Master Thesis
Spring 2013

The Exposure Puzzle Revisited on the U.S. Stock Market

By

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Abstract

This thesis reexamines the exposure puzzle by studying the presence of foreign exchange rate exposure in the U.S. stock market using firms included in the S&P 500 index as of February 2013, and a methodology that attempts to address issues in previous literature. We employ a multi-factor model and measure currency exposure as the percentage change in firm value on the percentage change in a trade-weighted exchange rate. We also use a new portfolio selection criterion based on firm specific Foreign Exchange Income (FEI) in relation to total sales as well as SIC based industry portfolios, multiple investment horizons up to 24 months, and three time periods covering 1994 to 2011, 1994 to 2002, and 2003 to 2011. Our findings imply that currency exposure can be detected in a high number of cases, but only for longer investment horizons. This suggests that studying longer horizons is more informative about the relationship between firm value and exchange rate changes. We also find evidence that cancellation effects from inferior portfolio selection criterions could help explain the weak results in the previous literature. Furthermore, our results imply that currency exposure could be time-varying, but it appears that time-varying exposure might not aid in the explanation of the exposure puzzle. Additionally, our findings suggest that currency exposure appears to be affected by various macroeconomic conditions, such as currency crises, and that this perhaps could help explain the weak results of previous studies.

Keywords: Exposure Puzzle, Currency Exposure, Foreign Exchange Income, Investment Horizons, Time-Varying Currency Exposure, Portfolio Noise, U.S. Stock Market

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I. Introduction

This section aims at giving the reader an introduction to our thesis by presenting some relevant background on the subject as well as a problem discussion, our purpose, and problem statement. The section ends with a summary of our findings and a presentation of the disposition of the thesis.

I.I Background

The extent to which a firm is impacted by changes in exchange rates is referred to as foreign exchange exposure (Shapiro, 2003). An unanticipated change in a an exchange rate could potentially have a large impact on a firm's cash flows through, in international finance described as, transaction and economic exposure. Transaction exposure is defined as the risk that an exchange rate in a foreign exchange rate transaction changes between initiation and settlement. Economic exposure, on the other hand, is defined as the risk that unanticipated exchange rate changes could impact future cash flows, and consequently firm value. (Shapiro, 2003 and Mullem and Verschoor, 2005) Adler and Dumas (1984), however, argue that even firms with no foreign involvement are generally exposed to currency risk through indirect means, since exchange rates impact price levels and interest rates, and thus also aggregate demand. Still, an unanticipated movement of the exchange rate may not affect all companies in the same manner. For instance, importing and exporting companies are impacted differently if the currency exposure cannot be completely hedged at zero cost.

While it is clear that changes in a firm's cash flow impact firm value (e.g. Merton, 1973), and that changes in exchange rates could impact firms' cash flows (Shapiro, 2003), it is still unclear how contemporaneous fluctuations in the exchange rate in reality impact firm value. Therefore, it is no surprise that the association between stock returns and exchange rates has been the subject of much empirical research. More puzzling is that although it in theory should be a strong relationship between exchange rates and firm value, previous research, as pointed out by for example Bartram and Bodnar (2005), has commonly not been able to find statistically significant exposure in more than 10 to 25 percent of the studied cases. This absence

of statistically significant results has therefore become known as the exposure puzzle in the exchange rate literature.

I.II Problem Discussion

Considerable research has been dedicated to solve the exposure puzzle, and researchers have brought up several possible rationales for the absence of statistically significant exposure. However, after studying the work of for instance Jorion (1991), Bartov and Bodnar (1994), Chow, Lee and Solt (1997), Williamson (2001) and Dominguez and Tesar (2001), we have identified three specific issues that we hypothesize best could help explain the absence of significant foreign exchange rate exposure in previous studies.

First of all, the majority of previous studies on the subject have used portfolios based on the Standardized Industry Classification (SIC) codes of distinctive firms. Just like Bartov and Bodnar (1994) and Chung and Zhou (2010) we identify a problem with this portfolio selection criterion since firms within the same industry do not necessarily react to exchange rate changes in the same manner. Dominguez and Tesar (2001) for instance, find that currency exposure coefficients are roughly evenly split between negative and positive values within an industry, and that exposed firms adapt their behavior differently in response to unanticipated exchange rate changes. Therefore, we hypothesize that pooling firms together that potentially react differently to currency changes, and perhaps even have opposite signs of their exposure, could create enough noise in the sample to cancel out significant exposure.

Second, for example Williamson (2000) and Priestley and Ødegaard (2007) find results indicating that currency exposure is in fact time-varying and not constant, as assumed in most previous studies. If currency exposure changes sign over time (i.e. from positive to negative) as firms adjust their strategies and business behavior, it could possibly lead to insignificant exposure since such changes could cancel each other out. This should however mostly become an issue if longer sample periods are used (Priestley and Ødegaard, 2007), as it for example takes time for firms to move their production. We therefore hypothesize that some researchers might have failed to find significant currency exposure simply because they use too long time periods.

Third, the weak evidence of currency exposure in the previous literature could be due to previous research focusing on the wrong investment horizon. Researchers, for example Nance, Smith and Smithson (1993), have found that many firms actively use financial instruments to hedge their exchange rate exposure, and that hedging results in real benefits by reducing the variance of firm value. One would especially expect this to be true for contemporaneous cash flows, where the short-term effect of changes in exchange rates are easy to measure and financial instruments are liquid. However, for cash flows further into the future, where the long-term impact of currency changes are difficult to determine, one would expect hedging to become more challenging. (Chow et al., 1997) In other words, prior research that have focused on monthly stock returns may have failed to detect exposure because they studied short horizons where firms simply are too effective at hedging their exposure. Also, short horizon stock prices may contain estimation errors made by investors in predicting the long-term impact of contemporaneous exchange rate changes. Bartov and Bodnar (1994) for instance find evidence suggesting that investors do not take all publicly available information into account when forecasting changes in future cash flows from contemporary changes in exchange rates. A rationale for this could be that the connection between exchange rates and firm value simply is too complex for investors to fully comprehend. Chow et al. (1997) also argue that these estimation errors are adjusted only after the impact of changes in exchange rates on future cash flows is revealed over time. Consequently, we hypothesize that using longer investment horizons may be more informative about the link between firm value and exchange rate changes. Studying longer horizons, however, brings a different issue as firms over time can adjust their strategy to counter the exchange rate effects, for example move production or adjust prices.

I.III Purpose

The purpose of this thesis is to reexamine the exposure puzzle by studying the presence of foreign exchange rate exposure in the U.S. stock market using a new methodology that attempts to address the issues brought up in the problem discussion. By this approach we hope to contribute to the general understanding of currency risk exposure, and the impact of unanticipated exchange rate changes on firm value. There is also a wider interest in better understanding the link between firm value and

exchange rate changes, as the world markets continue to become ever more integrated.

I.IV Problem Statement

The purpose of this thesis can be summarized into the following two objectives:

- To investigate whether foreign exchange rate exposure can be detected in the U.S. stock market using a new methodology.
- To investigate whether the issues with inferior portfolio construction methodology, time-varying exposure, and previous research focusing on the wrong investment horizon can help explain the anomaly known as the exposure puzzle.

I.V Empirical Approach

To measure foreign exchange rate exposure we use a multi-factor model, and define exposure as the regression coefficient of the fluctuations in portfolio returns on the percentage change in a trade-weighted exchange rate. We limit our study to the U.S. stock market and the firms included in the S&P 500 index as of February 2013. In order to investigate cancellation effects from offsetting activities we use a new portfolio construction criterion based on firm specific Foreign Exchange Income (FEI) in relation to total sales and compare its performance to portfolios based on SIC industry codes. We also use portfolios based on SIC industry codes to increase the robustness of our findings and conclusions. To determine whether previous studies have focused on the wrong investment horizon, multiple investment horizons up to 24 months are used. To examine the time-varying effects, we also employ three time periods; 1994 to 2011, 1994 to 2002, and 2003 to 2011.

I.VI Findings

We find that currency exposure can be detected in a high number of cases, but only for longer investment horizons. Our results therefore suggest that studying longer horizons is more informative about the relationship between firm value and exchange rate changes, and that previous research has focused on too short horizons. We also find evidence that portfolios based on SIC industry codes are inferior in detecting

currency exposure, and that cancellation effects from offsetting activities therefore could help explain the weak results in the previous literature. Furthermore, we document that a high percentage of the portfolios change signs between the two subperiods. However, we find inconclusive evidence that cancellation effects from time-varying exposure could help explain the exposure puzzle. We additionally find evidence suggesting that currency exposure appears to be affected by various macroeconomic events, such as currency crises, and that perhaps these types of events could help explain the weak results of currency exposure in the exchange rate literature.

I.VII Disposition

The thesis is organized as follows. Section II reviews previous literature while section III presents our methodology. This is followed by a description of the data in section IV. The empirical results are then analyzed in section V, and the last section contains our conclusions, weaknesses, and suggestions for further research.

