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The impact development of scheduled U.S. macroeconomic announcements on foreign exchange rates: An empirical study of the nonfarm payrolls announcement and the EURUSD over the past two decades

Master Thesis submitted in fulfillment of the Degree

Master of Business Administration

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AFFIDAVIT

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ABSTRACT

The foreign exchange market underwent countless changes throughout the last decades, which resulted in many unidentified developments. This thesis investigates 237 intraday event studies of the monthly published nonfarm payrolls announcement between the years 2000 and 2020 to identify long-term developments and patterns regarding the individual 1-minute abnormal returns for the EURUSD foreign exchange rate. Based on an explanatory sequential mixed methods research framework, the main focus is placed on the quantitative research using descriptive and inferential analysis in combination with qualitative research in the form of expert interviews. Individual peak periods of especially high abnormal returns could be found in the data and afterwards associated with corresponding potential triggers by industry experts. Additionally, a continuous decrease of the overall impact magnitude between 2017 and 2020 could be detected. Nevertheless, the nonfarm payrolls announcements still resulted in statistically significant abnormal returns throughout the past years, as also the magnitude of the abnormal returns in the equivalent estimation periods has become smaller. Decreasing volatility alongside with rising liquidity from new market participants, changing market conditions and trading behaviors are only some of the possible reasons that could be named by the interviewed experts with regards to the observed stagnating impact of the nonfarm payrolls announcement on the EURUSD foreign exchange rate.

ACKNOWLEDGEMENTS

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LIST OF ABBREVIATIONS

ADJ … Adjustment period

ANT … Anticipation period

BIS … Bank of International Settlements

BLS … U.S. Bureau of Labor Statistics

CABSAR … Cumulative absolute abnormal return

CAR … Cumulative abnormal return

CFD … Contract for differences

EBS … Electronic broking services

EME … Emerging market economy

EMH … Efficient market hypothesis

EURUSD … Nominal bilateral exchange rate quote of the Euro and the Dollar

Fed … Federal Reserve

FOREX … Foreign exchange

FX … Foreign exchange

IPA … Interpretive phenomenological analysis

MAXABS … Absolute maximum

MINABS … Absolute minimum

NFP … Nonfarm payroll

OLS … Ordinary least squares

OTC … Over-the-counter

PUB … Publication period

SNB … Swiss National Bank

1 INTRODUCTION

1.1 Context and previous research

The global foreign exchange market, also known as the FOREX market or FX market, is the most traded financial market in the world, which has experienced steady growth over time and as of April 2019 has moved up to $6.6 trillion in currencies around the world every day (Bank of International Settlements [BIS], 2019a). The FX market attracts a lot of attention from the various individual participants, including central banks, governments, commercial banks, retail traders and many more, who for example need to facilitate international trade, invest abroad or want to profit through speculation from the extensive volume of money that is pushed through the market (King et al., 2011). Additionally, also new potential market participants are constantly looking for ways and opportunities to become a part of this market each and every year. The exponential growth of the foreign exchange market has also been closely tied to the steady increase of global trading and investments over the past decades, which required vast amounts of currencies being exchanged from one currency to another (Coyle, 2000). However, not only the market liquidity experienced major developments over time, but also the way the financial markets are traded changed significantly with the revolutionary advances in technology which allowed the individual market participants to analyze, execute and manage their trades faster than ever before (James et al., 2012). Especially, with the expansion of the internet and computing power, news announcement trading received a lot of attention by being able to act on news faster. Additionally, many new market makers have entered the market and financial instruments have been created to better suit the individual market participants' needs, which had a profound impact on the successful growth of the foreign exchange market (King et al., 2011). With the integration of new financial instruments, new market participants and various trading centers all around the world, also the individual factors causing impacts in the market expanded over time.

Thereby, it is worth noting that many scholars and financial experts spent considerable amounts of resources for the research of the individual forces and factors that have an impact on the financial markets, also with a special focus on the foreign exchange market. The FX market is not only influenced by the actions of the individual investors and market participants, but also by the many macroeconomic factors and events happening all around the world that may either strengthen or weaken a certain currency (Kočenda & Moravcová, 2016). With regards to the individual analyses of financial instruments, including foreign exchange rates, various different methods and tools have been developed over time to better predict the future price moves, whereby two of the most popular tools are the technical and fundamental analysis (Schlichting, 2008). The technical analysis solely focuses on specific chart patterns that emerged throughout the past in order to predict future price movements and the fundamental analysis focuses on

the underlying fundamental factors in order to determine the fair value of the security to see if profit can be generated with regards to the current price (Schlichting, 2008; Taylor & Allen, 1992). Thereby, it is worth mentioning that those bespoken underlying factors of a security can differ from security to security and from security class to security class. With regards to the foreign exchange rates, also called nominal bilateral exchange rates (Baillie & McMahon, 1989), which are based on two different nations' currencies, various economic, political, but also macroeconomic and global factors can have an impact on the buying and selling behavior of the different market participants in the FX market. Many industry experts and academics already researched the significant impact of the various macroeconomic news announcements on foreign exchange rates in order to make predictions about the possible resulting price changes and adapt their trading behavior accordingly by for example either hedging or speculating from unexpected number publications. However, due to the bespoken changes the foreign exchange market went through the past decades and partially still goes through, also the way news announcements are being traded might have changed. Consequently, it is of major interest, if due to all of the changes any measurable and significant developments in macroeconomic news event trading can be found and what particular reasons have caused these developments in order to learn from them for future decisions.

1.2   Research aims and objectives

The overall aim of this thesis is the study of the impact development the nonfarm payrolls, short NFP, macroeconomic announcement has on the EURUSD foreign exchange rate. Up to the current point in time, where this thesis has been written, researchers and academics have mostly spent their time on better understanding which, how and why macroeconomic indicators, like the nonfarm payrolls announcement, have impacted certain securities. However, there has been no long-term study specifically designed to measure and better understand the impact development. Thereby, it is worth mentioning that those bespoken studies have all been done during specific, but different time periods, each with their individual study setups, variables and currency rates, which makes it impossible to create any stable long-term study of a single currency pair that captures the possible developments of the impact the nonfarm payrolls announcement had. Therefore, this thesis attempts to narrow the present research gap, by analyzing every single monthly published nonfarm payrolls announcement over the past 20 years with regards to the EURUSD foreign exchange rate on a 1-minute scale in order to determine how the related returns developed over time with regards to various different aspects including significance testing.

Through the application of several individual event studies, which have been used by many different academics especially in the field of finance in order to tie certain market reactions to individual events, it has been possible to analyze the significance and the magnitude of the individual abnormal returns right before, at the, and after the publication. Thereby, it has been achievable to not only study the statistical significance of the abnormal returns during the event,

but also to compare the results from the individual events in order to make assumptions about the development over the past twenty years. However, to better understand the individual results and key finding from the event studies, experts have been included in the research process in order to tie their individual experiences and knowledge to the quantitative findings. Therefore, with a systematic approach to analyze the qualitative expert interviews it has been the objective to find possible explanations to the quantitative results that could have been gathered in order to create coherent answers about the development of the NFP impacting the EURUSD between 2000 and 2020. Additionally, the experts have been asked to provide general insights about the nonfarm payrolls news trading and their belief about the future importance of such macroeconomic indicators regarding the impacts they have on foreign exchange rates. Together with the quantitative analysis of the data set and the qualitative analysis of the expert interviews, this thesis strives to narrow the current research gap of the missing long-term studies on specific macroeconomic indicators in relation to a certain foreign exchange rate. Consequently, throughout the thesis three individual research questions are in focus, each one having a different level of importance with regards to the overall research aim.

The following primary research question has been defined for the overall objective of this thesis:

Have there been any measurable patterns or developments in the immediate 1-minute intraday abnormal returns of the EURUSD foreign exchange rate, with regards to the nonfarm payrolls macroeconomic indicator announcement between the years 2000 and 2020?

Additionally, the following secondary research question which is supposed to complement the primary research question has been defined:

If any patterns or developments can be found in the analysis of the NFP announcements and the EURUSD between the years 2000 and 2020, what were the underlying factors or triggers that could have caused them?

Lastly, the following tertiary research question will be subject to this thesis:

What will the detection of certain patterns or developments in combination with their underlying origins mean for the future impact behavior of the nonfarm payrolls announcement and the EURUSD?

1.3 Structure of the thesis

The overall thesis is split into five main parts, whereby each individual part has its own structure and purpose by guiding the reader through the single steps undertaken in this thesis to answer the individual research questions. Thereby, the introduction is designed to provide a broad

overview of the topic and the underlying importance of this thesis by explaining the individual research objectives. The second part of this thesis will establish the relevant knowledge base with a concise literature review showcasing and summarizing the most relevant literature and theoretical frameworks defining the current status-quo in the academic literature, by at the same time clearly showing where the current research gap is and how this thesis will attempt to narrow it. Thereby, the individual concepts and methods are discussed and outlined broadly in order to better understand the subsequent research methodology part and the way the literature links to the applied research. In the third part of the thesis, the methodology section, the selection of the explanatory sequential mixed methods research setup will be discussed and laid out step by step. Consequently, not only the various research instruments that are used throughout this thesis will be explained, but also the sampling procedures and the data analyses will be covered in full detail. Whereby, in the research instrument sub-section the main methods which will be used for the analysis are decided on, in the data analysis sub-section the specific mathematical tools which are used to analyze the gathered data will be explained in more detail. Additionally, the various limitations of the methodology will be discussed in this section in order to highlight possible weak points and improvements for further research that can be conducted on this matter. Based on the research framework laid out in the methodology, in the beginning of the fourth part of this thesis, the individual results of the quantitative analysis will be presented, and the key findings are stated representing the starting point for the expert interviews in the qualitative analysis phase. Thereby, not only the experts' insights and explanations on the questions from the quantitative analysis are contrasted against each other, but also further research based on the individual experts' insights is included to develop coherent inputs that narrow the present research gap. Lastly, in the fifth part of the thesis, the conclusion, a critical summary of all concepts and findings are presented and linked back to the individual research questions, before suggesting further research that can enhance the understanding of this research area.

2   LITERATURE REVIEW

2.1   Literature review introduction

Throughout the literature review section of this thesis, the current status-quo of the scientific knowledge about the research topic is presented in more detail in order to better understand the current gap in the literature this thesis attempts to narrow. Therefore, the overall framework of the involved theoretical concepts will be highlighted at first, after which the individual components will be discussed one after another, whereby at the beginning the focus is on the broader topics which get more specific with the progress of the literature review section. Thereby, it is worth noting that a special focus will be on the foreign exchange rate market, fundamental analysis and the event study literature as these are the main building blocks of the methodology which this thesis will be built on.

2.2   Overview of the theoretical framework

Overall, it is important to highlight, that this thesis touches various interconnected topics and areas in investing and trading, which all require more explanation in order to be able to understand their individual connections towards the research questions and the analyses that will be carried out throughout this thesis. Figure 1 provides a general overview of how all the different topics within the literature relate to one another, and how they all come together in this research setting.
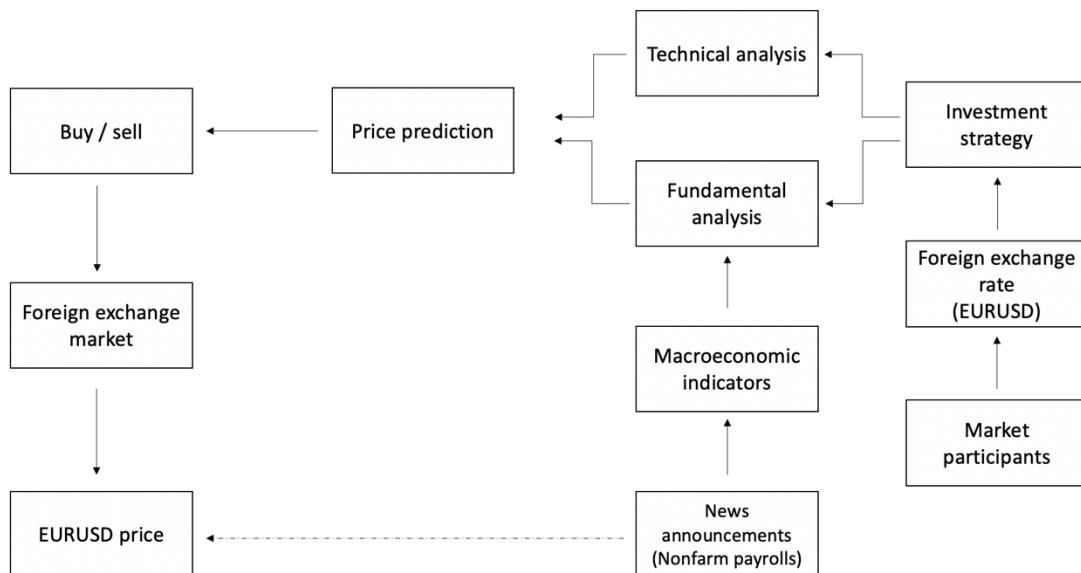
FIGURE 1 ... THEORETICAL FRAMEWORK

Source: Own illustration

It is important to mention that there are many different participants in the foreign exchange market that all have different strategies and goals using various investment tools (Sager & Taylor, 2006). Depending on the security and the individual objective of the market participant there are many different analysis techniques, including the technical and the fundamental analysis (Menkhoff & Taylor, 2006). Within this thesis the fundamental analysis is the main focus, as within this analysis type, there is a focal point on macroeconomic indicators or news such as the nonfarm payrolls in FOREX trading. Based on the fundamental analysis, the market participant will build a price prediction of where the price will go in the future compared to where it is right now (Schlichting, 2008). Depending on the future price a market participant may choose to buy or sell a certain currency, which he can do on the foreign exchange market. In this thesis the EURUSD nominal bilateral exchange rate will be analyzed to react to the nonfarm payrolls news announcement. In the case the market participant correctly anticipated the price movement resulting from the news announcement, he might be able to profit on this particular trade, given that the trading fees and commissions do not outweigh the price movement he wanted to profit on. Thereby, it is worth mentioning that depending on the overall investment strategy and FOREX investment transaction the process might be slightly different.

Within the next sub-sections of this thesis the individual theoretical building blocks that have been laid out in Figure 1, will be separately addressed with regards to the already existing literature about them in order to create the foundation for the methodology, the analysis and the discussion of the results. Therefore, various different sources ranging from academic books, research articles, financial reports, news articles, journals and many more, will be utilized to contribute to this thesis.

2.3   Trading the foreign exchange market

2.3.1   The FOREX market

Overall, the *foreign exchange market* is, by trading volume, the largest financial market compared to the equity and bond market (Jackson & Schmidt, 2021). According to Bloomberg, the Bank of International Settlements, short BIS, published in its 2019 triennial report that the global foreign exchange market reached a $6.6 trillion daily trading volume, whereby it was stressed that the swaps and forwards outpaced the spot market (BIS, 2019a; Debnath & Barton, 2019). The foreign exchange market is an *over-the-counter*, also called *OTC*, *market*, which means that in comparison to the equities market, there is no single market place or exchange where the individual trades are executed among the various market or exchange members (Dun & Bradstreet, 2007). This means that the FOREX market by its nature is a dispersed market as all of its participants are separated from another in addition to all the electronic transactions which are fragmented through medias such as computers and telephones (Sager & Taylor, 2006).

However, even though the foreign exchange market is decentralized there are several physical trading center dispersed throughout the world where especially the market-making dealers are situated, whereby London is known to be the biggest one, followed by other important trading centers such as New York and Tokyo (Sager & Taylor, 2006). Additional trading centers can be found in Frankfurt, Zurich, Singapore and Hongkong (Dun & Bradstreet, 2007). Due to the geographical dispersion of these international trading centers around the world, they enable the possibility to match different categories of sellers and buyers around the clock starting from Sunday 10:00 pm GMT, which is the time when the Sydney market opens, until Friday 10:00 pm GMT when the U.S. market shuts down, which only leaves the weekend closed.

Furthermore, according to Coyle (2000), the total currency markets can be split into the cash markets which consist of the foreign exchange markets, the eurocurrency markets and the derivative markets. Whereby, the main purpose of the foreign exchange markets is to create places where currencies can by bought and sold, he states that the eurocurrency markets are there to borrow and lend currencies. However, from the 1970s onwards, currencies can also be traded as sophisticated derivative instruments derived from an underlying transaction in one of the two already mentioned foreign currency cash markets (Coyle, 2000).

According to Dun and Bradstreet (2007), the foreign exchange market can also be broadly split into the wholesale and retail market, whereby the *wholesale market* is also called *the interbank market* where the commercial-, central-, and investment banks alongside businesses interact. With regards to the individual market participants that operate in the foreign exchange market it can be said that overall there are dealers and customers. According to Sager and Taylor (2006) the *dealers market*, which roughly accounted up to 59% of the market liquidity in 2002 is described as the market whose participants include the market-makers, leverage-, proprietary- and senior risk traders, whereby the market-maker's primary role is to provide the interdealer liquidity and to execute for the customers. As already mentioned, the individual customers interact with the dealers in order to acquire financial instruments on the market with the main goal to hedge or profit from it by buying and selling currencies in an active or passive way (Sager & Taylor, 2006). Thereby, the active participation of customers in the foreign exchange market is based on the action of buying or selling currencies to resell or rebuy it after a certain amount of time to profit from the price change that occurred within that time (Dun & Bradstreet, 2007). On the contrary, passive customers are exposed to currencies either due to the acquisition of underlying assets such as international equities and bonds or the implementation of hedges for underlying benchmark positions (Sager & Taylor, 2006).

In general, it can be said that there are many different ways that can be used when interacting with the foreign exchange market, each having a different goal underlying unique rules. In order to better analyze and understand the foreign exchange market the Bank of International Settlements defined five major types of foreign exchange transactions including FX swaps, currency swaps, spot, outright forwards and OTC options on which they continuously measure the FX

market on (BIS, 2021). Thereby, it is worth mentioning that all of the mentioned financial investment transactions have their very own purpose in the market, offering the individual participants different advantages. However, it has to be kept in mind that every single transaction category also comes with its associated risks.

The BIS (2021, p. 11) defines a *spot* foreign exchange transaction as a "single outright transaction involving the exchange of two currencies at a rate agreed on the date of the contract for value or delivery within two business days" including cash and same day transactions. According to the Bank of China (2021) a spot transaction is the most essential form of foreign exchange rate transactions as it is not only used to speculate in the market and set up customer's foreign currency portfolios, but also due to the fact that spot transactions are necessary for their customers for conducting payments and business deals in different currencies.

In comparison to a spot trade where the transaction is fulfilled immediately, an *OTC option* defines a transaction where the buyer or seller only gets the right to buy or sell a currency at a specified exchange rate during a specific period (BIS, 2021). However, the privilege to not instantly buy or sell the currency, comes with a premium charge. Thereby, it is worth mentioning that there are many variations of possible option transactions within this category. According to Reuters (Williams, 2013), banks were increasing the size of their options trading desks from 2013 onwards, due to the fact that many companies and hedge funds were increasingly looking for ways to either protect themselves from major currency moves or even profit from them.

Outright forwards are similar to the spot transactions, but differ in that the agreed rate of exchange value is settled either at the contract or delivery date, which has to be at least two days later (BIS, 2021). According to the Bangkok Bank (2018), forwards have the advantage of hedging exchange rate risks of future price changes in a currency as a forward allows the investor to lock-in the future FOREX expenses and revenues. However, due to the fact that the future rate is fixed, this consequently means that an investor cannot profit from any favorable exchange rate developments (Zuger Kantonalbank, n.d.). Additionally, it is worth mentioning that outright forwards are not traded on organized exchanges and that their contracts are not standardized in comparison to the spot transitions (BIS, 2021). Within this forwards category also contracts for differences, short CFDs, which are a very popular investment tool for investors to speculate in the market, fall into.

Foreign exchange *swaps*, also called *FX swaps*, are defined by the BIS (2021, p. 12) as transactions which involve "the actual exchange of two currencies on a specific date at a rate agreed at the time of the conclusion the contract, and a reverse exchange of the same two currencies at a dater further in the future at a rate agreed at the time of the contract". Therefore, a swap can also be explained by consisting of two parts, whereby the first one is a simple spot transaction in combination to the second one which is a forward, giving the investor the option to lengthen or shorten the terms of a spot, forward or another swap transaction, which however

means that due to the fixed forward rate no gains can be achieved from any positive future exchange rate developments (Zuger Kantonalbank, n.d.).

Lastly, *currency swaps* are contracts where two parties agree on exchanging either streams of interest payments or principal amounts in different currencies at a pre-set date in the future (BIS, 2021). Currency swaps are mainly used from companies that are situated in different countries, which want to hedge their risk of currency fluctuations or lower interest rates on specific loans in the foreign currency (Corporate Finance Institute[CFI], 2021c). Consequently, currency swaps allow companies who would get a worse interest rate in the foreign country, but a better one in the own country in comparison to the foreign company, the possibility to make use of the better interest rates within the own country and swap it to the other company to receive the better interest rate in the foreign country.

With regards to the shares of the individual foreign exchange investment transactions within the whole FOREX market, the BIS (2019a) published in their latest triennial survey a market overview, whereby it can be retrieved from Figure 2 that with 49% nearly half of all transactions are FX swaps, followed by spot transactions which account for 30%, forwards with 15% and the remaining 6% is split between currency swaps and other options or products. This market turnover overview is very useful in better understanding the overall foreign exchange market as the individual instruments help explaining how the market participants can make use of the various foreign exchange rate transactions to suit their own objectives.
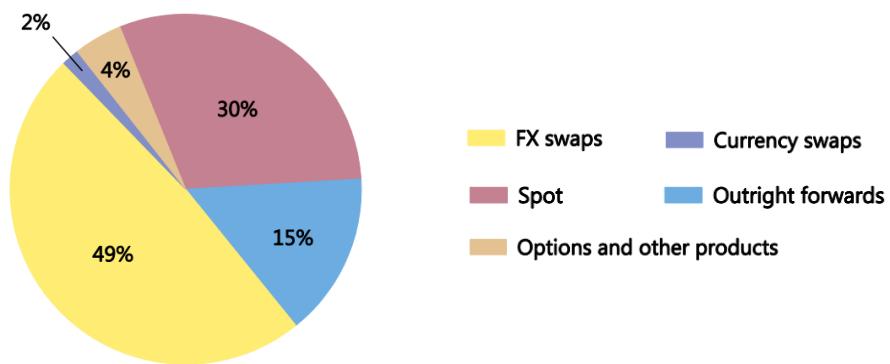
FIGURE 2 ... FOREIGN EXCHANGE MARKET TURNOVER BY INSTRUMENT 2019

Source: BIS, 2019a

2.3.1.1   Key developments in the FX market

Over the time, the foreign exchange market underwent many changes, however as James et al. (2012) mentioned, the foreign exchange market that we know as of today only emerged in the 1970s. After World War II, the Bretton Woods Agreement was established in 1944 among the allied nations to create a new global monetary system in which not only the dollar has to be the

dominant currency fixed to gold at \$35 an ounce, but also all other currencies have to maintain a fixed exchange rate between their currency and the dollar (Federal Reserve History, 2013a). However, when in 1961 the outstanding dollar claims for the international reserves exceeded the U.S. gold stock, fears started to emerge that the dollar had to be devalued and over the next years countries tried to exchange the dollar for gold, while rising U.S. inflation, unemployment and the increasing trade deficit forced the U.S. to stop allowing countries to buy gold and start devaluing the dollar (Federal Reserve History, 2013b). Consequently, the pressure on the dollar grew and one country after another pushed its limits of the exchange rate bands, until gold prices kept on increasing and speculation against dollar increased to a point in 1973 when all currencies have become free floating and the Bretton Woods Agreement finally failed (Federal Reserve History, 2013b; Securities and Exchange Commission, 1973).

With the start and increase of international trade, the individual foreign exchange rates gained interest and importance as not only individuals and businesses, but also governments needed to buy, sell or borrow foreign currencies (Coyle, 2000). Thereby, it is worth nothing that each nation has its own currency, issued by the central bank, to facilitate domestic trade transactions (Dun & Bradstreet, 2007). One major development of the foreign exchange market over the time is the way trading is conducted, meaning that the procedure of matching the individual buyers and sellers changed with the advances in technology. In the early years of foreign exchange trading, the brokers themselves performed the matching function between the individual traders by either calling them via the telephone or other simple electronic methods making the process of taking an order and executing it more difficult and considerably longer (Chaboud & Weinberg, 2002, cited in Chaboud et al., 2007). Since the incorporation of *Electronic Broking Services*, short EBS, into the foreign exchange market in the beginning of the early 1990s, so-called electronic brokerage systems which can be seen as electronic limit order books that match the individual buyers and sellers, have gained in importance and acceptance until they became the standard for trading the major currency pairs (Chaboud et al., 2007).

Thereby, it is worth mentioning that not only the process of taking orders and executing them became faster and more efficient over time, but also the lowered cost of trading enabled new market participants to enter (Garner, 2012). Whereby, in the beginning foreign exchange trading was mostly for the international trade of goods, with the advances over time, new participants entered the market as speculation, hedging and arbitrage trading became more popular (King et al., 2011). These new participants, except the initial importers and exporters, have now been expanded to central banks, asset managers, high-frequency traders and also small individual traders, which are also called retail traders (King et al., 2011). These new market participants

and foreign exchange market interaction methods did also increase the amount of currency which has been traded in the market.
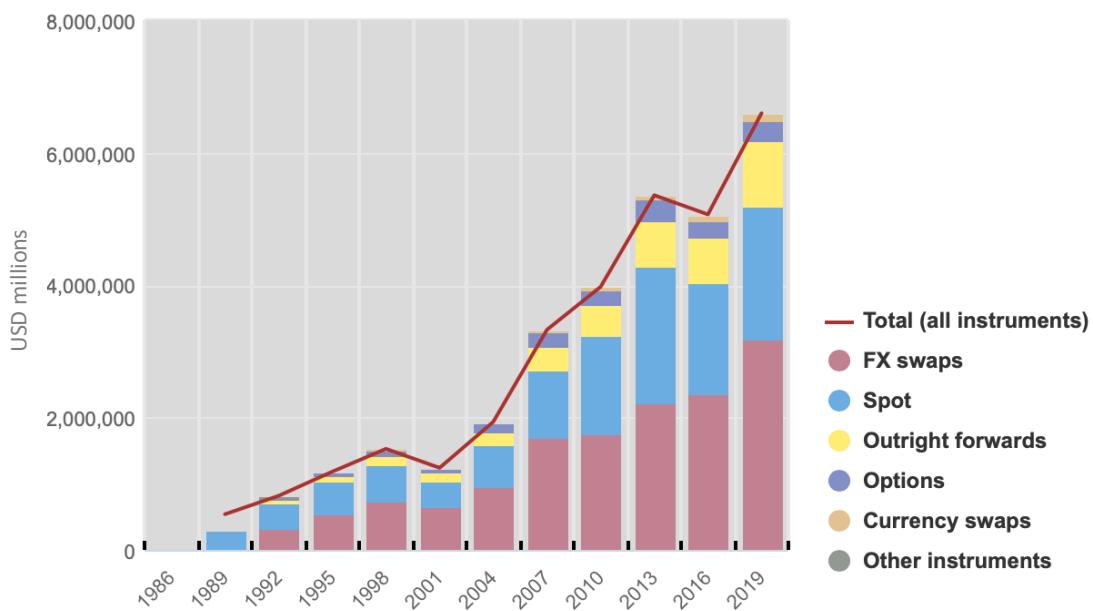
FIGURE 3 ... HISTORICAL FOREIGN EXCHANGE MARKET DAILY TURNOVER BY INSTRUMENT

Source: BIS, 2019b

From the 2019 triennial central bank survey (BIS, 2019b), in Figure 3, the development of the daily global foreign exchange market turnover split into the transaction categories over time can be retrieved, whereby not only the growth of the overall market, but also of the individual categories can be tracked. Thereby, it is worth mentioning that the FX swaps experienced the biggest growth over time, followed by spot trades, which were roughly similar to the FX swaps in terms of transaction volume until 2004, which was when the swaps started to increase at a faster rate. With regards to the outright forwards, it can be said that they started to increase only incrementally, but also gained of importance after the financial crisis in 2008. Currency swaps and OTC options are still very small in comparison to the other categories, whereby the options were able to surpass the currency swaps within the last years. Nevertheless, taking into account all transaction categories, it is important to highlight that the foreign exchange market experienced tremendous growth throughout the last years, showing the increased interest in and importance of the foreign exchange market.

2.3.2 The EURUSD foreign exchange rate

Currencies traded through the foreign exchange are always priced at the price of another currency, which is why they are also called to be *nominal bilateral exchange rate quotes* (Baillie & McMahon, 1989). This means a foreign exchange rate is the quoted price at which one unit of a currency can be traded or exchanged for another unit of currency. Thereby, it can be

distinguished between the base currency and the quote currency. The base currency, which is always quoted on the first position of an exchange rate, is the currency a trader is buying or selling in order to receive the respective amount of the quote currency (Garner, 2012). Consequently, it can be inferred that in case someone buys the base currency, at the same time that person is also selling the quote currency.

Furthermore, it can be distinguished between currency pairs and currency crosses. Whereby, a *currency pair* involves one foreign currency which is directly quoted against the trader's home currency, in a *currency cross*, two currencies are involved which do not match the trader's own currency (Garner, 2012). According to Garner (2012), for example, in the case where a U.S. trader is trading the EURUSD this pair would be called to be a normal currency pair. If, however the U.S. trader trades the EURJPY, this rate would be referred to as a currency cross, as the USD needs to be converted into EUR before the trader then can purchase or sell JPY. Thereby, it is worth noting that the individual foreign exchange rates can be generally classified in three groups, which are called the majors, the minors and the exotics. The majors are the currency pairs that do not only have the USD, the world's leading currency, either as the base or quote currency in it, but are also the most frequently traded currencies worldwide, which means that they have the highest liquidity and usually also the lowest spreads (Chen, 2021). In contrast, all minor currency pairs, also called cross-currency pairs, do not have the USD within the rate, whereby exotic currency pairs are comprised of two currencies which usually have no natural affinity and often involve a currency from a developing or frontier economy with much less liquidity which also means that the spreads are far higher (Chen, 2021; Pepperstone, 2021).

According to the latest triennial survey about the foreign exchange turnover in April 2019, the USD was the world's dominant currency as it was involved in 88% of all currency trades on one side, whereby, the EUR was the second most traded currency with about 32% participation in currency transactions (BIS, 2019a). From Figure 4 the most frequently traded currencies can be retrieved, whereby it is worth mentioning that the total percentage, including the remaining smaller currencies that are not listed here, overall sums up to 200% as in each transaction two currencies are involved. Additionally, the so-called EME currency is not a single currency but a bundle of all currencies of the emerging market economies.
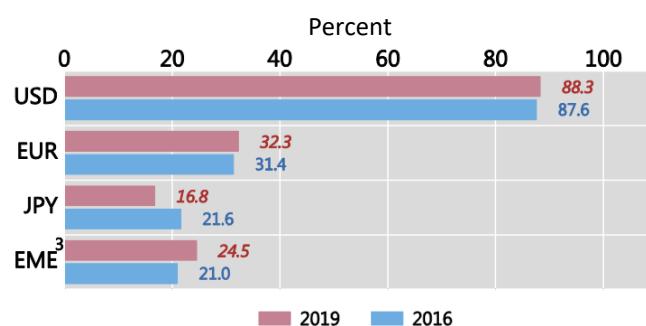
FIGURE 4 ... FOREIGN EXCHANGE MARKET TURNOVER BY CURRENCY

Source: BIS, 2019a

From Figure 5 it can be retrieved that the USDEUR, which is the EURUSD, was the most widely traded foreign exchange rate with about 24% in daily transactions out of all currency pairs traded world-wide (BIS, 2019a). This means that roughly every fourth currency transaction done throughout a day on a global scale, involved the EURUSD foreign exchange rate. This high inter-est in the foreign exchange rate has many advantages for the many market participants in com-parison to foreign exchange rates which are traded much less frequently. First of all, the EURUSD enjoys the advantages of being a highly liquid currency pair, which means that usually the spreads are very low, only minimal commissions for rolling over positions to the next day are charged, small or even no commissions for opening a trade have to be considered and fast trade execution can be expected (FXSSI, 2021). Depending on the trade size the risk of not being able to enter or exit a trade at a certain price level is much lower, as there is a lot of liquidity present. Additionally, currency pairs which are as important as the EURUSD, enjoy the benefit of getting a lot of information coverage, meaning that many analysts and experts spend their time analyz-ing this currency pair and providing opinions, reviews and news about it, while also many trading forecasts, signals and guides can be found (FXSSI, 2021).
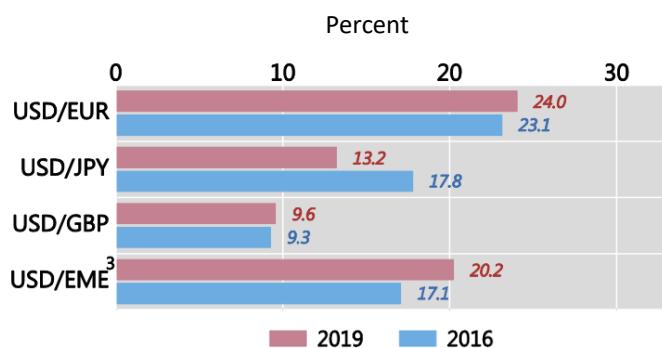
FIGURE 5 ... FOREIGN EXCHANGE MARKET TURNOVER BY CURRENCY PAIR

Source: BIS, 2019a

2.4 Technical and fundamental analysis

Overall, there are many different ways for an investor to determine the future price of a certain security, like an exchange rate, whereby it is worth mentioning that the fundamental and the technical analysis are the most prominent ones. The industry is split with regards to the applica-tion of the two analyses, whereby some only use one out of the two by completely neglecting the other one and others use both types of analyses to complement the strengths and weak-nesses of them to see if they come to the same conclusion about the future price of the security (Schlichting, 2008). However, the two analyses types are completely different in their nature, whereby in the technical analysis only chart data is used to predict the next price moves, in fundamental analysis related and underlying information of the security is used to calculate the potential underlying value (Kumar & Mohapatra, 2015).

