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Foreign Exchange-Rate Exposure of Swedish Firms

BACHELOR THESIS in ECONOMICS

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Abstract

The main focus of the paper is the problem of exchange-rate exposure of Swedish firms between Jan, 1st 2002 and Sep, 27th 2006. Defined as “*a measure of the potential for a firm’s profitability, net cash flow, market value to change because of a change in exchange rates*”, the problem of exchange rate exposure is investigated, making use of the “Market Value Approach” (also known as “Stock Market Approach”), with certain additional extensions. With Sweden being a very open economy with strong export orientation, we expected to find a greater number of firms showing significant exchange rate exposure to one or more of the chosen 6 bilateral exchange rates (SEK/EUR, SEK/USD, SEK/DKK, SEK/NOK, SEK/GBP and SEK/JPY). Also, companies are divided into categories with respect to their main operating activity. The empirical study finds 78% of all companies in the sample with significant exposure, with dominance of lagged effect over contemporaneous. This percentage is higher than found in previous empirical studies, being in support of the suggestion that relation exists between economy openness and exchange rate exposure of firms. However, the significant cross-section differences across categories and the high level of heterogeneity within categories deter us from determining the sign, direction and magnitude of the exchange rate exposure. Suggestions are made for further studies and possible extensions of the topic of the present paper.

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Chapter 1. Introduction

1.1 Background

Today's companies are facing a vast variety of risks in almost every aspect of their economic activities on a daily basis, which require to be carefully managed and tended to in order to secure the companies' future existence and profitability. In the past few decades, however, one risk in particular, and its management, have been and continue to be of major concern to the majority of enterprises – namely, foreign exchange rate risk. The collapse of the fixed exchange rates regimes in the 1970's and the followed adoption of floating exchange rates, as well as the steadily intensifying degree of globalization in world's economy have significantly exacerbated the importance of managing and minimizing the exchange rate risks. The gradual reduction of trade restrictions such as tariffs and quotas, the internationalization of modern business and the rapid change in the technology of money transfers are just few of the factors that contributed to the rapid growth of world trade.

The bigger world market and its opportunities that opened for the companies came at the cost of greater uncertainty and risks. As firms “went international” and spread their economic activity over and beyond national borders, cash denominated in different currencies started flowing in. This raised the issue of how companies should manage the increased uncertainty and avoid or minimize the potential losses associated with movements in the exchange rates of these currencies. As such movements affect the costs of inputs, outputs and substitute goods, currency risk is borne by not only companies involved in international trade, but also by domestic non-exporting ones. It is rather transferred through the change in prices charged by suppliers, for example, than borne directly. However, the result is change in competitiveness, which depends on the direction of movements in exchange rates. This problem is even more serious for enterprises involved in international competition and for multinational corporations (MNCs), which have to cope with exchange rate uncertainty at much larger scale.

The increased trade flows and opening of national economies posed the question on to what extent are companies actually exposed to foreign exchange risks and what is the direct impact on their profitability. More specifically, attention was paid on the general concept of exposure – the relation between the value of companies and fluctuations in exchange rates, and on how to measure that exposure.

1.2 Literature Review

The estimation of foreign exchange rate exposure is a relatively young branch of studies in the field of international finance. It has gained significant attention only after the collapse of the Bretton Woods Agreement and the Gold Standard in 1972, since when economists have grown more concerned about exchange rates and their effect on company value.

The early works on exposure were focused more on the relationship between multinationals and its subsidiaries in foreign countries and the effect of changes in inflation rates and exchange rates on profitability (Shapiro, 1975). Also, the problem was probed into within the framework of two-country model and from the perspective of international trade theory. Although such model is unrealistic, taking into consideration the complex relationships that companies are involved in internationally nowadays, the author made some important predictions. His main finding was that the value of the firm in the home country increases as this country's

currency depreciates. This is in line with trade theory, according to which depreciation results in decrease in output prices in terms of foreign currency, hence increased competitiveness, trade flows and sales.

The concept of currency risk exposure was further explored by Hodder (1982), who employed the so-called “Cash Flow Approach”. This approach involved estimating the influence of exchange rates on the cash flows of firms by running a linear regression, in which exchange rates enter as explanatory and cash flow figures as dependent variable. Although both theoretically and logically sound, the approach had a minor drawback – it required access to insider information about the bundle of currencies companies dealt with and, as pointed out by Marston (2000) – “*a significant amount of firm-specific and competitor-specific information*” for the purpose of accurate estimation. This rendered the approach troublesome to employ, especially when large number of companies are to be examined and compared.

In their seminal study, Adler & Dumas (1984) take into consideration the ideas of Hodder (1982) when constructing their “Market Value Approach”. Instead of focusing on current cash flows for the purpose of measuring exchange rate exposure, they make use of the current value of future cash flows – that is, the value of companies as suggested by the market. More specifically, the authors define exposure as “*the elasticity between the change in company’s value and exchange rate*”. This approach is empirically attractive as it requires only market data – namely data on stock prices – which is publicly available.

However, if employed in the very form suggested by Adler & Dumas (1984), the approach yields arbitrary results. The authors’ model measures company’s total exposure to exchange rate risk and does not distinguish between effects that influence the value of the individual firm, and such that influence the value of all firms. The latter include macroeconomic effects such as changes in risk-free interest rate, market risk and, not the least, investors’ expectations. Therefore, if a researcher employs the “Market Value Approach” in this form, he or she would not be able to detect what portion of the exposure could be attributed to macroeconomic factors, and what to firm-specific characteristics. Nevertheless, Adler & Dumas (1984) found that even entirely domestic companies, not engaged in international operations or competition, are affected by changes in exchange rates through the effects of such changes on input prices.

An improvement to the “Market Value Approach” was proposed by Jorion (1990). In his study of exchange rate exposure of US industries, he let the stock returns of companies to be explained by trade-weighted basket of currencies and the return of the market portfolio, using a stock index as a proxy. Thus, the inclusion of this stock index is aimed to capture the macroeconomic effects, which are applicable to all the firms. This improved approach was later on used by Bordnar & Gentry (1993) for US, Canadian and Japanese firms, Amihud (1994) and Choi & Pasad (1995) for US multinationals, among many others. Surprisingly, few of the companies investigated by these researchers exhibit significant sensitivity to foreign exchange-rate fluctuations.

One of the reasons for such finding is the plausible suggestion that exchange rate exposure might differ from country to country. Most of the empirical research has been carried out for companies in USA (multinationals or not), while the US economy, although largest, is considered to be a less open one. A priori, one can suggest that companies in more open economies might be more sensitive to exchange rate fluctuations than those in less open ones.

The first empirical support for such intuitive statement has been provided by Bordnar & Gentry (1993), who found out that Japanese and Canadian companies are more affected by exchange-rate changes than their US counterparts. Also, Friberg & Nydahl (1999) found a strong

positive relationship between economy openness and sensitivity of national stock market to exchange rate movements. At firm-level, for the case of Netherlands, Jong, Ligterink & Macrae (2002) found that Dutch firms are far more exposed than ones in less open economies as, for example, USA both in terms of percentage of firms and degree of exposure. Indeed, The Netherlands is one of the most open economies in terms of trade in the world, ranked 8th in A.T.Kearney's Globalization Index (2005), while USA is occupying 61st place in the same ranking.

However, very few studies have focused on countries other than USA, and even fewer investigate the problem of exchange rate exposure at the much larger international scale. The most important to mention is the one by Doidge, Griffin and Williamson (2002), whose study cover companies in 18 different countries. Their findings are in support to previous studies on that exchange rate movements have large impact on stock returns and value of firms, but most importantly, the authors find that the magnitude of this impact depends on the size of these firms, as well as on other determinants such as level of international sales, foreign income and foreign assets. That is, "*large firms gain (lose) relative to small firms, during currency depreciations (appreciations), even after controlling for the level of foreign activity*".

1.3 Purpose of the Thesis

Sweden is a relatively small market with export-oriented economy, as for 2004 export and imports accounted for respectively 47.6% and 38.4% of total GDP (U.S. Department of State, 2006), which makes the country one of the most open economies in the world. As such, in the line of previously conducted research in the field, one can expect that Swedish firms would be more sensitive to fluctuations in the foreign exchange rates as compared to firms in less open economies, for example USA, which have been thoroughly examined in the literature.

Our main goal in this research paper is to examine the presence/absence of exposure of a sample of Swedish firms for the period between January, 1st 2002 and September 27th 2006. The results are to be compared to findings in previous studies with the purpose to make inference between exposure and openness of economy. Also, studying of a sample of Swedish companies allows us to observe whether there are differences in sensitivity to exchange rate movements across sectors of the economy – namely industry, services, finance, among others. Our secondary goal is to determine, on aggregate, the exposure of these economy sectors to exchange rates, as derived by the results of the individual exposure of firms, operating within these sectors.

1.4 Outline of the Thesis

The thesis is organised as follows. In Chapter 2 we provide a theoretical explanation of the effect of exchange rate movements on the economic activity of companies, both at firm-specific and macroeconomic level. Forces behind exchange rate movements are thoroughly discussed. Subsequently, in Chapter 3, the results of previous empirical studies are reviewed, to which the results of our investigation are compared. Chapter 4 is devoted to the methodology that is to be implemented in the empirical study of exchange rate exposure, and also information about the data is presented, as well as the process of its selection. Finally, results from the empirical research are presented along with the accompanying analysis (Chapter 5). Conclusions are presented in Chapter 6, followed by suggestions for further studies (Chapter 7).

Chapter 2. Theoretical Background

2.1 Foreign Exchange-Rate Exposure

Foreign exchange-rate exposure can be defined as “*a measure of the potential for a firm’s profitability, net cash flow, market value to change because of a change in exchange rates*” (Eiteman, Stonehill & Moffett, 1998). However, such definition requires a division into the four different types – namely translation, transaction, economic and tax exposure.

2.1.1 Translation exposure

Translation exposure, also called accounting exposure, arises from the organizational structure of international companies. If, for example, an MNC has affiliates or subsidiaries in foreign countries, their financial statements are required to be restated (“translated”) in the currency of the parent company. As exchange rates change, this affects the accounting value of parent company’s equity, assets and liabilities in the consolidated financial statements. In order to manage this type of exposure, companies make use various techniques such as balance sheet hedging. This involves speculation about the exchange rate and taking a position in the forward market aiming to offset the change in the value of exposed liabilities with a gain from that position. However, such techniques require very accurate prediction of future exchange rates, and also involve complications associated with taxation. In addition, balance sheet hedging means incurring substantial transaction and borrowing costs that may not justify the hedging.

