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Exchange rate exposure in Swedish firms

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Abstract

Title: Exchange rate exposure in Swedish firms.

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Research questions: Does the exchange rate influence the value of the stocks in a company? Is the model obtained by Doukas, Hall and Lang's applicable to the Swedish market? Which further factors, except stock value and exchange rate, should be included in the model to give an accurate result? Does the level of foreign involvement matter? Are the results obtained in this thesis going to differ from the results obtained by Doukas, Hall and Lang's for the Japanese stock market?

Purpose: The purpose of this paper is to apply the model in Doukas, Hall and Lang's paper (2003), in order to analyze the exchange rate exposure of Swedish firms. Further, we will examine if the foreign involvement and the market value of the firm affect the results.

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Methodology: We started with understanding the model and the theory applied in this thesis. The assumption, that the same macroeconomic factors applied to the Japanese market also was applicable to the Swedish market, was made. Before performing the regression we had to gather a great amount of data, which consisted of 78 stocks and a time period of ten years, 1995 – 2004. The regression was performed using Ordinary least square. In addition, a

classification was made in order to evaluate differences between multinationals, high-exporting, low-exporting and domestic firms.

Conclusions: We did not find enough evidence to state that Swedish stock values, in general, are sensitive to fluctuations in exchange rate. This conclusion is built upon the result that only six to seven percent of the stocks had a significant coefficient in front of the unexpected exchange rate movements. It is difficult to come to a conclusion regarding the different results obtained for the kronor/dollar exchange rate and the trade-weighted exchange rate, in addition to the different level of exports. The reason for the result could more be a question of randomness, because of the low number of firms with a significant coefficient in front of the unexpected exchange rate movements.

Key words: Exchange rate, firm value, risk management, stock value.

Words of importance

Small Cap

Refers to stocks with a relatively small market capitalization i.e. the number of shares times the current market price. The definition of small cap can vary among brokerages, but generally it is a company with a market capitalization of between $300 million and $2 billion.[1]

Large Cap

Companies having a market capitalization between $10 billion and $200 billion.[2]

Value stock

A stock that is considered to be undervalued by a investor. Common characteristics of such stocks include a high dividend yield and a low price-to-book ratio.[3]

Price-To-Book Ratio, P/B

A ratio used to compare a stock's market value to its book value. It is calculated by dividing the current closing price of the stock by the latest quarter's book value, i.e. assets minus liabilities.[4]

Efficient Market Hypothesis, EMH

An investment theory that states that it is impossible to "beat the market" since prices already include and reflect all relevant information.[5]

Bilateral exchange rates

This exchange rate relates to two countries' currencies. Usually, it is a result of matching demand and supply on financial markets or in banking transaction, usually with the central bank as one side of the relationship. Some bilateral exchange rates may be computed from triangular relationships. For example if the kronor/dollar exchange rate is 10 and the

[1] http://www.investopedia.com, 2005-03-13
[2] http://www.investopedia.com, 2005-03-13
[3] http://www.investopedia.com, 2005-03-13
[4] http://www.investopedia.com, 2005-03-13
[5] http://www.investopedia.com, 2005-03-13

yen/dollar is 100 then, one krona is worth 10 yen. Hence, no direct kronor/yen transaction needs to take place. If there exist a financial market for kronor to be exchanged with yen, no-arbitrage will bring the parity to 10 yen per krona. [6]

Multilateral / trade-weighted exchange rates

The multilateral exchange rates are computed in order to judge the general dynamics of a country's currency toward the rest of the world. A basket is constructed by different currencies with a set of relative weights. Then the effective exchange rate, of that country's currency, is computed.[7]

[6] http://www.economicswebinstitute.org/glossary/exchrate.htm, 2005-03-23
[7] http://www.economicswebinstitute.org/glossary/exchrate.htm, 2005-03-23

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1. Introduction

The objective with this chapter is to provide the reader with a background and comprehension for this thesis. The introductory background is followed by the problem discussion that leads into the purpose. Furthermore the chapter contains selected delimitations, target audience and the thesis' disposition.

1.1 Background

In order to forecast the stock market many analyst rely heavily on forecasts of macroeconomic variables, such as GDP, interest rates and the rate of inflation, which are all difficult to predict accurately.[8] Another important macroeconomic factor that may influence the value of the stock, on the market, is the exchange rate.

A devaluation of the currency can have a positive or a negative effect on the stock value in a company, depending to some extent on firm, industry and macroeconomic effects. If the company is a heavily net exporter it would then expect to gain from a home currency devaluation, because their products would become cheaper and more competitive. On the other hand, if the company is a heavily net importer it would then expect the costs to raise and may have to compete with cheaper imported goods and this would lead to a decrease in stock value.[9]

For example, if a country with a trade deficit experiences a devaluation of its home currency the import prices rise and due to this domestic inflation will also rise. The combination of these effects will reduce the real wealth of the domestic economy. The consequence will be a fall in stock price given a home currency depreciation. On the other hand, the devaluation should make domestic goods more competitive abroad. The real effect on the stock price is determined by which effect the market thinks will dominate.[10]

[8] Z Bodie, A Kane and A Marcus (2004), Essentials of investment
[9] Priestley Richard, Ødegaard Bernt Arne, Exchange rate regimes and exchange rate exposures
[10] Priestley Richard, Ødegaard Bernt Arne, Exchange rate regimes and exchange rate exposures

One of the most important changes on the financial market during the late twenties century was the continuously increase in the companies' use of derivatives. In order to manage the exposure of the exchange rate risks the firms started to use swaps, options together with other more complex instruments, to a much greater extent.[11]

There are several studies made on different markets in order to evaluate the exchange rate's influence on the value of the stocks. Most of these studies can not show a significant effect of the exchange rate on firms' value. However, Doukas, Hall and Lang (2003) perform an empirical study on the Japanese market, which shows significant exchange rate exposures both at the firm and the industry level. The study is based on a new approach. This is therefore interesting to apply this approach to evaluate the exchange rate exposure of the Swedish firms.

1.2 Problem discussion

Are there any relation between the exchange rate and the firm value on the Swedish market? How does the model obtained by Doukas, Hall and Lang function? Is it applicable to the Swedish market? In order to only measure the exchange rate exposure to the stock value, other macroeconomic effects must be cleared. Which are these other effects? Can the same macroeconomic variables that are applied on the Japanese market also be applied on the Swedish market?

A common assumption is that a higher level of foreign involvement also yields a higher exchange rate exposure? Can this assumption be verified in our study? Are domestic firms, with no foreign involvement, exposed to changes in the exchange rate? Does the level of exchange rate exposure to the firm value depend on the size of the company?

Will the results differ from the results obtained by Doukas, Hall and Lang for the Japanese stock market?

[11] Finanstidningen (2000), Modern finansiell ekonomi

1.3 Purpose

The purpose of this paper is to apply the model in Doukas, Hall and Lang's paper (2003), in order to analyze the exchange rate exposure of Swedish firms. Further, we will examine if the foreign involvement and the market value of the firm affect the results.

1.4 Delimitations

Because of the shift in the Swedish currency policy on November 19, 1992 to a floating exchange rate[12], together with the availability of data, we have determined to start their analysis on January, 1995. In order to just include whole years in the regression the last date will be December 2004. In addition to the period of time, the reliability of the results will increase with the number of stocks included in the regression. When taking the timeframe of this thesis into consideration, we have decided to include 78 stocks in this study.

1.5 Target audience

There are two main target groups for this thesis. The first group is students and teachers at Lund School of Economics and Management and other universities. The second group is anyone with an interest in the financial field treated in this thesis.

1.6 Outline of this thesis

The thesis will in the next chapter continue with a discussion of the theory which aims to introduce the reader to necessary theories in order to follow the empirical and analytical studies. First, some theories needed to understand the model will be described and in section 2.5 we will explain the model applied by Doukas, Hall and Lang. Finally, we will go through some earlier studies that have been performed in the same field.

The empirical part of this thesis is included in chapter three. In this chapter the collection and the features of the data is described. Further, we will give the reader information about how this data has been applied in the model.

[12] http://www.riksbanken.se/templates/speech.aspx?id=1782 2005-04-01

In the two final chapters the regressions results will be discussed and interpreted followed by our conclusions.

2. Theory

We will in this chapter introduce the reader to the economic theory used in this thesis. First, some features needed to understand the model and the model it self will be described. Finally, previous studies, in the same field, are reported.

2.1 Fama and French three factor model

In order to estimate the exchange rate exposure to the firm value Doukas, Hall and Lang use a multivariate model. In addition to some instrumental variables they also apply the Fama and French financial variables. Before we describe the model in section 2.5 we therefore would like to give the reader an introduction to the financial variables. We will start with describing the Fama and French three factor model and then how to calculate the Fama and French financial variables.

2.1.1 The three factor model

To compare a portfolio with the market as a whole CAPM uses a single factor, beta. But, in many surveys Fama and French have shown that beta has a finite ability to explain differences in return between stocks. Therefore, in order to receive an improved R-squared fit, other factors are added to the regression model. One approach, like this, is the three factor model which is developed by Gene Fama and Kenneth French. [13]

Fama and French started with the observation, shown in figure 2.1, that two classes of stocks have tended to do better than the market as a whole:

(i) small caps
(ii) stocks with a high book-value-to-price ratio, called "value" stocks and their opposites are called "growth" stocks.

The two factors where then added to CAPM:

[13] Finanstidningen (2000), Modern finansiell ekonomi

$$R_{it} - R_{ft} = \alpha_{it} + \beta_{mi}(R_{mt} - R_{ft}) + \beta_{si} SmB + \beta_{vi} HmL + \varepsilon_{it}$$

Where r is the portfolio's return rate, R_{ft} is the risk-free return rate, and R_{mt} is the return of the whole stock market. The "three factor" beta is analogous to the classical beta but not equal to it, since there are now two additional factors which do some of the work. In the expression SmB stands for "small (cap) minus big" and HmL stands for "high (book/price) minus low". This means that they measure the historic excess returns of small caps and value stocks over the market as a whole. By the way SmB and HmL are defined, the corresponding coefficients β_{si} and β_{vi} take values on a scale of roughly zero to one. A small cap portfolio would have a β_{si} close to one and β_{si} close to zero would instead be large cap. A portfolio with a high book/price ratio would have a β_{vi} close to one and a β_{vi} close to zero would be a portfolio with a low book/price ratio.[14]

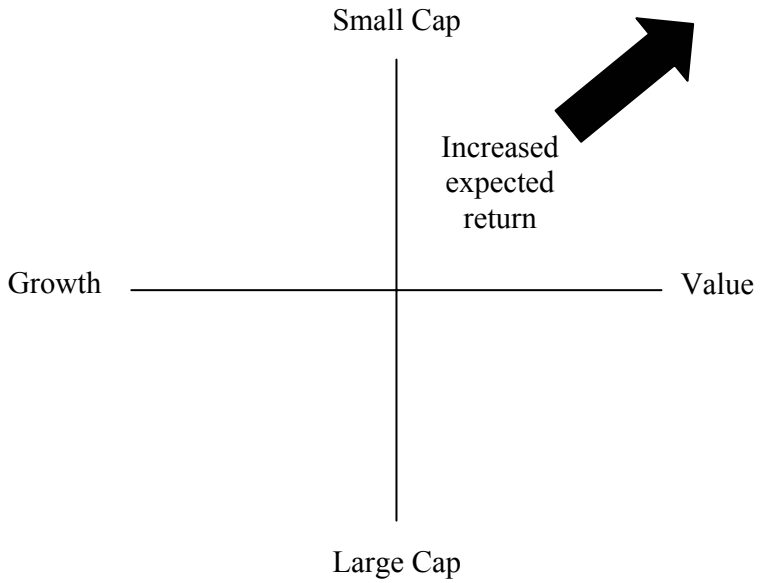

Figure 2.1 The Fama and French Model
(http://ifa.com , 2005-03-13)