As already briefly mentioned, *technical analysis*, also sometimes called *chartist analysis*, is solely based on the visual analysis of a security's historical prices and price action, by completely neglecting the underlying economic and fundamental information in order to come up with a future price expectation (Taylor & Allen, 1992). Consequently, it can be said that technical analysis is based on the premise that past chart patterns will also repeat themselves in the future and be respected, which allows the analyst to predict the probable next price move based on this historic chart pattern and price action. Thereby, Kirkpatrick and Dahlquist (2010) argue that the main objective of technical analysis is the spotting of trend beginnings and trend ends in order to be able to profit from the main trend either while buying or selling a certain security. However, for traders that are agile and flexible enough in their investment style, also price ranges can be traded which might form between trends in order to profit from the price swings within the range (Schwager, 1996). Thereby, it is important to say that depending on the trading horizon and strategy, different timeframes can be viewed and even combined in the analysis in order to analyze the most relevant price pattern and price action necessary for the selected strategy. According to Murphy (2021), one of the great features of technical analysis is the adaptability and flexibility to use the different timeframes allowing a trader to analyze the chart easily from an intraday perspective, but also from a long-term perspective.

However, it is worth noting that there are many different types the price of the security can be displayed at a certain point in time on the chart. Among the classic line chart, the dot chart, the bar chart and many more, the so-called "Japanese candlestick chart" is the most popular one, whereby every single candle represents the movement of the price within the certain period the chart is representing (CFI, 2021b). This candlestick chart became so popular due to the fact that within one single candle the analyst can read the opening, closing, high, and low price in addition to the colored representation of the candle body showing if the price was generally able to close up or below the opening price.

According to Menkhoff and Taylor (2006), technical analysis can be split into quantitative and qualitative methods, whereby in the quantitative methods indicators and in the qualitative one visual chart patterns and drawings are used to predict future price movements. With regards to the technical indicators it can be said that they are technical analysis tools based on functions used to better analyze trends, price averages, volatility and much more (Lobel, 2019). Consequently, technical indicators can be described to be representations of mathematical calculations done to visually describe the security's past behavior, including for example the moving average which is an indicator that prints a line according to the chosen period which depicts the average price development over time. In the qualitative approach, for example simple drawing tools such as horizontal or slanted trendlines are oftentimes used to determine trends or historic levels that have been well respected either as support or resistance in order to find reversal points (Kirkpatrick & Dahlquist, 2010). Additionally, the recognition of trend reversal patterns, which are certain arrangements and sequences of candle sticks, such as flags- or head and

shoulder patterns, are an essential part of the qualitative method (Menkhoff & Taylor, 2006). Overall, based on the individual candlesticks, patterns, drawing tools and the technical indicators the analyst picks a selection of tools in order to analyze the current price within the chart in order to make calculated guesses about the future price development.

In contrast to the technical analysis, where the price chart is the only source of analysis, the *fundamental analysis* can be much more complex with regards to the individual data sources that can be used to build a hypothesis. According to Schlichting (2008), fundamental analysis is based on the premise that the actual market price of the security does not always reflect the true intrinsic or fundamental value based on the underlying strength. Therefore, he holds that following fundamental analysis, the analyst attempts to process all necessary information available to derive at the price that a certain security should have, based on the underlying information that is available influencing the security directly or indirectly. However, it is worth mentioning that it is necessary that there is a difference between the intrinsic and the actual security value as otherwise traders would not have the advantage of analyzing the security and buying or selling it in order to bring the security to the perceived intrinsic value (Schlichting, 2008).

Both academic and financial experts have spent considerable amounts of time and effort to study the individual data variations that may have a significant impact on being able to successfully model a security's fair value. Depending on the security class, the sources of information that may have an impact on the underlying price can vary. For example, in order to find a company's intrinsic value, Thomsett (2006) holds that historical data like the financial statements, the earnings-potential, the quality of management, but also the capitalization, the future growth potential and the fiscal status, can be included in the analysis. Thereby, it is worth mentioning that also factors or data not directly impacting a certain security can have an impact on the intrinsic value, as besides the immediate related industry or sector, also the economy as a whole and world events, have to be factored into the analysis (Kumar & Mohapatra, 2015).

With regards to trading the fundamentals for the foreign exchange rates, which is also called trading the news, the analyst studies the various news events and economic statistics in order to predict the future value of a currency and the subsequent changes over time (Kadiri & Alabi, 2015; Oanda, 2020). In the process of analyzing a country's currency, multiple factors ranging from macro- and microeconomic data, geo-political events, GDP growth rates, employment statistics, interest rates, trade balances and many more are studied in order to factor in these individual fundamentals into the current currency price (Oanda, 2020). Thereby, it is worth mentioning that due to the fact that the exchange rate is bilateral, the data from both underlying currencies can have an impact on the exchange rate. Additionally, it can be inferred that with the number of increased global interdependencies and the expanding information technologies, also the number of possible relevant information increases steadily. Overall, based on the calculated price throughout the fundamental analysis, the analyst compares the current price to the intrinsic value, in order to see if there is a possible potential gain to be made by trading the

security, keeping in mind the various trading related costs. Therefore, it is the trader's obligation to select the correct amount and types of underlying information of the security in order to determine and limit the data that will be used in the analysis to determine the intrinsic value of the currency with regards to his personal trading horizon, strategy and purpose.

This thesis builds on the fundamental analysis method, due to the fact that the research aim is to analyze the impact development of the nonfarm payrolls news announcement on the EURUSD foreign exchange rate. In other words, the thesis follows a study of how a certain security's related fundamental economic information is impacting the perception of the intrinsic price based on the premise that the market is efficient in capitalizing on this potential by bringing the price to new levels.

2.5 Efficient market hypothesis

The *efficient market hypothesis*, short EMH, is still a very widely discussed and important concept, since it has become increasingly popular in the 1950's and early 1960's when it was established as the dominant paradigm, under the rubric of the "theory of random walks" or "rational expectations theory" which it is called in finance and mainstream economics literature (Jensen, 1978). According to Jula and Jula (2017), the underlying theory of random walks states that the market prices of securities do not follow predictable patterns a trader can profit from, but only random ones meaning that if someone wants to peruse the attempt of predicting a random set of data, he can only do this when testing for randomness and neglecting this hypothesis. Consequently, they highlight that when all price developments follow a random pattern, the prices of securities cannot be forecasted or anticipated, leaving the intelligent investor with no edge in the market to profit on. However, there are many economists and investors which dispute this pure form of random security prices. The degree of randomness is closely linked to the efficient market hypothesis, as in an efficient market, based on the premise that its participants are intelligent, the current price of a security always reflects all information from the past and the future no matter what will happen, meaning that no profits can be gained by any new information as this information would already be priced into the security, which means that the security will randomly change its price (Jula & Jula, 2017).

Thereby, it is worth mentioning that the overall concept of efficient markets plays a central role in finance, as the price of a security should be efficiently representative in a way to meet the expectations of the individual buyers and sellers in the market (Dimson & Mussavian, 1998). Even though, the term market efficiency is primarily based on the presumption that the market is able to process all relevant information in order to display it in the current price, some other economists refer to efficient markets in the context of the markets being able to use all resources necessary to operate the market in an efficient way, whereby the informational efficiency is of main interest (Dimson & Mussavian, 1998). Jensen (1978, p. 3), holds that the efficient market hypothesis is simplified "an extension of the zero-profit competitive equilibrium

condition" under conditions of uncertainty, whereby a market is efficient when it is impossible to make any economic profits through trading activity on the basis of a given information set.

However, it is important to highlight that over the time sightly adapted and different versions of the efficient market hypothesis have been up to discussion and tested in the literature, whereby the main differentiation factor across these variations is the bespoken information set. There are currently three main forms of the EMH in the literature which are important to discuss in more detail to understand their importance for this master thesis. Starting with the weak form, going over to the semi-strong form and ending with the strong form, whereby as already mentioned these forms differentiate among themselves with regards to the underlying information set which is to be efficiently represented in the security's price (Jensen, 1978).

The *weak form* of market efficiency is based on the premise that the current price of a security is the intrinsic value containing all past information sets until the present time (Dimson & Mussavian, 1998; Jensen, 1978; Jula & Jula, 2017). Consequently, the current price of a security can be defined to be based on all the historic information in fundamental and technical nature. In contrast to the weak form, the *semi-strong form* of the efficient market hypothesis holds that in addition to all historic information sets, also all publicly available information at the present time is reflected in the current price of a security, whereby an emphasis is put on the premise that this publicly accessible information is also relevant for the pricing (Dimson & Mussavian, 1998; Jensen, 1978; Jula & Jula, 2017). In the third and last form of the efficient market hypothesis, the *strong form*, all information available from all market participants is priced in the security, not restricted to publicly available one, which means that also insider information is included (Dimson & Mussavian, 1998; Jensen, 1978; Jula & Jula, 2017).

Overall, with regards to the individual forms of market efficiency, Fama (1970, cited in Dimson & Mussavian, 1998) concluded that there is strong evidence that the market follows the weak form of efficiency, and that there is extensive support that the market also efficiently handles the semi-strong and strong form, after reviewing many test forms, even though more research needed to be done according to him. Thereby, it is worth mentioning that the strong form of market efficiency is seen to be an extreme form, which has only been expected by a few individuals, whereas the semi-strong form is viewed to be as the accepted paradigm in the literature and hence also often directly referenced as efficient market hypothesis (Jensen, 1978). One of the mentioned test forms used to determine the semi-strong market efficiency is the so-called event study, which can be seen as a test in which the speed of information adoption due to a new publicly available information is analyzed in terms of the abnormal price change of a security (Dimson & Mussavian, 1998). Therefore, with regards to this thesis, event studies will be used to test the semi-strong form of the efficient market hypothesis in order to analyze if the new publicly available nonfarm payrolls announcement information causes any changes in the EURUSD foreign exchange rate.

2.6 Event studies

A very common and popular analysis tool used in economics and finance for investigating and measuring the impact of individual fundamental news information on a specific security is the so-called *event study* (Krivin et al., 2003). However, event studies are not limited to analyzing news or events in economics and finance, but have also been applied in law, information technology, marketing and many others according to Bohn et.al. (2013). While the original event study can be attributed to Dolly in 1933, the nowadays known event study of stock splits introduced by Fama, Fisher, Jensen and Roll in 1969, has developed considerably and became very popular for analyzing many different events not only restricted to stock splits (Hayward, 2018; Kramer, 1998). On the most basic level an event study investigates the price of a security around a specific event, whereby the major challenge is the separation of the security's price resulting due to the event from the normal price change that is not in correlation with the event (Hayward, 2018). According to Bohn et. al (2013) event studies investigating the impact of news can generally differ in three main areas, which are the underlying data of the security, the applied method and the respective news event. Thereby, it is worth mentioning that over time, multiple scholars have created various models and methods to differently isolate the price changes directly resulting from the analyzed event from the normal price change, each one having its own advantages and disadvantages.

Over the time, also the respective event study timeframe evolved, which means that the perspective of setting the event window with regards to the analysis evolved from long-, medium-, short-term and intraday timeframes. Thereby, Marshall et al. (2017) hold that the majority of research has been focused on the classic medium-term timeframe including days and months, due to the origins of the event analysis and the fact that long-term event studies are seen to be controversial as it is very difficult to calculate the abnormal returns with all the market interferences over time. However, due to the technological advances, intraday event studies have gained in popularity, as the news and security data became more accessible on the intraday level and it has also been proven through research that event studies have the statistical power to capture these very short-term abnormal returns which means that confidence can be placed on these results (Marshall et al., 2017). Therefore, it can be inferred that over the time, when the market became more reactive and faster due to the various technological advances, also the analysis adapted accordingly by increasing the research in those intraday timeframes. However, it is worth mentioning that the term intraday can also vary to the exact degree of the specified time interval, whereby common timeframes are the 4 hour, the 1 hour, the 30 minute, the 15 minute, the 5 minute, 1 minute and even 1 second interval for price referencing. The previously mentioned intraday event study research conducted by Marshall et al. (2017) had the main focus on the 30-, 15-, 5- and 1-minute interval for proving the power of these studies.

Overall, it is important to highlight that event studies are very popular tools to analyze the impacts of various fundamental news announcements for a variety of securities within the finance

sector. With the technological advances, intraday event studies have become mainstream as also the actual impacts could be better separated from the normal returns or other confounding events. With regards to this thesis the 1-minute timeframe will be analyzed as this was the smallest timeframe that was available to obtain the foreign exchange rate data for the past twenty years.

2.7   Macroeconomic news events

As previously stated, in the fundamental analysis of foreign exchange rates, the country's underlying fundamentals are a very important part to determine the intrinsic value of a currency. According to Majaski (2021) *fundamentals* can be defined as the general qualitative and quantitative information which contribute to the economic and financial condition of a certain company, security or currency. With regards to a country's fundamentals it can be further differentiated between microeconomic and macroeconomic fundamentals. Thereby, it can be said that *microeconomic fundamentals* focus on the activities on a smaller segment of a country, like a specific industry or sector, whereas the *macroeconomic fundamentals* focus on the large scale of a countries economy representing the whole level (Majaski, 2021).

Lai and Roy (2005) hold that there are many business and financial experts that spend big amounts of resources and effort to collect and analyze the individual macroeconomic indicators in order to use that data for portfolio and investment decisions. Thereby, it is important to highlight that there are many different variables and indicators for a nation, country or economy that can be important in finding out more about a country's current well-being and future outlook. Taking a closer look at the U.S. macroeconomic fundamentals, there are different federal government agencies that continuously release information about the bespoken U.S. macroeconomic variables (Kim et al., 2014). According to Lai and Roy (2005) many researchers attempted to use the individual daily macroeconomic news announcements in order to make meaningful predictions about the overall macroeconomic variables. Investors and experts can analyze the individual macroeconomic information in order to create a short-term bias or analyze them together with other fundamentals over a longer term to make more extensive future predictions.

Overall, it can be differentiated between the numeric, semantic written and spoken form depending on the fundamental information, which are different in the way they have to be analyzed. Thereby, indicators like the GDP, the interest rate, unemployment numbers and the CPI are well known quantitative macroeconomic indicators, whereas announcements about fiscal and monetary policy in addition to international trade are important qualitative indicators that all individually provide valuable insights into a country's economic condition (Majaski, 2021). With regards to the numeric quantitative indicator announcements, not only the change from the previous number to the newly published number can be taken into consideration, but also the difference between the, by experts, forecasted number and the actually published number

(Lai & Roy, 2005). Thereby, recent studies have shown that especially the difference between the forecasted and the actual values, which defines the surprise effect, seemed to be more important in comparison to the time series values when examining the security's prices (Lai & Roy, 2005). This is in line with the semi-strong market efficiency hypothesis, which states that the price of a security includes all historic information which in this case would be the previous and forecasted value, whereby the market quickly adapts to the published value which becomes new public information. Thereby, experts suggest that some macroeconomic news announcements lead to stronger market reactions than others depending not only on the individual market, but also due to their general relation to a country's fundamentals, the tardiness and the revision noise (Gilbert et al., 2016).

According to the IG Group Holdings Plc. (2021a), one of the leading brokers worldwide, it can be differentiated between leading and lagging indicators. Thereby, the broker holds that *leading indicators* are trying to predict the future outlook of an economy which are oftentimes used by governments to establish new policies to start off new business and economic cycles, including for example interest rates and yield curves. In contrast, *lagging indicators* depict the past economic performance often used to confirm new trends and cycles, even though it is worth mentioning that this group can also include indicators that are right in the middle of being a historic or future indicator happening during a trend shift. Whereas the stock market, the housing market, bond yields, production and manufacturing statistics, retail sales and interest rates belong to the most important leading indicators, the IG Group Holdings Plc. states that the GDP growth rates, the currency strength and stability, the CPI, the labor market statistics and the commodity prices belong to the most important lagging indicators which are necessary for a trader to watch. Thereby, with regards to the labor market statistics the nonfarm payrolls indicator which is studied throughout this thesis is said to be the most powerful and impactful lagging macroeconomic indicator (IG Group Holdings Plc., 2021a), which will be discussed in more detail within the next sub-section.

2.7.1   The nonfarm payrolls announcement

The *nonfarm payrolls announcement* gets released on the first Friday of every month at 08:30 ET by the U.S. Bureau of Labor Statistics publishing the nonfarm payrolls report which includes the change in employment. Thereby, it is worth mentioning that the published numbers are always about the previous month's data, hence the indicator is also called to be a lagging one. As previously mentioned, the nonfarm payrolls announcement counts to the most important macroeconomic labor market indicators, which is the reason why this specific indicator has been studied by many researchers with regards to the market's reaction. Thereby, the U.S. Bureau of Labor Statistics ([BLS], 2016), short BLS, defines the *nonfarm business sector*, which accounted for roughly 77% of the U.S. GDP in 2000, as a subset of the whole economy, whereby the economic activities of the general government, private households, non-profit organizations serving individuals and farms are not included. Additionally the BLS holds that the current employment

numbers account for all part-time or full-time employed people that receive payment including the 12th day of the current month excluding "proprietors, self-employed, unpaid family or volunteer workers, farm workers, and domestic workers" (BLS, 2016, section "P", para. 6).

With regards to the nonfarm payrolls employment, Horpedahl et al. (2019) from the center for economic research of the University of Central Arkansas, state that all the previously mentioned exclusions are important in order to focus on the overall cycle of the core economy, due to the fact that those roughly 80% that are covered by the nonfarm payrolls survey are most representative for the workforce that correlates with the economic business cycle. Correspondingly, they argue that the main purpose of the nonfarm payrolls indicator is to supply a meaningful representation of the current labor market that gives information about the current position of the U.S. with regards to the economic cycle. At the peak of the economic cycle the businesses flourish and hence also the employment numbers in the related industries will rise. The same, but reversed logic holds true for the other direction when the economy goes through a recession. This is the reason why the bespoken exclusions are essential to not distort the employment number which is used to describe the current economy. With regards to the agricultural employment numbers, Horpedahl et al. hold that the business cycle of the farming industry does not correlate with the overall economic business cycle, hence it is excluded, which is also why the governmental military and other governmental jobs are excluded as they will stay rather untouched by economic fluctuations. Additionally, also self-employed people will not fluctuate in the same way as the normal business employees will do, as they will not necessarily lose their self-employed job when a recession hits the economy, even though they will go through tough times (Horpedahl et al., 2019).

As already mentioned, this news announcement is important for many traders who want to trade on fundamental indicators, hence it is an essential part of all economic calendars and watched closely by many experts and traders. Thereby it is worth mentioning that there is already an extensive amount of literature as many academics and scholars analyzed the various impacts of U.S. and other international macroeconomic indicators and their announcements within different security classes and scopes. Thereby Kruger (1996, cited in Gurgul & Wójtowicz, 2014) found that from 1983 onwards the employment data published from the BLS influenced the bond and stock market not only on the publication day, but also on the day after. Gurgul and Wójtowicz (2014) stated that many other researchers have been able to identify that macroeconomic indicator announcements have been responsible for changes in treasury yields. Engle and Li (1998) contrasted the impacts of scheduled and unscheduled macroeconomic data announcements with regards to the volatility and found that even though scheduled announcements led to impacts on volatility in the short-run, theses had small persistence. Geske and Roll (1983, cited in Gurgul & Wójtowicz, 2014) examined the relationship between inflation rate announcements and stock returns as the expectations of the interest rate showed to have more widespread impacts, not only in the financial markets but also for the economy itself.

Consequently, it can be seen that the various macroeconomic indicators have been carefully examined with regards to their individual impacts they have on the different securities. The more recent the studies have become, the smaller also the analyzed timeframes got as more reliable data has been available. Steiner and Entorf (2006) for example analyzed the relation of the DAX with regards to ZEW financial market test publications on the intraday level, even going down to the 15 seconds timeframe.

Whereby, it can be seen that most of the literature centered around the equity and the bond market also the foreign exchange rate market has become more interesting. According to Chaboud et al. (2007), who also analyzed the EURUSD foreign exchange rate on a 5-year timeline between 1999 and 2004 with regards to the NFP announcement on a second-by-second frequency, the initial price jump occurred within the first few seconds after the publication, followed by comparably little additional trading volume until volatility and trading volume then picked up sharply about 15 seconds later. With regards to the speed of adjustment to news, Gurgul and Wójtowicz (2014) could find that securities with high liquidity and interest, reacted to news announcements the strongest within the first three minutes, whereas securities with less attention took more time. However, not only the speed and severity of various news announcement impacts have been studied successfully on various different currency pairs, but also the sentiment towards good and bad news announcement results. Kočenda and Moravcová (2016) found by analyzing various euro- and dollar-based currencies between 2011 and 2015, that the European denominated currencies under their investigation reacted with larger abnormal returns on good news, whereby dollar-based currencies reacted stronger on negative macroeconomic indicator announcements. Additionally, also the relationships between the macroeconomic indicator changes and surprise values with regards to the FOREX market returns have been investigated with the goal to create models to predict the market's reaction towards future news announcements (Jandejsek, 2016). Research has also been conducted to analyze the effects of news announcements on foreign exchange rates during pre-crisis and crisis times, whereby Égert and Kočenda (2013) concluded that during the financial crisis in 2008 and 2009 the market was narrowing its focus only to key macroeconomic indicators and verbal central bank communications, which in terms have not been that well followed during the pre-crisis time.

2.8 Literature review conclusion

Overall, it can be seen that macroeconomic indicators not only have been subject of many different studies within the various fields of finance and other application areas, but are also used as an investment decision factor in fundamental analysis to make predictions about the intrinsic value of a certain security. Thereby event studies have been proven to be a very useful tool in testing for the semi-strong form of the efficient market hypothesis, by analyzing the speed of market adaption due to short-term inefficiencies of information. However, it could be seen that the main emphasis of previously done research has been on discovering the market's behaviors

or certain effects of a security with regards to specific macroeconomic indicators, but not much focus has been placed on the development of certain effects over a long period of time. With regards to intraday event studies of certain securities, five years worth of data seemed to be a standard when studying other publications, as over these years many reference points for the analysis can be gathered. However, especially, with the recent changes and developments in the foreign exchange market, it would be of interest to see how certain analyzed effects and the market's reaction behaved over time and what the underlying reasons for the development have been. Therefore, this thesis focuses primarily on the impact development of the NFP announcement on the EURUSD foreign exchange rate between June 2000 and December 2020 in order to analyze the market's intraday inefficiencies in price which result in abnormal returns. In this way this thesis will narrow the present research gap and contribute to the literature by providing a long-term study of the impact development the NFP announcements had on the EURUSD.

3   METHODOLOGY

3.1   Methodology introduction

Throughout this part of the thesis, a wholistic overview of the methodology applied for the research that will be carried out to answer the research questions will be presented. Therefore, in the beginning of this section, the selection of methodology will be explained in more detail by clearly defining the individual research priorities and the sequence in which the study will be conducted. Afterwards, the individual research instruments in terms of the analyses and tests will be listed and summarized one after another in order to state and define the various variables and selected approaches. Additionally, also the various data and sample selections will be subject to revision in order to provide valuable information about the data that will be used throughout the individual analyses. In the end of this section the resulting limitations of the chosen methodological approach, the individual analyses and tests will be stated in order to be transparent with the strengths and weaknesses of this thesis, which could be used as a starting point for further research.

3.2   Selection of methodology

In the process of deciding which methodological approach will be used for this thesis, the research questions and topics have been carefully studied in order to find processes and analyses which are most suitable. Due to the fact that the main objective of this thesis is to discover and better understand the impact development of the nonfarm payrolls announcement on the EURUSD over the past 20 years, quantitative data needs to be analyzed in order to detect certain trends or developments. Whereby, the possibility of finding patterns, trends and certain developments is crucial, it is also necessary to understand why those have been present in order to gain knowledge that can be used for the future. Generally, there are many different ways in which additional information can be gathered about the quantitative findings, however as there might be very detailed questions that need explanatory articulation, a qualitative research appears to be most fitting for this setting in a second instance. As both, quantitative and qualitative data and analyses are crucial in fully answering the research questions, the selection of methodology applied throughout this thesis has been chosen to follow a *mixed methods research design*.

As the name already suggests, neither quantitative, nor qualitative analysis is applied exclusively, but both of them are carefully and strategically mixed together in the research process in order to provide a profound insight into the research questions. Creswell (2014) highlighted that the mixed methods research method was rather new, especially in social and human science back in 2014, but gained importance and acceptance over time as the benefits of this procedure became more prominent, as research topics have become more complex. According to him,

applying a mixed methods research design allows the researcher to compare, contrast and compound the different insights from the quantitative and qualitative analysis, which best broadens the perspectives from the individual analyses. Overall, Creswell concluded that the advantage of such a mixed methods approach is to complement the advantages of the qualitative and quantitative analysis by minimizing the limitations of each at the same time. Especially, with more complex research topics or when both quantitative and qualitative data may be available, a mixed methods approach is beneficial and sophisticated especially when new research areas are to be explored (Creswell, 2014).

In the mixed methods literature, there are many different ways and types with regards to the individual application and extent of use regarding qualitative and quantitative data. Creswell (2014), defined three major types of mixed methods design approaches mainly differentiated between timing and sequence of the qualitative and quantitative research. In the *convergent parallel mixed methods* design, which is the most basic one, he stated that both the quantitative and qualitative analyses are carried out at the same time, but analyzed separately to be then compared against each other to shed more light on the particular research question. However, in the *exploratory sequential mixed methods* approach, the qualitative analysis is carried out in the beginning to better understand and explore the research matter, before in the second instance the quantitative data is collected and analyzed based on the findings of the first instance. Lastly, in the *explanatory sequential mixed methods* design, at first the quantitative data is collected and analyzed and in the second phase through qualitative analysis the individual results are then tested in order to gain explanations about the quantitative findings (Creswell, 2014). Depending on the research question, the interests of the researcher, the available data and many more factors, it has to be decided which of the various types of mixed methods is the most appropriate for someone's own research. Thereby the so-called, *priority* defines if the quantitative or the qualitative research will be given more attention and the *implementation* defines the sequence in which the two researches will be conducted (Morgan, 1998).

Throughout this thesis the explanatory sequential mixed methods design has been applied, as according to Creswell (2014) this type of mixed methods research is especially appealing for topics with strong quantitative backgrounds or topics that are rather new or unconventional for qualitative approaches. Thereby, it is worth mentioning that especially research topics in finance are prone to be of a quantitative nature as usually the most information is extracted by analyzing vast amounts of quantitative data. Even though the quantitative analysis has the priority and comes first in the sequence, the qualitative analysis will be included to complement the thesis with additional knowledge about the researched topic. Consequently, the research has been split into two phases, whereby in the first phase the quantitative data is gathered and analyzed, before in the second phase the qualitative analysis will be used to gain more knowledge about the research topic and the insights that have been discovered throughout the quantitative analysis. Thereby, Figure 6 summarizes the structure and sequence of the individual analyses that

will be applied in order to be able to answer the research questions and narrow the present research gap.
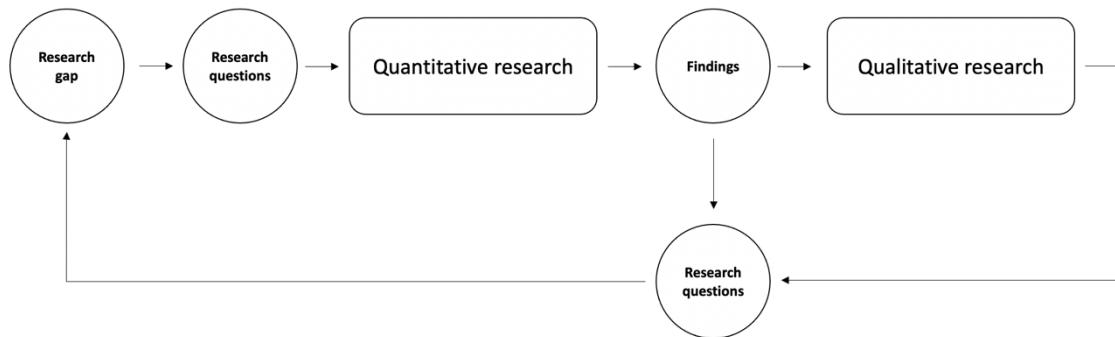
FIGURE 6 ... METHODOLOGY OVERVIEW

Source: Own illustration

With regards to the first phase of the research, the quantitative one, it can be said that by considering the purpose of this thesis and the presented research questions, the quantitative part of the research can be described to fall into Onwuegbuzie and Leech's (2006) third category of quantitative research purposes, which is the *relationship category*. Thereby, the relationship centered quantitative research question is said to be primarily concerned with the trends between or among two or more variables (Onwuegbuzie & Leech, 2006). The relational aspect of the primary research question for this thesis can be clearly established as it is the main purpose to study the influence or relation between the nonfarm payrolls announcement and the EURUSD foreign exchange rate. Additionally, being able to identify trends or patterns and test for the significance of the individual events throughout the quantitative analysis, it is of major importance to better understand the development of the impact the employment indicator had on the EURUSD to help answering the secondary research question. Onwuegbuzie and Leech (2006) presented a fourth category, the *historical* one, which is not as prominent in educational research. However, this category seems to have many areas of application especially in the financial research sector, due to the fact that the objective of this research category lies in predicting the future based on past trends or patterns, which can be mostly associated with the tertiary research question. Nevertheless, it can be argued that the focus of this thesis is to discover and understand the trends and patterns of the nonfarm payrolls and the EURUSD, while the future outlook will be a sub-section of additional information and will not be covered by quantitative research but rather be part of the qualitative research section to answer the tertiary research question.

The second phase of the research, the qualitative one, is conducted after the quantitative phase is finished and analyzed. As Creswell (2014) mentioned, the results and knowledge gained through the quantitative analysis usually provide the researcher with the direction for the qualitative participant selection and the type of follow-up questions that are of major interest for

this second phase of the research. Overall, the questions that shall be answered throughout this qualitative phase should provide the researcher with more details and explanations for the results that have been gained from the quantitative data. Thereby, it is worth mentioning that the qualitative research is based on general and open-ended questions in order to not limit or restrict the possible explanations that can be gained. In addition, to elaborate on the insights and results that have been gained through the first phase, it will be of utmost interest how industry experts are dealing with the nonfarm payrolls when it comes to trading the EURUSD and how they perceive their future importance. These additional questions, which are not based on the results of the quantitative analysis, will provide further knowledge about the foreign exchange industry while at the same time maybe uncovering more explanations regarding the findings of the quantitative analysis.

Overall, in this mixed methods research approach, the two sequential analysis phases shall provide a wholistic picture about what the financial quantitative data indicated over the past 20 years and how the industry experts explain these findings by providing additional insights into their profession and the future outlook. Therefore, the key objective of the quantitative analysis, which is of main focus in this thesis, is to answer the primary research question by helping to identify any patterns or developments of the impact the NFP announcements had on the EURUSD. Additionally, the quantitative research also provides partial information which can be used in combination with the qualitative research to answer the secondary research question. The qualitative analysis focuses on finding information and building knowledge to fully answer the secondary and tertiary research questions. The overarching research selection and methodology structure having been laid out, within the following subsections the individual research instruments, sample procedures and the analysis for the quantitative and the qualitative phase are to be explained in more detail.

3.3   Research instruments

3.3.1   Quantitative instruments

As it has already been defined in the selection of methodology section, quantitative research will be carried out in the first and main phase of the research in order to analyze the impact development of the nonfarm payrolls announcement on the EURUSD foreign exchange rate. According to Williams (2007, p. 66), a *quantitative research method* is based on a numeric or statistical approach in building the design of the research, whereby quantitative data is gathered and then analyzed by the use of "mathematical models as the methodology of data analysis". Thereby, the researcher investigates extensive "amounts, or quantities, of one or more variables of interest" in order to derive knowledge of the analyzed data and extract meaning about the researched topic (Ormrod & Leedy, 2015, p. 23). These analyzed data sets can either be of primary or secondary nature depending on the source they come from, whereby primary data is gathered by the researcher himself and secondary data is already existing as it has been

collected by another source (Benedictine University, 2021). Throughout this thesis only secondary data will be used for the quantitative analysis as both the exchange rate prices of the EURUSD and the nonfarm payrolls announcement numbers have been gathered from secondary sources.

According to Creswell (2014), if specified sets of variables are strictly controlled either through research design or statistical analyses, it is possible to test underlying theories based on the provided measures or observations. Variables can either be dependent or independent, whereby the dependent variable is the one that is researched to fluctuate as an effect of changes in the independent variable which is believed to be in relation to the dependent one (Swanson & Holton III, 2005). The bespoken strictly controlled research design that will be used in this thesis is the event study and the analyzed variables are the NFP news announcement data, which is the independent variable, and the EURUSD foreign exchange rate, which is the dependent variable. However, it is worth mentioning that neither of the two variables will be used for the descriptive or inferential analysis, but a third separate one, from which variations will be extrapolated. During the event study the main new variable, the abnormal return, is being calculated, which is the pip change of the EURUSD foreign exchange rate that can be attributed to the NFP announcement. According to the IG Group Holdings Plc. (2021b, para. 1) "the literal meaning of pip is 'point in percentage', and it is the smallest standardised move that a currency quote can change by", whereby for the EURUSD a pip change of 1 can be experienced at the fourth decimal place, which is equivalent to a change in price of 0.0001. This variable measuring the impact of the announcement on the foreign exchange rate will then be used for the descriptive and inferential analysis. Thereby, it is attempted to make use of quantitative analysis methods to see if there are any key-findings that can be taken out of the data over the past 20 years by analyzing the relationship between the independent and the dependent variable. The findings generated from quantitative analysis can either be predictive, explanatory or confirming depending on the research design and applied analysis method (Williams, 2007).