2.1.2 Transaction exposure

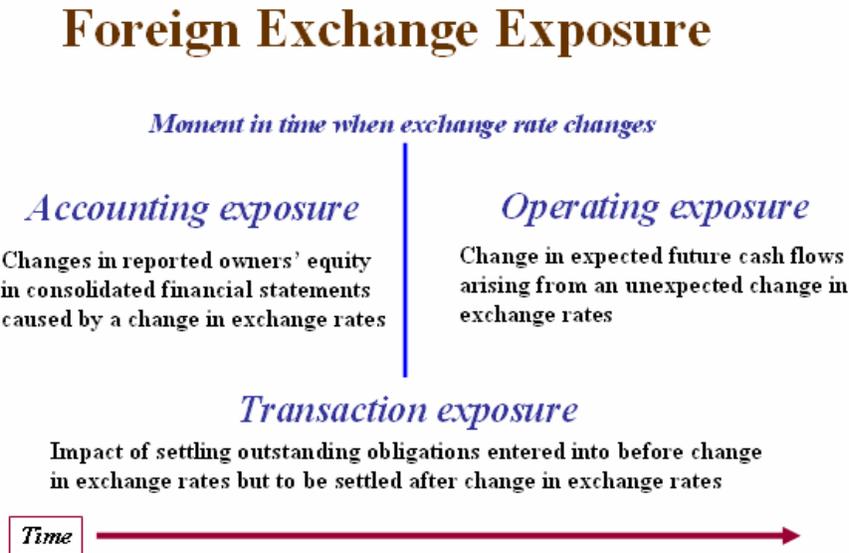
Transaction exposure is the measure of currency risk, faced by companies engaged in international trade, on their monetary assets or obligations with fixed nominal values. That is, companies enter contractual agreements to export or import, as well as into borrowing or lending activities. This implies that trade contract is settled at a fixed price in terms of foreign currency and is usually not subject to change immediately when a change in exchange rate occurs. Therefore, the company is entitled to pay or receive a fixed amount of foreign currency, as goods or services are invoiced. Having entered such contracts, both companies are being exposed to changes in exchange-rates. If such occur, obligations that have been incurred before the changes and which are due to be settled after it, affect the cash flows of the companies. Techniques, used by companies to minimize their transaction exposure include employing various contractual, operating and financial hedges, such as money market, option market and forward market hedging.

2.1.3 Economic (Operating) Exposure

Unlike translation and transaction exposure discussed above, economic exposure has a long-run effect on a company’s value and cash flows, as well as affects the company’s long-run competitive position. The reason behind is that it “*focuses on expected future cash flows that are potentially impacted by changing international competitiveness*” (Eitelman *et al*, 1998). As suggested by definition, operating exposure is much broader notion of how companies are affected by foreign exchange rate movements. This includes impact on operating cash flows (intra-company and inter-company payables and receivables, royalty and license fees, etc) and on financial cash flows (inter-company and intra-company loans, equity, dividends, etc). However, as pointed out by Adler & Dumas (1984), this makes the concept of operating exposure subjective and complex. It involves company’s expectations of its future transaction exposures, that is, the sensitivity to unexpected

movements in exchange rates. These unexpected movements are themselves, in turn, caused by changes in macroeconomic factors, mainly interest rates. Therefore, a proper investigation of the operating exposure of a company requires an economic analysis of this macroeconomic uncertainty, rather than an accounting-oriented approach of investigating cash flows. Another point in support is that a company's budget reflects the management's estimation and expectations of changes in exchange rates and it is the unexpected changes that the company is exposed to.

Figure 1. Conceptual comparison of difference between the different types of exposure



Source : Eiteman, Stonehill, & Moffett (1998)

Companies use various methods to manage their operating exposure. Some of the most common ones include diversifying their operations and financing, using leads and lags, sharing risk with long-term buyer/supplier, natural hedging by matching currency cash flows, entering back-to-back loans and currency swaps agreements.

2.1.4 Tax Exposure

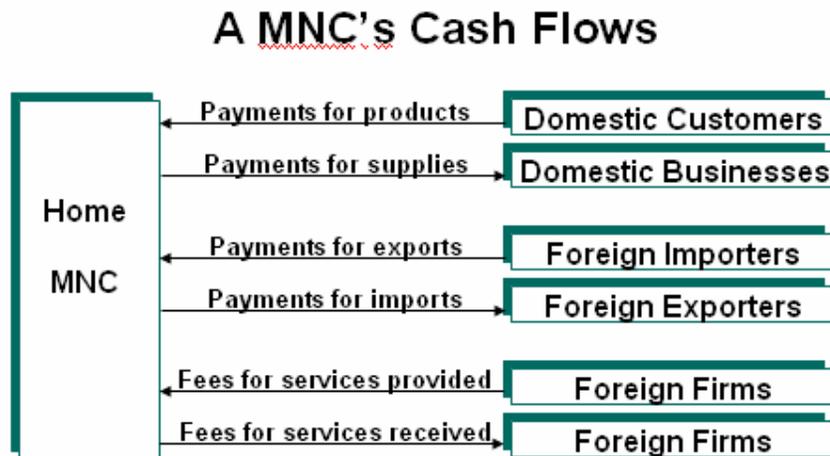
The effect of changes in exchange rates on tax reporting varies across countries, due to the not yet completely harmonized accounting practices. Also, this effect depends on whether it has been caused by operating, transaction or translation exposure. A simple rule-by-thumb is that only realized losses caused by foreign exchange-rate movements are tax-deductible, and, similarly, only realized gains must be taxed as income. For the case of transaction exposure, losses or gains are to be reported only for the year, in which they have occurred, while such caused by operating exposure affect income over a period of several years. On the other hand, since translation exposure is not followed by any cash losses/gains, hence they are not tax-deductible. Companies, if applicable for, can resort to tax credits, or implement centrally governed policies to manage the positive and negative effects of foreign exchange-rate changes on income.

2.2 Exchange-Rate Risk

For the purpose of illustration, companies can be divided roughly into 4 different categories with respect to their main economic activity in the context of exchange-rate exposure – multinationals with operations in foreign countries (MNCs), importers, exporters and domestic-market-oriented companies which are not engaged (directly) in international trade or foreign operating activities. Due to the heterogeneity of their operations, different companies are likely to be affected by exchange-rate fluctuations in different fashion and, also, through different channels.

It is widely believed that most affected by exchange rate fluctuations are MNCs. Indeed, the highly international profile of such companies makes them likely to have significant exchange rate exposure. Operating in different countries, MNCs hold international assets and liabilities, and have substantial foreign sales, which are usually denominated in various currencies. Roughly, the cash flows from operating activities of home-based MNCs can be summarized in the following figure, which can be extended almost unlimitedly:

Figure 2. Summary of an MNC's basic cash flows.



As MNCs engage in international trade, the proceeds of their foreign sales are sensitive to exchange rate changes, as the latter have a direct impact on products' price relative to competitors' prices. In the limit, it is likely that a depreciation of the home currency of a MNC would make its products relatively cheaper than competitors'. However, the production process usually involves not only domestic but also imported inputs. Hence, in the situation of depreciation, such imported inputs would turn out to be more expensive than before. The overall effect would depend on the actual structure, direction, volume and price sensitivity of the goods and cash flows.

Furthermore, even domestic inputs are affected, indirectly or directly, by exchange rate fluctuations. In the case of inputs being intermediate goods, the latter may, in turn, involve imported inputs for their production. In general, as the operation activity of a MNC involves both imports and exports, either of inputs, intermediate goods, outputs or altogether, its exposure to exchange rates decreases or increases, depending on whether the cash flows are denominated in the same currency.

Another point worth mentioning is in relation to a MNC's assets and liabilities. Having operating facilities in different countries implies transactions with economic agents in the respective countries' currencies. To push it even further, profits/losses, dividends and inter- and intra-company loans are then denominated in these currencies. Although eventually being an issue of translation exposure, such transactions involve cash flows in different currencies, hence affecting the company's economic exposure.

Secondly, as for the case of the next category of companies – namely exporters, the problem of exchange rate exposure is somewhat similar to that of MNCs', yet on smaller scale. As exporters are actively engaged in international trade, they are likely to face exchange rate risk. The problems of having exchange-rate price-sensitive inputs and intermediate goods in the case of MNCs also apply to export-orienting companies. Exporters may see their profits boost as a consequence of home currency depreciation but also shrink as price of inputs rises and therefore increases production costs. Thus, the direction of the effect of exchange-rate fluctuations on such companies is not straightforward but rather complicated.

The issue of exchange rate exposure for exporters is similar for the case of importers. However, import-oriented companies are likely to be affected in different fashion. As, by definition, they do not engage in production activities, but solely in trade, depreciation in their home currencies would make imports relatively more expensive than domestically produced goods, and, respectively, cheaper in the case of appreciation. However, the effect is not as simple as it seems, as in turn importers' exposure depends also on the exposure of their suppliers of, for example, logistic services.

Hypotheses have been made in the literature for a possible relation between exposure and the extent of company's engagement in international trade. That is, the more a company is involved in international trade, the greater the number of transactions denominated in different currencies this company has to enter, hence the greater its exposure is. The direction of this exposure would depend on the type of company. In the limit, an exporter is likely to benefit from home currency depreciation while an importer is likely to be harmed, and vice versa in case of appreciation.

Empirically, such hypotheses have not been put to extensive testing mostly because of the limited information at firm-level on foreign sales. An exception is Dominguez & Tesar (2001) who find significant relationship between engagement in international activity and exposure. Their findings apply to companies in certain countries (Germany, UK and Japan) and the authors conclude that it is MNCs, more than any other firms, which benefit from a home currency depreciation.

However, it is not only companies, engaged in international activities, but also purely domestic firms can be exposed to exchange-rate movements. For instance, if a company neither has any foreign sales nor imports inputs from abroad, it would still be affected if the price of its competitors' products falls because of a change in the exchange rate. By comparison, such exposure is rather indirect and is related to import competition.

To sum up, companies could be affected by exchange rate fluctuations in various ways. Regardless of whether this effect is direct (through exports and imports of inputs, intermediate goods or outputs) or indirect (through the impact on competitiveness), it has its impact on the value of the company's present and future cash flows, and in turn, on its market value. However, the exact direction of the effect (positive or negative) is somewhat difficult to determine before-

hand as companies nowadays engage in various activities, along both its production and financing processes, and usually with completely opposite consequences for its market value.

