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Currency Derivative Trade

- Banking Choices and Government Interventions

Abstract

This is a Master Thesis in Finance that aims to describe the choices banks make and how they interact with government institutions when trading currency derivatives.

Purpose and Method

The research question for the study is formulated as:

How do government institutions regulate, overlook and control the currency derivative trade in Sweden?

The purpose of this study is to give a deeper understanding in the subject of derivative and currency trade. The question is how banks act on the market, how government institutions supervise the trade, and how these parties interact with each other. A secondary purpose is to point out the key decisions a broker makes when trading currency derivatives

A qualitative method is used and four interviews are performed for this study, with representatives from three government institutions and one bank, all four in Sweden.

Findings and Conclusions

Government institutions are regulated under laws and regulations, and have a mandate to overlook and regulate the trade in Sweden for a fair and sound competition. Finansinspektionen is the regulatory body which authorizes banks before they can enter the market, and Finansinspektionen also overlooks the trade and can intervene if a party on the market is breaking regulations. Banks need authorization from Finansinspektionen when beginning their operations, or when changes are to be made in the organization. The Riksbank sets the monetary policies and uses the repo rate to affect the inflation rates in the country. Riksgäldskontoret administers the national debt and uses interesting strategies when acting as a key player on the market.

There is a continuous and close contact between the government institutions, as well as between the banks. The market is based on competition, but there is still a wide spread exchange of information between the parties. Currency options, swaps and forwards are traded in Sweden. The banks offer a full product line of derivatives, except for futures and some derivatives that can not be created because its currency is hindered with trade barriers. The price of a derivative is based on spot prices and expectations on the market.

The banks are in direct contact with Finansinspektionen, since they authorize and overlook the trade. But the banks also have an indirect relation the Riksbank, since they set the repo rate that affects both interest and exchange rates, and hence their choices will directly affect the parameters in the pricing models for derivatives.

Umeå, June 2005

CONTENTS

1. INTRODUCTION

This chapter presents the background and the outline for the thesis. I will at first introduce the reader to the importance of understanding the exposures for an international corporation, and then lead us to the topic of derivatives and hedging. The author's background and previous experience in the area is presented, and the work preceding the study will lead us to the problem formulation.

1.1. Introduction

Corporations on the international market have always been exposed to economic risks. The exposures can appear and affect the corporations operations in different ways, but they all increase the uncertainties for the corporation. It is crucial for the corporation to foresee and manage the exposures and risks and do all they can to eliminate, or at least reduce, the risks that they face.

As corporations operate over borders and in different countries they may buy, sell and trade goods and commodities in different currencies. It is impossible to predict exactly how much or in what direction two specific currencies will change to one another over time. Currency crisis will add to the uncertainty and volatility on the currency exchange market, and will hence directly affect international corporations.

When entering new markets or investing in new business the corporation faces even more uncertainties. If they want to invest in another company, the stock rate is crucial for the cost of the investment. And as stock rates also fluctuate there are uncertainties in these kinds of investments as well.

1.2. Problem Background

As we understand the uncertainties and risks that a corporation or investor is facing, we should ask ourselves how they can eliminate or reduce the exposures. If the exposure is significant, they may need to hedge the incomes or expenses for a business deal to be able to pursue the task.

Hedging with derivatives is useful both for the purpose of reducing exchange rate volatility and stock price uncertainties. Derivatives such as options, futures and forwards can be used to reduce these risks, and are the key tool in hedging strategies.

When trading securities or derivatives on a larger scale, it is important to be aware of the rules and regulations on the market, as well as how the government institutions want the trade to be performed. For a fair trading system, all actors on the market need to do business under the same laws, and act under the same rules. Therefore it is important that the government as an independent actor on the market regulates, oversees and follows up the trade.

For a fair trade there are some rules that apply. Even though the actors on the market can not be forced to set an exact price on a product, there are tools that the government can

use to push the trade in a specific direction. The Central Bank sets a repo rate that directly affects the interest rates, and it would also be interesting to study what tools the government institutions have to control pricing of derivatives on the open market.

There are different models that can be used to calculate the fair or businesslike price for a derivative. Some models are based on the exchange and interest rates of today, and leave little room for statistical estimations and therefore they have a very low level of mathematical complexity. Other models I will come across in the theoretical chapter of this thesis are more complex, and I will also find out if these models are used by banks on the market.

1.3. Problem Formulation

The problem background has now leaded us to the problem formulation, which is the basis for the study and the thesis.

Research question:

How do government institutions regulate, overlook and control the currency derivative trade in Sweden?

1.4. Purpose of the Study

The purpose of this study is to give a deeper understanding in the subject of derivative and currency trade. The question is how banks act on the market, how government institutions supervise the trade, and how these parties interact with each other.

A secondary purpose is to point out the key decisions a broker makes when trading currency derivatives. The roles of different government institutions on the market will also be analyzed for the purpose of explaining and understanding what parties the traders have to take into account in their operations.

1.5. Delimitations

For this study I will interview three government institutions and one bank. I choose not to contact any companies for this study, since the focus of this study is on banks and government relations. The reason why representatives from only one bank are interviewed is that other banks that I contacted refused to participate. The study is also limited to respondents on the Swedish market, since an international study would be too time consuming for the preset time frame of this thesis work.

In the theoretical framework I will present how the derivatives work and how they are priced and traded. I will avoid describing the legal issues in detail, since this thesis aims to give understanding about how the market works rather than how specific laws are applied. In the empirical study I will interview some representatives for the authorities which regulate and overlook the market. The scope is then to present how that work is performed in practice, not to see how the legal system in Sweden works.

The focus in this thesis is on currency derivatives. But some derivatives also involve interest rates and expectations. I will however limit the applications of the derivatives to the currency hedging purposes. Hence there will be no detailed presentation of how interest rates works for the market.

1.6. Thesis Disposition

Chapter 1 introduces the reader to the field that will be studied.
Chapter 2 presents the methodology that will be used for the study, and how theories of methodology have been used when preparing the study.
Chapter 3 contains all the theories that form a basis for the study, and the reader will be introduced to currencies and derivatives as well as risks and hedging. Some pricing models and their applications will be presented as well.
Chapter 4 introduces you to the respondents, and the raw material from the interviews is presented.
Chapter 5 presents the analysis of the material, where the theories from chapter 3 and the information from chapter 4 are linked together.
Chapter 6 concludes.
Chapter 7 suggests a few ideas for further reading and further studies in case the reader are interesting in developing his understanding for the subject.
Chapter 8 determines whether the study fulfills the criteria of validity, reliability and transferability, as well as if the study was performed according to ethic standards.

1.7. Acknowledgements

First of all I would like to thank the respondents who shared their valuable time to help me find interesting answers to my questions. My honest gratitude to Koivisto at the Riksbank, Arffman and Eliasson at Finansinspektionen, Hallberg and Westesson at Nordea, and Rådstam at Riksgäldskontoret, without your thoughtful aspects and opinions it would not have been possible to realize this thesis.

I want to thank Umeå School of Business and Economics, the Department of Business Administration and my supervisor Gösta Söderström for guidance and help during the course of the work in this study.

Finally I want to express my gratitude to Burhan Kawosa for introducing me to international financial management and thank him for awakening my interest in the field of foreign exchange.

2. METHODOLOGY

The methodology is the basis for the study. In this chapter I will present the theories of methodology that were used for the study and how they were applied in practice. The topics in the chapter both contain the theoretical framework for the methodology and a presentation of what choices I made before and during the study.

2.1. Introduction

As far back as the 60's there have been claims in literature that "the field of Finance is undergoing a great transformation" and that new models and applications are constantly being developed.[1] Some of the theories that are this old may not be suitable for financial purposes in the business of today, but it is however interesting to follow the development of theories, and how models and applications have been modified and refined over time. As the objective of business always has been to maximize revenues and profits[2], I find it interesting to study how the ways to do business has developed, as well as how the financial tools that are used today can be developed for the needs of tomorrow.

Before performing a study, the researcher has many choices to make. He needs to make sure he is aware what the purpose of the study is, and for whom it is performed. Depending on the purpose of the study it can be performed in different ways. The choice of methods, how to approach respondents and find answers to the questions in the study, will directly affect the conclusions and results in the end.

Since theses and papers are continuously produced at universities and colleges around the world, there will at many times be similar and almost identical theoretical methodologies presented by the writers. I see little use in repeating the same ideas and approaches in this thesis. It would not bring any new perspectives to me as a researcher or to you as a reader. Therefore my aim in this chapter is to present some new views in the art of methodology. I have deliberately chosen to present opinions and perspectives in methodology that I previously have not come across during my academic schooling. My hope is that it will enrich the reading experience for the reader, and I believe it will still be a valid methodology basis for my study.

2.2. Preconceptions

As a researcher enters the field that is to be studied, it is important for him to understand how his previous experience and preconceptions will affect the work. When entering a field that is unknown for the researcher, he may still have a vague and sometimes incorrect idea of what the field will bring him, and hence he may go in the wrong direction and not reach the objective of the study.[3]

[1] Weston, John Frederick. *The Scope and Methodology of Finance*, p vii
[2] Ibid, p 32
[3] Ely, Margot. *On writing qualitative research*, p 332-334

The most important thing to do when it comes to preconceptions is to at first be aware of what preconceptions you have as a researcher in the field, and then secondly present this to the reader. In this way, the study will have a higher degree of transparency and the reader is given a chance to decide if the researcher is biased or independent in relation to the respondents.[4]

2.2.1. The Researcher's Preceding Education

In 1999 I enrolled to Umeå University to study mathematics. After a few years of studies in mathematics and mathematical statistics, I came to realize that it would be both interesting and useful for me to combine the rather theoretical studies I had pursued so far with a subject that could be further used in practice. Therefore I chose to study Business Administration and have my second major in Finance.

One year ago I studied finance at Wright State University in the United States, and my interest for securities and derivatives was awakened. The two classes I took related to this field both explored hedging theories, security characteristics and the possibilities to use securities and derivatives to secure or protect investments.

2.2.2. Preceding Bachelor Thesis

During the fall semester of 2004, I wrote my bachelor thesis under the title "*Hedging With Currency Derivatives – A Useful Strategy for Smaller Companies?*". The scope of the study was to see how smaller and medium sized companies used currency options and currency forwards to hedge their incomes and expenses. In the study I performed interviews with three companies and one bank, and came to the conclusion that smaller companies may very well use forwards to hedge their currency flow, but the flow needs to be continuous or else the necessary predictions and estimations of the flow can not be made. For this thesis I have now changed the focus from the bank/customer relations to the government/bank relations and hence this thesis can be seen as a further study, developed from the findings in my bachelor thesis.

2.3. The Methodology Framework

2.3.1. Basic Assumptions

As an alternative background I will present the basic assumptions that the researcher sets when beginning the study. Since a purpose is determined before the actual study is performed, there are some fundamental assumptions that the researcher has to make.

Models are often applied to simplify and describe an event or phenomenon. They are based on assumptions that directly will affect the analysis as well as the results, but is a necessary simplification when describing a complex system. Some assumptions may hence narrow the perspectives in the study to make it comprehensible.

[4] Ferber, Robert. *Research Methods in Economics & Business*, p 236

The purpose of this study is both to describe how the trading system is works, but also how actors in the system behave under rules and regulations. I have hence assumed that there is a pattern in the behavior, as well as there is an interaction between the parties.

2.3.2. Setting the Purpose of a Study

As the writer comes to the beginning of the writing process, he should frame a purpose for the thesis. It can be presented by a formulated problem or a thesis statement, and should catch the essence of the study. The statement should be expressed in such a way that it both gives the reader a clear view of why the study is performed and at the same time serves as guidance for the researcher when he needs direction during the study. He shall frequently fall back onto the thesis statement and the purpose of the thesis, to make sure he is on the right track towards fulfilling the criteria of a successful study.[5]

Early on had many ideas for what I could study under the topic of currency trade, and it took me a few weeks before I could formulate a specific problem formulation and purpose for this study. As I discussed the topic with my supervisor and began looking for literature, my ideas developed and after a few weeks I could frame a purpose for the study. As some banks refused to participate, the focus of the study changed a little. In the beginning I intended to focus mainly on banks, but as I realized that the government institutions played a large role on the market and they probably would have interesting insights to the trade I decided to have a focus on the bank/government relations.

2.3.3. Quantitative versus Qualitative Research

As the topic is chosen and the theories are set, it is time for the researcher to determine what kind of research approach will be most appropriate for the study. In social science there are two methods that are commonly used. These are the quantitative and the qualitative research methods and they have specific characteristics that will be presented in this section.[6]

It has been suggested that the method itself is not the most important influence for the outcome of the study. What is more important for good results is how the research questions are formulated. The researcher may very well use combined methodologies, as long as they all help him fulfill the purpose of the study that initially was set.[7] Many of the books in methodology I have come across when writing this chapter, have also argued that a war have been going on between paradigms that have caused more harm than good for the art of methodology. Some researchers have blindly argued for “their” methods to claim that their research should be valued higher than others. And this warfare has then moved the focus from the results of the studies, to instead turn to how the researcher performed his studies.[8]

With this said I do not want to claim the selected methods for a study are irrelevant, but should rather be seen as a tool to reach the purpose of the study. Even if there is criticism

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[5] Gibaldi, Joseph. *MLA handbook for writers of research papers*, p 30
[6] Andersen, Ib. *Den uppenbara verkligheten*, p 31
[7] Tashakkori, Abbas. *Mixed methodology*, p 21-22
[8] Oakley, Ann. *Experiments in knowing*, p 23-24

to classifying methods and comparing them to find the "best" one for a study, I find it useful to present distinct research approaches and after that decide what will be the main method for this study. This also means that even if one method is chosen as a basis for the study, the researcher may at times act in ways that could cross over defined borders and into opposite methods. It is also important to point out if a structured or unstructured interview approach will be used even though this will not cause any harm to the validity of the study[9], which I will present in a coming section of this chapter.

The quantitative method is based on the use of statistics and the mathematical analysis of the collected data. There are rather strict instructions on how to perform these studies, and when coming to conclusions based on the data it is crucial to have statistical confidence in the results. There is hence little room for personal interpretations of the collected data. If results are produced with statistical confidence, you may be able to make predictions for the future.[10] Variables are measured and correlations are sought in the masses of data.[11] Byrne[12] argues that the variables themselves do not exist, but it is rather a tool to measure traces and find patterns that will give us an image of reality. The researcher is hence striving for specific explanations and to describe the reality in models and numbers rather than finding a general understanding in the subject.

Bradley and Schaefer have criticized the misuse of quantitative theories, since it can lead to impoverishment of understanding.[13] They argue that improper or poor measurement can lead to the wrong conclusions, as well as important information could be missed in the gathering process.[14] It is hence important to follow the rules of the design in the method, but also to make sure the study itself provides the proper preferences for the study.

