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Exchange Rate Exposure of UK Firms: An
Empirical Analysis of Narrow and Broad
Exchange Rate Indices**

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An Investigation into the Extent of Exchange Rate Exposure of UK Firms: An Empirical Analysis of Narrow and Broad Exchange Rate Indices

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Abstract

Since UK based firms operate globally it is essential that we understand how movements in exchange rates affect the profitability of these firms. Research on the effects of exchange rate exposure is a relatively recent area of investigation. Since the advent of the flexible exchange rate system in 1973, firms have become concerned about risk associated with foreign exchange rate fluctuations on returns. This study seeks to investigate the extent of exchange rate exposure of UK firms. This research is one of the very few attempts to investigate exposure when both financial companies and non-financial firms are included. The study followed the standard model for exchange rate exposure which is the model developed by Adler and Dumas (1984). This model measures the sensitivity of the market value of a firm to a change in exchange rate. In this paper a sample of 91 companies is analysed over the period between 2009 and 2012. Two regressions are carried out; the first is on both financial and non-financial firms and the second is on non-financial firms only.

The estimated coefficients are as follows: when all firms' exposure are calculated, using broad exchange rate indices, the exposure coefficients ranged between 23.569 and 25.101 over the sample period. When narrow exchange rate indices are applied, the exposure coefficients range from -30.635 to -28.750. The average coefficient over the 4 year period using broad exchange rate indices is 24.062 and it is -29.522 for the narrow indices. Estimates for non- financial firms show similar trend indicating no significant differences in the results for all firms and for non-financial firms. The results show significant exposure for UK firms.

Keywords: exchange rate exposure, financial firms, non-financial firms, coefficients, UK firms, narrow exchange rates, broad exchange rates.

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Introduction

Given that the UK economy is an open economy one would expect that firms would be sensitive to exchange rate movements. Dominguez and Tesar (2001) stress that the more open an economy is the more exposed the stock market is to changes in the effective exchange rate. Yet there is little empirical evidence to support the effect of exchange rate fluctuations on a firm's value. Given the high involvement of firms in the current era of globalization it is important that we examine the extent of exchange rate exposure. This study is aimed at analysing the impact of exchange rate changes on the returns of a sample of financial and non-financial firms in the UK. The magnitude of the exchange rate policy became a major election issue in the United States when the then presidential candidate Mitt Romney vowed to call China a currency manipulator in his first day in office, referring to the effects of China's exchange rate on the US economy as a whole (Walker 2012). If China keeps their currency value low, their companies would be in a stronger position as exporters to the US.

Background

The gold standard enabled nations to maintain stability in exchange rates and to keep inflation in check. But, the gold standard was discontinued at the outbreak of the First World War as economies were plunged into deep crises. Although many attempts were made to revive the gold standard, the dwindling supplies of gold reserves needed to cover the issue of currencies made this difficult for nations to maintain. Towards the end of the Second World War a fixed exchange rate system became established in 1944 allowing European currencies to be fixed to the US dollar that was in turn fixed to the price of gold at \$35 dollars per ounce (Copeland 2005). The advantage of this fixed exchange rate regime was that it encouraged stability in currencies relative to other currencies. The US was the world's economic power that possessed the largest amount of gold reserves and the US dollar was the major global currency. But as industrial growth began recovering in European countries, the rapid expansion in the rate of growth in European economies far outpaced the rate of growth in the USA. The latter together with, the increase in US welfare spending coupled with the high expenditure on financing of the Vietnam War led to rising inflation and an overvalued dollar in the USA. The initial parities were bound to become inappropriate. The US was forced to cancel the dollar convertibility into gold and US president Nixon suspended the Bretton Woods agreement in 1971 and allowed the dollar to float against other currencies by 1973.

Many countries since then adopted some form of floating exchange rates. Countries either adopt an exchange rate system described as either independently floating or as a 'managed float' where the central bank can deploy interventionist policy to affect the behaviour of exchange rates. Since the adoption of floating exchange rates, foreign exchange risk has been a major source of concern for companies as currency values have been

subject to wild fluctuations. This together with increasing amounts of multinational companies trading in many countries created a new problem, the foreign exchange exposure problem. According to Bodnar and Marston (2002) foreign exchange exposure of firms refers to the cash flow sensitivity of a firm to changes in exchange rate. My aim here is to investigate the extent of exchange rate exposure of UK firms. The empirical results of this research would assist managers to gain an understanding of how exchange rate changes affect the returns of firms and the research would benefit policy makers when making financial decisions.

Exchange rate exposure affects the economy in many different ways. It will affect the prices at consumer level since importers of goods from abroad are directly affected by exchange rate movements and importers tend to pass on the increased costs associated with exchange rate movements onto the consumers. Moreover, when prices rise due to exchange rate fluctuations, it could tend to lead to higher inflation rates in the domestic economy.

Determining and managing exchange rate risk is very important in order to plan for future exchange rate fluctuations. According to Madura (2011) exchange risk refers to the situation where a firm faces a risk in its value due to fluctuations in the exchange rate. In order to establish effective exposure measurement and management, types of exposure risk can be identified. Three main types of exposure risks normally discussed in the literature are translation risk, transaction risk and economic risk explained below.

Translation exposure occurs when the financial data of a multinational subsidiary denominated in one currency has to be converted into a parent company currency so that the accounts can be consolidated within the group's financial statements. Whilst, transaction exposure is the risk that a transaction will change its expected amount between the time of an agreement between two parties and the time of execution of the transaction due to exchange rate fluctuations¹. In the case of economic risk, it is possible that a change in exchange rates can reduce the future cash flows of foreign subsidiaries or the firm's operating costs may increase as a result of foreign exchange rate movements. Moreover, firms may find it difficult to hedge against such risks.