2.3 Macroeconomic Uncertainty

So far we have concentrated primarily on the effects of exchange rate fluctuations on the economic activity of firms and, more specifically, on their present and future cash flows. As outlined in the previous paragraph, these effects vary from firm to firm. However, firms are also subject to the impact of different macroeconomic factors on the economy and the economic environment in their respective countries, as well as on the world economy as a whole. These factors play a significant role in the determination of exchange rates, which is the main focus of our study. A few and most important forces behind exchange rates to mention are interest rates (differentials), inflation rates (differentials), current account surpluses/deficits, public debt, terms of trade, and political stability. We discuss these factors shortly, as each and every one of them is subject to elaborate research within the field of exchange rate determination theories.

2.3.1 Interest Rates Differentials

Differences in the interest rates between countries are an important factor that causes movements in exchange rates. Being under the control of central banks, interest rate differentials provide incentives to invest in one country as preferred to another. As capital searches for the most profitable opportunities, a higher interest rate in one country would result in capital inflow, depending on the degree of capital mobility. Investors start bidding up for assets denominated in this country's currency causing the spot exchange rate to fall due to the excess demand (appreciation) or the forward exchange rate to rise (depreciation) because of the view of the market that the currency is overvalued, or a combination of both. Regardless, the prevailing result is a change in the exchange rate, either spot or forward, as suggested theoretically by Uncovered and Covered Interest Rate Parities¹, which affect the whole economy. Furthermore, the higher interest rates increase the cost of capital borne by domestic companies, as well as the changes in exchange rate are reflected by the various types of exposure discussed earlier, and, not least, have impact on companies' hedging strategies. However, investors are rather concerned with real returns and not with nominal; hence the inflation rates come into play.

2.3.2 Inflation Rates Differentials

With respect to exchange rates, countries with lower inflation rates experience a rise in the purchasing power of their respective currencies, or, in other words, appreciation. The reason for that is, keeping other things constant; decreasing rate inflation implies increasing real interest rate, triggering the process explained in the previous paragraph.

From the point of view of relative PPP (purchasing power parity), the difference in inflation rates between countries is equal to the change in the spot exchange rate of their currencies. A more rapidly increasing price level in one country relative to another means that its output becomes relatively more expensive at the prevailing exchange rate, which in turn results in deprecia-

¹ For clarity reasons, note that in the case of Covered Interest Rate Parity, the result is a change in the forward exchange rate, while in the case of Uncovered Interest Rate Parity – change in the expected exchange rate in the subsequent period.

tion in that exchange rate. In other words, inflation rates play their role both in the money and the goods market. Typically, countries with high inflation rates have higher nominal interests rate, as well as a depreciating currency relative to other countries².

2.3.3 Current Account Surpluses/Deficits

The current account of a country reflects its balance of international trade. If a country is running a deficit in its current account, this means that it is importing more than exporting. Therefore, it requires more foreign currency in order to cover this excess import than it is earning from its exports. Hence, the country needs to borrow capital from abroad. In brief, this means that there is an excess demand for foreign currency and excess supply of home currency. Such a situation results in depreciation in home currency relative to foreign. At the equilibrium exchange rate, home output becomes cheaper for foreigners, as well as foreign assets become more expensive for domestic investors, all relative to the period before depreciation occurred.

2.3.4 Public Debt

Public debt is an essential part of a country's money stock². As government engages in various projects with the purpose of fiscal stimulation of the economy through the increase in government purchases, public debt rises as the increased expenditure is financed by issuing bonds. However, at maturity, the outstanding debt has to be repaid.

Basically, the government has three options. First, it can print out money in order to repay its debt, that is, a monetary expansion. Such an action would cause a subsequent inflation, leading essentially to the lower real interest rates and exchange rate depreciation, as already discussed above. Second, the government could raise the required funds by issuing more debt securities for sale to foreigners. However, this increased supply would undoubtedly lower the prices of these securities. Also, such an action would only postpone the repayment of the debt and would replace the domestic claim-holders with foreign. The third option for the government is to default on its debt. Obviously, this is the most unfavourable of all as it makes investors reluctant to own this country's issued securities, as well as decreases the country's debt rating and increases the risk of investments. In the limit, a substantial outstanding public debt implies higher inflation in the future and, in turn, depreciation in the home currency.

2.3.5 Terms of Trade

By definition, terms of trade of a country is the ratio of its export prices relative to import prices. Improving terms of trade imply increased demand for the country's export and, therefore, increased demand for its currency as a follow-up of, for example, the increased number of transactions. This pushes the value of the currency upwards and results in appreciation. Analogously, deteriorating terms of trade lead to decreasing demand for this country's currency and, eventually, bring on depreciation. The notion of terms of trade is tightly connected with the current account and balance of payments of a country, as well as it reflects the cumulative effect of a firms' operating activity on trade and exchange rates through the channels of exports and imports.

² Typically, a country's money stock is defined as $M = FX + DC$, where FX denotes the volume of foreign currency reservers, and DC – the volume of domestic credit. In turn, domestic credit includes the volume of government lending (public debt) and lending to the private sector.

2.3.6 Political Stability

Usually neglected in studies concerned with exchange rate determinants, political (in)stability could be a significant cause of exchange rate fluctuations of a country's currency. The reason for that is simple – companies (mostly multinationals) and capital investors are affected by a change in political relations between countries and by disturbances in the economic environment, which henceforth influence the well-being of economic agents. If such events occur, these economic agents are bound to face an additional risk, called political risk.

The aspects of political risk are various – both micro- and macroeconomic. In the first half of the 20th century as well as in the years after World War II, political risk was almost identical with expropriation risk. The danger of a government of certain countries seizing the private assets owned by foreign-based companies operating in these countries was substantial and could not be neglected when taking decision to invest abroad. Few examples of such events are the expropriations of businesses in Eastern Europe, China and Cuba when communist regime stepped into force, as well as the cases of Exxon subsidiaries in Peru and US copper companies in Chile, seized in 1968 and 1971, respectively. Such expropriation is a right of any country, as according to international law, on the condition that the owners of the affected businesses are properly compensated. However, in reality, compensation occurred after prolonged negotiations and, usually, not reflecting the true market value of the businesses.

Another type of macroeconomic political risk that gained ground during the 1990s was caused by ethnic, religious, civil or racial strife. Examples of such are the events in Afghanistan, Iran, Iraq, Turkey, Israel, Palestine and Bosnia and Herzegovina. Although not occurring in countries of prime interest of, for instance, multinational companies (except for the cases of extractive business), such events results in rapid change of governments, hence policies, which bring about increased uncertainty in the economic environment in such countries. Such an increased political risk is likely to cause loss in confidence in this country's currency and outflow of capital, leaving behind currency depreciation or even currency collapse. This is usually accompanied by hyperinflation which makes the country even less attractive for investment.

The two examples mentioned above seem like “stories from the past”, up to a certain extent. In general, the economic environment, looked from the perspective of political risk (expropriation and strife), can be considered as a relatively stable during the last decade. As a consequence, the focus has turn in favour of “policy stability” of governments. Nowadays, it is rather the monetary, fiscal, balance of payments, exchange rate, and economic development policies that are of major concern and form the expectations of economic agents about the path of exchange rates, and therefore its relation to exchange rate exposure.

After the collapse of the fixed-exchange-rate system, governments had to change their national economic priorities. Fixed exchange rates deprived policymakers from the use of monetary policy as a tool to influence the economy and required holding foreign exchange reserves, but at the same time provided price level stability and low rates of inflation. On the other hand, flexible exchange rates brought greater domestic economic policy autonomy, as governments could choose, for example, between different combinations of inflation rates and output. In addition, control over monetary policy was a powerful tool for mitigation the effects of international economic shocks. However, this brought along more problems on economic agents to cope with. As governments could engage in expansionary or contractionary fiscal or monetary policy, unprohibited by commitment to keep exchange rate constant, agents had to look for signals for such actions and adjust their expectations accordingly. Moreover, the credibility of governments had to be considered. The result was increased exchange rate uncertainty and volatility.

The 1990s were marked by three major currency crises – the ERM crisis of 1992-3, the Latin crises of 1994-5, and the Asian crisis of 1997. We present, in brief, their specific details and causes, in the context of political stability.

A) The ERM crisis (1992-1993)

The European Exchange Rate Mechanism³ was introduced with the intention of reducing exchange rate volatility and achieving monetary stability in Europe. The currencies involved in the ERM-system were allowed to fluctuate, but within pre-designated margins, making the ERM a managed float exchange rate system. The central banks of the member countries had to intervene in order to keep their currency exchange rate within the margins⁴.

The reunification of Germany in 1990, however, spelled the collapse of the system. Government transfers to East Germany were substantial and so was the increase in the money stock of Deutschmarks (DM). To tackle the rising inflation, Germany conducted a contractionary monetary policy, causing a rise in interest rates both in Germany and the other ERM members, as well as in Sweden and Finland, who had pegged their currencies to the DM. The result was outflow of funds from the countries with lower interest rates, leaving UK, Finland and Sweden among others struggling to keep their currency exchange rates within the margins. As the central banks of these countries were running down on foreign reserves, pressure was exercised on them to either devalue their currencies or leave the ERM. Speculative attacks, most active of which by George Soros, eventually forced UK, Italy, Spain, Portugal, Finland, Sweden, France and Ireland to devalue or float their currency, causing a major exchange rate disruption in whole Europe.

B) The Latin Crises (1994-1995)

A severe exchange-rate crisis stroke Mexico and subsequently Argentina during the 1994-95 period. It shared some features with the ERM crisis, but also serves as an example how political instability and incoherent policies could have serious repercussions on the economy.

Mexico experienced a deteriorating political situation during 1994, fuelled by the peasant rebellion in Chiapas and the assassination of a favourite Presidential candidate. The country experienced increasing foreign capital outflows and depleting foreign reserves as a consequence. The government decided to widen the fixed exchange rate margins up to 15 percent and eventually to devalue the peso. The loss of credibility of government's policies and general loss of confidence in the government led to investors withdrawing their investments. The outcome was devastating – interest rates rose up to 80%, exchange rate depreciated twice compared to the pre-crisis level, domestic demand shrank and real GDP decreased by 7% in the year after the crisis.

The case of Argentina differed, but yet with similar results in the end. The government had adopted a currency board system and backed the peso with dollars in the foreign exchange reserves. However, the country had a very high unemployment rate. With the outbreak of the crisis in Mexico, speculative attacks were directed towards the Argentinean peso, as market agents were expecting the country to abandon its currency board and float the peso. Similarly to Mexico's case, foreign capital flowed out, followed by a collapse of the bank system. Real GDP plummeted by 7.6% in the course of just a single year.

³ The European Exchange Rate Mechanism included as member countries, Belgium, Denmark, France, Germany, Ireland, Italy, Luxembourg, The Netherlands, Portugal, Spain and the United Kingdom.

