Exchange rate risk in Automobile Industry:
-An Empirical Study on Swedish, French, and German Multinational Companies.
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Abstract

Recently, both company executives as well as national media have claimed that short currency exchange rate fluctuations are negatively affecting the stock returns of certain firms. However, most previous studies focusing on companies in the US and Asia have been unable to find empirical support for a statistically significant linkage between firm value and exchange rate risk. By using a quantitative method with a deductive approach, the present research investigates if currency exchange rate movements impact the stock return of European based car companies with market interests in the US. By selecting French Renault and Peugeot, German Audi and BMW and Swedish Saab and Volvo, we were able to analyze three currencies exchange rates in our study: SEK/USD, SEK/Euro and Euro/USD. In addition, we included three macroeconomic factors: GDP, stock market index and Oil price to perform a multiple regression analysis. In consistency with the earlier studies, our results indicate that for five out of the six investigated companies, short movements in the three exchange rates do not significantly affect the stock returns of the companies investigated. By analyzing the annual report of the investigated companies, we found that derivatives instruments such as currency option, foreign exchange forwards, currency futures and currency swaps were used to hedge exchange risk. This might be one of the reasons why it was difficult to capture exchange rate risk. The fact that BMW was the only company showing a significant effect could indicate that the company is not applying the accurate hedging strategy. Another reason might be that the company is more exposed to exchange risk due to its large exporting activity compared to the other investigated companies.
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Equations

(1): \( \pi = p \cdot f[L, K, X] - wL - rK - qX \)
(2): \( \pi = p \cdot Ex \)
(3): \( \pi = p \cdot Ex \cdot f[L, K, X] - wL - rK - qX \)
(4): \( R = f(Ex, G, O, M) \)
(5): \( ri = rf + b1(F1) + b2(F2)... + bn(Fn) \)
(6): \( ri = rf + bex(Ex) + bg(G) + bm(M) + bo(O) \)
(7): \( ri - rf = bex*(Ex - rf) + bg*(G - rf) + bm*(M - rf) + bo*(O - rf) \)

Abbreviations

EMU: Economic and Monetary Union
GDP: Gross Domestic Product
MNCs: Multinational Companies
APT: Arbitrage Pricing Theory
FCDD: foreign currency denominated debt
ASX: Australian Stock Exchange
SEK: Swedish Kronor
USD: United States Dollars
CAPM: Capital Asset Pricing Model
ERM: Enterprise Risk Management
MERM: Multilateral Exchange Rate Model

Key words: currency exchange rate, foreign exchange exposure, hedging strategy, risk management.
This section contains the problem background of the research, the research question, the statement of the purpose, the earlier studies, and the outlines.

1. Introduction

1.1 Problem Background

Political liberalization and economic globalization has provided a worldwide market for companies willing to operate internationally. Numerous companies increasingly engage in global activities such as outsourcing, exports, imports, and establishment of production and sales abroad (Moosa 2003). Since the break down of the Bretton Woods regime (1971), floating exchange rates have proved tremendously volatile with aggressive short-term fluctuations and also long over- and undervaluation of major currencies such as the US dollar and the English Pound (Copeland 2005). In contrast to companies that only operate within a country, multinational companies (MNCs) face gains and/or losses arising from exchange rate risks caused by the uncertainty of the exchange rates prevailing in the future (Matson 1996). As companies are spreading out their production facilities and market interest throughout the world, the decision on whether or not it is necessary and beneficial to hedge the risk of a depreciation of the foreign currency compared to the home currency becomes more and more urgent.

Over the last two decades, markets within the European Union have become progressively integrated because of the close of the Single Market Project in 1992 and the start of Economic and Monetary Union (EMU) in 1999. The aim of the EMU was to introduce a common currency and thereby remove exchange rate variations between the members of the Euro zone. A common currency would permit a deep integration by decreasing exchange-rate-risk premia, decreasing uncertainty, lowering transactions costs and making cross-border business more beneficial (Allington, Kattuman, and Waldmann 2005).

However, today many companies within the European Union are still exposed to exchange rate risk. For instance, German based SAP, the world's largest business software company, was hurt extensively by the decline of the US dollar against the euro.
within the last five years. As the company sells a big portion of its products on the US market, their American depositary receipts lost 10.4% of their value, reducing SAP’s market capitalization by approximately $6 billion in the last year (Corporate Financing News 2007). For the same reason, Ford Motors signalled its intention to cut Volvo’s output by 17 per cent in the first quarter of 2008, compared with a year earlier. Besides the pressure coming from the weak US dollar, Volvo has also been hit by adverse exchange rates for the euro and Swedish kronor (Reed & Simon 2008). Even one of the most profitable car manufacturers in the world, the German Bayrische Motoren Werke (BMW), proclaimed in February 2008 that 8 100 jobs were to be eliminated due to the weak US-dollar. This was proclaimed by the company’s personal executive committee member Ernest Bauman, causing uproar in the German media (Henning 2008). The company announced that: “Segment earnings were adversely affected by exchange rate fluctuations, higher raw material prices, etc” (Hetzner 2007).

Today, more and more firms attempt to measure, monitor and manage the exchange rate exposure through hedging. Hedging is taking a contract that will rise (or fall) in value and offset a drop (or rise) in value of an existing position (Eiteman 2007). Thus, the main purpose of a hedge is to reduce the volatility of existing position risks caused by the exchange rate movements. Many studies show that several companies create formal risk management policies including hedging strategies to mitigate the negative impact of exchange rate fluctuations (Corporate Finance News 2007).

Considering the exchange rate risk that MNCs face when operating in foreign markets, movements in exchange rates may have an impact on companies’ expected stock returns. Taking into account, that most of the previous studies investigating how exchange rate fluctuations affect companies stock returns (Corporate Finance news 2007) have focused mainly on USA and Asian MNCs, we chose to emphasise on the European MNCs to help to complete the picture. Given that exchange rate movements may affect the value of firms, the aim of this paper is divided in three parts. First, the aim is to investigate the impact of the volatility of exchange rate on stock returns of MNCs. For this, we selected the Swedish, German and French automobile industry. The focus on the automotive
industry arises from the fact that this business represents the leading industry in many countries of the world, i.e. when it comes to using and developing the most recent technologies. The second aim is to investigate if there are differences on how exchange rate movements impact Swedish automotive companies compared to French and German automotive companies. The comparison is especially informative as Sweden has its own home currency the SEK, whereas Germany and France are both part of the Euro zone. The third aim is to provide some potential financial derivatives that can be used by companies to mitigate currency risk.

1.2 Research question
- Do exchange rate fluctuations affect the stock market returns of French, German and Swedish automobile companies?
- Is there any significant difference on how exchange rate movements impact Swedish automobile companies compared to French and German automobile companies?
- What are the possible hedging strategies that can be implemented / used to mitigate exchange rate exposure?

1.3 Purpose
The purpose is to assess the currency risk for French, German and Swedish automotive companies’ stock returns due to exchange rate fluctuations. This is achieved by analyzing the impact of exchange rate volatility on companies’ stock returns. Also, we want to illustrate it is possible to hedged short exchange rate fluctuations to avoid big impacts on the company’s stock returns by using financial derivatives. Six chosen companies are to be investigated, two for each country: French based Renault and Peugeot, Germanys Audi and BMW, as well as Swedish Volvo and SAAB. Within these countries two different home currencies are used, the SEK and the Euro. In addition all six car companies operate on the US market enabling us to analyse three exchange rates: SEK/USD, EURO/USD and SEK/EURO.

1.4 Earlier studies
To enable the reader an understanding of our topic, in the following we provide a literature overview of the published findings with relevance to the subject.
When over-viewing a number of empirical studies conducted to determine, explain and analyze the linkage between firm value and exchange rate fluctuations, it became clear that this field of economic research is much differentiated. Some of the studies, including Smith (1992), Solnik (1987), Aggarwala (1981), Frank and Young (1972), Phylaktis and Ravazzolo (2000), Granger et al. (2000), Abdalla and Murinde (1997), and Apte (2001) illustrate that stock market returns and exchange rates movements are positively related. Others studies, such as Soenen and Hennigar (1998), Ajayi and Mougoue (1996), Ma and Kao (1990) provide empirical results showing a negative relationship between stock market returns and exchange rate volatility. Still, there are many studies including Bartov and Bodnar (1994), Frank and Young (1972), Domínguez and Tesar (2001), Bodnar and Gentry (1993), Doige et al. (2002) which indicate that the linkage is very weak or simply does not exist. The last citations corroborate to the notion that it is difficult to find empirical supports for a statistically significant linkage between firm value and exchange rate exposure within the current literature (Stefan Nydahl 1999).