Many prior studies on exchange rate exposure have concentrated on US and Japanese companies whilst relatively fewer studies have been done on UK firms. Since the UK has an open economy, exchange rates movements are critical considerations for the economy as a whole, especially for the firms which are involved in foreign operations. It is argued that the UK's manufacturing decline can be partly explained by the more competitive exchange rates of the emerging economies which have had an effect in eroding the competitiveness of UK's firms.

¹Even though transaction exposure can be quite problematic according to Bodnar and Marston (1996), firms can use hedging techniques such as investing in derivatives to protect against such risks.

The rest of the paper is organized as follows: in section two a critical evaluation of the literature on the effects of exchange rate exposure is presented. The third section explains the research methodology and describes the sample data used in the study. In section four, the process of calculation and the model regression results on exchange rate exposure of UK firms are presented. In the final section, conclusion and summary of the findings are discussed.

Review of Literature

The Impact of Exchange Rate Exposure

Exchange rate variations affect the relative prices of goods sold in different countries and could adversely affect firms' profit margins and hence their competitive position as underlined by Shapiro (1974), Flood and Lessard (1986), Levi (1994) and Marston (2001). A study carried out by Kanagaraj and Sikarwar (2011) analysed over 300 Indian companies between 2006 and 2011 and their findings were that 16% of firms had exchange rate exposure at 10% level of significance. El Masry et al (2007) examined exchange rate exposure of non-financial UK firms over the period from 1981 to 2001 and their results revealed that there were a higher percentage of non-financial UK firms with significant exchange rate exposure than those reported in earlier papers. But, some studies which include Bodnar and Gentry (1993), Amihud (1994), Bartov and Bodnar (1994) and Bartov, Bodnar and Kaul (1996), have failed to find a relationship between exchange rates and market value.

The Effect of Exchange Rates Changes on Stock Returns and Firm Value

The firm value is related to the profitability of the company which is an important indicator of firm performance. The effects could be wide ranging and one of the most important effects it may have is on the stock price. The stock price will in turn affect the value of the firm. Doidge et al (2006) found this relationship in their research. They analysed firms from 18 countries and found that exchange rate fluctuations affect factors like cash flow and firm value and they concluded that overall exposure has a large impact on average stock returns and hence the value of firms.

Frazer and Pantzalis (2004) further confirmed the relationship between stock returns for US multinational firms and exchange rates, emphasizing the importance of the research methodology. They contend that there is only significant exposure when a firm specific proxy rate is used rather than the traditional common rate used in most studies. They believe that the exchange rate index should only include the currencies used by countries that the firm operates in as this will make the index more relevant to the firm. The issue of concern with their suggestion is that a firm specific proxy will have to be adjusted to be used as a predictive tool for future exposure for the firm. Orion (1990) also examined the stock returns of 287 US

multinational firms in order to test the relationship between returns and changes in exchange rates. His findings were that only 10% of the firms were exposed to exchange rate risk. Dominguez and Tesar (2001) applied both company and industry level stock returns of different countries to examine the extent of exposure if any. They found a sizeable percentage of exposure ranging from 14% to 46%.

The issue of the so-called time horizon which is the length of period over which exposure observation is carried out seems to have significant influence on the severity of the exposure. Some studies have demonstrated as the time period of the data increases, the exposure level also increases. Indeed, Chow et al (1997) found this relationship. They argue that exchange rate exposure measured over a short period of time shows negligible exposure but the opposite is true when exposure is measured over the long term.

Exchange Rate Exposure and Firm Characteristics

A panel data analysis by Solakoglu (2006) examined the relationship between exchange rate exposure and firm characteristics including the size of the company and the extent of their operation. He analysed weekly exchange rate data of 137 firms from Turkey over a period from 2001 to 2003. Solakoglu (2006) found that larger firms with higher international trade have less exposure than smaller firms. However, this can be due to large firms having more resources and expertise to deal with this exposure. For example, bigger companies are affected less because they may have better exchange risk management mechanism to reduce exposure. This includes hedging their positions against risk which may be difficult for small firms as they may not have the expertise and the resources to protect themselves from exchange rate fluctuations.

Dahlquist and Robertsson (2001) examined a sample of Swedish firms' exposure to exchange rate fluctuations. They opposed previous studies which found no exposure and which relied too much on aggregated datasets. For this reason they used a different approach utilizing less aggregated datasets. In their findings they found that large export firms which have foreign shareholders are noticeably more exposed. Furthermore they concluded that the level of exposure depends on firm's unique characteristics. Bodnar and Wong (2003) and Dominguez and Tesar (2001) opposed the above in that they argue that small firms are more likely to be affected by exchange rate exposure as compared to large firms which tend to be more globally diversified. On the other hand, Griffin and Stulz (2001) found that a lot of the literature regarding this issue ignores other industry factors that also contribute to firm value changes.

Exchange Rate Exposure Puzzle

An issue encountered in the exchange rate literature is known as the "exchange rate exposure puzzle" problem. Despite expectations of exchange rate effects on firms, many studies found no or negligible evidence of exposure hence, there is a gap to be bridged between theoretical foundation

that supports the existence of exchange rate risks and the lack of empirical evidence to back up such theoretical foundation. The theoretical belief is evidenced by the wide ranging currency hedging techniques available and used by multinational firms so, how can one reconcile this theoretical belief and the lack of empirical evidence? Many scholars aim to solve this so-called exchange rate puzzle.

Bartram and Bodnar (2007) argue that the issue of contention lies in currency risk management undertaken by firms. For instance, many former studies exclude financial firms because they use complex hedging techniques which they believe will understate exposure. They then only analyse non-financial firms to measure exposure. However, it must be borne in mind that such firms may use “operational hedging” to reduce exposure. Bartram and Bodnar (2007) believe that it is this operational hedging that can understate exposure. For example firms will adjust their operational location according to exchange rate volatility of the location. In addition there are other techniques that may be used by firms which will understate exposure.