⁴ The Deutschmark was the unofficial reserve currency of the member states.

C) The Asian Crisis (1997)

The loss of confidence in government policies after the Latin crises raised the attention paid to the booming (“Tiger”) economies in South-East Asia. The countries in that region maintained high interest rates in order to attract foreign funds and eventually achieving real GDP growth rates in the range of 8-12% per annum. However, they (most especially Thailand, South Korea and Indonesia) were running pegged exchange rate regimes (to the dollar) and substantial current account deficits. This called for excessive borrowing from abroad, leading to significant exchange rate exposure of economy.

Similarly to previous crises, speculators attacked the Thai currency (baht), which was considered to be overvalued, forcing the government to use up reserves to prevent the exchange-rate from depreciation. Eventually, the Thai Central Bank decided to float the baht, resulting in a sudden 17% plunge in its rate, and more than a 75% drop in the stock market.

The events in Thailand triggered a domino effect, which spread over whole South-East Asia. Speculators attacked the currencies of South Korea, Malaysia, Philippines, among others, forcing their respective banks to intervene heavily to defend the exchange rates. The results were heavily depreciated currencies, soaring interest and inflation rates, a sudden decrease in real GDP.

The crisis was not restricted only for the South-East Asia, but had a worldwide impact. Japan and USA were also affected, but quick measures were taken. The New York Stock Exchange experienced a mini-crash, but very soon after the gained up ground. The consequences for Japan, as a leading economy in the region, were more serious. The Japanese yen lost 40% of its value, but quick fought back as the Bank of Japan used up its vast foreign exchange reserves to defend it. However, the slump in trade and the loss of competitiveness, mainly due to the depreciated currencies of the other South-East Asian countries, slowed down the Japanese economy, leading eventually to a recession.

Certain conclusions can be drawn out of the events of the past. Firstly, political (in)stability does matter as it affects the economic environment, the expectations about macroeconomic variables, the confidence of economic agents in the credibility of governments’ policies and signals, and, most importantly for the purpose of our study – the path and stability of exchange rates. Furthermore, such events are generally unforeseen and therefore not explicitly defended against. Secondly, exchange rates have a vast impact on the economic activity of agents and economies, and political risks in that context cannot be neglected.

However, the period chosen for our exchange-rate exposure investigation, exhibits certain simplifying features in respect to political stability. In a purely European context, it marks the time from the introduction of the common European currency to present day – a period not associated with major disturbance of political character on the exchange-rates. Worldwide, the situation is similar, with very few exceptions. Nevertheless, one can state that such a time span provides an opportunity for a firm-exchange-rate exposure analysis in the normal course of firms’ activities, from the point of view of the absence of significant exchange-rate-related crises. In other words, the question could be rephrase as – are Swedish firms exposed to exchange-rates fluctuations in time of political stability and what are the characteristics of their exposure?

Chapter 3. Previous Empirical Evidence

In general, the existing empirical research on exchange-rate exposure gives mixed and somewhat inconclusive results of the extent to which companies are sensitive to fluctuations in the exchange rates. This is rather surprising as according to financial theory, a firm's value is affected by such fluctuations. As mentioned earlier, the focus has been predominantly on US companies, and multinationals in particular, and little attention has been paid to countries other than USA: Below, we review the empirical findings of the most important studies, both of US and non-US companies, which will serve as a basis for comparison for our own empirical research.

Firstly, Jorion (1990) examines the exposure of a sample of 287 US multinationals for the period between 1971 and 1987, using the "Stock Market Approach". He finds little evidence on significant sensitivity to exchange-rate movements. Only 15 companies from the sample have residual exposure significantly different from zero, with the mean exposure being -0.093. This can be interpreted as that a 1% depreciation of the US dollar results in 0.09% loss of company value. However, when examining 14 foreign multinationals listed on the NYSE, the author finds 9 of them exhibiting non-zero exposure with mean value of 0.563. Also, Jorion (1990) finds that exposure varies over time and that it has decreased substantially for US multinationals over the examined period. Nevertheless, after examining the determinants of exposure, he reaches the conclusion that the more internationally involved a company is, the more sensitive it is to exchange-rate movements.

This relationship is, later on, examined by Amihud (1994) for a sample of the 32 largest US exporting companies between 1982 and 1988. Surprisingly and not in line with the findings by Jorion (1990), the results are insignificantly different from zero. However, when testing for lagged effect using quarterly data, the author discovers a significant non-contemporaneous effect of movements in exchange-rates on a company's value. In support to such effect is the study by Bartov & Bodnar (1994). Using a sample of 208 US companies, the authors find no evidence of contemporaneous effect but significant lagged exchange-rate exposure. However, this exposure decreases over time, suggesting about possible hedging actions taken by companies' management.

One of the most extensive researches of US multinational companies was conducted by Choi & Prasad (1995). Unlike the aforementioned studies, the authors find a significant relationship between the changes in exchange-rates and companies' market value. Studying a sample of 409 firms during the 1978-1989 period, Choi & Prasad (1995) discover that approximately 60% of US multinationals are sensitive to exchange-rate movements. In line with previous research, this sensitivity varies over time, but follows a rather different pattern. Unlike the findings in Jorion (1990), US companies benefit from dollar depreciation, that is, experience an increase in their market value. Most importantly, the authors find that exchange-rate exposure differs across companies operating in different industries (e.g. companies within textiles, retail and department stores lose from dollar depreciations, while those within utilities, resources and manufacturing gain).

Nevertheless, the results of studies, focused on US corporations are in weak support to the notion of the sensitivity of a firm's value to exchange-rate movements. In contrast, research on smaller and more open economies has found evidence of significant exchange-rate exposure. Bodnar & Gentry (1993) compare companies at industry level in three countries – USA, Japan and Canada – and find out that industries in smaller and more open economy such as Japan are more sensitive to exchange-rate fluctuations. Based on their results (35%, 21% and 28% of industries in respectively Japan, Canada and USA exhibit significant residual exposure), the authors test

and subsequently do not reject the hypothesis that smaller and more open economies are more sensitive to exchange-rate changes than their larger and relatively closed counterparts.

The findings of Bodnar & Gentry (1993) raised the attention on the relationship between openness and exposure and, as a consequence, empirical research turned to studying the exposure of firms in economies other than USA. He & Ng (1998) pushed the investigation of Japanese firms further by looking at firm- rather than the aggregate industry level. Using a sample of 171 companies, the authors find that 43 of them (25%) exhibit significant (positive) exposure, suggesting that companies benefit from a depreciating Yen, which can be attributed to the strong export orientation of Japanese firms.

Contrastingly, El-Masry (2006) discovers a negative relationship between exchange-rate movements and changes in UK companies' value. Studying a sample 364 non-financial firms, the author finds that, in general, UK firms benefit from an appreciating pound. However, the magnitude of exposure differs substantially across industry. For example, while industries such as Transport, Construction, Households, Telecommunication and Utilities gain from appreciation, others such as Aerospace and Defence Industries lose.

In a most recent study, Jong *et al* (2006) focus on 47 Dutch non-financial firms over the 1994-1998 period. With the Netherlands being one of the most open economies in the world, the authors argue and expect that the majority of them will exhibit significant exchange-rate exposure. Indeed, 51% of Dutch firms display significant (positive) exposure with coefficients ranging from 1.09 to 10.92. This suggests that they benefit from depreciation in the Dutch guilder⁵. Also, the authors find evidence of lagged effect of exchange-rate fluctuations on companies' market value.

As pointed out earlier, the existing empirical evidence of exchange-rate exposure is rather inconclusive and differs across countries and industries. However, a certain pattern forms - companies and industries in rather large economies such as USA and Canada are affected to a lesser degree by exchange-rate fluctuations, while such in heavily export-oriented and more open economies such as Japan and the Netherlands are. Furthermore, the direction of the effect differs. While companies in USA, UK and Canada benefit from appreciation in their respective home currencies, companies in Japan and the Netherlands are harmed.

In that context, we are interested to see the actual exchange-rate exposure situation of Swedish firms. As an open economy with a strong international and export profile, we expect to find a significant sensitivity to exchange-rate movements, and also differences in that sensitivity across industries, firms and in respect to different currencies.

⁵ The study covers a pre-Euro period (January, 1st 1994 to December, 31st 1998).

Chapter 4. Methodology and Data

4.1 The Stock Market Approach

Since Adler & Dumas (1984), the stock market approach has been widely used to measure the exchange rate exposure of firms. The approach itself suggests that as the market value of the firm is actually the present value of its expected future cash flows, as defined in basic financial theory, by examining the change in firm's market value for a unit change in exchange rates, one can measure this firm's exchange rate exposure. In turn, market value is presented by the price of company's shares. This involves a simple time-series regression model, which is usually in the following form:

$$R_j = \alpha_j + \lambda_j * FX_t + \varepsilon_j \quad (\text{Eq. 4.1})$$

, where R_j is the stock return of company j and FX_t denotes the change in exchange rate measured as the price of foreign currency in terms of home currency. Therefore, the parameter λ_j can be interpreted as the elasticity of company's value to change in exchange rates. Both the R_j and FX_t terms are defined as percentage changes.

However, this model has been criticized in the literature on its simplicity. The λ_j parameter does not distinguish between firm-specific effects and macroeconomic effects that affect the economy as a whole. It rather measures the total exposure of a firm, which includes two components – effect that is anticipated by the company's management, and the aforementioned macroeconomic affects that have impact on “*the valuation of all firms, such as changes in the risk-free rate, the market risk premium, and investor sentiment that happen to be correlated with the exchange rate*” (Bodnar & Wong, 2003).

Instead of the original model, we use its extended form as proposed by Jorion (1990). This involves adding a variable that controls for the macroeconomic effects – namely the returns of a market index. Thus, one can distinguish between the influence on all the firms and the economy itself, as the market index is commonly used as a benchmark for the performance of the economy, as well as the returns of the index can be considered as a proxy for the returns of the market portfolio. Therefore, the regression model takes the following form:

$$R_{j,t} = \alpha_j + \lambda_j * FX_t + \beta_j * RM_t + \varepsilon_j \quad (\text{Eq. 4.2})$$

, where $R_{j,t}$ denotes the return of stock of firm j at time t , FX_t is again the change in exchange rate, and RM_t is the return of the market portfolio at time t . As one may notice, the expression in Eq.4.2 is very similar to the Capital Asset Pricing Model (CAPM), the interpretation of which suggests that a company is facing only market risk and its value is correlated with the market return. This correlation is in fact the company's market beta (β_j). However, the inclusion of the λ_j parameter as a measure of the exchange risk exposure implies that if it is different from zero, it is not only the market risk that has an impact on a company's value.