Taking a closer look at some other published works we find out, for instance, a study conducted by Abe de Jong, Jeroen Ligterink and Victor Macrae (2006) on 47 Dutch firms, investigating the relationship between exchange rate fluctuations and stock returns. Their findings indicate that over 50% of the firms were significantly exposed to exchange rate risk. The results demonstrate that firms could benefit from exchange rate fluctuation, a depreciation of the Dutch guilder relative to a trade-weighted currency index (period: 1994-1998). Two variables, firm size and the foreign sales ratio, were proven to have a significant and positive linkage with exchange rate exposure. Fang and Miller (2002) studied the impact of daily currency depreciation on Korean Stock market return in the period of 1997 to 2000. Their results provided evidence that currency depreciation has a significant impact on stock market returns. The findings are illustrated in three ways including the level of exchange rate depreciation, which has a negative impact on stock market returns; exchange rate depreciation volatility which has a positive impact on stock market returns and finally stock-market returns volatility which responds to exchange rate depreciation volatility (Alok Kumar Mishra 2004). Stefan Nydahl (1999) studied the
effect of exchange rate movements on 47 Swedish companies’ value. The results proved that only 26% of the firms were significantly exposed to exchange rate fluctuations. These findings revealed evidence that the level of foreign sales/total sales significantly raise currency exposure. Jorion (1990) also found that only 15 firms out of 287 USA firms showed a significant currency exposure in the Multilateral Exchange Rate Model (MERM) index. Luetherman (1991) studied the hypothesis that an exogenous real home currency depreciation improves the competitive advantage of home manufacturers firms compared to foreign competitors. The findings demonstrate that firms do not gain from a depreciation of the home country but instead they are faced with a significant decrease in their market share of industry (Yücel & Kurt 2003). On the other hand, Doidge et al. (2002) used 27,000 stocks in 21 developed and 29 emerging markets when studying the exchange rate exposure, finding only very low exchange rate sensitivity. Dominguez and Tesar (2001) cover over 2000 firms in eight countries when exploring the effect of exchange rate variations and find low exposure. Solnik (1987) analyzed the influence of exchange rate on stock prices of nine industrialized countries. Their results showed that movements in exchange rates are non-significant factors in explaining the changes in stock prices. Muhammad and Rasheed (2003) used monthly data based on two South Asian countries, Pakistan and India, for the period of 1994 to 2000. Their finding revealed that there is no relationship between exchange rates and stock prices in either short-run or long-run (Stavarek 2005). Additionally, Solnik (1984), Adler and Simon (1986) found a weak correlation between stock market indices and currency movements (Fang and Loo 1996). Jorion (1990, 1991), Bodnar and Gentry (1993) were unable to find a significant relationship between exchange rates and stock returns when investigating US firms. Their results indicated a very weak linkage. He & Ng (1998) found that only 75% of their samples (171 Japanese’s MNCs) indicate no significant relationship between exchange rate exposure and stock returns.

There are several possible reasons explaining for why many studies fail to find a significant relationship between exchange rate movements and stock returns. First, it could be that only a few firms in the study sample were exposed to exchange rate risk, thus leading to low foreign exchange exposure. Most of the researches studied US firms
while US is considered to be the least open economy worldwide. It could therefore be expected that if the studies were done in more open economies, i.e. the European Union, the results could be different with exchange rate exposure being more prevalent. This can be illustrated by the fact that USA exports and imports in 2007 were respectively only 9.2% and 12.8% of the GDP whereas in Netherlands exports and imports represent respectively 50.4% and 46.7% of GDP. Second, studies may not apply the correct methodology to capture the firms’ sensitivity to exchange rate movements. The methodology used could for instance be biased, leading to biased results of empirical studies. Finally, firms may have protected themselves against exchange rate risks by using financial instruments as hedging strategies, making it difficult to capture exchange rate exposure (Abe de Jong, Jeroen Ligterink and Victor Macrae 2006). Crabb (2002) uses data on financial hedging activities for 276 U.S. MNCs to measure the net exposure to exchange rate fluctuations. Earlier results for this cross section provided findings with no significant exchange exposures. Based on his findings, he illustrated that the non significant results of exchange rate exposure were partly likely due to the mitigating effect of financial hedging activities applied by these companies.

After reviewing the significance of exchange rate exposure, it is now necessary to look into the benefit of hedging for firms with significant exchange rate exposure. Nguyen and Faff (2004) analyzed the role of foreign currency denominated debt (FCDD) as a hedging strategy. They studied 481 of the largest firms listed on the Australian Stock Exchange (ASX) between the periods of 1999-2000. The findings indicated that FCDD did not lead to a direct decrease of exchange rate exposure. Furthermore, even though firms are more likely expected to use FCDD to offset their foreign revenue exposure, there was no empirical evidence supporting this for the sample. Allayannis and Ofek (2001) conducted a survey using a sample of S&P 500 nonfinancial firms for 1993 to study if firms use foreign currency derivatives for hedging or for speculative purposes. The findings demonstrated that there is empirical evidence supporting the use of currency derivatives for hedging strategies and that it resulted in reducing the exchange rate exposure face by these firms. The decision to use derivatives seem to depend on exposure factors such as foreign sales and foreign trade but also on variables strongly related to theories of optimal
hedging. They even found that the level of derivatives used depend only on a company’s exposure via foreign sales and trade. A survey from 720 large US non financial firms between 1990-1995 by Allayannis, G., Weston, J., 2001 illustrates that if firms have foreign sales they may be affected by exchange rate movements through exporting activities. They are therefore exposed to exchange rate risks. Furthermore, evidence proved that hedging could be considered as a value increasing strategy, where using foreign currency instruments can positively and significantly be related to the firm value. Firms that used currency derivatives had a 4.87% higher value than those firms that chose to be unhedged. The increase value involves several factors such as firm size, profitability, leverage, geographic diversification, industry growth opportunities, ability to access financial markets etc.

1.5 Outline

The second chapter gives a short presentation and an overview of the selected companies. The third chapter presents and discusses the suitable methodology used in order to perform the proposed research and describes how data is collected. An appropriate theoretical framework for the research is developed in the fourth chapter. The fifth chapter presents the data. The sixth chapter presents and describes the results. An analysis and discussion of the findings are done in the seventh chapter. Finally, the eighth chapter embodies the summary of the empirical findings, the conclusion linked to the research question and theory. Recommendation for the sample and suggestions for further research are as well provided.
This section starts with an introduction of the automobile industry. It is then divided in three segments: Sweden, France and Germany. For each country, two automobile companies are presented.

2. Automobile Industry

2.1 Overview

As one of the leading industries in the world, the automobile industry represents a tremendous market with a worldwide market worth over 1000 billion dollars per year and an annual production of 66.5 million vehicles. The sector face increased competition from Asian manufacturers and countries with low manpower costs, in terms of the bid for new industrial development projects. Major manufactures are shifting operations to new and low cost locations such as Eastern Europe (John Wiley & Sons 2007). This industry is facing constant change, for instance an increased public attention towards environmental issues puts pressure on car manufacturers to decrease their negative impacts by environmental innovations. Consequently, automotive companies are faced with new regulations and demands, leading to profits or losses, advantages or disadvantages.

2.2 Sweden: Volvo and Saab

2.2.1 Volvo

The Volvo group is composed of six brands: Volvo, Mack, Prevost, Renault Trucks, Nissan Diesel and Nova Buss. The company’s customers are mainly in Europe, North America and Asia. Volvo has approximately 83,000 employees and production facilities in 18 countries. The company has its customers in more than 180 markets. In 2007, the Group’s workforce rose to more than 100,000 employees in 58 countries. The majority of employees are based in Sweden, France and the US. Volvo Group’s sales increased with 10% to SEK 285.4 billion. The main sale revenue comes from Europe, 55% of its net sales, North America and South America cover 18% and 6% respectively. Asia and other markets share the rest market share, 15% and 6% respectively (www.volvo.com).
2.2.2 Saab

Founded in 1949, Saab is a Swedish company that from the beginning was focused on manufacturing automobiles. Amongst the world's smallest carmakers, Saab is known for its individualistic design. With an annual production of about 126 000 cars, Saab's current model lineup includes the 9-3 (available as a convertible or sport sedan), the luxury 9-5 sedan (also available in a sport wagon), and the new 7-passenger 9-7X SUV available only through Saab dealerships and marketed under the name Saab Expressions. Saab offers other kinds of merchandise including pen and pencil sets, martini glasses, toys, and watches. Saab Automobile is a wholly owned subsidiary of General Motors. The company is marketing and selling cars in more than 60 countries worldwide. The most important markets are: USA, United Kingdom, Sweden, Germany, Switzerland, Italy, Australia, France, The Netherlands and Norway. Saab has 4 733 employees till 31/12 2006, the number of cars sold in 2006 was 133 167 (www.saab.com).

2.3 France: Peugeot and Renault

2.3.1 Peugeot

PSA Peugeot Citroen comprises two different brands, Peugeot and Citroen, where one of each has its own identity and own commercial policy. It is the second largest automaker in Europe, behind Volkswagen. It has two major brands Peugeot and Citroen but we chose to focus on Peugeot brand which has an over 100 year long history (www.peugeot.com). With operations in 150 countries, Peugeot is actively expanding its sales in new, fast-growing markets and today nearly one third of its business is generated outside Western Europe. The employees are dispersed as following: 60% employees in France, outside France but within Europe are 30%, and other countries like Asia, South Africa, and North America share the rest 10% of employees. Europe market contributes of 70% of Peugeot’s sales revenue. Peugeot takes 5% market share in each America and Asia market, Africa and other markets share the rest. In 2007, Peugeot vehicle sales grew 3.7% to 1 786 000 units (www.peugeot.com).
2.3.2 Renault

Renault is a leading automobile manufacturer that is based in France. The company was founded in 1898 by Louis Renault, who was mostly interested in motor sports. Renault comprises out of three brands: Renault, Dacia and Samsung. The company manufactures a range of small to midsized cars which include Clio, Laguna, Megane, Modus, Logan, Espace, Twingo and scenic. Renault is a partly state-owned car maker where the French Government still holds 44% shares of the company today. This kind of structure is rare in automotive industry of today. Renault and Nissan were merged in 1993 by way of cross-shareholding where Renault has a stake of 44,4% in Nissan while Nissan in turn has shareholding of 15% in Renault (http://www.xwheeler.co.uk/used-renault.aspx). In 2007, the group made revenues of € 40 682 millions, an increase of 1,8% compared to 2006 and the employees were 128 893 in 2006. European market is Renault’s biggest market, which accounts for 60%. North America has the second position with the market share of 21% whereas Asia takes 13% of the total sales. The remaining 6% goes to other markets (www.renault.com).