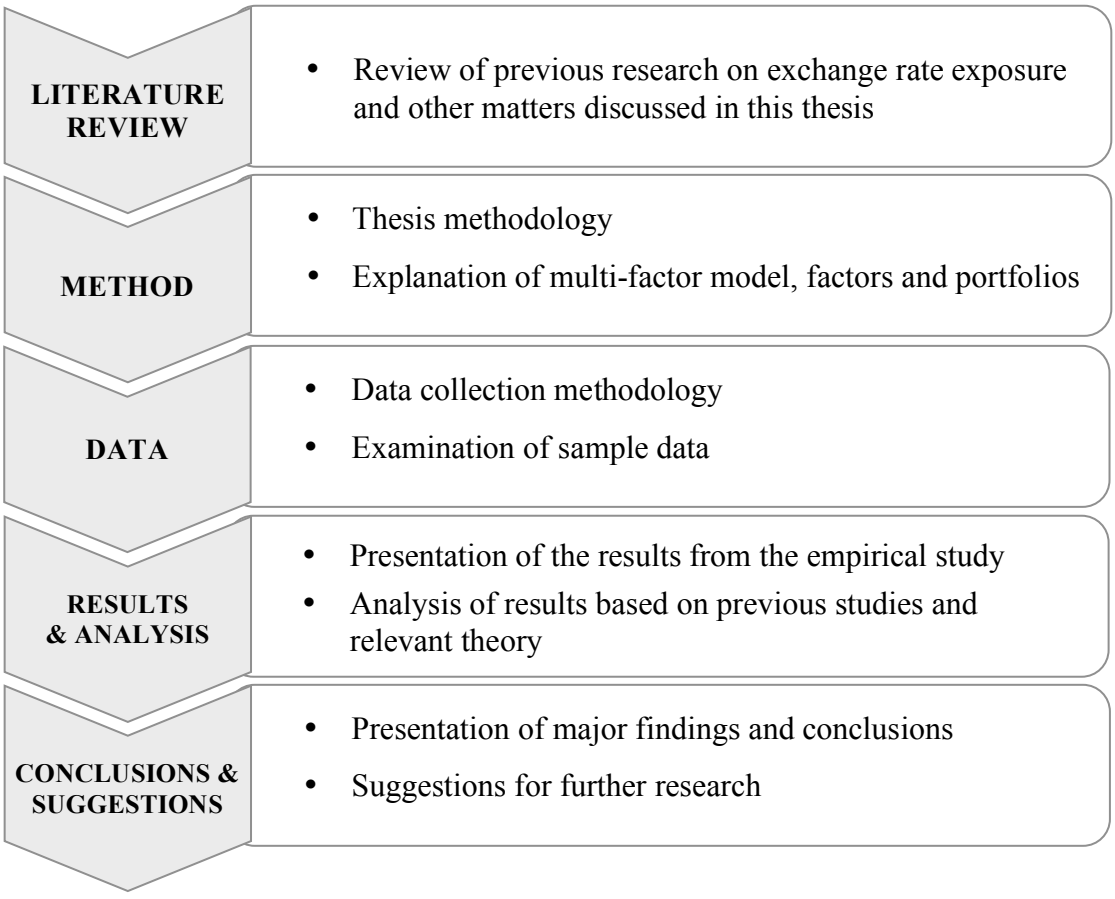

Figure 1. *The figure above presents the disposition of this thesis.*

II. Literature Review

This section aims at giving a review of previous studies and papers. The section begins with an overview of what has been done in the field of exchange rate exposure. Followed is a review of the literature on cancellation effects. This is followed by a presentation of certain papers taking different investment horizons into consideration. Finally we review some possible determinants of exchange rate exposure.

II.I Exchange Rate Exposure

The foreign exchange exposure can be divided into transaction exposure and economic exposure. (Shapiro, 2003) Transaction exposure is described as the risk that exchange rates change between the time a currency transaction is entered into and the time it is settled. Economic exposure, on the other hand, is described as the risk that exchange rate changes will affect the long-term cash flows of a firm and consequently its value. (Shapiro, 2003, and Mullem and Verschoor, 2005) Transaction exposure is therefore mainly a problem in the short term, while economic exposure becomes an issue for longer horizons. Transaction and economic exposure can be handled through financial decisions such as hedging with financial instruments, for example forwards, futures and options, as well as real decisions. In other words, currency exposure also consists of an "operational" component that accounts for the firm's responsiveness to exchange rate changes. For instance, the ability of multinational firms to shift their production from one country to another reduces their exposure to changes in exchange rates. (Dumas, 1978)

Chow et al. (1997) argue that the impact on stock returns from exchange rate changes depends on how exchange rate fluctuations are correlated with changes in cash flows as well as interest rates. For example, exporting firms benefit from a depreciation of the local currency as the foreign demand increases when the exporting firms' products become relatively less expensive for foreign customers. Contrary, corporations that rely mostly on imported goods might see their profits shrink as a consequence of increasing production costs when the local currency depreciates. (Jorion, 1991) Naturally, the opposite is true if the local currency appreciates. Another factor that may affect a firm's currency exposure is their ability to pass through the impact of

exchange rate changes to customers through product price adjustments (Griffin and Stulz, 2001). Bodnar, Dumas and Marston (2002) argue that a firm's pass-through capabilities are closely related to the substitutability of the firm's products. For example, if the product substitutability in a market increases, then pass-through opportunities decline and currency exposure increases.

So far we have covered theories on how firms with direct foreign exchange exposure are affected by exchange rate changes. Some researchers (e.g. Adler and Dumas, 1984), however, argue that even purely domestic firms without foreign operations, assets or liabilities are exposed to currency rate movements. The argumentation behind this is that changes in exchange rates impact macroeconomic factors such as interest rates, price levels, and competition, but also because a part of the domestic firm's customer base potentially is exposed to currency fluctuations (Hodder, 1982 and Jorion, 1991).

Several empirical studies have been conducted on the relationship between exchange rate exposure and firm value. One of the most recited is done by Jorion (1990). He investigates whether U.S. multinational firms are exposed to foreign exchange rates, and measures exposure as the regression coefficient of the fluctuations of firm value on the change in a trade-weighted exchange rate. His study documents significant cross-sectional differences in the exposure of the examined firms, but only detects significant exposure for approximately 16 percent of the studied firms. Jorion (1991) later reexamined the presence of currency exposure and the pricing of currency risk in 1991. His later study uses SIC industry portfolios and APT models, and measures exposure as the percentage change in the orthogonolized trade-weighted exchange rate to firm value. The study, however, only documents significant currency exposure for approximately 30 percent of the industry portfolios.

Other examples of studies on the U.S. stock market are Bodnar and Gentry (1993), Amihud (1994), Allayannis (1997), and Griffin and Stulz (2001). Amihud (1994) only documents little evidence of significant currency exposure for the 32 largest U.S. exporting firms. Bodnar and Gentry (1993) use all firms in the CRSP to create 39 industry portfolios. However, they only find that 11 out of their 39 industry portfolios have significant foreign exchange rate exposure. Allayannis (1997) and Griffin and

Stulz (2001) find equally weak evidence of a significant relationship between contemporaneous exchange rate changes and firm value.

The evidence of currency exposure outside of the U.S. is also poor. For instance, Dominguez and Tesar (2001) investigate the presence of exchange rate exposure on 8 non-US industrialized and developing countries. They use a two-factor model, and measure both firm level and industry level exposure as the change in firm value to three different exchange rates. The authors document significant exposure for 5 to 30 percent of the firms in the different countries, Japan having the highest percentage and Chile having the lowest. For the industry level exposure they find a slightly wider range, with significant exposure in 5 to 60 percent of the industries, with Germany displaying the highest exposure and Chile once again the lowest. Their results also suggest that exposure is not concentrated to any specific industry category or industry characteristic.

Bodnar and Marston (2002) take another approach to measure exchange rate exposure. They create a simple model without the need of stock return data, and measure currency exposure as the derivative of current profits of a firm with respect to foreign exchange rates. Their study documents that firms with an operational hedge can offset foreign currency revenues and costs and thereby protect themselves from changes in exchange rates. In other words, firms with balanced foreign denominated revenues and costs will most probably not have large exposure, even though they are highly involved in international operations. Instead, Bodnar and Marston (2002) suggest that firms involved purely in export or import, especially in low profit markets, should be expected to have the highest degree of currency exposure.

II.II Cancellation Effects: Sample Noise and Time-Varying Exposure

Bartov and Bodnar (1994) argue that the sample selection procedure of previous studies often leads to severe noise and consequently insignificant currency exposure. For example, it is common in the exchange rate literature to use SIC industry codes (e.g. Jorion, 1991 and Bartov and Bodnar, 1994) as a portfolio construction criterion. This approach is beneficial since most firms within an industry conduct similar activities, such as import or export. It, however, becomes a problem if the firms

within an industry react differently to exchange rate changes. Dominguez and Tesar (2001) for instance, find that currency exposure coefficients are roughly evenly split between positive and negative values within an industry, and that exposed firms adapt their strategy differently in response to unanticipated exchange rate changes. Friberg and Granslandt (2007) even find that firms with identical products are affected differently by currency exposure. Bartov and Bodnar (1994) argue that putting firms with such differing characteristics into the same portfolio leads to severe noise and cancellation of significant currency exposure, and that it is necessary to apply a selection criterion that reduces such effects. Bartov and Bodnar (1994) test their theories by selecting firms that are likely to have the same sign on their currency exposure by using reported foreign currency adjustments. They then measure exposure as the fluctuations in firm value on the change in a trade-weighted exchange rate. The authors, however, fail to document a clear and statistically significant relationship between current changes in the exchange rate and firm value.

Another issue that could result in cancellation of significant currency exposure is the existence of time-varying currency exposure. Priestley and Ødegaard (2007) for instance point out that foreign exchange rate exposure changes sign over time due to factors such as shifts in firm behavior, and that significant exposure is cancelled out over time when longer sample periods are considered. Williamson (2001) uses a sample of U.S. and Japanese automotive firms, and divides the sample into three subperiods. He finds that time-varying foreign exchange exposure appears to exist across countries for multinational firms, and that the exposure changes over time as the competition and structure of the industry change. Time-varying exposure is also to some extent confirmed in other studies, such as Jorion (1990), Amihud (1994), and Levi (1994).

Chung and Zhou (2010) try to address the issue of time-varying currency exposure, as implied by the findings of Levi (1994) and Williamson (2001), and the issues of cancellation effects connected with SIC industry portfolios, as suggested by Bartov and Bodnar (1994). The authors use monthly returns and construct portfolios sorted on Foreign Exchange Income (FEI), and employ both a two-factor and a multi-factor asset-pricing model that allows for time-varying currency exposure and risk premiums, and nonlinearity in the return generation process. The authors, however,

only find statistically significant currency exposure at the 5 percent level in 1 out of 5 portfolios when using the two-factor model on their full sample period. When using two shorter subperiods the authors cannot find statistically significant exposure for any of the portfolios. Similar results are found when the multi-factor model is used. In other words, 1 out of 5 portfolios have significant exposure at the 5 percent level for the whole sample period, while none of the portfolios have significant exposure in the two subperiods.

II.III Investment Horizons: Hedging and Estimation Errors

In traditional asset pricing theory, high expected returns can only be achieved if investors are willing to accept high levels of systematic risks. However, different factors of systematic risk have been discovered to be relevant on different investment horizons. (Kamara, Korajczyk, Lou and Sadka, 2012)

Chow et al. (1997) argue that the absence of significant currency exposure in previous studies might be because corporations hedge their exposure so effectively that the firm value simply becomes insensitive to unanticipated changes in exchange rates. This theory is supported by Nance et al., (1993) and Allayannis and Ofek (2001), who found that many firms actively use financial instruments, such as forwards and options, to hedge their exchange rate exposure and that hedging brings measurable benefits by reducing the variance of firm value. Dumas (1978) also argues that hedging activities, if known and incorporated in stock prices, will reduce the relationship between stock prices and exchange rate changes. One would expect this to be particularly true for contemporary cash flows, where the short-term impact of changes in exchange rates are easy to determine and financial instruments are liquid. However, for long-term cash flows, where the future impact of exchange rate changes is difficult to quantify, hedging is likely to become more challenging. (Chow et al., 1997) This is supported by Bodnar, Hayt and Marston (1998) who suggest that most hedges are short-term, and that the majority of the examined firms use derivatives with maturity of 90 days or shorter. Simkins and Laux (1997), however, only find weak evidence that these hedging activities influence currency exposure, and Hentschel and Kothari (1997) find no such evidence. This could possibly be explained by the arguments of Jacque (1981) who suggests that while complete cash flow

hedging is theoretically feasible, it is not necessarily optimal. Bodnar et al. (1998) for instance found that U.S. firms hedge less than 50 percent of their payables and receivables determined in a foreign currency. Studies have, however, shown that hedging activities for U.S. firms have increased over time (Bodnar et al., 1998), making hedging a more prominent issue for recent years.