A qualitative method on the other hand aims to reach a deeper understanding for complex problems. It is crucial to relate the meaning of the problem to a wider perspective, rather than focusing on minor details. The method is not explanatory but do primary search for understanding in the field of the subject.[15] It can be performed in different ways, for example as a technique of destruction where the researcher searches for multiple meanings in an event or phenomenon. He will both point out the dominant meaning of the analyzed event and show some alternative ways to interpret the essence of it.[16]

2.3.4. The Proper Method for this Study

Before choosing the method for this study there are a few parameters to take into account. First of all we know that the purpose of the study is to seek understanding in the field of derivative theories. I intend to explore how these derivatives are developed and used by banks, and how the trade is monitored by government agencies. A quantitative method is

[9] Borell, Klas. *Att spegla verkligheten*, p 14
[10] Andersen, Ib. *Den uppenbara verkligheten*, p 31
[11] Byrne, David. *Interpreting quantitative data*, p 29-30
[12] Ibid, p 32
[13] Bradley, James. *The uses and misuses of data and models*, p 108-109
[14] Ibid, p 109
[15] Andersen, Ib. *Den uppenbara verkligheten,* p 31
[16] Feldman, Martha S. *Strategies for interpreting qualitative data*, p 5

not applicable since the aim is not to collect data on how the banks work in detail, or explain how the trading system is constructed. Even though that kind of information may be presented in Chapter 3, where the background theories are presented, it should only be considered as background information for the reader.

To further argue for that a quantitative method would not be useful for this study, it should also be noted that the aim of this study is not to reach out to a large number of respondents. An unreliable result would develop in a quantitative study if only a small number of respondents were to be contacted. This kind of mismeasurement would only mislead us and could not fulfill the purpose of the study. Hence I did not find a quantitative method suitable.

I determine it to be more useful to apply a qualitative method in the study. In the purpose of this study it was determined that the aim is to present what choices banks make, why these choices are made, and how government institutions support and overlook the banks.

It has been suggested that the actors in a system are dependent on the rules, regulations and limitations that the system design sets.[17] It is therefore interesting to ask how much the actors can decide themselves and what is predetermined by government, laws and regulations. To find an answer to this question I will approach the respondents with a qualitative interview. There are only few yes and no questions, since I intend to study how the actors see themselves and the situation they are in, rather than focusing on specific characteristics of the system. The system may be constructed to work in one way, but actually in practice work in a very different way. It is then my job to show this difference and find proper explanations for its existence.

It has been debated on whether it is the participants or the design of the method that is driving the study forward. Some have suggested that it is the participants that drive the study forward with their preconceptions and understandings[18], while Swanson and Chapman[19] have found that it is the design of the method that will help the study develop. It is hard to determine by default that either the participants or the design would lead the researcher forward in the study. I believe it is crucial as a researcher to have an open mind for new information, especially when performing a qualitative study. This way new perspectives or ideas can, if relevant, be brought in to enrich the study. Thereby both the researcher's preconceptions and the methodology will form a basis for the study.

2.3.5. Selection of Respondents

When selecting respondents, the researcher first sets up certain selection criteria for the process. For the transparency of the thesis it is important to present how respondents were chosen, which respondents were discarded, and most importantly why these selection choices were made. Since the use of a qualitative research method may imply a small number of respondents, it is important that the ones that are chosen are well informed and aware of the topic, so that useful information and data can be collected. If

[17] Hovi, Jon. *Samhällsvetenskapliga analysprinciper*, p 67
[18] Morse, Janice M. *Critical issues in qualitative research methods*, p 77
[19] Ibid, p 77

too few respondents are available at first, the chain- or snowball effect can be used to reach more respondents.[20] This method is used by the researcher when asking the selected respondents for other suitable respondents, such as colleagues, competitors or affiliates in the same field. Thereby one selected respondent can open up doors to other interesting respondents or areas.

To specify who I wanted to interview I set some criteria for whom within the bank or institution I wanted to get in touch with. The criteria were mainly that it had to be a person who worked with issues concerning derivatives, and of course someone who had enough experience in the field.

It was rather easy to get in touch with respondents in the government institutions, since they had information or press secretaries who could lead me directly to the right person. I sent them my frame questions for the interview, so that they could help me find the suitable respondents. By sending them the questions in advance I saved time finding the right respondents, since the first person I talked to could guide me directly to the suitable respondents. It also made it easier for the respondent to prepare for the interview, which I noticed later on during the interviews.

When I contacted the banks it was harder to get in touch with willing respondents. When I called and asked for managers or directors at their currency or security departments, it caused some confusion. I was redirected to many different employees within the banks, who worked with everything from home loans to general custom relations. But after a few tries, I got in touch with the right personnel. I was in touch with three of the larger banks in Sweden. One of them claimed they could not help me with the study, since my questions could not be answered because of bank secrecy issues or that they were related to classified information. Another bank told me they had a policy not to help with this kind of studies because of the time it would cost them to help me. The third bank was however very helpful, and they quickly helped me get in touch with the suitable respondents, who willingly agreed to participate.

2.3.6. The Interview Structure

When constructing a question form, the researcher want to both include all the relevant questions and give room for follow up questions. If new information is discovered during the course of the interview, it is important to be able to fill in with more detailed questions. This shall only be done if it can happen without pushing the conversation off the main track of the interview. It is also important to be consequent when formulating and asking questions since the aim is to get clear answers to the problem formulation in the study. The researcher should try to keep the questions short and focused on the purpose. It can however be good for the respondent's understanding to combine the question with explanations so that the background of the question is clear.[21]

Interviews can be structured, semi structured or unstructured. Quantitative studies based on surveys have a rigid structure and leaves no room for follow up questions. A

[20] Bryman, Alan. *Samhällsvetenskapliga metoder*, p 313
[21] Lewis-Beck, Michael S. *Research practice*, p 93

qualitative research form are usually more room for interpretations during the course of the study and are thereby semi- or unstructured. In a semi structured interview the researcher has either prepared a list of frame questions he want answers to or a list of themes for the interview. With the unstructured method the researcher will have no prepared questions, except the problem formulation itself, and will let the respondents speak freely within the topic of the study. The interview would then be performed like a normal conversation.[22]

I chose a semi structured interview method where I prepared my frame questions in advance, and also sent them to the respondents so that they could prepare for the interviews. During the interviews, some new information came up, and thereby I had to modify the questions as the conversations moved in to new areas. But at the end of each interview, I made sure I had the answers to the frame questions so that no gaps were left uncovered. As the respondents were very willing to answer me and they were very involved in the process finding the proper answers for the questions, my role as a researcher became more of a role as a discussion partner.

I used a mini disc recorder to tape the interviews, and only a few days after the interviews were performed I transcribed the material and started process the collected material. All interviews were performed in Swedish, but when transcribing the interviews I directly translated the material to English. Thereafter I processed the material a couple of times, both the structure and the content, before I began the analysis.

2.3.7. Question Form

The question form works as a map for the researcher during the interview. Introductory questions can have a wide perspective and be very general about the subject. At the beginning of the interview, the researcher may not have a clear idea what the exact focus for the conversation with the respondent will be. But as the interview takes form and the researcher closes in on the very essence of the study, he should narrow down the questions to be more precise and concrete in its formulation and direction.[23]

Some questions will have the obvious purpose of data gathering, to collect information for a background profile of the respondent. Other questions will be focused on the respondent's opinions or views in the matters. The different kinds of questions give the researcher room to elaborate and combine question types, to improve the conversation between the two parties. It is however important to point out that in qualitative research most questions are of the opinion or interaction type, and for a simple data gathering process a quantitative method would be better suited.[24]

In a qualitative study the researcher's language and question formulation is both a tool for the interview and a basis for the analysis. The interview takes the role of a focused

[22] Bryman, Alan. *Samhällsvetenskapliga metoder*, p 301
[23] Strauss, Anselm L. *Basics of qualitative research*, p75
[24] Ibid, p 75-76

conversation between the researcher and the respondent, to negotiate an understanding for the topic.[25]

2.3.8. Linking to Theories

In theoretical sampling, the data gathering will lead to the analysis, and the researcher is aware of this. The information that is collected will build on previous events during the study, and new information will be confirmed or discarded depending on what other respondents reply to similar questions.[26] As I will interview both government authorities and banks, I will get answers from two types of actors on the market. Hence their answers can be compared to clarify how the relationship is built between the different parties.

When comparing one event to another that has been observed, the analysis takes its form. This strategy is self-explanatory since the answers are in the differences and similarities between the observed objects.[27]

2.3.9. Performing the Analysis

The situation the researcher finds the respondent in can be analyzed on a logical basis where the nature of the surrounding environment and the decision base are the two key elements. In this approach the researcher explains actions that are performed by parties within the observed environment. The two components that describe the elements are the observed situation and the decision process. [28]

The first element is dependent on the situation the respondent is in. His choices are dependent on the physical environment, social environment and the nature of the problem. The physical environment, i.e. surroundings, consists of both the elements in his surrounding that always have been there, and the man made elements. The social environment is formed from other relevant actors and institutions in his surroundings. Finally the situation of the problem includes the choices he has to make based on the nature of the problem he is facing.[29]

The second element is the principle of rationalism. The researcher aims to display patterns to why the respondent has made, and continues to make, certain decisions. He will try to put this in relation to the context of the field where the choices are made, and motivate rational decision processes as the tool for the observed party's decisions.[30]

From previous studies the researcher can perform a secondary analysis of the collected data. He is then to reevaluate the collected information and draw new conclusions. This can probably be efficient when using quantitative data, but can be harder to perform when using qualitative methods. The gathered information will be taken out of its context

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[25] Bruhn Jensen, Klaus. *A handbook of qualitative methodologies*, p 32-33
[26] Strauss, Anselm L. *Basics of qualitative research*, p 203
[27] Ibid, p 79
[28] Hovi, Jon. *Samhällsvetenskapliga analysprinciper*, p 59
[29] Ibid, p 59
[30] Ibid, p 59

or cultural meaning if it is recycled in a secondary analysis.[31] Therefore I will not use the information from my bachelor thesis, or any other studies, in the empirics of this study. Even if I had personally collected the information, and it was done quite recently, I believe it will not lead to any new or useful conclusions if recycling the data. It may however be used as background information for this study, and it can be useful for the reader to be aware of the work that has proceeded the study.

2.4. Ontology and Interpretations of Results

2.4.1. Empiricism versus Rationalism

As our personal or professional opinions in a topic are shaped, there are different sources for our beliefs and preconceptions. Our beliefs are shaped from how we perceive events or remember facts. Depending on who we are and what ethical values we hold, we remember and interpret events differently. And hence we learn and understand things differently. [32]

From our preconceptions and our perceptual and memorial beliefs, we may infer general truths in a subject. We can also shape new ideas and understandings from reason and rational arguments, and hence new or modified beliefs are created. By rational and logical arguments we can develop our perspectives and apply known theories in new fields. [33]

This boils down to two important conclusions. First and foremost our empirical beliefs shape our knowledge base in a subject, and secondly our rational thinking and arguments create a wider understanding and helps us develop what we already know in the subject.[34]

Since our preconceptions are the very base of our understanding in a topic, it is very important to have a thorough understanding before we enter the field. It is also important to have the necessary tools for a rational and logic development as we go deeper into the subject. As seen in section 2.2.1, my preconceptions are mainly based on academic schooling in Finance. But since I also have experience from the more theoretical field of mathematics it is possible for me as a researcher to understand models and equations in such a way that I may modify and apply them to new problems. Just knowing how to use a model in the way it is presented here and now is not always enough. Sometimes it is necessary to understand it in theory so that you can use it in new fields, or use it even if some of the parameters are unknown.

2.4.2. Realism versus Idealism

As empiricism and rationalism explains how we learn and the way knowledge is shaped, realism and idealism are ways to describe what things actually mean. Realists believe reality is in objects while idealists think reality is in the mind and meaning of the

[31] Bryman, Alan. *Samhällsvetenskapliga metoder*, p 388-389
[32] Ryan, Bob. *Research method and methodology in finance and accounting*, p 11
[33] Ibid, p 11
[34] Ibid, p 11

subject.[35] Hence reality can be understood or described in different ways by different people, even if it is perceived and experienced in the same way.

The field of applied mathematics in finance can be perceived to be very complicated for the observer. But I do believe that even the most theoretical and abstract formula can be understood if the observer uses it to solve rather simple and practical problems to start with, and as he understands the essence of it, he may move on to more advanced applications. This leads to an understanding of the theories and will not be limited by any first impression of the model. Without being able to apply the formulas and models to practical problems, the theories will fall flat when it comes to a practical value. I hence look at the theories with and idealist's eye, since my aim with this study is to explain how models and equations are applied, rather than proving them in theory.

2.4.3. Explanation versus Prediction

Both when speculating on the market, and when studying a phenomenon in theory, we use both predictions in advance and explanations afterwards. When explaining consequences from previously made choices, you argue that "Y because of X". Hence Y happened because X happened, and thereby Y would not have happened if X had not happened. By explaining the causes and consequences this way, you will not by any certainty be able to say that "X implies Y" since X very well could cause other events than Y.[36]

When a researcher wants to create logic arguments for the causes and consequences, he should rather use a prediction approach for the problem. This means, finding ways to prove that "If X, then Y", i.e. "X implies Y". This means that every time the event X occurs, the event Y will by an absolute certainty occur afterwards.[37]

If a theory is tested to be accurate, with reference to a set of empirical data, it is more accurate to say that the data is consistent with the theory, rather than believing that the theory has been proven to be true to all sets of data. This means that we may be more confident that the theory is true for many (maybe all) sets of data, but we can not be completely confident that the theory is absolutely accurate. To be able to produce the valid proof for a theory, we must stay within the theoretical framework.[38]

As an investor is putting money into a project, he wants a return after a period of time, and most likely he will sooner or later want the invested capital back. At the initial stage of the investment, he tries to make predictions of the project, to see if it is worth the risk to invest. Sometimes the predictions will prove to be accurate, sometimes they not. It is hence hard, if not impossible, for an investor to make absolute accurate predictions, since a lot of the parameters in X are unknown, and hence there will be no exact Y to expect as the outcome.

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[35] Ryan, Bob. *Research method and methodology in finance and accounting*, p 13
[36] Ibid, p 19
[37] Ibid, p 19
[38] Weston, John Frederick. *The Scope and Methodology of Finance*, p 41

It is then easier to create explanations after the investment is done. In time, we will know the Y, and by interpreting the result in Y, we may go back to X and find the proper values for the previously unknown parameters. But I strongly believe it is not feasible to only rely on explanations in finance. We would then never be able to go in to new projects or try new types of businesses. I believe the best way to apply predictions and explanations is to learn from previous projects and find explanations to what caused the success or failure. Thereafter we adjust the future predictions since more of the unknowns in X now are known.