2.4 Germany: Audi and BMW

2.4.1 BMW

The BMW group is made up of three brands: BMW, MINI and Rolls-Royce Motor Cars. The BMW group main target is the premium sector in the international automobile market.

The Organization covers over 150 countries where the global BMW group activities are coordinated from the corporation’s head office in Munich, Germany. The organization had 106 575 employees in 2006. At the present, the BMW Group includes 17 production facilities in six countries: in Germany it is the plant in Munich, Berlin, Dingolfingen and Eisenach. Contract productions are situated in Graz (Austria), Goodwood plant (GB), Hams Hall plant (GB), Landshut plant, Leipzig plant, Oxford plant (GB), Regensburg plant, Rosslyn plant (South Africa), Shenyang plant (China), Spartanburg plant (USA), Steyr plant (Austria), Swindon plant (GB), Wackersdorf plant (www.bmw.com). The main market for BMW is Europe; it occupies 43% of the total revenue. US market is the
second market representing 22% market share of its total sales. The remaining is shared by other worldwide markets (www.bmw.com).

2.4.2 Audi

Audi, a 99%-owned subsidiary of Volkswagen, is one of the major manufactures of luxury cars, headquartered in Ingoldstadt, Germany. It is one of the largest car manufacturers in Europe, producing more than 790 000 cars per year. The company has several renowned models in its line-up of A-series cars, which include the A4, A6, and A8. AUDI sells its products worldwide. The company has five production locations: Germany, China, Italy, Hungary, and Belgium with 53 347 employees that cover all of its global locations. The main market of Audi is Europe; it takes 60% of its total sales whereas the other markets are dispersed worldwide with South America covering approximately 15% and Asian market 12% (www.audi.com)
This section presents the methods used to achieve the purpose of this study. It begins by providing the reasons of why the subject was chosen, followed by the perspective and preconceptions. Different approaches that are available for making a scientific research are discussed and relevant approaches are identified in the process. A discussion of the credibility of the study including reliability and validity is included. The chapter ends by describing how the data is collected.

3. Methodology

3.1 Choice of Subject

The choice of the subject was mainly based on the previous knowledge acquired in the previous courses including cash and risk management course, investment course. The idea of writing on exchange rate risk came up when reading the article: “Corporate Financing Focus; Increased Volatility in Exchange Rates Spurs Adoption of Best Practices in Currency-risk Management” (Corporate Financing News, May 2007). It was then developed during the discussion with our supervisor. We found the topic very interesting, relevant and challenging since these is a dramatic rise of firms operating worldwide, thus increasing international transactions and thereby facing exchange rate risk. Furthermore, the foreign exchange market has by far become the largest financial market in the world where, as mentioned before, rating rates have proved extremely volatile with aggressive fluctuations. This study focuses on the automotive industry. Being the most outspread industry in the world, with deliverers, manufactures and customers being situated in different countries it is especially affected by the ever changing exchange rates of national currencies. For instance, production and demand for the finished product is depending on both the global and the domestic market and therefore difficult to balance.

Previous studies have mentioned how important exchange rate fluctuations have become for firms operating internationally (Steven B. Kamin, John Schindler and Shawna Samuel 2007). However, most of these studies (Abe de Jong, Jeroen Ligterink and Victor Macrae 2006) were dealing with firms of Asia and the US. We therefore decided that a study on European automotive industry firms could help to complete the picture on how exchange rate fluctuations are linked to stock returns. We believe that our findings could be used by managers to determine whether it is necessary to implement hedging strategies against
exchange rate exposures or not, based on the impact of exchange rate fluctuations on the value of each particular firm.

3.2 Perspectives
Perspective can be referred to different views that people have on a particular subject (Sunders et al 2003). We have adopted a financial management perspective (the company perspective). Managing the impact of the exchange rate volatility on companies’ stock returns is important for MNCs, especially in the automobile industry where activities are strongly dependent from the international market. Management of exchange rate risk affects a company in various manners such as import and export, turnover, profitability, cost of the products, competitive advantage and cash flows. A good management of exchange rate risk can therefore be beneficial for MNCs.

3.3 Preconceptions
Since the research on automotive industry is done from real figures, data and reports; we are sure that individual preconceptions will not be biased on the outcome of the research.

3.4 Research Approach
There are two methods of reasoning for the scientific approach, the deductive and the inductive approach. Inductive approach is a "bottom up" approach. It begins with specific observations and measures, formulate some hypotheses that are to be explored, and finally ends up developing some general conclusions or theories. It emphasizes on developing insights and generalizations about the data collected. Inductive approach is often associated with qualitative method (Bryman & Bell 2007). The deductive approach is a "top-down" approach, a hypothesis testing theory. It begins with one or more theories about a topic, and then narrows that down into more specific hypotheses which can be tested. A deductive approach is often associated with quantitative research. The researcher goes further into data collection to address the hypotheses that can be tested. The hypotheses can then be either confirmed or rejected, leading to a confirmation or a revision of the theories (Bryman & Bell 2007).
We chose to use the deductive approach since it is better suitable for our purpose and the hypotheses are generated from the chosen theories which can be tested. We use quantitative data applying the APT to test the hypotheses.

3.5 Research Method

There are two main research methods in business research: quantitative and qualitative. The qualitative method entails an emphasis on non-numerical values. It is more concerned with issues of the richness, quality, and ‘feeling’ of raw data. The quantitative method focuses on the measurement and analysis of causal and effect relationships between variables. It is more concerned with issues of design, measurement, and sampling (Bryman & Bell 2007).

The research method to be adopted in this research is the quantitative method since the paper is more concerned with relationships between variables and analysis of causal using numerical data and statistics. The present study is constructed through a model of regression analysis, applying the APT model, and using the software application SPSS and Microsoft Office Excel. There are mainly three steps that are necessary for any kind of quantitative research (Studenmund 2000):

1. specifying the models or relationships to be studied
2. collecting the data needed to quantify the models
3. quantifying the models with the data

The two first steps are similar in all quantitative work. However, the techniques used in the last step can extensively differ from one discipline to another. In this paper, the chosen technique is a regression analysis based on the APT model and including different variables to measure the impact of exchange rate on stock returns. The variables involved are exchange rate, GDP, stock market index and oil price.
To be able to answer the research question, historical data from the DataStream are used. The time frame for all historical data is quarterly data between 2000-01-01 and 2007-12-31.

3.6 Limitations

Our study is limited to six multinational automobile companies from three European countries. We chose to investigate companies from the automobile industry since it is the most internationalized industry and therefore largely exposed to exchange rate fluctuations. The countries were limited to France, Germany and Sweden since, apart from Italia, they are considered to inhabit the biggest car industry in Europe. Although being aware of the exchange rate risk management employed by the companies in the sample, because of time constrains, we focus on evidence illustrating if companies face exchange rate risks or not. Further, we limited our analysis of exchange rate risk to three exchange rates, – SEK/Euro, SEK/USD and Euro/USD. This is due to the specific home currency used in the selected countries as well as the fact that all companies chosen have big interests in the North American market. The variables used in the empirical part of the study were selected after studying the theoretical framework and previous empirical evidence on this kind of topic. Finally, in this research, currency risk and exchange rate exposure were used in the same content as exchange rate risk.

3.7 Research Design

A research design is a framework for conducting and analyzing data. It details the procedures necessary for obtaining the information needed to structure or solve the research problems. There are many research design methods available, such as longitudinal design, case study design, comparative design, experimental design and cross-section design. Longitudinal is a research design to configure changes by time in business research. A cross-section design entails the collection of data on more than one case and at a single point in time in order to collect a body of quantitative or quantifiable data in connection with two or more variables. They are then examined to detect patterns of association. An experimental design is used as a yardstick against which non-experimental research is assessed. A comparative research design embodies the logic of comparison. The case study design is to detail and intense a single case or multi-cases. It
is concerned with the complexity and particular nature of the case in question. A case study can be in terms of persons, events, locations or organizations (Bryman & Bell 2007).

We decided that the case study design and the comparative design are to be used in this study. We want to know if exchange rate fluctuations have an impact on the sampled companies. Furthermore, we want to study if there is a significant difference between the companies selected from countries with different home currencies.

3.8 Choice of theories
The theory selected for our study was based mainly on two major objectives. The first is to create an understanding of how exchange rate movements can impact the stock returns of multinational companies. The second is to explain that if MNCs are exposed to exchange rate risk, they can use hedging strategies to mitigate currency risk. The intention with the theories on risk is to give a basic understanding and knowledge about what kind of risk a company might face. In this part, we focused on the currency risk since the objective of this research is investigating its impact on companies’ stock return. The theories on risk managements were selected based on the appropriate financial instruments that are used to mitigate currency risk. We finally developed some theoretical explanations on what model to be used in the empirical part and why the model is appropriate for our research. For the choice of theories we also orientated ourselves on the previous studies done on this topic. Finally, we chose theories to meet the standpoint of this study, the financial management perspective (the company perspective).

3.9 Selection of sources and criticisms
The majority of the articles used in this paper were scientific articles found in the database Business Source Premier at the library of Umeå University. Few scientific articles were primarily found through Google Scholar and thereafter tracked down to find their original sources in the database. We also used some scientific articles from the previous courses such as cash and risk management, investment and corporate governance. All these articles were published in well respected scientific journals, which are edited by known scientists in this research area. By limiting ourselves to only using
articles that were published in highly stated journals we ensure a high reliability and credibility for our own study. However, a high number of articles were published on currency risk and hedging strategies over these last decades and it is impossible to cover all studies published on this topic. Therefore, we had to limit our selection to articles that we found particularly interesting, reliable and relevant to our subject.