Based on the idea that hedging effectiveness is high for shorter horizons, Chow et al. (1997) create both equally-weighted and value-weighted portfolios of NYSE stocks and use a multi-factor model to measure exposure for time horizons of 1, 3, 6, 12, 24, 36, and 48 months. In line with their hypothesis, the results show no statistically significant correlation of stock returns and exchange exposure for horizons shorter than 6 months. The authors also use 65 industry portfolios, and find that exchange rate exposure is only statistically significant for time horizons of one year and longer. The observed number of significantly exposed industries also tends to increase with horizon length, supporting their theories of investment horizons.

Bartov and Bodnar (1994) give another possible explanation to why investment horizons could play an important role in detecting currency exposure. They argue that the absence of empirically significant currency exposure is due to mispricing of stock prices in the short run, which arises from systematic errors of stock prices made by investors when trying to estimate the long-term relationship between exchange rates and firm value. The estimation errors are in turn only adjusted as new information about the cash flow impact of exchange rate changes are revealed over time. In order to account for these issues, Bartov and Bodnar (1994) study lagged as well as contemporaneous changes in the dollar and firm value. In line with their expectations, they fail to detect a statistically significant relationship between current changes in the exchange rate and firm value and, similarly to Amihud (1994), they find that lagged changes in the exchange rate explain firms' returns, suggesting that mispricing does occur.

II.IV Determinants of Currency Exposure

II.IV.I Foreign Involvement

As discussed above, it is possible for firms with little to no foreign involvement to still be exposed to exchange rate risk through indirect means. (Adler and Dumas, 1984) However, there is little doubt that multinational firms with a lot of foreign assets, liabilities, and transactions are directly exposed to exchange rate fluctuations through at least some of these channels.

Gao (2000) conducts a study that examines the connection between currency exposure and firms' foreign involvement. The author finds that firm revenues and production costs are directly impacted by exchange rate fluctuations through foreign sales and foreign production, and that the stock market reacts to the profitability effect from these channels. Doidge, Griffin and Williamson (2002) also test different determinants of foreign exchange exposure through cross-sectional regressions of exchange rate betas on foreign sales, export sales, foreign income, and foreign assets. The authors find that exposure varies with international activity and that the variables tested are negatively related to exposure. For example, firms with high international sales benefit from local currency depreciations and are thus hurt by local currency appreciations. By measuring cross-sectional differences in returns between firms with high and no international involvement the authors also find that large firms, across all tested markets, with high international sales are more sensitive to exchange rate movements than small firms with low international sales.

Dominguez and Tesar (2001) examine whether there is an existent correlation between currency exposure and the nature of a firm's involvement in international markets. The authors find that some of the studied countries' multinational firms, on average, have higher levels of currency exposure than domestic firms. Dominguez and Tesar (2001), however, cannot find any clear relationship between significant currency exposure and foreign sales and level of international assets.

II.IV.II Industry Characteristics

Bodnar and Gentry (1993) examine the relationship between changes in exchange rates and different industry categories in Canada, Japan and the USA. The results are found to be statistically significant in approximately 10 to 30 percent of the industries for each of the countries. The authors also try to determine which industry characteristics that drive exchange rate exposure. They suggest that exposure may be large for industries heavily involved in a single activity such as for example importing or exporting, and small for industries that are involved in a combination of activities. This is related to the later findings of Bodnar and Marston (2002) who also determine that industries with offsetting activities do not show significant currency exposure. Bodnar and Gentry (1993) argue that it must be the interrelation of these activities that determines industry exchange rate exposure and therefore model the exposure as a function of different industry characteristics. The authors examine characteristics such as non-traded goods vs. traded goods (non-traded goods are goods that have too high transportation costs to be internationally traded), export vs. import, and the use of internationally priced inputs. They find that these characteristics affect an industry's currency exposure in a way that is mostly consistent with economic theory. In other words, industries with high export ratios gain from a depreciation, foreign denominated inputs gain from an appreciation, while industries with non-traded goods, apart from in the U.S., gain from an appreciation of the local currency.

II.IV.III Firm Size

Dominguez and Tesar (2001), as well as Doidge et al (2002), propose that larger companies are more likely to be internationally involved and thereby should have higher currency exposure. However, they also argue that it might be the case that larger firms have a higher level of hedging activities and thus the net exposure might be smaller for these firms rather than larger.

Doidge et al. (2002) also discuss that firm size often serves as a proxy for the amount of information available to the market regarding a firm's operations. Thus, it is possible to make market inefficiency arguments for findings of low exposure. If investors are assumed to better understand the effect of currency exposure on firm value for large firms, for which more information is available, then the market

inefficiency argument would suggest that large firms have higher exposure than small firms. It can thereby be argued that although small firms are less likely to use derivatives to hedge their exposure, they have large estimation errors in their stock prices due to information asymmetry, and as a result small firms could display less currency exposure.

Doidge et al. (2002) test their theories and, in line with their expectations, the results show that large firms in the U.S. are generally more exposed than small firms. They reason that because large firms are more likely to hedge themselves, hedging cannot be an explanation for their results. Another possible explanation brought up by the authors is that large firms compete in markets where demand is price sensitive, making pass-through very difficult, whereas small firms are niched in markets with inelastic demand and therefore can adjust their prices.

Other examples of studies that document evidence of larger firms being more exposed than smaller firms are He and Ng (1998) and Bodnar and Wong (2000). They both find that larger firms are more exposed even after adjusting for the extent of foreign sales. Dominguez and Tesar's (2001) findings, however, suggest that exposure is not dependent on firm size, but rather appears to be firm specific. The authors therefore find it no surprise that previous studies focusing on industry level or large companies in only a few industries have not been able to detect evidence of currency exposure.

III. Methodology

This section aims at explaining the thesis methodology. The section is organized as follows. It begins with a description of the exposure regression which is followed by our variable description and a short explanation of the econometric issues. The section ends with a description of the portfolios of study and portfolio construction methodology.

III.I The Exposure Regression

To measure currency exposure we use the Fama-French three-factor model (Fama and French, 1992, 1993, 1996), with an additional exchange rate factor. The reason for this is two folded. First of all, the Fama-French three-factor model, together with the Carhart (1997) extension, has been proven to be very effective in explaining asset returns in time series regressions, and has therefore been commonly used in the exchange rate literature (e.g. Kolari, Moorman, and Sorescu, 2008, and Chung and Zhou, 2010). Secondly, if a change in the exchange rate can push a firm into financial distress, as argued by Starks and Wei (2005), then currency risk can be seen as a distress risk much similar to the factors in the Fama-French three-factor model.

In line with previous research (e.g. Adler and Dumas, 1984, Jorion, 1990 and Bartov and Bodnar, 1994), we assume the changes in the spot exchange rate to be unanticipated by the market, and define foreign exchange rate exposure as the relationship between fluctuations in excess returns and the percentage change in the exchange rate. More formally this allows us to empirically measure currency exposure as the value of β_{EX} from running the following time series regression:

$$R_{t,t+T} = \beta_0 + \beta_{MKT}R_{MKT;t,t+T} + \beta_{SMB}SMB_{t,t+T} + \beta_{HML}HML_{t,t+T} + \beta_{EX}EX_{t,t+T} + \varepsilon_{i;t,t+T} \quad (1)$$

$R_{t,t+T}$ is the excess return of portfolio *i* from *t* to *t* + *T*. $R_{MKT;t,t+T}$, $SMB_{t,t+T}$, and $HML_{t,t+T}$ are the Fama-French factors, and $EX_{t,t+T}$ is the percentage change in the exchange rate, also known as the exposure factor. Using this definition, the beta of the

exposure factor represents the change in portfolio returns that can be explained by unanticipated changes in the exchange rate. The finding of a significant and non-zero exposure coefficient would therefore suggest that unanticipated changes in the exchange rate impact stock returns.

In order to examine the potential cancellation effects from time-varying exposure the regression will be run over three sample periods covering; 1994 to 2011, 1994 to 2002, and 2003 to 2011. To investigate whether previous studies have focused on too short horizons we will also consider different investment horizons up to 24 months, where T=1, 6, 12, 18, and 24 months.

III.II Variable Description

For investment horizons longer than one month, all of the returns for our portfolios and factors are continuously compounded monthly returns. For example, the excess return for our portfolios, $R_{t,t+T}$, at the T-month investment horizon is calculated by subtracting the continuously compounded 1-month Treasury bill rate from the continuously compounded return in the portfolio.

$R_{MKT;t,t+T}$ is the continuous value-weighted return on the market portfolio in excess of the 1-month Treasury bill rate over the time period *t* to *t* + *T*. $SMB_{t,t+T}$ is the return of a portfolio of small capitalization stocks in excess of the return on a portfolio of large capitalization stocks. $HML_{t,t+T}$ is the return on a portfolio of high book-to-market stocks in excess of the return on a portfolio of low book-to-market stocks.

$EX_{t,t+T}$ is the percentage change in a trade-weighted exchange rate over the time period. The trade-weighted exchange rate is defined as the amount of U.S. dollar it takes to buy one unit of a trade-weighted pool of currencies. This means that an increase in the factor represents a depreciation of the U.S. dollar, while the opposite holds for a decrease. The trade-weighted exchange rate is derived as a weighted average of the 10 largest U.S. trading partners, and is updated annually. The argument for using a trade-weighted exchange rate is, as argued by Jorion (1990), that it is a good proxy for the effect of exchange rate changes while it at the same time avoids the problem of multicollinearity when distinct but correlated exchange rates are used

in a time series regression. Williamson (2001), however, criticizes the use of a trade-weighted exchange rate as it could lead to an underestimation of the exposure. He argues that this underestimation could occur if the asset or portfolio tested is only exposed to a small number of the currencies used. Tailoring firm or portfolio specific exchange rates could of course avoid this issue, but it is not clear how to effectively select and determine these exchange rates for larger samples.

In order to avoid that the finding of significant exposure is a result of high correlation with some of the priced Fama-French factors we will orthogonolize the exposure factor. The orthogonalization follows the approach of previous research (e.g. Jorion, 1991). In other words, we orthogonalize the exchange rate factor over the other three Fama-French factors, and use the orthogonalized component as exposure factor. More formally our exposure factor is given by:

$$EX_{t,t+T} = R_{EX;t,t+T} - (\beta_{MKT} R_{MKT;t,t+T} + \beta_{SMB} SMB_{t,t+T} + \beta_{HML} HML_{t,t+T}) \qquad (2)$$

Thus, $EX_{t,t+T}$ is defined as the residual of the regression of the percentage change in the trade-weighted exchange rate, $R_{EX;t,t+T}$, on the Fama-French factors.