In the theories of hedging, prediction is the main approach. By predicting currency movement, or predicting the outcome of a possible hedging strategy, we can make choices that most likely will be the best suited in the situation. Given the correct parameters we can make well motivated decisions and hence be certain that we will be given a specific outcome at the end of the investment. Therefore explanation and prediction are interesting approaches when studying hedging strategies.

2.4.4. Empirical versus Theoretical Discoveries

There are models in finance that have developed and become more refined or advanced over time. By empirical studies researchers have been able to determine some patterns in behavior, and from these findings models have been developed. Models are seen as an abstract theoretical description of a problem in reality, which should not be confused with theories in the mathematical or logical sense. Models are only ways to present and help the researcher understand a phenomenon. And even though it has been validated and refined through thorough experiments, it can not be used to predict or prove events or behavior since it has left out some of the unknowns. These unknowns may at first seem irrelevant, but may still affect the outcome in some cases.[39]

This thesis will present ways to use derivatives, for example to prevent negative outcome of an investment. The models are developed both from the characteristics of the derivatives, and the predictions of how currencies or markets fluctuates. But in the fluctuations, there are many unknowns, and hence it can not be said with certainty that it today will be more profitable to use a certain derivative. But arguments such as “If you believe tomorrow will bring Y, you should today do X” can be presented. Hence these models will be explanations for strategies, rather than predictions of future exchange rates.

[39] Ryan, Bob. *Research method and methodology in finance and accounting*, p 27

3. THEORY

In this chapter the theoretical framework for the study will be presented. As an introduction I will give a brief overview of the government institutions that oversee the market, and how currencies have developed and been used over time. Thereafter I will introduce you to the derivatives that are available on the market, how they can be applied and how pricing models work.

3.1. Introduction

In the United States the Federal Reserve (the Fed) supervises and regulates the commercial banks. They also serve the banks as lenders and hold the Treasury checking account. Monetary policies are implemented through the Fed to adjust the money supply.[40] The setup in Sweden is a bit different. In Sweden it is also the government who controls and performs the above mentioned functions, but here the functions are divided between different government institutions.

The Central Bank in Sweden, the Riksbank, is tasked to maintain price stability and promote a safe and efficient payment system.[41] The price stability is measured continuously with the consumer price index model and the Riksbank set an inflation goal of 2%[42], which has been the main monetary goal since 1995[43]. The Riksbank's main tool when influencing the inflation is the repo rate which is the rate which all interest rates relate to.

Swedish National Debt Office, Riksgäldskontoret, is the government's financial administration which manages the debt, and has a mandate to issue government guarantees.[44] They issue treasury bonds to finance the national debt[45], which is 1 269 billion SEK as of March 31 2005[46] of which 313 billion is in foreign currencies[47]. Their main responsibility for Riksgäldskontoret is to act as the internal bank for the government institutions and thereby supervise the state's cash management. They also make forecasts for the needs of the governments borrowing requirements.[48]

The Swedish Financial Supervisory Authority, Finansinspektionen, is a public authority accountable under the Ministry of Finance. They authorize, supervise and monitor all companies, banks and institutions operating on the Swedish financial markets. Their role on the market is to promote stability and efficiency in the financial system and to ensure the consumer protection.[49]

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[40] Eakins, Stanley G. *Finance; investments, institutions and management*, p 96
[41] The Riksbank – *The Riksbank's tasks*
[42] The Riksbank – *Price stability*
[43] Sveriges Riksbank, *Penning- och valutapolitik*, p 20
[44] Riksgäldskontoret – *Mandate*
[45] Riksgäldskontoret. *Handbok om statspapper*, p 5
[46] Riksgäldskontoret – *Government debt*
[47] Riksgäldskontoret, *Den svenska statsskulden – The Swedish Central Government Debt*, p 7
[48] Riksgäldskontoret – *About the Debt Office*
[49] Finansinspektionen – *About Finansinspektionen*

The government institutions are regulated under law, and the areas which they are responsible for are well defined. But in some cases there may be an overlap in their operations, and therefore they also have agreements in between the institutions that define how the shared areas is to be handled to avoid that the same work is done in both institutions.[50]

As business cycles and market volatility cause insecurities for future investments, it is important to analyze the alternatives before entering long term commitments. Some fluctuations can be hedged with derivatives or other financial instruments, while other risks can only be reduced by avoidance. Studies have shown that the reduction of insecurities for a company will not only lock in future incomes and expenses, but will also increase the market value of the company. After the foundation of the EMU, companies from previously unstable economies have increased their value on the market, since they now have a reduced exposure to exchange rates.[51] It has also been found that the decreased insecurity for the company has lowered their cost of capital, and hence made it possible for them to bear more debt which makes it possible to invest in new projects.[52]

The volatilities on the market will expose the actors to many risks. Markowitz' defined risk as the volatility of the reward from an investment.[53] If you for example invest in stocks you expect a return, i.e. the reward. Sometimes the reward can be lower or higher than what you expected, and this deviation from the average that you expected is a measurement for the risk. In your daily life you may think of risks as something that always is negative, and therefore you may want to avoid risks. But financial risk is different to the risks in our everyday lives. Financial risk always includes a reward for you if you accept to carry the risk.[54] The challenge when handling the financial risks is hence to reduce the volatility and uncertainties without reducing the long term rewards.

Hedging can be done with two purposes. Companies primarily hedge to insure their income, or lock in the prices for their expenses. This strategy is called *Insurance Hedging*. Investors can also hedge for *Value Adding* purposes. This is done by speculating in market arbitrage, and can be used to take advantage of market discrepancies to increase the value of a portfolio or position.[55]

3.2. Currencies

Currencies are issued by states and governments as the means of payment in the exchange of goods or services. The use of currencies has developed from the 19th century when states issued national currencies to simplify the trade within and between the countries. For example the English government processed currencies during the 2nd

[50] Sveriges Riksbank, *Överenskommelse mellan Riksbanken och Finansinspektionen*
[51] Bris, Arturo. *The Euro is good after all*, p 22-23
[52] Ibid, p 23
[53] Bradley, Brendan. *Financial Risk and Heavy Tails*, p 39
[54] Lavinio, Stefano. *The hedge fund handbook*, p 33-34
[55] Lake, Ronald A. *Evaluating and implementing hedge fund strategies*, p 23

quarter of the century on a gold basis, meaning they exchanged goods with gold as payment in the exchange. They later turned to bank notes that they had backed up with gold in their reserves as a security.[56] Notes were easier to handle, and were the predecessors to the bills we use today.

As international trade increased, the debate of fixed or flexible exchange rates grew. Some currencies have been, and are still, fixed to foreign currencies such as the USD. They can be either fixed within a set span, or have a so called hard peg, meaning there is no fluctuation between the currencies. Most currencies are however free floating today.[57] Some countries use a foreign currency as the legal tender, such as the USD in El Salvador. This is called "Dollarization" and is done by a government which pegs the exchange rate of their local currency to a foreign currency. This will increase the stability on a short term, but can be costly in the long run, since their local currency will be highly over- or under valued as the real exchange rates will differ a lot to the pegged nominal rate.[58] A fixed exchange rate also ties the hands of the government, since they are limited in the possibilities of using monetary policies to control inflation rates in the country.[59]

The discussion of fixed of floating exchange rates also involves the question of "Optimal currency areas" (OCA). This expression refers to a currency area where different sub areas may have different qualifications such as business cycles or means of production. These differences may make it unsuitable to use the same currency in different areas. But at the same time, it may not be suitable to have a large variety of local currencies, since this would lead to fluctuations and uncertainties between the sub areas. It is hence a task for the governments to determine if it will gain or harm the country to enter a monetary union, since entering the union will imply a fixed nominal exchange rate to other currencies.[60]

One purpose of monetary unions is the increased independence of foreign economies.[61] But if the currency area is not optimal, asymmetric shocks can cause disturbance in some areas, as their local economies develop faster or slower than the other areas in the currency area.[62] Despite the positive side of a European Monetary Union, as the countries have come closer with more trade across the borders, the EMU is far from being an OCA.[63] The member countries differ in their macroeconomic development and are still not as integrated as the states in USA. And even if the EMU would have been an OCA, there would have been fluctuations to other countries, such as the case of the EUR and the USD. Hence monetary unions may only reduce, but not eliminate, the exchange rate exposure.

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[56] Keynes, John Maynard. *Indian currency and finance*, p 11
[57] Levy Yeyati, Eduardo. *Dollarization*, p 6
[58] Asal, Maher. *Real exchange rate determination and the adjustment process*, p 10
[59] Levy Yeyati, Eduardo. *Dollarization*, p 23
[60] Ibid, p 7
[61] German council of economic experts, *Toward a new basis for international monetary policy*, p 21
[62] Bris, Arturo. *Corporate leverage and currency crises*, p 18
[63] Ljungberg, Jonas. *The price of the Euro*, p 45

3.3. Derivatives

Cost efficiency is an important aspect in business, and all companies strive for lowered costs.[64] As they operate on the international market, they are exposed to exchange rates fluctuations that sometimes can be hard to predict. They may manage the fluctuations by charging a risk premium that is added to the product price, and thereby cover losses due to exchange rates in bad times. But this will of course increase their prices, and reduce their chances to provide competitive prices. Instead of adding a risk premium to the price list, they may hedge their incomes and expenses to lock in the price list and thereby ensure their buyers of competitive prices. This can be done with the help of derivatives.

Derivatives can be categorized into financial derivatives and commodity derivatives depending on the underlying asset. Financial derivatives are instruments that concern and are derived from a financial claim, such as stocks or currencies. [65] Derivatives with stocks as the underlying asset are usually referred to as equity derivatives. [66] Commodity derivatives derive from commodities, such as farmers' product, oil or raw material.[67] The commodity derivatives are sometimes also referred to as real derivatives[68].

In the following description of derivatives, I will refer to the underlying financial assets or commodities simply as "underlying commodity" or "commodity". This simplification is done so that the focus can be set on the characteristics of the derivatives rather than the type of asset the derivative is derived from. The pricing models and hedging strategies presented in this thesis can be used for both financial and commodity derivatives.

There are many different kinds of derivatives, but they can mainly be categorized in to the following groups; option contracts (options), forward contracts (forwards), future contracts (futures) and swaps. These four kinds of derivatives will now be described and explained in the following sections.

3.3.1. Options

Options are one of the most straight forward derivatives in their construction and characteristics. But options can be used and applied in very complicated investments or hedging strategies, and pricing options is a world of its own.

When issuing an option, the seller (writer) sells the contract to a buyer (holder) and receives a premium. The size of the premium is related to the risk the writer is taking, i.e. related to how much the commodity fluctuates. The option gives the holder the right to wait and see how the market develops, and can thereafter make the decision whether to invest. When buying stocks or bonds, you have to put up a rather large amount of money up front when you invest, while when trading options you are investing on the margins. This calls for great opportunities of speculation, since the leverage is much larger than in stock investments. Leverage means investing a small deposit of capital to gain a larger

[64] Lind, Johnny. *Strategi och ekonomistyrning*, p 21
[65] King, David N. *Financial claims and derivatives*, p 109
[66] Alexander, Carol. *The handbook of risk management and analysis*, p 4
[67] King, David N. *Financial claims and derivatives*, p 109
[68] Brach, Marion A. *Real options in practice*, p 1

sum than had been done with a regular investment[69] but at the same time the investor will loose more if the investment doesn't turn out as planned.

As a holder of the option you can exercise your right to purchase the underlying commodity on or before the expiry date. If you choose to exercise your right, you will buy a specified amount of the commodity and will only pay the predetermined strike price, no matter what the market price is at the time. This implies an obligation for the writer of the option to provide the commodity for that price.[70]

3.3.1.1. Call and Put Options

There are two types of rights that are defined depending on the option type. A call option gives the holder the right to buy (and hence the writer the obligation to sell) the commodity, while a put option gives the holder the right to sell the commodity.[71] This implies that the price of a call option will increase as the market price increases, while the price of a put option will move in the opposite direction.

3.3.1.2. American and European Options

The only difference between American and European options is that the European options may only be exercised on the expiry date, while the American options may be exercised anytime up to the expiry date.[72] American and European options are in the simplest form of options, and are therefore often referred to as *Plan Vanilla* options.

3.3.1.3. Exotic Options

Asian options, also known as average options, are available in two different types. The average price option was developed for the currency market, and pays off the average of two currency payoffs. Thereby the volatility is reduced compared to the volatility of each commodity viewed separately.[73] The average strike option has a strike price that is set to be the average of the asset price over time, and has thereby no predetermined strike price.[74]

Rainbow options have more than one underlying assets. A so called two-color rainbow option has two underlying commodities, etc[75]. The payoff as the option expires can be of different kinds, and for example it can be based on the payoff from asset 1, asset 2 or a previously set cash payoff.[76] It can also pay off based on only the two underlying assets without any fixed cash alternative, and can then pay off either from the most risky asset or the less risky asset.[77]

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[69] Wasendorf, Russell R. *Foreign currency trading*, p 20
[70] King, David N. *Financial claims and derivatives*, p 180
[71] Pilbeam, Keith. *Finance and financial markets*, p 302
[72] King, David N. *Financial claims and derivatives*, p 185
[73] Watsham, Terry J. *Futures and options in risk management*, p 507-508
[74] Ibid, p 508-509
[75] Briys, Eric C. *Options, futures and exotic derivatives*, p 313-315
[76] Kolb, Robert W. *Futures, options and swaps*, p 557
[77] Ibid, p 559-562

The exotic options also come in the form of so called *Barrier* options, which are cancelled or activated when the spot price rise over or fall under a predetermined trigger price, the so called barrier.[78] For details and further reading, see Watsham[79] or Briys[80].