We are certain that we were able to meet our own high standards also with the books that we choose to cite in the present research. They all were issued by well respected publishers and the authors are known in the academic world. The information on the selected companies, their markets share and their hedging strategies, were based mainly on sources such as annual reports and the official internet homepage of the companies. Although, we believe that most information attained from official company homepages is accurate, we tried to confirm them by other sources whenever possible.

3.10 Data collection method and criticisms

There are two kinds of data: primary and secondary data. Primary data is collected by the researcher himself/herself. Secondary data refers to the data that has already been collected by someone else for a different purpose (Sanders, Lewis & Thornhill 2000). The data used in this paper is secondary data. We began our data collection by searching the Thomson DataStream at the library of Umeå University. Apart from collecting data on the stock price of each selected company, we also attained information on the oil price as well as GDP, the T-Bills, and the stock market index for each country during the time period investigated. We also collected exchange rates for the currencies of the involved countries. All the data were selected quarterly and from the same time period, from 01/01/2000 to 31/12/2007.

Although we are aware of the limitations of using secondary data, we believe that in our case they are outweighed by the advantages, most importantly, the saving in time and money resources (Sanders, Lewis & Thornhill 2000). By using the DataStream collection, we are sure of the high quality and reliability of the data used, since DataStream is a financial statistical database well respected worldwide. Another advantage of this kind of
data is that the data is permanent and available for the public (Sanders, Lewis & Thornhill 2000).

3.11 Validity

According to Bryman A & Bell E (2007), “…validity is concerned with the integrity of the conclusions that are generated from a piece of research”. To achieve high quality of a study, a research should measure what it claims to measure and there should not be any logical errors in drawing conclusions from the data. Validity is a measurement of whether the researcher is observing, identifying, or measuring the data coinciding with what he/she is supposed to do (Bryman & Bell 2007).

There are different types of validity: measurement, internal, external and ecological. Measurement validity refers to the issue of whether or not an indicator that is devised to estimate a concept really measures that concept. Internal validity deals with findings being believable. The external validity is on the other hand concerned with the findings being applicable to other contexts (Bryman & Bell 2007). External validity is therefore related to generalizing (Campbell & Stanely 1966). Finally, the ecological validity measures whether the findings are applicable to natural social environments (Bryman & Bell 2007). This paper is not concerned with external or ecological validity but rather measurement and internal validity. The findings of our study are not to be generalized since we are conducting a case study research with a specific number of companies. With this research paper, we want to know, show and explain what is going on in these particular companies based on our research question.

We are sure of the validity of the data. All the data used in this thesis are from the DataStream. They are deemed to have a high degree of reliability. The sources are highly reliable sources of information thus measuring what is supposed to measure and being as well believable.


3.12 Reliability

Reliability is concerned with the consistency of a measure of a concept. It is important that a study generate trustworthy and reliable results (Bryman & Bell 2007). There are some questions that one can use to assess reliability:

- Will the measures yield the same results on other occasions?
- Will similar observations be reached by other observers?
- Is there transparency in how sense was made from the data?

When analysing how the data were collected and used, we believe that we have reached a high reliability. We have applied reliable and transparent tools, measurements and models. The observations can easily be reached by other observers since they have been collected from a public source with a high validity and credibility. We are therefore quite sure that if other researchers use the same set of data for the same sampled companies they will come up with the same kind of results. Furthermore, our findings are consistent with previous studies done in this field as already mentioned in the theoretical framework.

The data collection and analysis (using SPSS) have been done with a careful attitude. We are therefore sure of the consistency, transparency and trustworthiness of this study.
In this section, an appropriate theoretical framework is explained and developed to give an insight and deep understanding of the paper.

4. Theoretical Framework

This section begins by explaining the risks that MNCs are exposed to. It then focuses on the exchange rate risk, illustrating its classification and covering the exchange risk management. The part ends with a theoretical model explaining the model underlying the empirical part of the paper.

Section I: Risk and Risk Management

4.1 Risk
Risk can be defined as the unexpected changes that have an adverse impact on a firm’s cash flow, value or profitability. Risks can be divided in three main categories: firm-specific risk, industry-specific risk and macroeconomic risk. Macroeconomic risk depends on the uncertainty in the environment of all companies in a country. It is a risk related to the movements in macroeconomic factors and can not usually be taken away by diversification, whereas firm-specific risk and industry-specific risk can be eliminated through an appropriate diversification (Jorion 2001). However, by using hedging strategies or insurances, firms have possibilities and capabilities to actively influence its opportunities in order to profit and/or to avoid the costs of macroeconomic variations.

To create value, companies need to take risks, but they try to avoid those risks that carry no compensating gain. Two companies are seldom exposed to the same risk. Whenever a company is running overseas business, the company is exposed to different categories of risk including commercial risk, financial risk, country risk and foreign exchange risk (Oxelheim 1984).
As illustrated above, company risk consists of two major risks: foreign exchange risk and country risk. It is difficult to separate them since they are closely related to each other. The foreign exchange risk, commercial risk and financial risk are overlapping under the country risk. A previous study of Oetzel, Bettis & Zenner (2000) points out that there are several economic factors potentially influencing a company such as national macroeconomic policies, political risk, inflation, exchange rate variability and sensitivity to global economic events. When a country's economic conditions become unstable, country risk may increase.

**4.1.1 Commercial Risk**

Commercial risk is defined as the variation in relative prices and sales volume. It occurs when a debtor becomes insolvent, unable to pay its debts or complete his/her obligation according to the established agreement (Oxelheim 1984).

**4.1.2 Financial Risk**

Financial risk is the risk related to any form of financing. It is the risk that a company’s cash flow is insufficient to meet its financial obligations. Financial risk is also the additional risk a shareholder bears when a company use debt to equity financing (Oxelheim 1984).
4.1.3 Country Risk

Country risk refers to the changes in the business environment, which adversely affect operating profits or the value of assets in a specific country. The country risk can mainly be analysed through two components that are closely connected: political risk and risk of suspended payments. For example, political factors such as regulatory changes, political stability, mass riots, civil war and other potential events contribute to companies' operational risks. However country risk is a more narrow term, which generally only refers to risks affecting all companies operating within a particular country. The country risk varies from one country to another. Normally, a stable country with low political risk may encourage the foreign investment whereas countries with high political risk and instability may discourage the foreign investment (Copeland 2005).

4.1.4 Foreign Exchange Risk

An exchange rate can be defined as the current market price for which one currency can be exchanged for another. It is a price of, for example, how much money you have to pay with domestic money to receive a certain amount of foreign money. The foreign exchange market is where currency of one country is traded for the currency of another. Foreign activities are said to be an important source of exchange rate exposure (Copeland 2005).

So what is foreign exchange risk? According to Shapiro (2006), foreign exchange rate exposure can be defined as “… a measure of the potential changes in a firm’s profitability, net cash flow and market value because of a change in exchange rates”. Exchange rate movements occur when a firm is operating internationally, involving foreign currency other than the home currency. Exchange rate exposure is thereby a measure of the sensitivity or the risk of the home currency values of assets, liabilities and cash flows because of the changes in the exchange rate. As a result it will bring the changes, gain or loss, in the company’s future economic value. The extent of exchange rate fluctuation will change the company’s foreign currency position; influence its firm value and its competitive advantage in the industry.
In a theoretical framework, the link between exchange rates movements and stock returns depend upon a number of factors such as a firm’s or industry’s ratio of the net foreign revenues and total revenues, risk management practices and the degree of exchange rate pass-through (Hartmann & Pierdzioch 2007).

4.2 Classification of Foreign Exchange Risk

To get an overall understanding of the target company’s exchange rate risk, it is crucial to define and classify the exchange rate exposure further. There are three main categories of foreign exchange risk: transaction exposure, translation exposure, operating exposure.

4.2.1 Transaction Exposure

Transaction exposure results from the business transactions. It is the gain or loss associated with the settlement of business transaction, contractually binding future cash inflows or/and outflows denominated in different foreign currencies. Due to the change of exchange rates between now and the settlement of these transactions in the past, the value of their associated foreign currency cash flows fluctuates along with these changes, leading to currency gains or losses (Eiteman 2007).

There exist four possibilities by which transaction exposure may arise (Eiteman 2007):

- When prices are stated in foreign currencies and the firm decides to purchase or sell goods or services.
- When borrowing or lending funds while contractual agreements on repayment are to be made in a foreign currency.
- When becoming a party to an unimplemented foreign exchange forward contract.
- When incurring liabilities or acquiring assets which are denominated in foreign currencies.

4.2.2 Translation Exposure

Translation exposure, also termed as accounting exposure, arises when financial statements of a foreign subsidiary are translated into the parent company’s domestic currency for the purpose of consolidating the financial reporting. The company’s
liabilities, revenues, expenses, gains and losses which are denominated in foreign currencies will therefore vary because of the exchange rate fluctuations.

### 4.2.3 Operating Exposure

Operating exposure is the possibility that the long-term net present value of a firm’s expected cash flows will change due to unexpected changes in exchange rates. It measures the extent to which currency fluctuations can alter a company’s future operating cash flows, that is, its future revenues and costs. Operating exposure arises when companies operate abroad for example through new-product development, distribution network, foreign supply contracts, or production facilities. Operating exposure may also occur from cash flow risks which will impact on revenues and costs, future profitability and market value.