Similar with CAPM Fama and French see high returns as a reward for taking on high risk. One implication of this is that if returns increase with book/price, then stocks with a high book/price ratio must be *more* risky than average. This is exactly the opposite of what a traditional business analyst would tell. The difference comes from whether the efficient market theory is adapted. The business analyst would state that a high book/price indicates a

[14] Fama and French (1996), Multifactor explanations of asset pricing anomalies

buying opportunity since the stock then looks cheap. But if the efficient market theory is adapted a cheap stocks can only be cheap for one reason, investors think that they are risky.[15]

2.1.2 The Fama and French financial factors[16]

The Fama and French financial factors are constructed using six value-weight portfolios shown in table 2.1. The portfolios are formed on the size, market equity (ME), and the sizes are *small* and *big*. In addition to size the portfolios are formed on the book-to-market value (BE/ME) of the company and the different groups are *value*, *neutral* and *growth*. The portfolios are constructed at the end of June each year. The median ME for year t is the median NYSE market equity at the end of June of year t. BE/ME for June of year t is constructed by dividing the book equity for the end of the last financial year in t-1 by ME for December of year t-1. The BE/ME breakpoints are then the 30th and 70th NYSE percentiles.

	Median ME	
70th BE/ME percentile	Small Value	Big Value
	Small Neutral	Big Neutral
30th BE/ME percentile	Small Growth	Big Growth

Tabel 2.1: The Fama and French six value-weighted portfolios
(http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/, 2005-04-20)

These portfolios are then used in order to calculate the two Fama and French financial factors. The financial factor *Small minus Big* (SmB) is the average return on the three small portfolios minus the average return on the three big portfolios:

$$SmB = \frac{1}{3}(\text{Small Value} + \text{Small Neutral} + \text{Small Growth}) - \frac{1}{3}(\text{Big Value} + \text{Big Neutral} + \text{Big Growth})$$

With the same method the financial factor *High minus Low* (HmL) is the average return on the two value portfolios minus the average return on the two growth portfolios:

$$HmL = \frac{1}{2}(\text{Small Value} + \text{Big Value}) - \frac{1}{2}(\text{Small Growth} + \text{Big Growth})$$

[15] http://www.moneychimp.com/articles/risk/multifactor.htm, 2005-03-13
[16] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/, 2005-04-20

The SmB financial factor was not available for the Swedish market, therefore another index, the Carnegie index, were used. But the financial factor HmL was available for the Swedish market and was therefore used in the regression.

2.2 Data for economic and econometric analysis[17]

The success of any econometric study depends highly on the availability of the appropriate data. There are three types of data that may be available for empirical analysis: time series, cross section and pooled data.

A *time series* is a set of observations on the values that a variable takes at different times. Such data may be collected at regular time intervals such as daily, weekly, monthly, quarterly, annually etc. Although time series are frequently used in econometrics they present a special problem. Most empirical work assumes that the underlying time series is stationary, i.e. its mean and variance do not vary systematically over time. An example of such a time series is the temperature measured in Celsius in a specific city during a year. It is stationary because the mean and variance only depend on the month and day the measurement has taken place, not which year.

Cross section data is data on one or more variables collected at the same point in time. An example is sales figures for a company, in different countries. As with time series, cross sectional data have their own problems where heterogeneity often is the biggest issue. Size and scale effects must be taken into account in order to compare data.

Pooled or combined data is a combination of both time series and cross sectional data. For example sales data in different countries for several time periods is a set of pooled data.

2.3 The ordinary least squares method

The most common and basic method of estimating the parameters of the linear regression model is called *the Ordinary Least Squares* method.[18] The population quantity, **β,** is a vector of unknown parameters of the probability distribution of **y,** whose values are to be estimated

[17] Damodar N. Gujarati (2003), Basic econometrics
[18] Hayashi F (2000), Econometrics

with the sample data. The principle or method of least squares chooses the estimator **b** in such a matter such that for a given sample or set of data the sum of squared residuals, $\sum e_i^2$, is minimized. In other words the least square coefficient vector, **b,** minimizes the function:

$$\sum_{i=1}^{n} \varepsilon_{i0}^2 = \sum_{i=1}^{n} (y_i - \mathbf{x_i}'\mathbf{b})^2 = (\mathbf{y} - \mathbf{Xb})'(\mathbf{y} - \mathbf{Xb})$$

where **b** is a hypothetical value of **β**.[19] Hence the OLS estimate, **b,** minimizes the sum of squared residuals also called the *error sum of squares* (ESS) or the *residual sum of squares* (RSS).[20] By having squared residuals in the objective function this method imposes a heavy penalty on large residuals, which implies that the OLS estimate is chosen to prevent large residuals for a few observations at the expense of tolerating relatively small residuals for many other observations.[21]

2.3.1 The coefficient of determination, R^2

A crucial issue when performing regressions is to evaluate how well the sample regression line fits the data. If all observations where to lie on the regression line, the regression result would be a perfect fit, i.e $\mathbf{y} = \hat{\mathbf{y}}$. However this is rarely the case and there will in contrary exist both positive and negative residuals, e_i. The hope is that the residuals around the regression line are as small as possible.[22] The coefficient of determination r^2, two-variable case, or R^2, multiple regressions, summarizes how well the sample regression line fits the data, i.e. the extent to which the variation in the dependent variable is explained by the variation in the explanatory variables.[23] R^2 takes a value between zero and one and the closer the fitted value tracks the dependent variable, the closer R^2 is to one, which is illustrated in figure 2.2.[24] On the other hand a R^2 of zero indicates that there is no relationship between the regressand and the regressor.[25]

[19] Greene W H. (2000), Econometric Analysis
[20] Damodar N.G (2003), Basic Econometrics
[21] Hayashi F (2000), Econometrics
[22] Damodar N. G (2003), Basic econometrics
[23] Damodar N. G (2003), Basic econometrics
[24] Hayashi F (2000), Econometrics
[25] Damodar N. G (2003), Basic econometrics

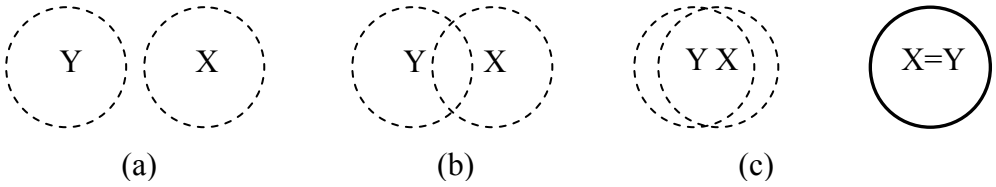

Figure 2.2: The Ballentine view of r^2: (a) $r^2 = 0$ (d) $r^2 = 1$. (Damodar N G (2003), p82)

2.4 Hypothesis testing[26]

Hypothesis testing procedures compare a conjecture about a population to the information contained in a sample of data. In other words, the conjectures tested concern the unknown parameters of the economic model. In every hypothesis test there must be:

1. A *null* hypothesis, H_0
2. An *alternative* hypothesis, H_1
3. A test *statistic*
4. A *rejection* region

The null hypothesis, denoted H_0, specifies a value for a parameter. Hypothesis of the form H_0: $\beta_k = c$ versus H_1: $\beta_k \neq c$, where c is a specified constant, are called *two-tailed test.* The null hypothesis is the belief that will be maintained until there are enough evidence that it is not true, in which case the null hypothesis is rejected. The alternative hypothesis, H_1 will be accepted if the null hypothesis is rejected. H_1 must contain all the possible outcomes that are not included in H_0.

2.4.1 Test of significance

One important hypothesis is H_0: $\beta_k = 0$. The hypothesis states if the independent variable has no effect upon the dependent variable and are called tests of significance. If the hypothesis is rejected it implies that there is a "statistically significant" relationship between the dependent and the independent variable. It should also be mentioned that "statistically significant" do not necessarily imply "economically significant".[27]

[26] Hill R C, Griffiths W E, Judge G G (2000), Undergraduate Econometrics
[27] Hill R C, Griffiths W E, Judge G G (2000), Undergraduate Econometrics

2.4.2 The p-value of a hypothesis test

When reporting the statistical hypothesis tests, it is common to report the *p*-value. The *p*-value of a test is calculated by finding the probability that a *t*-distribution can take a value greater than or equal to the absolute value of the sample test statistic. When the *p*-value of a hypothesis test is smaller than the chosen value of α, the null hypothesis should be rejected. Conversely, if the *p*-value is greater than or equal to α, we do not reject the null hypothesis.[28] I.e. do reject the null hypothesis if

$$P\left(\left|t_{(n-K)}\right| \geq t\right) < \alpha$$

and the tested variable is then significant.

2.5 Foreign currency exposure

In this section we will describe the model that was applied in Doukas, Hall and Lang's paper, in order to estimate the exchange rate exposure.

Foreign currency exposure can be defined as the sensitivity of the market value of a firm to unanticipated exchange rate movements. Therefore, exchange rate effects are dependent upon the firm's:

(i) foreign exposure, i.e. operating revenues, cost exposure and cash flow margin
(ii) use of foreign currency hedging instruments.[29]

It also can be argued that there are operational elements that may decrease the exchange rate effect on the firm's market value. For example, a company with the ability to shift production from one country to another will protect themselves from the unexpected fluctuations of the exchange rates.[30] But in general, it is expected that firms with a high percentage of foreign revenues or costs are more likely to be exposed to exchange rate movements than firms with smaller involvement in foreign operations or trade. Therefore, firms with a high level of foreign revenues or costs would tend to use more foreign currency hedging instruments. Such

[28] Hill R C, Griffiths W E, Judge G G (2000), Undergraduate Econometrics
[29] Adler and Dumas (1980), The exposure of long-term foreign currency bonds
[30] Dumas (1978), The theory of trading firms revisited

hedging transactions, if known to market participants, will tend to lessen the relation between stock prices and unexpected exchange rate movements.[31]

Domestic firms might also be affected by unexpected exchange rate changes, through variations in aggregate demand or on the cost of imported goods. But, the use of currency hedging derivatives will depend upon managers' familiarity with derivative products and the existence of substantial fixed costs required. It is expected that these two additional factors will make the use of a currency hedging program less attractive to smaller firms and firms with lower foreign currency exposures than it is to companies with a high level of foreign exposure.[32]

As a consequence, the foreign currency exposure are likely to be asymmetrical and non-uniform across firms due to differences in real operating structures, use of hedging instruments, methods of financing, and foreign economic linkages. Furthermore, a firm's foreign currency exposure is likely to change over time and is therefore difficult to detect over short horizon intervals.[33]