Hedging, Exchange Rate Exposure and Firm Value

In order to address the issue of whether exchange rate hedging is beneficial to a firm, it is important to look at the literature regarding the wider relationship between firm value and hedging.² Hedging is used by multinational companies to reduce financial risk including exchange rate risk. The ultimate goal is to protect the firm’s value, however, in and Jorion (2006) argue that this is not always the case. They researched the risk management activities of over 100 hundred companies in the oil and gas industry and surprisingly, they found that hedging did not affect the market values of these companies but there are several issues with their research. First their findings are industry specific in that their research is concentrated in the oil and gas industry and their findings may not be applicable to firms in different industries nor may their sample size be representative enough.

³Allayanis and Weston (2001) examined 720 US multinational companies over a period of five years in addition they use various “controls” to eliminate other factors that may affect firm value. These include taking in to account the size of the company, profitability, access to financial markets and investment growth. Large companies are believed to be more profitable and thus have bigger market value. Another control this study used is to account for leverage as the capital structure may impact the firm value. Unlike Jin and Jorion (2006), they found a positive relationship between hedging and firm value. Their study showed that firms which use

²Hagelin and Pramborg (2006) and Nance et al (1993) show that hedging is particularly popular amongst firms with considerable growth opportunities, high probability of financial distress and low levels of liquid assets.

³Allayanis and Weston (2001) and Dune et al (2004) argue that firm exposure to exchange rate movement is related to firm specific factors such as size, liquidity, industrial and geographic distribution, hedging activities and growth opportunities which are expected to vary over time.

currency derivatives have on average 4.8% more market value than companies that do not use currency derivatives. It must be noted that this study focused on multinationals from the US and hence may not apply to firms from other countries. Another study from Colombia confirms Allayanis and Weston (2001) findings. Gomez-Gonzalez et al (2012) researched over eighty non-financial companies in Colombia using the same methodology as Allayanis and Weston (2001) and they found that increase in hedging by those firms coincided with increase in growth in the firm value.

Another study by Hagelin and Pramborg (2004) examined the benefits obtained by firms when they use currency derivatives and other hedging tools like foreign currency debts. In their study, they sampled the relationship between Swedish companies' hedging techniques and foreign exchange exposure over a period of five years. In that period companies were sent questionnaires three times. They found that financial hedging effectively reduces the risk associated with foreign currency exposure reducing cost and thus increasing firm value however, two disadvantages exist in their study.

Firstly their research like many others concerning exchange rate exposure is country specific so is limited to firms from one country rather than multiple countries. For this reason it may not be applied globally as Swedish firms have different risk profile when compared to firms in other countries. This is because some countries' firms are more risk averse than others in the way they adopt their approach. The second disadvantage is the sample used may be unreliable. Their primary data collection includes sending questionnaires to Swedish companies. Some of the disadvantages of this sampling method include questions that are standardized in nature and may not reflect a detailed insight. Another major concern is that companies will respond in a way that is favourable for their firms and may omit unfavourable data or answers.

One of the major debates in foreign exchange exposure management is whether to use foreign currency derivatives or foreign currency debt. Clack and Judge (2009) examined the use of foreign currency derivatives against the use of foreign currency debt. They found that it is unsuitable to compare different firms that use foreign currency debt and others that use foreign currency derivatives. In addition, they argue that differences exist and that some hedging instruments like forwards and options are suitable for short term exchange rate exposures on the other hand they said that swaps are suitable for long term foreign currency exposure. In the next section we will look at the different types of hedging instruments used by multinational companies in order to reduce exchange rate risk.

Future Contracts, Forward Contracts and Options

⁴Futures can be used to hedge and reduce the risk of currency exchange rate fluctuations, however, futures can go either way depending on the forecast. The success of the hedge will depend on the differences between the forecasted exchange rate at the beginning and the prevailing rate at the predetermined date. Just like futures contracts, forward contracts can be used to hedge against exchange rate risk where the exchange rate will be fixed and agreed at the date of the contract. Abraham Lioui (1998) researched whether one should use forward or future contracts to hedge against exchange rate risk. The study concluded the choice of hedging tool depends on factors inherent in the firm.

Options can be used as another hedging tool to mitigate exchange rate exposure. Earlier studies comparing the use of options and futures for currency purposes include the work carried out by Chang and Shankar (1986). They argue that when transaction cost and margin requirements are taken in to account, the currency future contract performed better as a hedging instrument than the currency options contract. However, it is important to note that currency options were a relatively new phenomenon at the time of the study and there may not be enough data and history to compare the two. It seems that futures are more suited to speculating purposes than as a risk hedging tool by a business. However, Lien et al (2001) also confirmed earlier findings carried out by Shanker and Chang (1986). Using lower partial moment risk measure (LPM) they tested the risk to a hedger using future and options. They found that a rational risk adverse hedger will almost always benefit more from futures hedging method than options on the other hand, research by Hancoke and Weise (1994) showed no difference. Furthermore, they contend that no hedging instrument is more effective than another and firms must evaluate other factors when deciding the best hedging strategy. These factors may include transaction costs, types of contract and associated risks.

Research Methodology*Introduction*

In this study, two main variables namely exchange rate indices and firms' returns are analysed to investigate the sensitivity of UK firms' stock returns to exchange rate changes. The motivation behind choosing UK firms is because such firms have high levels of foreign operations in an open economy like the UK and are more likely to be sensitive to fluctuations in exchange rates. This makes foreign exchange exposure a very essential topic of study and investigation. Moreover, many previous studies found no major or negligible effects of exchange rate exposure on UK firms and there

⁴Allayanis and Ofek (2001) and Nguyen and Faff (2003) among others, establish that the use of derivatives reduces exchange rate exposure.

are also very few studies that are specific to UK multinationals, so our attempt is to give a deeper insight into this area research.

