	no/no	-0.02%	
Deutsche Bank AG	23.04.15	R^2	Abnormal Return t	Significance t/t+1	Abnormal Return t+1	R^2	Abnormal Return t	Significance t/t+1	Abnormal Return t+1	Citigroup Inc.
	1. Two factor model	48.11%	0.08%	no/no	-0.66%	72.56%	-0.48%	no/no	-1.66%	
	2. CAPM	44.8%	-0.06%	no/no	-0.52%	60.24%	0.77%	no/no	-2.13%	25.05.16
	3. FF3FM	43.61%	0.49%	no/no	0.16%	73.05%	0.83%	no/no	-1.22%	
Realized Returns	Date/Bank	Lloyds Banking Group	JP Morgan Chase & Co.	Deutsche Bank AG	Citigroup Inc.		t		t+1	Market index Return (ACWI)
						28.07.14	0.01%	29.07.14	-0.19%	
						21.10.14	1.38%	22.10.14	-0.15%	
	t	0%	2.3%	0.59%	2.35%	23.04.15	0.34%	24.04.15	0.44%	
	t+1	0.58%	-0.83%	0.32%	-1.77%	25.05.16	0.94%	26.05.16	0.22%	

Table V.4

Also, this bank´s performance failed to deliver any significant results. The explanatory power of the models estimating the returns is relatively low over the estimation period with the Fama-French-3-Factor-Model being the most precise by providing an R^2 of 35.26%. On the day of the event Lloyds stock price performance stagnated at a 0% level. Quite similar to this the market did gain a mere 0.01%, resulting in only minimal abnormal returns of less than 0.05% in absolute terms for all of the three models. The consequent trading day either failed to deliver a negative AR. In contrast, due to the slight stock price improvement of the Banking Group by 0,58% and a negative market development, abnormal returns ranged from 0.83% for model 1 to 1.36% for model 3.

On 21 October 2014, JP Morgan Chase & Co. realized a return of 2.3%, when the market moved by just 1.38%. In contrast, on the following trading day, the market outperformed JPM by 0.68%. With 78.4 million US-Dollar, the smallest of all fines (see table V.2) against the biggest bank in the Libor panel, resulted in positive abnormal returns of 0.38% for Model 1, 0.52% for model 2 and -0.18% for model 3 on day t. Similar to those of the first day, all abnormal returns on the second day were negative but not significantly different from 0 with ARs ranging from -0.02% to -0.71%. As typical for the US banks, the FF3FM seems to be most promising regarding the R^2 with 58.7% compared to 41.67% and 36.05% of the other models 1 and 2. Over the two days, the company's stock price movement primarily reflected the general market development which is not surprising bearing in mind the size of the company compared to the fine. Also, it was nothing new to shareholders of JP Morgan to pay enormous financial penalties. An example is a 13 billion US-Dollar settlement it the previous year according to the Wall Street Journal (Barrett, Fitzpatrick, 2013).

The results from the analysis of the second last Bank that is subject to this part of the event study, Deutsche Bank AG, can also be found in table V.4. On the first and second day of the event window,

[7] Results regarding the EU-Commission's fine are attached to this thesis in table A.1

the market index gained 0.34% and 0.44% and the Bank's stock price 0.59% and 0.32% respectively. The R^2s of the models are with 44.8% for the CAPM and 48.11% for the two-factor model reflecting a characteristic that has been observable throughout the whole analysis. Due to the fact that with the industry index an additional factor other than the market index helped to explain variation in model 1, the coefficient of determination is always larger for model 1 than it is for model 2. By further concentrating at the ARs it can be noticed that on the first day abnormal returns were only marginally different from 0 for model 1 and 2. The Fama-French-3-Factor-model in contrast reveals a positive AR of around 0.5%. On the second day although negative for model 1 and 2 with -0.66% and -0.52% respectively, abnormal returns failed to capture the massive fine that totaled to above 2.516 Billion US-Dollar according to table V.2. One could argue that the market had already priced in the fine prior to the event. What again casts doubt on the market efficiency however, is that according to the press the penalty was higher than expected. The Stuttgarter Zeitung stresses that provisions and estimations regarding the impact of this financial obligation and other litigation expenses was only as much as 1.5 billion Euro for the period (Schäder, 2015).

Solely fined by the CFTC, Citigroup realized a return of 2.35% on the day of the imposition of the fine and -1.77% on the next day, while the market moved by 0.94% and 0.22%. Although looking at a US bank, the coefficient of determination was quite high this time for all of the three models with a R^2 ranging from 60.24% to 73.05%. Abnormal returns on day t were positive for model 2 and 3 with 0.77% and 0.83% and were with this quite substantially different from the two-factor model's performance of -0.48%. This provides a good opportunity to take a closer look at model 1. The two-factor model considers not just market movements, but also industry related developments. The model works especially well if the whole banking sector is influenced by news that only marginally affect the market. By increasing by 2.13% on that day, The MSCI International World Index for Banks supports this theory. According to the Agence France Presse (2016a) hopes of a new Fed rate increase that would allow banks to pass on higher rates to consumers triggered this banking index movement. Apparently, this news is much more important for banks than it is for the market as a whole. Abnormal returns on day t+1 were ranging up to -2.13% in the case of model 2. Agence France Presse (2016b) however stated, that several US banks including Citi, JPM and Bank of America all incurred losses on this day and indicated that this might be due to corrections after a previous two-day rally.

Also, for this section no clear pattern in ARs could be identified. As suggested by the media as a reaction to the positive abnormal return of RBS, there must be another point in time when the market realized the negative effects of involvement into the Libor scandal. Barclays plc was the first bank to settle with the regulators and the only company to have significantly negative abnormal returns disregarding of the model used on t+1. It might make sense to take a look at the stock price developments of its competitors on this day.

5.4. Abnormal Returns of All Banks When Barclays was Fined

So far neither of the two previous event categories has delivered consistent results. But when looking closer at 28 June 2012 it becomes clear that all of the other banks under consideration also had highly negative returns on the day after Barclays's settlement.

UBS AG	28.06.12	R^2	Abnormal Return t+1	Significance t+1	R^2	Abnormal Return t+1	Significance t+1	Citigroup Inc.
	1. Two factor model	54.14%	-1.77%	no	62.07%	-2.06%	no	
	2. CAPM	53.99%	-1.95%	no	62.05%	-2.15%	no	
	3. FF3FM	66.36%	-2.39%	no	82.83%	-3.04%	yes	
RBS plc	0	R^2	Abnormal Return t+1	Significance t/t+1	R^2	Abnormal Return t+1	Significance t/t+1	Deutsche Bank AG
	1. Two factor model	64.53%	-8.72%	yes	69.61%	-2.93%	no	
	2. CAPM	60.38%	-9.42%	yes	66.46%	-3.54%	no	
	3. FF3FM	64.17%	-9.9%	yes	70.44%	-4.02%	no	
JP Morgan Chase & Co	0	R^2	Abnormal Return t+1	Significance t/t+1	R^2	Abnormal Return t+1	Significance t/t+1	Lloyds Banking Group
	1. Two factor model	54.21%	-2.08%	no	61.23%	-2.45%	no	
	2. CAPM	54.13%	-2.11%	no	57.26%	-3.1%	no	
	3. FF3FM	81.93%	-2.99%	yes	58.55%	-3.4%	no	
Realized Returns	Date/Bank	UBS AG	Citigroup Inc.	RBS PLC	Deutsche Bank AG	JP Morgan Chase & Co	Lloyds Banking Group	Market Index Return (ACWI)
	t+1	-2.35%	-2.62%	-9.96%	-4.08%	-2.45%	-3.61%	-0.22%