2.5.1 The model for exchange rate exposure

Economic exposure to exchange rate movements is estimated by the regression coefficient describing; the relation between the market value of the firm and the unexpected exchange rate change, accounting for market movements.[34] However, if exchange rates and stock returns are generated by a set of common macroeconomic factors, stock prices should be responsive to unanticipated exchange rate changes, after controlling for the influence of common macroeconomic factors. These common macroeconomic factors reflect the constant impact of business conditions on the foreign exchange and stock markets. Economic agents form expectations about exchange rate and stock market movements based on information that is available to them at the beginning of each period, they can then influence exchange rates in response to changing economic conditions and their changing currency risk perceptions. This implies that exchange rate and stock market changes must be expressed as functions of a set of macroeconomic variables that determine the way expected exchange rates

[31] Allayannis and Ofek (2001), Exchange rate exposure, hedging and the use of foreign currency derivatives
[32] Doukas, Hall and Lang (2003), Exchange rate exposure at the firm and industry level
[33] Doukas, Hall and Lang (2003), Exchange rate exposure at the firm and industry level
[34] Adler and Dumas (1980), The exposure of long-term foreign currency bonds

and market returns vary systematically through time. As a result, currency exposure tests should rely on unexpected currency and market movements that they are orthogonal to each other and to investors' conditioning information in any given point in time.[35]

Orthogonalization between the foreign exchange market and the stock market is achieved through the estimation of the residual market factor that is not explained by the set of predetermined macro variables, including the unexpected exchange rate change.[36] This is also motivated by the widely held view that foreign exchange market movements are more likely to influence the stock market, rather than being influenced by stock market changes. Investors' ex ante conditioning information can be expressed in terms of instrumental variables. Therefore, the unexpected components of the exchange rate and market changes are obtained from the following regressions:

$$\mathbf{R}_{st} = \phi_{0s} + \sum_{j=1}^{7} \phi_{js} \mathbf{IV}_{jt-1} + \sum_{i=1}^{2} \beta_{is} \mathbf{R}_{it-1} + \varepsilon_{st} \qquad (1)$$

,

$$\mathbf{R}_{mt} = \phi_{0m} + \sum_{j=1}^{7} \phi_{jm} \mathbf{IV}_{jt-1} + \sum_{i=1}^{2} \beta_{im} \mathbf{R}_{it-1} + \beta_{sm} \hat{\varepsilon}_{st-1} + \varepsilon_{mt} \qquad (2)$$

where $\mathbf{R}_{st}$ is the rate of change in the exchange rate (BXR) or the rate of change in the trade-weighted exchange rate (TWXR), ϕ_j s are the slope coefficients of the lagged instrumental variables ($\mathbf{IV}_j$). R_{it-1} represents the Fama and French financial variables: value minus growth and small minus large return variables, $\mathbf{R}_{mt}$ is the market rate of return, β_i's measure the sensitivities to the financial factors, and ε_{st-1} is the residual Swedish currency return, and ε_t are the random error terms.[37]

The specification implies that agents form expectations about exchange rate and stock market movements and therefore they are not essentially unanticipated. Hence, the residual components of equation (1) and (2) are used in estimating the currency exposure coefficient:

$$\mathbf{R}_{it} = \beta_{0i} + \beta_{1i} \hat{\varepsilon}_{st} + \beta_{2i} \hat{\varepsilon}_{mt} + \sum_{j=1}^{7} \rho_{jp} \mathbf{IV}_{jt-1} + \varepsilon_{it} \qquad (3)$$

[35] Doukas, Hall and Lang (2003), Exchange rate exposure at the firm and industry level
[36] Brown and Otsuki (1994), Exchange-rate volatility and equity returns. In Exchange rates and Corporate performance
[37] Doukas, Hall and Lang (2003), Exchange rate exposure at the firm and industry level

where $\mathbf{R}_{it}$ is the rate of return on the ith firm's common stock, ε_{st} and ε_{mt} are the residual, unexpected currency and market returns obtained from regressions (1) and (2).[38]

2.6 Previous studies

There have been some studies before in this area primarily in the American and in the Japanese stock market. The results have been various, some show a significant relation between the exchange rate fluctuation and the stock value in the companies and some do not. These studies have used different models to be able to find out if there is a relation between the stock market and the exchange rate.

The reason to why there have been different results in previous studies is:[39]

- That the company may not be exposed to the exchange rate exposure because they have been hedging their position.
- The empirical models may have been misspecified.
- There might have been different currency policy regimes during the test period.
- Too few companies have been analyzed.

In a paper by Doukas, Hall, Lang (2004) they examine the relation between Japanese stock returns and unanticipated exchange rate changes for 1079 firms traded on the Tokyo stock exchange over the 1975-1995 period. They find a significant relation between stock returns and unanticipated yen fluctuations. They also find that the exposure effect on multinational companies and high-exporting companies is higher than for low-exporting and domestic companies[40]. In a paper by Priestley, Ødegaard (2001) they analyze the Norwegian stock market and their conclusion is that there is a strong support for stock returns having exposure to the exchange rate[41].

Bodnar and Marston shows in a paper from October 2000 that the exchange rate exposure is quite low for a majority of the firms in their test. They used a sample of 103 U.S firms and they developed a model of foreign exchange exposure dependent on only three variables, the

[38] Doukas, Hall and Lang (2003), Exchange rate exposure at the firm and industry level
[39] Priestley Richard, Ødegaard Bernt Arne; Exchange rate regimes and exchange rate exposures
[40] Doukas, Hall and Lang (2003), Exchange rate exposure at the firm and industry level
[41] Priestley Richard, Ødegaard Bernt Arne; Exchange rate regimes and exchange rate exposures

percentage of the firm's revenues and expenses denominated in foreign currency and its profit rate. Their conclusion to the low level of exchange rate exposure was that a majority of firms in the sample have been able to match their foreign currency revenues and costs leaving them with little net exposure. They think that this why previous studies have found low or negligible levels of exposure when they studied the sensitivity of share prices to foreign exchange rates.[42]

In a paper by Bartov and Bodnar (1994)[43] they show that neither U.S. multinationals nor U.S manufacturing industries are significantly affected by contemporaneous exchange rate movements. Sheng-Yung Yang (2003)[44] shows in his paper from 2003 that changes in exchange rates have no direct impacts on future changes of stock prices for Canada, France, Germany, Italy, and UK. Except these studies there are a lot of other studies that show no significant relation between the exchange rate and the stock value.

[42] Bodnar G, Marston R; A simple model of foreign exchange exposure
[43] Bartow E, Bodnar G; Foreign currency translation reporting and the exchange rate exposure effect
[44] Yang S; Price and volatility spillovers between stock prices and exchangerates: Empirical evidence from the G-7 countries

3. Empirical part

In this chapter we will describe the data and how this data was processed. Further the regression together with the classification on firms will be described.

3.1 Data collection

In this study, we have chosen to consider not only multinational and high exporting firms in the analysis but also firms with different degrees of linkages to the international environment, such as low exporting and domestic firms. The use of pure domestic firms in the analysis permits us to examine whether such firms are indirectly exposed to unexpected exchange rate volatility. When taking the availability of data and time into consideration we have chosen to include 39 A-listed stocks and another 39 random stocks from the O-list in the regression. We have to exclude all the companies that had been registered for less than 10 years, since data for a ten year period was needed to perform the regression. The reason for not only including the biggest companies is that big international companies tend to use derivatives to hedge the exchange rate risk. In addition we have chosen a sample period of ten years, i.e. 1995-2004. The use of a long sample period should reduce the difficulty of economic agents to consider the valuation effects of unanticipated exchange rate changes and examine whether foreign currency exposure varies over time. We have used monthly data through the whole paper, this because of the availability of data and the time schedule for the thesis.

3.2 The data material

3.2.1 Rate of return on the common stock

$\mathbf{R}_{it}$ is the rate of return on the i:th firm's common stock. We have chosen to use the monthly stock returns for 39 A-list traded stocks and 39 random O-list traded stocks on the Stockholm Stock Exchange over the 1995-2004 period. This data material was gathered form the database EcoWin. The firms that are represented in the sample span different industries, to make sure that movements in stock return are not just in a certain industry. The companies were divided into four groups based on the multinational status of the firm and the size of foreign sales. The different firms were classified using the corresponding websites and the

book "Sveriges största företag"[45]. To classify a firm as a multinational (MNC), we have used criteria specified in earlier studies[46]:

(i) firms must have a minimum of 25 % of the voting equity of manufacturing or mining companies in at least three foreign countries
(ii) firms must have a minimum of 5 % of consolidate sales or assets attributed to foreign investments
(iii) firms must have a minimum of 500 million kronor in sales generated by foreign production operations.

The remaining non-MNC firms are sorted into three samples according to their foreign to total sales ratio. The three groups are, according to earlier studies[47]:

High-exporting firms: Foreign sales to total sales in excess of 20 %.
Low-exporting firms: Foreign to total sales in excess of 0 %, but less than 20 %.
Domestic firms: Firms that report no foreign sales.

Table 3.1 shows how we classified the different companies and how many companies and what percentage in the different classes.

Class	**Number**	**Percent**
MNCs	25	32.06%
High Exporting	7	8.97%
Low Exporting	11	14.10%
Domestic	35	44.87%
Total	78	100%

Table 3.1: Shows the number of companies in the different classes.

[45] Sveriges största företag 2003/2004 (2003)
[46] Doukas, Hall and Lang (2003), Exchange rate exposure at the firm and industry level
[47] Doukas, Hall and Lang (2003), Exchange rate exposure at the firm and industry level

3.2.2 Fama and French financial variables

$\mathbf{R_{it-1}}$ represents the Fama and French financial variables: value minus growth and small minus large return variables. The Fama and French value minus growth financial variables for Swedish stocks, defined earlier in the theory, were obtained from Kenneth French's website[48] and The Fama and French large minus small financial variables for Swedish stocks were obtained using Carnegie large cap minus Carnegie small cap from the Ecowin database.

3.2.3 Bilateral and multilateral exchange rate

$\mathbf{R_{st}}$ is the rate of change in the bilateral exchange rate for the Swedish krona against the U.S dollar (BXR), obtained from Bank of England[49], or the rate of change in the trade-weighted exchange rate (TWXR), obtained from Ecowin.

The trade-weighted exchange rate is a multilateral exchange rate consisting of a basket of foreign currencies where different currencies have different weights, it is measured in krona per unit of foreign currencies in period t. The trade-weighted exchange rate used in this thesis is the J.P. Morgan´s trade-weighted exchange rate. It measures nominal exchange rate strength of individual major currencies relative to a basket of 16 other currencies. The Swedish index measures the kronor's strength against a basket consisting of U.S., Canada, Japan, Euro, Denmark, Norway, Switzerland, UK, Mexico, Australia, New Zealand, China, Hong Kong, Korea, Singapore and Taiwan. These indices are weighted to reflect the global pattern of bilateral trade in manufactured goods in 2000. An increase in the index represents a depreciation of the Swedish krona.