Overall, it is important to mention that there are many different approaches and methods towards quantitative research, however Ormrod and Leedy (2015) defined two broad classifications including descriptive research and experimental, quasi-experimental or ex post facto designs, whereby for analyzing the quantitative data they distinguished between descriptive statistics and inferential statistics. In *descriptive quantitative research*, they held that either the identification of individual characteristics of variables or the exploration of possible connections or correlations among variables is the main focus through the examination of the present situation without interfering or changing any variables in the researched situation. In contrast, through *inferential research* the researcher wants to understand the cause-and-effect relationship certain independent variables have on dependent ones, by either performing an *experiment* where the independent variables are completely controlled or *quasi-experiment* where the dependent variables cannot be completely controlled in order to measure the effect on the

dependent variable. *Ex post facto designs*, in which the researcher investigates an event that has already happened or is already present in order to understand the possible relationships among the variables without any manipulation, are often confused with the correlational descriptive design, however an ex post facto design has a clearly identifiable dependent and independent variable (Ormrod & Leedy, 2015). Therefore, with regards to the applied quantitative research design, it can be said that both descriptive and inferential analysis performed on the abnormal return variable will be of importance as even though the relation between the NFP announcements and the EURUSD is at the forefront, it is also very insightful to learn more about the main variable that is being analyzed.

Regarding the statistical approaches which can be used to analyze the quantitative data that has been collected within the research design, this thesis will use both descriptive and inferential statistics. Descriptive analysis, which is the step by step analysis of one variable after another with regards to its frequency, central tendency and variability, is usually done right at the start of any analysis in order to get a broad overview of the data variables (Patel, 2009). In comparison to descriptive statistics in inferential analysis, statistical significance among different variables in hypotheses is tested which allows the researcher to make conclusions about the cause-and effect relationships in a data set (Hackett, 2019). Thereby, it is worth mentioning that there are many different methods and types of statistical significance testing which can be performed for the inferential analysis, depending on the individual variables that are to be tested for. In finance, when it comes to statistically testing the impact of a certain event, like the publication of the nonfarm payrolls numbers, on a certain financial instrument as for example the EURUSD foreign exchange rate, the event study and the related t-testing procedure proofed to be a very popular research tool (Henderson, 1990). Consequently, to summarize, the quantitative analysis will be carried out by performing the individual event studies in combination with the standard descriptive and inferential analysis on the abnormal return measured in pips in order to be able to analyze the impact and the development of the NFP news announcement with regards to the abnormal returns generated for the EURUSD foreign exchange rate.

3.3.1.1 The event study

Event studies are a very popular tool, which became a standard in economics and finance for measuring the impact resulting from a particular event or announcement (Krivin et al., 2003). Within this thesis, classic event study analyses according to Brown and Warner (1985) are being carried out in order to test for significance and market efficiency. Thereby, it has been stated that throughout an event study, a security's returns resulting through a certain information shock, which in this study is the nonfarm payrolls news announcement, is compared to the normally expected returns of the analyzed security, which in this study is the EURUSD foreign exchange rate, in order to see if the event had any significant impact. The residual amounts of the normally expected returns of a security that have been subtracted from the returns throughout

the analyzed event time, are called *excess returns* or *abnormal returns*, which can be tested for statistical significance through the test statistic (Brown & Warner, 1985).

However, in order to be able to perform an event study, the respective timeframes of the pre-event, anticipation, publication and adjustment period have to be chosen. In accordance to the studies performed by Gurgul and Wójtowicz (2014) and Kočenda and Moravcová (2016) an estimation window of 130 minutes has been set for analyzing short-term impacts resulting from news announcements. The main purpose of the estimation window is to define a period right before the event window, which serves as a reference for the normal returns which are not influenced by the studied event. Consequently, this *estimation window*, also called *pre-event period* throughout this study, takes into account 130 minutes before the anticipation period of the event window starts. By taking into account the average returns of more than two hours, it is possible to retain a reliable benchmark return that is adequate for the specific trading day on which the event is analyzed. In general, it is worth mentioning that an estimation period containing more than 100 observations is enough in order to get a representative sample data as possible outliers will be evened-out (Sorescu et al., 2017). Additionally, Brooks (2014) holds that for event studies with a very short event window, the length of the estimation window and the corresponding expected return can receive much less attention as it will be very close to zero anyways.

In accordance to other scholars who performed intraday short-term event studies, an anticipation period of 5 minutes has been chosen for this thesis (Kočenda & Moravcová, 2016). The *anticipation period* is the period in an event study which is examined in order to test for any insider trading, information leakage or changes in return resulting from the expected change of the upcoming news release. The *publication period* is the very minute, the news announcement gets published and announced to the world. The *adjustment period* has been chosen to be 20 minutes long in which the foreign exchange rate is being tested for having significant abnormal returns due to the news release. According to Égert and Kočenda (2011, cited in Kočenda & Moravcová, 2016) an adjustment period of 20 minutes is sufficient enough and effective to track any relevant immediate intraday returns resulting from the publication of a news event. Therefore, summing up all the periods, the *total event period* or *event window*, measures 26 minutes. A visual representation of the various event periods and windows can be retrieved from Figure 7.
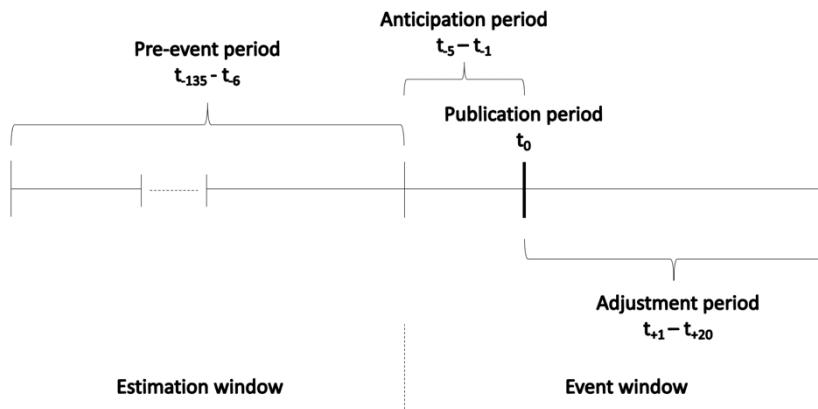
FIGURE 7 ... EVENT STUDY LAYOUT

Source: Own illustration

Malpezzi and Martimo (2017) hold that event studies performed on a short-term horizon can be said to be more reliable than long-term horizon studies, due to the fact that the longer the time horizon gets, the more possibilities are given, where some other factors could have an impact on the studied security. Therefore, the bigger the event window gets, the harder it is to separate the studied event from other influencing factors. This is also the reason, why intraday event studies have gained a lot of popularity over time, as within an intraday event study the variables can be better controlled against the risk of the price being impacted by some other events happening which might influence the validity of the event study (Marshall et al., 2017).

Brown and Warner (1980) state that it is only possible to analyze a security's abnormal return, if there is a benchmark those excess returns can be compared to. There are different models used to calculate the benchmark return, which include the mean-adjusted returns model, the market adjusted returns model and the market model, which is also called the market and risk adjusted returns model (Brown & Warner, 1980; Dyckman et al., 1984). Thereby, it is worth mentioning that all three models are built on the following base formula (1), each one setting its emphasis on different parts of the equation, whereby only the market model uses the full formula (Dyckman et al., 1984).

$$\epsilon_{it} = R_{it} - (\alpha_i + \beta_i * R_{mt}) \qquad (1)$$

Thereby, ϵ_{it} is the prediction error, also called the abnormal return, R_{it} the actual return, R_{mt} the market return and α_i and β_i security specific constants whereby *i* is the security and *t* is the point in time (Brown & Warner, 1980; Dyckman et al., 1984). In the *mean-adjusted returns model*, there is no market interference accounted for by setting β_i to zero, while setting α_i to the mean return of the security over the estimation period. Therefore, in this model, the predicted return of a security is only based on the average returns it was able to generate over the past as the security has constant systematic risk and a constant expected return. In contrast, the

market-adjusted returns model, holds that the predicted return of a security is based only on the market return by disregarding the constant α_i for the security, stating that the expected returns are not necessarily constant for the security (Brown & Warner, 1980). In the last model, the *market model*, the expected security return is based on a linear function of the market return using an OLS beta to calculate the α_i and β_i over the estimation window, in order to account for both market-wide factors and the systematic risk of the individual security (Brown & Warner, 1980; Dyckman et al., 1984).

Even though it is possible to bring multiple factors, in addition to the market factor, into the abnormal return calculation, Campbell et al. (1997) hold that the additional factors do not increase the explanatory power enough as they bring little reduction in variance only. Therefore, it is a general recommendation to use the market model if all the necessary data is available and to keep in mind that the restricted forms like the mean-adjusted and the market-adjusted returns model do impose certain biases and limitations (Campbell et al., 1997). For this thesis, the mean-adjusted returns model has been chosen, because both other models would have required the 1-minute price data of a representative benchmark market for the calculation of the market returns, which unfortunately could not be obtained. However, it is worth mentioning that the mean-adjusted model is one of the most widely used models to calculate abnormal returns (Campbell et al., 1997, cited in Vryghem, 2017). Additionally, according to Marshall et al. (2017) who compared those three models with regards to intraday event studies, found that there was no evidence that one model was able to generate a superior result over the other one. Therefore, with regards to the previously mentioned market model formula (2) by Dyckman et al. (1984), α_i will be substituded by $\bar{R}_i$ as calculated in (3) and β_i will be set to zero in order to calculate the abnormal return $A_{i,t}$ according to Brown and Warner (1985) which is equivalent to ϵ_{it} in (4).

$$\epsilon_{it} = R_{it} - (\bar{R}_i + 0 * R_{mt}) \tag{2}$$

$$\bar{R}_i = \frac{1}{130} * \sum_{t=-135}^{-6} R_{i,t`} \tag{3}$$

$$\epsilon_{it} = A_{i,t} = R_{i,t} - \bar{\bar{R}}_{i`} \tag{4}$$

The abnormal return measured in pips calculated through the event study setup, is the variable of interest throughout this thesis, in order to be used for descriptive and inferential analysis to

better describe the impact development of the nonfarm payrolls announcement on the analyzed EURUSD foreign exchange rate.

3.3.1.2 Descriptive analysis

As previously mentioned, the goal of the *descriptive analysis* is to analyze the body of a variable and describe it by performing a number of calculations for getting an overview of certain frequencies, central tendencies and variabilities within the analyzed variable (Patel, 2009). The variable that will be of major interest in this thesis is the abnormal return, which is the impact that the nonfarm payrolls news announcement had on the EURUSD foreign exchange rate. Within descriptive analysis there are many different calculations that can be done to best describe the analyzed variable in order to get a better understanding of it. However, depending on the research objective, the nature of the analyzed variable and the overall context, some calculations might be more effective than others to best describe the variable. With regards to the *central tendency*, Ormrod and Leedy (2015) argue that this bespoken measure is a technique used to determine a point of central tendency, which in other words is the point around the data of a particular variable revolves around. The three techniques for determining this point are the mean, median and mode (Patel, 2009). For this thesis the mean of the abnormal return has been decided to be of the most interest, as it best describes the central tendency within this context. Thereby, the *mean*, as indicated in (5), is calculated by dividing be the sum of the analyzed data points by the number of observations (Field et al., 2012).

$$\bar{X} = \frac{\sum_{i=1}^{n} x_i}{n} \tag{5}$$

Additionally, with regards to the variability, which is the dispersion or deviation away from the mean for the analyzed variable, the range, standard deviation and the variance are all measures of possible interest (Ormrod & Leedy, 2015). For the purpose of this study, a variation of the range in addition to the standard deviation are of main interest in order to be able to get the most information out of the data set. Whereby, the *range* is the difference between the maximum and the minimum, within this research the *maximum absolute* and *minimum absolute* of the abnormal returns will be calculated due to the fact that the abnormal returns can be both positive and negative depending on the direction of the news announcement, which means that when an announcement triggers a huge price decrease this change would not be reflected in the maximum, but in the minimum. In addition to the minimum absolute and the maximum absolute, also the *standard deviation* (6) will be calculated in order to quantify the average distance of each value to the sample mean as a measure of data variability (Patel, 2009; Field et al., 2012). Overall, due to the application of the various calculations through descriptive analysis in the prescribed quantitative research setting, it will be able to better describe the data set.

$$S = \sqrt{\frac{\sum(x_i - \bar{X})^2}{N - 1}} \qquad (6)$$

3.3.1.3 Inferential analysis

In their original study of daily stock returns with event studies, according to Brown and Warner (1985), the procedure to test if a certain event had a statistically significant impact on the event day, is defined by the *test statistic, or t-test*, calculating the ratio of the mean abnormal returns on the event day and the estimated standard deviation from the time-series of the equivalent mean abnormal returns as it can be retrieved from (7).

$$test\ statistic = \frac{\bar{A}_t}{\hat{S}(\bar{A}_t)} \qquad (7)$$

Dyckman et al. (1984), highlighted three different methods used to test for significant abnormal returns in the presence of event-date uncertainty. Thereby, according to them, in *Method 1*, a single-day estimation approach with abnormal returns only on the event day will be used, whereby in *Method 2* the single-day estimation approach with abnormal returns accumulated over an uncertain event period builds the base. Lastly, in *Method 3*, a multiday estimation approach with the abnormal returns accumulated over the same multiday period will be used to determine if the analyzed abnormal return is statistically significant. It has been concluded that Methods 2 and 3 are more likely to result in less significant outcomes as the according variance is getting larger (Dyckman et al., 1984). The underlying principal of these three methods can be applied to the significance testing procedure used within this thesis which is based on the original test statistic formula (7) of Brown and Warner (1985). The objective of the individual significance tests is to detect in which minutes or event study periods the abnormal returns are statistically significant, which can be compared to the underlying concept of the event-date uncertainty framework of Dyckman et.al (1984). Consequently, depending on which of the above defined methods for the estimation approach of abnormal returns and the corresponding benchmark period, the correct abnormal return and standard deviation have to be chosen. Running the t-test, the calculated p-value can then be compared to the chosen significance level in order to determine if a statistically significant abnormal return due to the event can be detected, which means that the null hypothesis of a no-change, resulting from the analyzed event, can be dismissed.

3.3.2 Qualitative instruments

In the second phase of the research, the qualitative analysis will be performed in order to complement the results of the quantitative analysis to answer the secondary and tertiary research question. Thereby, it is worth highlighting once more that the main focus of this thesis is placed on the quantitative analysis in order to answer the primary research question and come up with the main key findings from the analyzed data. The qualitative analysis is carried out to add further information to better understand and explain the detected developments. Even though qualitative research is a rather broad topic including many different methods for data collection and analysis, the main objective is to identify and investigate the participant's point of view with regards to their individual interpretation of the analyzed events, behaviors or objects (Hennink et al., 2010).

The chosen data collection method for the qualitative analysis that will be carried out in this research setting is the interview method with the overall objective to add information about the research questions and the results found in the quantitative research phase. According to Creswell (2014), the *interview* belongs to the four basic types to collect data within a qualitative research setting, where a researcher conducts sessions either face-to-face, over the telephone or within focus groups in order to ask the participants questions to get their views, opinions and experiences about a certain topic. Thereby, he argues that even though interviews are very useful especially when the researcher wants to have control over the questioning and gather some historical information or experiences about the participant, it has to be kept in mind that there are also certain limitations to interviews. With regards to the limitations, interviews represent information that has been filtered and processed through the perception of the interviewee, which might be biased or not fully represent his actions (Creswell, 2014).

In general, according to Qu and Dumay (2011) there are three distinct forms of interviews, the structured interview, the semi-structured and the unstructured one, each ranging in the degree of the interviewer's level of freedom when it comes to the way the questions are asked and the interview is handled. Whereby they hold that in the *unstructured interview* setting there is no fixed guideline of questions at all, in the *structed interview* the mostly closed-end questions are defined right from the beginning allowing as little deviation as possible. The *semi-structured interview* however, lies in-between the two previously mentioned interview forms and belongs to the most popular interview choice among researchers due to the flexibility to uncover important insights. Thereby, Qu and Dumay state that there is a general structure to the interview that must be followed throughout the session, although the researcher is allowed to jump on the individual responses from the participant and ask additional questions. Consequently, through such an interview setting it is possible to get answers to all of the questions the researcher is interested in, however at the same time leaving the interview participant with the option to go much more into detail. Additionally, the researcher has the ability to come up with follow-up questions that might be valuable for the overall research but have not been thought of before

(Qu & Dumay, 2011). Due to the many advantages of this semi-structured interview format, the interviews for this thesis will be conducted in such a format.

Thereby, it is worth mentioning that the interviews that will be held will be so-called *expert interviews*, which per definition of Meuser and Nagel (2009, p. 17) is "a method of qualitative empirical research, designed to explore expert knowledge", where the interview setting is restricted to expert participants only in order to exclusively collect data from individuals that have certain inferior knowledge about the researched topic. However, it is important to mention that they noted that when it comes to expert interviews which have been popular especially in social research, it is highly debated among scholars and researchers how an individual is becoming an expert in a certain field. This is due to the fact that the researcher's interpretation and definition of an expert has a profound impact on the qualitative research in terms of the group of participants the research is limited to. Therefore, Meuser and Nagel conclude that it is important to clearly define what professional traits and skills make an individual to an expert for the respective research setting as this might also bring certain biases and limitations to the analysis. Even though there are many different approaches to define an expert, in scientific research an expert is an individual that according to the researcher possess some special knowledge relevant for the research that not anybody else has which distinguishes him (Meuser & Nagel, 2009).

Thereby, it is important to keep in mind that interviewing is not about hypothesis testing, but to get a personal insight into the interviewee's lived experience (Seidman, 2006). The main purpose of the expert interviews will be placed on their individual approaches toward the NFP news announcement, their trading related strategies or rules, in addition to explain the key-findings from the quantitative analysis. Lastly, the experts will be asked to give more insights into their personal view of the future outlook regarding news trading and especially the NFP news announcements. Overall, the main purpose with these interview question themes is to get personal access to the context of behavior and at the same time providing meaning to it in terms of the research topic in order to be able to apply these insights (Seidman, 2006). The experiences and behaviors of the individual experts with regards to the nonfarm payrolls announcement and their trading or investing actions towards the EURUSD or other foreign exchange rates, may provide the necessary insights to not only better understand the key-findings that may come up during the quantitative analysis, but also the research topic in general.

Seidman (2006) highlighted and summarized Dolbeare and Schuman's (1982, cited in Seidman, 2006) *three stage interview model*, where the overall interview is split into three separate interviews with a few days between them in order to best understand the participant and put the experiences into context. Thereby, the first interview is about the participant's history and background, the second one about the reconstruction of the experience and the last one about the participant's reflection about the topic (Dolbeare & Schuman, 1982, cited in Seidman, 2006). With regards to the priority of the interviews in the context of this thesis it has to be kept in mind that the qualitative research is applied in a sequential explanatory mixed methods

research setting and builds upon the quantitative analysis in order to add explanations, which is the reason why the three stage model will be only applied in a condensed version. Thereby, the three individual stages will be covered overall through the selected interview questions, however within one single interview session. Additionally, it has to be mentioned that the purpose of these interviews is not to explore a completely new research topic, which would be the case in a qualitative research only setting or sequential exploratory mixed methods research. Even though there has not been a pre-set interview length, the number of questions and the nature of them, will bring the length of the interview to roughly 30 - 45 minutes, which is also shorter than the 90-minute format that has been recommended by Dolbeare and Schuhman (1982, cited in Seidman, 2006). Nevertheless, it has to be kept in mind that this condensed form of the interview setting may lead to some missing context or experience that might be taken as a starting point for further research, which is not too severe as the main purpose of this thesis is the quantitative analysis. Below the general interview structure of the qualitative research can be taken from Figure 8, which graphically summarizes the above explained procedure and main areas of interest.
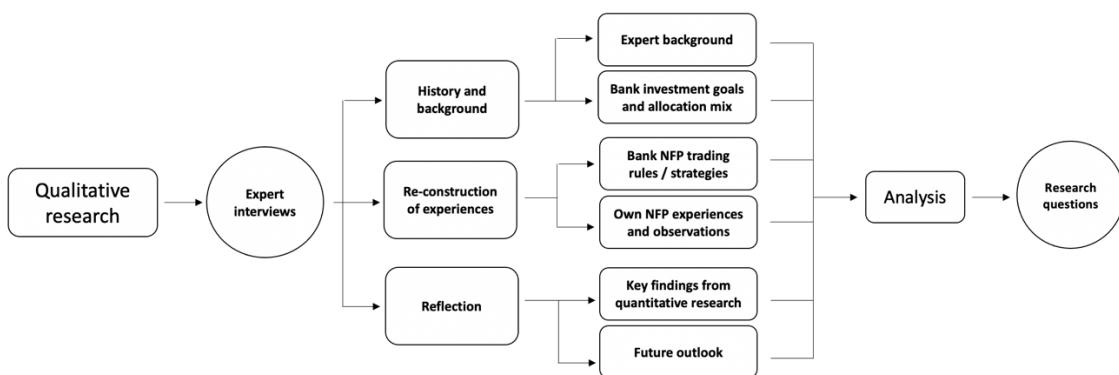
FIGURE 8 ... QUALITATIVE RESEARCH FRAMEWORK

Source: Own illustration

3.4 Sampling procedures

3.4.1 Quantitative analysis

3.4.1.1 Unemployment data

The nonfarm payrolls announcement dates and times as well as the released data have been gathered from the economic calendars provided by Bloomberg and Forexfactory. Both Bloomberg and Forexfactory are well-known and trusted data providers for FOREX traders around the world. Thereby not only the date and the announcement time, but also the newly published, previously revised and predicted values could be retrieved. The forecasted NFP value is the expected employment change that has been predicted by financial experts and gets published in the economic calendars before the actual numbers are to be released. All published and

previous revised numbers have been cross-checked and supplemented with the data from the official source of publication, the U.S. Bureau of Labor Statistics, short BLS, which publishes the data on a monthly base. The BLS (2021) also publishes summarizing tables for every single year dating back long before the time where this thesis starts to gather the data, which are named "Nonfarm Payroll Employment: Revisions between over-the-month estimates" where all the original and revised numbers are being laid out. Thereby it is worth knowing that the initially published NFP numbers are getting revised over the month as the results get more detailed. Table 1 shows the 2019 NFP over-the-month revisions, whereby the number in the 1st column is the actually published value from the initial publication date. The 2nd highlighted column represents the revised value that is referred to as the previous number at the next NFP publication in the economic calendar.

Nonfarm Payroll Employment: Revisions between over-the-month estimates, 2019

| Month | Year | Seasonally adjusted | | | | | | Not seasonally adjusted | | | | | |
| | | Over-the-month change | | | Revision* in over-the-month change | | | Over-the-month change | | | Revision* in over-the-month change | | |
		1st	2nd	3rd	2nd - 1st	3rd - 2nd	3rd - 1st	1st	2nd	3rd	2nd - 1st	3rd - 2nd	3rd - 1st
Jan.	2019	304	311	312	7	1	8	-2981	-2897	-2908	84	-11	73
Feb.	2019	20	33	56	13	23	36	827	848	853	21	5	26
Mar.	2019	196	189	153	-7	-36	-43	724	714	716	-10	2	-8
Apr.	2019	263	224	216	-39	-8	-47	1126	1078	1074	-48	-4	-52
May	2019	75	72	62	-3	-10	-13	687	662	672	-25	10	-15
Jun.	2019	224	193	178	-31	-15	-46	707	632	633	-75	1	-74
Jul.	2019	164	159	166	-5	7	2	-1059	-1074	-1074	-15	0	-15
Aug.	2019	130	168	219	38	51	89	348	418	438	70	20	90
Sep.	2019	136	180	193	44	13	57	362	408	409	46	1	47
Oct.	2019	128	156	152	28	-4	24	947	986	985	39	-1	38
Nov.	2019	266	256	261	-10	5	-5	622	619	607	-3	-12	-15
Dec.	2019	145	147	184	2	37	39	-278	-243	-248	35	-5	30
Mean revision	2019				3	5	8				10	1	10
Mean absolute revision	2019				19	18	34				39	6	40

TABLE 1 ... U.S. BUREAU OF LABOR STATISTICS - REVISIONS TABLE 2019

Source: BLS, 2021

3.4.1.2 Foreign exchange rate

The 1-minute EURUSD foreign exchange rate data has been provided by HistData.com, which is a free foreign exchange rate data provider. HistData.com has been founded by a group of traders and strategy developers who needed historical data for their computations (HistData.com, 2021). Provided for many different foreign exchange rate pairs, some commodities and indices, the 1-minute data of a complete year can be downloaded in various formats including the Microsoft Excel format, which has been the chosen format for this thesis. All yearly Excel charts provide the timestamp, the opening, closing, high and low price of every single trading minute. Thereby, it is important to mention that throughout this thesis the closing price of the 1-minute foreign exchange rate has been used. The data does have some missing 1-minute values that have to be addressed when they fall into one of the analyzed event study windows. Therefore, throughout this thesis the following rule has been applied, where whenever a missing 1-minute value has been present, it has been substituted by the last minutes-data, meaning that no change in price was present for the missing minute. Nevertheless, it is worth noting that these missing values can have an impact on the individual event studies, especially when the number

of missing values is rather high. In order to keep track of the missing values they will be analyzed in a separate analysis in order be able to judge if these missing values could have an impact on the individual event period.

3.4.1.2.1 Daylight saving time issue

During the initial event study round and the subsequent descriptive analysis, a very strong seasonality could be detected across various calculations. Thereby annual peaks across all calculations, but especially with the cumulative absolute abnormal return, the sum of all absolute abnormal returns over the event window, could be detected throughout the winter months, which immediately got lost during the summer months as it can be retrieved from Figure 9. As the pattern started to emerge over the exact same months every single year, further research has been done to find out if any such pattern might have already been discovered before by some other academics. However, no such information could be found, but after some time and additional research the idea came up that the data does not respect the daylight saving time correctly.
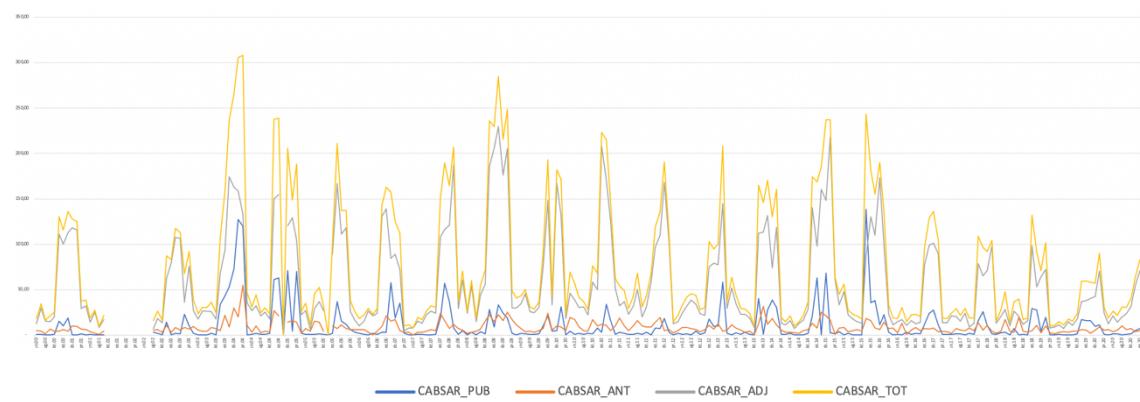
FIGURE 9 ... CABSAR - SEASONALITY

Source: Own chart

The foreign exchange rate data provider, HistData.com, clearly stated that the data is represented in EST time during the whole year, meaning that there is no daylight saving time adjustment. Explaining this in more detail, it can be said that the nonfarm payrolls news announcement is always being published at 08:30 sharp throughout the whole year. This means, that in the winter months where there is no daylight saving time, the time of publication exactly matches with the 08:30 EST time in the data set. However, throughout the summer months the Bureau of Labor Statistics continues to publish the nonfarm payrolls data exactly at 08:30, however this is now at 08:30 EDT, which is 1 hour ahead of EST. Consequently, the nonfarm payrolls news announcement impact in the summer months should be able to be detected at 07:30 EST in the data set.

In order to validate the correctness of the information that the data set does not change to EDT over the summer months, a crosscheck with two additional data providers has been done in

order the minimize the risk of looking for abnormal returns at the wrong time in the summer months. Therefore, a winter month sample data as well as a summer month sample data from the data provider "Firstratedata" which also only reports EST data has been compared with the original "HistData.com" data set. A second data sample set from an additional data provider called "Backtestmarket", which has been sampled in GMT-6s, that does not reflect any daylight saving time, has been taken as a reference for checking this anomaly. All reference data samples being confirm with the original data set used for this thesis, this seasonality effect seemed to be legit, however with an additional data check via the charting software "Tradingview", which also pinpoints the news events on the chart, it could be identified that the original data providers did not correct for the daylight saving time accordingly. Even though the data providers apparently did correct for the American daylight saving time, they did not correct for the European daylight saving time which starts a few weeks later. Taking a closer look at the weekend where the European daylight saving time change happens, it can be seen in the data that the closing price was logged at 15:59 and the opening price at 17:00 whereas, the price should have been denoted at 16:00 if no daylight saving time would have been included. Either the quoted prices for the EURUSD foreign exchange rate has been delivered from an European exchange or the data has been formatted to fit the European exchange time zone even though the time was in EST-5. The same analogy holds true for the switch back at the end of the summertime. Therefore, the 08:30 publication time in the data holds also for the summer months as the European daylight saving time has been included in the data files, which meant that all event studies during the summertime had to be redone in addition to all the calculations and analyses.

3.4.2 Qualitative analysis

3.4.2.1 Participant and interview location sampling

Throughout the process of setting up the structure of the qualitative analysis, which has been done in form of expert interviews, the decision of which experts to include in the participant sample is one vital variable that has to be decided on as it plays an important role in the definition of the research method (Maxwell & Wooffitt, 2005). Overall, as the number of expert interviews is being limited to three experts for the purpose of this qualitative analysis, the underlying selection criteria for the sampling process will be limited too. Thereby, according to Maxwell and Wooffitt (2005) the actual meaning and purpose of sampling in the context of qualitative research brings many challenges as a researcher attempts to select a representative participant sample which is generally problematic and difficult to achieve. With regards to the sampling procedure applied for this thesis, it has to be highlighted that it has not been the main objective of the qualitative analysis applied within this sequential explanatory mixed methods research setting to come up with any representative generalizations. This is due to the fact that the main purpose of the expert interviews has been to get additional explanatory information about the key findings that came up through the quantitative analysis. Additionally, the interviewed participants have been asked about their trading habits regarding the nonfarm payrolls

announcement and their observation over the past years in order to get some first-hand insights to better understand the results of the quantitative analysis and the overall research topic.

With regards to the actual selection procedure of the three interviewees, neither a pure probability sampling nor a complete convenience sampling, has been applied, whereby in a *probability sampling* every chosen participant had the same statical probability to be selected and in a *convenience sampling* not (Maxwell & Wooffitt, 2005). In general, even though the participant group has been chosen purposefully with a specific intention in the first step, the actual participants have then been quasi-randomly assigned. In order to better understand the sampling procedure, the mentioned two steps will be explained in more detail. It should be emphasized that for this thesis the main focus of the expert selection has been on commercial banks that operate in Austria and internationally. This is due to their proximity to the Austrian market, their higher occurrence in comparison to investment banks and their courteous willingness to cooperate. In the search process for participants multiple Austrian banks have been contacted and overall two banks and one former employee of an Austrian Bank agreed to be part of the interview. For the purpose of this thesis the names neither of the banks nor the interviewed experts will be mentioned, in order to protect their identity, which however does not have any impact on the thesis. Nevertheless, it can be said that with regards to the individual experts, all of them have more than 15 years of experience in banking or trading, one of them even 35 years, whereby all of them have at least worked 10 years in foreign exchange departments in various important positions including leading ones. However, it is important to mention that the banks they work or worked for all have different approaches to trading the FX market due to their core businesses. This was an important information that has been uncovered through the interviews as it changes the individual approaches of the experts towards news announcement trading, which allowed to put their answers into better perspective.

With regards to the individual expert selection, two banks assigned a specific trader for this interview, which means that there has been no selection bias except maybe from the bank itself, meaning the probability to be assigned, the selected trader can be labeled random. The one former employee who agreed to participate, has been recommended by another former employee of the bank as he has more detailed knowledge about this topic. Therefore, overall it can be seen that the selection process has not been a pure probability sampling, but rather a so-called *criterion based selection* which according to Maxwell and Wooffitt (2005) is sampling in which the selection process of the participants is deliberate due to the individual's ability to meaningfully contribute to the investigated topic. Therefore it has been suggested to exchange the term "sample" rather by the term "panel" as the participants all belong to a certain selective group of people which are chosen for a specific reason (Maxwell & Wooffitt, 2005).

Additionally, it is important to highlight that all participants received the interview question structure before they agreed to the actual interview in order for them to see if they can provide the experience necessary for this research topic and are also allowed to share this knowledge

from their employers' side. This preliminary step has been highlighted by literature, as otherwise it could happen during the interview that the participant could refuse to answer as he is not allowed to or does not want to share the information which would make the interview inefficient and unproductive (Knox & Burkard, 2009). In the so-called sampling process also the decision of where the research is conducted has to be considered as it could have an impact on the overall outcome (Maxwell & Wooffitt, 2005). Thereby, it is worth mentioning that one of the interviews has been conducted in person in the company of the participant and the other two have been done over a video-call.