### 4.3 Exchange Rate Risks Management: Hedging Strategies

An important issue for executives is to identify, evaluate and control the risks and uncertainties a company faces. Managers are more and more being called upon to meet financial obligations and expectations, manage risks and increase the shareholder value. Again, companies are not only accountable to their investors but also to a large range of stakeholders. As a consequence, executives are also protecting companies from financial distress to please stakeholders (Wheeler & Sillanpaa 1997). Still, empirical evidence has shown that hedging motives are strongly related to shareholders’ interest rather than to the stakeholders’ interests (Joseph & Hewins 1997).

Compared to companies operating only in domestic markets, exchange rate volatility represents an additional risk factor for companies wanting to operate internationally. Therefore, it is vital to examine whether hedging the exchange rate risk is worthwhile and to what extent. Enterprise Risk Management (ERM) is one of the methods implemented by firms to manage risks and uncertainties by using both insurance and financial instruments (Neil 2000). Numerous internal and external hedging techniques are used by MNCs to minimize the impacts of exchange rate and interest rate fluctuations on assets and liabilities (Solomon & Cardiff 2000). Without proper management of exchange rate risk, direct loss (as a result of unhedged exposures) and indirect loss in the firm’s assets
and liabilities, turnover, profitability and stock market value may take place (Oxelheim 1984). The influence of exchange rate risk might raise the cost of capital and lower the optimal debt ratio for MNCs affected by changes in the exchange rate (Eiteman 2001).

Evidence from George and Eli (2001) by using a sample of S&P 500 nonfinancial firms supports that firms use foreign currency derivatives to protect themselves from unexpected exchange-rate movements. Firm value and cash flow are sensitive to the movement of exchange rates. As a consequence, with the appropriate hedging strategies and financial instruments, firms could significantly reduce the exchange rate exposure that companies are facing. Many methods have been used in order to effectively manage the currency risk including multi-currency diversification, currency swaps, and hedging via forwards, futures and options. Choosing an appropriate hedging tool depends upon a number of factors including the type of currency exposure (transaction, translation or economic risk) the size of the firm, the industry effect, the risk preference of the manager or the firm and his/her familiarity with the available financial instruments and techniques. Furthermore, the chosen hedge instruments should match the risk profile of the underlying currency position as closely as possible (DeMaskey 1995). Thus, firms have the ability to hedge away their exchange rate exposure, implying a zero correlation between stock price of return and exchange rate (Nydahl 1999).

4.4 Financial Derivative Instruments

In this paper we investigate if exchange rate fluctuations affect companies’ stock returns. If MNCs are exposed to exchange rate risk, there are possibilities that they can use hedging strategies to prevent themselves from financial losses and even increase the firm value (Klimczak 2008). To some extent, firms that use currency hedging instruments should be less sensitive to exchange rate movements than firms that do not (Hagaline & Pramborg 2006). Evidence indicates that there is a positive relationship between the firm size and its usage of derivatives. If firms are larger, they more frequently use derivatives to hedge the exchange rate risk (Grant & Marshall 1997). Allayannis and Ofek, (2001) mentioned that the proportion of abroad sales is the most important factor to determine
what kind of derivative is to be used but also import and export are other factors to be considered.

There are different derivatives instruments that can be used to hedge exchange rate risk including currency option, foreign exchange forwards currency futures and currency swaps.

4.4.1 Currency option
A foreign exchange option is a financial instrument giving the holder the right but not the obligation to buy (call option) or sell (put option) a specified amount of a certain currency transaction at a predetermined price (also called strike or exercise price) on a specified date. Option premium is required to obtain a right of contract. Thus, call options give its holder the right to buy and put options give its holders the right to sell. The owner of a call option can profit from an increasing price, whereas for the owner of a put option it is the inverse. The advantage of currency option is its flexibility to exercise the option, its lower cost than the forward, and its maximum loss (premium) that can be predicted (Bodie, Kane and Marcus 2008).

4.4.2 Foreign exchange Forwards
A foreign exchange forward is an agreement to buy or sell one currency at a certain future date for a certain price with a specific amount. It is the most common instrument used to hedge currency risk. The predetermined exchange rate is the forward exchange rate. The amount of the transaction, the transaction date, and the exchange rate are all determined in advance where the exchange rate is fixed on the day of the contract but the actual exchange takes place on a pre-determined date in the future. In major currencies, forward contracts can be available daily with maturities of up to 30, 90 or 180 days (Bodie, Kane & Marcus 2008).

A survey by Belk and Glaum (1990) indicates that the most common method used to hedge exchange rate risk is the forward contract. An empirical study of Bengt and
Pramborg (2002), also demonstrates that firms can be fully hedged with forward contracts.

4.4.3 Currency Futures

As a financial instrument, the currency future is used to reduce the exchange rate risk binding with an exchange-traded contract, specifying a standard volume of a certain currency on a specific settlement date. It has some similarities with a forward contract, but there are some differences. One of the differences is that future contracts are standardized for the amounts and the delivery date, whereas forward contract is an agreement between two parties. Another important difference is that the future contract is traded on organized exchange market, while the forward is not. Both future and forward contracts are important instruments to hedge exchange risks (Bodie, Kane & Marcus 2008). David Tien (2002) states that if a firm is involved in receiving or paying a fixed amount in foreign currency, it can hedge the transaction by using either future or forward contract. Some other studies as Dufey, G. and Srinivasulu, S. L. (1984) also indicate that forward and future contract have similar function however their application is slightly different. Evidence shows that currency forward has been the most common hedging tool, compared to currency options to hedge foreign currency exposure (Raimond & Shohreh 2007).

4.4.4 Currency Swaps

As an external hedging strategy, a currency swap is a foreign exchange transaction between two parties to exchange a given amount of one currency for another. It is frequently used as an effective method between two companies, in a situation where one company runs its activities in one currency but has to borrow money in another currency. Currency swaps are often combined with interest rate swaps. A currency swap is effective in getting cheap funds for companies. Currency swap maturities are negotiable for at least 10 years, making them a very flexible method of hedging foreign exchange exposure.
Section II: The firm, the theoretical and empirical model

4.5 The firm

A firm is an organisation that transforms inputs into outputs and earns the difference between revenues and costs. The aim of most firms is to maximize their profits or equivalently minimize its losses. A firm’s profit is given by (Carlton & Perloff 2005):

\[ \pi = p \cdot f[L, K, X] - wL - rK - qX \]  

(1)

Where \( \pi \) is the profit, \( p \) the price, \( L \) labour, \( K \) capital, \( X \) other inputs such as oil, \( w \) the wage, \( r \) the interest rate and \( q \) the cost of other inputs. If firms are selling the goods abroad, the price \( p \) is influenced by the currency exchange rate, \( e \). Thus \( e \) is expressed as for example SEK/USD.

\[ p = p^* \cdot Ex \]  

(2)

Firms constantly make strategic behaviour in order to impact the market environment and increase their profits. Thus, a firm produces only if it is beneficial to produce. The market environment encompasses several factors that might be manipulated by a firm to increase its value and avoid losses. These factors influence the market outcome such as prices, quantities, profits, etc (Carlton & Perloff 2005). According to Ross (2005) and others, there are mainly four macro-economic factors that play a significant role in explaining the return on a stock including inflation, GDP, Investor Confidence and Shifts in the Yield Curve. However, other literatures show that macroeconomic variables such as the crude oil price, the exchange rate are also to be considered, especially for companies operating abroad. It has been proved that the GDP of the foreign country where the goods are exported have an impact on the price of the goods. Thus, the GDP is reflected in the price. Since the stock market index measures a stock market for a given country, the changes in the price are captured in the stock market index. This leads us to the mathematical function:

Thus (1) becomes:

\[ \pi = p^* \cdot Ex \cdot f[L, K, X] - wL - rK - qX \]  

(3)
To analyze more closely how the exchange rate influences stock returns, a regression analysis model will be used. Empirically, the Arbitrage Pricing Theory (APT) and the Capital Asset Pricing Model (CAPM) are among the most influential theories on stock and asset pricing today. Traditionally, the CAPM relates the expected return on an asset to the expected return on the market and to the risk free rate. This model is a restricted since it only allows one variable in the function. Other models including more variables have been developed such as MFM of King (1966), the Arbitrage Pricing Theory of Ross (1976) and some others (Kumar Mishra 2004). For this research, we chose to use the APT model since it is less restrictive in its assumptions and includes several factors. According to the APT, “the expected return on an asset is a function of many factors and the sensitivity of the stock to these factors”. The APT model incorporates variables that are expected to have an impact on the expected stock return meaning that if the variables move the expected stock return will also move, thus affecting the value of the investor. Therefore, a stock return is affected by an amount of independent factors. The APT model states that there is a linear relationship between stock market returns and a number of factors. Since the trade is done in an open market the return of an investment is a function of the investment sensitivity to various common risk factors including GDP, inflation, exchange rate (Ross et Al 2005).

By using a regression analysis model, we test if exchange rate factor, as an independent variable, affect companies stock return. Other independent variables are also incorporated in the regression analysis to test they influence on the dependent variable, the stock return. The main disadvantage of the APT model is that the model does not provide any guidance or rule about which factors should be included in the equation. However, to be able to choose appropriate factors, we used the theoretical framework and empirical research indicating the importance and significance of macroeconomic variables to be considered in this kind of research. The regression analysis model does not include all the factors that can affect stock returns but rather the macroeconomic variables that are likely to have a significant influence. In our case, a number of macroeconomic characteristics thought to impact stock returns of our sample are: the exchange rate (Ex), the crude oil price in US $ (O), GDP (G) and Market Index (M) of each country. Since a firm’s profit
also represent the rate to return of that firm, stock return is also a function of the exchange rate, the oil price, the GDP and the Market index.