3.2.4 Market rate of returns

$\mathbf{R}_{mt}$ is the market rate of return, this is the value-weighted index of all firms included in the OMX index gathered from the OMXgroup's homepage.[50]

[48] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/, 2005-04-04
[49] http://www.bankofengland.co.uk/mfsd/, 2005-03-28
[50] www.omxgroup.com 2005-03-28

3.2.5 Instrumental variables

$\mathbf{IV}_j$ is the instrumental variables. Since there are no models that specify the choice of instrumental variables, the choice of which instrumental variables to include is bound to be somewhat arbitrary. We choice of instrumental variables were guided by the variables used in previous studies[51]. We concluded the instrumental variables used for the Japanese market also have validity in Sweden; therefore the same variables were used.

The instrumental variables that were used in this paper are:

- IP, the industrial production growth series, for Sweden, constructed as the logarithm of price relatives of the seasonally adjusted index of industrial production. (IFS, International Financial Statistics online)[52]
- UI, unexpected inflation, estimated by subtracting the expected inflation at month t-1 from the realized inflation (CPI) rate during month t. The expected rate of inflation is estimated according to Chen, Roll, Ross (1986). To estimate the expected rate of inflation we used an ARMA process in Eviews. (Statistiska centralbyrån)[53]
- UTS, term structure spread between Swedish long-term government bond and short-term government bond rates. (Ecowin)
- MS, is the monthly change in the Swedish money supply. (Ecowin)
- UJS, the US-Sweden short-term bill rates spread. (IFS, International Financial Statistics online)[54]
- XM, the trade balance series, is the monthly logarithmic difference between export and import. (Ecowin)
- R_{st-1}, this is the lagged value for the exchange rate, used in equation (1).
- R_{mt-1}, this is the lagged value for the market rate of return, used in equation (2).
- R_{it-1}, this is the lagged value for the rate of return on the common stock, used in equation (3).

[51] Doukas, Hall, Lang (2003)
[52] http://ifs.apdi.net/imf/, 2005-03-28
[53] www.scb.se, 2005-03-28
[54] http://ifs.apdi.net/imf/, 2005-03-28

3.3 Regressions

After collecting all the data needed for the paper we started with performing the regressions for the first equation. We used Eviews to do the desired OLS regressions, the reason for this was that Eviews is an easy program to use and it contained all the functions needed for this paper. From equation (1) it was the residual Swedish currency return ε_{st} that we needed for equation (2). The use of the residual currency returns in this thesis is motivated by Mark's (1995) evidence which shows that exchange rates are predictable by such macroeconomic factors over the long horizon[55]. After using the results form equation (1) in equation (2) we received the random error term ε_{mt}. Both ε_{st} and ε_{mt} was calculated using the bilateral and the multilateral exchange rate.

With the results from equation (1) and equation (2) we were able to perform the regressions for equation (3). We estimated equation (3) to investigate whether exchange rate fluctuations do influence stock returns, using OLS. This regression had to be performed twice for each stock included in the research, once with the bilateral exchange rate and once with the multilateral exchange rate. After each regression the results was stored in an Excel file in order to prepare for the analysis.

The sensitivity of stock returns to unanticipated exchange rate movements is measured by the coefficient $\boldsymbol{\beta_1}$. The systematic relationship between the unanticipated exchange rate changes and stock returns will be tested using a null hypothesis. The null hypothesis that is tested is if the regression coefficient, $\boldsymbol{\beta_1}$ in equation (3) receives a zero value. Because firms with higher international involvement are likely to have greater net operating cash flow exposure, it is also hypothesized that they are likely to have greater currency exposure[56].

[55] Mark, Nelson (1995); Exchange rate and fundamentals: evidence on long horizon predictability. American Economic Review 85
[56] Doukas, Hall and Lang (2003), Exchange rate exposure at the firm and industry level

4. Analysis

In this chapter the empirical results are depicted and analyzed. We will start with analysing the regression results from equation one and two for the two different exchange rates, followed by an analysis of the results obtained from equation three. In addition a comparison with the results obtained by Doukas, Hall and Lang will be performed.

4.1 Descriptive statistics

This will be a short description of the variables used in this thesis. Diagram 4.1 shows the bilateral exchange rate Swedish krona / US dollar for the period January 1995 until December 2004. Diagram 4.2 shows the multilateral exchange rate for the Swedish krona against a basket of currencies for the same time period. From the two diagrams the assumption that they are correct can be made, because when the Swedish krona gets stronger the curve in diagram 4.1 decreases and the curve in diagram 4.2 increases.

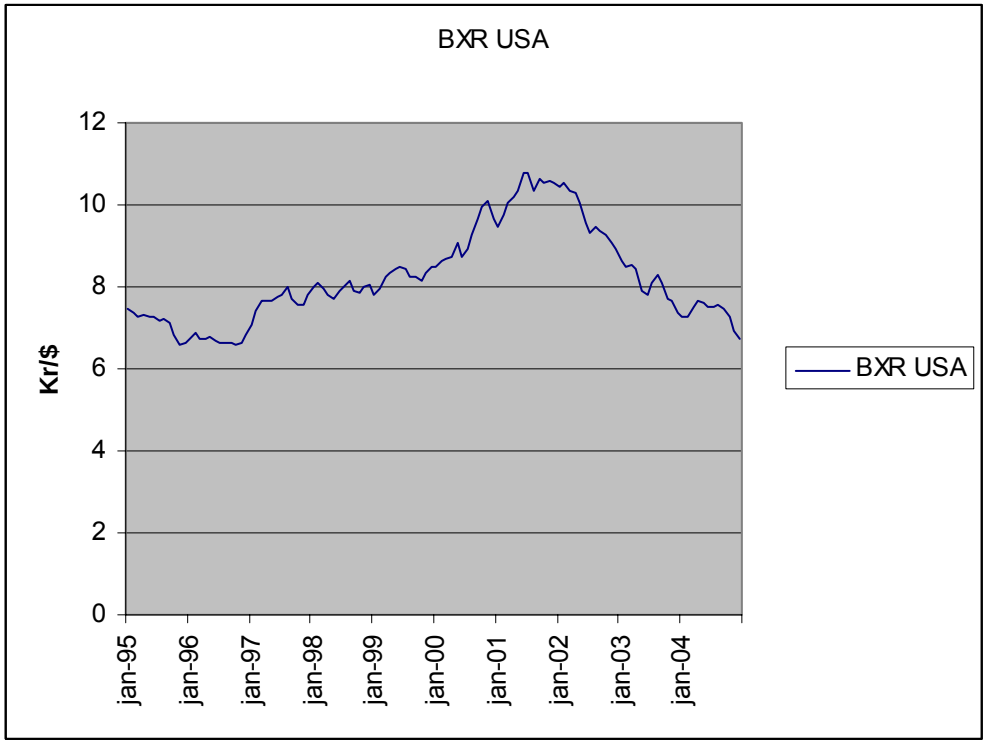

Diagram 4.1: This Diagram shows the Swedish Kr/ US $ exchange rate

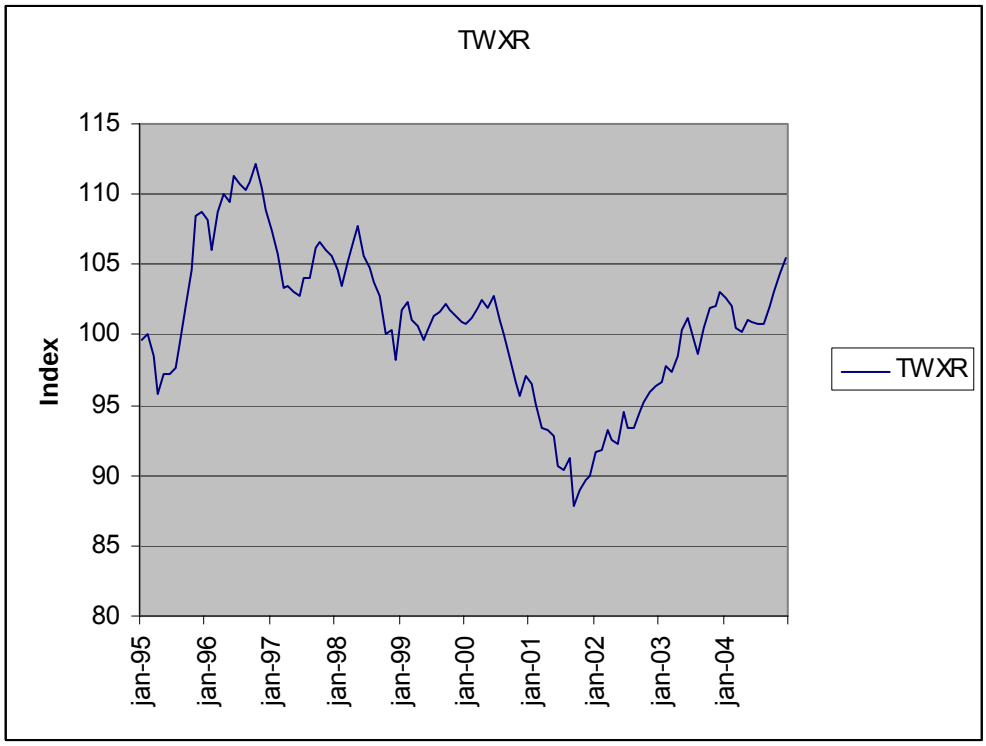

Diagram 4.2: This Diagram shows the multilateral exchange rate.

Diagram 4.3 shows the OMX index for the Swedish market. It is hard to tell if the exchange rate has anything to do with the stock market, just from studying these diagrams. In order to say anything about the relationship other effect must be cleared. For example that is the reason for including our macroeconomic factors in the regression model.

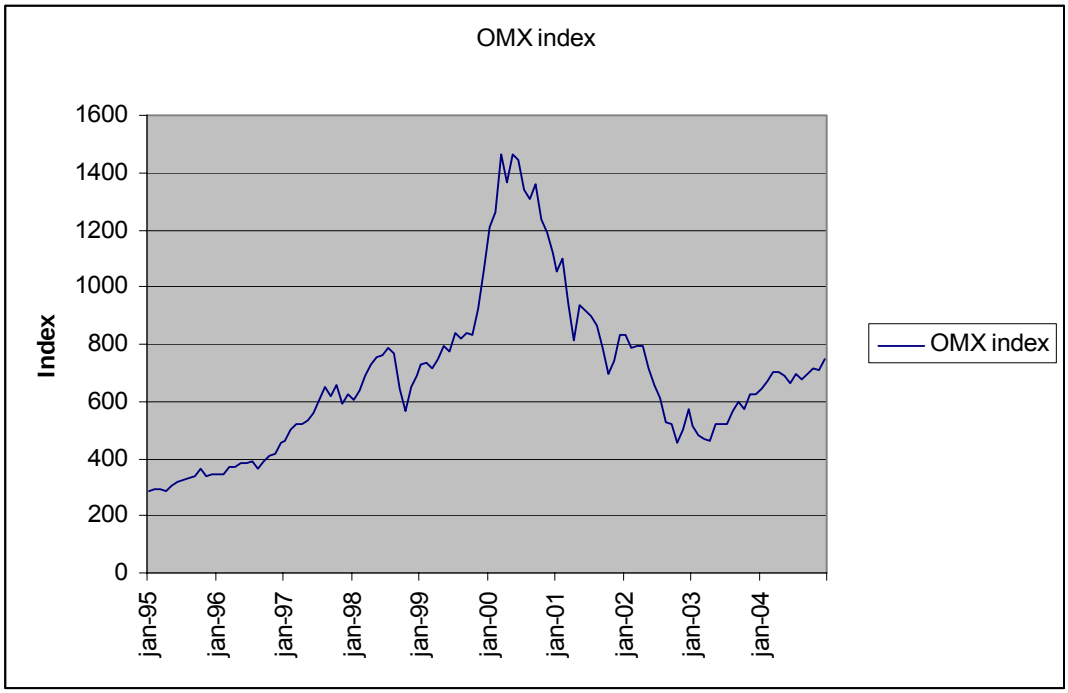

Diagram 4.3: This Diagram shows the OMX index.