Overall, the applied selection method for the qualitative analysis within this research setting and the restriction on the quantity of the participants in the so-called panel, bring some limitations to the ability to make any generalizations which will be discussed in more detail within the limitations section. With regards to future research, it might be interesting to interview additional market participants in order to get more diverse information. For example, an expert from a small investment company might trade the EURUSD in order to create profits from actively trading whereas, the traders from a commercial and investment bank may use foreign exchange rate derivatives for portfolio hedges, speculative trading and FOREX transactions for their clients.

3.4.2.2   Question selection

As previously stated, in a sequential explanatory mixed methods research, the qualitative analysis has its main purpose in gaining additional knowledge through follow-up questions about the results found in the quantitative research. Congruent with explanatory qualitative research the questions are designed to be open-ended in order to not limit the possibility of gaining more specific answers. With open ended questions it is the objective to be able to build on the interviewee's responses in order to reconstruct the full experience by keeping in mind the overall research topic (Seidman, 2006). Additionally, when participants in an interview are confronted with open-end questions instead of closed-end ones, they have to come up with their very own answers instead of pre-defined ones which helps the researcher to get insights into individual variables that might not be defined right from the beginning (Johnson & Christensen, 2008). As previously mentioned, the questions are designed to follow a condensed version of Dolbeare and Schuman's (1982, cited in Seidman, 2006) three phase interview plan, where first questions about the background and the context of the participant are asked, followed by questions about the main topic and the experiences the interviewee had, before finishing off with questions that allow the participant to put everything into perspective. Therefore, overall there will be 24 questions that will be used as a questions guideline for the interview which can be retrieved from Appendix 2.

Out of these 24 open-end questions, the first 9 questions are designed to find out more about the participant and his trading or investment style which is necessary to better understand the following answers in relation to the individual trading approach and expert area. Thereby, not

only the job title of the participant, and the past professional experience is of interest, but also the individual assets and the overall trading strategies are important in order to put the experiences into more context. Consequently, it will be possible to group the three experts according to their history and style of trading which will be essential to judge their approach towards news announcement trading. With regards to the second interview phase, questions 10 to 19 are geared towards the interviewee's perception and experience with news trading, the nonfarm payrolls news announcement and the EURUSD over his career. The main purpose of these questions is to get a deeper understanding of the participant's trading behavior and experiences when it comes to trading news announcements including specific rules or strategies. Additionally, it is of major interest if the expert experienced any patterns or catalysts for market reactions as they might be explaining the findings that have been gathered throughout the quantitative analysis. This middle part of the interview is especially important to uncover possible hidden variables of information that might play a worthwhile role in further researching the underlying factors to the results that have been found in the quantitative analysis.

The last 5 questions are designed in a way that the participant is asked to do a reflection of his experiences and put them into the context of the quantitative analysis findings that he will be presented with during those questions. Special focus will be put on these questions as they are crucial in gaining the explanatory expert knowledge about the individual patterns and trends that could have been detected, before the expert is openly asked to share any additional insights that he might think are important to highlight. Lastly, also a question about the interviewee's future outlook is included in the questionnaire in order to see if the industry experts all have the same predictions about the upcoming years. In general, it is worth mentioning that the prepared questionnaire will be used as a guideline as due to the fact that the questions are open-ended, additional questions may come up and more links or underlying factors towards the results of the quantitative analysis can be up for debate. Overall, every single question has its own purpose in the process of better understanding the expert, his experience and explanatory answers, by also getting a better sense of the individual interviewees as they might have traded completely different which would also have an impact on the answers they give.

3.5 Data analysis

3.5.1 Quantitative data analysis

Overall, the objective of the quantitative analysis is to determine the development of the impact the nonfarm payrolls announcements had on the EURUSD foreign exchange rate over the past twenty years. Therefore, conducting standard descriptive and inferential analysis after the performance of the event studies, allows an in-depth data analysis of the individual news announcements. The base for the variable that has to be analyzed through the descriptive analysis is the abnormal return which is the calculated result of the event study. Thereby, with regards to the descriptive analysis the mean, minimum absolute, maximum absolute and the standard

deviation of the abnormal returns are to be calculated in order to attain knowledge about the data set and the impact of the individual events. Throughout the process of the event studies also the cumulative abnormal returns have been calculated, as they are necessary for the test statistic, which will be analyzed together with the cumulative absolute abnormal return as part of the quantitative analysis as these two computations are a valuable extension in better understanding the magnitude of the analyzed impacts. Additionally, under the concept of the inferential ex post facto method in connection to the event study layout, various test statistics are calculated in order to be able to make any case-and-effect relationship judgements. Thereby, the event studies, the descriptive and inferential analysis are applied to the anticipation, publication, adjustment and the total period in order to study the changes and impacts within these individual periods. Comparing the results from the event studies with descriptive and inferential analysis will allow to give conclusion about the development of abnormal returns over the past twenty years.

3.5.1.1 The mean

The mean abnormal return will provide the average abnormal return though the anticipation, publication, adjustment and total event period. Derived from equation (5), the following equation (8) can be created for measuring the average abnormal return. Thereby, it is worth mentioning that depending on the period of which the mean has to be calculated the respective time intervals for t_1 and t_2 have to be selected.

$$\overline{A_{(t_1, t_2)}} = \frac{\sum_{t=t_1}^{t_2} A_t}{t_2 - t_1} \tag{8}$$

The analysis of the mean abnormal returns allows to gain information about the general direction and magnitude within the certain period making it possible to judge if a certain event resulted in an average positive or negative abnormal return. Additionally, when comparing the individual means throughout time, a comparison of the trend might be able to be detected in order to see if general directions or patterns might be present. Thereby it is worth mentioning that the mean of the publication period will only be the mean of a single minute and therefore not be a representative mean when compared to the means of the other periods which have more than just one minute within their calculation period. Therefore, special consideration has been applied throughout the analysis in order to not skew any perspectives. Additionally, it is worth mentioning that yearly average absolutes have been calculated in the analysis section in order to make better predictions about the yearly values which should provide a better overview of the development.

3.5.1.2 The minimum absolute

The minimum value will be of interest in order to be able to draw conclusion on the question if the overall minimum impacts changed over time. Due to the fact that depending on the outcome of the news announcement either a positive or a negative impact can be anticipated, calculating only the minimum would not be meaningful as one would have to split the positive events from the negative ones. Otherwise it would not be possible to analyze the graph as a positive NFP result would normally lead to a negative impact on the EURUSD which would result in a high minimum number that would mislead from the minimum impact that should be measured. Therefore, instead of the minimum, the minimum absolute is calculated and analyzed throughout this thesis in order to counteract this problem. This has been applied to the anticipation, adjustment and total event period in order to see if these different time frames reacted similar over time. The minimum absolute of the actual event time will not be considered in this analysis as the publication period only consists of one minute and therefore will skew the comparability with other minimum absolute values.

3.5.1.3 The maximum absolute

Similar to the minimum values, also the maximum values will be of interest in the analysis of the impact development the NFP news announcement had on the EURUSD in order to provide information on the question if the maximum impacts became smaller or bigger over time. Analog to the problem explained above why the minimum absolute has been chosen over the normal minimum, also the maximum absolute will be calculated throughout this thesis instead of the normal maximum. Contrary to the minimum absolute, for the maximum absolute all timeframes will be calculated, including the publication period. This allows to better judge which individual period most significantly contributed to the overall maximum absolute value of the entire event window.

3.5.1.4 The standard deviation

Due to the fact that the study of the impact development of the market's reaction stays in the center of this thesis, the analysis of the standard deviation becomes a useful tool to better understand the variability of the abnormal returns over the past two decades. Thereby, with regards to the individual abnormal returns throughout the event window the standard deviation will be calculated according to (9) in order to be able to analyze the development of the average distance of each abnormal return to the mean abnormal return of the event window. The bigger the standard deviation the higher was the divergence of the individual abnormal returns to the mean abnormal return within the event window. This allows to make conclusions about the dispersion of abnormal returns and how they developed between the years 2000 and 2020 in order to see if any patterns can be identified.

$$S_{Event\ window} = \sqrt{\frac{\sum_{i=-5}^{20}(A_i - \bar{A})^2}{26 - 1}} \tag{9}$$

3.5.1.5 The cumulative abnormal return

The analysis of *the cumulative abnormal return* (10), short CAR, stems from the event study and is the sum of all abnormal returns for the individual observation period (Cowan, 1992).

$$CAR(t_1, t_2) = \sum_{t=t_1}^{t_2} A_t \tag{10}$$

Thereby, it is worth mentioning that the cumulative abnormal return allows to draw conclusion about the overall effect direction an individual event had. In addition to be able to say if a certain event resulted in a positive or negative effect direction, the cumulative abnormal return also represents a measurement of the effect magnitude. This information may be especially valuable as for example many abnormal returns in the same effect direction will lead to a higher CAR than when indecision is present in the market about a certain announcement where positive and negative abnormal returns may cancel each other out. The analysis of the CAR with regards to the individual observation periods, will also present the opportunity to get deeper insights of the price impacts for the certain periods, which might allow to see general trends for the observation periods, that might otherwise not be able to be detected when only analyzing the overall event period.

3.5.1.6 The cumulative absolute abnormal return

In comparison to the cumulative abnormal return from Cowan (1992), the *cumulative absolute abnormal return* in (11), short CABSAR, is a deviation that can be interpreted as a measure of overall volatility in abnormal returns as it cumulates all positive and negative returns (Zheng, 2013).

$$CABSAR(t_1, t_2) = \sum_{t=t_1}^{t_2} |A_t| \tag{11}$$

Additionally, the CABSAR of the individual event periods will be calculated and analyzed in order to get a better feeling of the individual return volatility of the certain periods (Zheng, 2013).

Therefore, it might be possible to analyze which individual period results in the highest 1-minute abnormal return changes, either positive or negative. Unlike the cumulative abnormal return, the cumulative absolute abnormal return is not affected by whether a particular event resulted in a positive or negative abnormal return at the end of the analyzed period, but by the magnitude of the individual 1-minute abnormal returns within the period under consideration. However, it is worth mentioning that the CABSAR may only be a simplified measurement for the volatility as only the 1-minute closing prices are analyzed and not the 1-minute high-/ low prices which consequently disregards the entire volatility within the minute. When analyzing the cumulative absolute abnormal returns over time, it will be especially interesting to see if the overall volatility caused by the nonfarm payrolls news announcement measured in abnormal returns changed in magnitude over time.

3.5.1.7 Significance testing

As highlighted in the literature review, there are not only different models which can be used for significance testing, but also different ways to calculate the abnormal returns. Thereby, it is worth mentioning that the mean-adjusted returns model has been used for calculating the abnormal returns. For the significance testing, the underlying principles of Methods 1 and 2 from Dyckman et al. (1984) have been used regarding the individual significance tests. Thereby, four different standard deviations have been calculated with regards to the time-series of the equivalent mean abnormal returns. The respective standard deviations for testing a single minute, the anticipation period with 5 minutes, the adjustment period with 20 minutes and the total event window with 26 minutes had to be calculated. The scaled 5, 20 and 26-minute standard deviations are calculated from the 1-minute standard deviation (12) by multiplying it by the square root of the respective longer period (13).

$$S_1 = \sqrt{\frac{\sum_{i=-135}^{-6}(A_i - \bar{A})^2}{130 - 1}} \tag{12}$$

$$S_x = S_1 * \sqrt{x} \tag{13}$$

With regards to Method 1, a certain 1-minute abnormal return will be tested for being significant in comparison to the standard deviation of a single-minute estimation approach over the total 26-minute event window. Consequently, in the process of the test statistic, the abnormal return of the analyzed event window minute will be divided by the standard deviation of the estimation window for one equivalent minute, building the formula for the Method 1 significance test statistic in (14) according to Kothari and Warner (2007).

$$test\ statistic\ (t) = \frac{A_t}{S_{(1)}} \tag{14}$$

In accordance to Method 2, the accumulated abnormal returns, also known as CARs, of the anticipation, publication, adjustment and total event period will be tested for significance with the matching standard deviation of this period in (15) according to (Kothari & Warner, 2007). Thereby, it is worth mentioning that the Method 2 testing for the publication period matches the Method 1 testing for the 1-minute abnormal return right at the publication.

$$test\ statistic\ \left(t_{1,}t_2, x\right) = \frac{CAR_{(t_1,t_2)}}{S_{(x)}} \tag{15}$$

With regards to the significance levels that the further calculated p-values of the test statistic will be compared to in order to determine if a certain abnormal return or accumulated abnormal return is statistically significant, an alpha level of 1%, 5% and 10% has been chosen for this thesis. Thereby, the 10% level is the easiest to reach and the 1% level is the most difficult to reach, as the level corresponds to the percentage at which the significance test is allowed to falsely provide a significant result. An alpha level of 10% would consequently mean that the probability of rejecting the null hypothesis stating that the event does not cause any abnormal returns, even though it is true, is 10%.

The individual Method 2 tests will allow to provide an overall significance overview of the individual periods, which will allow to better understand the importance of the individual periods that have been defined for the event study. Additionally, Method 1 allows to provide a clear picture about the distribution of significant 1-minute abnormal returns across the total 26-minute event window, allowing to better judge when the greatest number of significant minutes occurred. The Method 1 analysis also allows to create a comparison of the total number of significant minutes within an individual event over time, which will give a graphical representation of the development of significant event minutes over the past twenty years.

3.5.1.8 Missing value analysis

As previously mentioned, there are individual 1-minute gaps within the original data set of the observed periods throughout the past twenty years that have been replaced with the previous 1-minute value in order to simulate a no-change minute. The number of these missing values may have an impact depending on the individual period they occur in. In order to better

understand if there have been any event studies with an especially high number of missing values, a comparison of all missing values with regards to their number of occurrences in the respective periods will be done. Consequently, this analysis allows to better judge if any severe limitations are to be expected due to the individual missing values in the data set.

3.5.2   Qualitative data analysis

The overall goal of the qualitative analysis is to add explanations and valuable insights from the individual experts to the research topic. Therefore, three semi-structured expert interviews have been conducted in person or over a video-call throughout which the experts have been asked to answer 25 different questions which are outlined in the interview question manual that can be accessed in Appendix 2. However, it is worth nothing that due to the fact that the interviews were semi-structured, there was the possibility to go beyond these pre-set questions if interesting interview conversations started building up in order to get more detailed insights which may be on top of the originally thought questions. In order to be able to analyze the expert responses after the interview, each interview has been recorded and transcribed. Therefore, each participant signed a research consent form, which can be seen in Appendix 1, which allowed the individually gathered data to be used for this thesis. In general, it is worth noting, that there are multiple different analysis types, methods and frameworks that are being used by academics for analyzing qualitative data.

Grounded theory, interpretive phenomenological analysis also called IPA and thematic analysis are just a few methods and frameworks to mention, which are very popular in the literature (Braun & Clarke, 2006). These mentioned theories, frameworks and analyses are all distinct tools a researcher can use to gather, identify, analyze and report data in order to retrieve valuable knowledge from it. Depending on what the researcher is trying to study, it is important that the theoretical framework and chosen method matches his expectations (Herzog et al., 2019). Unlike *grounded theory* and *IPA* which both follow a strict pre-existing complex theoretical framework, the *thematic analysis* offers a lot of flexibility in its application and is more accessible to be used for many different qualitative researches (Herzog et al., 2019). The basic and flexible nature makes thematic analysis a very strong tool which can be integrated in already pre-existing research frameworks as unlike most other methods, thematic analysis is a stand-alone analysis tool. Therefore, for this thesis the thematic analysis has been the chosen method for the qualitative data analysis. In the following sub-section, the thematic analysis in general and how it will be used to analyze the gathered interview data will be outlined in more detail.

3.5.2.1   Thematic analysis

Overall, it is important to mention that thematic analysis has become a very popular and widely used qualitative data analyzing tool in many areas of research (Terry et al., 2017). According to Braun and Clarke (2012, p. 57) thematic analysis is a flexible "method for systematically

identifying, organizing and offering insights into patterns of meaning (*themes*) across a data set". However, it is worth mentioning that there is a special emphasis on the word "across" as thematic analysis is a method which is popular for researchers that want to make meaning of a collection of data sets which share common information, as thematic analysis is not intended to focus on experiences found only within a single data item (Braun & Clarke, 2012). Throughout this thesis it is the goal to apply thematic analysis in order to analyze the three interviews which have been transcribed in order to find insights and information that the experts have in common. Thereby, it is worth mentioning that thematic analysis is in general suitable not only for large data sets, but also for small and medium-sized ones, due to its basic and flexible structure (Herzog et al., 2019). However, there are numerous variations of thematic analysis, that all slightly differ in terms of the individual defining variable decisions regarding its analysis. Nevertheless, it can be said that thematic analysis always follows a certain structure containing six main phases which have been outlined by Braun and Clarke (2006) and visually summarized in Figure 10.
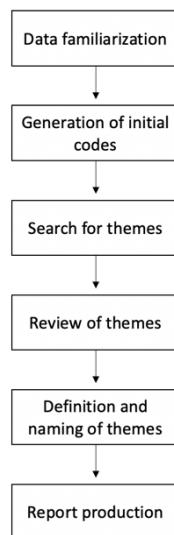
FIGURE 10 ... THEMATIC ANALYSIS STRUCTURE

Source: Own illustration based on Braun & Clarke's structure (2006)

Starting off with the first phase where the researcher should familiarize himself with the data, it is the main objective to read through the entire set of data in order to take in the overall data corpus and impressions (Maguire & Delahunt, 2017). In phase 2, the analysis starts by creating the *codes* for the individual data items in order to condense all the data into smaller and more efficient pieces of meaning that helps the analyst to better understand the data (Maguire & Delahunt, 2017; Terry et al., 2017). Thereby, it is worth highlighting that codes are individual labels that identify or name a certain feature or interpretation of the data which might be interesting for the research (Braun & Clarke, 2006). Throughout this whole phase the researcher goes

through all the data items step by step and decides if there is information that either fits an already created code item or if a new one needs to be created. Thereby, the coding process is not only flexible as the researcher defines the codes for himself, whereby one data item can have multiple codes, but also iterative as codes may get revisions throughout the analysis process (Terry et al., 2017). At the end of the coding phase the researcher should have a list of codes which will then be used in phase 3 as a starting point for the theme creation.

According to Braun and Clarke (2006), the focus is not on the individual code blocks anymore, but rather on the broader level, with the goal of creating a thematic map, connecting all the themes, whereby also sub-themes can be created to better sort the individual codes. Thereby, they state that the researcher goes through all the codes he has in his list in order to find codes which share the same meaning or topic in order to come up with an overarching theme. The condensed list of themes and sub-themes at the end of phase 3 will be completely reviewed in phase 4 in order to check if they adequately fit the gathered data (Braun & Clarke, 2006). Consequently, all the themes will be first analyzed if each one individually has a coherent pattern of codes and secondly if the themes show a consistent validity with regards to the overall data set, before they can then be further defined, named and grouped in the fifth phase (Braun & Clarke, 2012; Terry et al., 2017). Within this fifth step the so-called thematic map or maps are finalized which are a great tool to group the individual codes to visually connect all the themes. The thematic maps generated throughout this thesis can be retrieved from Appendix 3. Lastly, in phase six, after all themes are completely worked out, the researcher writes down his final analysis (Braun & Clarke, 2006). Thereby it is worth mentioning that this process partly already runs parallel to the previous phases in order to provide a coherent and logical argumentation of the individual steps that have been undertaken throughout the analysis to create meaningful conclusions (Braun & Clarke, 2006).

Overall, the six-phase thematic analysis structure provided by Braun and Clarke (2006) is a strong qualitative analysis tool, that allows the researcher to flexibly use it within many different research frameworks in order to retrieve valuable and meaningful knowledge out of qualitatively gathered data. Therefore, throughout the analysis of the expert interviews a thematic structure will be followed whereby the sixth phase, the report writing, will be merged with the "qualitative analysis and results discussion" section of the thesis, where all the individual findings have been incorporated.

3.6 Limitations

Within this section of the thesis the various limitations of the applied research methodology will be discussed in more detail in order to highlight possible weak points or areas that might require further research. Additionally, it is the objective to be completely transparent about the individual limitational factors and their possible consequences in order to increase the validity of the applied research methodology. Thereby, it is important to mention that due to limiting factors

such as, the overall scope, the resources, the applied tests and the chosen variables certain possible pitfalls are inevitable. In the following subsections the recognized and most important individual limitations of the quantitative and qualitative research will be discussed in detail.

3.6.1   Quantitative limitations

3.6.1.1   Data quality and format

Even though the selected exchange rate data provider offers the data free of charge, this does not discount the quality of the data. Histdata.com is a well-known data provider many traders and developers use for back testing and training as they offer a wide range of foreign exchange rate data, some commodities and the most important indices going back many years. Thereby, it is worth mentioning that for most of the securities even very small time-intervals of the data are available, such as the 1-minute data which has been used throughout this thesis. However, due to the fact that they offer the data for free, Histdata.com does not offer any guarantee for the validity and accuracy even though for each data file containing foreign exchange data, they attach a separate file listing all the gaps in the data. Although the FOREX data provided by Histdata.com was the base, multiple cross-checks haven been done with the prices from two other data providers, called "Backtestmarket" and "Firstratedata". Throughout these cross-checks, which all have been positive, the quality of the used base data could be validated on various random intervals. The difference between the prices from the different data providers ranged on a 1-3% level roughly, which might be explained as the data providers used different exchanges or data feeds for their collection. Consequently, even though there is no guarantee for the base data, successful attempts have been taken to test the validity of it.

With regards to the foreign exchange rate data, the 1-minute time interval that has been chosen for this thesis also imposes a limitation to the ability to find the exact impacts of the nonfarm payrolls announcement on the EURUSD. As only the closing price of a certain trading minute has been considered, this ignores the minimum and maximum price fluctuations within the individual trading minute, which might provide valuable insights. Thereby, one of the interviewed experts mentioned that "tick data" would be required to be able to analyze the exact price changes, taking into account every single price move in the market, which would allow to better analyze the individual impacts. Hence, additional research could be done to find out if the time intervals changed with regards to the impact timing over the years in order to be able to better analyze the individual price changes tick by tick.

Additionally, also the NFP news announcement numbers from the economic calendars may be subject to mistakes. Therefore, the actual and previous numbers from the economic calendar have all been compared to the archived numbers of the BLS which proves their correctness. However, it is worth mentioning that the forecasted numbers, have not been able to be checked, as there was no reference where the forecasted numbers could be taken from. According to the

interviewed experts, they have not been using the forecasted numbers only from a single source, but rather gathered them from various different ones including brokers, Bloomberg or Reuters. They even completed their own research to get a better feeling for the possible forecasted number ranges. Consequently, the forecasted numbers taken from the economic calendar are only one possible forecast value, ignoring all other forecasts, which leaves place for further research on this topic.

3.6.1.2 Event window selection

In the process of setting up and designing the overall layout of an event study the estimation and event window selection and the associated periods are playing an important role for the calculation of abnormal returns and the significance testing. The chosen event window, consisting of the anticipation, publication and adjustment period, is especially important in order to be able to detect a possible market reaction, if there is one to detect. If the corresponding period is to short, during significance testing no market reaction might be detectable as the corresponding abnormal returns might be outside the analyzed period. The same holds true when the periods are too long, as the aggregated period testing might not be significant anymore or other confounding events might be happening. With regards to the estimation window the selection process determines the number of observations that are included for the mean returns function which in a later step is vital for the calculation of the abnormal return. If the number of observations would be too low, the mean could not reflect the typical return fluctuation. Therefore, according to similar studies which have been mentioned in the literature review and the methodology sections above, the individual windows and periods have been carefully chosen in accordance to similar intraday event study researches. Nevertheless, the selection of the individual event windows and periods has an important impact on this thesis, and different intervals might lead to different results, which could be analyzed in a future study.

3.6.1.3 Compensation of missing values

As already mentioned in the data sampling section, there are certain gaps in the original foreign exchange rate data supplied by HistData.com, which had to be substituted for in order to carry out the individual event studies. Due to the fact that these missing values have been replaced with the previous minute's price, which simulates a no-change, depending in which event period this missing value has fallen into, this could have had an impact on the event study significance test result. In this missing minute, price could have been much higher or much lower which would either alter the result of the calculated estimation period average, if the missing value was within the estimation period or the abnormal return if the missing value was within one of the three analyzed event periods. In order to be aware of the missing values, a separate analysis has been conducted where the missing values are counted and benchmarked against each other in order to see if there are any periods in the event studies where especially many missing values had to be substituted. Thereby, it is worth mentioning that the number of missing values within

the estimation window, is not that important in comparison to the number of missing values in the event window, as in the estimation window the mean of 130 minutes is calculated, which means that some individual missing values might not be that important, percentage wise. However, for event studies, where there were many missing values, especially in the event periods, caution has to be practiced with regards to the validity of the event study result. Therefore, it would be advisable to run these event studies with the data of another foreign exchange rate data supplier which may not have the same missing values in order to see if the results would have changed.

Additionally, it is important to highlight that there has been a gap of ten consecutive months between October 2001 and July 2002 where no FOREX data at all was recorded during the analyzed nonfarm payrolls announcements. Attempts to get this data from the two other data providers that have been used for comparisons in this thesis, were unsuccessful as their 1-minute data does not go back that far in time. Therefore, in the analysis these months have been excluded, which however means that due to the fact that the burst of the dotcom bubble was within this time, valuable data has been missing which could add additional value with regards to the impact development of the NFP announcement during crisis time where unemployment numbers are usually higher. Nevertheless, these missing months have no impact on the remaining event analyses and data that has been collected and analyzed. Further attempts in future research would be advisable to find data that might be able to close this gap in order to see if the data within these months provide additional information.

3.6.1.4   Event correlation

Price changes in foreign exchange rates can be based on many different reasons, whereby macroeconomic news announcements are only one of them. The EURUSD foreign exchange rate for example, by its nature is subject to be impacted by both individual currencies, the EUR and the USD. Therefore, even though the foreign exchange rate prices are analyzed with regards to be impacted by nonfarm payrolls news announcements, there is also the possibility that other factors led to the observed price changes. Thereby, for example political news announcements regarding the European Union or the U.S. might strengthen or weaken their individual currency, could have happened on the exact same day. Additionally, also global events such as natural hazards or wars can lead to fluctuations in the various currencies. Due to the missing market comparison data, the event study methodology had to be limited to the mean-adjusted returns model, which removes the impact for the general market from the otherwise complete market model formula for calculating the abnormal returns. However, also with regards to the individual macroeconomic indicator news publications, it is necessary to highlight that sometimes multiple indicators get released by the same authority at the same time, which means that these might also impact the underlying currency. Furthermore, according to one of the interviewed experts, also the NFP announcement is not only comprised of the total number, but also sector relevant numbers are being published within the same report which might be of value for certain

investors. Lastly, also macroeconomic indicators for the European Union or its strongest countries might have an impact that could lead to the studied exchange rate fluctuations if released at the same time. Nevertheless, it is important to highlight that due to the small event window, which is analyzed within this thesis, the probability that another event happens exactly within the same observed 26-minute window is rather small as due to the fact that market reactions are quickly mirrored in the corresponding price changes, only announcements that have been published within the observed event window would be interesting. Nevertheless, for this thesis the assumption that the measured price changes are due to the nonfarm payrolls news announcement, could therefore decrease the validity as also other factors could have caused the price changes.

3.6.2 Qualitative limitations

3.6.2.1 Sample size

With regards to the sample size in the expert interview selection process it is worth highlighting that the number of participants is rather limited in quantity which means that it might be difficult to generate any generalizations. The number of interviews has been limited to three in total in order to keep the extent of the qualitative analysis in line with the overall research methodology laid out for this thesis. Nevertheless, it has to be kept in mind that the qualitative analysis in this explanatory sequential mixed methods research setting is not designed to be able to make any generalizations, but rather to gain individual explanations and additional information which could be used to support the quantitative findings. With respect to this thesis, it is the objective of the qualitative analysis to add some overall consensus from the business world to the quantitative analysis, trying to give an overall sentiment towards the NFP announcements from the perspective of the banking industry. Further research could be done based on the findings of this qualitative analysis which can be used as a starting stone. Additionally, also qualitative research with an increased number of participants could add some further knowledge to this research area.

3.6.2.2 Sample selection

With regards to the actual selection process it is important to highlight that the focus has been limited to industry experts from commercial banks that operate in Austria but are not limited to also operate in other countries. Even though there are multiple market participants which would be suitable for this expert interview setting, for the scope of this thesis, it has been decided to limit it to one group only. The reasoning behind this decision has been that it might be more beneficial to interview three experts within one industry group instead of three experts from different ones in order to see if there are any common grounds within a single industry group. Consequently, it has to be kept in mind that the gained knowledge might only be applicable to these types of banks as other market participants such as investment banks might have different experiences or rules regarding the nonfarm payrolls announcement. Therefore, it would be

interesting to expand the research also to other industry participants to get more diverse information.

3.6.2.3 Applied expert interview methodology

As already highlighted in the selection of methodology section, the simplification of the qualitative analysis interview setup, does also impose certain limitations and risks on the information gathered through these interviews. This is due to the fact that some context might be missed that was not able to be retrieved during the shortened interview setting. Nevertheless, due to the fact that the nature of qualitative analysis is explanatory and not exploratory, this self-imposed limitation can be discounted. Additionally, based on the remark that the main focus of this thesis is the quantitative analysis and that the qualitative analysis is only an add-on to expand on the knowledge gained through the event studies, the overall validity has to be kept in mind. Thereby, it is also worth noting that the explanatory sequential mixed methods research methodology does limit the information gained through the interviews as the questions have a special focus on the results gained through the quantitative analysis. Consequently, the selected questions might be biased towards certain areas, resulting in the case where the interviewee is already guided in a certain direction.

In order to counter these bespoken limitations of the missing context the interview questions have been designed in a way that enough background information about the individual interviewee is gathered which not only allows to compare the participants, but also put them into perspective regarding their interaction with the researched topic. Additionally, the questions regarding the impact and the development of the nonfarm payrolls on the EURUSD have been designed in a way that in the first phase no bias regarding the quantitative research results is present before asking specific questions about the key findings. Through such a questionnaire structure it is attempted to decrease the bespoken limitations, even though it has to be kept in mind that it is not possible to completely get rid of them. Therefore, further research could be done with a special focus on qualitative analysis in order to get more detailed information from the industry experts and participants.

3.7 Methodology conclusion

Overall in this chapter, the general methodology selection has been laid out, by determining the research setup for this thesis. Thereby, an explanatory sequential mixed methods research framework has been chosen, whereby in the first and major phase, the quantitative analysis is being conducted in order to be complemented afterwards with a qualitative research by providing additional explanations to the research topic and the findings. The quantitative analysis is split into the descriptive analysis and the inferential analysis, whereby the former one's objective is to provide a general overview about the data set and the later one attempts to derive with meaningful cause-effect relationships through significance testing. The base for all

calculations done in the quantitative analysis are the abnormal returns that could be gained by performing event studies. The individual statistical significance tests of the performed event analyses and the related calculations stay at the heart of this thesis in being able to make any generalizations about the development of the intraday impact the NFP had on the EURUSD over the past twenty years. Both the foreign exchange rate data as well as the macroeconomic news announcement data have been collected from third-party sources. Throughout the setup of the event studies not only the estimation window, but also the event window had to be set with regards to the exact number of 1-minute price data points that are included, whereby the event window, had been further split into the anticipation, publication and adjustment period, each having its individual timeframe. In the second part of the explanatory sequential mixed methods research, the expert interviews in the qualitative analysis layout have been explained in more detail including the expert selection process. Throughout the expert interviews the interviewees are not only asked about their interpretations of the key quantitative research findings, but also about their backgrounds and experiences with regards to this research topic. Furthermore, the qualitative analysis tool, the thematic analysis and the individual steps within the analysis have been explained in more detail. Lastly, throughout this part of the thesis, also the various limitations have been listed and explained in full length in order to highlight possible weak points, which might be useful for further research that can be done on this topic. Thereby, the limitations have been split into quantitative and qualitative ones, including the data quality, the event study window selection, the missing values and the event correlation for the former one and the sample size, sample selection and expert interview method for the qualitative limitations.

4 RESULTS AND DISCUSSION

4.1 Results and discussion introduction

This part of the thesis will be split into four main sections, this introduction being the first one already. In section two, the individual results of the quantitative analysis will be highlighted, before the key findings will be gathered and condensed to the main topics that require further explanation in the qualitative analysis. Thereby, the individual charts and numbers of the descriptive and inferential analysis will be explained in detail to present the results. Starting off with the results of the descriptive analysis the mean, minimum absolute and maximum absolute will be analyzed in order to better understand the impact of the NFP news announcement over the past twenty years. Additionally, the cumulative abnormal return and the cumulative absolute abnormal return, which are additional computations of the abnormal return from the event study methodology are examined before ending with the significance testing. Throughout the significance testing, the individual NFP announcements between 2000 and 2020 will be tested for statistical significance not only with regards to the individual 1-minute abnormal returns throughout the event window, but also with regards to the individual event periods that have been identified in the methodology section. Together the descriptive and inferential analysis based on the individual event studies will highlight the major development of the NFP news announcement impacting the EURUSD foreign exchange rate with regards to the quantitative aspect.

In the third section, the qualitative results from the expert interviews are complemented with some additional research in order to explain the key findings of the quantitative analysis and the insights for the secondary and tertiary research question. Thereby it is worth mentioning that the discussion of the quantitative analysis and the expert interviews will be split into three major parts. Whereby, the first two parts are concerned with the experts' experiences and insights about the main areas of interest from the quantitative analysis, in the third part the relevant insights and future outlook regarding the nonfarm payrolls news announcement in terms of the EURUSD will be highlighted and contrasted. Together these three parts summarize and contrast the information that has been gained through the qualitative analysis, with the results from the quantitative analysis. Merging the results of these two analysis formats will be vital in answering the overall research questions and will bring more light into the NFP's impact on the EURUSD foreign exchange rate also from a professional point of view. Lastly, in the fourth and last section, the main findings of the qualitative and quantitative analysis will be summarized and compared in order to narrow the present research gap.