This can mathematically be illustrated as follow:  \( R = f(Ex, G, O, M) \)  \( \quad (4) \)

### 4.7 The empirical Model: The APT

The APT model is illustrated by the formula (Bodie, Kane and Marcus 2008):

\[
ri = rf + b1(F1) + b2(F2)... + bn(Fn)
\]  \( \quad (5) \)

<table>
<thead>
<tr>
<th>Table 1: The regression model with its variables</th>
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<tbody>
<tr>
<td>Variables</td>
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<tr>
<td>Denotations</td>
</tr>
<tr>
<td>Rate of return</td>
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<tr>
<td>Beta</td>
</tr>
<tr>
<td>Variables</td>
</tr>
<tr>
<td>Risk free rate of return</td>
</tr>
<tr>
<td>Risk Premium</td>
</tr>
</tbody>
</table>

Based on (4), the function (5) becomes:  \( ri = rf + bex(Ex) + bg(G) + bm(M) + bo(O) \)  \( \quad (6) \)

Where:  \( Ex \) is the exchange rate (SEK/EURO, SEK/USD, EURO/USD) and  \( bex \) is the sensitivity of the stock return to the movements of the exchange rate.  \( G \) is the GDP of each country and  \( bg \) is the sensitivity of the stock return to the movements of the GDP.  \( O \) is the Oil price and  \( bo \) is the sensitivity of the stock return to the movements of the Oil price.  \( M \) is the stock market index and  \( bm \) is the sensitivity of the stock return to the movements of the market index.

Generally, there will be a beta and a risk premium for every significant source of risk that can be hedged. Thus (6) can be written as:
\[ ri - rf = bex \times (Ex - rf) + bg \times (G - rf) + bm \times (M - rf) + bo \times (O - rf) \]  \hspace{1cm} (7)

- Currency fluctuations are one of these influential factors that impact both the prices and quantities of the inputs and outputs of MNCs. As a consequence, it leads to competitive advantages or disadvantages in the global market. Their cash flow changes and as a consequence the firms’ values change (Heckerman 1972; Hekman 1985). It is assumed that the volatility of the exchange rate impact stock returns: the higher the exchange rate the lower the rate of return (Matson 1996).

- Studies on how the oil price is related to the stock price show that changes in oil price strongly predict future stock market returns. A rise on oil price suggests lower stock prices and a fall in oil price infers an increase in stock prices. The predictability can be illustrated as: Stock returns have a tendency to drop after an increase of the oil price and to rise if the oil price decreases in the previous month. This has been strongly significant in many developed countries markets and in the world market index. The results are based on almost thirty years of monthly observations (Gerben Driesprong, Benjamin Maat and Ben Jacobsen 2007).

- Literatures show that stock prices tend to rise if interest rates fall, and fall if interest rates rise which is also the case for the free rate of return (i.e. T-Bills). Thus a raise in interest rate tends to make the stock price of the company slightly less attractive (Alper O 2007).

- GDP could be viewed as a stock market indicator; it leads the future direction of stock prices. GDP affects the stock market via its impact on inflation. Any significant increase or decrease in the GDP can have a huge impact on investing sentiment. Thus, if an investor believes that the economy is booming, he/she is more likely to pay more for a given stock (and vice versa) (Graham 2004). The empirical study of the Dow Jones Industrial index shows that faster economic growth presents higher stock prices for the period of 1916 to 2006 (Charles W.M & Narayanan 2007).

- A stock market index can be defined as a method of measuring a stock market as a whole. Changes in the stock market index of a particular country mostly tend to reflect and capture changes in a given company stock return operating in that stock market index.
In this part, the data are presented. This section begins with an illustration of currency movements followed by other explanatory variables.

5. Data

The data is collected from Thomson DataStream and Databases from Umeå University Library. The data used in the regression analysis are cross-sectional data, meaning that all the observations are from the same point in time (from 2000-01-01 to 2007-12-31). They are also selected from different countries:
- Country: Germany, France and Sweden;
- Companies: BMW, Audi, Peugeot, Renault, Saab and Volvo.

5.1 Currency movements

This part illustrates the movements of exchange rates over the period that we are investigating. This illustration will help us to interpret the data in the next chapter.

Figure 2: Time Plot for SEK/USD and SEK/EURO Exchange Rate Movements (the unit on the vertical axis is in SEK)

The figure above illustrates the movements of the exchange rates of the SEK/EURO and the SEK/USD for the period of January 2000 to December 2007. The green curve
indicates the movements in the SEK/USD, whereas the blue curve represents movements in the SEK/EURO. We observe that the US dollar is more unstable, volatile and dropping than the Euro. The trend in the US dollar fluctuations from January 2000 to around June 2001 shows a big depreciation relative to the SEK. Around September 2001, the US dollar appreciated dramatically as evidenced by the downward fluctuating trend. From January of 2005, the US dollar took an upward fluctuating trend but falls again right after the first quarter of 2006. The euro appears to be fairly stable right after the fourth quarter of 2001 to December 2005. However, it depreciates against the SEK from around January 2000 to 2002 as we observe an upward move against the SEK. The Euro exhibits more stability than the USD.

**Figure 3**: Time Plot for EUR/USD Exchange Rate Movements (the unit on the vertical axis is the euro)

5.2 Oil price Movements

The crude oil price used is in the regression model is the spot priced of various barrels of oil.

**Figure 4:** Time plot for oil price (In USD) movements

From 2000 to the third quarterly of 2004, oil price was between 20 to 40 US dollars per barrel. After that, oil price increases tremendously with fluctuations going up and down. In the end of 2007, the oil price was around 80 US dollar per barrel.

5.3 GDP Movements

We collected the GDP data for each country. The GDP used in the regression analysis depended on the home country of the company. Based on the data collected from DataStream, we observe that GDP for France, Germany and Sweden have been growing over the last decades (see appendix 3). The GDP measures a country's total aggregate output of economy.
5.4 Stock Market Index Movements

The stock market indexes for the three countries show almost the same trend. Stock market indexes are high in the beginning of 2000 and begin to fall in the end of that year. It reaches a very low value between approximately the third quarters 2002 to the second quarter 2003 and then begins to rise again until 2007 (see appendix 4).
In this section, we present the findings of our research.

6. APT Model and regression analysis

In this part the results of how exchange rate fluctuations impact a MNC stock return are presented for the six selected companies. We used the APT model, as a multiple regression analysis. As mentioned before, the dependent variable is the stock return of each company and the explanatory variables are: market index, GDP, Exchange rate and Oil Price.

The formula applied is the following is the formula (7) that we develop in the previous chapters:

\[ r_i - rf = b_{ex} (Ex - rf) + b_{g} (G - rf) + b_{m} (M - rf) + b_{o} (O - rf) \]

Table 2: Regression of changes in all variables at 0.05 levels

<table>
<thead>
<tr>
<th>Company</th>
<th>Percentage changes in independent variables – risk-free rate</th>
<th>Standardized coefficients</th>
<th>t</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volvo</td>
<td>(constant)</td>
<td>1,688</td>
<td>0,104</td>
<td></td>
</tr>
<tr>
<td></td>
<td>% change in index - rf</td>
<td>0,777</td>
<td>4,437</td>
<td>0,000</td>
</tr>
<tr>
<td></td>
<td>% change SEK/USD - rf</td>
<td>-0,075</td>
<td>-0,243</td>
<td>0,810</td>
</tr>
<tr>
<td></td>
<td>% change SEK/EUR - rf</td>
<td>0,410</td>
<td>0,502</td>
<td>0,620</td>
</tr>
<tr>
<td></td>
<td>% change in GDP - rf</td>
<td>-0,257</td>
<td>-0,319</td>
<td>0,753</td>
</tr>
<tr>
<td></td>
<td>% change in oil price - rf</td>
<td>0,052</td>
<td>0,435</td>
<td>0,667</td>
</tr>
<tr>
<td>SAAB</td>
<td>(constant)</td>
<td>1,272</td>
<td>0,215</td>
<td></td>
</tr>
<tr>
<td></td>
<td>% change in index - rf</td>
<td>0,551</td>
<td>2,523</td>
<td>0,018</td>
</tr>
<tr>
<td></td>
<td>% change SEK/USD - rf</td>
<td>0,255</td>
<td>0,665</td>
<td>0,512</td>
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<tr>
<td></td>
<td>% change SEK/EUR - rf</td>
<td>-0,398</td>
<td>-0,391</td>
<td>0,699</td>
</tr>
<tr>
<td></td>
<td>% change in GDP - rf</td>
<td>0,317</td>
<td>0,315</td>
<td>0,756</td>
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<tr>
<td></td>
<td>% change in oil price - rf</td>
<td>-0,115</td>
<td>-0,765</td>
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</tr>
<tr>
<td>Peugeot</td>
<td>(constant)</td>
<td>0,845</td>
<td>0,406</td>
<td></td>
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<td></td>
<td>% change in index - rf</td>
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<td></td>
<td>% change EUR/USD - rf</td>
<td>0,105</td>
<td>0,431</td>
<td>0,670</td>
</tr>
<tr>
<td></td>
<td>% change in GDP -rf</td>
<td>0,162</td>
<td>0,652</td>
<td>0,520</td>
</tr>
<tr>
<td></td>
<td>% change in oil price -rf</td>
<td>0,133</td>
<td>1,013</td>
<td>0,320</td>
</tr>
</tbody>
</table>
The table above sums up the results obtained from fitting the regression model and using SPSS with the data collected. A close look at those specific parameters for different companies give us details to analyze how each independent variable impacts each firm’s stock returns. We decide to use 5% or 0.05 as our critical alpha value or significance level and it can be denoted by the Greek letter $\alpha$. Statistically, the significant data refers to P-values. If an obtained P-Value is less than the chosen $\alpha$ level of 0.05, the P-Value is significant. As a consequence, we conclude that the concerned independent variable is a significant factor when explaining the changes in a given company’s stock return and the betas provide the sensitivity of the movements.