3.3.2. Future Contracts

Future contracts (futures) are standardized contracts that are traded for oil, farmers products, raw material, currencies or other commodities that can be standardized in amount and price.[81] In the contract the underlying commodity, contract size, delivery date and delivery price will be defined.[82]

When trading future contracts, the holder must set up a margin account with his broker. This account holds enough money to cover temporary fluctuations of the future price. The losses and gains from the future contract are cleared to the margin account. If the commodity's market price has depreciated, the holder has to use the margin account to cover the loss, while an appreciation of the future will pay off to the margin account. This clearing to the current market price is called "market-to-market" and is being done at the end of each trading day. If the future depreciates below margin, i.e. depreciates more than the margin account can cover, the broker will force the holder of the future either to put more money into the account or sell the futures.[83] The same is applied for the writer of the future, but with the reversed argument. If the future depreciates, it will pay off to the writer while an appreciation will cause a loss for the writer. The loss for the writer is equal to the holders gain and vice versa.[84]

There is no such thing as European or American futures and hence you can not exercise your rights before the expiry date. You may however close your long position by taking a short position in the same future with the same expiry date.[85]

3.3.2.1. Hedging with Futures

As the market price for the commodity fluctuates, the price of the future fluctuates. If an investor for example knows that he will be selling a commodity in one month, he may take a short position in a future contract for the commodity. When the month has passed, he can sell the future. Any loss in the future trade can be covered with an equal gain of the commodity trade and vice versa.[86] In a similar way, an investor who will be buying the commodity can take a long position in the same future, to cover his losses and secure his gains. It should however be noted that futures are only available for a limited number of currencies[87], and hence forward contracts are usually more suitable for the specific needs of a company.

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[78] Watsham, Terry J. *Futures and options in risk management*, p 512-513
[79] Ibid, p 512-520
[80] Briys, Eric C. *Options, futures and exotic derivatives*, p 364-378
[81] King, David N. *Financial claims and derivatives*, p 143-145
[82] Hull, John C. *Options, futures, and other derivatives*, p 17
[83] Hull, John C. *Introduction to futures and options markets*, p 23-24
[84] King, David N. *Financial claims and derivatives*, p 150-155
[85] Hull, John C. *Introduction to futures and options markets*, p 17-18
[86] Hull, John C. *Options, futures, and other derivatives,* p 31-32
[87] Wasendorf, Russell R. Foreign currency trading, p 9

3.3.3. Forward Contracts

Forward contracts (forwards) and futures have many characteristics in common. Both derivatives are contracts with underlying commodity, contract size, delivery date and price as clearly defined parameters. But though futures are standardized and traded on an open market, forwards are tailored to the buyer's needs and it is a contract between two parties that it is not traded on the open market.[88] The contract time is usually 30, 60 or 90 days and the forward rate can be set either by using the current exchange rate and adjust it for interest rate differences, or it can be set based on expectations on the exchange rate as the contract matures.[89] The latter method does however call for a larger deal of speculation.

3.3.4. Swaps

Swaps are tailored contracts between two parties and are not traded on the open market.[90] They are usually traded for the purpose of debt control or currency positioning. In debt control the companies will use interest rate swaps, while currency swaps are used for currency positioning.[91] Interest rate swaps can be used to switch from a fixed to a floating interest rate, or vice versa.[92]

If one company have a debt at a floating rate of interest, but wish to fix the interest rate, while another company have fixed interest rates on their loans, but would prefer a floating rate, they may enter a swap contract. Entering the contract the companies will swap some or all of its debt with each other, and hence get the kind of interest rates that they prefer. This strategy is easier and takes less time than to repurchase their debts and reissue them in the preferred form. It can also imply lower interest rates for the two parties, which will be explained in an upcoming example.[93]

The currency swap is in its characteristics similar to an interest rate swap. Let us consider two investors in different countries, with loans in each others currencies. Since there is no exchange rate exposure if the company takes a loan in their own local currency, the bank may allow them a lower interest for local loans than for foreign loans. Thereby the two companies can take loans for each other in their local currency, and then swap the money. When interest is to be paid, the first company will cover the interest for the loan that the other company took and vice versa. When the loans mature, the companies will pay back each other the same amount as was initially swapped. Thereby they both got lower interest rates, and any gain or loss in the exchange rate will not have affected any of the companies and nor the banks. The risks for the loans have hence been transferred from the banks to the companies. The swap agreement can involve both fixed and floating interest rates on the loans. If the company's choose fixed or floating interest rates it will not affect each other, since the companies pay the interest rates for their own loan.[94]

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[88] King, David N. *Financial claims and derivatives*, p 109-111
[89] Wasendorf, Russell R. *Foreign currency trading*, p 3, 5
[90] Kohn, Meir G. *Financial institutions and markets*, p 308
[91] Pilbeam, Keith. *Finance and financial markets*, p 347, 351 & 356
[92] Gup, Benton E. *Interest rate risk management*, p 132
[93] Pilbeam, Keith. *Finance and financial markets*, p 348-349
[94] Kohn, Meir G. *Financial institutions and markets*, p 489

3.3.4.1. Using Swaps

I will now present an example including both fixed and floating exchange rates. The floating interest rate I will be using is the LIBOR (London Inter-Bank Offer Rate) [95], but any other floating rate would do in the example.

Let us consider a company in France and a company in the US. The company in France plans to take a loan in USD and can do so at their local bank with an interest rate of *5%*. The American company is also planning to take a loan, in EUR and can do so with a floating rate of *LIBOR + 1.00%*. But since the French company has a French bank, they can get a lower interest rate on a EUR loan than on a USD loan. And vice versa the American company can negotiate a lower interest rate on a USD loan than on a EUR loan. Hence it would be a win-win situation if both the French company and the American investor could help each other with the loans. If entering a currency swap contract, this is possible to achieve.

The following table shows the possible interest rates the two companies can get from negotiating with their banks.

Currency swap, interest table

	USD fixed rate	EUR floating rate
French company	5.00%	LIBOR + 0.50%
American investor	4.50%	LIBOR + 1.00%

In the swap contract the French company will agree to takes a loan in EUR, for a specified amount and to a floating interest rate of *LIBOR + 0.50%*. At the same time, the American company takes a USD loan with fixed interest rate *4.50%*.

In the next step, the French company transfers the EUR to the American company and vice versa with the USD from the American to the French company. When time comes to pay the interest on the loans, the French company transfers *4.50% * the USD loan* and similarly the American company transfers *LIBOR + 0.50% * the EUR loan*.

When mortgages are to be paid on the loans and when they finally mature, the companies transfer the proper sum of EUR and USD to each other, so that they can pay back the loans they had taken.

The gain with this agreement is in the lowered interest rates. In our example, both companies gained a lowered interest rate of 0.50%. The cost for the swap agreement is commission costs that both companies have to pay to their derivative broker. [96]

3.3.5. Other Derivatives and Strategies

The above mentioned derivatives can also be combined to construct new types of derivatives. For example a Swaption is an option contract that gives the holder the right

[95] Pilbeam, Keith. *Finance and financial markets*, p 76
[96] Ibid, p 355-358

but not the obligation to enter a swap contract.[97] Options can also be used with future contracts as the underlying commodity to construct a so called Future Option.[98] And with derivatives such as options and swaps you can develop new applications since the contracts are negotiated by two independent parties, and there is no formal need for standardization. As an example, swaps can be tailored for real estate index hedging, or options can be modified for specific needs that the buyer has.[99]

Companies may also invoice in a third currency that is neither their local nor the buyers local currency.[100] This strategy simplifies the invoice procedures, since commodities often are priced in USD. [101] Two European companies may hence make transactions in USD to reduce their exchange rate exposure and hence reduce the need of hedging.

3.4. Pricing Models for Derivatives

Most pricing models for derivatives are in theory very extensive and complex to grasp for the average reader. I will therefore not go in to detail how derivatives are suggested to be priced in the academic papers and essays. I have chosen to just briefly describe and explain how the pricing models work, and recommend the reader Chapter 7, Further Readings, for suggestions of literature if you are interested in the details of the pricing models.

When setting the prices on currencies, both an ask price and a bid price is set. The ask price is always lower then the bid price, and the difference is called *the spread*.[102] The derivatives are priced in the same way. A currency forward where you agree to sell the currency will give you a lower price than the price set in a forward where you agree to buy the currency. The difference between the spot price and the derivative price is called *the basis*.[103]

3.4.1. Futures

When calculating the fair price for a future contract, many different models can be used. A simple equation to calculate the future price is simply based on the spot rate and the interest rates.[104]

$$F = S\,(1 + (i - d) * t / 360)$$

F is the calculated forward price, based on the spot price S, the risk free interest rate i with deduction for the dividend d that the commodity pays off. With this equation, the future price will converge to the spot price the as we approach the expiration date. Note that currencies does not pay dividends, hence $d = 0$ in this model.

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[97] Blix, Magnus. *Essays in mathematical finance*, p 7
[98] Ibid, p6
[99] Björk, Tomas. *A note on the pricing of real estate index linked swaps*, p 3
[100] Friberg, Richard. *On the role of pricing exports in a third currency*, p 4
[101] Ibid, p 26
[102] Kolb, Robert W. *Understanding futures markets*, p 62-63
[103] Ibid, p 63
[104] Kolb, Robert W. *Practical readings in financial derivatives*, p 9

Another common model presented in recent literature is based on stochastic probability functions and partial differential equations.[105] Before using this pricing model the proper background statistics is to be collected to set the values for the parameters.[106] The data used in the model may not be completely accurate, since seasonal changes and fluctuations on the market can have a large impact on the statistics, if data is selected from only a short time period. It is therefore important to select data from a longer period, and also exclude data that is obviously seasonal or disposable for other reasons.[107]

The stochastic equations are used to calculate the price of the future at specified time periods, such as the end of each trading day. The spot price of the commodity at the present time will of course be included as a parameter in the model and the models with probability functions also include parameters such as how much the underlying commodity fluctuates, based on historical data.[108] This data is used in equations to predict future price spot price movements, and hence a fair price for the future is calculated.

3.4.2. Forwards

If the interest rates in the two countries are presumed to be deterministic, the pricing models for futures can be used when calculating the price for forwards.[109] This is possible since forwards and futures are similar in their characteristics, except for the obvious fact that futures are standardized and forwards are tailored for the specific needs of contract size.

3.4.3. Options

When calculating the proper price for the option there is a few more factors and parameters that will be taken into account. [110] Assumptions of the underlying commodity's spot price and future expectations of the price have to be made[111]; since future market price fluctuations will affect how much our commodities will be worth if the holder were to exercise the option contract. The strike price is of course of importance since it is how much the buyer would have to pay to exercise the option.

As the time goes by, the price of the option may change, and time to expiration is of the essence, since the longer you are from the expiry date, the longer you can speculate in how the commodity price will fluctuate. Note also that the importance of the time to expiration is different for American and European options, since the American options can be exercised before date of expiry.

If the underlying commodity has a history of large fluctuations, the writer of the option carries larger risks, and hence the price of the option will be higher. The possibility of

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[105] Blix, Magnus. *Essays in mathematical finance*, p 6 & 9, 28, 46, 57
[106] Schwager, Jack D. *Schwager on futures*, p 217
[107] Ibid, p 217-218
[108] Blix, Magnus. *Essays in mathematical finance,* p 56
[109] Ibid, p 6
[110] Hull, John C. *Options, futures, and other derivatives*, p 156-158
[111] Dahlgren, Martin. *Some applications of variational methods in mathematical finance and numerics*, p 8

investing the money in other assets or securities will also affect the option price and hence the expected risk free interest rate needs to be deducted. Finally, any expected dividends during the life of the option has to be taken into account, since future dividend payments will be paid to the holder of the commodity, not the holder of the options.

When pricing options, there are several methods and models that can be used. The most common ones are based on the Black-Scholes partial differential equations[112] or other equations with stochastic probabilities as a base for the calculations.

I have chosen a model that can be easily explained to the reader, since it involves rather basic assumptions of the option contract, and the model can be depicted with the help of a couple of figures. It is called the "binomial tree method" and has been presented by both Stampfli[113] and Watsham[114], and I will base my presentation on their work. If the reader is interested in further studies of the model, I can also recommend Chriss[115].

The model does not include any dividend payments, and does note speculate in changes in the interest rates. It is a finite discrete-time calculation, but it should be noted that more extensive calculation methods can be used in a continuous time space.[116]

As the option contract is based on a contingent claim the holder can view the contract he is holding as a possibility to at any time exercise his rights and thereby buy the underlying commodity.[117] Therefore he could calculate the value of the contract in discrete time periods and assume a value to the contract based on future expectations of each period. This method begins with assuming probabilities to how the underlying commodity may fluctuate, and thereafter assume values of the options at the expiry date. This value is then directly affecting the value in previous time periods, as I will show now in an example.

Let us consider an example of two currencies and how they may fluctuate to each other over a period of time. At the initial time $t=0$ the exchange rate is E_0. As time passes by, the probability of the exchange rate is determined to increase or decrease to certain key values E_i and E_d. The probability is denoted p for E_i and hence $1-p$ for E_d.

As another time period is predicted ahead in time, there are four new exchange rates E_{ii}, E_{id}, E_{di} and E_{dd}. These key values are also predicted to occur with probabilities p^2, $p(1-p)$, $(1-p)p$ and $(1-p)^2$.[118] This model can of course be further developed, but I will stop here and leave it open to the reader to extend the model.

The predictions will now be displayed in the following time tree, and for our convenience we assume that $E_{id} = E_{di}$;

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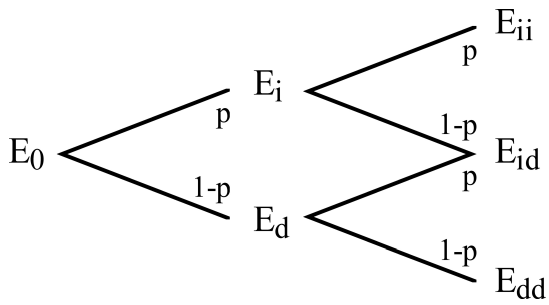
[112] Dahlgren, Martin. *Some applications of variational methods in mathematical finance and numerics*, p 12
[113] Stampfli, Joseph. *The mathematics of finance*, p 44
[114] Watsham, Terry J. *Futures and options in risk management*, p 308-310
[115] Chriss, Neil. *Black-Scholes and beyond*, p 219-272
[116] Ammann, Manuel. *Pricing derivative credit risk*, p 15, 19
[117] Mel'nikov, A. V. *Mathematics of financial obligations*, p 121
[118] Stampfli, Joseph. *The mathematics of finance*, p 45



I will now create an example of how this binary tree model can be used to set the price of an option. Let us first assume that the spot rate is *1* at time *t=0* and the strike price for the option is *1.05*. The probability *p* is calculated with respect to the expected fluctuations and the risk free interest rate denoted *r*. Let us assume a risk free interest rate of *3%*. We then have;

$$p = (e^{rt} - 0.93) / (1.07 - 0.93)$$
$$\rightarrow \quad p = (e^{0.03} - 0.93) / (1.07 - 0.93)$$
$$\rightarrow \quad p = (1.0305 - 0.93) / (1.07 - 0.93) = 0.7179$$

We will then assign values to E_{ii}, E_{id} and E_{dd}. Let us use fluctuations of *7%* in each time period. We then have;

E_{ii}; $1 * 1.07^2 = 1.1449 - 1.05, \quad \rightarrow E_{ii} = 0.0949$
E_{id}; $1 * 1.07 * 0.97 = 0.9951 - 1.05, \quad \rightarrow E_{id} = 0$ [119]
E_{dd}; $1 * 0.93^2 = 0.8649 - 1.05, \quad \rightarrow E_{dd} = 0$

We will now assign values for E_d and E_i. $E_d = 0$ since $E_{id} = 0$ and $E_{dd}=0$. But E_i can be calculated with the following equation;

$$E_i = e^{-rt} (p * E_{ii} + (1 - p) * E_{id})$$
$$= e^{-0.03} (0.7179 * 0.0949 + (1 - 0.7179) * 0)$$
$$= 0.9704 * (0.7179 * 0.0949)$$
$$= 0.0661$$

We have now calculated the option price at time *t=1*, but as we of course want to know the price of the option as of today, *t=0*, we will use the equation again in one more step;

$$E_0 = e^{-rt} (p * E_i + (1 - p) * E_d)$$
$$= e^{-0.03} (0.7179 * 0.0661 + (1 - 0.7179) * 0)$$
$$= 0.9704 * (0.7179 * 0.\ 0661)$$
$$= 0.04605$$

Hence the price for our option should be set to *0.04605*. If you extend the model to work over a longer period of time, you will see larger fluctuations and hence possibilities for higher option prices.[120]

[119] *Note that the value can not be negative*

This model is however very much simplified compared to other stochastic and differential equation models that are more applicable when pricing options. But since these models both need extensive understanding in mathematics and also would take up a lot of room in this thesis, I will not present the models but only recommend Dahlgren[121] for further readings.