Table V.5

Table V.5 summarizes the stock price development of the other banks on the day when shareholders of Barclays reacted to the fine imposed on their company. Without exception, all returns of the banks were negative. In terms of realized returns RBS was hit hardest, closing at approximately -10% lower than on the previous day. Further, its peers that are headquartered within the European Union seem to have suffered more than Swiss and American competitors with Lloyds and Deutsche Bank losing -3.61% and -4.08% respectively. The other three banks, UBS AG, Citigroup Inc. and JP Morgan Chase & co. were negatively affected by around -2.5%. The R^2s of all banks throughout for models are well above 50% and generally higher than during the estimation periods prior to the other event dates. Worth mentioning is the high goodness of fit of the FF3FM for the American banks Citigroup and JP Morgan with 82.83% and 81.93% respectively. Although market movements mitigated the abnormal compared the realized returns, still, they stayed negative as well. For RBS all ARs and for Citi and JP Morgan those that relate to the FF3FM were statistically significant negative on a 5% level. Unluckily, the international press reveals that there have also been other factors than the Libor scandal causing the US banks to lose shareholder value. According to ICN.com (2012), JP Morgan had a negative return due to losses from credit derivative trading that also affected the share price of Citigroup. Here it is questionable to what extend losses can be attributed to Libor manipulation. In contrast, losses of the other banks are clearly linked to the Libor scandal (Agence France Presse, 2012).

This last event window reveals a consistent pattern among the banks regarding the occurrence of abnormal returns. It seems that there has been additional information linked to the fine imposed on Barclays that let other banks reassess the Libor scandal's impact on their future earnings. In the following section the abnormal returns of the banks from 28 June 2012 will be compared with their market capitalization.

5.5. Comparison of Abnormal Returns and the Market Capitalization of the Banks

As in the previous section it makes sense to account for movements of the broad market and for other factors that might drive not fine related stock price changes. Therefore, not the changes in market capitalization based on the realized returns, but rather on the abnormal returns are important to the analysis. Bloomberg does only provide daily market cap data for the period of five years back from now. Beyond this time there is only weekly data available. Therefore, the number of outstanding shares of the beginning of a week is assumed not to change through the course of a seven-day period. As an effect, the market capitalization is assumed to be only driven by stock price changes for these short intervals. To obtain the figures of interest at time t, the abnormal return on t is multiplied with the market capitalization of the previous closing. For the sake of clarity, the focus will from now on be on the FF3FM only for which the average R^2 over the estimation periods was highest among all models.

Already small abnormal returns result in considerable changes in market capitalization. This is due to the large market cap the prime banks in the Libor panel have. As of 27 June 2012, the day when Barclays plc was fined, all of the seven banks considered had a market cap that exceeded the amount of 30 billion US-Dollar as Table V.6 shows.

27.06.12	Barclays plc	UBS AG	RBS plc	Lloyds Banking Group	Deutsche Bank AG	Citigroup Inc.	JP Morgan Chase & Co
Market Cap End of Day in Billion USD	37.42	43.99	41.35	33.98	32.83	79.46	140.01

Table V.6

The leading banks in terms of size come from the US with Citi and JP Morgan exceeding 79 billion US-Dollar and 140 billion US-Dollar.

Table V.7 concentrates on the 28 June 2012, the day after financial regulators had levied the first fine against Barclays plc. Further it just considers the banks that were not affected by events other than the Libor scandal, therefore excluding Citigroup Inc. and JP Morgan Chase & Co. Two out of five companies, namely Barclays plc and the Royal Bank of Scotland had negative statistically significant abnormal returns on this day. The other three Banks, Deutsche Bank AG, Lloyds Banking Group and UBS AG, did also have highly negative returns. The market capitalization lost by these banks on this day is presented in Table V.7.

28.06.12	Barclays	UBS	RBS	Lloyds	Deutsche Bank	Total:
Change in Market Cap Based on Abnormal	-4,512.75	-1,049.76	-4,095.36	-1,155.75	-1,320.15	-12,133.77

Table V.7

Barclays alone lost in excess of 4.5 billion in share price value. Compared to the height of the fine of 453 million US-Dollar (see table V.2), this reaction seems to be quite intense. Although not being directly affected by the penalty, RBS also lost a similar amount in relation to the event. Altogether, the event caused the share price of banks to decline by as much as 12 billion US-Dollar. When considering Citigroup and JP Morgan, it even 18.7 billion US-Dollar were lost.[8] This shows, that penalties imposed by regulators do have a strong impact on shareholders.

[8] The table V.7 including Citigroup and JP Morgan is attached to the thesis in table A.2

The now resulting question however is why the AR of Barclays was that well in excess of the financial penalty and which of these drivers also affected RBS and the other European banks causing such a huge destruction of market capitalization.

5.6. Reasons for Stock Price Reactions on the Day Following Barclay's Settlement

5.6.1. Barclays Stock Price Movement on 28.06.2012

There are several reasons that might explain Barclays stock price reaction on an individual level.

Firstly, the fine itself. The reaction of the other banks that did not receive a financial penalty shows that the market had not adequately priced in the involvement into investigations. Therefore, with Barclays being the first bank fined in relation to the Libor process, shareholders have possibly not expected the finical penalty to be imposed at all or to be that high. The FSA (2012) states in their press release that by this point in time, the fine imposed on Barclays was the highest in history.
Secondly, according to Citywire (2012) analysts estimated that Barclays would have to cope with high future litigation costs. The costs might mount up to sums well above the 452 million US-Dollar fine. Shareholders were possibly driven by this fear when assessing the fine's impact on the stock. Thirdly, another explanation of why the stock price of the British bank decreased by more than 12% certainly comes from personnel consequences that were discussed on the day following the settlement. According to Citywire (2012), Bob Diamond, CEO of Barclays was likely to be made responsible for the scandal that unfolded under his leadership. George Osborne, previous Chancellor of the Exchequer, also put additional pressure on Barclays and Diamond, when speaking in front of the parliament on 28.06.2012 (Citywire, 2012). Martin Taylor a previous CEO of Barclays attributed the success of the bank in the 2000s partly to Diamond`s leadership (Barr, 2012). A resignation of the CEO might has therefore not been in the interest of the shareholders.

5.6.2. Explanation for the Stock Price Movement of all Banks involved

Other reasons rather apply to all of the banks that have experienced negative stock price movements.

As indicated above, the market participants were apparently unable to estimate the effect of being a suspect in the Libor rate fixing scandal. The fine imposed on Barclays has possibly signaled other market participants who had also been under the regulators' microscope, that there were soon similar penalties to expect. Following Blend and Goodway (2012) those penalties were even anticipated to be higher, as regulators took into account Barclays's meaningful cooperation during the investigation.
Also, all banks involved into the Libor scandal incurred a substantial loss of reputation with the scandal unfolding in a time when markets were still sensitive to banking news due to the financial crisis. With reputation being an important component for doing business in this industry, some of the reduction in share price might be related to this factor. To make matters worse for banks the international press cited and spread embarrassing conversations among employees, previously revealed through the regulators. The British newspaper Daily Mail for example wrote on 28 June 2012: "What is perhaps most damaging to Barclays is the barrow boy' style language used by the traders […] calling each other dude' and chicken' and promising bottles of Bollinger for being let in on the scam." (Brummer, 2012)

The following conclusion will first sum up the findings of the thesis by drawing a conclusion regarding the efficient market hypothesis and the effect of fines as a tool for financial regulation. Then, finally, a short assessment regarding the future of the rate will be given.