In order to find any multi-co linearity relationship between the independent variables of each regression analysis of the selected company, a correlation matrix was produced (see appendix 2). We wanted to test if variables do not account for the same information in the regression analysis. For Swedish companies, we find that the SEK/USD exchange rate and the SEK/EURO exchange rate were highly correlated. We therefore tested the regression analysis without one of the exchange rate. However, the results remained the
same and we therefore chose to incorporate both exchange rates. For French companies, the GDP and the EURO/USD exchange rate were highly correlated. We could not test the regression analysis by excluding the exchange rate variable since this research is focusing on it. We therefore exclude the GDP but the results also remained the same. We therefore chose to have both variables in the regression analysis. For German companies, EURO/USD exchange rate and the GDP were found to be correlated but not at the same level as the above correlations.

6.1 Exchange rate

For Swedish automobile companies, Volvo and Saab, we used two exchange rates, the SEK/USD and the SEK/EURO. For these two companies, the results show that there is not a significant relationship between their stock return and the two explanatory variables. The p-values are above the 5% significance level and therefore not significant. Based on the betas values, we observe that Volvo stock return is negatively related to movements in SEK/USD whereas it is positively related to SEK/EURO. On the other hand, Saab stock return is positively related to movements in SEK/USD and positively related to SEK/EURO. For example, the beta can be interpreted like in this way: when the SEK appreciates by 1%, Volvo stock return will increase with 0.075% (and so on).

For the French and the German companies, only the EURO/USD exchange rate was used as a currency variable. Beginning with the French companies, Peugeot and Renault provide almost similar results. The findings indicate that the relationship between EURO/USD exchange rate and companies’ stock returns is not significant at the 5% level. The betas values show a positive linkage between the EURO/USD exchange rate and the companies’ stock returns.

For the German Companies, the results indicate that that there is no significant relationship between Audi stock return and the EURO/USD exchange rate at the 5% level of significance. However, BMW presents a different scenario from all the companies; the p-value indicates that there is a significant relationship between the BMW stock return
and the EURO/USD exchange rate. This means that fluctuations in the EURO/USD will lead to movements in BMW’s stock returns.

6.2 Market Index return

From the above table, it is clear that the stock return of all six companies, except Audi, has a significant P-value with the parameter of market index return. All the beta values are positive, pointing out a positive relationship between stock market index return and stock return for each company. An increase of market index return leads to an increase of the stock return of that company. Among those companies, we can see that BMW has the highest beta value, 0.781, meaning that BMW stock return is highly sensitive to fluctuations in market index return. Audi has the lowest beta, 0.330, showing that Audi stock return is least sensitive to changes in market index return.

6.3 GDP

For all companies, the p-values are higher than 5 % level of significance. It indicates that the relationship between stock return of each company and the GDP for the home country of each company is not significant at the 5% level of significance. The beta values for Volvo, Renault and BMW illustrate a negative linkage. This means that if the GDP goes up, the stock return of these companies goes down. For Saab, Peugeot and Audi, the beta values represent a positive linkage between the stock return and the GDP; meaning that if the GDP goes up the company’s stock return goes also up.

6.4 Oil price

The relationship between Oil price and each company’s stock return is not significant at the 5 % significance level since all P-values are above 0.05. Except Saab, all other five companies present a positive linkage between oil price and companies’ stock returns. This means that if the oil price goes up these companies’ stock return will go down. The beta value of Saab presents a negative linkage between oil price and stock return.
6.5 R square value for the selected companies

Table 3: R square value

<table>
<thead>
<tr>
<th>Company</th>
<th>R</th>
<th>R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volvo</td>
<td>.815</td>
<td>.663</td>
<td>.1134388</td>
</tr>
<tr>
<td>Saab</td>
<td>.69</td>
<td>.476</td>
<td>.1186382</td>
</tr>
<tr>
<td>Peugeot</td>
<td>.785</td>
<td>.616</td>
<td>.1000269</td>
</tr>
<tr>
<td>Renault</td>
<td>.738</td>
<td>.544</td>
<td>.1385793</td>
</tr>
<tr>
<td>BMW</td>
<td>.856</td>
<td>.734</td>
<td>.0871836</td>
</tr>
<tr>
<td>Audi</td>
<td>.540</td>
<td>.292</td>
<td>.2159493</td>
</tr>
</tbody>
</table>

Statistically, R square represents the proportion of the variability in one series that can be explained by the variability of one or more series in a regression model. The above table illustrates the R value for all the selected companies. $R^2$ measures correlation between the dependent and the independent variables. $R^2$ is therefore a statistic measurement that provides information about the goodness of fit of a model. The value of $R^2$ is between 0 and 100%. If $R^2$ is 1 (100%) the regression line perfectly fits the data. Consequently, the higher the value of $R^2$ the better is the fitness of the model.

Four out of six companies represent an $R^2$ above 50%, meaning that more than 50% of the variations of these companies’ stock returns account for variations in the explanatory variables. BMW represents the highest 0.734; illustrating that the variations in explanatory variables explain 73.4% of the variations in the BMW stock return while the remaining 26.6% are accounted for other variables not included in the model.
In this part, we analyse and discuss the results based on other parts of this paper. We divided this part based on the explanatory variables.

7. Analysis and Discussion

7.1 Exchange rate

Looking across all the companies, we observe that BMW is the only company where the stock return is significantly affected by both the short run movements in Euro/USD exchange rate. The sensitivity is positive, meaning that if for example the Euro depreciates by 1%, BMW’s stock return increases with 0.37% and vice versa. The finding is consistent with what the chairman of BMW announced in the news, stating that segment earnings were adversely affected by exchange rate movements. The weakness of the dollar has had a big impact on the company’s value. According to Stefan Nydahl (1999) the level of foreign sales/total sales significantly raises currency exposure. Additionally, exports and imports together with foreign investing and speculations are proved to lead to exchange rate exposure. This seems to be the case for BMW, since the US market represents the second most important market after the domestic market. Furthermore, Germany is one of the most open economy in Europe where import and export represent respectively 31.2% and 35.8% (www.exportgermany.com). Thus, the company might be more exposed to exchange risk due to its large exporting activity compared to the other investigated companies. However, this might also be an indication that the company is not using the appropriate hedging strategy to mitigate currency risk since the company still faces losses due to the movements in the Euro/USD exchange rate (for the period investigated). As mentioned in the theory section, several articles in the literature have stated and proved that hedging techniques can be used by MNCs to minimize the impacts of exchange rate movements on assets and liabilities. When analysing the BMW annual report of 2007, we found that the hedging strategies were not clearly explained. This makes it very difficult for us to analyse the results further.

Based on both the short and long run, currency movements of the exchange rates SEK/USD and Euro/USD (see figure 2 and 3), should be expected to impact significantly the stock returns of companies involved with businesses using largely these currencies. We observe that these currency exchange rates are very volatile. However, our results
indicate that SEK/USD and Euro/USD exchange rate movements were not able to explain movements in the companies’ stock returns for the remaining five companies (Saab, Volvo, Renault, Peugeot and Audi). Compared to the SEK/USD and Euro/USD, The SEK/Euro exchange rate appears to be stable. The small fluctuations of the SEK/euro did not either have an impact on the Swedish companies. There are many reasons why this could be the case. Based on the annual reports of these companies from 2007, several hedging strategies have been used to mitigate currency exchange rate movements. This might indicate that these companies are good in hedging since the movements in exchange rates do not significantly affect their stock returns. For instance, the Volvo Group’s currency risk management is applying financial instruments, such as forward contracts and currency options, to hedge the value of future payment flows in foreign currencies to reduce the short-term adverse effects. We found that most of these companies use hedging strategies, such as currency swaps and foreign exchange forwards. According to Abe de Jong, Jeroen Ligterink and Victor Macrae (2006), due to the fact that most companies have already protected themselves against exchange rate risk by using different hedging strategies, it is difficult to capture exchange rate exposure. We think might also be one of the reasons explaining why we did not find any significant linkage between stock returns and exchange rates for 84% of the investigation companies.

Although, Sweden is not part of the Euro zone, we were not able to find any significant difference between how the Swedish companies stock returns are affected by exchange rate movements compared to the French and German companies. This might be explained by the overall more stable value of the SEK towards the Euro compared to the US dollar. By analysing the annual reports (Volvo 2007 and Saab 2006) of Swedish companies, we found that the companies were almost using the same financial derivatives to mitigate currency risk as the one used by French and German companies. We think that this might also be an indication that Swedish companies are able to hedge effectively the additional risks that they might face when being outside the euro zone.
7.2 Oil price

The oil price is known to be inversely related to stock returns of companies which depend on oil as a basic substance for their product like cars. For the selected companies of this study however, the results did not indicate any significant linkage between stock return and oil price. The reason for this might be that by using the quarterly data, we were not able to capture the strong movements of oil price. This might have been possible, if these two variables were estimated from half year data. As observed in the data presentation, the oil price has been increasing, especially since 2003. This should have lead to a decrease in companies’ stock returns. However, we did not observe this since the linkage between stock return and oil price was too weak. Furthermore, based on the betas, we observe that five of the six companies indicate a positive relationship between oil price and stock returns. Meaning that if oil price goes down stock returns goes down (and vice versa). This is the contrary to some previous studies, which indicate that a fall in oil price should infer an increase in stock prices.