4.2   Quantitative analysis

Overall, 237 individual event studies have been conducted for the individual nonfarm payrolls announcements with regards to their impacts on the EURUSD foreign exchange rate between the years 2000 and 2020. Based on the individual results of these event studies the following analyses and tests within this section have been performed. Appendix 4 showcases one of the twelve performed event studies within the year 2015.
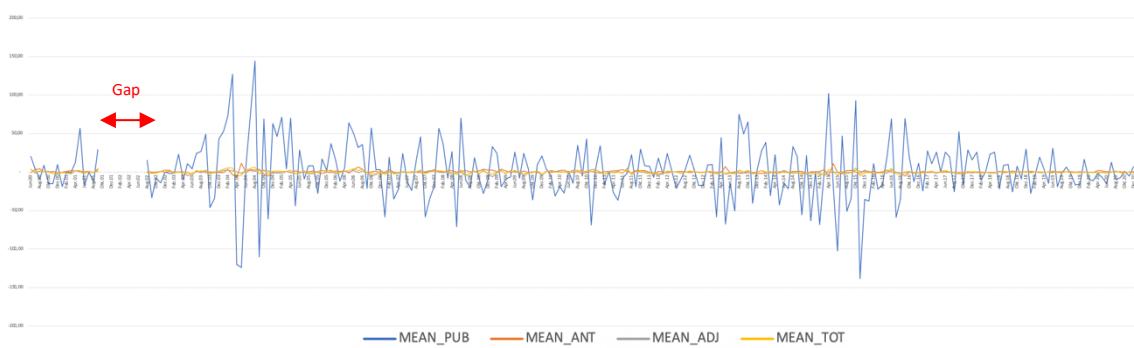
4.2.1   Mean abnormal return

FIGURE 11 … MEAN ABNORMAL RETURN COMPARISON

Source: Own graph

Overall, analyzing the individual mean curves in the means comparison graph, Figure 11, it can be clearly seen that the mean of the publication period shadows all the other means which are barely visible. Comparing the individual timeframes to get a better understanding of their individual importance, it can be seen that the abnormal price change measured in pips of the actual publication time was significantly higher in comparison to the anticipation and adjustment period highlighting the fast adaption of news after the event got published. This fast adoption is in line with the results found by Chaboud et. al (2007) when they could find that prices start picking up sharply after 15 seconds of the publication. Additionally, in comparison to the other means, the mean of the publication period only consists of one value and in the minute of the news publication the surprise effect of the news was the highest, suggesting that also the abnormal returns were significantly high. Additionally, it can be detected that during the time where the big positive or negative peaks occurred also in the following months rather large moves happened. It is important to highlight that between October 2001 and July 2002 there is a visible gap in all the future charts as during this time there was no foreign exchange rate data available to analyze as indicated in the methodology section. To better analyze the individual means, the publication period has been excluded in the following chart as it would draw away the attention from the core results as the pip change from the publication was proportionally lager. The values of the publication period will be analyzed in a separate chart.

Analyzing the mean of the anticipation, adjustment and the total event period in Figure 12, it can be seen that overall the oscillation of values became generally smaller over the time,

whereby the individual means for the events between 2004 and 2016, marked as "Period 2" were comparingly higher and stronger with regards to their amplitude and magnitude than the events throughout the years 2017 and 2020 in "Period 3". This decrease in mean abnormal returns can be seen from both negative and positive impacts equally becoming smaller, following the trendline funnel that has been drawn into the figure which became visually narrower over time. The upper trendline drawn into the graph connects the highs and the lower trendline connects the lows respectively over time in order to give an overall impression of the direction with regards to the impact development.

FIGURE 12 ... MEAN ABNORMAL RETURN COMPARISON - ANTICIPATION, ADJUSTMENT AND TOTAL EVENT PERIOD

Source: Own graph

Additionally, comparing the individual event study periods it can be said that the means of the anticipation and adjustment period showed considerably more extreme positive or negative peaks in certain times, whereby the mean over the total event period was more stable. One plausible reason for this is the increased number of observations included in the mean of the overall event period, especially when thinking about the mean of the anticipation period which only calculates the mean of the 5 minutes prior to the event. The fact that the anticipation period resulted in high mean peaks might be explained due to market euphoria, fear or leaked information. Nevertheless, it is worth keeping in mind that in the mean of the total event period also the large abnormal return of the publication minute is factored in, which will be analyzed separately in the following Figure 13.
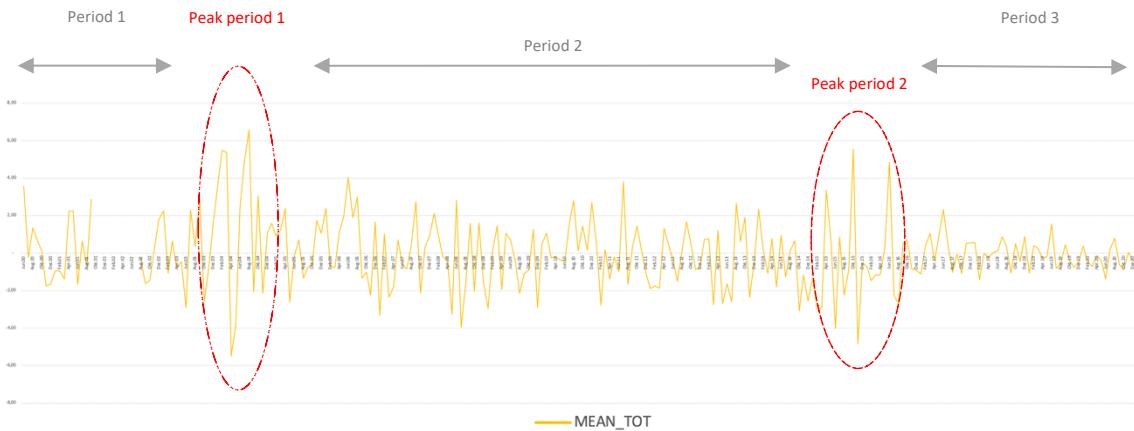
FIGURE 13 ... MEAN ABNORMAL RETURN - TOTAL EVENT PERIOD

Source: Own graph

Analyzing the mean of the total event period, spanning from the anticipation period, the publication period, and the adjustment period, in Figure 13 it can be seen that over the past 20 years there have been periods of large abnormal returns due to the nonfarm payrolls announcement especially in the year 2004 and 2015 marked as "Peak period 1" and "Peak period 2". Thereby the term *peak period* will be used to refer to a timespan in which many positive and, or negative peaks can be observed. However, it is important to mention that there was no uniform direction the individual peak periods pointed to. In the period between these two peaks periods, highlighted as "Period 2" the price shocks slowly became less strong until the year 2014, before the impact rapidly increased again. Generally, it can be seen that a peak was not only one individual event, but rather clustered consecutive events which were in the highlighted peak periods. After the peak in 2015 the foreign exchange rate seemed to react stronger within the "Peak period 2" to the news announcement before entering a period of low impacts in the end of 2016 which still lasts and is marked as "Period 3". Thereby, it was able to observe that even though during the corona pandemic the nonfarm payrolls events were of high magnitude, the foreign exchange rate did not move respectively.

Analyzing the mean of the publication period in Figure 14, the same findings could be discovered as in the previous charts, meaning that the same peaks in 2004 and 2015 could be experienced. However, it is important to mention that in comparison to the previously analyzed graphs, it can be clearly seen that the abnormal pip change at the publication time was clearly smaller in "Peak period 2" in comparison to "Peak period 1". However, with regards to the time period following the two Peaks periods, in "Period 2" after 2016 it can be seen that even though the impact was comparingly smaller, there has also been a period between 2008 and 2013, highlighted as "Period 1", with only a few outliers, that resulted in very low abnormal returns due to the studied events. With regards to the magnitude of the values of the abnormal pip changes at the minute the NFP news had been released, in peak times the NFP resulted in price changes above 100 pips

on average. Thereby, it is worth mentioning that throughout "Period 2" between 2017 and 2020 the average mean price change was only around 25 pips which was considerably lower than in the time between the two peak periods.
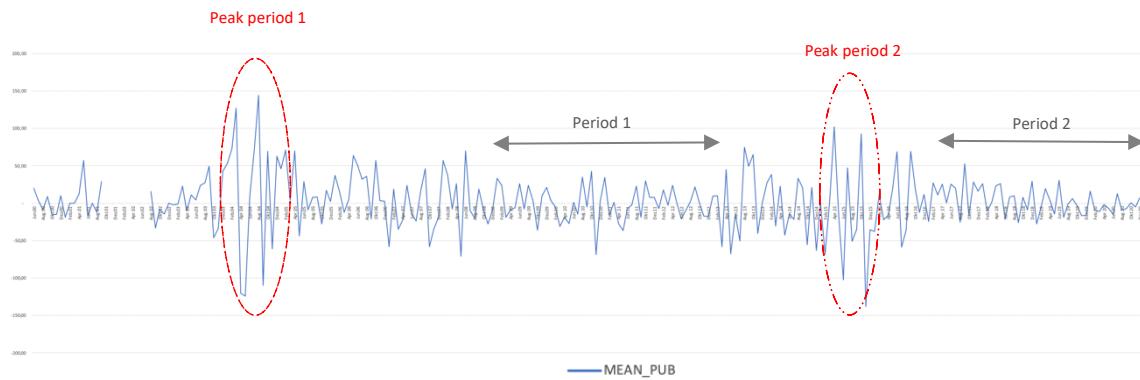

FIGURE 14 ... MEAN ABNORMAL RETURN - PUBLICATION PERIOD

Source: Own graph

4.2.2 Minimum absolute abnormal return

Overall, analyzing the minimum absolute in Figure 15 over the past twenty years it can be seen that the minimum absolute abnormal return measured in the pip change throughout all event periods stayed roughly within the same range of 0.5 and 2 pips. Nevertheless, it can be said that throughout the years 2000 until the end of 2016, marked as "Period 1" and "Period 2" in the graph, the bespoken minimum absolute abnormal pip change was considerably higher than within the time of 2017 and 2020 marked as "Period 3". Thereby, it can be said that comparing the years 2000 to 2016 and 2017 to 2020 the corresponding changes were only a half to a quarter of the average abnormal return during the event period. This can be clearly seen when contrasting the two red horizontal dashed lines inserted in the figure that represent the ranges in which the minimum absolute abnormal return stayed within the bespoken periods.
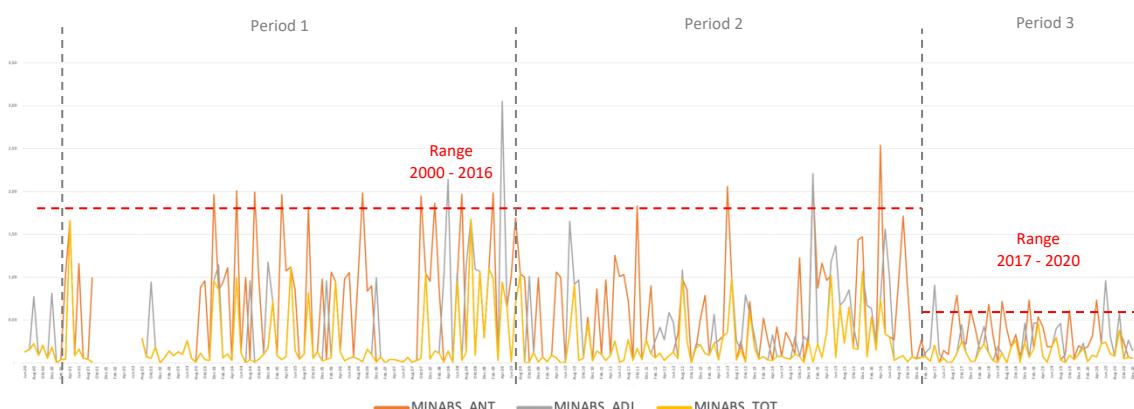

FIGURE 15 ... MINIMUM ABSOLUTE ABNORMAL RETURN COMPARISON

Source: Own graph

Additionally, analyzing Figure 15, it can be inferred that the frequency of peaks within "Period 1", representing minimum absolute abnormal returns for the events in the years 2000 till 2010, were considerably higher than in the following years between 2010 and 2016 represented by "Period 2". Even though, during the later period also peaks could be detected, the time between those increased seemingly. With regards to "Period 3" the gaps between the swings roughly stayed the same as in "Period 2", but it can be argued that the time between the peaks increased slightly. This overall widening observation between the individual peaks of minimum absolute abnormal returns over the time, suggests that the number of times the nonfarm payrolls news announcement led to higher minimum absolute abnormal pip changes decreased.

With regards to individual period timeframes and their correlation to the minimum absolute abnormal returns, it can be said that the anticipation period generally resulted in the highest pip changes. Thereby, it has to be considered that the minimum absolute abnormal pip change for the publication period has been excluded as it is based on only one value which is significantly higher than the others, which would not only make the graph unreadable, but also would not contribute to the intended analysis. Additionally, it can be detected that the adjustment period resulted in the highest minimum absolute abnormal pip change for certain news announcements suggesting that the event must have been very impactful as the adjustment period is 20 minutes long, which makes the probability for small abnormal returns within the period very likely.

Analyzing Figure 15 allowed to gain more insights into the lowest absolute abnormal returns during the event period, which gave information about the impact the announcements had on the foreign exchange rate. The lower the observed values, the lower the impact seemed to be, as high minimum absolute abnormal pip changes also suggest an overall higher impact, excluding any high or low swings within the 1-minute candle. Nevertheless, it is worth mentioning that it can be concluded that there was a visual change in the impact that the nonfarm payrolls had on the EURUSD throughout the last 4 years in "Period 3".

4.2.3   Maximum absolute abnormal return

Analyzing the maximum absolute abnormal return over the past twenty years it can be seen in Figure 16 that the data appeared to follow a cyclical wave pattern highlighted by the dashed red line which has been added to the graph. Thereby it is worth mentioning that the cyclical pattern encompassed the two highlighted peaks marked as "Peak 1" and "Peak 2" which were identical to the ones identified in the means analysis and roughly ten years apart. Before, between and after those two peaks the maximum absolute pip changes inclined, declined, then incline and finally declined again within "Period 1", "Period 2" and "Period 3" creating the bespoken wave patten. Nevertheless, it is vital to mention that overall it can be seen that the maximum absolute abnormal returns in "Period 3" throughout the years 2017 to 2020 were seemingly smaller than

they had been before. Thereby, it can even be argued that the values became smaller and smaller after the end of 2016.
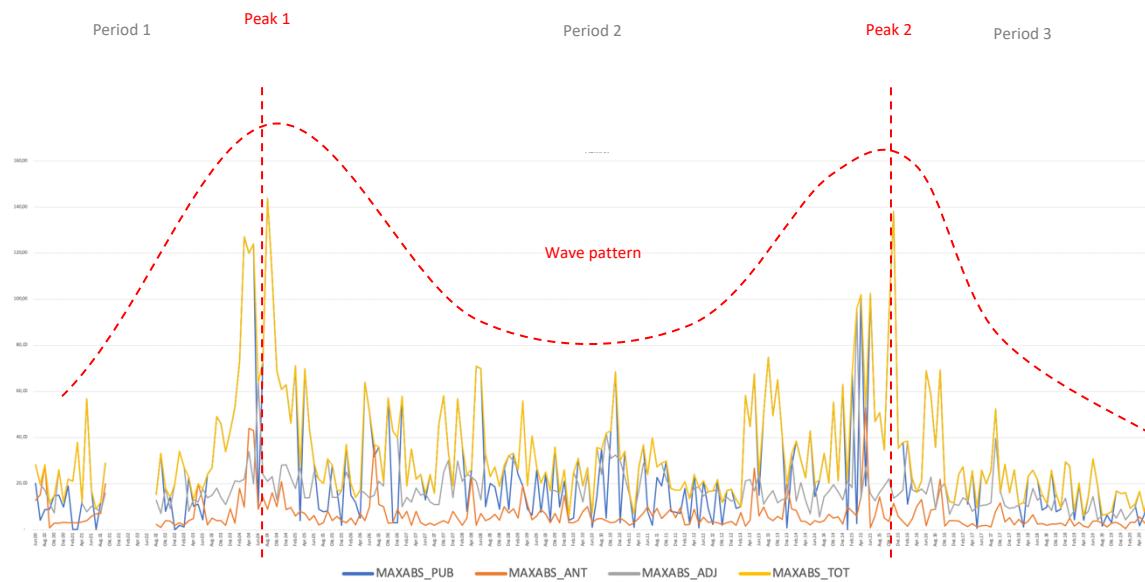

FIGURE 16 ... MAXIMUM ABSOLUTE ABNORMAL RETURN COMPARISON

Source: Own graph

In the process of analyzing the maximum absolute it was of major interest if the maximum abnormal pip change occurred in the anticipation, publication or adjustment period in order to better understand the reaction of the market to the news announcements. Thereby when analyzing the individual curves of the event periods with the maximum absolute curve of the total event period, it can be seen that the peak months in most cases overlayed with the publication period suggesting they resulted in the highest number of maximum absolute abnormal returns throughout the entire event observation period of 26 minutes. Consequently, this suggests that the market most of the times instantly reacted the strongest to the published announcement within the first minute. However, it is important to highlight that during some months the publication period got surpassed by the adjustment period. This might suggest that sometimes there was a delay of the impact caused by the news announcement resulting in the highest absolute abnormal pip change after the actual publication timepoint. However, this observation might also be possible, when at t_0 the price quickly recovered right before the 1-minute candle closed, before the price went further into the direction that the announcement caused.

Comparing the publication and adjustment period lines, especially throughout the years 2017 to 2020 it can be seen that even though the maximum absolute abnormal pip change decreased substantially, the values for the anticipation period stayed constant within this "Period 3" as they have already been considerably low. Additionally, it can be seen that the anticipation period resulted in the flattest of the three periods suggesting that information leaks and market euphoria right before the news announcement have not been present.

4.2.4 Standard deviation

With regards to the variability of the abnormal returns over the total event window, it can be inferred from Figure 17 that the overall pattern mirrors Figure 16 from analyzing the maximum absolute. The same wave pattern with exactly the same peaks can be found in this standard deviation comparison chart. "Period 2" being the longest in this chart showed a rather steady level of values, whereby the peak periods could be clearly identified. Additionally, the same decline in magnitude of the standard deviation in "Period 3" could be identified, suggesting that during this time also the variability of the individual abnormal returns to the mean decreased seemingly.
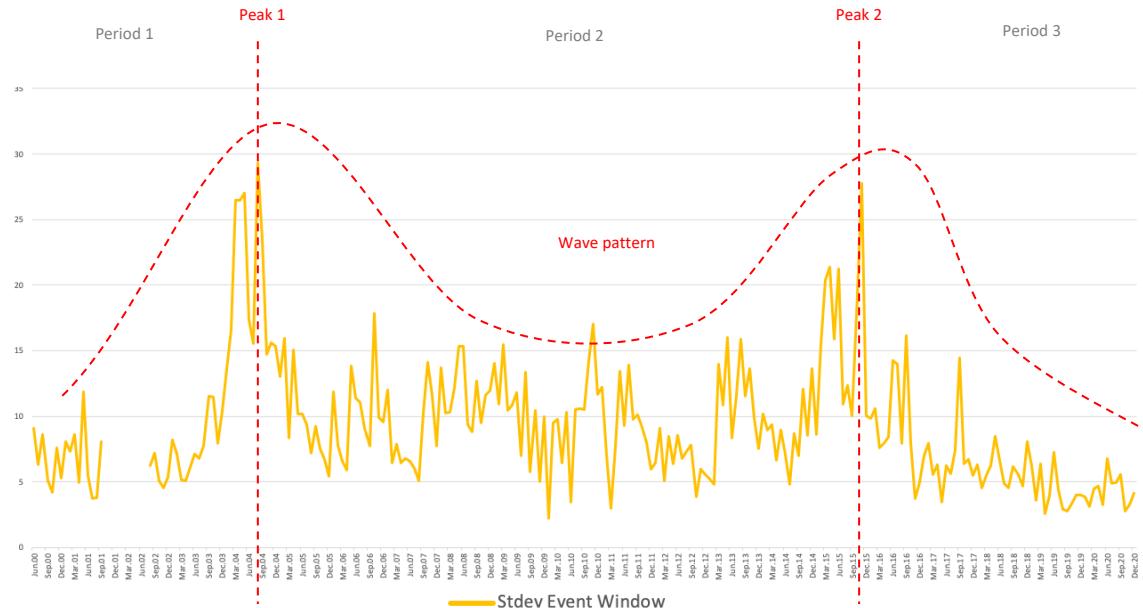
FIGURE 17 ... ABNORMAL RETURN STANDARD DEVIATION COMPARISON

Source: Own graph

Additionally, when looking at the standard deviation between the end of 2016 and 2020, it can be seen that the standard deviation of the abnormal returns within the event window, was constantly at a level which has only been spiked into at the extreme lows throughout the past twenty years. This clearly shows how strong the decrease in the variability of abnormal returns was in "Period 3". Nevertheless, it is worth mentioning that the variability alone does not tell much about the overall impact level as during this time the impact could have been constantly very high. Therefore, it is important to combine the individual analyses, as then it can be seen that that this was not the case and during this time not only the variability was low but also the strength of the impact. Overall, analyzing the standard deviation, it could be seen that the variability was also peaking in times when the abnormal returns were very high, whereas from the end of 2016 onwards the variability decreased drastically.

4.2.5   Cumulative abnormal return

In Figure 18 where the cumulative abnormal returns of all 4 periods have been plotted, it can be seen that overall the number of total positive and negative cumulative abnormal returns were very balanced throughout the past twenty years. Additionally, it can be seen that the overall trend of the cumulative abnormal returns became considerably smaller over time when comparing the development. This consistent downtrend has been highlighted by the two inserted dashed red lines which together created a funnel. Especially, during the period from 2017 onwards, the news announcements of the nonfarm payrolls caused seemingly less abnormal returns for the EURUSD within the observed event periods. With regards to the two peaks in the years 2004 and 2015, marked as "Peak period 1" and "Peak period 2", it can be said that these were identical to the ones which have been brought to attention in the maximum absolute and means analysis.
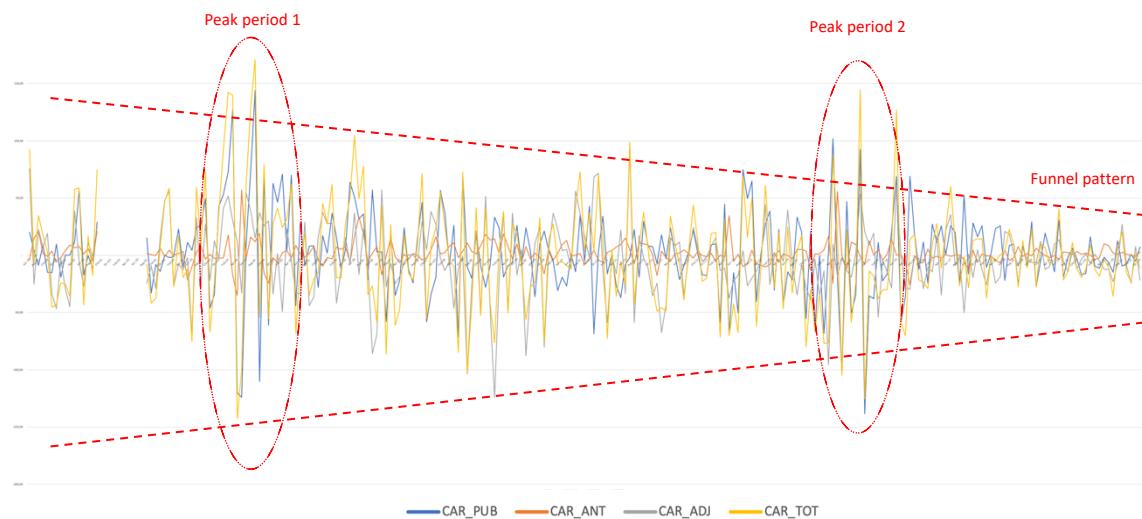
FIGURE 18 ... CUMULATIVE ABNORMAL RETURN COMPARISON

Source: Own graph

Comparing the individual event periods to the total event period, it can be detected that the publication period most often contributed the biggest share to the cumulative abnormal returns in general and especially with regards to the positive and negative peaks in 2004 and 2015. Nevertheless, it is worth mentioning that also the cumulative abnormal return within the adjustment period seemingly played an important role with regards to the magnitude of abnormal returns. This finding seems to be very plausible as the adjustment period is the longest one with 20 minutes out of the total event window which lasts for 26 minutes. Consequently, it can also be inferred from Figure 18 that the cumulative abnormal returns from the anticipation period were rather insignificant with regards to the other two periods, meaning that either the anticipation of the released news announcement did not cause any euphoria prior to the release or that traders stood still right before the news announcement, meaning that they did not see any major advantage of trading immediately before the publication.

Additionally, it can be detected that there was a considerable number of months where the publication period resulted either in a strong positive or negative pip change whereby the cumulative abnormal return of the total event period resulted in the exact opposite. This suggests that the abnormal returns throughout the adjustment period completely canceled out the abnormal returns generated in the publication period. Due to the fact that the adjustment period is considerably longer than the actual publication period it might be plausible that the initial reaction of the market to the event might not have aligned with the result of the publication, which then got reversed over the adjustment period by strong abnormal pip changes in the other direction. Another possible explanation might also be that some certain trading strategies might have caused this effect. However, it is important to point out that more concise and deeper analyses would have to be conducted during those exact times where such an effect has happened in order to give more detailed information.

4.2.6   Cumulative absolute abnormal return

Overall, it is important to highlight that the nonfarm payrolls announcement generally did result in large absolute abnormal returns throughout the observed event window as multiple total absolute abnormal cumulative returns above 250 pips within only 26 minutes could be experienced. In order to be able to better analyze the CABSAR comparison chart, Figure 19 has been divided in three periods according to their values, whereby "Period 2" was the longest one ranging from 2003 to 2017. Referencing back to the argument stated above that the NFP did result in important abnormal pip changes within the event window that a trader can leverage for his advantage, it can be said that the average pip change over time in "Period 2" was around 150 to 200 pips which was a considerable large number for intraday moves.
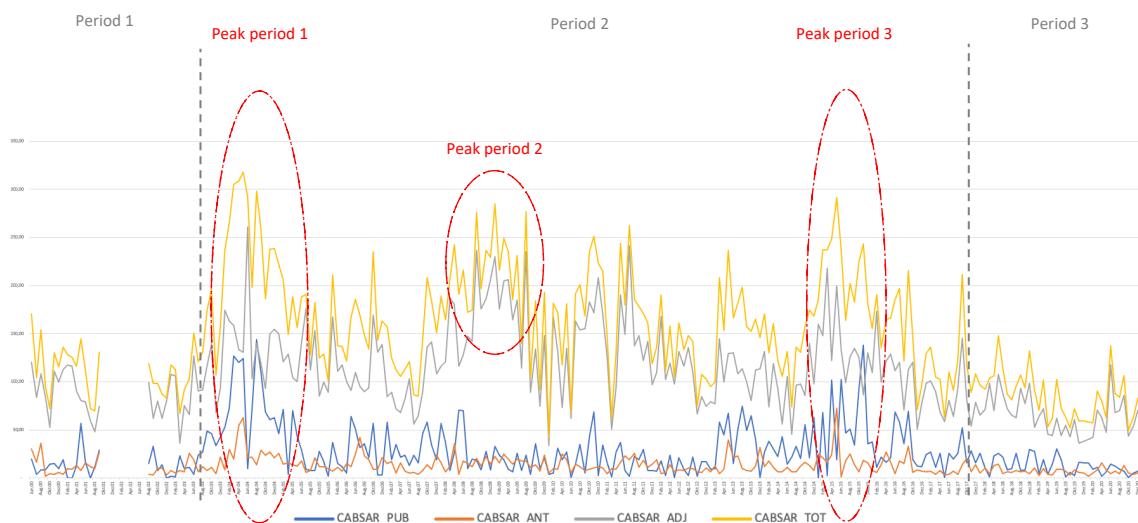

FIGURE 19 ... CUMULATIVE ABSOLUTE ABNORMAL RETURN COMPARISON

Source: Own graph

With regards to the peak periods highlighted in Figure 19, it can be said that the first one centered around 2004, the second one between 2008 and 2009 and the last one around 2015. Throughout these mentioned periods the total CABSAR of the events and the adjustment CABSAR showed considerable high and dense values. Possible reasons for those peak periods will be analyzed in more detail after the key findings section where all major findings will be brought together to form a general conclusion.

Similar to the findings of the previous analyses that have been done, it can be seen hat the cumulative absolute abnormal return throughout "Period 3", was seemingly lower than in the years prior to 2017 suggesting a possible decrease in importance with regards to the abnormal pip impact the nonfarm payrolls news announcement had on the EURUSD. This general finding can be supported by plotting the trendline, the black dotted line, of the total event period in Figure 20.
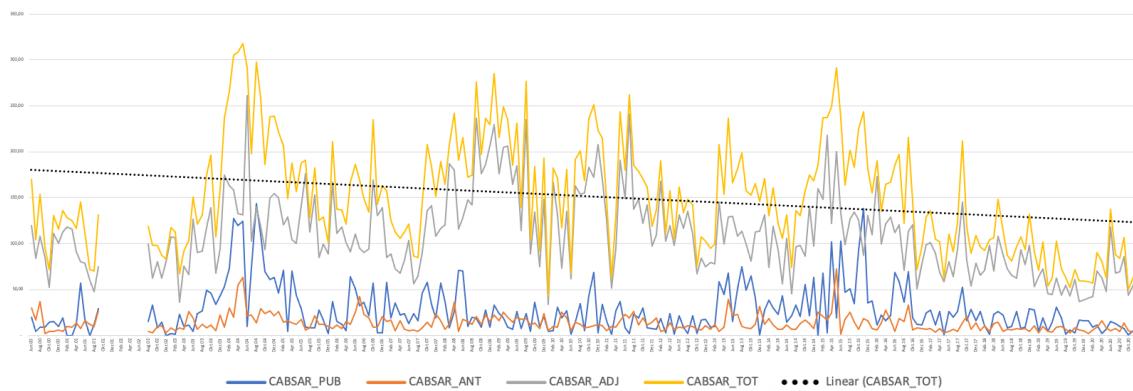
FIGURE 20 ... CUMULATIVE ABSOLUTE ABNORMAL RETURN COMPARISON WITH TRENDLINE

Source: Own graph

Thereby, it can be seen that the trendline has a negative slope for the total cumulative absolute abnormal returns, proofing that a steady decline in total cumulative absolute abnormal returns had been present with the progression of time over the last twenty years. Additionally, it can be seen from the trendline, that until 2017 the total cumulative absolute abnormal return was regularly above the trendline, whereas after the beginning of 2017 it barely broke above it which suggests an even faster decline.

With regards to the individual event periods, it can be said that by comparing the share of cumulative abnormal returns the individual periods contribute to the total cumulative absolute abnormal return, the majority of the abnormal return could be generated through the adjustment period. This becomes apparent when comparing the lines of the CABSAR_TOT and the CABSAR_ADJ, which had been the closest. While the publication period was the biggest contributor to the previously analyzed CAR_TOT, for the CABSAR_TOT the adjustment period was the

biggest contributor. This might suggest that within the adjustment period the impact measured in abnormal returns did not always continue to go in the same direction but rather fluctuated in positive and negative abnormal returns which were accounted for in the cumulative absolute abnormal return but not in the normal cumulative abnormal return. Therefore, the CABSAR proofs to be a very interesting indicator of the overall abnormal pip changes that occur within the event window, as it is signaling the magnitude of the overall market's reaction capturing both positive and negative changes.

4.2.7 Yearly average absolute comparison

Having analyzed the abnormal returns of the individual announcements with the various descriptive analysis tools, the interest emerged to directly compare and contrast some of these individual analyses in order to better understand the interconnection of these on a bigger level. Table 2 summarizes the yearly average absolute values of the abnormal returns from the publication period and the total event period, which are compared to the yearly average cumulative absolute abnormal return over the total event period. Thereby it is worth mentioning that the purpose of this table is to better understand the yearly development of the individual abnormal returns, which is the reason why the average absolute values have been chosen instead of only the average values, as otherwise the positive and negative values could cancel themselves out which would neglect the purpose of this analysis. The process of calculating the absolute values does not have any effect on the CABSAR as these values have already been absolute values. Whereby, the CABSAR is the cumulative abnormal return of all 26 minutes within the event period and hence gives a representation of the overall number of abnormal pip changes, the CAR gives an indication of the overall abnormal return at the end of the event window. Taking the absolute of the CAR is therefore different to the CABSAR as the absolute of the CAR is the cumulative abnormal return which includes all positive and negative abnormal returns within the event period that may have canceled each other out, which in the end has been taken as an absolute value for this analysis.