This model, however, requires certain attention on its interpretation. While in Eq.4.1 λ_j measures the elasticity of company's value to changes in exchange rates, or in other words, the total exposure, now a part of the effect is attributed to macroeconomic factors through the value of the market beta (β_j). Therefore, λ_j is rather the residual exposure and not the total exposure, as a share of the impact of exchange rate changes is attributable to all the companies in the economy and captured by their respective beta coefficients. Also, such a residual exposure coefficient

allows for a firm-specific analysis and comparison of companies operating in different sectors of the economy.

Statistically, the interpretation of results from a model as the one in Eq.4.2 is as follows:

- If the λ_j coefficient of a company is not significantly different from 0, this does not mean that the company has zero total exposure to changes in exchange rates. Rather, company's residual exposure is 0, and its total exposure is the same as that of the market portfolio.
- It is unlikely that the market portfolio has a zero exposure to changes in exchange rates, because of the impact of macroeconomic factors on the economy. This, however, raises the question on what type of market index is most appropriate to be used as a proxy for the returns of the market portfolio.

The model in Eq.4.2 accounts only for the contemporaneous effect of exchange-rate fluctuations on the market value of companies. However, it is plausible to suggest that such fluctuations affect also expected future cash flows and thus, this lagged impact should not be discarded. Such impact is accounted for in the studies by Amihud (1994) and Bartov & Bodnar (1994), who found a significant relationship between today's company's stock returns and changes in exchange rates that occurred in previous periods. Hence, we modify the regression model in Eq.4.2 and use the following instead:

$$R_{j,t} = \alpha_j + \lambda_{1,j} * FX_t + \lambda_{2,j} * FX_{t-1} + \dots + \lambda_{k,j} * FX_{t-k+1} + \beta_j * RM_t + \varepsilon_j \quad (\text{Eq.4.3})$$

, where the $\lambda_{1,j}$ coefficient measures the contemporaneous (residual) exposure, $\lambda_{2,j}$ measures the impact of last-period change in exchange rate on today's stock returns, and, similarly for all the previous periods. Also, FX_{t-1} denotes the change in the exchange rate that occurred the period before, and, similarly FX_{t-k+1} for the change k periods ago. Standard Akaike and Schwarz information criteria are used to determine the exact number of lags included in the regression. This number may vary from company to company. The remaining variables and parameters in Eq.4.3 are the same as in Eq.4.2.

A final extension to the model is estimating the returns of the market portfolio as a function of changes in the exchange rates. The reason for that is that Eq.4.3 allows us to estimate the residual exposure of firms, that is, their firm-specific exchange rate exposure. However, what if their residual exposure is not significantly different from zero? This still means that firms are sensitive to exchange rate fluctuations, but rather this sensitivity is the market portfolio's exposure, adjusted for each firm through their respective market beta coefficients. Therefore:

$$RM_t = \theta_j + \omega_1 * FX_1 + \omega_2 * FX_2 + \dots + \omega_k * FX_k + \mu_j * RM_{t-1} + u_j \quad (\text{Eq.4.4})$$

, where $\omega_1, \omega_2, \dots, \omega_k$ measure the sensitivity of market portfolio returns to changes in the FX_1, FX_2, \dots, FX_k exchange rates respectively, and the term RM_{t-1} accounts for lagged market returns. The intuition behind the inclusion of RM_{t-1} is that it has already reflected the impact of the lagged changes in exchange rates on the market returns in that period, and therefore can be used as an explanatory variable for the returns in the current period. Also, such a method allows for coping with problems such as autocorrelation and multicollinearity of the explanatory variables, as well as is not at the expense of a loss of degrees of freedom. We use Newey-West heteroskedasticity consistent coefficients method in the estimation of Eq.4.4.

4.2 Issues with the Stock Market Approach

Before proceeding with the application of the model stated above, we need to resolve certain issues concerning the variables to be included. The choice on what types of exchange rates, stock market returns and companies may be of significant importance to the accurate estimation of exchange rate exposure.

4.2.1 Exchange Rates

Most of the empirical studies on exchange rate exposure have concentrated on the use of trade-weighted basket of currencies, rather than bilateral exchange rates. Usually, such a basket is derived from country's trade data and constructed as a weighted average of the currencies in which the trade flows are denominated. An example is the Total Competitiveness Weights Index (TCW), reported by the Swedish Riksbanken, where the weights take account of imports, exports and third-country effects. However, the individual residual exposure of a firm is determined by its own operating and financing activities, rather than by the industry or the economy as a whole. This means that few or more currencies are relevant for the individual firm and not all the currencies that are involved in the trade flows of the country. As noted by Doidge, et al (2002), if trade-weighted basket is used and a company is exposed to a single or a few currencies, the results of its exposure would be underestimated. Thus, it is more appropriate to use bilateral exchange rates when conducting a firm-specific study of exposure.

On the other hand, the choice should not be highly restricted to the most used currencies. While company's products compete in the world market, it is not only the most commonly used currencies that determine company's exposure to exchange rate movements. As such movements are usually hedged against, it is also the less-frequently used currencies that influence, although indirectly, this exposure. We set our choice on the following bilateral exchange rates: SEK/USD, SEK/EUR, SEK/GBP, SEK/100 DKK, SEK/100 NOK, SEK/100 JPY. The different way the exchange rate between Swedish, Norwegian and Danish crowns and Japanese Yen is reported does not give rise to any additional problems, as it is the change in exchange rate that we are interested in, and not the exact rate.

Another problem that needs to be resolved is whether nominal or exchange rates should be used. Amihud (1994) and Choi & Prasad (1995) found out that there is little difference in the results, which is also supported by Atindehou & Gueyie (2001). The latter argue that since nominal and real exchange rates are highly correlated (especially for low-inflation countries) and therefore, in the absence of severe shocks, "*would have similar impact on stock returns*". Indeed, under the investigated period, the annual inflation rates in the chosen countries are roughly the same. The only difference is the inflation rate associated with the Euro currency, as it is not a single country's inflation, but rather the average inflation rate of the European Union countries. For the purpose of our study we use nominal exchange rates.

4.2.2 Stock Market Indices and Returns

Another problem that arises when investigating exchange-rate exposure is what type of market index that serves as a proxy for market returns should be chosen. As already explained above, such an index is used to capture the macroeconomic impacts of fluctuations in exchange rates. However, since companies, are directly or indirectly (through their supplier and distributor channels) affected by changes in the international macroeconomic environment, this suggests in-

tuitively that the returns of a global portfolio, and more precisely its sensitivity, should be included to account for this macroeconomic effect. However, such a global portfolio is very difficult to construct and its returns to be obtained. Secondly, empirical studies suggest that country-specific market portfolios provide better explanation to changes in company's returns (Dominguez & Tesar, 2001).

There is yet one more question to be answered – should equally weighted or value-weighted market index be chosen? Bodnar & Wong (2000) argue that larger corporations, multinationals and export-oriented companies have stronger impact on value-weighted indices and their returns, as such companies are more likely to experience changes in their cash flows values when their home currency appreciates or depreciates. The authors conclude that if value-weighted market index is included, the results would be biased towards no exposure, as well as the macroeconomic effect would be incorrectly captured and mitigated, in general. In that context, we set our choice on an equal-weighted market index, namely the OMXSPI, which is an all-share index and includes all the companies that are listed on the Stockholm Stock Exchange.

4.2.3 Company Categories

The research literature concerned with exchange rate exposure is almost exclusively focused on multinational and export-orienting firms – in other words – firms actively engaged in international operating and/or trading activities. Furthermore, financial companies are deliberately excluded from the analysis since they are practically assumed to be eliminating exchange rate risk because of the nature of their operations, as well as through various hedging strategies. In our study, we shall not discriminate between the various categories of companies, and would rather treat them on equal basis. However, a priori we expect to find insignificant residual exposure to movements in exchange rates for firms operating in the financial sector.

4.3 Data and Data Transformation

For the purpose of our empirical investigation, we use primary data on stock prices of a sample of 304 Swedish firms for the period between January, 1st 2002 and September, 27th 2006. All of the firms are listed on the Stockholm Stock Exchange and included in the calculation of OMXSPI. Following the sector classification by the Stockholm Stock Exchange, the companies are divided into the following categories: Energy (5 companies), Materials (18), Industrials (73), Consumer-related (48), Health Care (30), Financials (57), Information Technology (68), and Telecommunication (5).

However, due to low data quality and recent listing on the stock exchange, 168 companies were discarded, leaving us with a sample of 136. Category-wise, the companies are divided into Energy (2), Materials (8), Industrials (34), Consumer-related (20), Health Care (17), Financials (23), Information Technology (30), and Telecommunication (2). Data on their respective stock price is collected, as provided by Stockholm Stock Exchange, for each of the trading days in the chosen period.

Furthermore, daily data on the OMXSPI index quotes is obtained from Reuters. As for the exchange rates, daily data on the bilateral exchange rates SEK/100DKK, SEK/100NOK, SEK/GBP, SEK/USD, SEK/EUR is used, provided by the Swedish National Bank (Riksbanken). Data on the SEK/100 JPY rate is provided by Reuters.

In order to reduce the noise that is usually present in daily-data series, we take the weekly observations for each of the companies' stock market prices, the stock index quotes and the bilateral exchange rates. Also, as to avoid "Monday"- and "End-of-the-Week" effects on stock prices, we choose the observations on every Wednesday during the investigated period. Thus, we transform the data from daily to weekly observations. If Wednesday happens to be a non-trading day, the quotes and rates on the following trading day are taken instead.

Since we are interested in changes rather than actual level of prices and rates, as a last step of the data transformation, we calculate the changes in exchange rates, companies' stock prices and stock index market quotes as log differences. As a final result, we have 247 time-series observations for the weekly returns on companies' stock, the index market returns and the change in exchange rates.

One final problem needs to be considered. During the observed period, a number of companies, included in the sample, executed a "share-splitting" program, which resulted in a significant decrease in their stock price. This, however, does not cause a reduction in company's market value and its capitalization, but such a change is reflected in the calculation of weekly returns. Therefore, we estimate such a company's exposure in two sub-periods – before and after the split.

Chapter 5. Empirical Results and Analysis

The results from our empirical investigation are presented in Table 1 and Table 2. Due to the large number of companies (136), and hence the large number of regressions that have been run, we provide the summarized statistics for the exchange rate exposure for Swedish companies, subdivided into the discussed company categories (See Section 4.2.3), with respect to each of the 6 different bilateral exchange rates. Also, the results of the exposure effect are divided according to their “time characteristic” – that is, contemporaneous (Table 1) and lagged (Table 2). In Table 3, the total number of companies with significant exposure is shown – both within categories and in total.