III.III Econometric Issues

In order to make full use of the information in our dataset we will use overlapping returns for horizons longer than one month. This, however, creates a problem as the overlapping returns causes the error term in equation (1) to become serially correlated with order T-1, as mentioned by Chow et al. (1997). In other words, our variance-covariance matrix of estimated coefficients will be inconsistent, and needs to be adjusted.

In order to adjust the variance-covariance matrix for serial correlation, we employ the approach of Newey and West (1987). The Newey-West approach uses OLS residuals and takes into account that the stochastic process of the error term is weakly dependent, which means that the correlation between the error terms is reduced as their distance in time increases. More specifically this means that we need to decide on a lag after which we can assume that the serial correlation is zero. Selecting the lag

is straightforward in this case, as we know how many overlapping periods there are. For example, a 12-month investment horizon will at least be serially correlated of the order 11 (T-1), while a 6-month horizon will be serially correlated of the order 5 (T-1). This approach is hence applied for investment horizons longer than one month and the calculation of the Newey-West serial correlation consistent standard errors.

III.IV Portfolios of Study

Although theory proposes a number of different channels through which a firm may be exposed to exchange rate risk, it provides little guidance as to which type of firms or industries that are most likely to be exposed. This is because firms have direct and indirect currency exposure, and because factors such as hedging play an important role. Previous studies within the field have used portfolios formed mainly on industry affiliation. This portfolio category, however, could include a lot of noise, as firms do not necessarily react in the same manner to unanticipated exchange rate changes. To address this issue we will create a new set of portfolios, which are based on firm specific Foreign Exchange Income in relation to total sales. We will also compare the performance of our FEI portfolios to the more traditional SIC based industry portfolios.

III.IV.I Foreign Exchange Income in relation to Total Sales

The yearly FEI-value of a firm represents the foreign exchange gain or loss over the year, net of hedging activities. The use of foreign exchange income as portfolio selection criterion was first suggested by Bartov and Bodnar (1994), and recently used by Chung and Zhou (2010). Bartov and Bodnar (1994) argue that this approach avoid the problems of identifying firms that are internationally involved, and that are impacted differently by exchange rate changes. The authors also argue that it should help avoid the endogenity of hedging since FEI is reported net of hedging activities. This approach should in other words not only ensure that we use firms that truly are exposed, but also reduce the issues with portfolio noise and cancellation effects. We, however, believe that the approach of Bartov and Bodnar (1994) and Chung and Zhou (2010) could be further improved. Bartov and Bodnar (1994) for instance acknowledge that foreign currency adjustments are not an accurate representation of the economic impact of exchange rate changes on the firm. Let us elaborate. Let's say

that a firm such as GM has the highest positive FEI for a given year. This means that Bartov and Bodnar (1994) and Chung and Zhou (2010) would interpret GM to be the most positively exposed company in the sample for that year. However, as GM is such a large company, the reported FEI-value might be small in relation to GM's total income, and therefore not have a large economic impact on the firm. To avoid this, we propose creating portfolios based on FEI in relation to total sales. Taking firm size into account allows us to detect which firms that receive the most severe economic impact from exchange rate changes. This portfolio selection criterion should therefore better than previously used criterions reduce the risk of creating portfolios with firms that are impacted differently by exchange rate changes.

For each year we identify all firms in our sample that report FEI to Compustat. We then calculate a relative Foreign Exchange Income value for each firm by dividing their FEI with their total sales. All companies are then ranked on a yearly basis based on their relative FEI-value, from highest to lowest. Five value-weighted portfolios are then formed based on a preselected criterion in order to ensure that Portfolio 1 and 5 contain the most, positively versus negatively, exposed companies while portfolio 3 contains firms with close to neutral exposure.

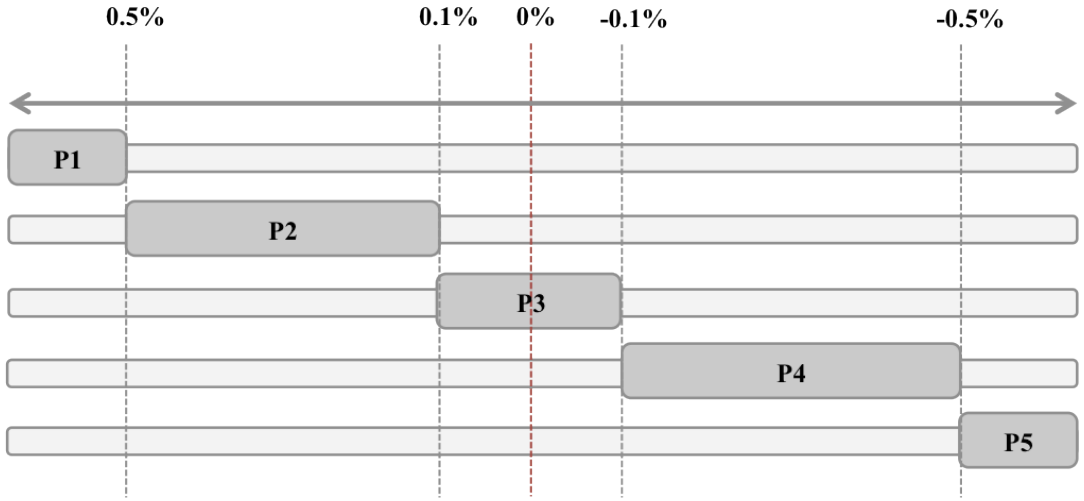

Figure 2. *The figure above graphically presents on what criterion the FEI portfolios are constructed.*

Portfolio 1 consists of companies with relative FEI-values larger than 0.5 percent, Portfolio 2 from 0.1 percent up to 0.5 percent, Portfolio 3 between 0.1 percent and -0.1 percent, Portfolio 4 between -0.1 percent and -0.5 percent, and Portfolio 5 consists

of companies with a relative FEI-value lower than -0.5 percent. By this approach we ensure that firms that are very positively exposed are not included in the same portfolio as firms with very negative exposure. The portfolios are rebalanced each year, at an assumed zero cost, for all investment horizons.

III.IV.II Industry Affiliation

Using SIC codes to create portfolios has been common in the exchange rate literature (e.g. Jorion, 1991 and Bartov and Bodnar, 1994) since it ensures that firms with at least similar activities, such as importing and exporting, are pooled together. However, as discussed in our introduction, and shown in our literature review, the SIC industry approach have its drawbacks as firms within an industry still can react very differently to unanticipated exchange rate movements. This could result in severe noise in the industry portfolios and, in a worst-case scenario, cancellation of significant exchange rate exposure.

The industry portfolios are constructed with a similar methodology as Kenneth French's industry portfolios. First we identify SIC codes of all the firms in our sample. The SIC system was established in the United States in 1937 and is used to classify industries by a four-digit code. Each code represents an industry affiliation and the codes can be grouped in larger divisions. For instance, 1000 to 1499 represents the Mining industry, while 4000 to 4999 represents the industries of Transportation, Communications, Electric, Gas and Sanitary service, see Appendix for a full list of SIC divisions. Based on these categories, and the SIC codes of the individual firms in our sample, we create 8 value-weighted industry portfolios.

1. Mining
2. Construction
3. Manufacturing
4. Transportation, Communications, Electric, Gas, and Sanitary Services (TCEGS)
5. Wholesale Trade
6. Retail Trade
7. Finance, Insurance, and Real Estate (FIR)
8. Services

IV Data

In this section we discuss our data. The section is organized as follows. It begins with a discussion of the rationale behind our limitations. This is followed by a description of how we acquired the data for our portfolios, as well as a short interpretation of its characteristics. The section ends with an examination of the correlations between the factors in our multi-factor model.

IV.I Thesis Limitations

We have decided to limit our study to the U.S. stock market, as U.S. listed firms are the only corporations that actively report their Foreign Exchange Income to Compustat. Furthermore, FEI is a rather new variable in the Compustat database and it is only in the last 10 to 20 years that an increasing number of companies have started to actively report it. We have therefore decided to limit the study to the time period January 1994 to December 2011. Another rationale for why we use this specific time period is that it enables us to construct two equally sized subperiods with potentially different characteristics, which could help detect time-varying exposure. The years 1994 to 2002 are for example characterized by a large number of currency crises. We also limit our sample to the companies in the S&P 500 index as of February 2013. Using the firms in the S&P 500 index makes our dataset easy to handle, while ensuring that the firms included are a good representation of the industries in the USA. Larger firms are also beneficial since such firms have been documented to be more exposed than smaller firms. They are generally more internationally involved, operate in more mature and competitive markets, and provide more publicly available information. (Doidge et al., 2002) However, using large firms could add a level of ambiguity, since larger firms are more likely to have a risk management department and well developed hedging policies which could reduce the measured exposure. Doidge et al. (2002), however, found that hedging in larger firms is not an issue for detecting currency exposure.

IV.II S&P 500 Stock Data

The monthly historical stock data for the companies in the S&P 500 as of February 2013 were obtained from Datastream for the time period January 1994 to December

2011. As we use companies included in the S&P 500 as of February 2013 our initial dataset contains firms that have not existed or been public for the full length of our sample period and also some firms that for other reasons have missing data. Since we want a continuous base sample over time, we remove all companies that have data missing for our sample period. This left us with a total of 328 firms.

IV.III Foreign Exchange Income

Annual Foreign Exchange Income data was retrieved from the Annual Compustat Database for the period 1994 to 2011. As it can be seen from the table below (Table 1), the number of firms reporting FEI in their annual income statements has increased, from 79 in 1994 to an all-time high of 123 in 2009. This could either mean that firms have become more internationally involved or simply that more firms have begun to report FEI to Compustat. The higher number of firms reporting FEI for the later years also suggests that the results for the second subperiod should be more robust, and that we therefore should focus our analysis on those years.

Year	Number of S&P 500 firms reporting FEI		
	FEI	FEI = 0	FEI ≠ 0
1994	79	3	76
1995	78	3	75
1996	77	4	73
1997	80	3	77
1998	80	3	77
1999	75	2	73
2000	73	3	70
2001	71	3	68
2002	85	2	83
2003	92	4	88
2004	104	4	100
2005	109	4	105
2006	112	9	103
2007	116	5	111
2008	122	5	117
2009	123	5	118
2010	122	5	117
2011	116	8	108
Mean	**95**	**4**	**91**

Table 1. *The table shows statistics of how many companies in our S&P 500 sample that report FEI-values over our sample period (1994-2011).*

Annual total sales figures for our relative FEI measures were obtained from a combination of Datastream and Compustat for the period 1994 to 2011. In Table 2 below we present the number of firms included in each of our relative FEI portfolios over the entire sample period. The average portfolio size ranges from the smallest of 5 firms in Portfolio 5 to the largest of 51 firms in Portfolio 3. As seen above, Table 1 could indicate that more firms have become exposed to foreign exchange rate risk in recent years. We would therefore expect to see proportionally more firms in the most extreme portfolios for the more recent years. However, we cannot see any such pattern, and instead it appears that it is only the number of firms in Portfolio 3 that have considerably increased over time. One possible explanation for these findings is that while firms have become more exposed in absolute terms, they have also grown in size, keeping the economic impact of the exchange rate exposure at the same level as before.