Year	Average absolute		
	PUB	CAR TOT	CABSAR TOT
2000	11.66	34.63	120.37
2001	16.29	39.24	115.10
2002	17.65	28.20	97.17
2003	22.88	40.08	127.66
2004	85.59	99.47	261.90
2005	28.02	32.75	163.90
2006	28.02	47.87	162.79
2007	30.67	37.27	132.85
2008	30.27	48.08	207.96
2009	18.34	36.65	199.30
2010	21.31	25.37	169.40
2011	17.69	31.65	171.24
2012	11.99	27.91	131.00
2013	40.50	44.28	163.37
2014	32.56	34.72	138.55
2015	57.73	65.52	219.62
2016	32.04	37.99	153.82
2017	22.78	21.34	115.56
2018	16.59	14.10	104.92
2019	13.60	15.65	71.74
2020	8.53	13.97	80.05

TABLE 2 ... YEARLY AVERAGE ABSOLUTE ABNORMAL RETURN COMPARISON

Source: Own representation of calculated numbers

From Table 2 it can be taken that all three analyzed averages followed roughly the same pattern and only differed in magnitude. With regards to the average absolute abnormal return at the publication time, after 2015 the values significantly dropped whereby 2020 showed the smallest number even though the corona crisis struck the worldwide market. In the years 2004 and 2015 the average absolute abnormal returns at the event time was considerably high, underlining the importance of the NFP news announcement. Even though the PUB values from 2000 to 2002 were also considerably low, the CAR TOT values were similar to the ones between 2005 and 2014 which had much higher PUB numbers. This suggests that during the early years in 2000 the market overall reacted strong to the NFP news announcement, but not on average in the very minute the news announcement was published, but rather over the entire event window, suggesting a delay in the market reaction. The same analogy however does not hold for the significantly low values in the years 2017 to 2020, suggesting that the market's reaction became less strong in these years. Analyzing the CABSAR TOT which represents the total amount of average cumulative absolute abnormal returns over the entire event period, it can be seen that over the time from 2000 to 2016 the values stayed within the same range, however through the period of 2017 to 2020 there was the same drop in abnormal returns that could be detected as with the PUB and the CAR TOT.
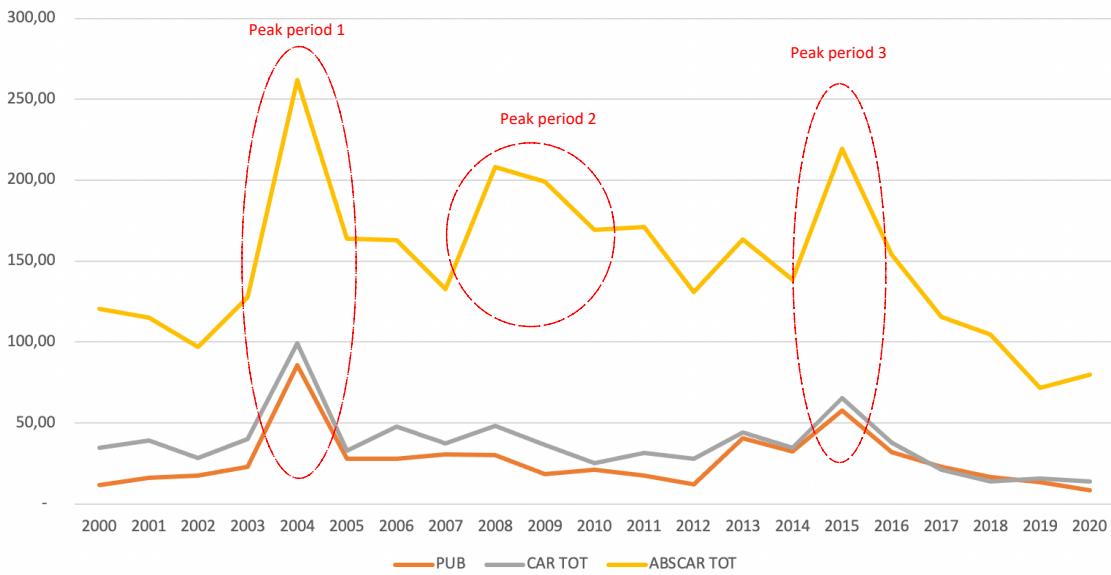
FIGURE 21 ... YEARLY AVERAGE ABSOLUTE ABNORMAL RETURN DEVELOPMENT

Source: Own graph

Figure 21 visually represents Table 2 that has been previously analyzed, where the same effects can be visually detected. Thereby it can be seen that the PUB and the CAR TOT line were very closely together meaning that the publication period was a substantial part of the absolute average cumulative abnormal return over the total event period. The line of the CABSAR TOT was about 2.5 times higher than the other two lines meaning that throughout the event window there have been considerable amounts of positive and negative abnormal returns which accumulated. Nevertheless, it can be noted that the gap between the PUB and CAR TOT line became smaller and smaller from 2013 onwards. Additionally, the drop in the CABSAR TOT had been much more drastic than the decline in PUB and CAR TOT, suggesting that the individual abnormal returns throughout the event period were becoming significantly lower over the cumulated time period.

With regards to the highlighted peak periods that can be observed, it is important to mention that whereby during "Peak period 1" and "Peak period 3" all three lines were clearly plotting high numbers, during "Peak period 2" only the CABSAR numbers seemingly increased. This suggests that during this peak period the market did not react that aggressively towards the announcement resulting in a clear move throughout the total event period, measured by the CAR, but rather that the market was very undecided during this second peak period, as the high number of positive and negative abnormal returns resulted in high CABSAR values.

4.2.8 Significance testing

Throughout the significance testing all 237 recorded nonfarm payrolls news announcements had been tested for statistical significance based on the event studies with regards to the publication impacting the EURUSD foreign exchange rate by causing abnormal returns. In more detail, three different significance levels had been tested and compared, whereby the 1%, 5% and 10% alpha level had been analyzed. Figure 22, the significance occurrence overview, provides a comparison of the individual periods throughout the event window with regards to the number of significant occurrences. Thereby, it can be seen that out of the 237 event studies the NFP announcement led to 187 significant total event periods at the 10% significance level, 175 at the 5% level and even 148 at the 1% level. This means that between the years 2000 and 2020 the chance that a nonfarm payrolls announcement lead to a significant cumulated abnormal return over the whole event window at a 10% level was roughly 79%. Out of these significant events about 79% have even been significant on a 1% level. Consequently, it can be seen why the nonfarm payrolls announcement is perceived to be one of the most important macroeconomic indicators.
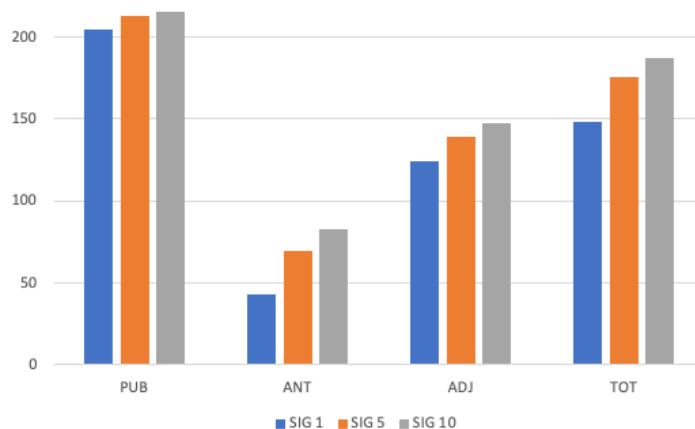
FIGURE 22 ... SIGNIFICANCE OCCURRENCE OVERVIEW

Source: Own graph

With regards to the anticipation, publication and adjustment period it can be identified that the publication period resulted in the highest number of significant periods, followed by the adjustment period and lastly by the anticipation period. Additionally, the publication period clearly surpassed the total event period suggesting that the measured abnormal returns have been very high within the first minute of publication in comparison to the expected standard deviation. Thereby, with regards to the publication period it is worth mentioning that out of the 237 events, 215 were significant at a 10% level, 213 at a 5% level and 204 even at a 1% level meaning that 86% of the events resulted in a statistically significant abnormal return on the 1% significance level right in the first minute when the announcement had been published. Consequently, in 90% of the observed cases the news announcement resulted in a significant result at the 10% level. Thereby, it is worth mentioning that it could be identified that about 95% of all the 215

significant events have been significant at a 1% level, meaning that the chance of a significant publication period being significant at a 1% level was very high over the past twenty years.

However, due to the fact that more than half of the adjustment periods have been statistically significant at the 1% level suggests that the adjustment period experienced a considerable number of abnormal returns as in comparison to the publication period the adjustment period is twenty times longer. Consequently, the anticipation period can be labeled to the least important out of these observed periods, as even though it is only comprised of 5 minutes, the statistically significant occurrences have been visibly lower.

In order to better understand the distribution of the significant EURUSD abnormal returns due to the nonfarm payrolls announcement on the individual 1-minute timeframe over the entire event study observation window, Figure 23 compares the 1%, 5% and 10% significance level abnormal returns starting from the anticipation period at t_{-5}, the actual publication at t_0 up until the end of the adjustment period at t_{+20}. This allows to draw more conclusion about the individual significant abnormal pip changes with regards to their point in time, giving a better understanding of when these significant price changes were more likely to occur and how they were distributed throughout the observation period in order to make better investment decisions.
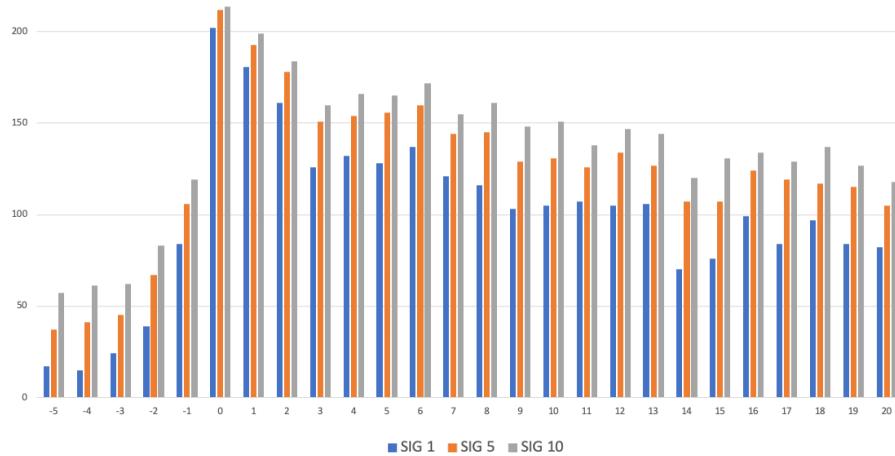
FIGURE 23 ... SIGNIFICANCE OCCURRENCE DISTRIBUTION

Source: Own graph

Similar, to the already observed significance occurrences at the actual publication in Figure 22, it can also be seen that with regards to the distribution within Figure 23, throughout the overall event window the most significant abnormal returns centered at the actual minute of publication. In general, it can be seen that the distribution of significant abnormal pip changes followed a right skewed distribution, whereby the significant 1-minute changes started to increase exponentially the closer the publication came, peaked at the actual publication and slowly declined right after the announcement. Consequently, it can be said that the market was very quick and efficient in reacting to the news announcement. This finding is in line with the findings of

Chaboud et al. (2007) and Gurgul and Wójtowicz (2014), as it could be proven for such a highly liquid and popular security like the EURUSD foreign exchange rate the speed of adjustment was very fast, already showing the highest abnormal returns within the first minute of the publication.

Additionally, it can be said that only in the immediate minutes right before the publication any market euphoria or action could be experienced due to possible information leaks or fear of the expected price changes due to the news announcement. However, it is worth mentioning that the EURUSD experienced considerable amounts of significant 1-minute abnormal returns as a consequence of the NFP announcements during the past 20 years as it can be seen that also after the publication the significant occurrences have been rather high throughout the whole adjustment period. Nevertheless, it can be taken from the chart that the number of significant 1-minute changes decreased steadily especially when comparing the significant minutes at the 10% and 1% level.

In order to better understand the development of the significant events over the past twenty years the individual 1-minute significance occurrences were counted and displayed over the years 2000 to 2020 in Figure 24. The number of significant 1-minute abnormal returns have been counted within the overall 26-minute event observation window and then displayed as a bar, whereby, the height of the bar represents the number of significant occurrences. With regards to the significance, the occurrences of the 1%, 5% and 10% alpha level will be contrasted against each other.
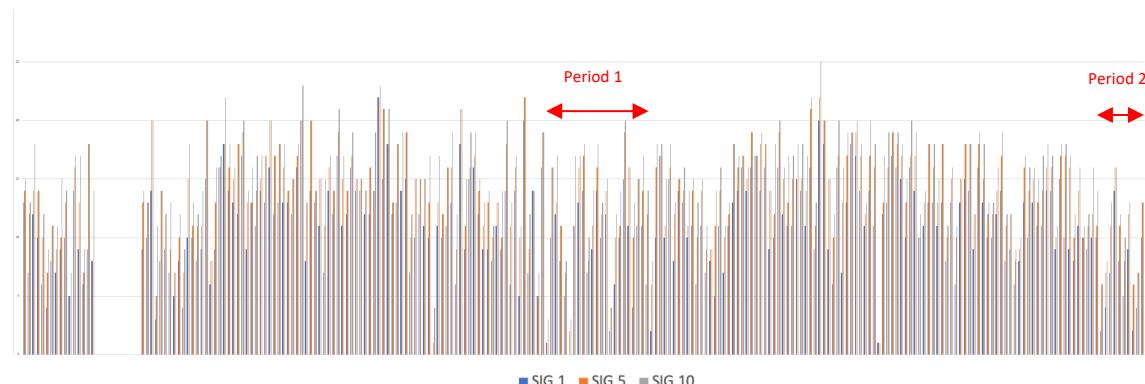
FIGURE 24 ... SIGNIFICANCE OCCURRENCE COMPARISON

Source: Own graph

Analyzing the development and distribution of the significant 1-minute occurrences over the past twenty years, it can be said that overall the number of significant occurrences with regards to the individual events seemed very evenly distributed on the first sight. Nevertheless, it can be seen that within "Period 1" between January 2010 and December 2011 the density of the individual bars was visually lower suggesting that during this period the NFP announcement resulted in less significant 1-minute abnormal returns. Similarly, a smaller but still visible "Period 2" can be retrieved, from March 2020 onwards. However, in order to be able to better analyze

the significance development, the individual alpha levels will be separately displayed in order to see if any development over time can be experienced.
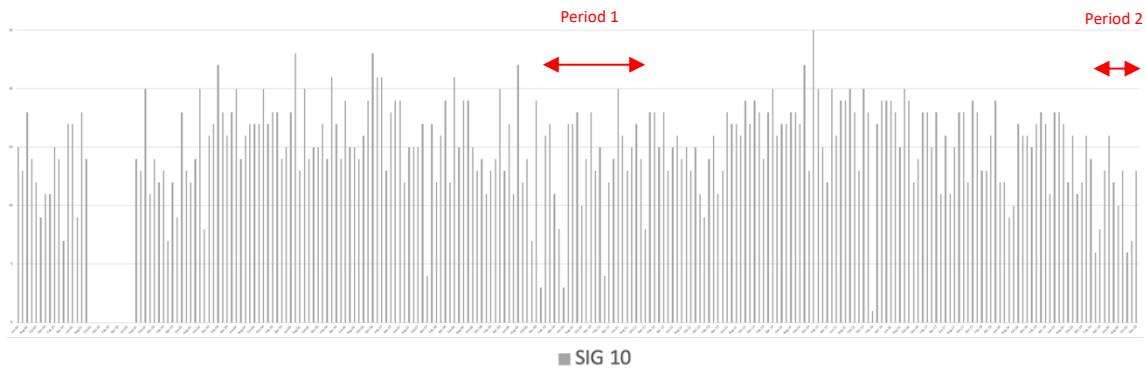
FIGURE 25 ... SIG 10 OCCURRENCE DEVELOPMENT

Source: Own graph

Figure 25 displays only the significant 1-minute abnormal returns with regards to the 10% significance level. On first sight, no obvious change in the distribution of significant minute occurrences can be detected as the overall level of the bars stayed the same over the past twenty years. Only the exact same already mentioned periods from Figure 24 can be seen again, giving no additional indication of a general development. Therefore, in order to get a better understanding of the significance development as the 10% level analysis did not provide a clearer picture, the 5% significance level will be analyzed in the next step.
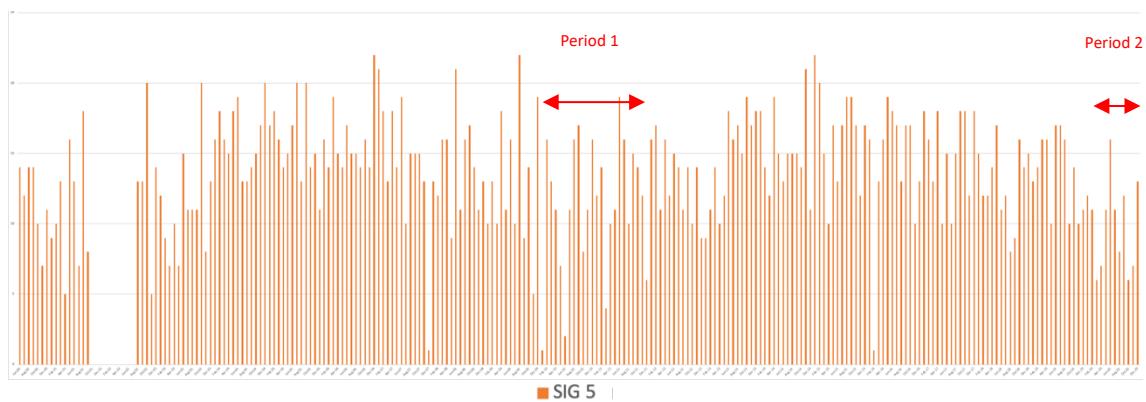
FIGURE 26 ... SIG 5 OCCURRENCE DEVELOPMENT

Source: Own graph

Thereby, taking a closer look at Figure 26, it can be seen that with regards to the 5% level there was still no clear indication of a change over the past twenty years as the number of significant 1-minute occurrences were very constant over time, with only a few outliers which have been evenly distributed. Therefore, in the last step a comparison of the SIG 1 occurrences has to be done.

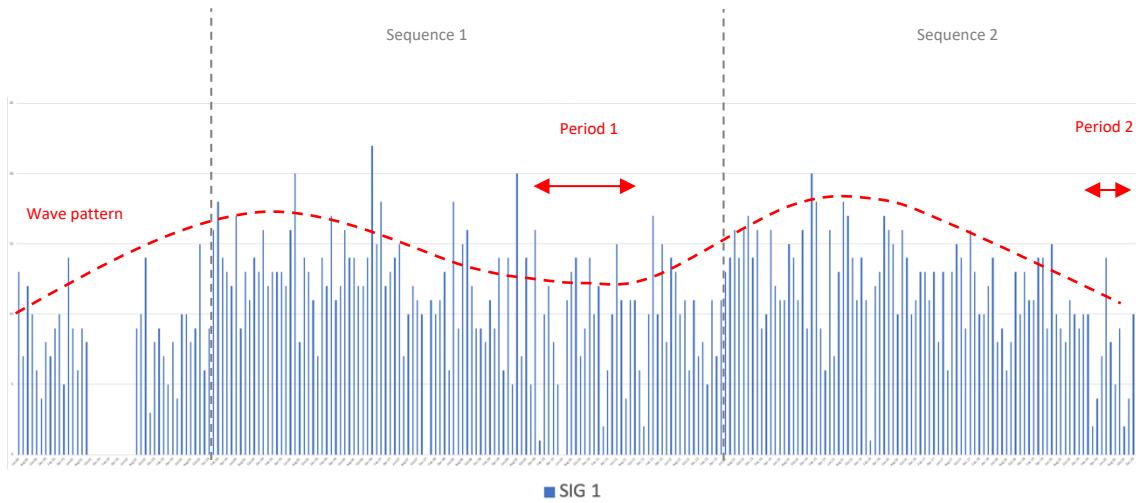FIGURE 27 ... SIG 1 OCCURRENCE DEVELOPMENT

Source: Own graph

Lastly, analyzing the significance development chart of the 1-minute occurrences at the 1% alpha level in Figure 27 the general development became clearer. Thereby, it is worth highlighting that the bespoken drops in significant occurrences within "Period 1" and "Period 2" became much clearer at this significance level. Additionally, a pattern that looks similar to a wave can be seen in the chart that roughly matches the wave pattern found in the descriptive analysis. Thereby, it seems that this bespoken pattern followed certain sequences highlighted as "Sequence 1" and "Sequence 2", whereby in the beginning of each sequence the number of statistically significant 1-minute abnormal returns occurred at a much higher rate than in the end of the sequence. However, it is important to mention that in order to confirm any such pattern, this analysis would have to be done over many more years to see if these sequences repeated themselves more than just two times. Nevertheless, it is important to highlight that even though the descriptive analysis clearly indicated that the magnitude of the abnormal returns experienced between the years 2017 and 2020, this finding could not be confirmed to the same degree as only in 2020 clears gaps in significant 1-minute occurrences could be found. However, it can be argued that with regards to the wave pattern, the mentioned 2017-2020 period is on the decreasing side of the wave signaling a slow decline.

4.2.9   Missing value analysis

From the missing value analysis plotted in Figure 28, it can be seen that the older the data was, the more missing values could be detected. Especially, between the years 2000 and 2007 the number of missing values was rather high in comparison to the other years. Thereby it is worth mentioning that for most of the recorded high numbers of missing values, they were within the estimation window, which is indicated with the blue colored bars. The higher the number of

missing values within the estimation window, the closer the average return came to the value zero. Consequently, the closer the average return was to zero, the more likely a certain analyzed abnormal return throughout the event analysis may have become bigger and hence more significant in general. However, given the magnitude of abnormal returns that could have been analyzed throughout the descriptive analysis, the observed significant abnormal returns would not have been impacted significantly by a slightly lower average return. This is in line with Brooks' (2014) argument that the expected return within a short-term event study is very close to zero, which is the reason why individual missing values in the estimation window can be discounted if the occurrence was not that high.
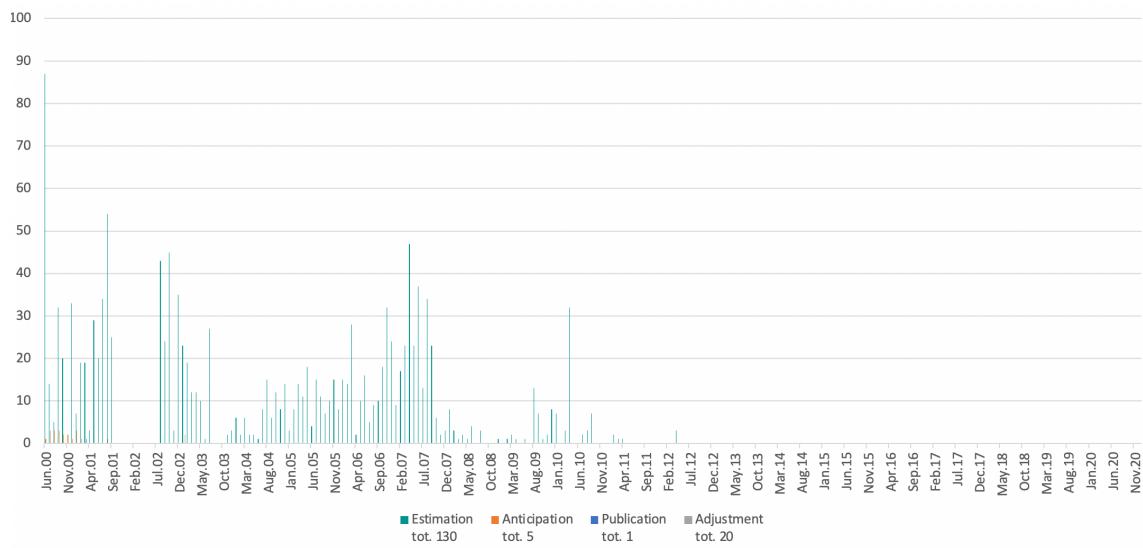
FIGURE 28 ... MISSING VALUE OCCURRENCE COMPARISON

Source: Own graph

However, it is worth mentioning that the number of missing values within the anticipation, publication and adjustment period might have a significant impact. For the single case in March 2001 when there was a missing value for the actual publication period it may be important to highlight that further research could be done in order to find data from a different provider. Additionally, depending on the number and the magnitude of missing values in the anticipation and adjustment period it is worth mentioning that the corresponding number of significant 1-minute changes might be lower or higher in the respective observed period. This is especially applicable in the time between June 2000 and February 2001. Overall, it could be seen that there have been event studies which had various missing values either within the estimation or the event window, which represents a certain limitation with varying degrees that could be considered in future research.

4.2.10 Key findings

Within this last section of the quantitative analysis part, all major key findings of the individual analyses are briefly listed in order to give a concise overview. In the end of this section the common denominators of these key findings are condensed in order to come up with the main conclusions that could be gained through this quantitative analysis. These major conclusions will then be analyzed in more detail in order to find out if any findings cannot be explained with already existing data and knowledge. These knowledge gaps will then be included in the questionnaire for the expert interviews. The following key findings could be found throughout the quantitative analysis:

- 79% of all NFP announcements resulted in significant cumulative abnormal returns at least at a 10% significance level over the total 26-minute event period, whereby 79% of these resulted in significant cumulative abnormal returns even at a 1% significance level.
- 86% of the 237 analyzed event studies resulted in a 1% significant abnormal return right in the publication minute.
- Out of all the analyzed event periods, the publication period has been the period with the most significant occurrences, followed by the total event period, the adjustment period and lastly by the anticipation period.
- There was an exponential increase in significant 1-minute occurrences within the anticipation period, whereby the peak was at the publication, after which the occurrences decreased slowly, but gradually, still counting high numbers of occurrences.
- Peaks in CABSAR values around 2004, 2008-2009 and 2015 could be detected, whereby only during the peaks in 2004 and 2015 the CAR, MAXABS and mean abnormal returns showed a similar behavior, suggesting that during 2008-2009 there was a lot of indecision.
- A cyclical wave pattern could be observed in the MAXABS and standard deviation analysis which's peaks overlapped with the already mentioned peaks in 2004 and 2015.
- The observed wave pattern matched the sequences found in the SIG 1 occurrence development figure, where the peaks of the MAXABS pattern overlapped with the period of dense 1-minute occurrences.
- There was no visually clear change in the overall significant 1-minute abnormal changes on the aggregated 1%, 5% and 10% significance level chart over the past twenty years.
- There have been visual gaps of significant 1-minute abnormal returns, caused by the NFP announcements during 2010 to 2011 and 2020, especially with regards to the 1% significance level.
- Between 2017 and 2020 the standard deviations of the abnormal returns from the 26-minute event window were constantly at a level which has only been spiked into at the extreme lows throughout the past twenty years.

- There was a general decline of total CABSAR values throughout the past twenty years, whereby throughout the period from 2017 to 2020 the values were clearly below the trendline signaling a faster decrease.
- A steady decrease of the market's reaction of both negative and positive abnormal returns could be found in the narrowing funnel within the CAR and mean analysis.
- A decline in abnormal returns measured for the publication period and the CABSAR could be found in the analysis of the yearly average absolute numbers.
- In the period between 2017 and 2020 the minimum abnormal returns have been more than 50% lower on average in comparison to all the years before.

Overall, it could be seen that there are many common grounds within the key findings that could be gained from the individual analyses. In accordance to previously done research by other scholars, also this quantitative analysis could show that the nonfarm payrolls announcement did result in essential and significant abnormal returns especially with regards to the immediate minutes, before, at and after the publication. Thereby, it can be highlighted that 62% of all analyzed NFP announcements resulted in significant cumulative abnormal returns at a 1% significance level over the total event period, whereby even 86% of all 237 analyzed event studies resulted in significant abnormal returns at a 1% significance level right in the minute of the publication. Additionally, across all descriptive analyses it could be seen that throughout the last couple of years, in 2017 to 2020, the overall impact of the NFP news announcement on the EURUSD foreign exchange rate started to decline seemingly. Nevertheless, from the event studies and the inferential statistics it can be concluded that overall the NFP announcements still resulted in many statistically significant abnormal returns throughout the years 2017 to 2020 even through a slight decrease could be found especially throughout the year 2020. Additionally, three main peak periods especially with regards to the CABSAR could be detected throughout the last twenty years, whereby only two of them also resulted in similar results with regards to the CAR and abnormal return at the publication minute.

Therefore, with regards to the qualitative phase of the research, which is based on the results on this quantitative analysis in order to add explanatory value, two main areas of interest could be formed which will be of major focus in the expert interviews. First of all, the three main peak periods are of interest in order to find out more about the possible factors that could have led to these seemingly big increases in the market's reaction towards the announcement of the nonfarm payrolls numbers. Additionally, and maybe even more important with regards to better understand the impact development of the NFP news announcement over the last 20 years, it will be of major importance to uncover plausible explanations why the market resulted in seemingly less strong abnormal returns from 2017 onwards.

4.3 Qualitative analysis and results discussion

Within this section of the thesis, the results of the qualitative analysis will be presented in a result discussion format in order to provide a better understanding not only of the individual research questions, but also the two major topics of interest that could be retrieved from the quantitative analysis. The two bespoken topics are the decreasing impact of the NFP announcements on the EURUSD throughout the years 2017 and 2020 and the individual peaks that occurred throughout three main periods over the past twenty years. Therefore, throughout this section of the analysis part, these two topics condensed from all the key-findings of the quantitative analysis will be discussed with regards to the information that could have been retrieved from the qualitative expert interviews. The individual expert interviews have been transcribed and studied with thematic analysis in order to retrieve the respective expert knowledge. Thereby, it is worth mentioning that the main purpose of the expert interviews has been to provide explanatory insights from industry experts to the main two topics that could have been retrieved from the quantitative analysis in addition to provide general insights to foreign exchange trading and news announcement trading within Austrian banks. Together, the findings of the qualitative analysis will not only contribute to the quantitative analysis, but also to the individual research questions.

Overall, this section will be split into three main parts, whereby in the first part the peak period analysis will be discussed, in the second one the diminishing impact effect of the NFP news announcement will be analyzed and lastly in the third section, the general insights and the future outlook in the experts' perspectives will be laid out in more detail. Thereby, in the first two parts, for each of the two topics further quantitative results, explanations from the experts and additional findings from other scholars will be brought together in order to properly discuss the findings, the explanations of the experts and highlight possible areas for further research.

4.3.1 Peak period analysis

As highlighted in the findings area of the quantitative research, three main peak periods could be found within the last twenty years. The first peak centered around the months in 2004, the second one between 2008 and 2009 and the last one within the year 2015. Throughout these periods the abnormal returns have been comparingly higher than in the other years. Therefore, it has been of major interest why during these years the NFP announcements resulted in such strong impacts on the EURUSD.

Throughout the expert interviews, the individual interviewees have been shown Figure 21 of the quantitative analysis, where the yearly absolute average abnormal returns have been plotted, clearly showing the three mentioned peak periods. Thereby, all interviewed experts stated that in general whenever the market reacts comparingly strong to individual announcements within a certain time period, then there might be a good chance that during this time there is an

underlying event or condition happening which influences the market's reaction. Therefore, closely analyzing the years in which these peaks occurred, references to major U.S. events and economic states will be examined in order to find more information about a possible connection. Thereby, it is worth mentioning that when looking at the published NFP numbers in Figure 29, it can be detected that during the peak in 2004 the announced employment changes were moderately positive, whereas when looking at the numbers between 2008 and 2009, they were high in negative terms. However, with regards to the actual numbers in the 2015 peak period it can be said that they were comparable to the 2004 numbers.
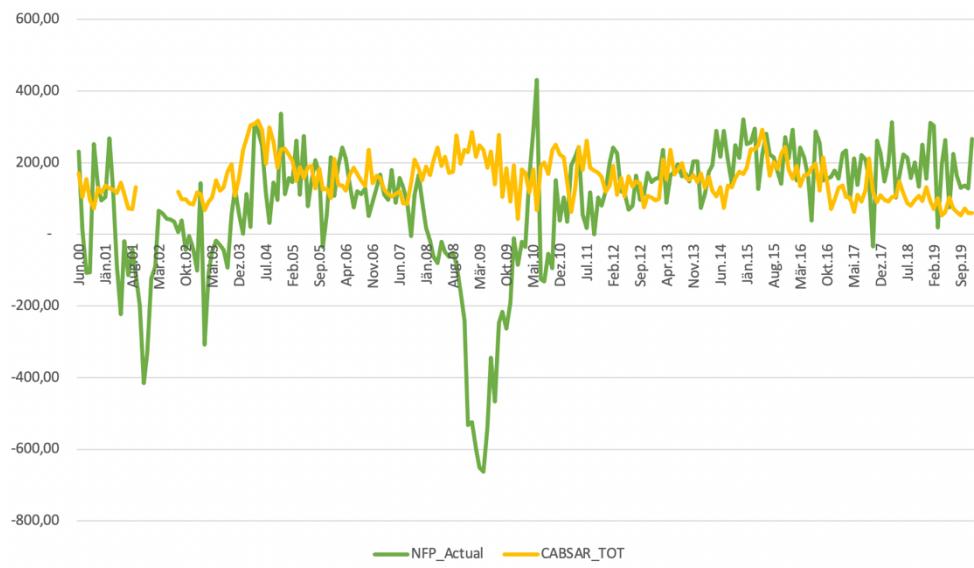
FIGURE 29 ... ACTUAL NFP NUMBER IN THOUSANDS - CABSAR COMPARISON 2000-2019

Source: Own graph

Thereby, it is worth mentioning that the year 2020 has been excluded from Figure 29 as otherwise the chart would not be meaningful for any comparison as the actual NFP number published during the corona crisis was about 100 times bigger than the normal values. Figure 30 displays the actual NFP numbers however this time in absolute terms in order to be better comparable with the cumulative absolute abnormal returns. Seeing the actual NFP numbers in absolute values it becomes apparent, that throughout the observed time only the 2008-2009 peak period could be recognized whereby, however the supposed peaks in 2004 and 2015 did not become that apparent.
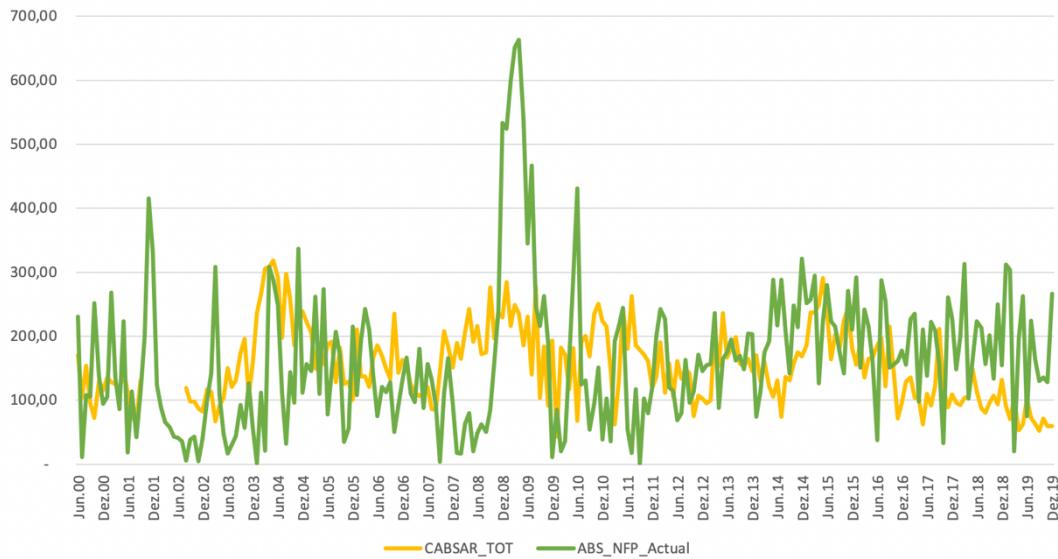
FIGURE 30 ... ABSOLUTE ACTUAL NFP NUMBER IN THOUSANDS - CABSAR 2000 - 2019

Source: Own graph

4.3.1.1 2008-2009 peak period

With regards to the highlighted three peak periods, all of the participants could immediately associate the 2008-2009 peak period with the 2008 financial crisis. According to an IMF working paper (Chen et al., 2019), the 2008 financial crisis and especially the bankruptcy of the investment bank Lehman Brothers, represented the most radical and impactful shock to the global market in more than 70 years. Deposit and money market withdrawals due to illiquidity and panic, forced asset sales, freezes of credits and many more actions lead to the worst recession which's consequences and policy responses can still be experienced in the current market (Chen et al., 2019). According to one of the interviewed experts, the market's uncertainty and decreased liquidity is due to the fact that many liquidity providers got hurt, which made the market more susceptible to bigger volatility. In the following months and years after the initial crisis shock, businesses started to close down or lay off workforce which explains the on-holding impacts through the observed peak period. When the financial crisis started to wear off again, more and more people found back into the work life which resulted in a very positive sentiment. As it was highlighted before, the CABSAR was considerably high during this time, signaling a very unstable reaction towards the published numbers with many positive and negative abnormal pip changes. However, it is worth repeating that due to the fact that the same effect as with the CABSAR could not be seen as strong with the CAR and mean abnormal return at the publication, this might suggest that there was generally more market indecision rather than a clear perspective. Otherwise, the CAR and the mean abnormal return in the publication minute would have mirrored the ABSCAR more as within 2004 and 2015. According to the interviewed experts, the

financial markets experienced extreme turbulence during this time, which resulted in a lot of volatility. According to Orbex (2018), FOREX volatility is not only essential for short-term traders to make money in the market from the price fluctuations, but also for long-term swing traders to determine the most suitable entry and exit points. These expert insights are congruent with the quantitative findings and also with the conclusion of Égert and Kočenda (2013), stating that during crisis times the market is putting more emphasis on the key macroeconomic announcements instead of focusing on all the individual economic indicators.