6. Conclusion

The thesis lets the reader draw some very interesting conclusions concerning the efficient market hypothesis. Other than implied by the semistrong-form efficiency, the market did not show any clear reactions when involvement of a bank into the scandal was revealed. Also, over the months following the initial publication by UBS AG, when international press brought a lot of attention to the Libor scandal, markets failed to assess the consequences of the scandal. This could be seen by the heavy stock price reaction of Barclays plc and its competitors on the day after the British bank had been fined. From this day onwards however, the findings in combination with the other financial penalties seem to be mostly in line with the theory. The absence of any further systematic negative stock price movement shows that all following penalties have been adequately priced in prior to the settlements. What appears puzzling however, is that there was no stronger reaction to the Deutsche Bank AG's penalty although it was substantially higher than expected. The reaction of Barclays's peers on 28 June 2012 shows that only then, when negative developments for the British competitor materialized, shareholders of the other banks were able to account for the implications of the scandal. This reveals the inability of market participants to draw conclusion from information that they cannot easily assess and therefore limits the impact radius of the semistrong-form of the Efficient Market Theory.

The analysis furthermore showed how well financial fines help to penalize internationally operating companies. The impact of such a fine is not limited to its direct reduction of shareholder value, but implies a series of inconvenient consequences such as the shareholders' fear of further litigation, political pressure on key personalities to resign or a substantial reputational loss. The time following the settlement of Barclays showed that the market's assessment on that day was quite right. Barclays CEO, Bob Diamond, resigned only a couple of days later (Colchester and Schaefer Muñoz, 2012). Also, as mentioned in Part I of this thesis further private lawsuits against Barclays and other banks were filed later on.

The thesis has revealed some of the major shortcomings of the Libor as a benchmark rate. The future of the Libor has therefore been discussed since the scandal unfolded many years ago. Additionally, according to Andrew Bailey, current CEO of the FCA, Libor as a benchmark is even less suitable than it was prior to and during the scandal. Banks more and more rely on expert judgement when making submissions as borrowing and lending became less frequent in the unsecure inter-banking market (fca.org.uk., 2017). But still, as of today, in excess of 370 trillion US-Dollar are referenced to the rate (Harris, 2018). Baileys assumes that a shift to another benchmark would take in excess of four to five years and therefore agreed with panel banks to maintain Libor until the end of 2021 (fca.org.uk., 2017). According to Bloomberg the Secured Overnight Funding Rate (SOFR) is the most promising alternative to the Libor (Harris, 2018). SOFR is published since 03 April 2018 and is based on the treasury repo market (Brettell, 2018). According to Reuters, a number of other benchmarks that could replace Libor as well have been selected by a range of councils and committees around the world (Brettell, 2018). Time will tell if any or even several of these reference rates will finally substitute the London Interbank Offered Rate or if Libor might continue to be the most important reference rate in the world.

References

Annual/Interim Reports

Barclays plc, (2011). Barclays PLC - Interim Management Statement. [Online]. Available from: https://www.home.barclays/content/dam/barclayspublic/docs/InvestorRelations/ResultAnnouncements/2011Q1IMS/Q1-2011-Interim-Management-Statement-IMS.pdf [Accessed on 24 April 2018]

Royal Bank of Scotland plc, (2011). Q1 Interim Management Statement. [Online]. Available from: https://investors.rbs.com/~/media/Files/R/RBS-IR/Archived/q1-ims-2011.pdf [Accessed on 24 April 2018]

UBS AG, (2011a). Annual Report 2010. [Online]. Available from: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwigj4PFyNXaAhXEB5oKHYd5AUkQFggqMAA&url=https%3A%2F%2Fwww.ubs.com%2Fglobal%2Fen%2Fabout_ubs%2Finvestor_relations%2Fannualreporting%2Farchive%2F_jcr_content%2Fpar%2Faccordionbox_c1db%2Fteaserbox_e506%2Fteaser_87c2%2Flinklist%2Flink_7b5c.1396496368.file%2FbGluay9wYXRoPS9jb250ZW50L2RhbS91YnMvZ2xvYmFsL2Fib3V0X3Vicy9pbnZlc3Rvcl9yZWxhdGlvbnMvMTg5MTcyX0FSMjAxMF9lLnBkZg%3D%3D%2F189172_AR2010_e.pdf&usg=AOvVaw1m_h-SdGF-jpLiqxU5eBy5 [Accessed on 24 April 2018]

UBS AG, (2011b). Second Quarter 2011 Report. [Online]. Available from: https://www.ubs.com/global/de/about_ubs/investor_relations/quarterly_reporting/2011/_jcr_content/par/table.1456867909.file/dGFibGVUZXh0PS9jb250ZW50L2RhbS91YnMvZ2xvYmFsL2Fib3V0X3Vicy9pbnZlc3Rvcl9yZWxhdGlvbnMvMlExMV9GaW5hbmNpYWxfUmVwb3J0X1VCUy5wZGY=/2Q11_Financial_Report_UBS.pdf [Accessed on 27 April 2018]

Books

Albrecht, P., Maurer, R. (2008). Investment- und Risikomanagement. 3rd revised ed. Stuttgart: Schäffer-Poeschel Verlag

Benninga, S. (2014). Financial Modelling. 4th ed. Cambridge: The MIT Press

Bodie, Z., Kane, A., Marcus, A. and Jain, R. (2014). Investments. Asia Global ed. New York: McGraw-Hill Education Holdings, LLC.

Brealey, R., Myers, S. and Allen, F. (2017). Principles of Corporate Finance. 12th ed. New York: McGraw-Hill Education

Institutions:

British Bankers' Association, (2008). Understanding the construction and operation of BBA LIBOR – strengthening for the future. [Online]. Available from: https://assets.documentcloud.org/documents/403811/bba-libor-report-june-2008.pdf [Accessed on 30 April 2018]

Intercontinental Exchange, Inc, (ICE), (2017). Libor:
Frequently asked Questions. ICE Benchmark Administration. [Online]. Available from: https://www.theice.com/publicdocs/IBA_LIBOR_FAQ.pdf [Accessed on 05 April 2018]

Intercontinental Exchange, Inc. (ICE), (2014). Position Paper on the Evolution of ICE Libor. ICE Benchmark Administration [Online]. Available from: https://www.theice.com/publicdocs/ICE_LIBOR_Position_Paper.pdf [Accessed on 05 April 2018]

MSCI, (2018a). ACWI. [Online]. Available from: https://www.msci.com/documents/1296102/1362201/MSCI-MIS-ACWI-May-2018.pdf/2eda5573-4e0c-56f9-b3ca-d6b3eb3552e7 [Accessed on 15 April 2018]

MSCI. (2018b). MSCI WORLD BANKS INDEX (USD). [Online]. Available from: https://www.msci.com/documents/10199/5aba8305-c399-4057-8159-3c96eb30c3ef [Accessed on 15 April 2018]