Year	Portfolios				
	P1	**P2**	**P3**	**P4**	**P5**
1994	7	8	30	25	9
1995	5	10	37	22	4
1996	4	11	45	15	2
1997	6	15	35	22	2
1998	6	10	36	27	1
1999	6	12	40	15	2
2000	6	14	35	16	2
2001	5	11	42	12	1
2002	7	10	38	24	6
2003	11	14	39	23	5
2004	9	15	43	32	5
2005	7	16	55	28	3
2006	6	20	62	23	1
2007	12	24	58	16	6
2008	13	23	41	32	13
2009	9	24	51	31	8
2010	9	11	63	10	10
2011	6	7	69	25	7
Mean	**7**	**14**	**46**	**22**	**5**

Table 2. *The table shows statistics of the number of firms distributed into every FEI-constructed portfolio over our sample period (1994-2011).*

IV.IV SIC Based Industries

As can be seen in Table 3 below, the number of firms in the industries varies between a low 21 in the Mining industry to a high 148 in Manufacturing. Also, from Table 4 we observe that the average firm size, as expected, has increased over time for all industries. The largest average firm size can be found in the Manufacturing industry with an average of USD 27 billions. Mining on the other hand is the smallest industry with USD 6.9 billions. Furthermore, it appears that there is no apparent relationship between the average firm size within an industry and the number of firms it contains, for our sample.

	Number of Firms in Each Industry Portfolio							
	Mining	**Constr**	**Manuf**	**TCEGS**	**Wholesale**	**Retail**	**FIR**	**Services**
Nr. of Firms	21	3	148	52	6	23	50	25

Table 3. *The table shows the average number of firms included in each of our portfolios constructed on industry.*

Year	Average Firm Size for Each Industry (Millions USD)							
	Mining	**Constr**	**Manuf**	**TCEGS**	**Wholesale**	**Retail**	**FIR**	**Services**
1994	2044	5360	7423	5255	2187	7354	4163	4783
1995	2331	5837	8849	5986	2458	8766	4722	5825
1996	3011	8685	11588	7919	3214	11646	6344	7818
1997	3521	11038	15165	9461	3850	14996	7536	9641
1998	5271	15596	22324	14145	5572	21419	11330	14506
1999	5874	22405	29853	17415	5788	25764	14463	19297
2000	5749	23309	34693	18939	5684	35166	14697	20600
2001	6384	23251	32370	18901	6421	30917	14635	20287
2002	6761	21683	30155	18340	6730	29439	14456	19755
2003	5686	18954	26429	15410	5744	25404	12662	16799
2004	7947	25158	31936	20105	7963	30406	16937	21194
2005	8446	24088	32280	20655	8499	30475	16988	20874
2006	10393	27442	35543	24069	10553	34127	20171	24362
2007	11791	29802	39464	26799	11990	36696	22456	27514
2008	10722	24866	36992	25456	11197	35737	20335	24573
2009	6638	16168	23585	15528	6844	21299	12789	16359
2010	10007	25125	33789	23863	10259	31555	19150	24516
2011	11231	27443	37068	25297	11398	32359	21546	26073
Mean	**6878**	**19789**	**27195**	**17419**	**7020**	**25751**	**14188**	**18043**

Table 4. *The table shows the average firm size in millions of USD for firms included in each of our portfolios constructed on industry.*

IV.V Factors

The Fama-French factors and the 1-month Treasury bill rate were obtained from Kenneth French's personal research homepage for the period January 1994 to

December 2011. Annual trade data of the major U.S. trade partners was obtained from the Federal Reserve Bank Reports in the Wharton Research Data Service (WRDS) for the period 1994 to 2011. The monthly exchange rates for the largest U.S. trading partners were obtained from Datastream for the period January 1994 to December 2011.

In Figure 3 below we have plotted the fluctuations of the trade-weighted exchange rate, here defined as an index with base year 1994. As we mentioned in our variable description, the trade-weighted exchange rate is defined as the amount of USD required to buy 1 unit of the trade-weighted pool of foreign currencies. As can be seen in the figure, the first half of the sample period is characterized by years of appreciation of the dollar; from a maximum of 1.05 in late 1995 to a minimum of 0.75 in early 2002. The second subperiod, on the other hand, appears to be more stable apart from the years around the recent financial crisis. These observations support our decision to use this time period, as it enables us to observe two distinct subperiods with different characteristics.

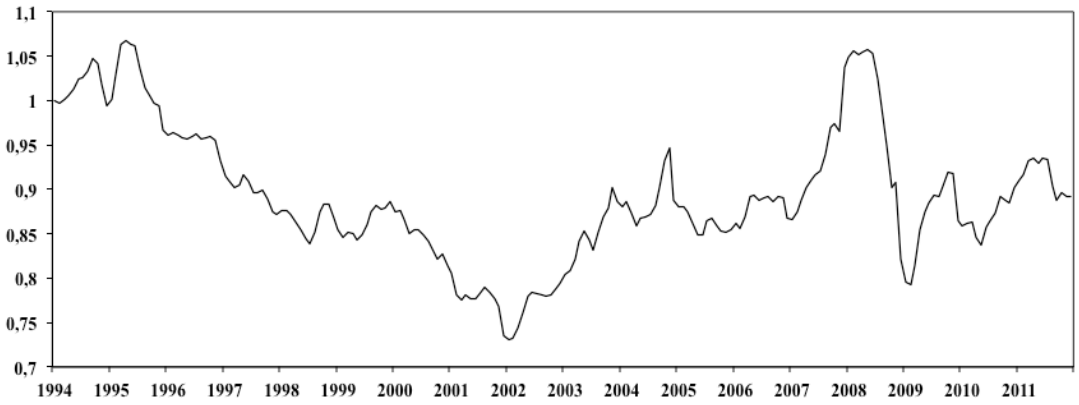

Figure 3. *This figure plots the monthly fluctuations in the trade-weighted exchange rate, here defined as an index with base year 1994, for the period January 1994 to December 2011.*

IV.VI Correlations Between Variables

The table below (Table 5) presents the correlations between our regression factors, both for the whole sample period and the two subperiods, 1994 to 2002 and 2003 to 2011. The currency exposure factor is significantly and positively correlated with the Mkt-RF factor, both for the whole sample period and the period of 2003 to 2011. The

positive correlation between these factors indicates that the return of Mkt-RF increase as the dollar depreciates. The exposure factor is also significantly correlated with the HML factor at the 10 percent level for the period of 1994 to 2002. The presence of a significant correlation between our exposure factor and these two priced Fama-French factors shows how important it is to orthogonolize our exposure factor before running any regressions, in order to avoid problems with multicollinearity.

Sample Period	Variable	Variable			
		Mkt-RF	SMB	HML	EX
January 1994 - December 2011	**Mkt-RF**	1,000	-	-	-
	t-stat	-	-	-	-
	SMB	**0.245**	1,000	-	-
	t-stat	(3.692**)	-	-	-
	HML	**-0.241**	**-0.362**	1,000	-
	t-stat	(-3.635**)	(-5.688**)	-	-
	EX	**0.200**	0.029	-0.034	1,000
	t-stat	(2.991**)	(0.425)	(-0.491)	-
January 1994 - December 2002	**Mkt-RF**	1,000	-	-	-
	t-stat	-	-	-	-
	SMB	0.141	1,000	-	-
	t-stat	(1.466)	-	-	-
	HML	**-0.574**	**-0.528**	1,000	-
	t-stat	(-7.211**)	(-6.394**)	-	-
	EX	0.030	0.059	-0.158	1,000
	t-stat	(0.309)	(0.604)	(-1.648*)	-
January 2003 - December 2011	**Mkt-RF**	1,000	-	-	-
	t-stat	-	-	-	-
	SMB	**0.487**	1,000	-	-
	t-stat	(5.746**)	-	-	-
	HML	**0.320**	**0.160**	1,000	-
	t-stat	(3.476**)	(1.672*)	-	-
	EX	**0.321**	0.002	0.080	1,000
	t-stat	(3.490**)	(0.021)	(0.822)	-

Table 5. *The table presents the correlation between our regression factors for the whole sample period (1994-2011) as well as the two subperiods (1994-2002 and 2003-2011). The coefficients' t-stats are reported in parentheses and (**) and highlighted coefficients indicate statistical significance at a 5 percent level, while (*) indicates a statistical significance at the 10 percent level.*

V. Results & Analysis

In this section we will present and analyze the results from our regressions. The section is organized as follows. It begins with a presentation and analysis of the results from the regressions on the whole sample period, 1994 to 2011. Followed is an analysis of the results from the regressions on our two subperiods; 1994 to 2002 and 2003 to 2011.

V.I Currency Exposure - Sample Period 1994 to 2011

V.I.I Whole Sample Regression

In the introduction of this thesis we introduced possible explanations as to why an exposure puzzle exists in the exchange rate literature. We discussed cancellation effects due to inferior portfolio selection criterions and time-varying exposure, as well as issues of hedging effectiveness and short term estimation errors. As an introduction to our examination of currency exposure we will therefore run our multi-factor model on a value-weighted index of all 328 companies, over the period 1994 to 2011. By doing so, we hope to find an initial confirmation of the concerns brought up in the problem discussion, and also create a point of reference to which we can compare the performance of our FEI and industry portfolios.

Portfolio Category	Variable	Investment Horizon (Months)				
		1	6	12	18	24
Full sample	EX	0.031	-0.042	-0.103	-0.271	-0.398
	t-stat	*(0.614)*	*(-0.610)*	*(-1.127)*	*(-1.753*)*	*(-1.779*)*

Table 6. *The table presents the exposure coefficients for each investment horizon when a regression is run on the whole sample. The coefficients' t-stats are reported in parentheses and (**) and highlighted coefficients indicate statistical significance at a 5 percent level, while (*) indicates a statistical significance at the 10 percent level.*

From Table 6 above it can be observed that none of the coefficients are significant at the 5 percent significance level, which suggests that we were right in our concerns about cancellation effects. The results also support our hypothesis of investment horizons. The exposure coefficients continuously move towards statistical

significance for horizons longer than 6 months, and we document significant exposure at the 10 percent level for the 18-month and 24-month horizons.