Data Sample

The sample size consists of 91 multinational UK companies listed on the London Stock Exchange. Out of the 91 firms in the sample, 75 are non-financial firms and the remaining 16 are financial firms. As for the type of firms included in the study, a selection of ⁵large firms listed on the London Stock Exchange is chosen. Large firms were selected as such firms tend to be more geographically diversified. Doukas et al (2003) found that exposure effects are greatest on large multinationals and firms with high export activities. This they say is in contrast to those firms that are not involved or have limited involvement in exports.

The research involves populating monthly data for broad and narrow exchange rate indices for the UK over a period from 2009 to 2012. The exchange rate indices are annualized by taking the average over 12 months. This is calculated by totalling 12 month exchange rate indices and then dividing by 12. Secondary data for company stock returns over the same period from 2009 to 2012 were compiled and structured as the dependent variable in model 1 specified in section 3.3.

Data Collection and Sources

Bodnar and Gentry (1993) and Amihud (1994) examined exchange rate exposure of firms from various industries. Similarly, in our data sample, the ⁶companies are in various industries showing inclusivity across all industries. Stock returns of our sample of 91 companies listed on the London Stock Exchange were extracted from the annual reports of all the participating companies. This data was accessed from Bloomberg database between 30/11/14 to 20/3/15.

One must also consider the reliability of secondary data sources when collecting such data. Our concern is about the reliability of the data for company returns which were compiled by others. We need to consider whether the data reflects any biasness of the compiler. Another concern that is well documented is that companies are known to use “creative accounting” to increase various important figures in the financial statements including but not limited to profit figures. In this way companies may attract investors and obtain favourable debt service rates from banks and other lending institutions. However, what we can say here is that our source of data is known for its authenticity and reliability.

For this research the exchange rate indices were collected from the Bank of International Settlements (BIS) data source at www.bis/statistics/eer.htm, 24/6/14. BIS data was chosen due to this data source being renowned for high quality and reliability. Microsoft Excel was used to make the data manageable in order to analyse within E-views5. For the analysis of

⁵Large firms have market capitalization exceeding £1,000.00 million.

⁶The data sample also includes financial companies that use complex hedging techniques.

firms' returns and exchange rates, we adopted a model that was used in prior studies which is the Adler and Dumas (1984) model. Software packages E-Views5 and SPSS were utilized for the regression analysis of the data.

Firstly, all firms were analysed and then only non- financial firms were analysed. The London Stock Exchange provides industry classification of the UK firms. This facility was used to distinguish between financial and non-financial companies. Then, firms were grouped according to industry as this enables one to delineate patterns in which exchange rate exposure arises within the different types of industries.

The data for exchange rate indices and for stock returns of 91 UK firms over the sample period from 2009 to 2012 were compiled and analysed as follows. Exchange rate is structured as the independent variable and company returns as the dependent variable. This framework is based on previous research that showed a correlation between firms' returns and exchange rate exposure. We use the following Adler and Dumas (1984) model to carry out the analysis.

$$R_{it} = \alpha_i + \beta_i e_t + e_{it}$$

R_{it} = Stock return for firm i , e_t = Percentage change in exchange rate, β_i = the elasticity of firm value to exchange rate change, α_i = intercept, e_{it} = residual

Nominal versus Real Effective Exchange Rate Indices

The Bank of International Settlement (BIS) defined nominal effective exchange rate as the index of some weighted average bilateral exchange rates that reflects the relative importance to international competitiveness whilst the real effective exchange rate is defined as the nominal exchange rate adjusted by some measure of relative prices or costs in the home currency. This means that the real exchange rate takes in to account changes in relative prices. Mark (1990), Atindehou and Gueyie (2001) argue that using real effective exchange rate indices or the nominal effective rate indices will not have any major influence on the results. However, according to BIS, the real effective exchange rate which is trade weighted and deflated by a price index serves better for various purposes including market analysis, policy making and international competitiveness therefore this study has chosen to use the real effective exchange rate for analysis.

Narrow and Broad Indices

There are two indices made available by the Bank of International Settlements (BIS). According to the BIS, the narrow indices take into account 27 economies while the broad indices include up to 61 countries. This is done to include new economies that recently gained significance in the global economy. The broad indices include the emerging market economies in Asia, Central and Eastern Europe and Latin America, the Euro area and industrialized countries such as the USA, Germany, France, and

Switzerland totalling 61 countries. The narrow indices contain a basket of currencies from the more developed countries which include mainly industrialized countries like Germany, France, the USA, the Netherlands, Sweden, the Euro area, and the newly industrialized countries, Hong Kong, South Korea, Singapore, and Taiwan as well as China. Our research has analysed both narrow and broad indices.

Data Type

The research made use of the panel data approach, which pools the data across firms and time, in order to improve estimation efficiency. According to Baltagi (2013), panel data refers to the pooling of observations on cross-section of households, countries, firms etc. over several time periods. In this study the UK firms were pooled in to various groups over a specified period. Baltagi (2013) highlighted the importance of controlling for individual heterogeneity when using panel data unlike other methods of data analysis. Moreover, panel data analysis eliminates problems of multicollinearity.

Data Analysis

In this section the data analysis and calculations are presented. A regression analysis is carried out on model 1 specified below. This is especially useful when analysing a relationship between two or more variables. The model used to measure exchange rate exposure is adopted from Adler and Dumas (1984). This model measures exchange rate exposure as the slope coefficient of the regression. Some studies use the Jorion (1990) model which differs in that it includes market risk however, many studies did not find a difference and the study adopts the original model specified below.