Table 4.1 shows the maximum, minimum, average and the median value for all the variables used in this thesis. This table together with the diagrams for the different variables, depicted in appendix 1, gave us an idea of the reliability of the data.

	BXR	TWXR	IP	UI	UTS	MS
Average	8,23	100,74	95,30	-0,01	1,07	7,94E+10
Median	7,98	101,10	97,00	-0,01	1,03	8,11E+10
Min	6,60	87,80	54,90	-1,57	0,10	6,28E+10
Max	10,78	112,20	116,60	1,06	2,42	9,85E+10

	UJS	XM	SML	VMG	Rmt
Average	-0,48	1,15E+10	0,00	0,44	0,01
Median	-0,26	1,14E+10	0,01	0,55	0,01
Min	-3,79	4,40E+09	-0,14	-32,14	-0,17
Max	2,18	2,10E+10	0,11	19,62	0,16

Table 4.1: Maximum, minimum, average and the median values for the different variables used in this thesis

4.2 Currency and market exposure analysis

The results obtained from equation (1) and (2) are depicted in table 4.2 and 4.3. The results show that the lagged bilateral exchange rate, in equation (1), and the Fama and French financial variable value minus growth, in equation (1) and (2), are the only variables that have a significant coefficient. This result differs from the result obtained by Doukas, Hall and Lang, who obtained the U.S.-Japanese interest rate spread, in equation (1), as the only significant variable. The significant coefficient in equation (1) for bilateral exchange rates suggests that exchange rate changes are not fully dominated by noise as it is generally believed. However, the low R-squared value (0,2098) shows that only a small fraction of the exchange rate movements is predictable.

The residuals from equation (1) and (2), represent the unexpected exchange rate (ε_{st}) and market index (ε_{mt}) changes, where then used in estimating regression (3).

Bilateral (BXR) exchange rate (1995 - 2004)

Risk Factor	$ø_0$	$ø_{IP-1}$	$ø_{UI-1}$	$ø_{UTS-1}$	$ø_{MS-1}$	$ø_{UJS-1}$	$ø_{EX-1}$	$ø_i$	$β_{sml-1}$	$β_{vmg-1}$	$β_{fs-1}$	R^2
Currency	-0,0004	-0,1143	-0,0015	0,0100	-0,0495	0,0021	-0,0101	0,3309	0,0545	-0,0004		0,2098
	-0,8569	*0,0646*	*0,7571*	*0,0919*	*0,5734*	*0,1425*	*0,8749*	*0,0002*	*0,2852*	*0,1644*		
Market	0,0113	-0,2160	-0,0181	-0,0250	0,1488	-0,0017	0,0451	0,1837	0,2849	-0,0042	0,0450	0,2671
	0,0551	*0,2222*	*0,2061*	*0,1442*	*0,5582*	*0,6767*	*0,8059*	*0,0872*	*0,1222*	*0,0000*	*0,8720*	

Tabel 4.2: The coefficients from equation (1) and (2), the numbers written with cursive letters are the p-values

Multilateral (TWXR) exchange rate (1995 - 2004)

Risk Factor	$ø_0$	$ø_{IP-1}$	$ø_{UI-1}$	$ø_{UTS-1}$	$ø_{MS-1}$	$ø_{UJS-1}$	$ø_{EX-1}$	$ø_i$	$β_{sml-1}$	$β_{vmg-1}$	$β_{fs-1}$	R^2
Currency	0,0008	0,0426	0,0021	-0,0057	-0,0035	-0,0005	0,0583	0,1525	-0,0138	0,0000		0,0908
	0,5220	*0,2648*	*0,5040*	*0,1274*	*0,9496*	*0,5447*	*0,1424*	*0,1106*	*0,6598*	*0,9127*		
Market	0,0111	-0,2436	-0,0191	-0,0214	0,2034	-0,0011	0,0265	0,1732	0,2918	-0,0043	0,5329	0,2758
	0,0567	*0,1686*	*0,1795*	*0,2118*	*0,4264*	*0,7851*	*0,8849*	*0,1056*	*0,1115*	*0,0000*	*0,2504*	

Tabel 4.3: The coefficients from equation (1) and (2), the numbers written with cursive letters are the p-values

4.2.1 Analysis of the currency exposure to the stock value

In order to verify if the unexpected exchange rate and market movements have a significant exposure to the firm value, we tested the hypothesis if β_1 and β_2 are equal to zero. The results obtained for all companies are shown in table 4.4.

	BXR:		*TWXR:*	
Significance level:	**5 %**	**10 %**	**5 %**	**10 %**
Currency	6,41	11,54	5,13	7,69
Market	62,82	66,67	58,97	64,10

Table 4.4: Percent of companies for which β_1 and β_2 are significant

The result was that 11,5% of the 78 firms had a significant exposure in response to kronor/dollar exchange rate movements and 7,7% in response to the trade-weighted exchange rate movements at the 10% level of significance.

The value of the companies showed a high response to the unexpected market component, β_2 were significant for 66,7% of the firms when using the kronor/dollar exchange rate respective 64,1% when using the trade-weighted exchange rate. This result will not be analysed any further since it is not included in the purpose of this thesis.

4.2.2 Analysis with respect to export

In order to evaluate differences between multinationals (MCNs), high-exporting, low-exporting and domestic firms we have divided, as described in the empirical part, the companies into the four groups. Within each group we calculated the percentage of companies with a significant exchange rate exposure. In order to find out more about the relationship between the exchange rate and the value of the stocks, we also checked if the value of β_1 was positive or negative and if this value was significant. The results for the bilateral exchange rate are shown in table 4.5 and for the multilateral exchange rate in table 4.6.

Bilateral exchange rate:

	$\beta_1 > 0$	Sig. $\beta_1 > 0$	$\beta_1 < 0$	Sig. $\beta_1 < 0$	Total significant	**Nbr of companies:**
MCN:s	16	0	9	2	8,00 %	**25**
High-exporting	5	2	2	1	42,86 %	**7**
Low-exporting	7	1	4	0	9,09 %	**11**
Domestic	18	2	17	1	8,57 %	**35**
Total	**46**	**5**	**32**	**4**	**11,54 %**	**78**

Table 4.5: Number of companies, within the group, with a positive respective a negative value of β_1 in addition to the number for which the value was significant. In the right columns the percent of companies with a significant exchange rate exposure is depicted together with the total number of companies in this study.

Multilateral exchange rate:

	$\beta_1 > 0$	Sig. $\beta_1 > 0$	$\beta_1 < 0$	Sig. $\beta_1 < 0$	Total significant	**Nbr of companies:**
MCN:s	3	0	8	0	4,00%	**25**
High-exporting	6	1	10	0	0,00%	**7**
Low-exporting	4	0	7	1	9,09%	**11**
Domestic	26	2	14	2	11,43%	**35**
Total	**39**	**3**	**39**	**3**	**7,69%**	**78**

Table 4.6: Number of companies, within the group, with a positive respective a negative value of β_1 in addition to the number for which the value was significant. In the right columns the percent of companies with a significant exchange rate exposure is depicted together with the total number of companies in this study.

Even though the total percent of companies with a significant β_1 is almost the same when using the kronor/dollar exchange rate respective the trade-weighted exchange rate, the results differs a lot within the four groups. Specially the result differs for the high-exporting firms, 42,9% for BXR and 0,0% for TWXR. One reason might be that the high exporting firms tend to do the most of their business in dollars. The dollar has been an important currency for a long time, and some companies tend to be more dependent on the US market.

Further we had expected that the MCN:s should show the highest response to exchange rate movements, but that is not the case in our analysis. An explanation to this result might be, that big firms tend to hedge more of the risks associated to the exchange rate. We had also expected a lower level of significance for the low-exporting and domestic firms compared to the MCN:s and high-exporting firms. Therefore, it was a surprise when the contrary result was obtained in this thesis. Even domestic firms are exposed to exchange rate risks. For

example there can be a dependence on foreign inputs of production and fluctuations in domestic demand because of changes in price of non-domestic substitutes. Domestic, often smaller, firms tend to hedge less to exchange rate risks and could therefore be exposed to the fluctuations. Because of the rather small number of companies with a significant β_1 in this analysis, one company makes a great difference. As a consequence the result could be an effect of randomness when choosing the companies included in the regression.

From the results we also can see that almost as many countries have a negative as a positive exchange rate exposure. This was an expected result since there must be almost as many importing as exporting companies. The two different kinds of extreme companies will then react completely different to the fluctuations in the exchange rate.

In addition to previous analyses the regression relations were tested between the level of exposure and the level of exports in addition to the market value of respective company. As the level of exchange rate exposure we used the value for β_1. The same procedure was performed for the bilateral and the multilateral exchange rate. The results obtained are depicted in table 4.7 for the bilateral exchange rate and 4.8 for the multilateral exchange rate.

Bilateral exchange rate:

Statistics:	Coefficient	Std error	P-value	Lower 90%	Upper 90%	R2
Constant	0,075481	0,066144	0,257437	-0,034678	0,185639	0,009218
Export	-0,001554	0,002137	0,469307	-0,005112	0,002004	
Market value	0,000001	0,000001	0,526044	-0,000001	0,000002	

Table 4.7: The regression results obtained with the level of significance as the dependent variable. In test one and two export respective market value are used as independent variables.

Multilateral exchange rate:

Statistics:	Coefficient	Std error	P-value	Lower 90%	Upper 90%	R2
Constant	0,283065	0,108135	0,010703	0,102975	0,463155	0,113744
Export	-0,001740	0,004793	0,717693	-0,009723	0,006243	
Market value	-0,000004	0,000002	0,013458	-0,000007	-0,000002	

Table 4.8: The regression results obtained with the level of significance as the dependent variable. In test one and two export respective market value are used as independent variables.

The aim with this analysis was to, as a complement the previous analysis, check whether a high level of foreign exposure also yields a higher level of exchange rate exposure to the

stock value. The coefficients in front of the independent variable export are less than zero for both types of exchange rates. This means that a higher level of export yields a lower level of significance in the exchange rate exposure. The result does not correspond to our prior beliefs, but it is also far from being statistically secured at a 10 % level of significance.

We used the market value to be a measure of the size of the company. For both types of exchange rates the value of the coefficient are very close to zero. Because of the very low value of the standard error it is almost statistically secured that the coefficient in front of the market value, for the multilateral exchange rate, is unequal to zero. This means that the market value of the firm does affect the exchange rate exposure but the effect is very small.

There is a quite big difference in R-squared between the two exchange rates. This means that the level of exports and the market value of the firm explain the exchange rate exposure to a much greater extent for the multilateral exchange rate than for the bilateral exchange rate.