V.I.II Foreign Exchange Income vs. Industry Allocation, 1994 to 2011

In this part of the thesis we present and analyze the results from the regressions on our FEI portfolios and SIC industry portfolios for the period 1994 to 2011. Based on our problem discussion and the findings of previous research, we would expect both of our portfolio categories to be able to detect at least some currency exposure, as compared to the value-weighted index. We also expect our FEI portfolios to perform better than the portfolios constructed on industry allocation, since the industry portfolios possibly contain more noise and subsequent cancellation effects.

In Table 7 below it can be observed that out of the portfolios constructed on FEI in relation to total sales, only Portfolio 3 is statistically significant at the 1-month horizon. This is in line with most previous studies that usually find significant exposure in only 10 to 25 percent of the cases at the 1-month horizon (Bartram and Bodnar, 2005). However, at the 12-month horizon we find 3 out of 5 FEI portfolios to be significant at the 5 percent level. The number of significant portfolios then drops for the remaining horizons. Only 1 portfolio is significant at the 18-month horizon, and 2 out of 5 at the 24-month horizon. These findings are therefore not entirely in line with our expectations, since contrary to for example Chow et al. (1997) we find a maximum of the number of significant portfolios at the 12-month horizon, instead of a continuously increasing number over time. However, the results do indicate a higher number of significantly exposed portfolios for longer horizons, suggesting that previous studies have focused on too short horizons, and that hedging effectiveness and short-term estimation errors (e.g. Bartov and Bodnar, 1994) could help explain the weak results of many previous studies.

All of the significantly exposed FEI portfolios have positive coefficients, meaning that portfolio value increases with a depreciation of the dollar to the trade-weighted currency. This also suggests that both the short-term cash flows transaction exposure and the long-term economic exposure are positive.

Another interesting observation from the results of the FEI portfolios for the whole sample period is that it is mainly Portfolio 3 that displays significant exposure. This is not what we initially expected as Portfolio 3 by construction should contain firms that have the smallest economic impact from their foreign exchange income. We have no reasonable explanation as to why we find these results. It should also be noted that the somewhat contradictory results for our FEI portfolios on the whole sample period could be a consequence of time-varying exposure, since such effects could cancel out significant exposure for some portfolios and horizons (e.g. Williamson, 2001, and Priestley and Ødegaard, 2007).

Portfolio Category	Portfolio	Investment Horizon (Months)				
		1	6	12	18	24
Foreign Exchange Income	**P1**	0.114	0.2920	0.371	0.400	**0.464**
	t-stat	*(0.724)*	*(1.333)*	*(1.400)*	*(1.629)*	*(2.290**)*
	P2	0.045	0.297	**0.376**	0.294	0.232
	t-stat	*(0.298)*	*(1.634)*	*(2.284**)*	*(1.313)*	*(0.887)*
	P3	**0.182**	0.244	**0.469**	**0.490**	**0.544**
	t-stat	*(2.905**)*	*(1.732*)*	*(2.334**)*	*(2.235**)*	*(2.995**)*
	P4	0.117	0.132	0.199	0.083	-0.065
	t-stat	*(0.909)*	*(1.307)*	*(1.771*)*	*(1.014)*	*(-0.588)*
	P5	-0.023	0.219	**0.516**	0.713	0.643
	t-stat	*(-0.106)*	*(1.072)*	*(1.979**)*	*(1.773*)*	*(1.279)*
SIC Industries	**Mining**	**0.956**	**0.7199**	**0.952**	0.790	0.838
	t-stat	*(4.400**)*	*(2.678**)*	*(2.369**)*	*(1.479)*	*(1.769*)*
	Construction	-0.384	**-0.640**	-0.544	-0.554	-0.458
	t-stat	*(-1.394)*	*(-2.178**)*	*(-1.212)*	*(-0.865)*	*(-0.583)*
	Manufacturing	0.055	0.103	**0.203**	0.087	0.038
	t-stat	*(0.782)*	*(1.341)*	*(2.529**)*	*(0.889)*	*(0.301)*
	TCEGS	-0.012	0.052	0.216	**0.403**	**0.414**
	t-stat	*(-0.122)*	*(0.435)*	*(1.611)*	*(2.550**)*	*(2.326**)*
	Wholesale Trade	-0.184	-0.224	-0.029	-0.074	-0.237
	t-stat	(-1.717)	(-1.591)	(-0.211)	(-0.445)	(-1.931*)
	Retail Trade	**-0.306**	**-0.577**	**-0.750**	**-0.856**	**-0.921**
	t-stat	*(-2.398**)*	*(-4.058**)*	*(-4.250**)*	*(-4.009**)*	*(-3.809**)*
	Fin, Ins & Real Est	-0.116	-0.132	**-0.290**	**-0.386**	**-0.523**
	t-stat	*(-1.061)*	*(-0.965)*	*(-2.246**)*	*(-2.324**)*	*(-3.064**)*
	Services	0.076	0.046	-0.140	-0.437	0.565
	t-stat	*(0.871)*	*(0.358)*	*(-0.947)*	*(-1.861*)*	*(1.584)*

Table 7. *The table presents the currency exposure coefficients of regressions run over the whole sample period (1994-2011). Two different regressions were run using FEI portfolios and industry portfolios as the dependent variable. The coefficients' t-stats are reported in parentheses and (**) and highlighted coefficients indicate statistical significance at a 5 percent level, while (*) indicates a statistical significance at the 10 percent level.*

If we look at the industry portfolios we can see that they outperform the FEI portfolios over the period 1994 to 2011, as a total of 15 out of 40 (37.5 percent) industry portfolios display significant exposure, while the same number is 7 out or 25 (28

percent) for FEI. The FEI portfolios, however, display a higher number of significant exposure coefficients for the 12 and 18-month investment horizons. The weak performance of FEI compared to the industry portfolios suggests that, contrary to what we expected based on the argumentation by Bartov and Bodnar (1994), FEI in relation to total sales is not superior at reducing portfolio noise. One should however keep in mind that this could be the consequence of fewer firms reporting FEI in the first subperiod, which potentially could distort the results of that subperiod, and thereby also for the whole sample period. This hypothesis can however not be supported until after studying and comparing the results of the two subperiods.

The SIC industry portfolios also display a similar pattern as the FEI portfolios. We find that 2 out of 8 industry portfolios are significantly exposed at the 1-month horizon, which is in line with previous studies (e.g. Jorion, 1991). We also find more significant exposure coefficients for longer horizons, with a maximum of 4 out of 8 industries at the 12-month horizon, followed by a drop in the number of significant exposure betas. The higher percentage of significantly exposed industries at horizons longer than 1 month however supports the idea that previous studies have focused on too short horizons, as argued by Chow et al. (1997) and Bartov and Bodnar (1994). Three of the significantly exposed industry portfolios display consistently negative exposure, suggesting that both the short-term transaction exposure and the long-term economic exposure are negative for these industries. The other three significantly exposed industry portfolios instead appear to have positive transaction and economic exposure.

To summarize, the results for the whole sample period, 1994 to 2011, suggest that our FEI based portfolio selection criterion is inferior to the traditional SIC industry criterion, as the industry portfolios outperform our FEI portfolios for these years. Furthermore, contradictory to the findings of for example Chow et al. (1997), we find a maximum of significantly exposed portfolios at the 12-month horizon instead of a continuously increasing number for longer investment horizons. The evidence, however, suggests that investment horizons do help in the explanation of the exposure puzzle, as we found most of the significantly exposed portfolios at longer horizons.

V.II Time-Varying Currency Exposure

In order to investigate whether time-varying exposure has an impact on the results, we continue with our examination of currency exposure on the two subperiods: 1994 to 2002 and 2003 to 2011. Based on our initial hypothesis, built on the argumentation and findings of Williamson (2001) and Priestley and Ødegaard (2007), we expect a higher number of significant exposure betas for these shorter sample periods, since the issue with time-varying exposure should become less prominent.

V.II.I Foreign Exchange Income vs. Industry Allocation, 1994 to 2002

For the first subperiod we use data for the period January 1994 to December 2002. The results from the regressions are presented in Table 8 below.

From Table 8 we document that none of the FEI portfolios are significantly exposed for the first 2 investment horizons, but that 1 out of 5 FEI portfolios display significant exposure at the 5 percent level for the 12, 18 and 24-month investment horizons. The results for our FEI portfolios in other words deteriorate compared to the whole sample period, which is not what we expected. This lack of improvement could indicate that, contrary to the findings of Priestley and Ødegaard (2007), cancellation effects from time-varying exposure does not adversely affect the results when longer sample periods are used. However, we document that some of the portfolios have different sign on their exposure coefficient compared to the whole sample period, which suggest that, in line with the findings of Williamson (2001), the exposure could be time-varying. Also, similar to the whole sample period the results indicate that investment horizons do matter since significantly exposed FEI portfolios are found only at investment horizons longer than 6 months. It is possible that the lower number of firms reporting FEI for these years negatively affects the results of the FEI portfolios.

The industry portfolios also display worsening results compared to the whole sample period. Only 1 industry portfolio is significantly exposed at the 6 and 18-month investment horizons respectively. For the 24-month horizon, however, 3 out of 8 industry portfolios show significant exposure. This means that the results, although weaker than before, still suggest that longer investment horizons are more informative

about the relationship between exchange rate changes and firm value. Furthermore, it is not evident which portfolio category that performs best for this subperiod, since the overall results for both categories are inconsistent and poor. 12 percent of all our FEI portfolios are significantly exposed, compared to 12.5 percent for the industry portfolios, and in percentage the industry portfolio outperform FEI at the 6 and 24-month horizons, while the opposite is true for the 12 and 18-month horizons. The results therefore give no clear indication whether our FEI selection criterion is superior to the SIC industry based. Moreover, in line with for example William (2001) we observe that some industry exposure coefficients have changed sign compared to the whole sample period, suggesting time-varying exposure.

The overall weak results for the first subperiod are somewhat puzzling, since we expected an increase in the performance of both of our portfolio categories in the subperiods. This could mean that the firms did not have much exposure during these years. We however believe that it is more likely that the results are explained by external factors, i.e. by the macroeconomic events present throughout the years of 1994 to 2002. During these years there were several currency crises, such as the Mexican peso crisis in 1994, the Asian currency crisis in 1997, and the Argentine peso crisis in 1999. As some of the countries affected by these crises are major trading partners to the U.S., it is likely that these crises could result in spurious noise in the trade-weighted exchange rate, which reduce the relationship between firm value and exchange rate changes, and thus also creates an underestimation of currency exposure.

Another potential explanation could be the IT crash in the beginning of 2000. It is possible that the highly volatile markets in the time of economic crises could add noise to the stock portfolios, which subsequently also might reduce the relationship between stock returns and exchange rates. We tested this hypothesis by removing the data of the last years in this subperiod, 2000 to 2002. As can be seen in Table V in the Appendix the results improve for both portfolio categories. The results are, however, still weak compared to the whole sample period, suggesting that volatile stock returns is not the sole explanation of the lack of exposure for the first subperiod. Furthermore, these tests should be interpreted with caution since as we remove observations; we also reduce the statistical power and increase the risk of Type II errors. This particularly becomes an issue for the longer investment horizons.