Model 1	$R_{it} = \alpha_i + \beta_i e_t + e_{it}$
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R_{it} is stock returns for firm i and is the dependent variable, β_i is the regression coefficient which measures the sensitivity of firm i stock returns to exchange rate movements, e_t is the percentage change in the exchange rate and is the independent variable, while α_i is the constant variable and e_{it} is the residual in the equation specified in model 1 above.

The first regression of model 1 was carried out on all the 91 firms in the sample. Further regression was conducted separately on the group of seventy five non-financial firms. Least square regression analysis was carried out to estimate model 1 as structured above. The p-value is less than 5% and the confidence level is 95%. The exposure coefficients for both

broad exchange rate and narrow exchange rate (independent variable) were obtained.

Results for all firms

Table 1 below shows the regression results for all firms using the Adler and Dumas (1984) model specified above as model 1. The exposure coefficient ranged between 23.569 and 25.101 over the sample period when broad exchange rate indices are regressed against firms' stock returns. When the narrow indices are regressed the coefficient that measures the elasticity of firm value to exchange rate change ranges from -30.635 and -28.750.

The coefficients change sign when using different indices. Priestly and Odegaard (2005) argue that change in the sign of the coefficient could be explained by the different exposures in the different time periods experienced by firms due to changes in a host of variables like changes in competition, hedging policies, imported costs, tariff and quotas. It is interesting to note that the exposure coefficient sign is negative for the narrow index which mainly consists of currencies of the developed countries while exposure coefficient is positive for the broad indices where a set of diverse currencies from 61 countries are included. We need to take into account that trade weighted narrow indices (refer to section 3.5) better gauge the competitiveness of the UK's main trading partners. Negative coefficients imply that an appreciation of the sterling would decrease firms' value. This could be explained by the ⁷increasing competition from emerging economies faced by UK firms. Another factor that is important here is that many of the main trading partners of the UK, trade products that have similar elasticity of substitution due to the high level of intra-industry trade that takes place amongst them. This implies that trading partners can switch to cheaper alternatives if the UK sterling pound appreciates since competing exporters produce similar goods at a lower relative export price.

The positive coefficients for broad indices imply that importing firm will benefit from sterling currency appreciation. It will make the goods cheaper for the importing firms since the local currency is worth more in the foreign currency. Moreover, exporting firms would benefit from an appreciation of the pound sterling since the demand for UK exports from the rest of the world outside the Euro area is rapidly increasing.

Results for Non –Financial Firms

In table 2 below the results of non-financial firms are presented. The narrow exchange rate coefficients are negative. This means that firms' stock returns will decrease as the exchange rate appreciates. Exposure coefficients for the narrow exchange rate indices range from -29.420 to -27.519 whilst

⁷These results are consistent with the findings from the Bank of England quarterly review which emphasized that UK loss of market share in the EU during that period of time can be explained by the increasing competition from emerging economies.

the coefficients for the broad exchange rate indices range from 23.80 to 25.271.

Table 1. *Results for All (both financial and non-financial) firms*

Period	Observations	Sample size	Exposure coefficient (broad index)	Exposure coefficient (narrow index)
2009	91	91	23.569	-28.750
2010	91	91	23.718	-29.282
2011	91	91	23.858	-29.419
2012	91	91	25.101	-30.635
Totals	364	91	96.246	-118.086
Average exposure coefficient			24.062	-29.522

Source: Author's own estimations. The main results of the regression are in appendix 2

The results in table 2 show positive relationship when the broad exchange rate is applied and negative relationship when the narrow exchange rate is applied. Positive coefficients imply that an appreciation of the pound sterling would be beneficial to firms that trade with the bigger group of countries. When the exchange rate exposure coefficient is negative it corresponds to lower returns to appreciation of the pound sterling while depreciation of the pound corresponds to higher returns. These results are very similar to the results in table 1 for all firms which show that the inclusion or exclusion of financial firms does not make a significant difference to the results obtained. UK firms that trade with the more developed countries (narrow indices) will benefit from a depreciation of sterling while appreciation of currency will have an adverse effect on firms' value. In the context of UK firms, since they are in close competition in terms of exports with developed countries which are its main traders (see pie chart 2 in Appendix 1) then they are likely to benefit from depreciation.

Table 2. Results for Non-Financial Firms

Period	Observations	Sample size	Exposure coefficient broad index	Exposure coefficient Narrow index
2009	75	75	23.800	-27.519
2010	75	75	23.944	-28.056
2011	75	75	24.079	-28.193
2012	75	75	25.271	-29.420
Totals	300	75	97.094	-113.188
Average exposure coefficients			24.024	-28.297

Source: Author's own estimations. The main results of the regression are in appendix 2.