5. Conclusions

The purpose with this thesis was to examine whether the model, used in Doukas, Hall and Lang's paper (2003), shows that the exchange rate influences the stock returns on the Stockholm Stock Exchange. The test was performed for 78 stocks during the period 1995 to the end of 2004. We came to the conclusion that the null hypothesis could not be rejected. This means that we did not find enough evidence to state that Swedish stock values, in general, are sensitive to exchange rate fluctuations. This conclusion is built upon the result that only six to seven percent of the stocks had a significant coefficient in front of the unexpected exchange rate movements. It is difficult to draw conclusions from the different results obtained for the kronor/dollar exchange rate and the trade-weighted exchange rate, in addition to the different level of exports. The reason for the result could more be a question of randomness. In addition, we could not prove a relation between market value of the firm and exchange rate exposure. Our result also showed that the differences between small and large firms are small when it comes to exchange rate exposure.

To avoid systematically errors in this thesis we tried to have a high correspondence between the theoretical and the empirical facts during the whole paper. But because of the many variables affecting the stock market it is difficult to achieve a very high validity in this kind of projects.

The factor that greatly determines the reliability in this thesis is the accuracy of the historical data collected. If the data includes standard errors the results will become misleading. We have therefore been careful when choosing the sources. In addition, our skillfulness in software programs and theoretical knowledge is essential for this project's reliability. The empirical part and the analysis are based on a relatively high number of companies and a wide time period. We believe that the reliability would be even higher if the analysis could be based on even more companies and with a longer time horizon.

The quantitative nature of this thesis made it possible for us to remain unbiased and to obtain objectiveness. Conclusions are drawn from numerical models and regressions, which have minimized possible impacts of personal values. The fact that there are two authors, that gather and analyse the sources of information, has lowered the risk of biased thoughts and lack of constant awareness.

It is difficult to compare the results obtained in this thesis with the results for the Japanese market, since we in the two essays have chosen to use different methods when analysing the results. In contrast to the result in this thesis Doukas, Hall and Lang obtained the highest level of significance for the MCN:s, followed by the high-exporting firms. Doukas, Hall and Lang also came to the dissimilar conclusion that the exchange rate exposure to the stock value is essentially the same for both exchange rates, BXR and TWXR. It can also be added that other studies, for example for the US market, have shown a lower level of currency exposure to the firm value.

Finally we would like to give some examples of some further research in the same field as treated in this thesis. For example the regression could be performed using additional companies. A higher number of companies would yield a higher level of reliability in the results. In addition to more companies, a longer period of time could give some interesting results. The time horizon could also be divided into periods according to the different exchange rate policy regimes. Changing the macroeconomic factors used in this thesis would perhaps give another result. Perhaps some other macroeconomic factors are more significant at the Swedish market.

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Appendix 1

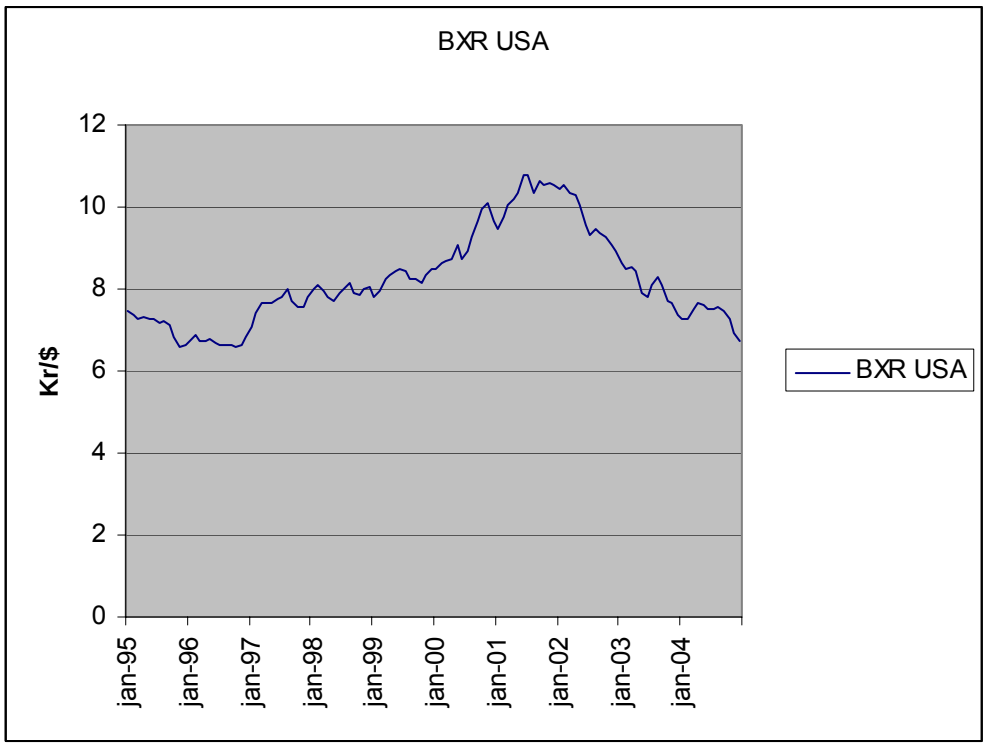

Diagram 5.1 shows the Swedish Kr/ US $ exchange rate.

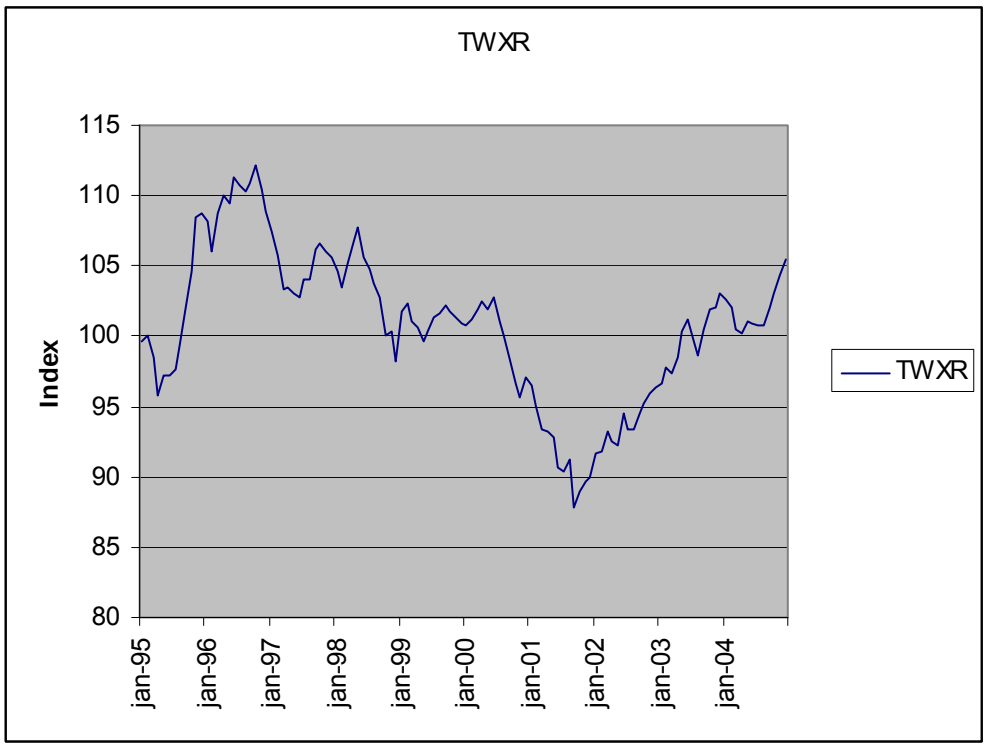

Diagram 5.2 shows the multilateral exchange rate for Sweden.

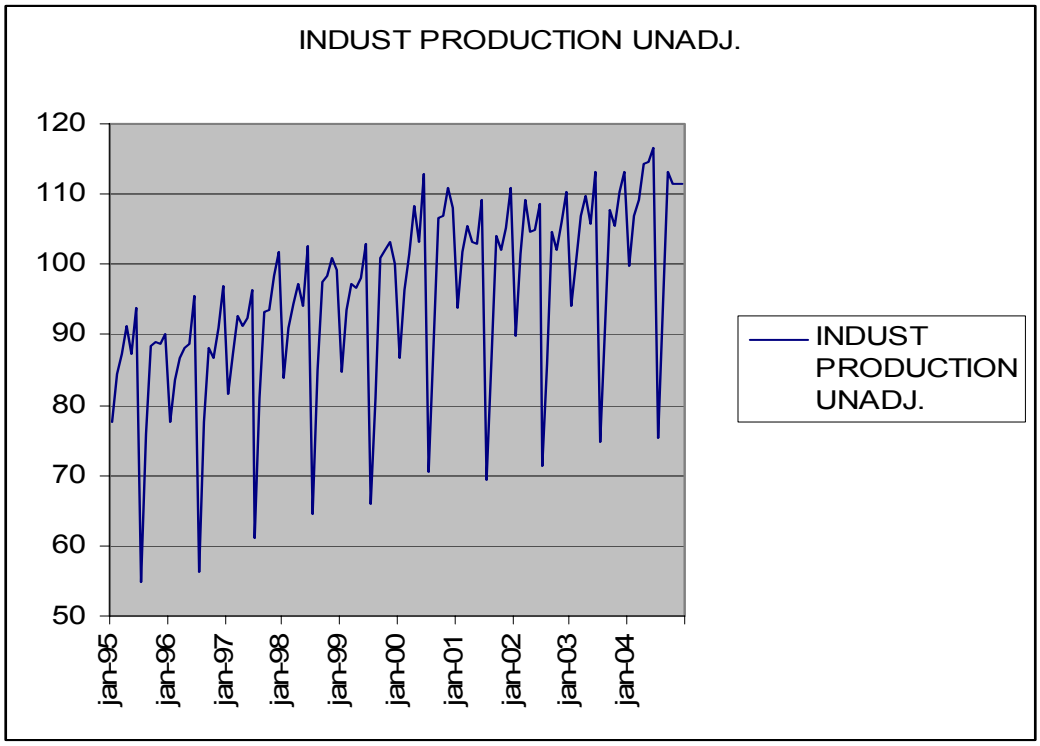

Diagram 5.3 shows the unadjusted industrial production for Sweden.