Jurisdiction/ Regulators

Commodity Futures Trading Commission (United States of America), (2012a). ORDER INSTITUTING PROCEEDINGS PURSUANT TO SECTIONS 6(c) AND 6(d) OF THE COMMODITY EXCHANGE ACT, AS AMENDED, MAKING FINDINGS AND IMPOSING REMEDIAL SANCTIONS. Washington, DC. Release Number: 6289-12. [Online]. Available From: https://www.cftc.gov/sites/default/files/idc/groups/public/@lrenforcementactions/documents/legalpleading/enfbarclaysorder062712.pdf [Accessed on 10 April 2018]

Commodity Futures Trading Commission (United States of America), (2012b). ORDER INSTITUTING PROCEEDINGS PURSUANT TO SECTIONS 6(c) AND 6(d) OF THE COMMODITY EXCHANGE ACT MAKING FINDINGS AND IMPOSING REMEDIAL SANCTIONS. Washington, DC. Release Number: 6472-12. [Online]. Available from: https://www.cftc.gov/sites/default/files/idc/groups/public/@lrenforcementactions/documents/legalpleading/enfubsorder121912.pdf [Accessed on 11 April 2018]

Commodity Futures Trading Commission (United States of America), (2013a). ORDER INSTITUTING PROCEEDINGS PURSUANT TO SECTIONS 6(c) AND 6(d) OF THE COMMODITY EXCHANGE ACT, MAKING FINDINGS AND IMPOSING REMEDIAL SANCTIONS. Washington, DC. Release Number: 6510-13. [Online]. Available from: https://www.cftc.gov/sites/default/files/idc/groups/public/@lrenforcementactions/documents/legalpleading/enfrbsorder020613.pdf [Accessed 13 April 2018]

Commodity Futures Trading Commission (United States of America), (2013b). ORDER INSTITUTING PROCEEDINGS PURSUANT TO SECTIONS 6(c) AND 6(d) OF THE COMMODITY EXCHANGE ACT MAKING FINDINGS AND IMPOSING REMEDIAL SANCTIONS. Washington, DC. Press Release Number: 6708-13. [Online]. Available from: https://www.cftc.gov/sites/default/files/idc/groups/public/@lrenforcementactions/documents/legalpleading/enficaporder092513.pdf [Accessed on 16 April 2018]

Commodity Futures Trading Commission (United States of America), (2013c). ORDER INSTITUTING PROCEEDINGS PURSUANT TO SECTIONS 6(c) AND 6(d) OF THE COMMODITY EXCHANGE ACT MAKING FINDINGS AND IMPOSING REMEDIAL SANCTIONS. Washington, DC. Release Number: 6752-13. [Online]. Available from: https://www.cftc.gov/sites/default/files/idc/groups/public/@lrenforcementactions/documents/legalpleading/enfrabobank102913.pdf [Accessed on 16 April 2018]

Commodity Futures Trading Commission (United States of America), (2014a). ORDER INSTITUTING PROCEEDINGS PURSUANT TO SECTIONS 6(c) AND 6(d) OF THE COMMODITY EXCHANGE ACT MAKING FINDINGS AND IMPOSING REMEDIAL SANCTIONS. Washington, DC. Release Number: 6930-14. [Online]. Available from:

https://www.cftc.gov/sites/default/files/idc/groups/public/@lrenforcementactions/documents/legalpleading/enfrpmartinorder051514.pdf [Accessed on 17 April 2018]

Commodity Futures Trading Commission (United States of America), (2014b). ORDER INSTITUTING PROCEEDINGS PURSUANT TO SECTIONS 6(c) AND 6(d) OF THE COMMODITY EXCHANGE ACT, MAKING FINDINGS, AND IMPOSING REMEDIAL SANCTIONS. Washington, DC. Release Number: 6966-14. [Online]. Available from: https://www.cftc.gov/sites/default/files/idc/groups/public/@lrenforcementactions/documents/legalpleading/enflloydsorderdf072814.pdf [Accessed on 18 April 2018]

Commodity Futures Trading Commission (United States of America), (2015a). Deutsche Bank to Pay $800 Million Penalty to Settle CFTC Charges of Manipulation, Attempted Manipulation, and False Reporting of LIBOR and Euribor. Washington, DC. Release Number: 7159-15. [Online]. Available from: https://www.cftc.gov/PressRoom/PressReleases/7159-15 [Accessed on 19 April 2018]

Commodity Futures Trading Commission (United States of America), (2015b). ORDER INSTITUTING PROCEEDINGS PURSUANT TO SECTIONS 6(c) AND 6(d) OF THE COMMODITY EXCHANGE ACT, MAKING FINDINGS, AND IMPOSING REMEDIAL SANCTIONS. Washington, DC. Release Number: 7159-15. [Online]. Available from: https://www.cftc.gov/sites/default/files/idc/groups/public/@lrenforcementactions/documents/legalpleading/enfdeutscheorder042315.pdf [Accessed on 19 April 2018]

Commodity Futures Trading Commission (United States of America), (2016). ORDER INSTITUTING PROCEEDINGS PURSUANT TO SECTIONS 6(c) AND 6(d) OF THE COMMODITY EXCHANGE ACT, MAKING FINDINGS AND IMPOSING REMEDIAL SANCTIONS. Washington, DC. Release Number: 7372-16. [Online]. Available from: https://www.cftc.gov/sites/default/files/idc/groups/public/@lrenforcementactions/documents/legalpleading/enfcitibankliborder052516.pdf [Accessed on 22 April 2018]

Competition Commission (Swiss), (2012). COMCO opens investigation against banks. Bern. Press Release. [Online]. Available from: https://www.weko.admin.ch/weko/en/home/latest-news/press-releases/nsb-news.msg-id-43321.html [Accessed on 25 April]

Eidgenössiche Finanzaufsicht FINMA (Switzerland), (2012). FINMA Investigation into the Submission of Interest Rates for the Calculation of Interest Reference Rates such as LIBOR by UBS AG, FINMA Summary Report UBS LIBOR. Bern. [Online]. Available at: https://www.finma.ch/en/~/media/finma/dokumente/dokumentencenter/8news/20121219-summary-report-ubs-libor.pdf?la=en [Accessed on 12 April 2018]

European Commission (Belgium), (2013). AMENDED1 - Antitrust: Commission fines banks € 1.49 billion for participating in cartels in the interest rate derivatives industry. Brussels. Press Release IP/13/1208. [Online]. Available from: http://europa.eu/rapid/press-release_IP-13-1208_en.htm [Accessed on 17 April 2018]

European Commission (Belgium), (2014). Antitrust: Commission settles RBS-JPMorgan cartel in derivatives based on Swiss franc LIBOR; imposes € 61.6 million fine on JPMorgan. Brussels. Press Release IP-14-1189. [Online]. Available from: http://europa.eu/rapid/press-release_IP-14-1189_en.htm [Accessed on 27.05.2018]

European Commission (Belgium), (2015). Antitrust: Commission fines broker ICAP € 14.9 million for participation in several cartels in Yen interest rate derivatives sector. Brussels. Press Release: IP/15/4104. [Online]. Available from: http://europa.eu/rapid/press-release_IP-15-4104_en.htm [Accessed on 22 April 2018]

European Commission (Belgium), (2016). Ententes: amende modifiée pour Société Générale pour sa participation dans le cartel des produits dérivés de taux d'intérêts en euros [MIS A JOUR]. Brussels. Daily News 06/04/2016. [Online]. Available from: http://europa.eu/rapid/press-release_MEX-16-1281_en.htm? [Accessed on 16 April 2018]