At first glance, the results for the different categories of companies are rather diverse. Furthermore, even within the categories, differences, both in the sign of the exchange rate of exposure and its magnitude could be found. Looking at Table 1 and Table 2, one can easily claim that it is rather lagged than contemporaneous effect that dominates in our firm-specific analysis. The percentage of firms with significant contemporaneous exposure is in the area of 9-16%, while lagged effect exhibit approximately 24-29% of the firms (in respect to the respective bilateral exchange rates). We proceed to analyzing the results for each single company category.

- **“Consumer Discretionary”** – Table 3 shows that 85% (17 out of 20) of the companies, falling into that category exhibit significant exchange rate exposure coefficients to at least one of the bilateral exchange rates. However, the impact of exchange rate fluctuations occurs rather with delay than immediately, with greater number of companies having “lagged-exposure” compared to contemporaneous (See Table 1 and 2). Little can be said about the sign of the exposure to the different exchange rates. Both contemporaneous and lagged effect coefficients are almost equally shared between “positive” and “negative”, with the mean absolute exposure higher for the contemporaneous effect in the cases of SEK/EUR, SEK/USD and SEK/DKK and lower in the cases of SEK/NOK, SEK/GBP and SEK/JPY, compared to the lagged. Whether companies gain or lose from depreciation of the Swedish crown and what the magnitude of their exposure is requires a separate cross-sectional study of the companies within that category. Nevertheless, the percentage of companies, exposed to exchange-rate fluctuations, is much higher compared to previous studies.

- **“Energy”** – The very small number of companies included in that category (only 2) prevents us from drawing any conclusions about the problem of exchange rate exposure. If anything is to be said is the company with the statistically significant coefficients - namely Vostok Nafta Investment Ltd, an oil and gas company, is harmed by depreciation of the Swedish crowns towards the USD and DKK, losing respectively approximately 0,47 and 0,98% of its stock value for every 1% increase in the exchange rate. Our investigation did not show any significant lagged effect. Nevertheless, a much larger sample is required for making any reliable statistical inference.

- **“Finance”** – Usually neglected in the literature, the financial companies in our investigations show some interesting results. The immediate effect of exchange-rate change on their stock price (and market value) is harmful, with 22 out of 25 statistically significant contemporaneous coefficients having a negative sign (See Table 1). However, the signs of the lagged exposure coefficients are shared equally between “positive” and “negative”, with this exposure having roughly similar magnitude, in absolute terms, for each of the chosen bilateral exchange rates. Also, some of the companies show both contemporaneous and lagged exposure. Taking into consideration the main activity of the firms included in this category, this result is somewhat understandable.

Table 1. Summary statistics of contemporaneous exchange rate exposure of Swedish firms (Jan, 1st 2002 – Sep, 27th 2006)

Company Category (number of firms)	Exposure to EUR (number of firms) (range) (mean abs. exposure) insign (+/-), signif (+/-)	Exposure to USD (number of firms) (range) (mean abs. exposure) insign (+/-), signif (+/-)	Exposure to DKK (number of firms) (range) (mean abs. exposure) insign (+/-), signif (+/-)	Exposure to NOK (number of firms) (range) (mean abs. exposure) insign (+/-), signif (+/-)	Exposure to GBP (number of firms) (range) (mean abs. exposure) insign (+/-), signif (+/-)	Exposure to JPY (number of firms) (range) (mean abs. exposure) insign (+/-), signif (+/-)
Consumer Discretionary (20)	3 out of 20 -0,83635 to 2,03564 1,485022 7+/10- ; 1+/-	3 out of 20 -0,45344 to 0,235102 0,361467 7+/10- ; 1+/-	3 out of 20 -1,557714 to 2,080098 1,493682 7+/10- ; 1+/-	1 out of 20 -0,415005 0,415005 8+/11- ; 0+/-	1 out of 20 -0,585097 0,585097 10+/9- ; 0+/-	4 out of 20 -0,607652 to 0,256519 0,358973 6+/10- ; 2+/-
Energy (2)	0 out of 2 <i>-0,95313 to 0,576305</i> 0,764719 1+/- ; 0+/-	1 out of 2 -0,469790 0,469790 1+/- ; 0+/-	1 out of 2 -0,983909 0,983909 1+/- ; 0+/-	0 out of 2 <i>-0,030974 to 0,008638</i> 0,019806 1+/- ; 0+/-	0 out of 2 <i>-0,203723 to -0,024402</i> 0,114062 0+/- ; 0+/-	0 out of 2 <i>-0,230182 to -0,075917</i> 0,153049 0+/- ; 0+/-
Finance (23)	3 out of 23 -1,02825 to -0,495263 0,631558 8+/12- ; 1+/-	3 out of 23 -0,252975 to -0,206538 0,225886 7+/13- ; 0+/-	6 out of 23 -1,019207 to -0,495220 0,582656 8+/9- ; 1+/-	2 out of 23 -1,110853 to -1,064369 1,087611 10+/11- ; 0+/-	7 out of 23 -0,700699 to -0,324882 0,405115 8+/8- ; 1+/-	4 out of 23 -1,478903 to -0,174905 0,547953 6+/13- ; 0+/-
Health (17)	2 out of 17 -1,66515 to 1,31965 1,492402 7+/8- ; 1+/-	1 out of 17 -1,359415 1,359415 7+/9- ; 0+/-	2 out of 17 -1,662382 to 1,255022 1,458702 7+/8- ; 1+/-	4 out of 17 -2,323235 to -0,807699 1,399322 2+/11- ; 0+/-	3 out of 17 -1,442450 to -0,712463 1,044740 7+/7- ; 0+/-	0 out of 17 <i>-0,877683 to 0,529094</i> 0,268122 9+/8- ; 0+/-
Industrial (34)	2 out of 34 0,959742 to 1,661613 1,310678 9+/32- ; 2+/-	4 out of 34 -0,676319 to 0,499126 0,491855 10+/20- ; 1+/-	2 out of 34 1,005895 to 1,691122 1,348508 10+/22- ; 2+/-	3 out of 34 -0,445623 to 1,570368 0,788472 15+/16- ; 1+/-	3 out of 34 -0,416211 to 0,786285 0,488598 11+/20- ; 1+/-	2 out of 34 0,333188 to 0,477273 0,405230 14+/18- ; 2+/-
IT (30)	3 out of 30 1,310654 to 1,481003 1,388784 14+/13- ; 3+/-	6 out of 30 -0,316214 to 0,962067 0,602394 16+/8- ; 5+/-	3 out of 30 1,284693 to 1,404556 1,353072 14+/13- ; 3+/-	3 out of 30 -1,305612 to 1,100696 1,08256 13+/14- ; 2+/-	4 out of 30 0,680674 to 1,733655 1,025615 17+/10- ; 4+/-	5 out of 30 0,654759 to 1,439492 0,977228 17+/8- ; 5+/-
Material (8)	1 out of 8 -0,498661 0,498661 2+/5- ; 0+/-	4 out of 8 -0,578615 to 0,790855 0,484442 1+/- ; 3+/-	1 out of 8 -0,500835 0,500835 2+/5- ; 0+/-	0 out of 8 <i>-0,625360 to 0,326976</i> 0,207320 4+/- ; 0+/-	1 out of 8 0,479300 0,479300 2+/5- ; 1+/-	1 out of 8 0,459293 0,459293 4+/- ; 1+/-
Telecommunication (2)	0 out of 2 <i>0,312281 to 0,526871</i> 0,419576 2+/- ; 0+/-	0 out of 2 <i>-0,276055 to -0,008169</i> 0,142112 0+/- ; 0+/-	0 out of 2 <i>0,259267 to 0,567664</i> 0,413465 2+/- ; 0+/-	0 out of 2 <i>0,235155 to 0,264946</i> 0,250050 2+/- ; 0+/-	0 out of 2 <i>-0,200561 to -0,018261</i> 0,109411 0+/- ; 0+/-	0 out of 2 <i>-0,094102 to -0,245184</i> 0,169643 0+/- ; 0+/-
TOTAL (136)	14 companies (10%)	22 companies (16%)	18 companies (13%)	13 companies (9%)	19 companies (14%)	16 companies (12%)

Legend : The first line shows the number of companies that exhibit statistically significant exposure to the respective exchange rate in the column. It is followed by the range of the values of the exposure, and the mean exposure in absolute terms. The last row shows the number of companies exhibiting statistically insignificant positive/negative exposure, as well as the number of companies with significant such. All the figures in bold and italic represent insignificant estimates and are included in the table for the purpose of completeness.

Table 2. Summary statistics of lagged exchange rate exposure of Swedish firms (Jan, 1st 2002 – Sep, 27th 2006)