3.4.4. Swaps

Pricing a swap contract is a process of negotiation between the two parties that are entering the contract. Three rather simple models can be used to determine the contract price and I will now briefly explain the models and show how they can be applied on the example from section *3.3.4.1* above. The prices are based on the interest rates that are set for the loans.

3.4.4.1. The Friendly Model

The "*Friendly*" model is a very straight forward pricing approach. As the French company needed a loan in USD, they will pay the interest rate of *4.5%* on the USD loan. Likewise the American company will pay the interest rate of *LIBOR + 0.50%* for the EUR loan. In this model, the companies will not be affected of the interest rates on each others' loans.[122]

3.4.4.2. The Arithmetic Average Model

Our second swap pricing model is the "*Arithmetic Average*" model that calculates the average between the initial interest rates and the lowered rates, and gives both parties the same nominal interest discount.[123] In our example we will have the following calculations; The USD loan has an interest rate of *4.5%* and the EUR loan has an interest rate of *LIBOR + 0.50%*, hence a total of *LIBOR + 5.00%*. Of this total interest rate we will give both companies the same nominal discount *x*, and hence the French company will pay *5.00% – x* and the American company will pay *LIBOR + 1.00% – x*. This obviously leads us to the equation:

$$
\begin{aligned}
& (5.00\% - x) + (\ LIBOR + 1.00\% - x) = LIBOR + 5.00\% \\
\rightarrow \quad & LIBOR + 6.00\% - 2x = LIBOR + 5.00\% \\
\rightarrow \quad & 2x = 1.00\% \\
\rightarrow \quad & x = 0.50\%
\end{aligned}
$$

And hence the negotiated interest rate for the French company is *4.50%* and for the American company we have *LIBOR + 0.50%*. Note that the calculations will need some modifications if the two loans are of different sizes.

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[120] Stampfli, Joseph. *The mathematics of finance*, p 49-51
[121] Dahlgren, Martin. *Some applications of variational methods in mathematical finance and numerics*, p 5-18
[122] Stampfli, Joseph. *The mathematics of finance*, p 145
[123] Ibid, p 145-146

3.4.4.3. The Geometric Average Model

The third model is similar to the "*Arithmetic Average*" model. The "*Geometric Average*" model gives the companies the same discount in percent values.[124] In our example this means that the French company will pay *5.00% * x* and the American company will pay (*LIBOR + 1.00%) * x*. Hence we have the equation:

$$5.00\% * x + (LIBOR + 1.00\%) * x = LIBOR + 5.00\%$$
$$\rightarrow \quad (LIBOR + 6.00\%) * x = LIBOR + 5.00\%$$
$$\rightarrow \quad x = (LIBOR + 5.00\%) / (LIBOR + 6.00\%)$$

The negotiated interest rate for the French company is now;
5.00% – (LIBOR + 5.00%) / (LIBOR + 6.00%)

and for the American company we have the interest rate;
LIBOR + 1.00% – (LIBOR + 5.00%) / (LIBOR + 6.00%)

Note that this may cause a conflict between the two parties, since they now both are paying a floating interest rate, which the French company had tried to avoid. By choosing other pricing models or adjusting the interest rates with alternative methods this can be avoided. And since the swap contract is negotiated between two parties this can be solved by the two parties before writing the contract.

[124] Stampfli, Joseph. *The mathematics of finance*, p 146

4. EMPIRICAL FINDINGS

By performing four interviews, I gathered new information for the study. In this chapter I present the result of the interviews, and it will be analyzed in the coming chapters. The frame questions for the interviews can be found in the appendices.

4.1. The Riksbank

4.1.1. The Swedish Central Bank

The Central Bank in Sweden (the Riksbank) manages the monetary policies in the country and lends money to banks under the so called repo rate. The current outstanding loans are around 10 billion SEK, which change with a few 100 million per week depending on how much cash is needed by the banks, and it also changes as the currency portfolio is managed.

Antti Koivisto works on the division for the short term analysis in the Riksbank. They make prognosis for days and weeks ahead in time. The long term analysis is handled by the monetary policy division.

The Riksbank has chosen 11 primary dealers which are the four largest banks in Sweden and 7 traders abroad. They have agreements to do their currency transactions with these dealers, but can in some situations trade with others. This is however done very rarely and only if necessary. It is with the primary dealers that the Riksbank makes their currency transactions when managing the currency reserve. Currency transactions are also used when making foreign exchange interventions.

In Sweden there are only a few actors on the currency market. The four largest banks do of course trade currencies, but smaller niche banks are specialized in other areas, such as loans or mortgages, and do not trade currencies.

4.1.1.1. The Currency Reserve

The currency reserve is placed abroad, mainly in interest bearing bonds and treasury bills. Each bank has a currency as *their* currency for the accounts in the bank. The Swedish banks only hold accounts nominated in SEK in Sweden, hence the Riksbank's currency portfolio is placed abroad, and when it is adjusted, it is done by transfers of money between the banks abroad. The Riksbank also have checking accounts for their assets. This is however never held in Swedish banks, since the IMF does not count accounts in local banks to the currency reserve. Counterparties when administering the currency reserve is not public information, and should not be confused with the primary dealers. The Riksbank has chosen 6 currencies for the portfolio, which are the following[125]:

● USD	37%	● EUR	37%
● GBP	11%	● JPY	8%
● CAD	4%	● AUD	3%

[125] Percentage numbers taken from The Riksbank – *Gold and foreign exchange reserve*

The Riksbank manage the currency portfolio by trading with counterparties abroad. In the currency trade, the Riksbank keeps a daily contact with the counterparties. They also receive market information from other parties, and the information is used for the analysis that is being performed both on a short- and long term basis.

The Riksbank perform a rather low number of transactions. They do use some currency swaps and make some exchange transactions, but it has decreased in the later years. They used to manage the incoming EUR payments that were to be transferred to government institutions in SEK, but this is now handled by Riksgäldskontoret.

With an active currency positioning strategy, the Riksbank keeps an operative readiness in case the need for interventions occurs. Since interventions often need to be done in haste, and in a short time large sums have to be managed, it is important to be ready ahead of time. Therefore the Riksbank performs more analysis and positioning than trades.

4.1.1.2. Trade with Derivatives

Plain vanilla swaps are used when managing currency and monetary policies. The outstanding loans under the repo rate are managed with interest swaps. They also use swaps from SEK to EUR to keep the money on deposit abroad. Sometimes forward contracts are used, mostly for the purpose of delaying currency transfers.

When using swaps for interest rate management, the transfer of currencies is performed on day 1 and on the expiry date. The transfer on the expiry date is adjusted according to the difference in interest rates for the two parties. There is however no exchange rate risk involved, since the exchange rate is fixed from day 1.

Swaps are also used when managing the currency reserve. As the currencies fluctuate their percentage of the reserve will change. If the USD for example would appreciate, it would hold a larger percentage of the currency reserve, and hence it would have to be adjusted to the other currencies. A swap could then be used over a period of time to even out discrepancies. Thereby the Riksbank can avoid selling or buying currencies on a short term basis, and use adjustments in swap contracts to manage temporary fluctuations. The counterparty in the swap agreements is one of the 11 primary dealers, and the Riksbank choose the party that can offer the best terms when writing the swap contract.

Foreign exchange swaps are available in USD to SEK, EUR to SEK, and vice versa. If a trader wants a SEK to GBP swap, such can be supplied by broker, but a contract of a SEK to EUR swap and a EUR to GBP swap is written behind the scenes by the broker. This standardization of swaps has lead to an increased liquidity on the swap market, and hence the transactions have been simplified.

Forwards are rarely used because the spread in forwards are larger than in swaps. The same applications can be created with swaps as with forwards, but swaps are easier to construct. It should also be noted that the liquidity on the swap market is higher, which is the main reason for the smaller spread. Currency futures are not used by the Riksbank,

but are available from traders on CBOT. They were introduced in Sweden in 1998, but there was no real demand for it, and hence the trade was never realized. Futures are used on interest market, however not in Sweden but in the EUR area.

Options are not used by the Riksbank. It could be used in the management of the currency portfolio, but has never been done as Koivisto can recall.

4.1.1.3. Market Care and Interaction

The Riksbank do of course have some control over their primer dealers. They have to continuously fulfill the terms of the primer deal agreement which includes economic soundness, no tolerance for criminal activities and a high business moral. If the agreement is not followed they will no longer be partners, which would cause reputation damages for them on the market.

To qualify as a primer dealer, you need to have market share of at least 3%. The dealers also need to have a certain level of liquidity to be able to find counterparties when swaps or other contracts are to be written. Added to that, the 11 counterparties periodically take part of a survey from the Riksbank, where they are evaluating each others effectiveness. Thereby the Riksbank receives information about all parties and how they act with each other on the market.

The Riksbank also has a responsibility for the market system, so that if one bank gets into trouble, it is to be managed so that it will not affect the other actors on the market. They have a stability division that supervises this, by looking what risk positions the banks hold.

Under the agreement the banks agree to always have market fair 2 way prices during their open hours. This includes a spread not above or below other banks spreads that can cause arbitrage. ACI[126] in Sweden has set the spread to 50 points. If a bank sets their prices outside this spread, questions will be raised. There is a self adjusting function in the system, since if larger spread is used the bank will loose customers and not last in the business.

The Riksbank does not adjust the prices for the banks and do not tell the banks to set a certain price on the currencies. This is done by market forces such as the supply and demand of currencies as well as expectations on the economic development. the Riksbank does not directly supervise the intra bank trade, but they can choose which partners to trade with and thereby affect their behavior.

The Riksbank receives information from their primary dealers as well as from other government institutions. Bank secrecy regulations limit the banks in such a way that they are not allowed to hand out information about a certain customer, except if a crime is suspected. The banks do thereby not share specific information with the Riksbank, but do share reports and updates.

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[126] ACI – *ACI Sweden*

Bank secrecy can cause complications if information needs to be shared between government institutions. The Riksbank can not take part of information from other government institutions such as the Riksgäldskontoret in some cases, because it will then become public. Hence the info is gathered from the banks, so it can be classified if needed. Likewise in the case of handing over information from the Riksbank to Riksgäldskontoret, the information should rather be given directly from the bank to Riksgäldskontoret. Even if another government institution has the proper information, they prefer not to share it between the institutions.

The Riksbank is independent, but is regulated and works under the Riksbank law. According to a direction in the law, 6 independent representatives are elected on 6 year long terms. They can only be removed if going against given directives, such as following directions from a political party.

The board of the Riksbank may have opinions on how cost efficient the Riksbank is, but they can not affect the monetary policy. They take part of same information as the public do. The board can come with opinions on how the currency reserve should be divided on the currencies, or how the Riksbank is organized, but they are not allowed not affect the monetary policies.

4.1.1.4. Monetary Goals

In the Riksbank law there are directions to keep a steady value of the money in Sweden. This is interpreted and applied in the inflation goal of 2% and prognoses of the inflation development are made on an 18-24 months basis. Exchange rates movements are indicator among others (GDP, unemployment, interest rates etc) for how the inflation will change, but there is no set goal for the SEK exchange rate. In 2001 the SEK was very weak to the USD and other currencies. The Riksbank then acted and started buying SEK, hoping that others would follow, to cause an appreciation of the SEK. These kinds of interventions are however only done in extreme cases. Different strategies can be used by central banks, and they can hold an interventional approach even if they have inflation goal, but Swedish the Riksbank has chosen to be passive on the market in this sense. The inflation goal definitely has the highest priority of in the monetary policies. It should however be noted that if the inflation goal is in no danger, other interventions can be made.

The Riksbank is the main actor for monetary policies in Sweden. Up until the SEK was free floating, the discussions were about monetary policies. Now currency policies are a part of monetary policy, but currency policies are lower in priority than the monetary. The repo rate is the main tool when managing interest rates and thereby the inflation rate in Sweden.

4.2. Finansinspektionen

Finansinspektionen is the supervising authority for the financial trade in Sweden. What is to be regulated and supervised, such as banks and institutions that trade securities, is defined by laws. For such trade to be performed by a bank or financial institution, permission must first be obtained from Finansinspektionen. Even though banks can get a general authorization for lending money, transferring payments and giving credits, a special permission is needed to trade and manage financial instruments.

Åsa Arffman and Vibekke Eliasson work on the legal division of Finansinspektionen. They overlook the market and make sure a stabile trade system is maintained. Their superior goal is to keep a stabile market and maintain good consumer protection. When supplying derivatives to customers, which include a number of risks, it is important to inform the customers according to the existing rules and regulations about the risks involved in the trade.

4.2.1. Supervising the Trade

Swedish Ltds and economic associations can receive permission for trading financial instruments. Within the EES companies can trade if permission is received from the authorities in one of the member countries. Foreign companies can also make trades in Sweden if they have made a notification according to the relevant Directive.

If the initial banking permission is received, you are authorized to perform a number of types of trade and have business within many different branches. Such areas of trade are payment transfer, currency trade and giving credit to customers.