Federal Reserve Bank of New York (United States of America), (2007). "August 28, 2007,: mass distribution e-mails:". Redacted by Barclays. New York. [Online]. Available from: https://www.newyorkfed.org/medialibrary/media/newsevents/news/markets/2012/libor/August_28_2007_mass_distribution_emails.pdf [Accessed on 9 April 2018]

Federal Reserve Bank of New York (United States of America), (2008) "April 11, 2008: transcript of phone call between Barclays employee and analyst in the Markets Group of the New York Fed". Redacted by Barclays. New York. [Online]. Available from: https://www.newyorkfed.org/medialibrary/media/newsevents/news/markets/2012/libor/April_11_2008_transcript.pdf [Accessed on 9 April 2018]

Federal Reserve Bank of New York (United States of America), (2012a). Explanatory Note. New York. [Online]. Available from: https://www.newyorkfed.org/medialibrary/media/newsevents/news/markets/2012/libor/explanatory_note.pdf [Accessed on 9 April 2018]

Financial Conduct Authority (United Kingdom), (2013b). Final Notice. London. FCA Reference Number: 188984. [Online]. Available from: https://www.fca.org.uk/publication/final-notices/icap-europe-limited.pdf [Accessed on 16 April 2018]

Financial Conduct Authority (United Kingdom), (2013c). Final Notice. London. FCA Reference Number: 171596. [Online]. Available from: https://www.fca.org.uk/publication/final-notices/rabobank.pdf [Accessed on 16 April 2018]

Financial Conduct Authority (United Kingdom), (2014a). Final Notice. London. FCA Reference Number: 187916. [Online]. Available from: https://www.fca.org.uk/publication/final-notices/martin-brokers-uk-ltd.pdf [Accessed on 17 April 2018]

Financial Conduct Authority (United Kingdom), (2014b). Final Notice. London. FCA Reference Number: 119278 and 169628. [Online]. Available from: https://www.fca.org.uk/publication/final-notices/lloyds-bank-of-scotland.pdf [Accessed on 18 April 2018]

Financial Conduct Authority (United Kingdom), (2015). Final Notice. London. FCA Reference Number: 150018. [Online]. Available from: https://www.fca.org.uk/publication/final-notices/deutsche-bank-ag-2015.pdf [Accessed on 19 April 2018]

Financial Service Authority (United Kingdom), (2012a). Final Notice. London. FSA Reference Number: 122702. [Online]. Available from: http://www.fsa.gov.uk/static/pubs/final/barclays-jun12.pdf [Accessed on 05 April 2018]

Financial Service Authority (United Kingdom), (2013a). Final Notice. London. FSA Reference Number: 121882. [Online]. Available from: http://www.fsa.gov.uk/static/pubs/final/rbs.pdf [Accessed on 13 April 2018]

Financial Services Authority (United Kingdom), (2012b). Final Notice. London. FSA Reference Number: 186958. [Online]. Available from: http://www.fsa.gov.uk/static/pubs/final/ubs.pdf [Accessed on 12 April 2018]

General Court of the European Union (Luxembourg), (2017). The EU General Court annuls in part the Commission's decision against the Icap Group in the cartels relating to Yen interest rate derivatives.

Luxembourg. Press Release: No 118/17. [Online]. Available from: https://curia.europa.eu/jcms/upload/docs/application/pdf/2017-11/cp170118en.pdf [Accessed on 22 April 2018]

New York State Department of Financial Services (United States of America), (2015). CONSENT ORDER UNDER NEW YORK BANKING LAW §§ 44 and 44-a. New York. Press Release. [Online]. Available from: https://www.dfs.ny.gov/about/ea/ea150423.pdf [Accessed on 19 April 2018]

Openbaar Ministerie (Netherlands), (2013). Rabobank pays Dutch Public Prosecutor € 70 million to settle LIBOR-investigation. The Hague. [Online]. Available from: https://www.om.nl/vaste-onderdelen/zoeken/@32207/rabobank-pays-dutch/ [Accessed on 16 April 2018]

United States Department of Justice (United States of America), (2012a). Statement of Facts. Washington, DC. Press Release Number 12-815. [Online]. Available from: https://www.justice.gov/iso/opa/resources/931201271017342636594 1.pdf [Accessed on 11 April 2018]

United States Department of Justice (United States of America), (2012c). Agreement. Washington, DC. Press Release Number:12-1522. [Online]. Available from: https://www.justice.gov/iso/opa/resources/139201212191174584575 7.pdf [Accessed on 12 April 2018]

United States Department of Justice (United States of America), (2012d), Statement of Facts. Washington, DC. Press release number: 12-1522. [Online]. Available from https://www.justice.gov/iso/opa/resources/694201212191172532062 4.pdf [Accessed on 12 April 2018]

United States Department of Justice (United States of America), (2013a). Plea Agreement. Washington, DC. Press Release Number: 13-161. [Online]. Available form: https://www.justice.gov/iso/opa/resources/28201326133127414481.pdf [Accessed on 13 April 2018]

United States Department of Justice (United States of America), (2013b). Deferred Prosecution Agreement. Washington, DC. Press Release Number: 13-1147. [Online]. Available from: https://www.justice.gov/sites/default/files/opa/press-releases/attachments/2014/11/06/deferred_prosecution_ agreement.pdf [Accessed on 16 April 2018]

United States Department of Justice (United States of America), (2014). Lloyds Banking Group Admits Wrongdoing in LIBOR Investigation, Agrees to Pay $86 Million Criminal Penalty. Washington, DC. Press Release Number: 14-786. [Online]. Available from: https://www.justice.gov/opa/pr/lloyds-banking-group-admits-wrongdoing-libor-investigation-agrees-pay-86-million-criminal [Accessed on 18 April 2018]

United States Department of Justice (United States of America), (2015a). Deferred Prosecution Agreement. Washington, DC. Press Release Number: 15-499. [Online]. Available from: https://www.justice.gov/sites/default/files/opa/press-releases/attachments/2015/04/23/db_dpa.pdf [Accessed on 19 April 2018]

United States Department of Justice (United States of America), (2015b). Plea Agreement. Washington, DC. Press Release Number: 15-499. [Online]. Available from: https://www.justice.gov/sites/default/files/opa/press-releases/attachments/2015/04/23/dbgs_plea_agreement.pdf [Accessed on 19 April 2018]

United States Department of Justice (United States of America), (2012b). Agreement. Press Release Number 12-815. [Online]. Available from: https://www.justice.gov/iso/opa/resources/337201271017335469822.pdf [Accessed on 11 April 2018]

Newspaper articles

Agence France Presse. (2011a). S&P sees 'negative' outlook for US. Retrieved through LexisNexis. [Online]. Available from: https://www-nexis-com.proxy.ub.uni-frankfurt.de/results/enhdocview.do?docLinkInd=true&ersKey=23_T27573327409&format=GNBFI&startDocNo=0&resultsUrlKey=0_T27573327411&backKey=20_T27573327412&csi=10903&docNo=1 [Accessed on 29 May 2018]

Agence France Presse. (2011b). European stocks down sharply. Retrieved through LexisNexis. [Online]. Available from: https://www-nexis-com.proxy.ub.uni-frankfurt.de/results/enhdocview.do?docLinkInd=true&ersKey=23_T27573528414&format=GNBFI&startDocNo=0&resultsUrlKey=0_T27573528416&backKey=20_T27573528417&csi=10903&docNo=1 [Accessed on 29 May 2018]