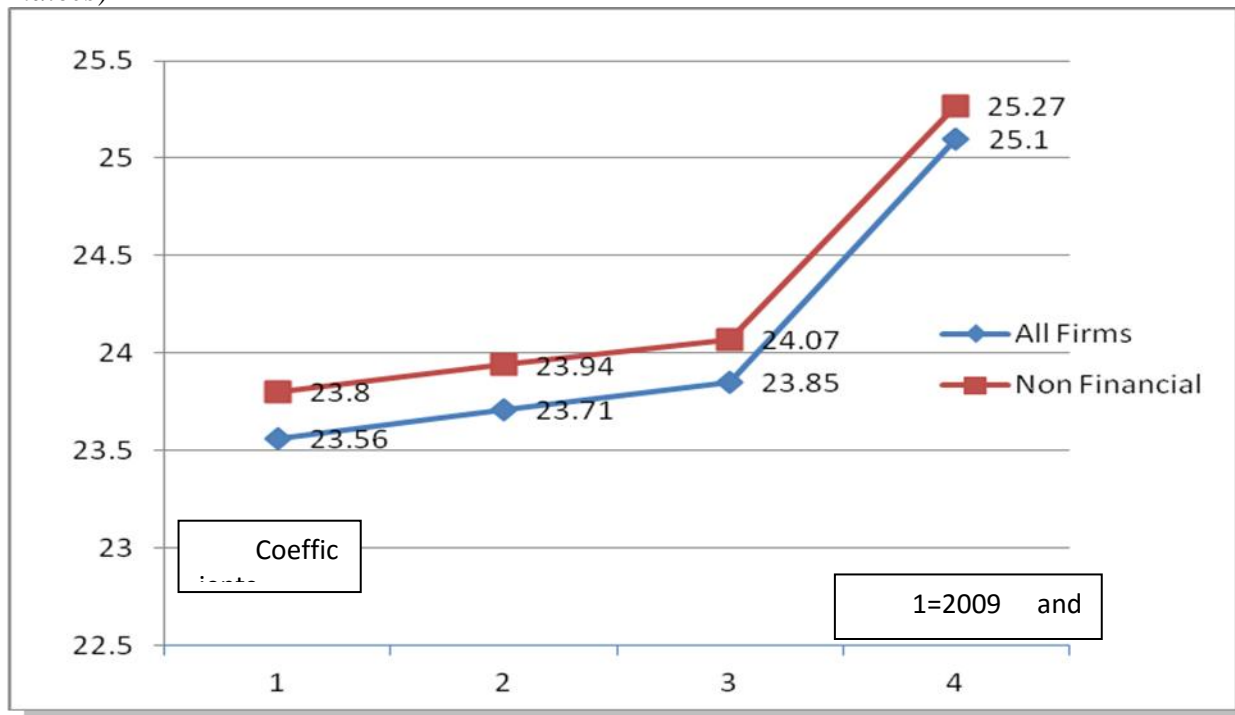
Aabo (2006), Bartram (2004), El Masry (2007) and many others investigating the exchange rate exposure have focused on non-financial companies. They argue that financial companies use advanced hedging techniques which makes detecting exchange rate exposure very hard. This study investigated exchange rate exposure on all firms (combination of financial and non-financial firms) and then on non-financial firms only. Figure 1 shows the exposure coefficients of mixed (all firms) and of non-financial firms when the broad indices are utilized. It can be seen that the coefficients are indeed very close. For example, the exposure coefficients for broad indices ranged from 23.56 to 25.10 for all firms and from 23.80 to 25.27 for non-financial firms over the sample period. There are little differences with non-financial firms showing a small amount of more exposure detection. Indeed no significant differences exist if one includes non-financial firms or omit such firms all together. The coefficients for the narrow exchange rate indices that consist of only a basket of currencies of industrialized and newly industrialized economies are shown in figure two.

Trends in Exposure Coefficients of All Firms and of Non-Financial Firms (Broad and Narrow indices)

The graphs below present the coefficient trends for broad and narrow indices. Figure 4.1 compares the broad index exposure coefficient trend for

all firms with non-financial firms whilst figure 4.2 shows the narrow index exposure coefficient trends for all firms and non- financial firms.

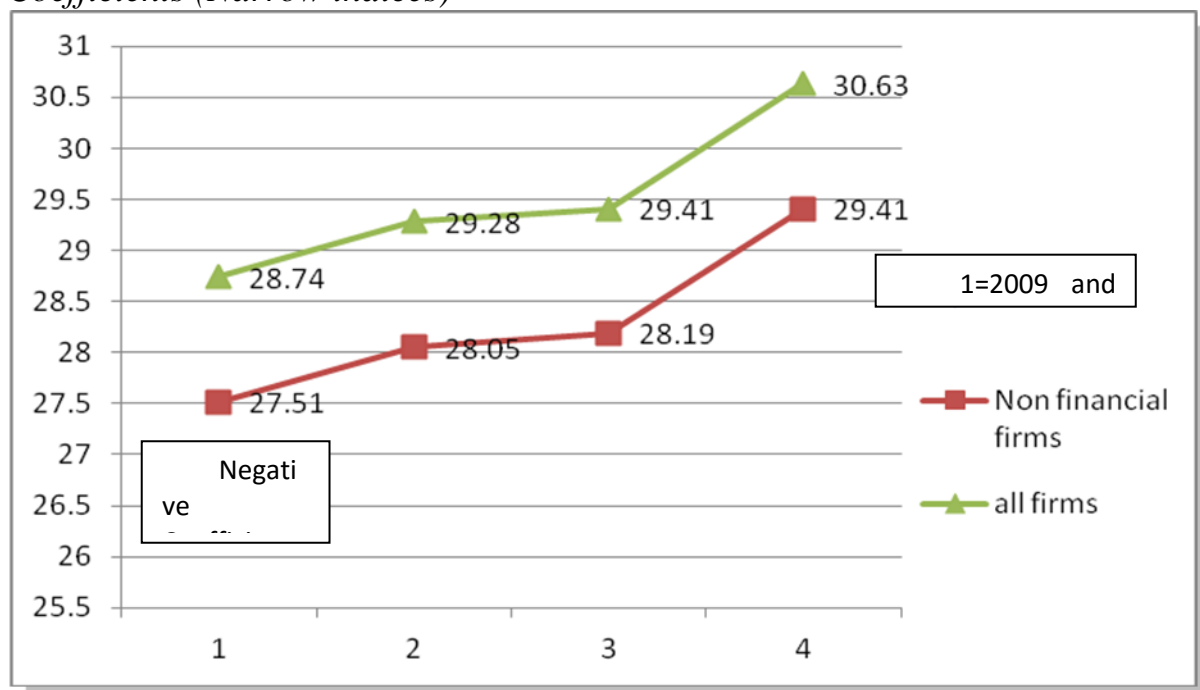
Figure 1. All Firms and Non-Financial Firms Exposure Coefficients (Broad Indices)