Company Category (number of firms)	Exposure to EUR (N firms, 1-2-3) (mean abs. exposure) insign (+/-) for 1-2-3 signf (+/-) for 1-2-3	Exposure to USD (N firms, 1-2-3) (mean abs. exposure) insign (+/-) for 1-2-3 signf (+/-) for 1-2-3	Exposure to DKK (number of firms) (mean abs. exposure) insign (+/-), signf (+/-)	Exposure to NOK (number of firms) (mean abs. exposure) insign (+/-), signf (+/-)	Exposure to GBP (number of firms) (mean abs. exposure) insign (+/-), signf (+/-)	Exposure to JPY (number of firms) (mean abs. exposure) insign (+/-), signf (+/-)
Consumer (20)	8 out of 20 (3-2-4)* (0,97) (0,72) (1,52) (9+/8-) (10+/8-) (4+/12-) (2+/1-) (2+/0-) (0+/4-)	3 out of 20 (1-0-2) (0,25) (0,18) (0,45) (7+/12-) (12+/8-) (7+/10-) (1+/0-) (0+/0-) (1+/1-)	8 out of 20 (3-2-4)* (0,98) (0,71) (1,49) (9+/8-) (12+/6-) (4+/12-) (2+/1-) (2+/0-) (0+/4-)	5 out of 20 (2-2-2)* (0,73) (0,40) (0,63) (7+/11-) (13+/5-) (8+/10-) (1+/1-) (1+/1-) (0+/2-)	6 out of 20 (2-3-3)* (0,82) (0,57) (0,73) (11+/7-) (11+/6-) (10+/7-) (0+/2-) (1+/2-) (1+/2-)	7 out of 20 (0-5-3)* (0,13) (0,54) (0,49) (14+/6-) (11+/5-) (9+/8-) (0+/0-) (2+/3-) (2+/1-)
Energy (2)	0 out of 2 (0-0-0) (0,28) (0,36) (0,53) (0+/2-) (0+/2-) (1+/1-) (0+/0-) (0+/0-) (0+/0-)	0 out of 2 (0-0-0) (0,15) (0,20) (0,15) (2+/0-) (2+/0-) (0+/2-) (0+/0-) (0+/0-) (0+/0-)	0 out of 2 (0-0-0) (0,28) (0,36) (0,48) (0+/2-) (0+/2-) (1+/1-) (0+/0-) (0+/0-) (0+/0-)	0 out of 2 (0-0-0) (0,12) (0,25) (0,24) (2+/0-) (1+/1-) (1+/1-) (0+/0-) (0+/0-) (0+/0-)	0 out of 2 (0-0-0) (0,05) (0,23) (0,11) (1+/1-) (0+/2-) (2+/0-) (0+/0-) (0+/0-) (0+/0-)	0 out of 2 (0-0-0) (0,15) (0,11) (0,13) (1+/1-) (0+/2-) (0+/2-) (0+/0-) (0+/0-) (0+/0-)
Finance (23)	3 out of 23 (1-1-1) (0,63) (1,40) (0,32) (7+/15-) (12+/10-) (14+/8-) (0+/1-) (1+/0-) (1+/0-)	6 out of 23 (2-3-1) (0,47) (0,23) (0,74) (12+/9-) (12+/8-) (12+/10-) (2+/0-) (3+/2-) (1+/0-)	2 out of 23 (1-2-0)* (0,62) (0,95) (0,36) (7+/15-) (13+/8-) (14+/9-) (0+/1-) (2+/0-) (0+/0-)	6 out of 23 (3-3-3)* (0,52) (0,57) (0,66) (9+/11-) (7+/13-) (10+/10-) (1+/2-) (2+/1-) (1+/2-)	4 out of 23 (2-1-1) (0,38) (0,26) (0,23) (7+/14-) (11+/11-) (12+/10-) (0+/2-) (0+/1-) (1+/0-)	5 out of 23 (0-4-1) (0,23) (0,43) (0,83) (17+/6-) (9+/10-) (13+/9-) (0+/0-) (3+/1-) (0+/1-)
Health (17)	3 out of 17 (0-0-3) (0,50) (0,48) (1,02) (6+/11-) (14+/3-) (9+/5-) (0+/0-) (0+/0-) (1+/2-)	7 out of 17 (2-1-4) (0,65) (0,87) (0,62) (4+/11-) (9+/7-) (6+/7-) (2+/0-) (0+/1-) (3+/1-)	3 out of 17 (1-0-3)* (0,82) (0,98) (1,00) (6+/10-) (13+/4-) (9+/5-) (0+/1-) (0+/0-) (1+/2-)	5 out of 17 (2-1-2) (0,97) (0,96) (0,88) (4+/11-) (10+/6-) (5+/10-) (0+/2-) (1+/0-) (1+/1-)	4 out of 17 (2-2-1)* (0,83) (0,84) (0,88) (9+/6-) (7+/8-) (10+/6-) (2+/0-) (2+/1-) (1+/0-)	5 out of 17 (1-2-2) (1,04) (0,68) (0,49) (8+/8-) (10+/5-) (8+/7-) (1+/0-) (2+/0-) (1+/1-)
Industrial (34)	9 out of 34 (4-3-4)* (1,04) (1,32) (0,76) (16+/14-) (20+/11-) (17+/13-) (0+/4-) (1+/2-) (3+/1-)	5 out of 34 (1-3-2)* (0,42) (0,44) (0,28) (22+/11-) (21+/10-) (17+/15-) (0+/1-) (2+/1-) (0+/2-)	6 out of 34 (3-1-4)* (1,15) (0,93) (0,77) (16+/15-) (18+/15-) (16+/14-) (0+/3-) (1+/0-) (3+/1-)	9 out of 34 (6-4-1)* (0,87) (1,28) (0,46) (15+/13-) (19+/11-) (15+/18-) (4+/2-) (3+/1-) (1+/0-)	4 out of 34 (1-2-1) (0,60) (0,81) (0,36) (18+/15-) (17+/15-) (23+/10-) (0+/1-) (1+/1-) (1+/0-)	7 out of 34 (1-3-3) (0,41) (0,77) (0,67) (20+/13-) (13+/18-) (14+/17-) (0+/1-) (3+/0-) (3+/0-)
IT (30)	14 out of 30 (10-4-7)* (1,19) (1,55) (1,45) (7+/13-) (14+/12-) (8+/15-) (0+/10-) (2+/2-) (4+/3-)	9 out of 30 (6-2-1) (0,59) (0,62) (0,70) (3+/21-) (14+/14-) (13+/16-) (0+/6-) (2+/1-) (1+/0-)	13 out of 30 (9-4-7)* (1,20) (1,54) (1,45) (6+/15-) (14+/12-) (8+/15-) (0+/9-) (2+/2-) (4+/3-)	13 out of 30 (9-6-6)* (1,12) (1,08) (1,05) (5+/16-) (15+/9-) (7+/17-) (0+/9-) (6+/0-) (1+/5-)	13 out of 30 (7-5-2)* (1,02) (0,95) (1,05) (6+/17-) (14+/11-) (17+/11-) (0+/7-) (4+/1-) (1+/1-)	11 out of 30 (4-7-3)* (0,68) (0,70) (0,61) (9+/17-) (15+/8-) (18+/9-) (0+/4-) (6+/1-) (2+/1-)
Material (8)	3 out of 8 (1-1-1) (0,50) (1,24) (1,52) (4+/3-) (4+/3-) (5+/2-) (1+/0-) (1+/0-) (0+/1-)	2 out of 8 (2-1-1)* (0,32) (0,48) (0,38) (6+/0-) (3+/4-) (2+/5-) (2+/0-) (1+/0-) (1+/0-)	4 out of 8 (2-2-1)* (0,65) (0,96) (0,57) (4+/2-) (3+/3-) (5+/2-) (1+/1-) (2+/0-) (0+/1-)	2 out of 8 (1-1-0) (1,07) (0,59) (0,19) (2+/5-) (3+/4-) (3+/5-) (1+/0-) (1+/0-) (0+/0-)	2 out of 8 (1-1-0) (0,42) (0,88) (0,15) (4+/3-) (3+/4-) (6+/2-) (1+/0-) (1+/0-) (0+/0-)	1 out of 8 (0-1-0) (0,14) (0,22) (0,18) (6+/2-) (4+/3-) (4+/4-) (0+/0-) (0+/1-) (0+/0-)
Telecommunication (2)	0 out of 2 (0-0-0) (0,33) (0,45) (0,39) (2+/0-) (0+/2-) (1+/1-) (0+/0-) (0+/0-) (0+/0-)	1 out of 2 (1-0-0) (0,65) (0,31) (0,24) (1+/0-) (1+/1-) (0+/2-) (0+/1-) (0+/0-) (0+/0-)	0 out of 2 (0-0-0) (0,32) (0,46) (0,38) (2+/0-) (0+/2-) (1+/1-) (0+/0-) (0+/0-) (0+/0-)	0 out of 2 (0-0-0) (0,13) (0,71) (0,18) (1+/1-) (0+/2-) (1+/1-) (0+/0-) (0+/0-) (0+/0-)	0 out of 2 (0-0-0) (0,27) (0,23) (0,17) (1+/1-) (0+/2-) (0+/2-) (0+/0-) (0+/0-) (0+/0-)	0 out of 2 (0-0-0) (0,25) (0,33) (0,23) (0+/2-) (0+/2-) (1+/1-) (0+/0-) (0+/0-) (0+/0-)
TOTAL (136)	40 companies (29%)	33 companies (24%)	36 companies (27%)	40 companies (29%)	33 companies (24%)	36 companies (27%)

Legend : The first row in each cell shows the number of firms with significant lagged exposure, followed by their distribution for periods (1,2 and 3 lags “ago”) in brackets. The asterisk symbol denotes that one or more of the companies exhibit exposure in more than one lagged period. The second row includes the average mean exposure of all firms in that category respectively for 1,2 and 3 lags. It is followed by the number of firms with insignificant exposure coefficients and their sign (positive/negative) for each lag, (row 3), as well as the number of firms with significant coefficients in an analogous manner (row 4). All figures in bold and italic are insignificant and included for purposes of completeness.

Company Categories/ /Criteria	Only Con- temporane- ous Effect	Only Lagged Effect	Contemporaneous & Lagged Effect	“Changing Signs”	TOTAL
Consumer (20)	3	6	7	4	17/20 (85%)
Energy (2)	1	0	0	0	1/2 (50%)
Finance (23)	4	6	8	4	18/23 (78%)
Health (17)	3	7	3	1	13/17 (76%)
Industrial (34)	2	11	10	3	23/34 (68%)
IT (30)	0	13	13	7	26/30 (87%)
Material (8)	0	2	5	1	7/8 (87%)
Telecommunication (2)	0	1	0	0	1/2 (50%)
TOTAL(136)	13	46	46	20	106/136 (78%)

Legend : The “Changing Signs”-column shows the number of companies that have either lagged coefficients or lagged plus contemporaneous coefficients with different signs within the frame of a single bilateral exchange rate (not across bilateral exchange rates).

With most of these companies being financial intermediaries (e.g. banks or investing holdings), it is easy to assume that a change in the value of the Swedish crown would affect their economic activities. The immediate effect would affect, for example, the most liquid of assets with rising number of transactions, while the effect on long-term and fixed-income assets would occur rather later – hence the lagged effect. However, the exact mechanics of the effect is out of the scope of our study. What actually matters is that 78% of the financial companies in the sample exhibit exchange rate exposure counter to the suggestions in the existing literature of zero exposure of financial companies.

- **“Health Care”** – the majority of companies falling into that category are either pharmaceuticals or dealing with medical equipment. The exchange rate exposure results are more in favour of lagged than contemporaneous effect. Few of the companies are affected by changes in the rates immediately (no effect at all in the case of SEK/JPY), with roughly similar magnitudes of that effect. As for the composition of the signs, companies tend to be harmed when the Swedish crowns loses value relative to NOK and GBP, but firm conclusions cannot be drawn due to the low number of significant coefficients. Similarly to the categories, discussed earlier, the lagged effects give rather mixed information. Although more companies show significant lagged effects, compared to contemporaneous, the signs of these effects are almost equally divided into “positive” and “negative”. In total, 76% of all “Health Care”-companies show some exchange rate exposure, which is quite higher than the results in previous studies.