Agence France Presse. (2012). European stocks, euro slide as EU summit opens. Retrieved through LexisNexis. [Online]. Available from: https://www.nexis.com/results/enhdocview.do?docLinkInd=true&ersKey=23_T27550984270&format=GNBFI&startDocNo=0&resultsUrlKey=0_T27550984272&backKey=20_T27550984273&csi=10903&docNo=3 [Accessed on 26 May 2018]

Agence France Presse. (2013). European stock markets slump, RBS shares rise. Retrieved through LexisNexis. [Online]. Available from: https://www-nexis-com.proxy.ub.uni-frankfurt.de/results/enhdocview.do?docLinkInd=true&ersKey=23_T27538398292&format=GNBFI&startDocNo=0&resultsUrlKey=0_T27538398294&backKey=20_T27538398295&csi=10903&docNo=1 [Accessed on 17 May 2018]

Agence France Presse. (2016a). US stocks rally continues as oil rises. Retrieved through LexisNexis. [Online]. Available from: https://www-nexis-com.proxy.ub.uni-frankfurt.de/results/enhdocview.do?docLinkInd=true&ersKey=23_T27567614427&format=GNBFI&startDocNo=1&resultsUrlKey=0_T27567625021&backKey=20_T27567625022&csi=10903&docNo=7 [Accessed on 27 May 2018]

Agence France Presse. (2016b). US stocks dip as bank shares retreat. Retrieved through LexisNexis. [Online]. Available from: https://www-nexis-com.proxy.ub.uni-frankfurt.de/results/enhdocview.do?docLinkInd=true&ersKey=23_T27568133313&format=GNBFI&startDocNo=0&resultsUrlKey=0_T27568133315&backKey=20_T27568133316&csi=10903&docNo=3 [Accessed on 27 May 2018]

Barr, R. (2012). UK probing more banks for interest rate fixing. The Associated Press. Retrieved through LexisNexis. [Online]. Available from: https://www.nexis.com/results/enhdocview.do?docLinkInd=true&ersKey=23_T27551638462&format=GNBFI&startDocNo=0&resultsUrlKey=0_T27551638464&backKey=20_T27551638465&csi=304478&docNo=4 [Accessed on 25 May 2018]

Barrett, D. and Fitzpatrick, D. (2013). J.P. Morgan, U.S. Settle for $13 Billion. The Wall Street Journal. [Online]. Available from: https://www.wsj.com/articles/jp-morgan-us-settle-for-13-billion-1384890222?mod=searchresults&page=1&pos=3&tesla=y [Accessed on 17 May 2018]

Blend, O. and Goodway, N. (2012). LIBOR SCANDAL AT BARCLAYS SENDS BANK SHARES DOWN. London Evening Standard. Retrieved through LexisNexis. [Online]. Available from: https://www.nexis.com/results/enhdocview.do?docNo=4&backKey=20_T27551882051&ersKey=23_T27551882022&format=GNBFI&pubTreeMax=false&csi=344171&pubTreeWidth=null [Accessed on 25 May 2018]

Brettell, K. (2018). What is SOFR? The new U.S. Libor alternative. Thomson Reuters. [Online]. Available from: https://www.reuters.com/article/us-usa-bonds-sofr-explainer/what-is-sofr-the-new-u-s-libor-alternative-idUSKCN1HA0H1 [Accessed on 27 May 2018]

Brummer, A. (2012). BARROW BOYS WITH MORALS OF THE CASINO. Daily Mail. Retrieved through LexisNexis. [Online]. Available from: https://www-nexis-com.proxy.ub.uni-frankfurt.de/results/enhdocview.do?docLinkInd=true&ersKey=23_T27564316172&format=GNBFI&startDocNo=0&resultsUrlKey=0_T27564316174&backKey=20_T27564316175&csi=138794&docNo=7 [Accessed on 26 May 2018]

Citywire. (2012). Barclays & RBS shares sink as Osborne weighs in. Retrieved through LexisNexis. [Online]. Available from: https://www.nexis.com/results/enhdocview.do?docLinkInd=true&ersKey=23_T27551416659&format=GNBFI&startDocNo=0&resultsUrlKey=0_T27551416661&backKey=20_T27551416662&csi=277874&docNo=2 [Accessed on 26 May 2018]

Colchester, M. and Schaefer Muñoz, S. (2012). Barclays Chief Says 'Sorry'. The Wall Street Journal. [Online]. Available from: https://www.wsj.com/articles/SB10001424052702304211804577501971852022572 [Accessed on 26 May 2018]

Harris, A. (2018). Libor Refuses to Die, Setting Up $370Trillion Benchmark Battle. Bloomberg. [Online]. Available from: https://www.bloomberg.com/news/articles/2018-05-06/libor-refuses-to-die-setting-up-battle-for-benchmark-supremacy [Accessed on 26 May 2018]

ICN.com Financial Markets, (2012). U.S shares plunged as JPMorgan shares plummeted... . Retrieved through LexisNexis. [Online]. Available from: https://www.nexis.com/results/enhdocview.do?docLinkInd=true&ersKey=23_T27550944687&format=GNBFI&startDocNo=0&resultsUrlKey=0_T27550944689&backKey=20_T27550944690&csi=363097&docNo=2 [Accessed on 28 May 2018]

Masters, B. (2013). FSA to give way to ‘twin peaks’ system, Financial Times (FT). [Online]. Available from: https://www.ft.com/content/32ebdd78-97bf-11e2-97e0-00144feabdc0 [Accessed on 15 April 2018]

Masters, B. and Murphy, M. (2011). Barclays at centre of Libor inquiry. Financial Times (FT). [Online]. Available form: https://www.ft.com/content/1c3228f6-5646-11e0-82aa-00144feab49a [Accessed on 24 April 2018]

Masters, B., Jenkins, P., and Baer, J. (2011a). Banks served subpoenas in Libor case. Financial Times (FT). [Online]. Available form: https://www.ft.com/content/52958d66-501f-11e0-9ad1-00144feab49a [Accessed on 24 April 2018]

Masters, B., Jenkins, P., and Baer, J. (2011b). Big banks investigated over Libor. Financial Times. [Online]. Available from: https://www.ft.com/content/ab563882-4f08-11e0-9c25-00144feab49a [Accessed on 27 April 2018]

Masters, B., Murphy, M. and Binham, C. (2011). Interbank loan probe focuses on yen rates. Financial Times (FT). [Online]. Available from: https://www.ft.com/content/2b82b026-b791-11e0-b95d-00144feabdc0 [Accessed on 28 April 2018]

Milford, P. (2011). Investment Funds Allege Banks Conspired to Manipulate Libor. Bloomberg. [Online]. Available from: https://www.bloomberg.com/news/articles/2011-04-18/investment-funds-allege-banks-conspired-to-manipulate-libor [Accessed on 25 April 2018]

Mollenkamp, C. (2008). Bankers cast doubt on key rate amid crisis. Wall Street Journal (WSJ). [Online]. Available from: https://www.wsj.com/articles/SB120831164167818299 [Accessed on 10 April 2018]

Pierson, B. (2017). Citi, Deutsche Bank, HSBC agree to pay $132 million to settle Libor claims. Thomson Reuters. [Online]. Available from: https://www.reuters.com/article/us-libor-settlement/citi-deutsche-bank-hsbc-agree-to-pay-132-million-to-settle-libor-claims-idUSKBN1CH36N [Accessed on 15 April]