Portfolio Category	Portfolio	Investment Horizon (Months)				
		1	6	12	18	24
Foreign Exchange Income	**P1**	-0.202	0.054	0.243	0.276	-1.245
	t-stat	*(-0.731)*	*(0.103)*	*(0.227)*	*(0.280)*	*(-1.329)*
	P2	-0.175	0.154	0.685	0.470	-0.481
	t-stat	*(-0.757)*	*(0.330)*	*(1.104)*	*(0.417)*	*(-0.500)*
	P3	0.209	0.325	**1.289**	**1.354**	0.610
	t-stat	*(1.451)*	*(1.003)*	*(2.362**)*	*(2.742**)*	*(1.758*)*
	P4	0.228	0.170	0.808	0.632	-0.439
	t-stat	*(0.919)*	*(0.747)*	*(1.356)*	*(0.800)*	*(-0.546)*
	P5	-0.414	-0.479	0.077	-1.284	**-2.893**
	t-stat	*(-0.827)*	*(-0.862)*	*(0.082)*	*(-1.010)*	*(-2.426**)*
Industries	**Mining**	1.032	0.196	-0.313	**-3.098**	**-3.627**
	t-stat	*(1.900*)*	*(0.395)*	*(-0.376)*	*(-3.282**)*	*(-4.688**)*
	Construction	-0.779	**-1.044**	-1.350	-2.016	-1.772
	t-stat	*(1.446)*	*(2.109**)*	*(-1.108)*	*(-1.076)*	*(-1.003)*
	Manufacturing	-0.135	-0.085	0.531	-0.001	-0.757
	t-stat	*(-0.602)*	*(-0.397)*	*(1.750*)*	*(-0.003)*	*(-1.900*)*
	TCEGS	-0.205	-0.364	0.269	-0.687	-0.687
	t-stat	*(-1.177)*	*(-1.885*)*	*(-0.854)*	*(-1.054)*	*(-0.847)*
	Wholesale Trade	0.071	-0.427	0.129	0.266	**0.666**
	t-stat	(0.319)	(-1.179)	(0.233)	(0.539)	(2.131**)
	Retail Trade	-0.433	-0.470	-1.111	0.018	0.317
	t-stat	*(-1.412)*	*(-1.369)*	*(-1.394)*	*(0.031)*	*(0.560)*
	Fin, Ins & Real Est	-0.024	-0.221	-0.451	-0.771	**-2.163**
	t-stat	*(-0.139)*	*(-0.913)*	*(-1.187)*	*(-1.821*)*	*(-6.027**)*
	Services	0.148	-0.243	-0.002	-0.628	-1.626
	t-stat	*(0.624)*	*(-0.595)*	*(-0.002)*	*(-0.550)*	*(-1.234)*

Table 8. *The table presents the currency exposure coefficients of regressions run over the first subperiod (1994-2002). Two different regressions were run using FEI portfolios and industry portfolios as the dependent variable. The coefficients' t-stats are reported in parentheses and (**) and highlighted coefficients indicate statistical significance at a 5 percent level, while (*) indicates a statistical significance at the 10 percent level.*

To summarize, for the first subperiod we document worsening results compared to the whole sample period, for both our FEI and industry portfolios, and it is unclear which portfolio category that outperforms the other. The results for both of the portfolio categories however suggest that investment horizons do matter as all significant portfolios are found at horizons longer than 1 month. Furthermore, we find some evidence of time-varying exposure as some portfolios display different signs on their exposure compared to the whole sample period. The overall worsening of the results compared to the whole sample period however indicates that the suggested cancellation effects (e.g. Priestley and Ødegaard, 2007) might not help in the explanation of the exposure puzzle. A possible explanation for the poor performance of our FEI and industry portfolios in the first subperiod could be the currency crises plaguing these years, and the IT-crash in the end of the period. It is possible that these macroeconomic events result in noise in the trade-weighted exchange rate and the stock portfolios, potentially reducing the relationship between the two.

V.II.II Foreign Exchange Income vs. Industry Allocation, 2003 to 2011

For the second subperiod we use data for the period January 2003 to December 2011. As previously pointed out, more firms report FEI to Compustat during these years, which mean that we should put more emphasis on this time period. Furthermore, as this time period is not plagued by any major currency crises we hope to find more significant exposure betas. The results from the regressions are presented in Table 9 below.

As expected, the results improve compared to the first subperiod. At the 1-month investment horizon, 2 out of the 5 FEI portfolios show significant exposure coefficients, while at the 6 and 12-month horizons, 3 out of 5 portfolios display significant coefficients. For the two longest investment horizons 4 out of 5 portfolios are significantly exposed at the 5 percent level. These results are far better than the findings of most previous studies (e.g. Chow et al., 1997 and Bartram and Bodnar, 2005), and not only suggest that investment horizons do matter when examining currency exposure, but also that our FEI portfolio selection criterion might be very effective at reducing portfolio noise.

Furthermore, in support of time-varying exposure, 9 out of 25 (36 percent) FEI exposure coefficients change sign compared to the first subperiod. This finding could aid in explaining why we failed to detect statistically significant exposure for our FEI portfolios at longer investment horizons for the whole sample period. All of the significant FEI portfolios have positive exposure, indicating that firm value increase with a deprecation of the U.S. dollar to the trade-weighted currency. It also means that both the transaction and economic exposure is positive.

The results of the SIC industry portfolios also show a clear improvement compared to the first subperiod. The significant exposure coefficients, however, are inconsistently spread over the different investment horizons and portfolios, except for the Retail Trade and Mining industries. 2 out of 8 industries show significant exposure at the 1-month horizon, the number increase to 3 out of 8 for the 6, 12 and 18-month horizons, and to 4 out 8 for the 24-month horizon. This support the theories of investment horizons, and suggests that hedging effectiveness and short term estimation errors could help explain the weak results of previous studies focusing on monthly returns,

as suggested by Chow, Lee and Solt (1997) and Bartov and Bodnar (1994). It also means that our FEI portfolios clearly outperform the industry portfolios for this subperiod, since 64 percent out of all the FEI portfolios are significantly exposed, while only 37.5 percent of the industry portfolios display significant exposure. The FEI portfolios also outperform the industry portfolios across all investment horizons. This is in other words coherent evidence that our FEI based selection criterion is more effective than the SIC based in reducing noise for this time period. We also document evidence of time-varying exposure for the industry portfolios as 17 out of 40 (42.5 percent) portfolios change sign compared to the first subperiod. However, since the number of significant industry portfolio is the same for both this subperiod and the whole sample period, there is no conclusive evidence that cancellation effects from time-varying exposure could help explain the exposure puzzle.

Portfolio Category	Portfolio	Investment Horizon (Months)				
		1	6	12	18	24
Foreign Exchange Income	**P1**	**0.352**	**0.963**	**1.134**	**1.250**	**0.912**
	t-stat	(2.354)	(7.823**)	*(7.011**)*	*(5.456**)*	*(2.797**)*
	P2	0.127	0.081	0.0367	0.037	-0.1482
	t-stat	(0.969)	(0.778)	*(0.234)*	*(0.412)*	*(-0.779)*
	P3	**0.185**	**0.240**	**0.455**	**0.459**	**0.428**
	t-stat	(2.780)	(2.135**)	*(4.943**)*	*(3.326)*	*(3.847**)*
	P4	0.140	**0.243**	**0.324**	**0.293**	**0.315**
	t-stat	(1.153)	(2.083**)	*(2.561**)*	*(4.012**)*	*(2.623**)*
	P5	0.060	0.097	-0.048	**0.484**	**0.551**
	t-stat	(0.256)	*(0.466)*	*(-0.400)*	*(2.732**)*	*(2.431**)*
SIC Industries	**Mining**	**0.988**	**0.866**	**1.041**	1.100	0.626
	t-stat	*(5.280**)*	*(2.669**)*	*(2.521**)*	*(1.735*)*	*(1.331)*
	Construction	-0.142	-0.382	-0.147	-0.196	0.497
	t-stat	*(-0.371)*	*(-0,829)*	*(-0.319)*	*(-0.583)*	*(0.888)*
	Manufacturing	0.029	0.111	0.191	**0.285**	**0.404**
	t-stat	*0.414*	*(1.730)*	*(1.903)*	*(2.531**)*	*(3.928**)*
	TCEGS	0.024	-0.006	**-0.141**	-0.062	-0.025
	t-stat	*(0.260)*	*(0.079)*	*(-2.212**)*	*(-0.714)*	*(-0.135)*
	Wholesale Trade	**-0.256**	**-0.406**	-0.328	-0.235	**-0.573**
	t-stat	(-3.185**)	(-2.970**)	(-1.898*)	(-1.350)	(-2.557**)
	Retail Trade	-0.119	**-0.253**	**-0.415**	**-0.342**	**-0.249**
	t-stat	*(-0.922)*	*(-2.083**)*	*(-3.912**)*	*(-4.324**)*	*(-3.149**)*
	Fin, Ins & Real Est	-0.141	-0.131	-0.336	**-0.381**	-0.349
	t-stat	*(-1.072)*	*(0.966)*	*(-1.941*)*	*(-2.926**)*	*(-1.492)*
	Services	0.069	0.093	-0.021	0.123	**0.386**
	t-stat	*(0.822)*	*(0.855)*	*(-0.185)*	*(0.929)*	*(3.401**)*

Table 9. *The table presents the currency exposure coefficients of regressions run over the second subperiod (2003-2011). Two different regressions were run using FEI portfolios and industry portfolios as the dependent variable. The coefficients' t-stats are reported in parentheses and (**) and highlighted coefficients indicate statistical significance at a 5 percent level, while (*) indicates a statistical significance at the 10 percent level.*

To summarize, the results of our FEI and industry portfolios significantly improve compared to the first subperiod, and we document very high percentages of significantly exposed FEI portfolios. This strong performance for both our portfolio categories indicates that the recent financial crisis does not adversely affect the relationship between exchange rates and firm value, at least not to a great extent. The findings for the second subperiod also suggest that our FEI based selection criterion is superior to the industry based, as our FEI portfolios greatly outperform the industry portfolios. Similar to the whole sample period and the first subperiod we also document a higher number of significant portfolios for longer investment horizons, suggesting that using longer investment horizons might be more informative about the relationship between exchange rate changes and firm value. Furthermore, in support of time-varying exposure we observe that a large part of our portfolios change sign compared to the first subperiod.

VI. Conclusions & Suggestions

In this section we summarize and present the major findings and conclusions of our results. We also discuss some weaknesses of this thesis as well as present some suggestions for further research that we have discovered during the course of this thesis.