Source: Author's own extrapolation

Each graph reveals an interesting trend. The coefficient trends shown in both graphs for broad and narrow indices above are very similar. Both figures 4.1 and 4.2 show that non- financial firms' exposure coefficients are higher especially in the case of the narrow indices. This shows the greater sensitivity of UK firms' returns to a change in the exchange rates when trade takes place with the countries that are in the basket of 27 currencies. The negative coefficients for narrow exchange rates show the negative relationship between exchange rates and firm's returns. While the broad exchange rates show opposite results, it is important to take in to account the basket size and the sample type. The broad index contains a wider basket of currencies including emerging economies and countries that influence the global trade like the oil producing countries.

Figure 2. *All Firms and Non-Financial Firms Exposure Coefficients (Narrow indices)*



Source: Author's own extrapolation

The results are in line with previous studies on exchange rate exposure. Yucel and Kurt (2003) found similar trend when examining exchange rate risk of Turkish companies. They used the original Adler and Dumas model (1984) and the Jorion (1990) model that include market risk. Their findings are very similar to our findings, as they found significant, mean positive exposure of 17% of the sample. Interestingly they found no significant differences when using the original model Adler and Dumas (1984) and the new Jorion (1990) model that included market risk. Unlike Yucel and Kurt (2003), this study looked at exposure by years and found a steady increase of 24% to 25% exposure from 2009 to 2012 when the broad indices are applied. Similarly, Bartov et al (1996) found that US firms were exposed to exchange rate exposure when he analysed 910 US firms in different time horizons. This included a similar annual time horizon as this study. Using the annual time horizon he found average exposure of 3 % and 6.9 % of those firms had negative exposure.

Regression Results and Interpretation

The following tables are from the regression model for all firms.

Table 3. Descriptive Statistics for All Firms

	Mean	Standard Deviation	Number of observations
R _i (returns)	0.260	0.422	364
Exchange rate (broad indices)	101.169	2.074	364
Exchange rate (narrow indices)	101.013	2.926	364

Source: Author's own estimation

Table 4. Model Summary for All Firms

Model	R _i	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	0.381*	0.145	0.141	0.391	0.145	30.697	2	361	0.000

Source: Author's own estimation

*R_i is returns of companies, the dependent variable.

In the above table the R-square is 15%. Since the dependent variable is company returns and the independent variables are narrow and broad exchange rate indices we can say that 15% of the variability in returns is due to fluctuations in narrow and broad exchange rate indices.

Table 5. ANOVA^a

Model	Sum of squares	Degrees of freedom	Mean Square	F-statistics	Significance
Regression	9.381	2	4.691	30.697	0.000 ^b
Residual	55.164	361	0.153		
Total	64.545	363			

Source: Author's own estimation.

a: Dependent variable is R_i

b: Predictors: (Constant), narrow exchange rate and broad exchange rate.

The null hypothesis that variability in the independent variable has no effect on the dependent variable can be rejected since the p-value is <0.001 while a p-value of less than 5% is required to reject the null hypotheses.

Table 6. Summary Statistics of Coefficients for All Firms

Model 1	Unstandardized Coefficients		Standardized Coefficients	T – Statistics	Sig.	95.0 % confidence interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
Intercept (constant)	5.682	1.610		-3.530	0.000	-8.848	-2.516
Broad exchange rate	0.294	0.046	1.447	6.356	0.000	0.203	0.385
Narrow exchange rate	-0.236	0.033	-1.637	-7.188	0.000	-0.300	-0.171

Source: Author’s own estimation

The coefficients of the model are significant as shown by the p-value of <0.001. Based on these figures, we shall reject the null hypothesis which is that there is no relationship between the independent variable and the dependent variable which are the exchange rates and the firms’ returns respectively.

The following analysis is on non-financial firms. The following tables below are for non-financial firms.

Table 7. Descriptive Statistics for Non-Financial Firms

	Mean	Standard Deviation	Number of observations
Ri (returns)	0.266	0.441	300
Exchange rate (broad indices)	101.169	2.075	300
Exchange rate (narrow indices)	101.012	2.927	300

Source: Author’s own estimation

a. Dependent Variable: Ri

Table 8. Non –Financial Firms Model Summary^b

Model	Ri	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	0.400 ^a	0.160	0.154	0.405	0.160	28.314		97	0.000	1.746

Source: Author’s own estimation.

b: dependent variable, Ri

Just like the R square for the all firms’ regression, the model is significant. The R square is 16%. This implies that 16% of the variability in firm returns can be attributed to exchange rate exposure. A value of close to 2 for Durbin Watson shows no autocorrelation.

Table 9. Summary Statistics of Coefficients for Non-Financial Firms

Model 1	Unstandardized Coefficients		Standardized Coefficients Beta	T - Statistics	Sig.	95.0 % confidence interval for B	
	B	Std. Error				Lower Bound	Upper Bound
Intercept (constant)	-4.256	1.839		-2.314	0.021	-7.875	-0.636
Broad exchange rate	0.282	0.053	1.328	0.337	0.000	0.178	0.386
Narrow exchange rate	-0.238	0.037	-1.580	-6.347	0.000	-0.312	-0.164

Source: Author’s own estimation

The coefficients are significant since the p-value is < 0.01. This is less than the 5 % threshold and for this reason we reject the null hypothesis that there is no relationship between company returns and exchange rate fluctuations in the case of non-financial firms.