Quah, M. (2011). Markets spiral downward as threat of radiation rises. The Business Times Singapore. Retrieved through LexisNexis. [Online]. Available from: https://www-nexis-com.proxy.ub.uni-frankfurt.de/results/enhdocview.do?docLinkInd=true&ersKey=23_T27536077942&format=GNBFI&startDocNo=51&resultsUrlKey=0_T27536077995&backKey=20_T27536077996&csi=11432&docNo=73 [Accessed on 17 May 2018]

Ridley, K. (2013). NYSE Euronext to take over scandal-hit Libor. Thomson Reuters. [Online]. Available from: https://www.reuters.com/article/us-libor-nyse/nyse-euronext-to-take-over-scandal-hit-libor-idUSBRE9680FD20130709 [Accessed on 15 April 2018]

Schäder, B., (2015). Deutsche Bank zahlt 2,5 Milliarden Dollar Strafe. Stuttgarter Zeitung. Retrieved through LexisNexis. [Online]. Available from: https://www-nexis-com.proxy.ub.uni-frankfurt.de/results/enhdocview.do?docLinkInd=true&ersKey=23_T27544608215&format=GNBFI&startDocNo=0&resultsUrlKey=0_T27544608217&backKey=20_T27544608218&csi=261699&docNo=10 [Accessed 20 May 2018]

Stempel, J. (2017). Deutsche Bank to pay $220 million in U.S. Libor probe. Thomson Reuters. [Online]. Available from https://www.reuters.com/article/us-deutschebank-settlement/deutsche-bank-to-pay-220-million-in-u-s-libor-probe-idUSKBN1CU2G4 [Accessed on 30 April 2018]

Stempel, J. (2018). Deutsche Bank to pay $240 mln to end Libor rigging lawsuit in U.S.. Thomson Reuters. [Online]. Available from https://in.reuters.com/article/deutsche-bank-libor-settlement/deutsche-bank-to-pay-240-mln-to-end-libor-rigging-lawsuit-in-us-idINL2N1QH2HI [Accessed on 30 April 2018]

Tett, G. (2007). Libor's value is called into question. Financial Times (FT). [Online]. Available from: https://www.ft.com/content/8c7dd45e-6b9c-11dc-863b-0000779fd2ac [Accessed on 23 April 2018]

Williams, H. and Crips, P. (2011). Footsie battered by Japan nuke fear. Belfast Telegraph. [Online]. Available from: https://www.belfasttelegraph.co.uk/business/news/footsie-battered-by-japan-nuke-fear-28598421.html [Accessed on 17 May 2018]

Wilson. H., (2011). Lloyds Banking Group in Libor investigation. The Telegraph. [Online]. Available from: https://www.telegraph.co.uk/finance/newsbysector/banksandfinance/8517191/Lloyds-Banking-Group-in-Libor-investigation.html [Accessed on 27 April 2018]

Paper

Bhagat, S. and Romano, R. (2001). Event Studies and the Law--Part I: Technique and Corporate Litigation. Yale Law School Legal Scholarship Repository. [Online]. pp. 1-33. Available from: http://digitalcommons.law.yale.edu/cgi/viewcontent.cgi?article=1021&context=lepp_papers

Fama, E. and French, K. (1993). Common risk factors in the returns on stocks and bonds*. Journal of Financial Economics. [Online]. 33(1). pp. 3-56. Available from: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.139.5892&rep=rep1&type=pdf [Accessed on 15 May 2018]

Hou, D. and Skeie, D. (2014). LIBOR: Origins, Economics, Crisis, Scandal, and Reform, Federal Reserve Bank of New York Staff Reports. [Online]. no. 667. pp. 1-18. Available from: https://www.newyorkfed.org/medialibrary/media/research/staff_reports/sr667.pdf [Accessed 4 April 2018]

Kohn, A. (2014). Libor: The Clearinghouse and Exchange Based Solution. Fordham Journal of Corporate & Financial Law. [Online]. 29(2) Art.4. pp. 456-491, Available from: https://ir.lawnet.fordham.edu/cgi/viewcontent.cgi?article=1388&context=jcfl [Accessed on 04 April 2018]

MacKenzie, D. (2008). What's in a Number?. London Review of Books. [Online]. 30(18). pp. 11-12. Available from https://www.lrb.co.uk/v30/n18/donald-mackenzie/whats-in-a-number [Accessed 4 April 2018]

Needham, C. (2012). Libor manipulation and its consequences. Library Briefing: Library of the European Parliament. [online] Ref no. 120343REV2. pp.1-6. Available from: http://www.europarl.europa.eu/eplibrary/Libor_manipulation_and_its_consequences.pdf [Accessed 4 April 2018]

Talley, E. and Strimling, S. (2013). The World's most important number: How a web of skewed incentives, broken hierarchies and compliance cultures conspired to undermine LIBOR. JASSA: The Finsia Journal of Applied Finance. (2). [Online]. pp. 50-56. Available from: https://www.finsia.com/docs/default-source/jassa-new/jassa-2013/jassa-2013-issue-2/the-worlds-most-important-number-how-a-web-of-skewed-incentives-broken-hierarchies-and-compliance-cultures-conspired-to-undermine-libor [Accessed 4 April 2018]

Tonkiss, F. (2009). Trust, Confidence and Economic Crisis. Intereconomics/Review of European Economic Policy. [Online]. 44(4). pp. 196-202. Available from: https://hds.hebis.de/ubffm/EBSCO/PDF?id=1063672|eoh [Accessed 28.04.2016]

Wheatley, M. (2012). The Wheatley Review of LIBOR: final report. HM Treasury. [Online]. pp. 1-92. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/191762/wheatley_review_libor_finalreport_280912.pdf [Accessed 4 April 2018]

Websites

24timezones.com. (2018). What Is It Around The World Right Now. [Online]. Available from: https://24timezones.com/#/map [Accessed on 05 May 2018]

data.oecd.org. (2018). Gross domestic product (GDP) (indicator). [Online]. doi: 10.1787/dc2f7aec-en. Available from: https://data.oecd.org/gdp/gross-domestic-product-gdp.htm [Accessed on 05 April 2018]

fca.org.uk. (2017). The future of LIBOR. [Online]. Available from: https://www.fca.org.uk/news/speeches/the-future-of-libor [Accessed on 28 May 2018]

mba.tuck.dartmouth.edu. (2018). Description of Fama/French Factors. [Online]. Available from: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/f-f_factors.html [Accessed on 12 May 2018]

theguardian.com. (2012). Libor rate fixing: see each bank's submission. [Online]. Available form: https://www.theguardian.com/news/datablog/interactive/2012/jul/03/libor-rate-fixing-bank-submissions [Accessed on 29 April 2018]