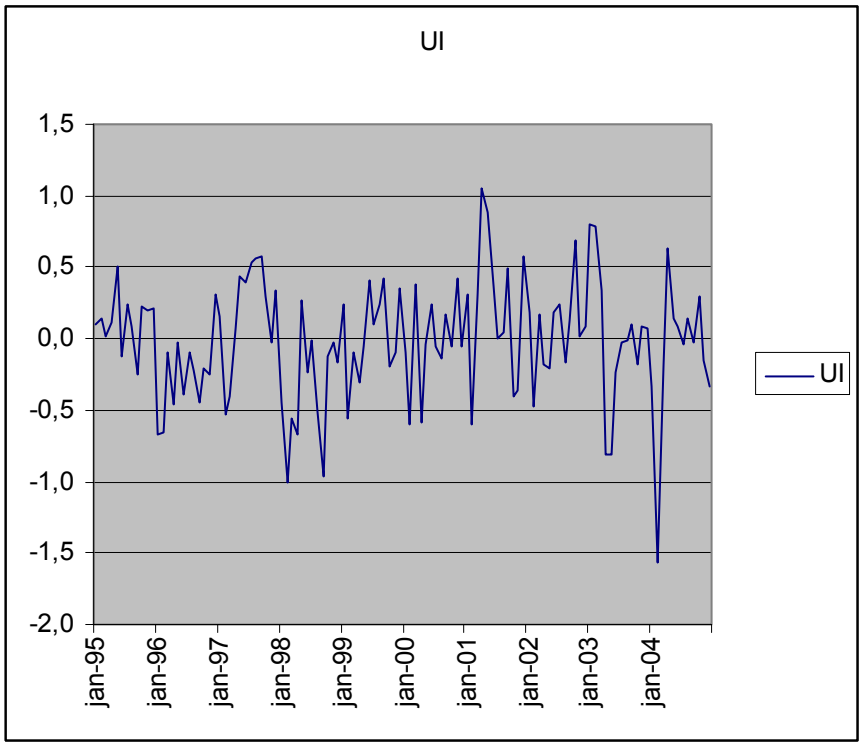

Diagram 5.4 shows the unexpected inflation for Sweden.

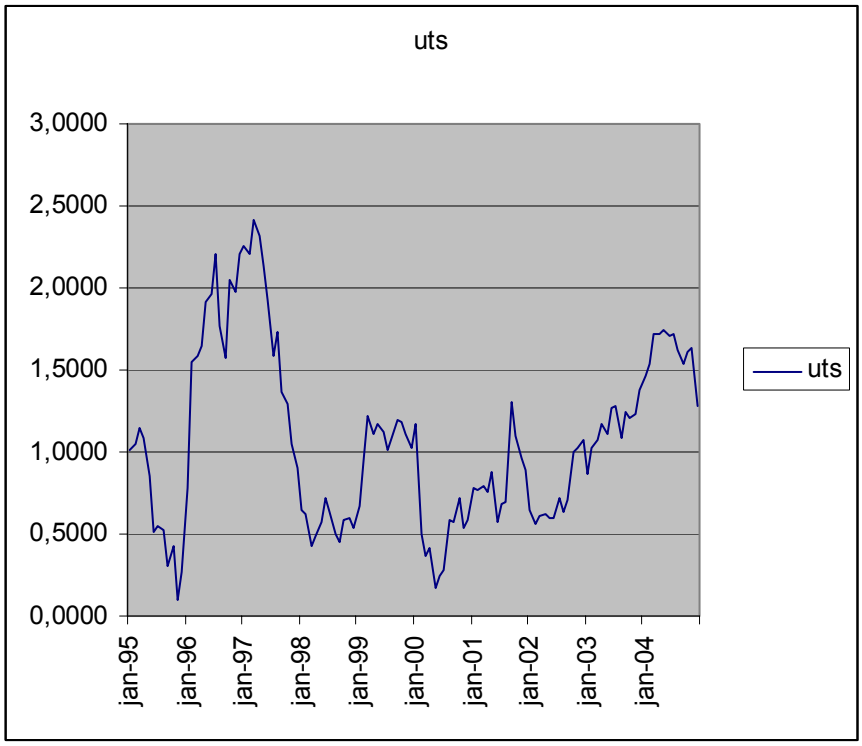

Diagram 5.5 shows the term structure series for Sweden.

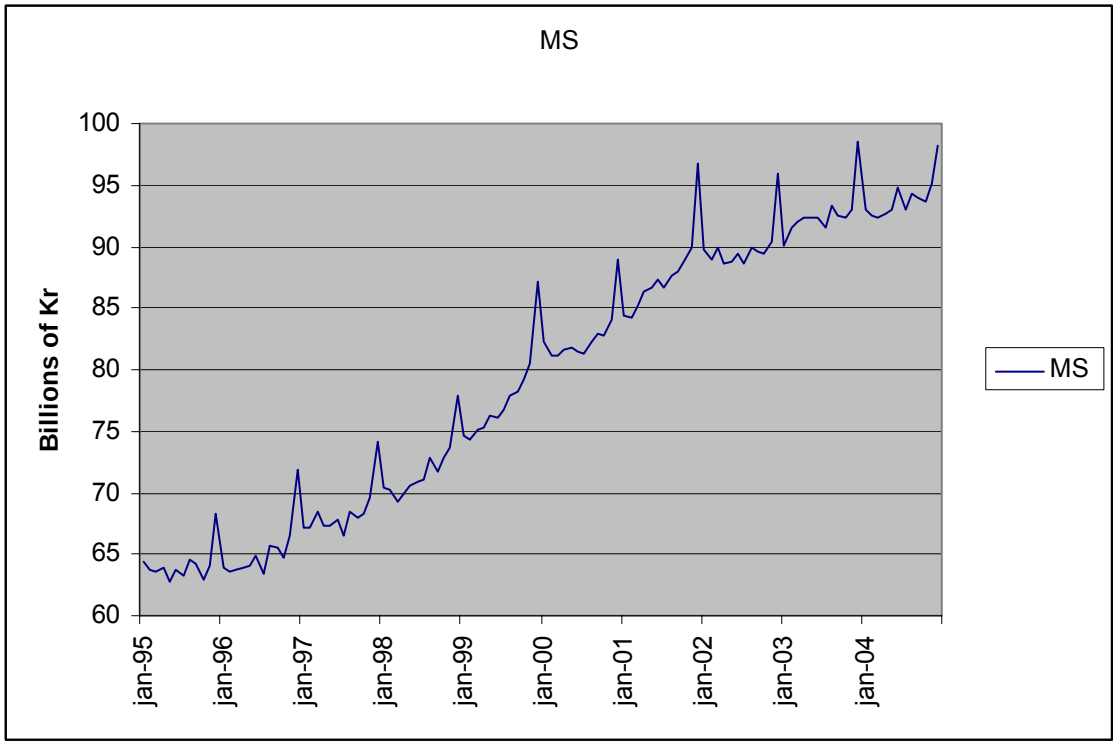

Diagram 5.6 shows the money supply series for Sweden.

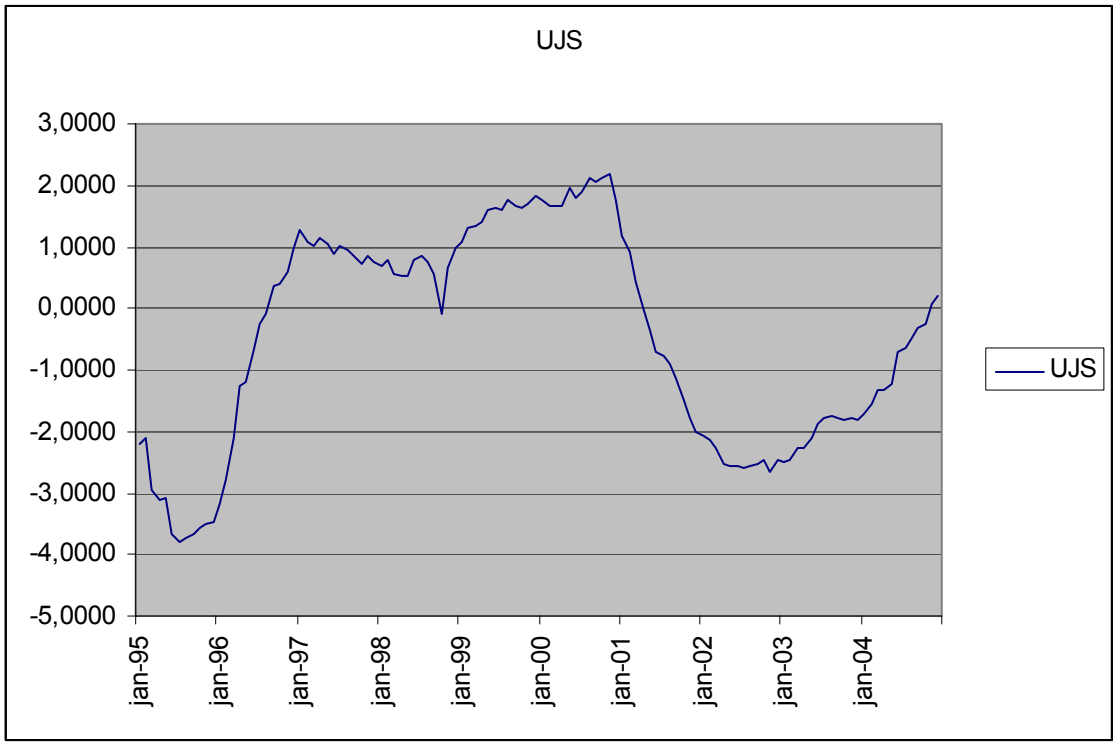

Diagram 5.7 shows the US-Sweden interest rate spread.

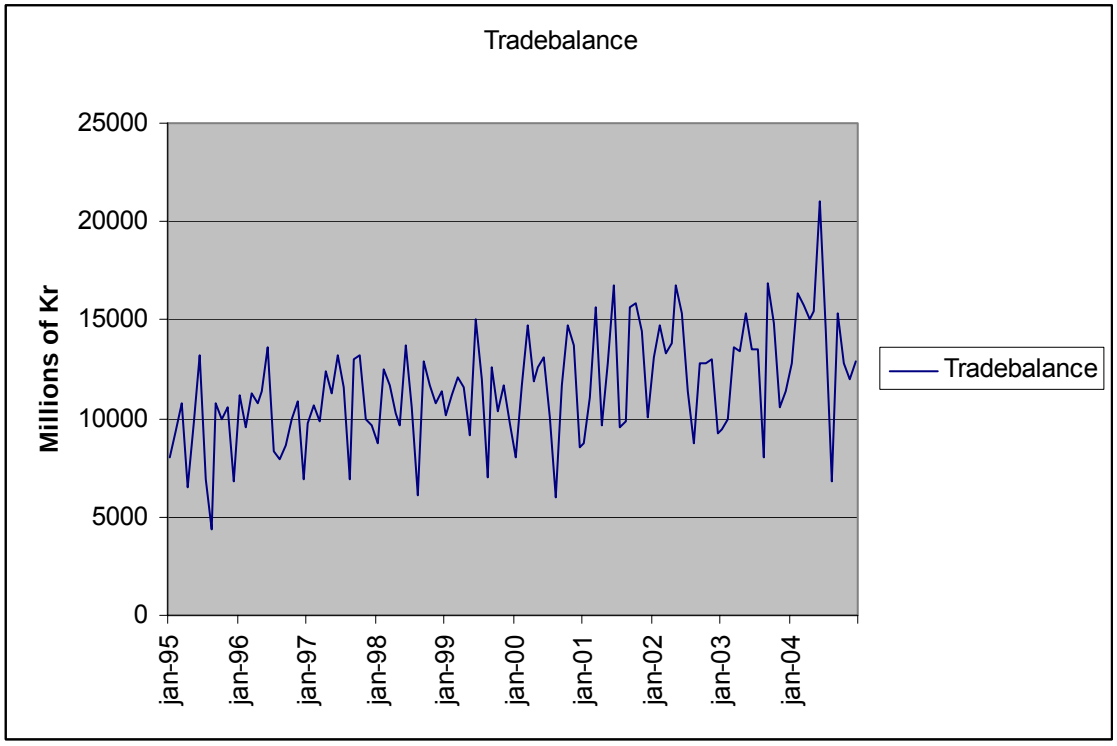

Diagram 5.8 shows the trade balance series for Sweden.