VI.I Conclusions

We document that currency exposure can be detected in a high number of cases, but only for longer investment horizons. These results therefore suggest that studying longer horizons is more informative about the relationship between firm value and exchange rate changes, and that previous studies have focused on too short horizons.

In the second subperiod our FEI portfolios display percentages of significant exposure much higher than our SIC industry portfolios and the great majority of previous studies. We argue that this is because our FEI portfolios are superior in reducing portfolio noise. We therefore propose that the weak results in previous research could be explained by an inferior portfolio selection criterion, which results in cancellation effects due to offsetting activities of the firms. However, it appears that the effectiveness of our proposed selection criterion could be dependent on the number of firms reporting FEI, as it is only in the second subperiod, where more firms report FEI, that the FEI portfolios significantly outperform the industry portfolios.

Concerning time-varying exposure, we document that a high percentage of the portfolios change sign between the two subperiods, and we therefore propose that currency exposure appears to be time-varying. However, we cannot conclude that cancellation effects from time-varying exposure reduce the number of significant exposure coefficients, as for example our industry portfolios display the same number of significant exposures for both the second subperiod and the whole sample period. It therefore appears that time-varying exposure perhaps cannot help explain the exposure puzzle.

We also propose that the exposure appears to be severely affected by various macroeconomic conditions, such as currency crises, and that these types of events perhaps could help explain the weak results of previous studies. This is based on the fact that both of our portfolio categories performed poorly in the first subperiod, where for example major trading partners to the U.S. suffered from currency crises.

To summarize, based on our findings we propose that the existence of an exposure puzzle in the exchange rate literature at least partially exists because of issues with inferior portfolio selection criterions, and previous studies focusing on the wrong investment horizon. Furthermore, our findings indicate that macroeconomic conditions affect the prospects of detecting currency exposure. However, although we observe time-varying exposure for both portfolio categories, we do not find conclusive evidence suggesting that time-varying exposure helps explain the weak results of previous studies.

VI.II Weaknesses

One weakness of our study is as we discussed in the methodology the use of a trade-weighted exchange rate. This is because, as pointed out by Williamson (2001), all firms are not necessarily exposed to all of the currencies used. This could likely have a negative impact on our results, as the reduced relationship between the trade-weighted exchange rate and firm value leads to an underestimation of exposure.

Another weakness is that we have limited our study to the firms included in the S&P 500 index. This was favorable as it kept our sample easy to handle while still ensuring that we had firms that were a good representation of the industries in the U.S. The small number of firms however reduces the robustness of our results. Also, while we actively choose the S&P 500 because of the large firms it contains, it is still possible that this decision could have a negative impact on our results, since larger firms have more developed risk management departments and hedging policies.

Furthermore, our sample period is not very long which means that we have a fairly low number of observations. This could be a problem for our results for the longest

investment horizons, which have the least number of observations, as the risk of Type II errors increase in smaller samples.

VI.III Suggestions for Further Research

During the course of this thesis we have come to think of one issue that we believe, if addressed, could further improve the results. Our study, like a majority of previous studies, focuses on the contemporaneous changes in the exchange rate. Using spot exchange rates could however be a major issue as exchange rates are assumed, and supported by research, to follow a random walk, which means that there is close to no correlation between changes in the spot exchange rate and the future exchange rate. We therefore suggest that future researchers should try to employ news about the future exchange rate changes when examining the presence of currency exposure.

Another topic for future research is to investigate how the relationship between firm value and exchange rate changes is impacted by macroeconomic conditions such as for example currency crises. We for example saw that the number of significantly exposed portfolios was high in a time of no currency crises, while the detection of currency exposure was very weak for years plagued by currency crises.

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Appendix

I. Full List of SIC Industry Divisions

1. 0 – 999: Agriculture, Forestry, and Fishing
2. 1000 – 1499: Mining
3. 1500 – 1799: Construction
4. 2000 – 3999: Manufacturing
5. 4000 – 4999: Transportation, Communications, Electric, Gas, and Sanitary Services
6. 5000 – 5199: Wholesale Trade
7. 5200 – 5999: Retail Trade
8. 6000 – 6799: Finance, Insurance, and Real Estate
9. 7000 – 8999: Services
10. 9100 – 9999: Public Services

II. R-Squared Whole Sample Period - 1994 to 2011

Portfolio Category	Portfolio	Investment Horizon (Months)				
		1	6	12	18	24
Foreign Exchange Income	P1	0.648	0.690	0.718	0.745	0.785
	P2	0.642	0.752	0.833	0.826	0.838
	P3	0.793	0.792	0.793	0.811	0.862
	P4	0.709	0.746	0.759	0.780	0.819
	P5	0.449	0.573	0.652	0.633	0.609
Industries	Mining	0.383	0.458	0.450	0.407	0.492
	Construction	0.485	0.590	0.586	0.592	0.627
	Manufacturing	0.886	0.904	0.909	0.931	0.941
	TCEGS	0.636	0.745	0.782	0.784	0.801
	Wholesale Trade	0.539	0.574	0.624	0.707	0.736
	Retial Trade	0.570	0.649	0.707	0.731	0.785
	Fin, Ins & Real Est	0.825	0.867	0.897	0.902	0.920
	Services	0.814	0.815	0.789	0.770	0.755

The table above presents the R-squared for the regressions run on the FEI portfolios and industry portfolios over the different investment horizons for the whole sample period (1994-2011).

III. R-Squared First Subperiod - 1994 to 2002

Portfolio Category	Portfolio	Investment Horizon (Months)				
		1	6	12	18	24
Foreign Exchange Income	P1	0.586	0.565	0.470	0.610	0.685
	P2	0.564	0.505	0.517	0.551	0.611
	P3	0.700	0.645	0.550	0.727	0.827
	P4	0.621	0.625	0.636	0.650	0.724
	P5	0.273	0.336	0.419	0.445	0.517
Industries	Mining	0.265	0.282	0.345	0.480	0.537
	Construction	0.443	0.606	0.613	0.660	0.700
	Manufacturing	0.824	0.783	0.764	0.837	0.888
	TCEGS	0.621	0.671	0.665	0.618	0.573
	Wholesale Trade	0.418	0.521	0.640	0.796	0.903
	Retial Trade	0.499	0.575	0.599	0.709	0.824
	Fin, Ins & Real Est	0.788	0.791	0.833	0.861	0.936
	Services	0.740	0.723	0.641	0.638	0.675

The table above presents the R-squared for the regressions run on the FEI portfolios and industry portfolios over the different investment horizons for the first subperiod (1994-2002).

IV. R-Squared Second Subperiod - 2003 to 2011

Portfolio Category	Portfolio	Investment Horizon (Months)				
		1	6	12	18	24
Foreign Exchange Income	P1	0.788	0.889	0.896	0.913	0.933
	P2	0.731	0.902	0.941	0.954	0.964
	P3	0.899	0.920	0.957	0.963	0.984
	P4	0.873	0.925	0.944	0.969	0.988
	P5	0.667	0.801	0.909	0.924	0.948
Industries	Mining	0.536	0.690	0.665	0.685	0.819
	Construction	0.506	0.696	0.735	0.758	0.813
	Manufacturing	0.954	0.970	0.967	0.974	0.986
	TCEGS	0.765	0.899	0.932	0.958	0.963
	Wholesale Trade	0.760	0.762	0.851	0.938	0.916
	Retial Trade	0.698	0.865	0.922	0.938	0.956
	Fin, Ins & Real Est	0.845	0.905	0.940	0.945	0.959
	Services	0.904	0.923	0.935	0.955	0.975

The table above presents the R-squared for the regressions run on the FEI portfolios and industry portfolios over the different investment horizons for the second subperiod (2003-2011).

V. First Subperiod less IT crash Results – 1994-2000

Portfolio Category	Portfolio	Investment Horizon (Months)				
		1	6	12	18	24
Foreign Exchange Income	**P1**	-0.334	-0.144	0.095	0.589	-0.673
	t-stat	*(-0.968)*	*(-0.209)*	*(0.066)*	*(0.448)*	*(-0.282)*
	P2	0.077	0.760	**1.515**	**2.093**	0.831
	t-stat	*(0.266)*	*(1.457)*	*(3.304**)*	*(3.052**)*	*(0.825)*
	P3	0.265	0.760	**1.689**	**1.895**	0.709
	t-stat	*(1.422)*	*(1.900*)*	*(2.960**)*	*(3.881**)*	*(0.850)*
	P4	0.323	0.233	**1.183**	**1.581**	0.934
	t-stat	*(1.078)*	*(0.805)*	*(2.012**)*	*(3.410**)*	*(1.177)*
	P5	-0.089	-0.207	0.891	-0.470	0.065
	t-stat	*(-0.170)*	*(-0.354)*	*(1.485)*	*(-0.456)*	*(0.113)*
Industries	**Mining**	**1.591**	-0.083	-0.663	**-3.084**	-1.495
	t-stat	*(2.530**)*	*(-0.372)*	*(-1.909*)*	*(-5.008**)*	*(-1.819*)*
	Construction	-0.828	**-0.477**	-1.680	-0.219	-0.673
	t-stat	*(-1.810*)*	*(-3.852**)*	*(-1.321)*	*(-0.108)*	*(0.322)*
	Manufacturing	**0.289**	-0.135	**0.898**	**0.508**	0.050
	t-stat	*(1.995**)*	*(-1.822*)*	*(5.754**)*	*(2.010**)*	*(0.200)*
	TCEGS	-0.130	-0.044	-0.097	0.129	0.396
	t-stat	*(-0.464)*	*(-0.438)*	*(-0.299)*	*(0.172)*	*(0.494)*
	Wholesale Trade	0.392	0.038	0.457	-0.047	0.676
	t-stat	(1.748*)	(0.280)	(0.928)	(-0.128)	(1.394)
	Retail Trade	-0.555	-0.328	**-1.667**	-0.664	-1.437
	t-stat	*(-1.461)*	*(-1.764*)*	*(-2.293**)*	*(-1.834*)*	*(1.757*)*
	Fin, Ins & Real Est	-0.084	-0.202	-0.669	**-0.564**	**-1.335**
	t-stat	*(-0.441)*	*(-1.759*)*	*(-1.837*)*	*(-2.806**)*	*(-3.333**)*
	Services	**0.557**	-0.251	0.871	0.925	0.839
	t-stat	*(2.575**)*	*(-1.885*)*	*(1.563)*	*(1.642*)*	*(1.487)*

The table presents the currency exposure coefficients of regressions run over the first subperiod without the years of the IT crash (1994-2000). Two different regressions were run using FEI portfolios and industry portfolios as the dependent variable. The coefficients' t-stats are reported in parentheses and (**) and highlighted coefficients indicate statistical significance at a 5 percent level, while (*) indicates a statistical significance at the 10 percent level.