Summary and Concluding Remarks

This study attempted to investigate exchange rate exposure of 91 (75 non-financial and 16 financial firms) large UK firms listed on the London Stock Exchange. Large firms were selected as such firms tend to be more internationally oriented. Data for broad and narrow real effective exchange rates were obtained from the Bank of International Settlements and data on

stock returns were sourced from Bloomberg Business data base. We analysed the sensitivity of the firms' stock returns to exchange rate changes over a period from 2009 to 2012. An empirical study was carried out following the Adler and Dumas (1984) model. It is one of the first and most trusted models to investigate exchange rate exposure of multinational firms. Jorion (1990) adds market risk to the model but because many prior studies did not find any significant differences in the results of those two models we decided to use the Adler and Dumas model (1984) for investigation.

Unlike prior studies that concentrated mainly on non-financial companies, in this study an analysis of exchange rate exposure of all firms (financial plus non-financial firms) was done separately from an analysis of non-financial firms. When all firms returns were regressed against narrow exchange rate indices, negative coefficients were obtained, which led to the conclusion that an appreciation of the UK sterling pound would lead to a fall in firms' returns. The top traders of the UK are within the basket of the narrow indices and these are mainly industrialized and emerging countries so the growing competition from the emerging economies and the substitutability of exports amongst such countries could negatively affect UK firms as pound sterling currency appreciates. We document a significant change in the signs of the coefficients when the broad real effective exchange rate indices were regressed against firms' returns. This means an appreciation of sterling would benefit firms that were trading with some newly emerging economies outside the Euro area and other developed economies. It was also shown that when non-financial firms were analysed separately the results were very similar to the results obtained for all firms. Inclusion of financial firms did not make any significant impact on the exposure coefficients we obtained. Like similar studies regarding exchange rate exposure including Yucel and Kurt (2003) and El Massy (2007), we found significant exposure for UK firms.

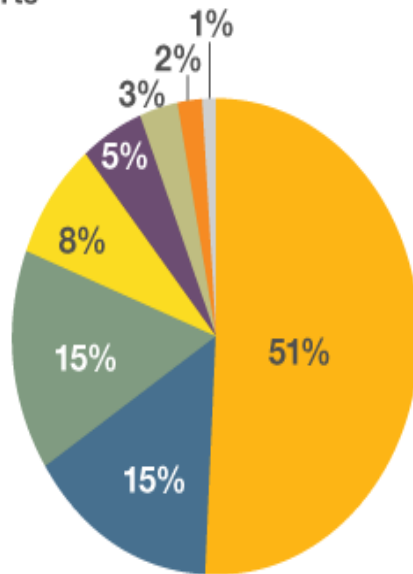
I recognize that I could have included more firm characteristics like using firms' export sales as a proportion of total sales or analysing firms by industry but such data is specialized and we can think about this in future research.

Appendix 1

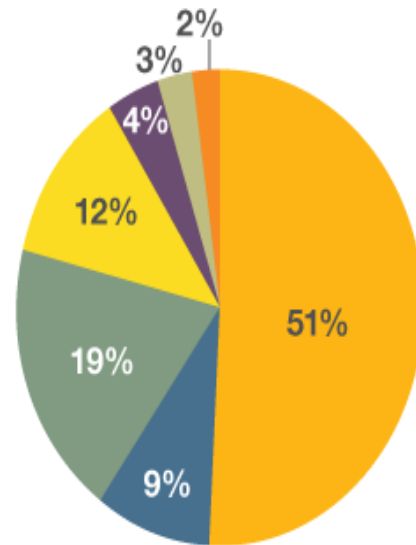
Where the UK trades



Exports



Imports



Source: HMRC, 2012 figures

The above pie chart shows the top exporting destination countries for the UK in 2012. Most of them are in the Euro zone area and UK firms are likely to use Euro currency.

Appendix 2

Analysis of all firms: Model 1: $R_{it} = \alpha_i + \beta_i e_t + e_{it}$

All Firms regression analysis

Constant α	Broad exchange rate $\beta_i e_t$	Narrow exchange rate $\beta_i e_t$
-5.682	0.294	-0.236

Source: Author's own estimates

Coefficient results for one company when all firms are analysed in the table below:

Year	Ri	Broad	Narrow	Exposure coefficient (broad index)	Exposure coefficient (narrow index)
2009	0.770573	99.4908	97.7442	23.5683	-28.7496
2010	0.236919	100.001	100	23.7182	-29.2820
2011	-0.27283	100.478	100.575	23.8594	-29.4177
2012	0.180797	104.705	105.7308	25.1013	-30.6345

AAL LN Equity
(All firms)

Exposure coefficients for broad and narrow indices are the same for the corresponding years for all the other ninety firms.

Analysis of non-financial firms: Model 1: $R_{it} = \alpha_i + \beta_i e_t + e_{it}$

Non-Financial Firms

Constant α	Broad exchange rate $\beta_i e_t$	Narrow exchange rate $\beta_i e_t$
-4.256	0.282	-0.238

Source: Author's own estimates

Coefficient results for one company when non-financial firms are analysed in the table below:

Year	Ri	Broad	Narrow	Exposure coefficient (broad index)	Exposure coefficient (narrow index)
2009	0.770573	99.49083	97.74417	23.800415	-27.519111
2010	0.236919	100.0008	100	23.944235	-28.056
2011	-0.272830	100.4775	100.575	24.078655	-28.19285
2012	-0.180797	104.705	105.7308	25.27081	-29.419938

AAL LN Equity
(Non- Financial firms)

Exposure coefficients for broad and narrow indices are the same for the corresponding years for all the other seventy four non-financial firms.

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