4.2.1.1. Exchange of Information and Bank Supervision

The initial contact with the banks, is established when a new bank want to start a business in Sweden. They contact Finansinspektionen with a prospect describing what kind of activities they will perform and how the bank will be organized. Finansinspektionen will then review the organization, internal structure, who the owners and directors for the bank are etc. When reviewing the owners and directors of the prospected bank their background is overlooked; crime records, tax records and their debt situation is reviewed to establish if they are suitable to run a bank. Thereafter Finansinspektionen can approve or reject the application.

To purchase stocks in a bank for a qualified membership (10% or more) you need permission from Finansinspektionen. The same evaluation is then performed to determine if the buyer is suitable to own a bank. Every time a member of the board is to be replaced, the bank needs to contact Finansinspektionen to get an approval of the new member. From the day that the bank receives their first authorization from Finansinspektionen, they are obligated to continuously inform Finansinspektionen if major changes are made in the organization.

In the continuous contact between Finansinspektionen and the banks, different personnel are contacted. Usually an employee is assigned as the contact person when the bank starts

the business. The different divisions in Finansinspektionen handling legal issues, market supervision and customer complaints have different contact personnel in the banks. The banks are often very large organizations and thereby one bank can have a number of contact personnel in the organization. If a larger question is raised Finansinspektionen can choose other employees than the assigned ones, and even managers on the very highest level can be contacted in serious matters. Managers on a higher level will of course be contacted if unauthorized activities have been observed and sanctions are to be put on to the company.

In the matter of currency trade, quarterly reports are given from the banks to Finansinspektionen where their market position, risks and other exposures are presented. The reports are written by assigned employees within the banks. Employees in different positions in different banks may submit the reports depending on the bank structure. Such standard report forms and what is asked for is public information, but the information that is given from the banks can be classified if necessary by Finansinspektionen.

If Finansinspektionen thinks that the information is not sufficient, they can on their own initiative contact higher personnel for further information gathering. There is no information that the bank can withhold from Finansinspektionen. They are obligated to share all the information that Finansinspektionen requests. There is however laws regulating information concerning customer relations between the bank and their customers, and such information are classified so that Finansinspektionen can not share it with other parties. But if general information about the bank is assumed not to damage the banks if released, it will not be classified.

Finansinspektionen can also look into specific cases between a bank and their customer, in case there is some movement on the market that can lead them to believe there are inappropriate activities by the parties. They are then primarily analyzing the market in its total, but can also look in to a specific bank/customer relation. Finansinspektionen can decide how their supervision is to be performed and can thereby both perform general market analyses as well as look into specific cases where unauthorized activities are suspected.

4.2.1.2. Trading Financial Instruments

If a bank chooses to start trading derivatives, they will apply for permission to trade financial instruments. Derivatives are defined as financial instruments, so as soon as such permission is received, the bank can trade all defined financial instruments. When applying for such permission the bank will present a prospect including how the trade will be organized, what customers they will have and how the trade will be performed in practice. A bank does not need any special permission to trade currency on the foreign exchange, but the other financial institutions need a specific permission for that trade.

The definition financial instrument is rather wide and includes securities such as stocks and bonds as well as derivatives and other instruments that are issued for public trade.

If a bank would misbehave and loose their permission, they loose it for all types of financial instruments. The authorization for trading financial instruments has never been limited to allow a bank to trade only certain instruments.

4.2.1.3. Introduction of new Financial Instruments

New financial instruments are developed and introduced to the market by the traders and actors on the market. If developing a new instrument, they will have to contact Finansinspektionen to get it classified as a financial instrument. Thereafter it can be traded by all banks and institutions that hold the permission to trade financial instruments. Finansinspektionen does not develop or introduce new instruments; it is solely done by actors on the market. If a financial instrument is determined to be very risky, it can still be approved but the banks are then obligated to inform their customers of the risks when trading the instrument

When combining two financial instruments, it will not by default create a new financial instrument. Hence combinations such as swaptions need to be defined by Finansinspektionen to be financial instruments before they can be traded. It is not sufficient that both swaps and options already are defined as financial instruments.

Options are allowed in all mentioned forms in Sweden. American, European and Exotic options are traded in Sweden, and the name does not limit them to be allowed only in certain regions.

Finansinspektionen are not adjusting the exchange rates. Government institutions and the actors on the market cooperate to maintain a safe and sound trade, but pricing issues are not handled by Finansinspektionen. If there are reasons to assume suspicious activities on the market, or if a bank is assumed to go against current rules and regulations, Finansinspektionen can intervene. If a bank is found to be guilty of the malicious activities Finansinspektionen can rule for sanctions, warnings, penalty fees, withdrawal of the permissions, order the bank to take action or forbid them to take action in the matter

4.3. Nordea

Nordea is one of the largest banks in Sweden and operates in Denmark, Norway, Finland, Poland and the Baltic states as well. For this thesis I interviewed Paul Westesson and Marcus Hallberg at Nordea Sweden.

Westesson is responsible for the derivative trade in Sweden. He works primarily with interest derivatives but also with commodity, stock and some currency derivatives. He has previously worked as a currency strategist.

Hallberg is a currency strategist, with duties including helping companies manage their currency risks and setting up hedging strategies for their cash flow. The customers range from major international companies, to the smaller companies as well. Hallberg has previously worked at the Riksbank.

4.3.1. The Bank and the Trade

Nordea supplies all currencies as long as there is a demand for each currency. If they choose not to supply certain currencies it can be for hinders such as trade barriers. If a currency is liquid, it can be traded, but in some countries there are internal structures and regulations that can hinder the trade and therefore there are also no derivatives for those currencies.

In Sweden there is an average turnover of 220 billion SEK each day in the currency trade and Nordea holds a 15% market share. Mainly EUR and USD is traded, but also NOK and GBP are exchanged. The trade depends highly on what countries Swedish companies make business in. Most of the currency trade is done with the use of derivatives, only 50 billion of the currency turnover is in the avista exchange[127].

Futures are not traded for currencies in Sweden, but are used for interest rates or commodities. Instead forwards are used, and even though forwards are described to be a tailored contract, the trade with currency forwards is today highly standardized to increase the liquidity on the market.

Forwards are priced with an interest rate model as a basis. The expectation of interest differences in the two currencies is included as a factor when pricing the forwards. It is in the spread of the forward ask and bid prices where the bank makes the money. No commission is charged when trading derivatives. The risk of trading forwards is exposed when there is a difference between the expected and the actual interest rates.

There is a spread on the interest market, as well as on the spot market for currencies. This spread is used to set the internal price, and thereafter the bank can take factors such as the customer's credit rating in to account when setting the price. Risks in the trade are not handled on a transaction basis, but on a portfolio basis. The brokers look at the larger picture with a number of transactions involved when determining acceptable risk levels.

[127] More statistics is available at The Riksbank – *FX Market*

The brokers hold a mandate to handle the risks, and it is up to them to judge depending on expectations if more or less risk can be taken in the portfolio.

The market is today very transparent and approximately the same prices are calculated by the banks in the market. There is no direct exchange information between the banks concerning the pricing. But there is an indirect effect from the competitors on the prices, since customers are very much aware of what prices the competitors can offer and will shop around for the best price. Most customers have more than one bank as the supplier. If prices are lower or higher than competitors, it will directly affect the demand for the products. Previously set prices can be analyzed, and thereby the prices of competitors can be followed as time passes by, but it is not projected in advance.

The global information company Reuters[128] provides a financial service on the currency market that very much reminds of the stock exchange system. They provide a market place, where orders for currencies can be placed with bid or ask offers. When ask and bid prices meet, a trade will be made. This system does not only serve as a market place for brokers, but can also be used for information gathering since it tells what the current market price is for a currency.

Brokers can also manually match exchange rates and thereby gain from discrepancies in the market. There are many sources for information on the market, and the high liquidity in the trade causes most of the prices to even out. Expectations of future fluctuations on the market do also have an effect on the prices. If fluctuations are expected to occur the brokers can adjust the rates in advance to attract or reject cash flows.

4.3.1.1. Options

Nordea provides all kinds of options; European, American and Exotic options in different forms are written and sold to the customers. Most of the options that the bank provides are written by themselves, but for some rare currencies options can be bought from another party in a mirror deal. Thereby the risk can be transferred to an external party, but the bank can still offer a full product line to the customer.

The pricing of the options is built in to the banks computer systems. As a basis for the pricing models, Black-Scholes is used for the most usual options. For exotic options, formulas are used, and for more structured options simulation models such as binomial trees or Monte Carlo can be used. There is no single model that is applied to calculate all prices; there is a mix of models depending on what kind of option there is to be priced.

In all the models there are a number of parameters to take into account. The strike price and time to expiration will of course be included, as well as spot prices and expectations of the volatility. It is mainly in the volatility expectations that adjustments can be made, to affect the final price of the option.

[128] For more information, visit Reuters – *Company Overview*

Swaps are also traded to a large extent, and as well as in the case of options, swaps are written between the bank and the customer. The pricing depends on the difference in interest rates, and is negotiated between the bank and the customer.

4.3.1.2. Combinations and Development

The bank can also provide combinations of derivatives, such as swaptions. There are also hybrids that combine a currency with a stock or interest transactions. The bank does also develop new derivatives for commercial trade. If there is a need for new solutions, the bank can help develop the instruments and apply them in hedge strategies for customers. There is seldom just one customer that has a need for new solutions and hence the new instruments can be used by many customers.

In 2003, Nordea introduced so called Flexible Forwards. This contract gives the buyer a slightly lower exchange rate than with a normal forward contract, but it has an option built in to the deal, and will thereby give a better exchange rate if the market price rice. If a customer want to buy a 1 million USD forward contract, and the forward rate is 7 SEK per USD, the flexible forward rate may be set to 6.97. But if the market price appreciates, the holder of the contract will take part of that increase up to a certain level. Hence the company agrees to enter the contract with a lower exchange rate, but will still both secure a lowest rate and have the chance to gain from price appreciates up until delivery. [129] When developing new derivatives, new pricing models are developed as well. The pricing model for a hybrid is based on the models for pricing the separate parts of the hybrid.

Companies do often hold a hedge policy for their business deals, and they have a rather mechanical view of the hedge approaches. Higher volatility for a currency will lead to higher costs for hedging with derivatives, and it is therefore more or less interesting to write options for different currencies since it will pay of differently for the bank.

Most companies have policies with a hedge horizon. They make prognoses over time to determine if their local currency is relatively high or low to other important currencies. This will affect how long they want to hedge, and thereby it can affect the demand for longer or shorter derivatives. The degree of hedging in the companies will also affect the demand for derivatives. Some companies may choose to hedge all their cash flows, while others may choose to hedge only parts of their incomes and expenses.

At the end of each trading day, there may be an excess or a lack of some currencies. If there is an excess of a currency it will be placed in accounts that can gain interest until the funds are needed again. Prognoses are made periodically for future cash flows, and therefore excess currency can be saved for later use or exchanged depending on the prognoses.

The liquidity of currencies is also handled within the bank. At the end of each trading day the positions are adjusted so that they can be ready to meet the needs for coming trade. If

[129] Dagens Industri, *Flexibel lösning för flaxig valuta*

a customer for example one day has bought a lot of USD, the bank will buy more USD to have the positions ready for the next trading day.

4.3.1.3. Government Relations

The relation to the government authorities is highly based on an exchange of information. For the questions regarding SEK, the bank is mainly working with the Riksbank. One of the so called market makers in the bank sets the prices and makes sure the trade works well in Sweden. This person is also in touch with the Riksbank on a regular basis for exchange of information.

The bank is also in close contact with Finansinspektionen for the exchange of information regarding rules and regulations on the market. This contact is however mainly handled by the legal division of Nordea, and not as often by the brokers on the trade floor.

On the interest market, Riksgäldskontoret is a government institution that the bank has very close relations to.

The government authorities both handle regulation and supervision on the market, and the bank maintains a regular contact both for regulatory and market care purposes. While Finansinspektionen is the regulatory authority, the Riksbank and Riksgäldskontoret are the market caring institutions.

The communication with the government institutions is a two way street. For example Finansinspektionen can contact the bank when gathering information and the bank can contact Finansinspektionen for information regarding new regulations. the Riksbank continuously gathers statistics over the trade in Sweden. The government institutions may also contact the bank to see how well the systems are working and if there is need for any change on the market. Nordea is also a body to which a proposed legislative measure is referred for consideration in currency and interest issues. Thereby there is a close contact between the parties on different levels of the bank.

When leaving information to the Riksbank or other government institutions, the bank can be anonymous so that if the Riksbank is handing out the information to a third party, the name of the bank will not be released. Nordea also shares their information so that they can take part of other actors' information. Therefore they are reluctant to classify information, unless it falls under the laws regarding bank secrecy.

4.3.1.4. Inflation Goals and Exchange Rates

Nordea does not think there are any conflicts with the Riksbank's goal of a steady inflation rate. Fluctuations of the currencies can affect the trade patterns for the bank since companies can see a higher or lower necessity to hedge. Higher fluctuations will lead to higher hedge rates, but this is however nothing that the bank strives for. The bank offers hedging tools and hedging strategies according to the customers' needs.

4.4. Riksgäldskontoret

Bengt Rådstam works at Riksgäldskontoret and administers the national debt. He mainly works with the administration of the currency debt, and his division performs two kinds of debt control; passive and active administration.

4.4.1. Passive and Active Administration

The passive administration is performed by measuring the distribution of the currencies, and keeping them in preset percentages of the currency debt. It also includes managing the interest rate risk, and daily transactions are made to stay within acceptable boundaries.

The currency debt is distributed over a set number of currencies. These are[130]

- EUR 65%
- CHF 9%
- JPY 4%
- USD 14%
- GBP 8%

Every third year a new frontier is set and towards this horizon Riksgäldskontoret will determine what choices are to be made to hold the lowest risk in the portfolio.

In the active administration, Riksgäldskontoret takes positions that are expected to gain profit over time. The directions are to take positions that carry a low risk but still guarantee an average profit in the long run.

Interest rate management used to be separated from the currency and SEK debt administration but is this is managed together now. When determining a proper risk level for the interest rates the directions are to keep it independent, robust and rather simple so that it can be overlooked at any given time. Riksgäldskontoret does not predict or make prognoses for interest rate movements. They take loans with a mix of fixed and floating interest rates, and keep an average of a 5 year horizon on the fixed rates. Mainly futures are used for the interest rate management. Swaps can be also be used; both to lower the interest rates, and change from floating to fixed rates or vice versa.