7.3 GDP

The GDP is expected to be positively related to stock returns meaning that faster economic growth presents higher stock prices (and vice versa). As we can observe on graphs of GDP for France, Germany and Sweden, the GDP have been increasing from 2000 to 2007. However, our results did not indicate any significant relationship between GDP and stock returns for the selected companies. One explanation could be that the effects of GDP are already incorporated in the movements of the stock market index factor. In the automobile industry section, we illustrate how the selected companies are exporting their products abroad and have plants in different countries. Thus, these companies have a big fraction of exports but also some importing activities. This might lead to the fact that their stock returns may not only be sensitive to the GDP of the home country, but also to the GDP of the importing (and exporting) countries. Therefore, by including only the GDP of the home country, we were not able to capture the impact of GDP.
7.4 Stock market Index

The stock market index is expected to be positively related to stock returns, thus a rise in stock market index should also increase a given company’s stock return (and vice versa). Previously, we observed that there is a linear dependence between stock return and stock market index for all the selected companies except Audi. Based on the regression analysis, the stock market movements explain the movements of the stock returns of five out of the six companies (Volvo, Saab, Peugeot, Renault and BMW). The beta values for all the companies are positive, which is in accordance with the literature stating a positive linkage between the two variables. Among all the explanatory variables, the stock market index factor was the only one that captures the movements of 84% of the selected companies at the significance level of 5%. We think that this can be explained by the fact that the stock market index is a factor that most of the time captures the changes in most of the macroeconomic variables.
In this section, we embody the summary of empirical findings. The conclusion and recommendation are provided and connected to our research question and existing theory. Also it brings identified areas for further research.

8. Conclusion and Recommendations

8.1 Conclusions and Recommendations

This research is investigating if movements in exchange rates affect stock market returns of six selected European automobile companies by applying the APT model. It also studies if there is any difference on how exchange rate movements impact Swedish automobile companies compared to French and German companies. A multiple regression model is used to incorporate other significant macroeconomic variables such as GDP, market index and oil price.

The data collected indicates that the SEK/USD and the Euro/USD exchange rates were fluctuating greatly compared to the SEK/Euro exchange rate. However, results from the regression analysis revealed that fluctuations in all the three exchange rates were not affecting the stock market returns of five out of the six investigated companies. For the Swedish companies, Saab and Volvo, we analysed the SEK/Euro and SEK/USD exchange rates and found that the linkage to their stock returns was not statistically significant. The same outcomes were observed for the French companies, Renault and Peugeot; and one of the German companies, Audi when investigating the impact of the Euro/USD exchange rate movements on the companies’ stock returns. In our theoretical framework, we mentioned some reasons explaining why results from earlier studies showed no significant linkage between stock market returns and exchange rates. One of these reasons was that hedging strategies applied by the companies might be successful leading to the difficulty of capturing exchange rate risks faced by these companies. We think that this might have been the case in our outcomes. Since the results did not reveal that these companies’ stock returns were affected by the volatility of exchange rates, we believe it will not be necessary to provide recommendations on their hedging strategies.

In contrast to other companies, BMW stock returns were significantly affected by the changes in Euro/USD exchange rate. This might be an indication that BMW was not
applying the appropriate hedging strategies to mitigate currency risk in the period investigated. For the future, our recommendations for BMW would be to improve its risk management to mitigate exchange rate risk.

By linking to the prior assumption, we asserted that the volatility of exchange rate does exert additional risk for the Swedish automobile companies compared to French and German companies. However, our findings show that there is no significant difference between the two. When analyzing the annual report of Swedish companies we found that they were using almost identical financial derivatives to hedge currency risk as the one used by French and German companies. Even though Swedish companies, being outside the euro zone, might face additional currency risks compared to French and German companies, they seem to be able to circumvent these risks so effectively that their impact is not significant. Hence, Swedish companies, like French and most German automobile MNCs, seem to use the same type of financial instruments.

In the regression analysis, this paper further included three more important macroeconomic variables like: GDP, market index and oil price. GDP and oil price factors did not show any significant relationship with stock returns of all six companies. However, the market index explanatory variable showed a significant impact on stock return to all six companies.

8.2 Further Research

As mentioned in our earlier parts, most of the previous studies about the linkage between exchange rate and stock market return were done on the USA and Asian firms; and less were done on the European firms. We think that further research on European companies from different industry should be done to give a more complete picture. This might help executives to see the impact of exchange rate fluctuations on firm’s value and thereby provide some suggestions about how European firms from different industries could use financial derivatives to hedge exchange rate exposure if necessary.
Some articles provided reasons behind the fact that most of the studies are showing no significance linkage between exchange rate and stock return. One of the reasons was that the data used was already including hedging strategies, making difficult to capture the impact of exchange rate volatility on stock return. We think that it would be interesting to study this topic using data that does not include hedging activities to see if it provides different outcomes.

This paper analyzes the impact of macroeconomic variables on a company’s stock returns. The macroeconomic variables studies were GDP, market index, oil price with a focus on exchange rate. It will be challenging and interesting to know the impact of other variables such as political risk and natural catastrophe on firm value.

These suggestions will not only benefit our understanding but also enable us to think about new applications that will facilitate future studies. Companies will also benefit from the findings when designing enterprise risk management or hedging strategies for MNCs.
References

Books


Articles


Internet:


http://report.conti-online.com/en/02_corporate_profile/chapter_2_11_en.html

http://www.autozine.org/Manufacturer/France.htm

http://www.volvo.com

http://www.saab.com

http://www.Peugeot.com

http://www.renault.com

http://www.bmw.com

http://www.audi.com

http://www.xwheeler.co.uk/used-renault.aspx
http://www.exportgermany.com

Other Sources
Volvo Annual Report 2007
Saab Annual report 2006
Renault Annual report 2007
PSA Peugeot Citroen Annual report 2007
BMW Annual Report 2007
Audi Annual Report 2007
Appendix 1: Regression analysis for the six companies

A. Volvo

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<th>Variables Removed</th>
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a  All requested variables entered.

b  Dependent Variable: RmTVol

Model Summary

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<th>Adjusted R Square</th>
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ANOVA(b)

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a  Predictors: (Constant), F4OilUS, F1indexSwe, F2ExSweEuro, F2EXSweUS, F3GDPSwe

b  Dependent Variable: RmTVol

Coefficients(a)

<table>
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<th>Standardized Coefficients</th>
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<th>Sig.</th>
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<td>Beta</td>
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a  Dependent Variable: RmTVol
B. Saab

Variables Entered/Removed(b)

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a Predictors: (Constant), F4OilUS, F1indexSwe, F2ExSweEuro, F2EXSweUS, F3GDPSwe

ANOVA(b)

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Coefficients(a)

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b  Dependent Variable: RmTPeu

### Model Summary

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a  Predictors: (Constant), F3GDPFr, F4OilUS, F1indexFr, F2ExEuUs

### ANOVA(b)

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a  Predictors: (Constant), F3GDPFr, F4OilUS, F1indexFr, F2ExEuUs

b  Dependent Variable: RmTPeu

### Coefficients(a)

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a  Dependent Variable: RmTPeu
D. Renault

Variables Entered/Removed(b)

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a All requested variables entered.
b Dependent Variable: RmTRenault

Model Summary

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a Predictors: (Constant), F3GDPFr, F4OilUS, F1indexFr, F2ExEuUs

ANOVA(b)

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a Predictors: (Constant), F3GDPFr, F4OilUS, F1indexFr, F2ExEuUs
b Dependent Variable: RmTRenault

Coefficients(a)

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a Dependent Variable: RmTRenault
### Variables Entered/Removed(b)

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a. All requested variables entered.
b. Dependent Variable: RmTBMW

### Model Summary

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a. Predictors: (Constant), F1indexGer, F4OilUS, F3GDPGer, F2ExEuUs

### ANOVA(b)

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a. Predictors: (Constant), F1indexGer, F4OilUS, F3GDPGer, F2ExEuUs
b. Dependent Variable: RmTBMW

### Coefficients(a)

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a. Dependent Variable: RmTBMW
F. Audi

Variables Entered/Removed(b)

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a All requested variables entered.

b Dependent Variable: RmTAudi

Model Summary

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a Predictors: (Constant), F1indexGer, F4OilUS, F3GDPGer, F2ExEuUs

ANOVA(b)

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a Predictors: (Constant), F1indexGer, F4OilUS, F3GDPGer, F2ExEuUs

b Dependent Variable: RmTAudi

Coefficients(a)

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<th>Sig.</th>
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a Dependent Variable: RmTAudi
Appendix 2: Correlation between independent variables

### Correlations for Volvo and SAAB

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<td>.585(**)</td>
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<td>.001</td>
<td>.000</td>
<td>.896</td>
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<td>31</td>
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<td>,585(**)</td>
<td>1</td>
<td>.924(**)</td>
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<td>.924(**)</td>
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<td>.985(**)</td>
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** Correlation is significant at the 0.01 level (2-tailed).

### Correlations for Peugeot and Renault

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** Correlation is significant at the 0.01 level (2-tailed).

- Correlation is significant at the 0.05 level (2-tailed).

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66
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* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed)
Appendix 3: GDP movements for France, Germany and Sweden

A. GDP: Sweden

B. GDP: France and Germany
Appendix 4: Stock market index movements

A. Stock market index: Sweden

B. Stock market index: Germany
C. Stock market index: France

![Graph showing the stock market index for France from Q1 2000 to Q4 2007](image_url)