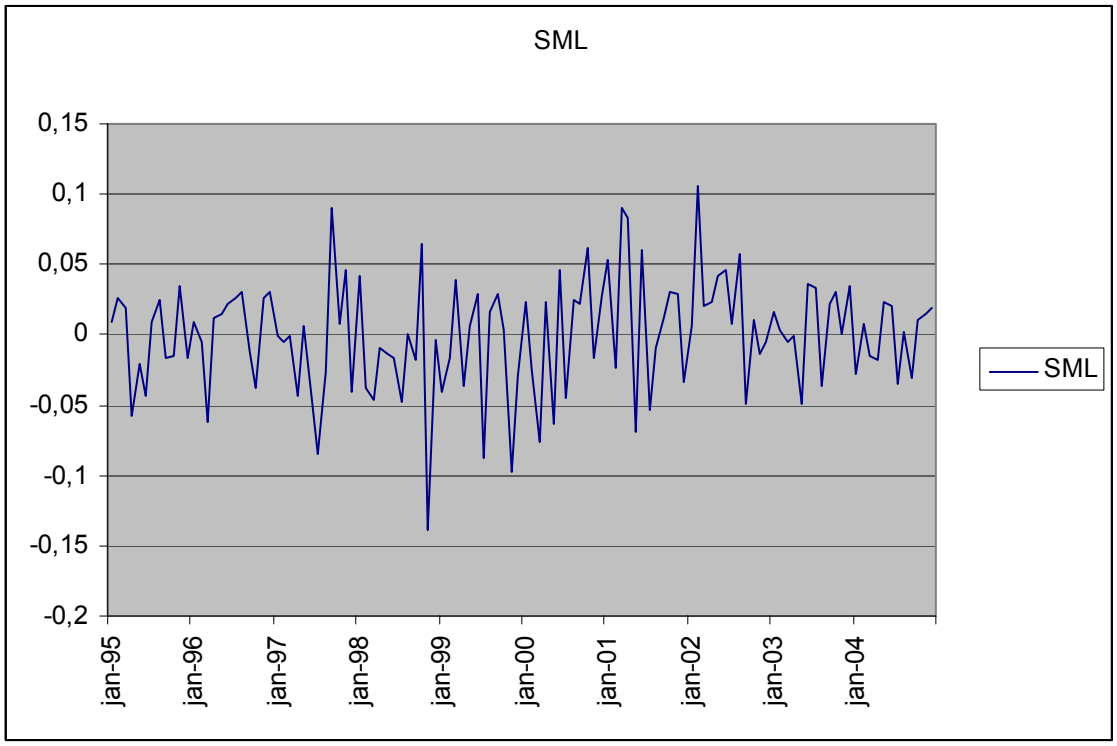

Diagram 5.9 shows the Fama & Frensh Small-Large financial variables for Sweden.

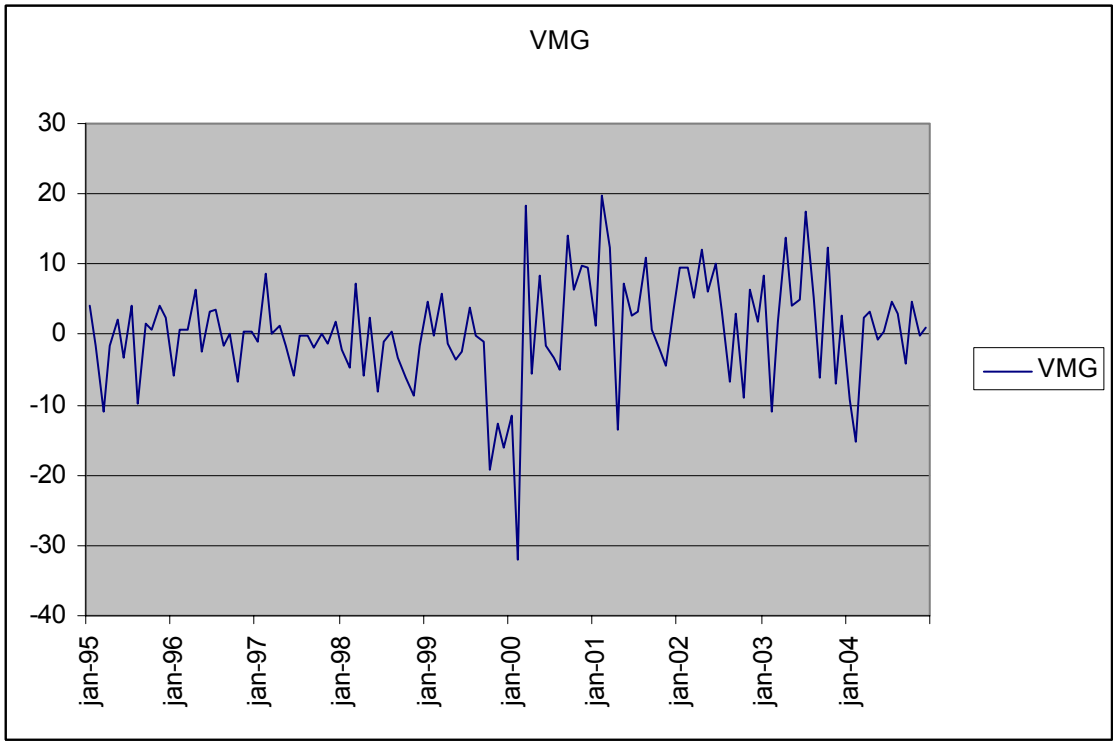

Diagram 5.10 shows the Fama & Frensh Value-Growth financial variables for Sweden

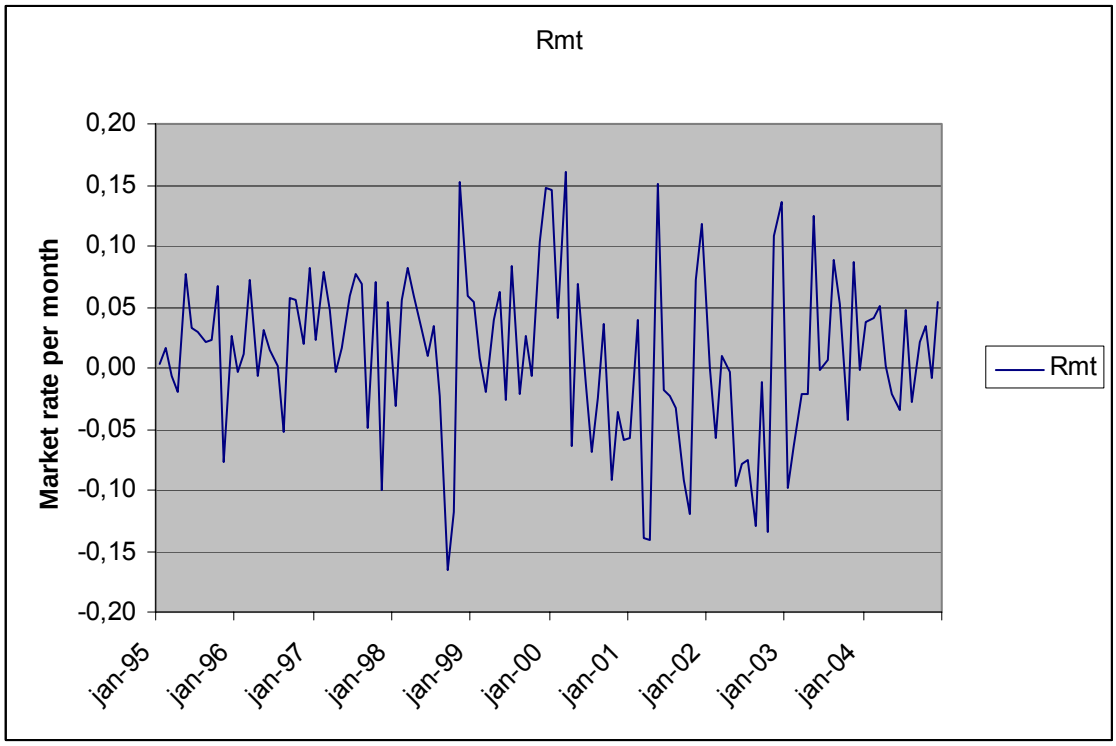

Diagram 5.11 shows the market rate of return for the Swedish market

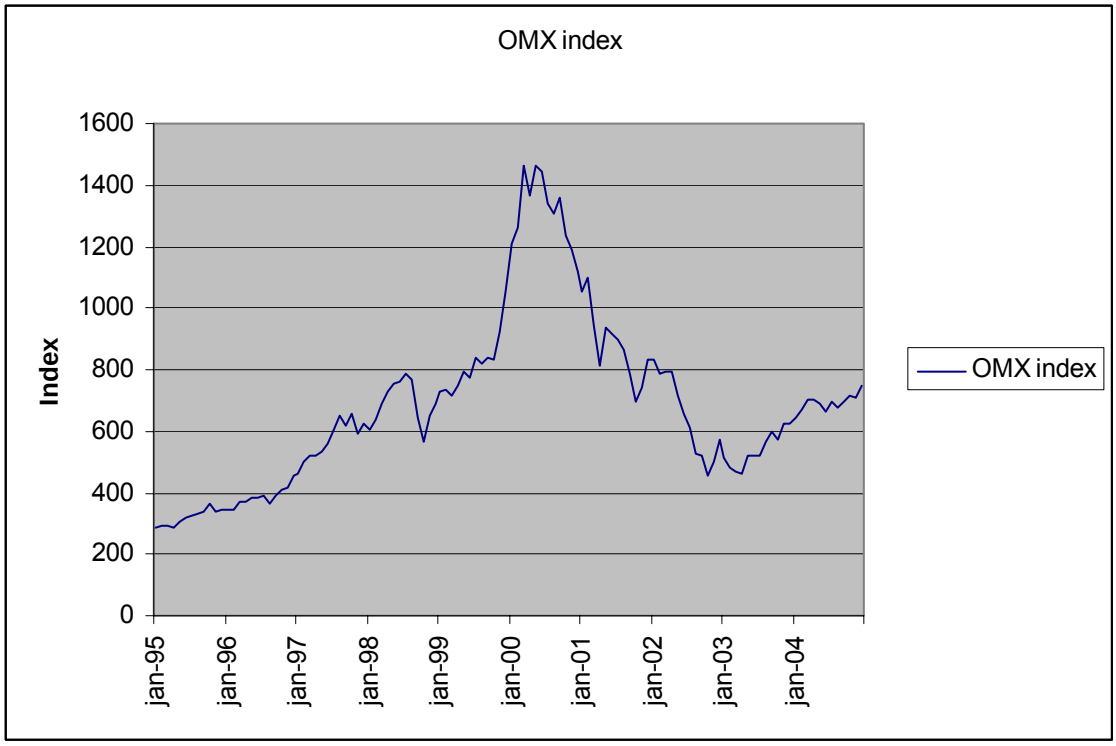

Diagram 5.12 shows the OMX index.