When handling the SEK debt, there are no derivatives that can be used and therefore the SEK loans will have longer durations. Thereby the objective for the duration of the debt as a whole will be a mix of both the duration of the SEK and the currency debt. Swaps are written with durations of up to 20 years. Current swap contracts are not extended when they expire. Instead a new swap is written if needed. Swaps can also be ended in advance if both parties agree, and are done so by simply closing the contract. Active manage

4.4.1.1. Contract Duration and Management

As time passes by, the duration of the loans will of course be shortened and this has to be managed as well. As some contracts expire, new ones may have to be entered and this

[130] More information can be found at Riksgäldskontoret – *Foreign currency distribution*

passive administration is performed on a daily basis. The duration of the loans will be evenly distributed so that not all loans expire at the same time.

The spreads used to be larger on the contracts, and in the 80s brokers were hired to lower the spreads. But competition on the market has now leaded to lower spreads, and thereby the contracts can be written without brokers.

In the passive administration many derivatives can be used. If for example a large USD loan is paid off, the USD part of the portfolio will be lower than the predetermined percentage. If no new loan is taken as one expires, forwards can be used to delay the change in the portfolio, or a swap can be used to neutralize the change. There are two ways to take loans or positions in a currency. You can both borrow the currency directly and thereby get the wanted position; or you can take a loan in SEK and then use swaps to take positions in foreign currencies.

Riksgäldskontoret pays an amortization equal to 25 billion SEK on the currency debt each year. Therefore new loans will be taken if the loans that expire add up to a total value higher than 25 billion SEK.

4.4.1.2. Aspects of the Borrowing Process

During the last years loans have mainly been taken in SEK, since Riksgäldskontoret can get the best conditions when borrowing the local currency. The loans can then be swapped to the wanted foreign currency. There are many aspects that have to be taken into account when borrowing. If they can get the same cost for borrowing in a foreign currency directly as when borrowing SEK and then swapping, the loan in SEK would still be preferred. Since the government now has better finances than they had a few years ago, there is not the same need to borrow anymore. Therefore loans in SEK are preferred, to increase the liquidity on the local market.

There are many transactions involved in the currency debt administration. If for example a large loan in JPY is taken, most of it will have to be swapped to the other currencies since the JPY portion of the portfolio only is allowed to be 4%. Sometimes loans are taken in currencies that are not supposed to be in the currency basket at all, and then the whole loan needs to be swapped to the selected currencies. If the loan is then swapped to USD, the USD in the portfolio has to be adjusted.

As the durations of the loans are shortened, futures can be used to increase the duration, for those currencies to which futures are available. Futures for USD are available with durations of 2, 5, 10 and 30 years. But futures for JPY and GBP are only available with durations of 10 years. Hence futures can not always be applied, if a longer horizon is wanted. Swaps can then be used in combination with the USD futures to create the wanted results. Futures are however the preferred tool, if available.

Initially there were complications for Riksgäldskontoret to use futures. The government is not allowed to pledge securities, and hence the future trade could not be applied. Riksgäldskontoret is also not allowed to hold assets, since the loans then would be higher than what is necessary. And the government institutions are not allowed to invest in

other's obligations, but only in their own. But the government decided that it would be ok for Riksgäldskontoret to use futures and changed the regulations in this specific matter and therefore futures are today. The margin accounts did not impose complications since it could be handled by the future broker.

Futures can expire and force the holder to deliver, which is not allowed to happen for the government institutions. Hence all contracts have to be monitored and closed before expiration.

4.4.1.3. Swaps, Interest Rates and the Portfolio

When borrowing SEK or foreign currencies, swaps is the most convenient tool that can switch between fixed or floating interest rates. But when adjusting the distribution of the currencies in the portfolio forwards can be used as well. And when adjusting the interest rate sensitivity, futures are the main instrument.

The distribution of the currencies in the portfolio may deviate with 3% from the preset percentage levels. If a currency is expected to appreciate, its part of the portfolio should be decreased and can be done so with forwards.

The national debt in foreign currencies has decreased from 398 billion SEK in 1996 to 301 billion SEK in 2004.[131] Riksgäldskontoret performs the active administration on 200 billion SEK of the currency debt. The risk mandate is to keep a daily value at risk of 95% on 200 billion SEK. The risk mandate also includes reviewing new positions in the portfolio, which is done on a daily basis. And as positions are to be taken, predictions can be made. If the USD for example is expected to depreciate, it can be sold to day in exchange of EUR and JPY, within the boundaries of the allowed deviation.

Riksgäldskontoret also use six external partners to manage the debt. They are given 6 billion SEK each to manage, so 164 billion of the debt is managed internally by Riksgäldskontoret. If one partner does better than the average within Riksgäldskontoret they could be given a larger portion of the debt to manage. All derivatives are written between Riksgäldskontoret and the banks they have as partners.

Currency options are used in the active administration of the debt. Plain vanilla options are used for the currency debt for all currencies, and prognoses are the basis for the positions that will be taken in options. As forwards and futures are traded, patterns can be seen in the movements of the currencies. If this goes against your wanted exchange rate, you can use options to control the movements. A premium has to be paid of course, but in the long run these strategies can pay off, if the correct predictions were made. If a currency has depreciated, call options can be bought to gain when exchange rates move back. Or if the depreciation is expected to continue, put options can be bought so that the continued depreciation won't cause any more losses.

Swaptions have been used in the interest rate administration, and options on futures will be used as soon as their system has been prepared for this new type of derivative. The

[131] More statistics can be found at Riksgäldskontoret – *Key figures*

systems are often rather complex when handling options on futures, since there are many factors that have to be taken into account in these combined derivatives. Except for future brokers, Riksgäldskontoret does not use brokers when trading derivatives. Mainly foreign banks are used as partners in the trade, but some Swedish banks are used as well.

4.4.1.4. Inflation Goal and Predictions

Riksgäldskontoret has no directives to support the inflation goal; this is all handled by Riksbanken. On the international currency market Riksgäldskontoret are too small to have any significant impact, but on the SEK market they are larger. They do however not make predictions of interest rate movements on the SEK market, since it could then be suspicions that they held insider information about the market. Hence they have to be careful and avoid having views on the interest rate development or the SEK exchange rate movements.

Riksgäldskontoret has no goal for a certain exchange rate. A few years ago the SEK was extremely weak to other currencies. Riksgäldskontoret then decided to delay the amortization on the USD loans for a while until the SEK was stronger. It is however harder to pay higher mortgages when a good exchange rate is given, since it would lead to lower liquidity for the government. The government has given directions to Riksgäldskontoret to decrease the currency debt in the total national debt. As directions are to be developed Riksgäldskontoret often works out a suggestion to the Ministry of Finance, which will review the suggestions and the return with directives to Riksgäldskontoret.

Riksgäldskontoret administrates the debt for most of the government bodies. Some bodies manage their own loans, but Riksgäldskontoret can still help them with advice in the borrowing process. Riksgäldskontoret can also perform the exchange or borrowing for the government bodies since they know the market and can find loans with better conditions.

4.4.1.5. New Derivatives

Banks does not make much money on the plain vanilla derivatives, so they can often suggest new solutions for Riksgäldskontoret with newly developed derivatives. Riksgäldskontoret does however not participate in the development of new derivatives.

If new derivatives or financial instruments are introduced to the market, Riksgäldskontoret is reluctant to apply those into their system, since the administration works very well as it is today. It is also important to keep a transparent system that is easy to overlook, and hence new derivatives has to be thoroughly reviewed if they were to be applied into the system. Plain vanilla options suits the needs for the debt administration today, but Riksgäldskontoret may use exotic options in the future. Before that can be done, the computer systems need to be modified so that they can handle the Monte Carlo simulations properly.

5. ANALYSIS

Based on the empirical findings that were presented in the previous chapter, I will now analyze the information that was gathered and compare it to the theoretical framework. This will lead is to conclusions which will be presented in a coming chapter.

5.1. Introduction

All three government institutions and the bank that I interviewed turned out to have a lot of interesting insights in the currency and derivative markets. As presented in the previous chapter we have seen what specific areas the institutions operate in, and how the banks make their choices. We will now analyze the relationship between the different respondents that will lead us to conclusions about the currency derivative market.

5.1.1. Banking choices

The bank offers a full product line of derivatives. As long as there is a demand for a derivative, they strive for supplying it. If a derivative is not available yet, or if the derivatives that are available are not sufficient, the bank develops new solutions for the customers to fulfill their hedging needs. When a new derivative is developed, as in the case with flexible forwards, the bank has to contact Finansinspektionen before it can be traded on the Swedish market.

The bank gains their revenues from the spread in the market, and even though the spread on standardized plain vanilla derivatives has decreased due to competition, it is still enough for making profit in the market. Therefore there is no need to charge commissions on the trades. If only charging a commission, it would lead to the same gain from different kinds of risks. Hence the spread is a more efficient way to receive the proper revenue due to the risks that are taken by the bank in the derivative trade.

If a trade involves rare currencies or derivatives, the risk can be transferred to a third party by writing another contract with the counterparty. By doing so the risk will be transferred, but the profits may also be limited. It is hence a balance act for the broker to determine what derivatives they should write themselves, and what risks that should be transferred to a third party.

I hence believe the supply is determined by the demand, and we can then see that as long as there is a demand for the derivatives, they will be supplied and hence traded. And since the broker hold a risk mandate they can determine some derivatives involves a risk that is too large to bear and can then choose to transfer the risk to an external party. They can thereby keep both the customer and the wanted risk level in the company.

5.1.1.1. Derivative Choices

The banks write all the derivatives they sell and hence they are the counterparty to their customers. There are a lot of information sources on the market and the banks have pricing models built in to their system and therefore the pricing of the derivatives can be performed rather smoothly. The brokers still have to determine the credit risk they are

willing to take for each customer, and expectations of the market still play a large role in the pricing process. But as soon as the values for the parameters are set, it is not hard to determine the price for the derivative. Both forecasts of future expectations and simulation models can be used when setting the price for the derivative, and hence there is more than one way to determine a fair market price.

As the liquidity on the market has increased we see both that the prices even out and the spreads have decreased. The liquidity is important for a functioning market, and therefore also Riksgäldskontoret take the liquidity of the SEK market into account when making their choices. This was one aspect that I could see that different actors in the market benefit from. A higher liquidity both leads to better competition on the market, as well as it gives the banks and other actors a larger range of alternatives to choose from.

One example of a derivative that the banks choose not to supply is futures, since the demand for this derivative was not large enough when it was introduced to the market. I believe that if Sweden one day enters the EMU, it may very well become interesting to ones again introduce currency futures to the market since they are already traded in the EUR area.

There is a correlation on the market between different factors and parameters. The interest rate movements are taken into account both when pricing forwards and swaps. The Riksbank and their inflation goal of 2% is also a factor that plays a role on the market. If the inflation is steady, the interest rates in the country will not fluctuate as much, which will directly affect both the investments and the pricing of the derivatives. Linking this to our study of derivatives and trade I want to point out that low interest rates leads to higher investments, and a steady interest rate development simplifies the pricing process of as well forwards as swaps. Since swaps are written with durations up to 20 years, it is therefore important to have a stabile market since you have commitments on very long terms.

5.1.2. Government Supervision

The government institutions both supervise and interact with participants on the market. There is a mutual need for this communication and the exchange of information leads to a more transparent environment. But still the government institutions are authorities, and if the actors on the markets don't follow the rules or regulations, they can impose sanctions or penalties against the supervised participants. There are two main objectives I want to emphasize when government institutions overlook the market; to regulate and to keep the market stabile as well as transparent.

5.1.2.1. Interaction between Government Institutions

When studying the literature and taking part of the information provided from the institutions, it is clear that there is a distinction of responsibilities for the different institutions. As Finansinspektionen is the regulatory government body and the Riksbank is more of a market caring body, it is important that there is an open communication between them so that the development of the market and the development of the regulations can remain correlated. And as the Riksbank manages the monetary policies

for the country as a whole, it is important for the other institutions not to make decisions that can interfere with the inflation goal.

The institutions exchange a lot of information, but if it is delicate material they will go to the source of the information so that it can be classified. If one institution shares information with another, it will become public, and if it is information that may need to be classified it has to be taken directly from a source outside the government sphere. This was confirmed by the different institutions, and hence we can see that they have the same view and approach in the matter.

5.1.2.2. Bank/Government relations

The relationship between the banks and the government is based both on the exchange of information and the regulation of the market. As the institutions can provide information to the banks about new regulations, the banks also have the obligation to notify the government when important changes are made in the organization. There is also a continuous exchange of information and statistics from the banks to the government, so that the government can keep track of movements and changes on the market.

Banks are in contact with the government institutions for different purposes. One could argue that the number of institutions that the bank has to maintain contact with, will slow down the banks in their operations and make it complicated for them to get hold of the proper information. But I believe, since there is a clear distinction between what the responsibilities for the different institutions are, that the banks and other actors on the market can always know who to turn to for advice or permissions. It can hence be a positive feature for the organization of the government that the responsibilities are divided among different institutions, as long as there is a clear structure in the organization so that the participants know who to turn to.

5.1.2.3. Initial Permission

It is obvious that the first government institution a new bank is in touch with is Finansinspektionen. They authorize new actors on the market, and it is only from them a new actor on the market can get permission to make business or trade. It should also be noted that if an actor wants to extend their operations on the market, they may also have to contact Finansinspektionen, since some areas such as derivative trade needs another permit.

5.1.2.4. Follow up and Evaluation

Finansinspektionen also has a responsibility to follow up the trade on the market, and as banks change their organization or setup they need to contact Finansinspektionen to get the change authorized. Other government institutions, such as the Riksbank, also play a role when evaluating the market systems. They overlook the market system and evaluate the actors with periodical surveys. As the government institutions also share a lot of information with each other, they help maintain a fair market system.

5.1.2.5. Market Care

The Riksbank both overlooks the market and have an effect on it by their monetary policies. There is no common goal for the exchange rates, but in times when the SEK is determined to be highly over or undervalued, the government agencies may interfere to

push the exchange rates in the other direction. This is however only done if there is no risk of harming the inflation goal which is the main monetary goal today.

There is no gain for the market with arbitrage, except for speculators. For fair competition it is important that the actors hold their prices within certain boundaries. The government does not interfere in the pricing of currencies or derivatives, but if one actor begins to deviate in their prices, eyebrows will be raised

Keeping a high liquidity is important for a fair competition. Riksgäldskontoret is a large actor on the SEK market, and hence they can make daily business decisions to support a high liquidity on the market. Hence the government institutions may act on the market even if they don't regulate or overlook the trade.

5.1.3. Market Development

I think financial markets always have been an interesting area for research. The tools have developed from currencies and bank notes, to the complex financial instruments that we have today. There are continuously new instruments introduced to the market, and old ones are refined and developed as new needs for the businesses emerge. Currency exchange is vital for the international trade, and as the international trade develops the instruments used in this trade will develop. As new instruments are introduced to the market, the need for others may decrease. Hence you can as well see the development of the instrument as a development of the market.