With regards to the EURUSD's reaction on NFP announcements in turbulent times, it would have been interesting to be able to analyze the gap of the missing foreign exchange rate numbers within October 2001 to July 2002 as this time can be associated with the burst of the dotcom bubble. Therefore, it would be of interest if during this time there was a significant peak as in the case of the financial crisis in 2008. Further research could be done, if the equivalent 1-minute EURUSD foreign exchange rate data could be retrieved for this time.

4.3.1.2 Missing 2020 corona crisis peak

However, with regards to crises and the NFP announcement, for the corona crisis it has been interesting to see that even though the unemployment numbers have never been higher before, the NFP news announcements did not result in any equivalent abnormal returns. Thereby, it is important to highlight that the abnormal returns throughout the corona crisis did not even come close to the abnormal returns of the analyzed 3 peak periods. The corona crisis that hit the U.S. economy during the analyzed year 2020, did not results in any major peaks in abnormal returns even though the published employment changes were up to 100 times larger in a negative way than previously recorded. Therefore, this observation was one of the questions that the experts have been asked, and a few possible reasons have been brought to attention, including for example that the market was already expecting such high numbers and therefore did not react to it when the high numbers have been published later, as the general consensus was the same. A possible reason was that due to the fact that the whole world was hit by the corona crisis, everyone was expecting that not only the U.S. would have high unemployment numbers, but also the European countries, canceling out the negative impacts. Another approach that has been mentioned by one of the interviewees, was that the whole world was experiencing lockdowns or severe pandemic consequences and therefore the interest in trading news announcements like the NFP numbers might not has been that high as people had bigger problems. One possible explanation that has been mentioned, was that the expert said that fundamental analysts have rather been interested in the unemployment numbers over longer periods, meaning that the U.S. strength would be measured on how well it starts to recover after the pandemic.

According to one of the experts, the divergence of a published announcement to the general consensus plays a very important role, as only when there is a difference then the market will show an equivalent reaction as otherwise the individual participants will already be positioned

accordingly. With regards to the one reason mentioned by the expert, where for these news announcements strong negative numbers were expected anyways before the actual publishment, which would have suggested that these very negative numbers were already reflected in the price, the quantitative numbers have been analyzed more closely with this regard. Therefore, it was of interest if a possible correlation between the market's reaction and the so-called "surprise effect" may be apparent as all other information might already be factored in by the market. The surprise can be defined as the difference between the forecasted NFP number and the actually published number. Figure 31 plots the absolute surprise values together with the total CABSAR from 2007 to 2019. Prior to 2007 there have been no forecasted numbers available from the economic calendars that could be found and during 2020 the numbers were completely out of scale due to the corona crisis, which would not make it able to generate any reasonable comparison. From Figure 31 it can be seen that the surprise value and CABSAR curve roughly follow the same pattern only at different levels, which is also an interesting insight that can be used for the analysis of the other peak periods. This means that in times with surprise spikes also CABSAR spikes can be detected and similarly low CABSAR values can be seen when the surprise value was rather low.
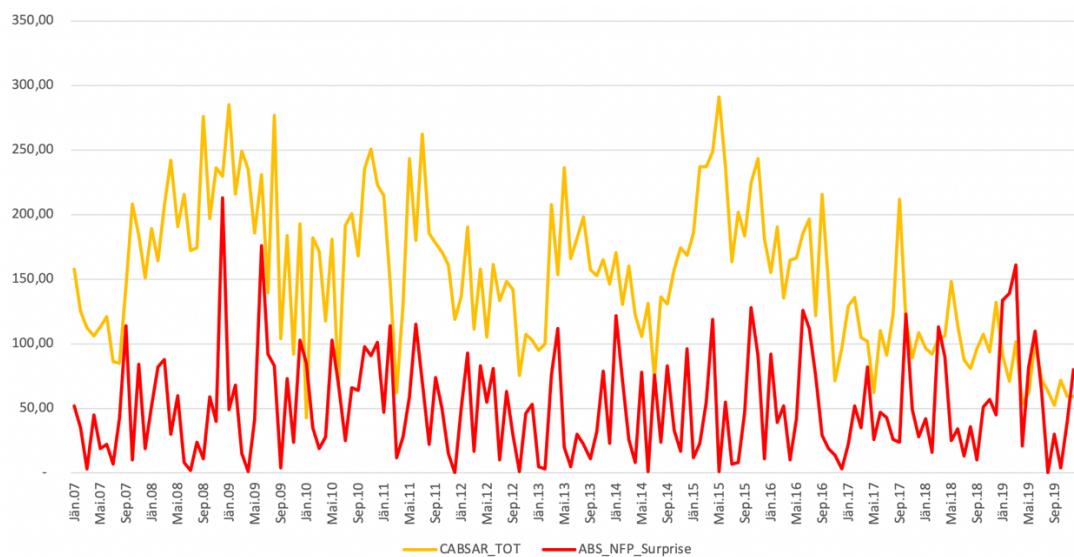
FIGURE 31 ... CABSAR – ABS NFP SURPRISE IN THOUSANDS COMPARISON 2007-2019

Source: Own graph

However, it is worth mentioning that this synchronicity did not have the same effect from 2018 onwards even though the CABSAR value still followed roughly the same pattern as the surprise curve did, but the intensity seemingly decreased in comparison to the past years. This becomes especially apparent when looking at Figure 32 where the 2020 numbers have been included and where even though a huge surprise spike could be experienced, the CABSAR seemed only to react minimal. This suggests that the absolute surprise number may not be the perfect indicator for predicting spikes in the CABSAR either, at least when talking about the corona crisis.

Therefore, when looking at the corresponding high numbers of the published NFP numbers in 2020 the percentage surprise might be more suitable for a comparison.
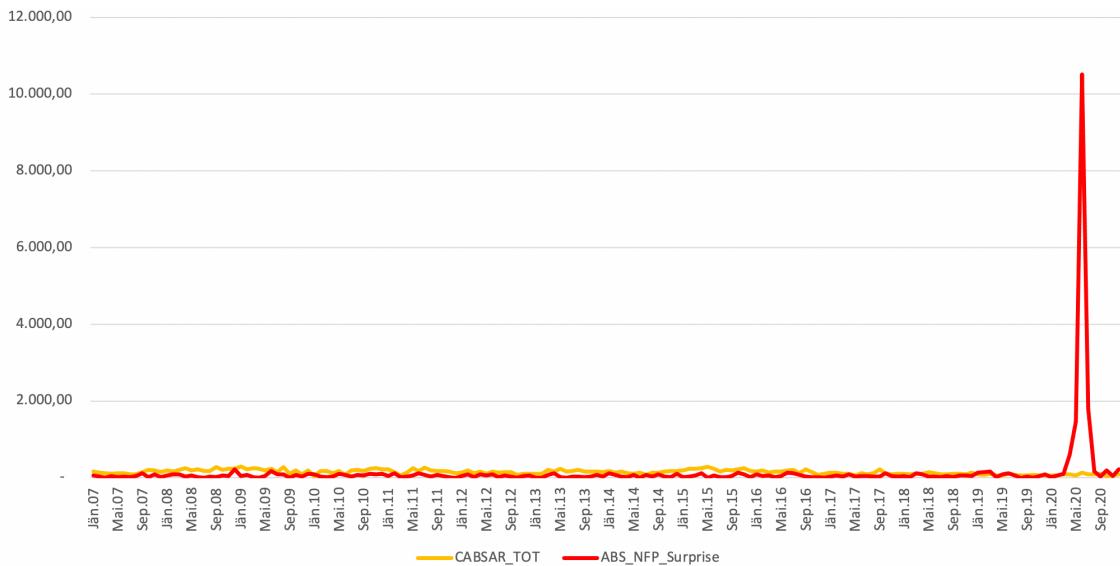
FIGURE 32 ... CABSAR - ABS NFP SURPRISE IN THOUSANDS COMPARISON 2007-2020

Source: Own graph

Figure 33 represents the CABSAR value in comparison to the surprise percentage which got multiplied by the factor 100 in order to make it visually representable. Additionally, it is worth mentioning that the spike in October 2010 which was originally at value 3266 has been reduced to 1000 in order to make the graph comparable. However, due to the fact that the October 2010 value can be interpreted as an outlier, as the percentage surprise effect was only that high because the forecasted number was disproportionately low. Even though, when disregarding the 2010 spike, the surprise spike in 2020 was huge with regards to the values of the past 20 years. From Figure 33, it can be seen that the percental surprise effect between 2007 and 2020 has been a good indicator for the oscillations in absolute abnormal returns, except for the 2020 corona crisis where the CABSAR was comparingly very low. However, it is worth mentioning that also for the peak period in 2015 no exceptional surprise values could be found in this figure, suggesting that there might be more to discover. Thereby, once more the already mentioned limitation has to be highlighted, stating that only the forecasted numbers from a single data provider has been taken as a reference for this calculation. Nevertheless, analyzing the missing surprise effect confirmation for the 2020 corona crisis means, that a possible explanation for this missing market's reaction cannot be pinpointed to a single reason, but rather suggests, that a mix of various reasons including all of the experts' mentioned ones have to be considered.
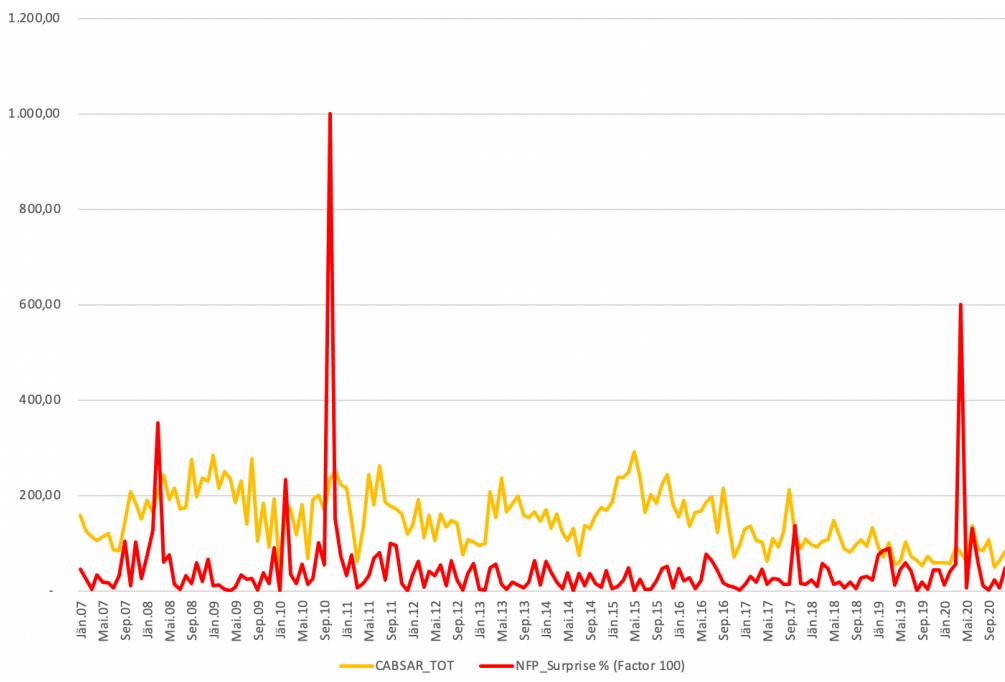
FIGURE 33 ... CABSAR - ABS SURPRISE % 2007 -2020

Source: Own graph

4.3.1.3 2015 peak period

Regarding the peak period in 2015 no concrete reason could be found during the quantitative analysis as not only the employment changes were moderately positive during this time, but also there has not been any surprises in the published numbers. Given the huge absolute abnormal returns during this peak period, is was especially interesting to find out if the experts have any explanation for this finding. Thereby, out of the interviewed experts two came up with a possible explanation for the 2015 volatility and high abnormal returns caused by the NFP news announcements. The bespoken possible reason the two experts mentioned why the 2015 abnormal returns have been that high, is the fall of the Swiss currency cap in early 2015. When, the third expert has been informed about this particular event, he immediately agreed. According to Baghdjian & Koltrowitz from Reuters (2015), on the 15th of January 2015 the Swiss National Bank, short SNB, removed the three-year old cap on the Swiss franc making the currency free floating. This information shocked the global financial market as only one month earlier the SNB chairman insisted on the importance of the currency rate cap, and consequently the franc rallied roughly 30% higher against the euro in the immediate aftermath of the announcement (Baghdjian & Koltrowitz, 2015).

According to all the experts, the currency markets have gone "crazy" across all currencies and market volatility skyrocketed. Therefore, during these times, where the market was extremely volatile also the NFP announcements might have seen increased impacts. According to Reuters (2015), the removal of the Swiss currency cap propelled the already existing global uncertainty as oil and copper prices have plunged, Russia's ruble lost 55% of the value, which was also

mentioned by one of the experts, whereby at the same time the central banks tried to stabilize the markets with monetary policy. Therefore, the fact that the Swiss National Bank made such a drastic change in their behavior brought a lot of uncertainty and speculation about further actions of other countries into the market. Similarly, Asian Banking and Finance (2020) held that due to the Swiss franc currency shock and the new regulations the banking industry was facing, the whole market had been very alert and hesitant to participate. According to the experts, another possible reason that is connected to the Swiss cap removal is the fact that investors and market participants got more alert to macroeconomic announcements which might explains the high abnormal returns throughout the immediate months that preceded the SNB's announcement. Similarly, as with the previously mentioned reference to the sensibility towards macroeconomic numbers within crises times, also in times of market uncertainty macroeconomic indicators like the nonfarm payrolls numbers are watched closely in order for the experts to better analyze the market and the direction it is heading to.

4.3.1.4   2004 peak period

In comparison to the other two peak periods neither the original quantitative analysis nor the expert interviews reached any conclusion about a specific event of why during the January 2004 and January 2005 the abnormal returns have been so high. Thereby, it is worth mentioning that during these months not only the absolute cumulative abnormal returns, the cumulative abnormal returns and the maximum abnormal returns, but also the abnormal returns at the publication minute have not been higher in any other period throughout the past twenty years.

Even though the experts could not tie this peak period to any specific economic or political events, one of the experts mentioned that possibly either the market's volatility, low liquidity and, or the increased interest in the NFP publications due to the corresponding interest rate cycle of the U.S. could be the reason for these increased abnormal returns. Consequently, during periods of high market volatility and or low liquidity the market in general reacts stronger to impacting factors. With regards to the U.S. interest rate cycle the expert held that, due to the fact that the Federal Reserve, short Fed, which is the U.S. central bank, watches the employment numbers closely for the interest rate decisions, during times when the rate is kept at the same level by all means on purpose, the NFP announcements will not lead to much market volatility. However, in times, when the central bank is receptive and willing to change the interest rate, the NFP numbers gain in importance as they receive much more weighting in the decision process leading to increased volatility. Analyzing the according historical interest rate levels during the years 2000 to 2020 in Figure 34, it can be seen that from 2000 to the end of 2002 the interest rate decreased from roughly 7% to only around 1% at which level it stayed till June 2004 when the Fed started a new rate hike period (Macrotrends, 2021).

FIGURE 34 ... FEDERAL FUNDS RATE - HISTORICAL ANNUAL YIELD DATA

Source: Macrotrends, 2021

Following the expert's argument, during this period where interest rates stayed rather on the same level, a lot of attention has been on economic indicators like the NFP announcement to see how the Fed reacts to them in terms of adapting the interest rate. Thereby, it is worth mentioning that the interest rate is one of the many instruments used by the central bank to regulate and manage the economic activities, as in times of economic crisis a decrease in interest rates promotes businesses and individuals to take on loans and therefore increase spending and investments that propel the economy again (Public Education & Outreach, 2021). However, if the interest rates stays too low for a long time then disparities in income and wealth along with shifts in the global markets are a likely result as people will turn to riskier assets in order to compensate for the low returns they get from the safe assets, which could create a severe bubble (Curran & Anstey, 2021; Mauldin, 2020). With regards to the period around 2004, the market was not only closely watching the NFP announcements, but also the uncertainty of the Fed's interest rate strategy, brought volatility into the market which might explain the high abnormal returns that could be detected throughout the quantitative analysis. Similarly, further research has shown that with regards to the positive NFP numbers published throughout 2004, it could be found that according to the Voice of America (2009), which is the largest U.S. international broadcaster, the U.S. economy registered the highest growth in five years, which would be in line with the above presented interest rate plan of the Fed. This high economic growth is also depicted in the positive NFP publication numbers which can be seen in Figure 29, which consequently could have led to the major impacts shown in the market's reaction.
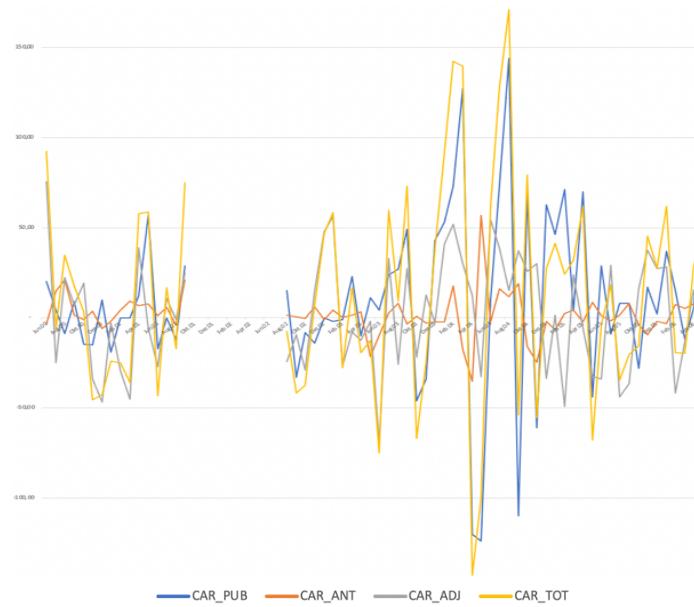
FIGURE 35 ... CAR EXCERPT 2000 - 2011

Source: Own graph

However, it is worth mentioning that when analyzing Figure 35, even though the employment changes throughout that peak period have been positive and the economy was thriving, the market's reaction was not uniformly reacting as the CAR also has been highly positive throughout this period. Therefore, it is worth highlighting, that positive employment changes communicated through the NFP announcements strength the USD which should decrease the price of the EURUSD foreign exchange rate. Consequently, any event showing a bad state of the U.S. workforce, weakens the USD and consequently should increase the EURUSD price. This might be explained by one of the experts mentioning that the so-called "consensus" plays a very important role when analyzing the market's reaction toward an announcement. Similarly, the expert stated that it has to be kept in mind that also other data is being published at the same announcement including, for example the unemployment rate or also the revised numbers. According to one expert for him especially the revised numbers that get published for the previous month's data could have a major impact depending on the direction and the degree of the revision. Thereby it is worth mentioning that the initially published NFP numbers are not final, which is the reason why at the publication of the next month's numbers the previously published number will be revised. According to another expert, he developed the feeling over many years in the industry, that the U.S. are usually prone to publish better employment numbers, only to revise them downwards at the next month stating that *"especially in the U.S., I think this is sort of a hobby or whatever you call it, to have better figures to announce and then revising the old figures in the wrong direction"*. Therefore, there are many reasons, why within certain months of overall positive employment numbers the market's reaction could be negative. In general, it is worth mentioning that this impact from the other publicized numbers can have consequences

on the analyzed abnormal return that might be different with regards to their direction of the anticipated effect direction.

Even though there was no specific economic or political event that could be found during the analyses, the experts have been able to mention various possible explanations that could be supported by the corresponding data that has been found in a further analysis stage. Thereby, the correlation to the interest rate period cycle has proven itself as a legitimate reason which could be analyzed in further research to gain more insights. Nevertheless, as not all of the bespoken event studies in this peak period uniformly resulted in a certain direction it is difficult to make any precise predictions about the overall correlation of these events with regards to the exact impact the NFP news announcement had on the EURUSD due to the many possible factors. Consequently, also these other mentioned factors like the revision's effect could be researched in more detail to be able to make better predictions about its impact.

Overall, it could be seen that the individual peak periods that have been uncovered throughout the quantitative analysis overlapped with economically significant periods, events or crises which had either an impact on the U.S. employment numbers, the economy itself or the global currency markets. However, it is worth mentioning that additionally, also the difference between the forecasted and the actual published numbers showed some correlation in abnormal returns with regards to the absolute numbers and its percentage, excluding 2020. As already mentioned, the corona crisis was not like any other analyzed crises and therefore has to receive special consideration. Similarly, the interest rate cycle proofed to be a valuable source for better understanding the impact development of the nonfarm payrolls announcement depending on the Fed's current state of focus. Thereby, it is worth highlighting that the expert interviews were an important source for the explanatory qualitative analysis phase within this research setting, as the experts have been able to tie the quantitative results to important events that happened within their career. Them experiencing the individual peak periods has been especially insightful in better understanding the underlying dynamics and key factors that drive the market through such times.

4.3.2 Nonfarm payrolls announcement impact weakening effect

The second major finding that could have been gained through the individual event studies and the descriptive analysis is the fact that the impact magnitude resulting from the NFP announcements seemingly weakened from the years 2017 to 2020. Nevertheless, it has to be kept in mind that even though the individual instruments of the descriptive analysis all suggested a clear decrease, the significance occurrence analysis could not detect this finding in the same degree between 2017 and 2019. Therefore, it will be of major interest if there are any underlying reasons that caused this weakening impact magnitude effect. As it could already be seen in the CABSAR – Surprise comparison Figures 31 to 33, there was no significant drop in surprise values, but the CABSAR decreased seemingly. In addition to the previously analyzed CABSAR surprise

comparison, also the already analyzed comparison of the actual unemployment change numbers to the CABSAR in Figure 29 and 30 showed no indication why the market's reaction flattened as the unemployment number in general did not get weaker over time. Similarly, the missing corona crisis peak period, might also be a result of the weakening effect. Therefore, it has been of major interest to get the individual opinions from interviewing the experts, to see if they can provide more insights into why the impact weakened in magnitude over the last couple of years.

Overall, it can be said that the individual ideas from the three experts all centered around one major explanatory topic why they belief that the market does not react that strong anymore to the NFP announcements, whereby every one of them had additional different reasons which will all be discussed subsequently within this section. According to the interviewed experts, the main reason why they believe that the impact effect weakened, is that the foreign exchange market has been flooded with liquidity over the past years. Consequently, the volatility of the individual foreign exchange rates, especially for the EURUSD, which is the most traded exchange rate worldwide, decreased drastically and this had profound and long-lasting impacts. This observation of the experts can be backed by comparing the exponential increase in trading volume as it could be retrieved from the triennial survey in 2019 (BIS, 2019b) and the following EURUSD volatility chart, which shows the weekly historical volatility of the foreign exchange rate from the years 2000 to 2020. The *historical volatility* can be defined as being a "statistical indicator that measures the distribution of returns for a specific security or market index over a specified period" (CFI, 2021c, para. 1). Taking a closer look at the weekly historical volatility chart with a period of 10, in Figure 36, it becomes apparent that that from 2016 onwards the volatility steadily decreased whereby only in 2020 during the corona crisis there was a spike. However, given the worldwide impact of the corona crisis in comparison to the other crises the volatility was comparingly small, even though within a few years this was the highest volatility that could be seen.
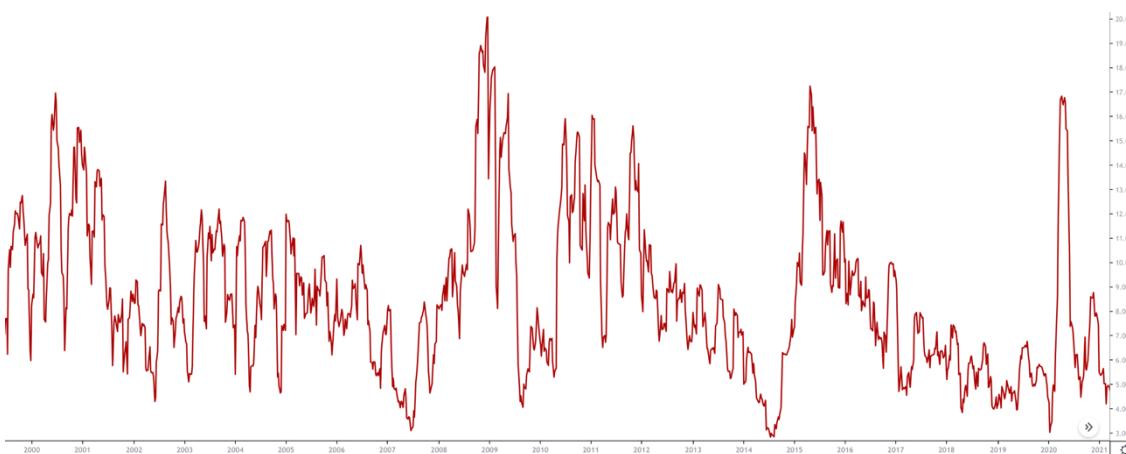

FIGURE 36 ... WEEKLY HISTORICAL VOLATILITY EURUSD

Source: Own chart created with Tradingview

Taking a closer look at Figure 37 which depicts the monthly volatility chart with a period of 10 for the EURUSD foreign exchange rate, the decrease in volatility can be seen even better. This observation is in line with the experiences from the experts that they could gain throughout their career. Further research can be done by also analyzing the implied volatility as mentioned by one of the experts.
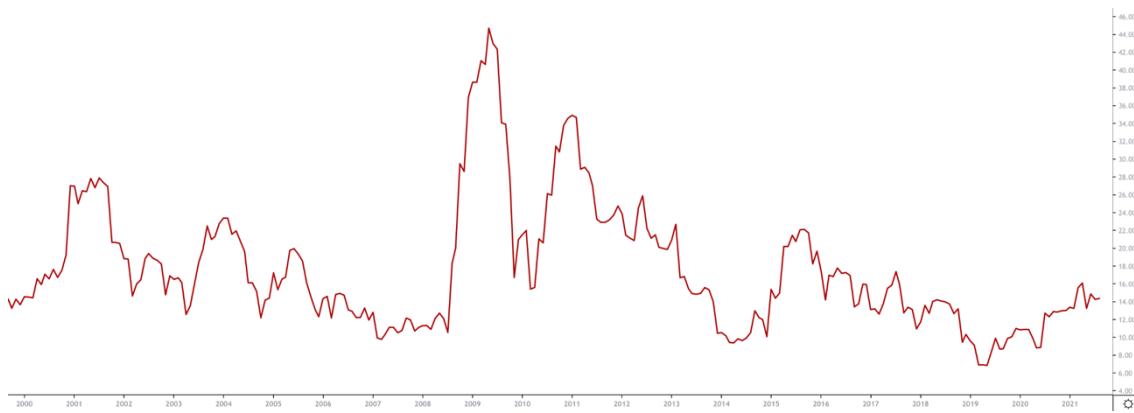
FIGURE 37 ... MONTHLY HISTORICAL VOLATILITY EURUSD

Source: Own chart created with Tradingview

The already bespoken liquidity flood according to one expert can also be tied to the increased share of high-frequency traders and hedge funds that entered or strengthened their position in the market throughout the last couple of years, which brough a lot of fresh capital into the market. Similarly, he stated that central banks keep on printing money which adds capital to the market. Additionally, the expert mentioned due to the fact that high frequency traders are sometimes only milliseconds in a position to profit from tiny movements before exiting again, there is not much traction that can be build up. However, in order to be able to profit from these tiny moves, the high frequency traders or hedge funds have to enter their positions with correspondingly high amounts. This is in line with what one of the experts mentioned, who said: *"So, for example ten years ago, when there was a deal of a 200 or 300 million EURGBP or EURUSD order that you fed the market, this moved to market! Now, there is no reaction at all. So, the market sucks everything up, because the liquidity amounts that are being pushed through are insane and that's the reason why the volatility is ultra-low, historically low."* Similarly, as there are so many trading systems and algorithms that oftentimes are already positioned before a news announcement, there can be the possibility that they cancel each other out. These short-term reactions of the market to announcements, also results in people taking profit after a short amount of time when profits are currently running, as they already expect that the reaction to the announcement will not be very long.

These explanations from the experts also brought more clarity to the question why the descriptive analysis resulted in such a clear impact decrease, whereby the significance testing could not mirror this to the same extend. Due to the fact that the market traded in much tighter ranges

throughout the bespoken 2017-2020 period due to the low volatility, consequently also the standard deviations of the equivalent estimation periods have been lower in the individual significance tests. Figure 38 visualizes the individual estimation window standard deviations throughout the past 20 years, whereby it can be clearly seen that already from September 2015 onwards the numbers reached a relatively low level where it stayed during the past years. Consequently, the results of the descriptive analysis stating that the abnormal returns decreased in magnitude over the past four years, even though the equivalent decrease of significant 1-minute occurrences could not be found to the same extend, can be explained by the fact that due to the lower standard deviations within that time, the chance of an abnormal return becoming statistically significant increased accordingly.
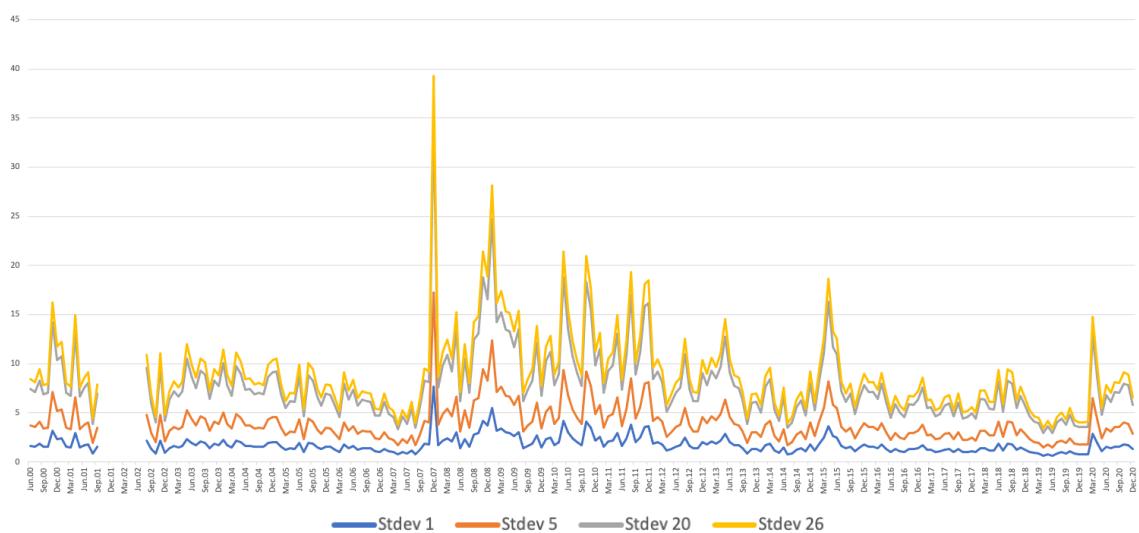
FIGURE 38 ... ESTIMATION WINDOW STANDARD DEVIATION

Source: Own chart

Another explanation one of the experts mentioned is the possibility that due to the many retail investors that joined the foreign exchange market over the past years, macroeconomic indicators like the nonfarm payrolls have not been their investment focus, which might be the reason why they did not react on them. One of the interviewed experts highlighted that when he learned to trade at the bank, his supervisor recommended him not to trade on news announcements as the chance of getting on the right side of the bet is 50/50, like a coinflip, and when being on the wrong side some serious losses could be the result. Additionally, also the importance of news announcement trading within the interviewed banks might be representable for other banks in their category. One expert also explained the reason why he was not trading any news announcements, is the fact that his bank is mainly flow trading, meaning that the bank mostly executes trades for clients. Therefore, trading orders are executed with no speculative reasoning from the bank's side, which means that they avoid market times of big uncertainty. On the contrary, the other interviewed expert, who is retired now, experienced the time when his bank was still proprietary trading, which meant that news announcements represented a lucrative option for potential profits. However, this time according to the expert ended already

many years ago, which could also align with the decreasing impact development. Similarly, another expert mentioned that not only some banks switched their focus from trading to market making due to the many new regulations and tighter trading ranges, but also the focus of the market itself switched from numbers to fundamentals.