- **“Industrials”** – The lagged exposure effects are dominated in the results for this company category. However, these results are highly heterogeneous. No single exchange rate stands out in its effect on the included companies, as well as the magnitude of the effects differ substantially from each other. With 68% of all companies included in the investigation having significant exposure, Swedish industrial firms show to be more affected by exchange rate fluctuations than their counterparts do in the existing empirical research. What can be pointed out is that the effect of such fluctuations occurs with delay, for reasons such as the existing contractual agreements etc, as discussed earlier in Section 2.2.

- **“IT”** – The most firm conclusions of all can be drawn for the case of Swedish IT companies. Showing the highest percentage (26/30 or 87%), such companies can be said to be sensitive to exchange-rate fluctuations. Again, most of them exhibit lagged rather than contemporaneous effects. Nevertheless, as for the latter, 22 out of 24 coefficients are positive, suggesting that the intermediate effect of a depreciating Swedish crown is firms’ value increasing. The picture is

rather different in the case of lagged exposure, with more negative than positive signs – hence a negative impact on firms’ market value. Also, 7 companies experience “changing signs”, that is benefiting in one period and losing in the other, not necessarily in that order. This number is highest of all of the company categories’, suggesting even higher degree of sensitivity for the Swedish IT companies. The results of the exact degree of this sensitivity are highly heterogeneous and differ substantially for each of the bilateral exchange rates.

- **“Material”** – Little can be said about the exposure of such Swedish companies, mostly because of the very small sample. The mean absolute exposure with respect to each bilateral exchange rate is roughly the same (approximately 0.50), but with dubious results about the actual signs, this cannot be considered representative for all the firms in that industry. Nevertheless, the results in Table 3, showing that 87% of companies in “Material”- category exhibit significant exchange rate exposure, are much higher than those in comparable previous empirical studies. However, for the purpose of trustworthy statistical inference, a larger sample is required.

- **“Telecommunication”** – Similarly to the case of “Energy”, no trustworthy conclusions can be drawn from the results of Swedish Telecommunication companies, as the sample consists of barely 2 companies. Only one of them shows a significant (contemporaneous) exposure – that is Tele2, having a coefficient of (-0, 65) with respect to USD. That means that the company loses 0,65% of its stock price with every 1% depreciation of the Swedish crown relative to the US dollar. None of the two companies shows statistically significant lagged effect. A more thorough investigation requires a much larger sample size, which we have not been able to obtain.

The results presented in Table 1, 2 and 3, however, show the residual exposure of Swedish firms, that is – their firm-specific sensitivity to fluctuations in the exchange rates. The question is then: What is the exposure of the firms that did not exhibit statistically significant coefficients? Don’t they have any exposure in that case?

Yes, they have, but it is rather the whole market’s exposure, adjusted with every company’s beta coefficients. The results of the regression of Eq.4.4 are presented in the Appendix. The Newey-West heteroskedasticity consistent coefficients are not significant at the 5% significance level, so we can conclude that the market returns are not subject to change when such occurs in the exchange rates. The market returns are dependent on its value in the previous period (with the coefficient of RM_{t-1} being significant). As for lagged effect on market returns, since RM_{t-1} is not affected by exchange-rates in that period, then the effect is not transmitted on to the current period, as RM_{t-1} acts as a proxy. Hence, we can conclude that it is not the exchange rates that affect the market returns but possibly, for example, the market’s expectations about these exchange rates associated with their paths and macroeconomic factors discussed earlier.

To sum up, Swedish firms can be roughly characterized as having significant firm-specific exchange rate exposure, especially when compared to results from previous empirical studies in that field. Out of 136 companies in total, 106 (or 78%) show statistically significant coefficients of sensitivity to exchange rate fluctuations with either contemporaneous effect, lagged effect or both. Such a high percentage stands out when compared to the results from the studies on other economies, and even to the study of Jong *et al* (2006) for a similar to the Swedish economy in terms of degree of openness and export-orientation. The presence of cross-sectional differences and the high level of heterogeneity in the companies call for further investigation in order to determine the magnitude and direction of the exchange rate exposure.

Chapter 6. Conclusion

As pointed out in the purpose of the thesis, the problem of exchange rate exposure in the context of Swedish companies has been investigated throughout the paper. Indeed, with 78% of examined companies showing statistically significant sensitivity of their stock returns to exchange rate fluctuations, we can affirmatively conclude that exchange rates do matter. Furthermore, looking at the broader picture, our results are in support of the suggestion made in the existing literature that companies in more open economies are more likely to be affected by exchange-rate fluctuations.

Using bilateral exchange rates and examining a period, experiencing relatively no significant crises of political or currency character, we have been able to examine the exposure of Swedish firms in their normal course of activity. That is, in absence of severe shocks of macroeconomic nature, how sensitive companies are to changes in the value of the Swedish crown.

Our firm-specific analysis, however, could not give us enough evidence to determine the exact direction and magnitude of exchange rate exposure, when examining company categories. The reasons for that are the significant cross-section differences among the companies falling into one and the same category. Indeed, the almost equal shares of companies with positive and negative exposure (either in contemporaneous or lagged terms) within categories render the aggregate conclusions about these categories rather arbitrary. Furthermore, the small number of firms within “Energy”-, “Materials”-, and “Telecommunication”-sectors prevent us from making any reliable statistical inference about their respective exchange-rate exposure.

Nevertheless, several firm conclusions can be drawn out. First, a greater percentage of Swedish firms show exchange rate sensitivity, when compared to previous empirical studies. The results are even higher than in the case of the study by Jong, *et al* (2006) on Netherlands, which is considered even a more open economy than Sweden. Second, the impact of exchange rates changes on companies’ value occurs with some delay rather than immediately. Third, financial companies (or at least Swedish companies) are not invulnerable to exchange rate movements, and therefore should not be excluded from future research.

What our investigation fails to determine is the magnitude and direction of exchange rate exposure of Swedish companies. This applies to analysis on firm-category level, as results on individual firms are available. The high heterogeneity of firms within same category, as well as the small number of firms within sub-categories (in order to accomplish relative homogeneity) deters us from drawing general conclusions. A larger sample of firms is required for the purpose of representative statistical inference is required.

Chapter 7. Further Studies

Several potential problems can be investigated, derived from the finding of our paper. Hereby we present some of them, which can be carried out on the condition of availability of company data.

Firstly, a sub-category analysis within each of the company categories discussed can be carried out. This requires a much larger sample of firms within each of the main categories in order to have reliable results. The main question would be: Do firms within same sub-category or sub-sector of the economy with similar characteristics in respect to operating activities have similar (if any) exchange rate exposure? If yes, is there any particular currency that companies are sensitive to?

Secondly, as our investigation focuses on a period with relative political stability, it could be interesting to see the other side of the coin. Namely, do companies suffer from exchange rate fluctuations caused by politically-related disruptions and up to what extent is effect firm-specific and macroeconomic? This, however, requires historical data, and may restrict the analysis to smaller sample of companies, and most especially to MNCs.

Thirdly, the exchange rate exposure of financial companies could be investigated, as they have been ignored in empirical research up to now. A possible research problem would be to examine the “changing-signs” phenomenon of their exposure, in the context of the different types of assets, as well as whether the matching operations of such companies provide natural hedging to exchange rate fluctuations.

Finally, the idea of efficiency of hedging activities of companies could be interesting to probe. Although empirical research has been carried out, it is rather aggregate and does not account for firm-specific characteristics. Obviously, the problem with data availability and “insider information” for companies has to be solved beforehand.

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Appendix

Regression results for Eq.4.4

Dependent Variable: DLOG(OMXSPI)				
Method: Least Squares				
Sample (adjusted): 3 248				
Included observations: 246 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001932	0.001838	1.051465	0.2941
DLOG(OMXSPI(-1))	-0.149817	0.060950	-2.458015	0.0147
DLOG(SEK_EUR)	8.142165	5.152650	1.580190	0.1154
DLOG(SEK_USD)	0.160305	0.179281	0.894153	0.3721
DLOG(SEK_NOK)	-0.037725	0.239930	-0.157233	0.8752
DLOG(SEK_DKK)	-9.628875	5.212388	-1.847306	0.0659
DLOG(SEK_GBP)	-0.100083	0.253369	-0.395009	0.6932
DLOG(SEK_JPY)	0.270924	0.182328	1.485916	0.1386
R-squared	0.133265	Mean dependent var		0.001370
Adjusted R-squared	0.107773	S.D. dependent var		0.030266
S.E. of regression	0.028588	Akaike info criterion		-4.239655
Sum squared resid	0.194516	Schwarz criterion		-4.125661
Log likelihood	529.4776	F-statistic		5.227669
Durbin-Watson stat	1.950464	Prob(F-statistic)		0.000015

List of companies included in the investigation (category-wise)

“Consumer”	Autoliv, Bilia, Clas Ohlson, Elanders, Electrolux, Enire, H&M, Home Properties, Lindex, Mekonomen, Metro International, Modern Times Group, New Wave, Skistar, Ticket Travel, Axfood, Cloetta Fazer, Sardus, Swedish Match, Wilh.Sonnesson.
“Energy”	Concordia Maritime, Vostok Nafta
“Finance”	Avanza, Castellum, D.Carnegie & Co, Fabege, Geveko, Hufvudstaden, Industrivärden, Investor, JM, Kinnevik, Kungsleden, Latour, Lundberföretagen, Neonet, Nordea, Novestra, Ratos, SEB, Svenska Handelsbanken, Swedbank, Svolder, Wallenstam, Öresund
“Health”	Active Biotech, Artimplant, AstraZeneca, Biogaia, Bioinvent, Biotage, Capio, Elekta, Getinge, Karo Bio, Meda, Medivir, Ortivus, Oxigene, Qmed, Sectra, Vitrolife
“Industry”	Abb, Assa Abloy, Atlas Copco, Beijer, Bergman & Beving, Broström, Cardo, Gunnebo, Haldex, Hexagon, HL Display, KMT; Munters, NCC, Nibe, Närke, Observer, Peab, Pergo, Proffice, Rederi, SAAB, Sandvik, SAS, Scania, Seco Tools, Sintercast, Skanska, SKF, Studsvik, Transcom, Trelleborg, Volvo, Ångpanneforeningen
“IT”	Acando, ASCS, Addtech, Anoto Group, Axis, Boss Media, Cash Guard, Cybercom, ElektronikGruppen, Enea, Ericsson, Fingerprint

	Cards, IBS, Industrial & Financial Systems, Micronic Laser Systems, Nokia SDB, Nolato, Orc Software, Partnertech, Precise Biometrics, Proact IT, Protect Data, Readsoft, Scribona, Semcon, Sigma, Teleca, Telligent, Telelogic,
“Material”	Billerud, Boliden, Holmen B, Höganäs, Rottneros, SCA; SSAB, Stora Enso
”Telecommunication”	Tele2, Thalamus Network