As markets integrate and monetary unions are founded, one may come to think that the need for derivatives and hedging will decrease. But on the contrary I believe that the integrated market can lead to new opportunities for the use of derivatives. Futures will always be needed for the trade of real commodities. And the interest rates will continue to fluctuate; hence interest rate derivatives will be continuously demanded. There will always be uncertainties in the market and as these uncertainties need to be hedged, insured or avoided we will continue to see a demand for derivatives. What I believe will be interesting to follow though, is how the use of derivatives may change and what new derivatives we may see in the future.

5.1.3.1. New Derivatives

We can see patterns that when the demand for an instrument is not large enough, the actors on the market will choose not to supply the instrument. This was the case with the currency futures when they were introduced to the Swedish market. The same arguments can be used for developing new derivatives when there is a need for them on the market. The introduction of Flexible forwards is one successful example of a modified derivative that was developed in Sweden and introduced here to the currency derivative market. This instrument combined the certainty in the forward contract with the uncertainty of an option contract, and offered the customer an increased but still limited leverage for a low price.

The new derivatives are developed by the banks or other actors on the market. The government's role in the development is to review the new instrument to determine if it is a financial instrument and hence can be authorized for trade. Derivatives can also be

introduced with inspiration from foreign exchange markets, but it will then still need clearance from Finansinspektionen before it can be traded in Sweden. If a new derivative is authorized by Finansinspektionen, it can be traded by all the actors that have permission for trading financial instruments. A derivative can hence not be exclusive or monopolized for one bank.

5.1.3.2. Final Observations

There is both a periodical and continuous contact between the actors on the market and the government institutions for evaluation of the market system. All participants will gain from a stabile and reliable market system, and therefore they will together strive for fair competition. The exchange of information helps develop the system as it is found out what works more or less well in the market and as the market develops, all participants are there to share and gain.

6. CONCLUSIONS

With one foot in the empirical findings, and one in the analysis, I will now present the conclusions of this study. We will here see if we have been able to find answers to the problem formulations, and if the study can be wrapped up. This chapter will at first summarize the study, and we will look back on the study questions to determine how they can be answered according to the empirical findings. To refresh our memory, we will first review the research question and the purpose of the study.

6.1. Review

Research question:

How do government institutions regulate, overlook and control the currency derivative trade in Sweden?

The purpose of this study is to give a deeper understanding in the subject of derivative and currency trade. The question is how banks act on the market, how government institutions supervise the trade, and how these parties interact with each other. A secondary purpose is to point out the key decisions a broker makes when trading currency derivatives. The roles of different government institutions on the market will also be analyzed for the purpose of explaining what parties the traders have to take into account in their operations

6.2. Summary of Findings

Government institutions are regulated under laws and regulations, and have a mandate to overlook and regulate the trade in Sweden for a fair and sound competition. Finansinspektionen is the regulatory body which authorizes banks before they can enter the market, and Finansinspektionen also overlooks the trade and can intervene if a party on the market is breaking regulations. Banks need authorization from Finansinspektionen when beginning their operations, or when changes are to be made in the organization. The Riksbank sets the monetary policies and uses the repo rate to affect the inflation rates in the country. Riksgäldskontoret administers the national debt and uses interesting strategies when acting as a key player on the market.

There is a continuous and close contact between the government institutions, as well as between the banks. The market is based on competition, but there is still a wide spread exchange of information between the parties. Currency options, swaps and forwards are traded in Sweden. The banks offer a full product line of derivatives, except for futures and some derivatives that can not be created because its currency is hindered with trade barriers. The price of a derivative is based on spot prices and expectations on the market.

The banks are in direct contact with Finansinspektionen, since they authorize and overlook the trade. But the banks also have an indirect relation the Riksbank, since they set the repo rate that affects both interest and exchange rates, and hence their choices will directly affect the parameters in the pricing models for derivatives.

7. FURTHER STUDIES

Even though this study now is finished, and conclusions have been reached, there are still important and interesting new angles the topic can be viewed from. If the reader wants to study the subject further, I will here suggest a few topics for further studies that can have this thesis as a basis.

7.1. Topics for Further Research

A comparative study of government regulations in different countries and areas of the world could show differences and similarities in the way they intervene, and could as well teach us useful lessons so we don't repeat others' mistakes. Central banks are organized differently depending in different countries, and their impact on the market could be further studied in a descriptive study.

Rules and regulations can differ between countries and this is one topic that could be further developed, to display differences and their impact on the financial markets.

Currency futures are used for different purposes abroad. The question is who are using currency futures and for what reasons? Do investors and businesses use these instruments, or is it mainly used by speculators?

The topic of exotic options could be further developed. It can at first seem complicated to understand all the functions included in the contracts. But with some practical applications and empirical studies of their usage, their characteristics could be described further.

As trade unions are formed, the market conditions change. Regions may integrate their trade, causing competition that implies refinements for the parties. The question is then what opportunities and threats trade unions impose the market actors?

These are a few, out of many, interesting topics for further studies.

8. INFORMATION CRITICS

Finally, we will not look back on how this study and thesis can be reviewed from a critical perspective. We will ask ourselves if the study and the processed material fulfill the requirements of a properly performed study.

8.1. Ethics of the Study

When approaching the respondents it is crucial for the ethics of the study that the respondents are well informed about the purpose and goal of the study. They must voluntarily agree to participate and this agreement must be based on complete and honest information.[132] It is also important for the ethics of the study that the researcher has the respondent's informed consent to publish the results. The researcher is also obligated to respect the respondents wish to be anonymous or other demands the respondent may have.[133] Otherwise the respondent may not give truthful answers to delicate questions and hence the study will not produce correct results.

When performing interviews and when publishing information concerning other parties it is crucial to follow the requirements of an ethical study. First of all we need to make sure we have the informed consent from the respondents. When approaching the respondents you need to inform them what the study is about, and for whom it is being performed.[134] If the respondents are not clearly informed of the purpose of the study, they may not approve of you publishing the results when the study is concluded.

When I first contacted the banks and the government institutions I informed them what the subject and purpose of my study was. It was of course important for me to get hold of respondents who could give me accurate answers to my questions, but it was also crucial that they knew what the study was concerning so that they could determine whether or not they could participate. Some banks that I contacted did not want to participate, and I respected their decision. But those who agreed to participate gave me their informed consent to publish the results of the interviews, both before the interviews were performed and when they had reviewed the processed material.

8.2. Validity

Validity is a rule of logic in methodology.[135] The analysis and conclusions are only valid, if they are in line with the findings, and therefore there shall be no conflicting arguments in the analysis to what is stated in the empirical findings.[136] No new information should be presented in the analysis or conclusions, since it would then not have any valid link to the information provided by the respondents. How we use our instruments also have a great influence on the validity of the study. If interviews don't fulfill the requirements of

[132] Denzin, Norman K. *Handbook of qualitative research*, p 138-139
[133] Bryman, Alan. *Samhällsvetenskapliga metoder*, p 313
[134] Kvale, Steinar. *Interviews*, p 111
[135] Kvale, Steinar. *Issues of validity in qualitative research*, p 145
[136] Ibid, p 64

an open and honest exchange of information, the results could not be considered valid in this context.[137]

When processing the interview material from transcripts to the text that is published in this thesis, I had the freedom to cut down the material if needed, and make the necessary adjustments in the material so that it would be consistent with the purpose of the study. After the material was processed, I sent it back to the respondents so that they could come with comments and demand for changes. All four respondents got back to me with comments both by phone and email. Thereafter I reviewed their comments and made the proper adjustments. Because of the limited time I had at the end of this study I did not get a chance to send the modified material back to the respondents one more time. I do however think the processed material meets the requirements of validity since I made all the changes that the respondents asked me to do.

8.3. Transferability

If the theories and findings in this study could be useful for future studies in the same field, or if the conclusions that we come to may be used for other purposes than the purpose of this study, we may say that this study meets the requirements for transferability.[138]

Theories of derivatives are very general, and the characteristics of derivatives are often described with a mechanical approach in the literature. Even when applying the derivatives in hedging strategies, they are used directly according to the rules and there are few surprises. In this thesis I have tried to show how currency derivatives are constructed, as well as how they are developed and used in practice. If further studies in the area were to be pursued, the conclusions in this thesis could be used as a basis. The empirical findings in this study could lay the ground if a comparative study were to be performed. If for example a study of the differences and similarities between governments on financial markets in different countries were to be pursued, this thesis could very well represent the Swedish market. Therefore I believe this thesis meets the requirements of transferability.

[137] Wolming, Simon. *Validitet*, p 13
[138] Johansson Lindfors, Maj-Britt, *Att utveckla kunskap*, p 169

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APPENDIX: Interview Manuals

Questionnaire for interview with the Riksbank

1. Relation to the banks
Do you have different business transactions depending on the size of the bank?
How is the contact with the bank established?
Do they contact you, you them, or does it go both way continuously?
How often are banks contacted in person, and how often is it done by automatic systems?
Which personnel in the bank do you contact?

2. Lending
What banks do you lend SEK to?
What bank do you lend foreign currency to?
How is the lending procedure in practice?
Do you give both long and short term loans?

3. Derivatives
Do you sell currency derivatives to the banks?
How large is the currency derivative trade to the currency trade?
How is the derivative trade represented in volume of futures, forwards and options?
Do you trade any other derivatives on the currency market?

4. Prices
Do you overlook the banks and their trade, exchange rates and pricing?
Do you use pricing models for the derivatives you sell?

5. Exchange of information
What kind of information do you demand from the banks for loans and trade?
What kind of information can you not share, because of bank secrecy or other reasons?
Are there any conflicts between information and secrecy issues?
Are there types of information you wish to take part of that you can not?

6. Regulations
What regulations do you work under in when trading SEK and other currencies?
What power do you have to regulate or influence the bank trade?
How does that regulation work?
What can happen if a bank does not follow your demands?
Has trade ever been stopped with a bank because of this? When?

7. Politics and goals for the trade
Some government institutions may have many motives for the monetary policy such as a stable exchange rate, controlled interest rate level or specific inflation rates.
Can there be a conflict of interest between the banks and the institutions?
How do you act as a central bank to reach these goals?
How are priorities made when all goals can’t be reached?

Questionnaire for interview with Finansinspektionen

1. Relation to the banks
What banks do you have in contact for permits and control?
How is that contact established?
Do they contact you, you them, or does it go both way continuously?
How often are banks contacted in person, and how often is it done by automatic systems?

2. Exchange of information
Which personnel in the bank do you contact?
What kind of information do you demand?
What kind of information can you share, because of bank secrecy or other reasons?
Are there any conflicts between government supervision and secrecy issues?
Are there types of information you wish to take part of that you can not?

3. Regulations
Do you regulate what derivatives the banks can trade?
Do you introduce new derivatives to the market, or does it come on initiatives from the banks?
What demands are set upon banks for permission to trade derivatives?
What can happen if a bank does not meet up with these demands?
Have you ever retracted permissions for a bank? When? For what reasons?

4. The trade
Are there today any other derivatives than futures and options on the currency market?
Are both European and American options traded in Sweden?
Are there any differences in the permissions for these two types?
Are both currency Futures and currency Forwards traded in Sweden?
How large is the currency derivative trade to the currency trade?
How is the derivative trade represented in volume of futures, forwards and options?

5. The government agenda
Some government institutions may have many motives for the monetary policy such as a certain exchange rate, interest rate level or inflation rate.
Can it here be a conflict of interest between the banks and the government?

6. Prices
How do you supervise the exchange rates that the banks offer?
How do you supervise the pricing of the banks' derivatives?
Do you have pricing models for currency derivatives, to control a fair pricing on the market?

Questionnaire for interview with Nordea

Trade
How large is trade with currency derivative your trade with currency trade?
How is the derivative trade represented in volume of futures, forwards and options?

Futures and Forwards
Do you trade both futures and forwards?
How do you set the prices?
Do you use pricing models?
How do you measure the risk in selling futures and forwards?

Options
Do you trade both European and American options?
How do you set the prices?
Do you use pricing models?
How do you measure the risk in selling options?

Do you trade any other kinds of derivatives?
For what currencies are derivatives demanded?
Can you see any patterns in demand for a specific currency, related to when it periodically has a very high or low exchange rate?

Excess of currency
When you have excess or shortage of a currency, how do you handle that?
Do you trade with parties within Sweden, or do you trade on the international market?
Is the trade reinsured by periodical approximations and future/forward trade with a third party?
What personnel are responsible for these decisions?

Relation to the Authorities
What authorities do you mainly have contact with for permissions and follow ups in the trade?
How does that contact take form?
Do they contact you, you them, or does it go both way continuously?
How often is authorities contacted “in person” and how often is it done automatically when exchanging information?

What personnel in your bank are in charge of the contact with authorities?
What kind of information do you share with them?
What kind of information can you not share, because of bank secrecy or other reasons?
Is there a conflict in government control and bank secrecy?

Some authorities have motives for the monetary policy such as exchange rates, interest rate levels or inflation rates. How do you view this compared to your trade of currencies?
Is there a conflict of interest for you, or can it benefit you in your trade with derivatives?

Questionnaire for interview with Riksgäldskontoret

1. Trade and purpose
What currency derivatives do you trade?
For what purposes do you choose options, futures or swaps?
Do you trade futures or forwards?
Who do you trade derivatives with?
Do you trade derivatives with banks or other financial institutions?
Do you trade currencies with foreign banks?

2. Risk management
Is the risks transferred to an external party by trading derivatives with them?
What derivatives are used for hedging of cash flows or positioning?
How long can you hedge a position?
How long ahead can a cash flow be approximated and hedged?
Who makes the policy decisions in currency- and derivative issues?

3. Currencies
What currencies do you hold positions in?
In the statistics I can see that EUR and USD stands for the largest part of the currency debt. But after derivative transactions the EUR part has increased significantly. How is this reconstruction created?
Do you use swaps in the currency management?
How long is their maturity?
Who is the other party on the swap agreement?

Do you have a role to play in adjusting the exchange rate for SEK?
How are the choices of currencies made to reach the wanted exchange rate?
Towards what foreign currencies is the wanted exchange rate set to?
Why are these currencies chosen?
How is the 2% inflation goal affecting the trade of currencies?
Can the currency and derivative trade affect this, or is it different issues?

4. Other government institutions
How do you control other government institutions' exposures to foreign currencies?
Do you manage their exposures and risks, or is it managed in each institution?

5. New instruments
How are new derivatives and financial instruments developed?
Do you take the initiative to introduce new derivatives to the Swedish market?
Do such initiatives come from outside parties?
How do you manage new instruments in your operations?
When do you dare to use them on a continuous basis?

Are there any other aspects in the use of derivatives and financial instruments that you would like to point out at the end now of this interview?