Overall, further insights and explanations could be gained on the decreasing impact effect the NFP news announcement had on the EURUSD foreign exchange rate, through the qualitative expert interview analysis. Due to the fact that the currency market has seen an exponential growth in volume due to the increased amount of money that flew into the market the volatility decreased and hence also the abnormal returns that could be measured with regards to the individual NFP announcements decreased from 2017 onwards. As the liquidity was that high the individual buying and selling at the announcement of the NFP numbers were smaller in terms of the total market liquidity which consequently is the reason why the price of the EURUSD did not react that much and led to smaller abnormal returns. Additionally, also the increased number of retail traders might have an impact on the weakening reaction as the focus of the them might not be on the macroeconomic indicators. Lastly, also the changing trading behavior of some banks and the tightened regulations for the financial market might play an important role. Together, the various reasons that offer explanations for the quantitative findings, represent a valuable starting point for further research that could be done in this area in order to better understand the underlying factors of the impact development the NFP news announcement had on the EURUSD foreign exchange rate.

4.3.3   General insights and future outlook

Throughout this last part of the qualitative analysis and results discussion section of the thesis, the general insights and the future outlook in the perspective of the individual interviewed experts will be summarized and highlighted. Thereby, the main objective is to link the literature and the quantitative analysis with the expert insights in order to provide a better understanding of the researched topic and to narrow the research gap with respect to the long-term impact development of the NFP announcement on the EURUSD. Additionally, it has not only been of major interest to retrieve a future outlook from the individual experts to provide possible scenarios with regards to the future importance of the NFP news announcement, but also to provide possible further starting points for research that can be done within this area.

One major insight that could be gained from all of the interviewed experts is that they uniformly highlighted that the market completely changed over time and things like the NFP macroeconomic indictor that used to move the market 10 years ago, does not seem to impact that market and the investors anymore at the same degree. This is not only due to the fact that the way the industry professionals trade today is completely different, but also the market participants, regulations and the volume that is pushed through the market changed. Additionally, it has been mentioned that the classic arbitrage banking business cannot be practiced in the same way as it

used to be when security prices have not been accessible by every single market participant at the same moment from all over the world. Hence, some banks focus on earning their share within this market by collecting the spread, which is more lucrative for the banks than the arbitrage business, as even small spreads at a big enough volume add up.

With regards to the future outlook of the impact the NFP macroeconomic indicator might have on the EURUSD foreign exchange rate, the believes diverged slightly. Whereby, one of the experts believes that the impacts of scheduled news will decrease further as more and more liquidity will come into the market, another interviewee thinks that the importance might come back slightly after the corona crisis has settled and macroeconomic indicators are gaining in importance again, however noting that the impact will not become as high as it used to be. According to the expert who mentioned that he believes that scheduled announcements will rarely move the markets in the future, he said that only so-called "black swan" events will cause major volatility in the market and hence offer the opportunity for abnormal returns occurring. According to Capital.com (2021), one of the major brokers worldwide, black swan events are rare, unexpected occurrences or events that have not been able to be predicted and resulted in huge ramifications that could not have been avoided. The third expert held that the importance of the nonfarm payrolls announcement might be smaller, but he stressed that it will be closely tied to the interest rate cycle and therefore worth watching it, as in times of interest rate uncertainty the NFP might lead to significant market impacts.

Overall, it can be concluded that according to the various expert insights, the foreign exchange market underwent many important changes, that reshaped the way professionals trade and analyze the market. This also has many important implications for macroeconomic news indicators like the NFP. Consequently, it will be interesting to see if the same effects and findings that could be gained through this thesis can also be seen with regards to other related macroeconomic indicators.

4.4 Analysis conclusion

Within this last section of the analysis part of this thesis, the main findings of the quantitative and qualitative analysis will be briefly summarized before in the last and final part of the whole thesis, the conclusion, everything will be brought together and linked back to the individual research questions. In the first phase of the explanatory sequential mixed methods research framework, the quantitative analysis, descriptive and inferential analysis have been carried out on the individual event studies that have been performed for the individual nonfarm payrolls announcements during the past twenty years. Thereby, for the abnormal return measured in pips the mean, MINABS, MAXABS, standard deviation, CAR and the CABSAR have been analyzed not only with regards to the whole event window, but also the individual anticipation, publication and adjustment period. Three individual peak periods could be detected based on the mean, MAXABS, standard deviation, CAR and CABSAR in the years 2004, 2008-2009 and 2015.

Additionally, across all analyzed calculations a decreasing impact throughout the past 4 years from 2017 onwards could be detected. With regards to the inferential analysis not only the individual 1-minute abnormal returns throughout the 26-minute event window have been tested for significance on a 1%, 5% and 10% alpha level using t-tests, but also the individual periods and the total event window. Throughout the individual 1-minute significance tests over the 237 performed event studies, it could be seen that the first significant abnormal returns started to increase exponentially before the actual announcement, at which time the most significant abnormal returns could be detected, after which the number started to slowly decrease again whereby even after the 20 minute adjustment period still many significant 1-minute abnormal returns could be found. From the significance analysis of the individual event periods, it could be seen that 62% of all analyzed NFP announcements resulted in significant cumulative abnormal returns at the 1% significance level over the total event period, whereby even 86% resulted in significant abnormal returns at a 1% significance level right in the minute of the publication. With regards to the number of significant minutes across the years 2000 and 2020 it could be seen that the NFP announcement still results in considerable amounts of significant abnormal returns even though the impact magnitude decreased.

Based on the findings of the quantitative analysis, the qualitative analysis in form of expert interviews which have been analyzed with thematic analysis, have been conducted to find explanations to the findings and contribute additional insights and future predictions. Three experts from Austrian banks which also act on a global scale, could associate the peak periods either to specific events or other factors which in their opinion could have resulted in the observed high abnormal returns. Thereby, with regards to the 2004 peak period, the NFP's correlation to the interest rate cycle could be a possible factor as macroeconomic indicators like the employment numbers are closely watched by the Fed to make their decisions about a possible interest rate hike. Consequently, also the market participants watch these NFP announcements closely in order to make their investment decisions. With regards to the 2008-2009 peak, similar to previously done academic research, also the experts have stated that due to the fact that in this time the financial crisis took place, a lot of uncertainty was in the market, which led to the case where important announcements like the NFP got a lot of attention. Additionally, the experts held that many liquidity providers got hurt during the crisis, which is why there was not a lot of liquidity in the market left and that resulted in higher volatility. The especially high abnormal returns in 2015 could be explained by the overall currency market uncertainty due to the Swiss currency cap removal, the Russian ruble devaluation and many other unpredictabilities within that time, which led to very volatile market behaviors. Contrary to the financial crisis, the corona crisis did not result in any excessive abnormal returns in comparison to the other peak periods. This has been partially explained by the experts as a consequence of the fact that everyone already knew that the unemployment numbers will be high. Consequently, the markets consensus was in synchronicity with the published numbers. At the same time, the whole world was facing similar problems and with all the lockdowns that happened, the focus might have been slightly shifted.

With regards to the decreased impact throughout the last years that could be found in the data, the experts stated, that in those recent years, many new market participants entered or enlarged their share in the FX market which brought massive liquidity. This resulted in a general decrease in volatility, which consequently also meant that the market traded in tighter ranges. This decreased volatility could also be associated with the anomaly of the rather unchanged numbers of significant 1-minute occurrences through the years 2017 to 2019, as even though the impact of the abnormal returns was comparingly low, the equivalent estimation periods for the significance test have been low as well. Thereby, it has to be highlighted that high-frequency trading systems, hedge funds, banks and also retail traders not only have a different focus regarding news announcement trading, but also trade and operate differently than the years before. Algorithmic trading systems allow high-frequency traders to enter and exit the market within milliseconds pushing millions of contracts in and out of the market not letting any momentum to build up. Additionally, one expert held that due to the massive liquidity of the FX market, it is very difficult that any continuous moves are developing in the market which consequently led to the decreased amount of abnormal returns that could be studied in the quantitative analysis.

5 CONCLUSION

Throughout this last part of the thesis, the overall research aim, the applied methodology and the individual analyses that have been carried out will summarized in order to provide a concise overview of the thesis. Thereby, the main results of the thesis will be highlighted and explained in a short and summarizing way to communicate the knowledge that could be generated to answer the individual research questions. Additionally, this bespoken knowledge will be linked to the academic literature in order to state the various contributions this thesis was be able to generate. However, not only the contributions to the academic knowledge have been the focus of this thesis, but also the corresponding implications the analyses have for the individual stakeholders that can apply the theoretical information. Lastly, throughout this thesis many ideas for further research have been uncovered which will be briefly summarized in order to highlight possible starting points to continue closing the research gap and adding further explanations to the findings of this thesis.

5.1 Summary

The foreign exchange market underwent many changes and challenges over the past decades, which did not only have an impact on the way the market is being traded, but also on the individual participants and their strategies to extract profits out of the currently biggest financial market worldwide. According to previously conducted research, foreign exchange rates are subject to be impacted by many different factors, whereby macroeconomic indicators are one identified group that is proven to lead to market reactions. With the changes the FX market underwent and all the new participants, it had to be questioned if this also has had any impacts on how certain announcements of macroeconomic indicators are impacting the foreign exchange rates. Therefore, the main objective of this thesis was to study the development of the nonfarm payrolls announcement impacting the EURUSD foreign exchange rate on the 1-minute intraday level over the years 2000 to 2020 in order to narrow the present research gap of the missing long-term studies that analyze the bespoken market impact of a specific security over a continuous amount of time.

Through the application of the explanatory sequential mixed methods research approach in the first and main phase a quantitative analysis of 237 event studies of the monthly nonfarm payrolls announcements have been carried out for the EURUSD over the past two decades. Thereby, answering the primary research question, if there have been any patterns or developments in the impact of the NFP announcement on the EURUSD between 2000 and 2020, individual periods in 2004, 2008-2009 and 2015 of especially high abnormal returns could be found in addition to a general impact magnitude decrease throughout the past 4 years from 2017 onwards. This has been particularly interesting when keeping in mind that especially during the corona crisis where the markets were experiencing a lot of uncertainty no excessive abnormal returns could be detected. In the second phase of the research, the possible answers for the secondary and tertiary research questions have been analyzed from an explanatory qualitative research

perspective through expert interviews in order to uncover the possible explanations for the quantitative findings and generate predictions about the future importance of the nonfarm payrolls in trading. Therefore, three industry experts from Austrian banks, which also act on a global scale, have been interviewed and subsequently analyzed through thematic analysis. Throughout these interviews the identified peak periods could have been attributed to major economical, global and financial policy events. The 2004 peak period could be mainly linked to the interest rate cycle, the 2008-2009 period to the uncertainty, volatility and missing liquidity due to the financial crisis and the 2015 peak period to the removal of the Swiss franc cap and general global currency market events which brought a lot of volatility and uncertainty. The missing peak period of abnormal returns of the NFP announcements during the corona crisis could be explained, by many reasons including the fact that the general consensus was expecting these bad results anyways and the traders had their focus not on trading the individual numbers, but rather the whole fundamental picture.

The decreasing impact magnitude development of abnormal returns throughout the last years that has been detected in the quantitative analysis could be assigned to the massive liquidity that has been brought to the market by the individual participants, especially the high frequency traders, hedge funds and retail traders, which resulted in a significant decrease of volatility. Nevertheless, it is important to mention that between 2017 and 2019 the NFP announcement still resulted in many significant abnormal returns even though the impact magnitude development decreased drastically, as also the abnormal returns of the equivalent estimation periods have become smaller. In addition, many insights and experiences about news announcement trading and the nonfarm payrolls could be uncovered throughout the qualitative analysis, which allowed to make predictions about their future importance in trading. The interviewed experts concluded that due to the various market changes and liquidity growths, the impact of the NFP announcement will probably not result in the same magnitude that it used to be in the previous decades. Only particular circumstances like, black swan events or upcoming interest rate hike scenarios might temporary cause increased impacts.

Overall, with regards to the present research gap of the missing long-term studies of a particular security being impacted by an individual announcement, this thesis was able to narrow this gap by answering the individual research questions to provide the individual stakeholders with findings that could be used for various application areas and future research.

5.2   Implications for relevant stakeholders

The quantitative and qualitative knowledge that could be gained throughout this thesis, represent valuable information that can be used by different stakeholders as not only the quantitative data of over twenty years has been analyzed, but also complimented by expert judgments providing possible explanations for the findings. First of all, the analyzed peak periods and the possible associated reasons can be used by traders and economists to better anticipate the

corresponding impacts during nonfarm payrolls announcements depending on the current economic or worldwide state. However, thereby it is important to mention that the uncovered reasons for each individual peak period are not only exclusively applicable to the very period they have been assigned to. This is because they can also play a role in the other period as oftentimes some of these mentioned reasons appear at the same time in different extends. Therefore, this thesis uncovered an array of possible factors that can be included in an expert's market analysis to better predict the market's reaction towards nonfarm payrolls announcements. Similarly, the diminishing impact magnitude throughout the last years with all the associated insights and explanations can be useful for the individual market participants and traders in the financial industry to better understand the implications of the NFP announcement and how important this macroeconomic indicator is for their daily business decisions. Thereby, it has to be mentioned that depending on the individual trading strategies and business activities, the findings of this thesis can sometimes only be applied on a superficial level as the stakeholder's individual approach requires more specific parameters. Therefore, the objective of this thesis was to analyze and present the reader with an overall wholistic long-term study of the EURUSD and the NFP announcement in order to build a base from which additionally and more specific tests can be done. Similarly, the thesis uncovered many areas of future research that can be done in order to increase the validity of this study and go beyond the initial scope of this research.

5.3 Future research

Throughout the progress of this thesis, there have been multiple occasions where possibilities of further research attempts have been mentioned and highlighted. These bespoken suggestions for further academic research have been attributed to possible weak points that have been uncovered not only in the methodology section, but also by the experts during the individual interviews. Additionally, it is vital to keep in mind that the thesis as a whole is subject to some limitations as during the analysis only one security has been investigated in terms of only one macroeconomic indicator, which means that the explanatory power of the gathered knowledge is only applicable to the EURUSD and the NFP news announcement. Therefore, further research could be done in order to investigate if other securities or even security classes and other macroeconomic indicators show similar results. Furthermore, it has to be kept in mind that this thesis is a historical analysis which means that the analyzed patterns, developments and associated factors may not be applicable for the future.

With regards to the foreign exchange rate data the missing data between October 2001 and July 2002 would be interesting additional data with regards to the impact behavior during the burst of the dotcom bubble. Additionally, as mentioned by one expert, the tick data of the EURUSD foreign exchange rate would be interesting to analyze in order to study the reaction of the market even better instead of only focusing on the 1-minute closing data. Furthermore, the data set could be tested with regards to different event window selections to test if different event study windows and periods would add additional knowledge. Researchers could also be interested in

studying the various other published numbers and events that collided with the chosen event window for better segregating the analyzed abnormal returns. Thereby, it is worth mentioning that depending on the availability and accessibility of the data also event studies using another methods, like for example the market model, could be applied for the same data set to see if a different model can replicate the same findings. Also, with regards to the qualitative analysis, more widespread and bigger analyses could be done by increasing the number of interviewed experts and involving more diverse groups of industry participants in order to see how their insights differ among them. Further research could also be conducted on the missing 2020 corona crisis peak period which came up during the peak period analysis. At the same time, academics could also build upon the various conclusions the experts have set up with regards to the individual factors that might have caused the peak periods of abnormal returns and the diminishing impact effect that has been detected over the past years. Thereby, the factors like market uncertainty, volatility, liquidity and the interest rate cycle could not only add valuable knowledge to the impact development of the EURUSD in terms of the NFP announcement, but these factors might also be interesting for other securities and announcements. Together the individual suggestions from both, the thesis' limitations and the experts' suggestions, represent valuable and potentially promising advancements of this thesis that will help in narrowing the present research gap about the impact development of macroeconomic announcements on foreign exchange rates.

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Appendix 1: Interview consent form for expert interviews

<u>Interview Consent Form</u>

Research project title: The impact development of scheduled U.S. macroeconomic announcements on foreign exchange rates: An empirical study of the nonfarm payrolls announcement and the EURUSD over the past two decades

Researcher: Thomas Jandejsek

Research participant name: _____

Thank you for agreeing to be interviewed as part of the above research project. The interview will take approximately 30-45 minutes. You have the right to stop the interview or withdraw from the research at any time. This consent form is necessary for me to ensure that you understand the purpose of your involvement and that you agree to the conditions of your participation. Would you therefore read the accompanying information and then sign this form to certify that you approve the following:

- the interview will be recorded and a transcript will be produced
- you will be sent the transcript and given the opportunity to correct any factual errors
- the transcript of the interview will be analyzed by Thomas Jandejsek as the researcher
- access to the interview transcript will be limited to Ulrich Gunter as the research supervisor and academic colleagues and researchers with whom he might collaborate as part of the research process
- any summary interview content, or direct quotations from the interview, that are made available through academic publication or other academic outlets will be anonymized so that you and your employer cannot be identified, and care will be taken to ensure that other information in the interview that could identify yourself or your employer is not revealed
- the actual recording will be kept by Thomas Jandejsek and must not be distributed
- any variation of the conditions above will only occur with your further explicit approval

By signing this form, I agree that:

- I am voluntarily taking part in this project. I understand that I don't have to take part, and I can stop the interview at any time;
- The transcribed interview or extracts from it may be used as described above;
- I have read the interview consent form;
- I have the authority to share this information;
- I don't expect to receive any benefit or payment for my participation;

- I can request a copy of the transcript of my interview and may make edits I feel necessary to ensure the effectiveness of any agreement made about confidentiality;
- I have been able to ask any questions I might have, and I understand that I am free to contact the researcher with any questions I may have in the future.

_____

Participant printed name

_____   _____

Participant signature   Date

_____   _____

Researcher signature   Date

Appendix 2: Questionnaire for expert interviews

<u>**Interview Questions**</u>

Research project title: The impact development of scheduled U.S. macroeconomic announcements on foreign exchange rates: An empirical study of the nonfarm payrolls announcement and the EURUSD over the past two decades

Researcher: Thomas Jandejsek

Interview aim: The purpose of this expert interview is to better understand the professional handlings, guidelines, strategies and rules with regards to FOREX news announcement trading with a special focus on the nonfarm payrolls news announcement. Additionally, the quantitative findings of the thesis will be discussed in order to get possible explanations over the impact development of the NFP news announcement on the EURUSD over the past 20 years. Thereby, it is worth highlighting that no monetary values or specific trade examples are of any interest!

1. **What is your position in the bank you are working for?** What are your responsibilities?

2. **How long have you been trading in general?** *How long have you been trading FOREX?*

3. **Do you trade in a team or individually?** How are the trading decisions formed?

4. **What is the main asset class you trade?**

5. **What other asset classes do you trade?** *Rough percentages of the mix?*

6. **Do you trade any specific FOREX pairs (majors, minors, exotics, specific ones only)?** *Do you trade the EURUSD often? With which financial instruments do you trade foreign exchange rates?*

7. **What is the main goal of your (FX) trading (active trading, passive hedging, trades for clients, …)?**

8. **What is your typical investment horizon (scalping, intraday, short-term, long-term)?**

9. **Do you use technical or fundamental analysis for your trading decisions?** *If only one is used, why? If both are used, what are the main purposes of each one in your trading decision?*

10. **Are you allowed to trade during news announcements?** *If not, why and how long before and after the publication no trading is allowed? Are there any specific rules around news announcement times?*

11. **Are there certain categories you/your bank assigns for news announcements with regards to their impact magnitude?** *If so, are there certain rules attached to these categories?*

12. **Do you trade on news announcements in general?** *Do you trade the NFP news announcement? Do you only trade on scheduled news announcements or also on unscheduled ones?*

13. **What specific strategies do you use for trading (NFP) news announcements?** *Do you trade certain news announcements differently? Do you trade shortly before or only right after the news publication? Do you use a straddle, OCO strategy or a completely different one (news announcement as a catalyst for new trends)? Do you only trade majors on news announcements (due to increased liquidity)? What is your trading horizon for news trading? Do you set hard stop loss levels and profit target levels, or just mental ones? Do you enter via a market or limit order?*

14. **What publication numbers (actual, forecast, previous) are important for you when trading NFP news?** *Do you put more emphasis on the change (actual – previous) or the surprise (actual – forecast)? Where do you take the numbers from?*

15. **Did your trading strategy for NFP announcements change over the time?**

16. **Do you believe the NFP news announcement is important in FOREX trading?** *If so, why? Did you experience high price changes during the NFP news announcements in the past?*

17. **Do you know any magnifiers/catalysts (economic or political) that propel the effect of the NFP announcements?**

18. **Did you experience any development about how the NFP news announcements influenced the USD?** *Did the impact get stronger / weaker, faster / slower over time?*

19. **Do you know any patterns / cycles that NFP numbers and reactions follow?**

20. **Do you have an idea or theory about why the abnormal returns in 2004 and 2015 were significantly higher than in all other analyzed periods?**

21. **I could detect a significant drop in the magnitude of influence the NFP announcements had on the EURUSD over the last 4 years. Why do you believe there was such a drop in significance?**

22. **Why do you think, did the 2020 NFP news announcements not result in any exorbitant market reactions even though unemployment numbers have not been higher before (in the 20-year time horizon)?**

23. **Do you have any other insights or comments about the NFP news announcement?**

24. **What do you think about the future importance of the NFP news announcement?** *Or general news announcements in FOREX trading?*

Appendix 3: Thematic maps

Peak Period Themes
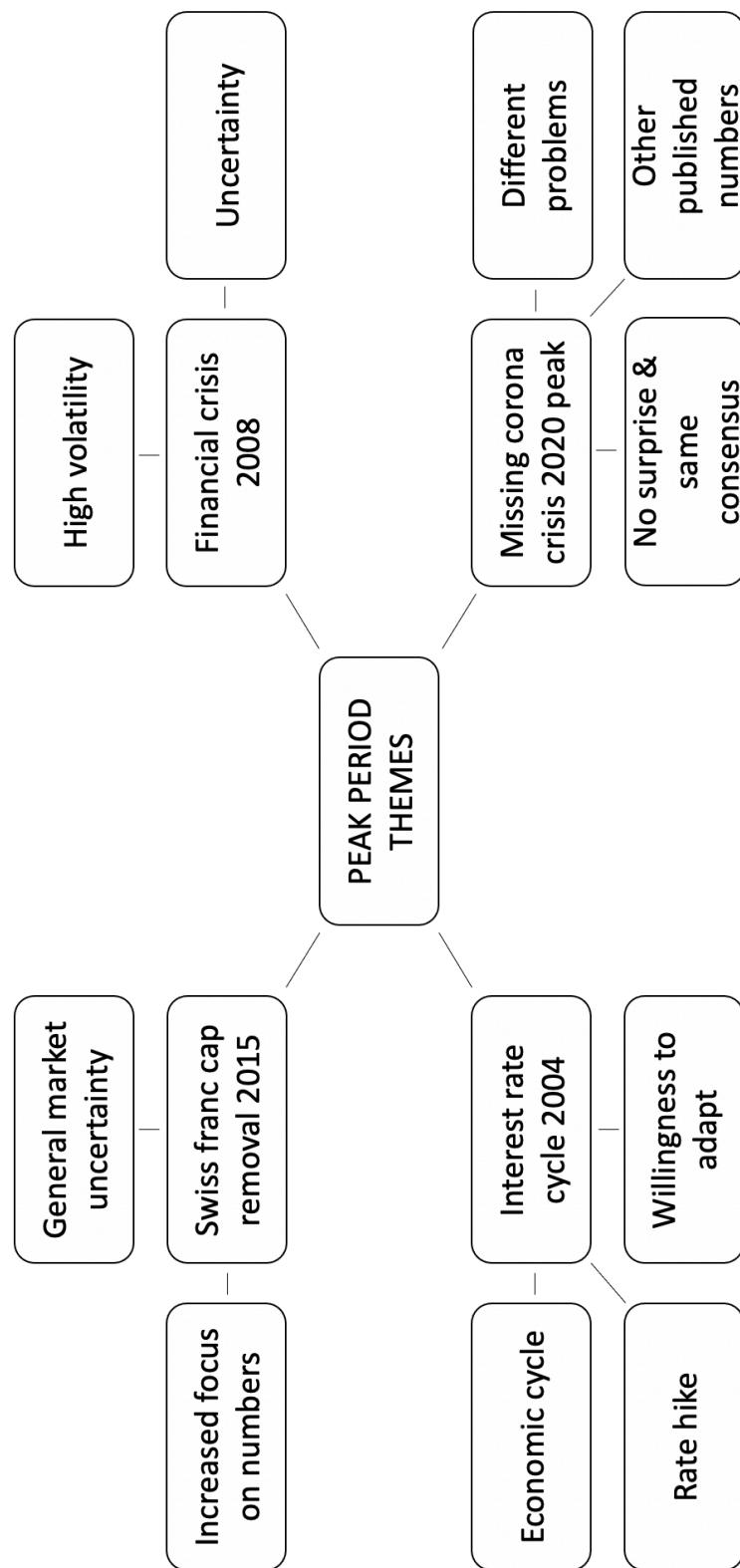
Impact Decrease Themes
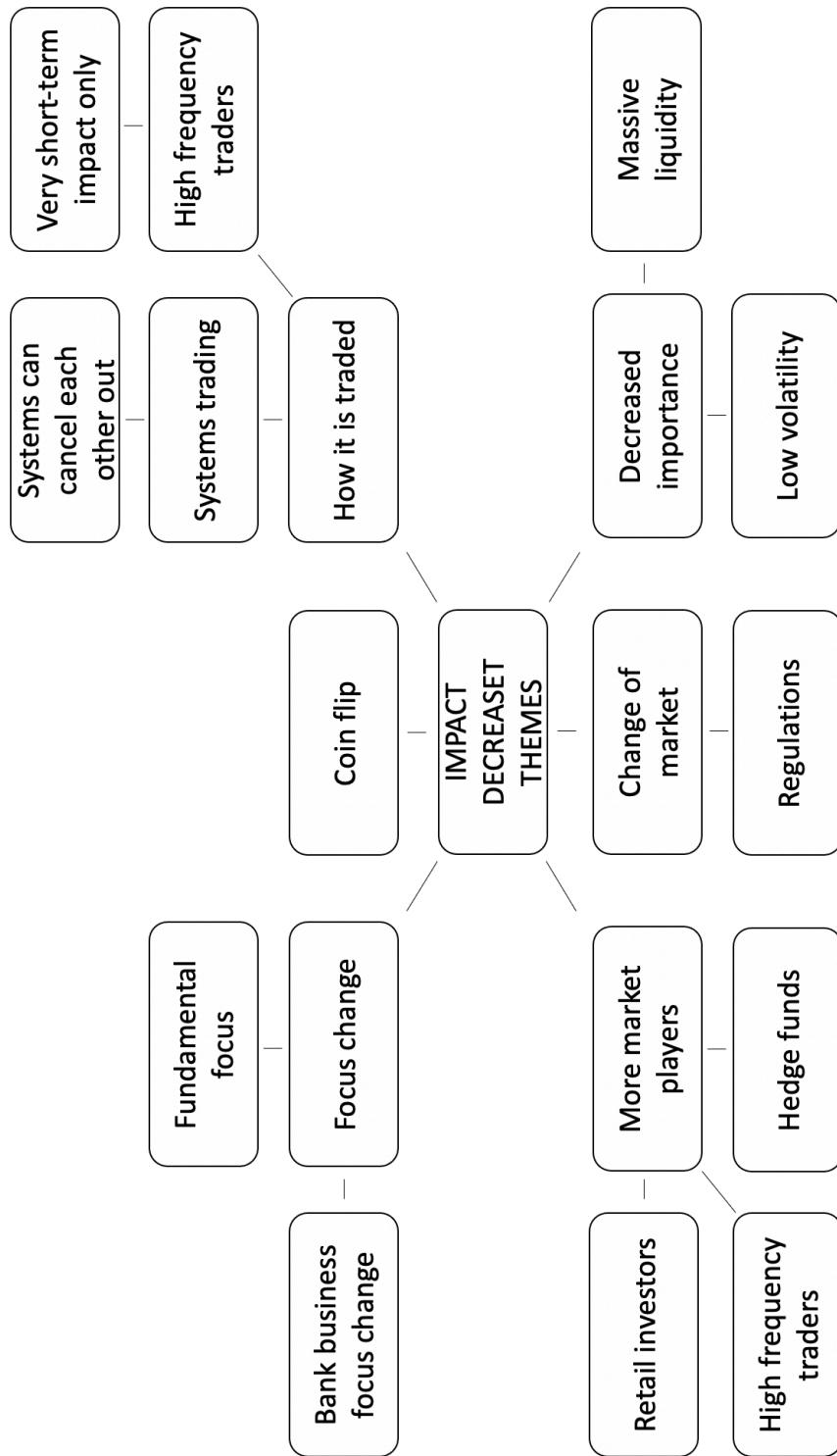
Appendix 4: Event study example from November 2015

Date_Time	Close_Bid	Return_Pips_Close_Bid	Abnormal return (A)	t-stat A	p-value A
2015-11-06 08:22	1.086640000	3.30	3.44		
2015-11-06 08:23	1.086410000	- 2.30	- 2.16		
2015-11-06 08:24	1.086140000	- 2.70	- 2.56		
2015-11-06 08:25	1.086270000	1.30	1.44	- 0.97	33%
2015-11-06 08:26	1.086110000	- 1.60	- 1.46	- 0.99	32%
2015-11-06 08:27	1.086260000	1.50	1.64	1.11	27%
2015-11-06 08:28	1.086470000	2.10	2.24	1.52	13%
2015-11-06 08:29	1.085300000	- 11.70	- 11.56	- 7.84	0%
2015-11-06 08:30	1.071470000	- 138.30	- 138.16	- 93.72	0%
2015-11-06 08:31	1.072830000	13.60	13.74	9.32	0%
2015-11-06 08:32	1.07290000	0.70	0.84	0.57	57%
2015-11-06 08:33	1.073730000	8.30	8.44	5.72	0%
2015-11-06 08:34	1.074780000	10.50	10.64	7.22	0%
2015-11-06 08:35	1.073710000	- 10.70	- 10.56	- 7.17	0%
2015-11-06 08:36	1.073880000	1.70	1.84	1.25	22%
2015-11-06 08:37	1.073850000	- 0.30	- 0.16	- 0.11	91%
2015-11-06 08:38	1.073790000	- 0.60	- 0.46	- 0.31	75%
2015-11-06 08:39	1.074210000	4.20	4.34	2.94	0%
2015-11-06 08:40	1.074040000	- 1.70	- 1.56	- 1.06	29%
2015-11-06 08:41	1.074590000	5.50	5.64	3.82	0%
2015-11-06 08:42	1.074610000	0.20	0.34	0.23	82%
2015-11-06 08:43	1.074170000	- 4.40	- 4.26	- 2.89	0%
2015-11-06 08:44	1.073830000	- 3.40	- 3.26	- 2.21	3%
2015-11-06 08:45	1.072870000	- 9.60	- 9.46	- 6.42	0%
2015-11-06 08:46	1.072780000	- 0.90	- 0.76	- 0.52	61%
2015-11-06 08:47	1.072980000	2.00	2.14	1.45	15%
2015-11-06 08:48	1.073070000	0.90	1.04	0.70	48%
2015-11-06 08:49	1.073520000	4.50	4.64	3.15	0%
2015-11-06 08:50	1.073230000	- 2.90	- 2.76	- 1.87	6%
2015-11-06 08:51	1.073320000	0.90			
2015-11-06 08:52	1.073500000	1.80			

Average return - Estimation window

	0.14

Standard deviation - Estimation window

Stdev	1.47
Stdev 5	3.30
Stdev 20	6.59
Stdev 26	7.52

Standard deviation - Event window

Stdev	27.80

Period	Mean	ABSMIN	ABSMAX	CAR	CABSAR	t-stat CAR	p-value CAR
PUB	- 138.16	138.16	138.16	- 138.16	- 138.16	- 93.72	0%
ANT	- 1.54	1.44	11.56	- 7.72	- 18.34	2.34	2%
ADJ	1.02	0.16	13.74	20.34	86.87	3.08	0%
TOT	- 4.83	0.16	138.16	- 125.54	- 32.95	16.70	0%