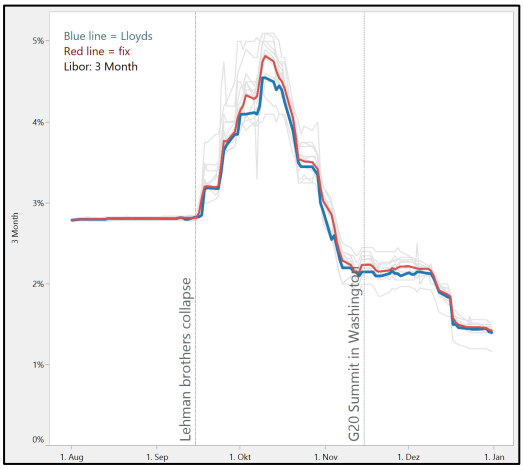
theice.com. (2018). Panel Composition. [Online]. Available from: https://www.theice.com/iba/libor#panel-composition [Accessed on 04 April 2018]

thomsonreuters.com. (2014). Thomson Reuters Establishes Subsidiary in Preparation for the Regulation of Financial Benchmarks. [Online]. Available from: https://www.thomsonreuters.com/en/press-releases/2014/thomson-reuters-establishes-subsidiary-in-preparation-for-the-regulation-of-financial-benchmarks.html [Accessed on 04 April 2018]

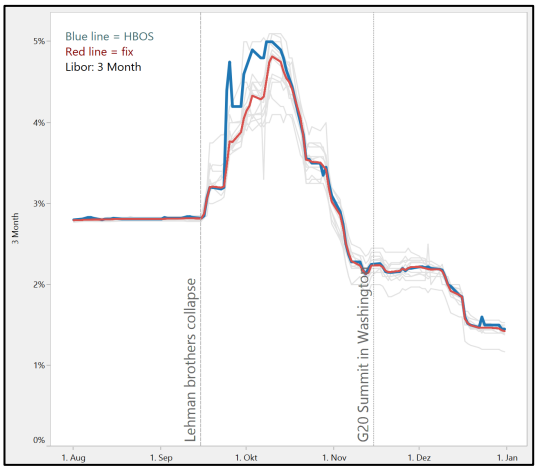
XE Corporation. (2018). Tabellen mit aktuellen und vergangenen Kursen. [Online]. Available from: https://www.xe.com/de/currencytables/ [Accessed on 16 May 2018]

A. Attachment

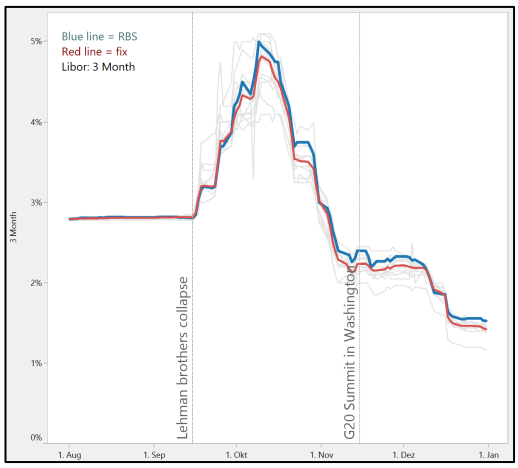
Graphs A.1 to A.5 show the three-month Libor submissions of the single banks in blue compared to the realized three-month Libor in red.



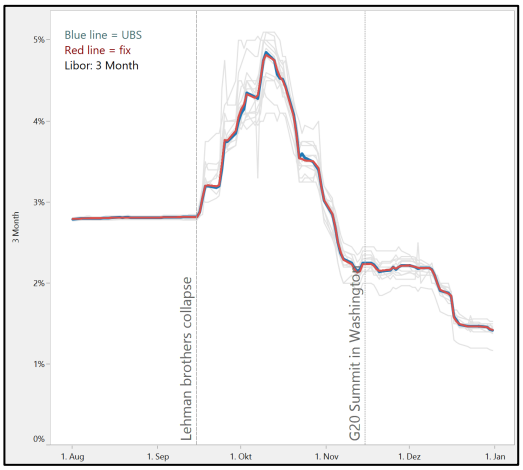
Lloyds; Graph A.1



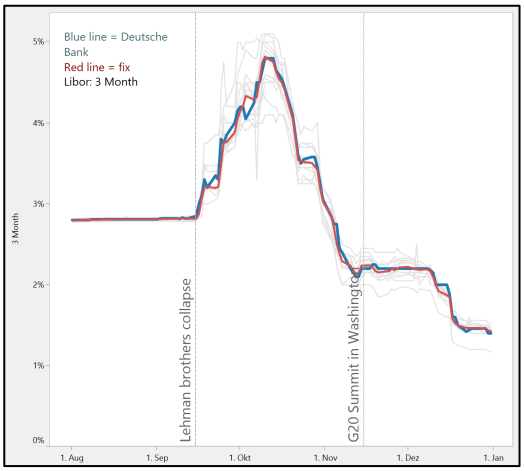
HBOS; Graph A.2



RBS; Graph A.3



UBS; Graph A.4



Deutsche Bank; Graph A.5

Table A.1 delivers the results of the models for Citigroup Inc., JP Morgan Chase & Co., Deutsche Bank AG and Royal Bank of Scotland plc for the 04 December 2013, t, and the following trading day, t+1, after the imposition of the EU-Commission's fine.

RBS PLC	04.12.13	R^2	Abnormal Return t	Significance t/t+1	Abnormal Return t+1	R^2	Abnormal Return t	Significance t/t+1	Abnormal Return t+1	Citigroup Inc.
	1. Two factor model	23.61%	1.44%	no/yes	0.47%	39.12%	0.47%	no/no	-1.67%	
	2. CAPM	21.34%	0.96%	no/no	-0.13%	38.92%	0.68%	no/no	-1.43%	
	3. FF3FM	23.57%	0.03%	no/no	0.33%	67.67%	-0.62%	no/no	0.03%	
JP Morgan Chase & Co		R^2	Abnormal Return t	Significance t/t+1	Abnormal Return t+1	R^2	Abnormal Return t	Significance t/t+1	Abnormal Return t+1	Deutsche Bank AG
	1. Two factor model	35.39%	0.99%	no/yes	-2.32%	45.44%	0.79%	no/no	-0.21%	
	2. CAPM	34.52%	1.22%	no/no	-2.05%	43.6%	0.37%	no/no	-0.72%	
	3. FF3FM	63.73%	0.23%	no/no	-0.87%	46.26%	-0.68%	no/no	0.13%	
Realized Returns	Date/Bank	RBS PLC	Citigroup Inc.	JP Morgan Chase & Co	Deutsche Bank AG		t		t+1	Market index Return (ACWI)
	t	0%	-0.17%	0.58%	-0.68%	04.12.13	-0.55%	05.12.13	-0.3%	
	t+1	0.65%	0,02%	-35,00%	-35,00%					

Table A.1

Table A.2 depicts the loss of the market cap data including Citigroup Inc. and JP Morgan Chase & Co.

28.06.12	Barclays	UBS	RBS	Lloyds	Deutsche Bank	Citigroup Inc.	JP Morgan Chase & Co.	Total:
Change in Market Cap Based on Abnormal Return in million US-Dollar	-4,512.75	-1,049.76	-4,095.36	-1,155.75	-1,320.15	-2,414.6	-4,191.19	-18,739.56

Table A.2

B. Statutory Declaration

"I herewith declare that I have composed the present thesis myself and without use of any other than the cited sources and aids. Sentences or parts of sentences quoted literally are marked as such; other references with regard to the statement and scope are indicated by full details of the publications concerned. The thesis in the same or similar form has not been submitted to any examination body and has not been published. This thesis was not yet, even in part, used in another examination or as a course performance. Furthermore I declare that the submitted written (bound) copies of the present thesis and the version submitted on a
data carrier are consistent with each other in contents."

Place, Date: ..... Signature: .....