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AN INVESTIGATION OF THE INTEREST RATE RISK AND EXCHANGE RATE RISK OF THE EUROPEAN FINANCIAL SECTOR: EURO ZONE VERSUS NON-EURO ZONE COUNTRIES

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ABSTRACT

This paper examines the sensitivity of financial sector stock returns to two risk factors – interest rates (both long-term and short-term) and exchange rates. Specifically we investigate the impact of the European Union and the introduction of the euro on European financial sector risk in the framework of a comparative analysis of financial sector returns across three broad groupings (Banking, Financial Services and Insurance) for a representative group of key euro and non-eurozone countries. Further we investigate the nature of interest rate and exchange rate exposure across increasing time horizons, enabling us to examine both its short and long-term effects on stock returns. Generally, our findings suggest that while Banks are more sensitive to short-term interest rates, the Financial Services and Insurance sectors are more sensitive to long-term interest rates. There is no notable trend in sensitivity pre-/post-euro and differences in terms of the impact of interest rate changes across countries seem to suggest (i) some evidence of integration, and (ii) differences in financial structures and regulation. Further, interest rate sensitivity increases significantly with increasing time intervals. Evidence of exchange rate exposure is weak across all countries and sectors although there is some evidence that it increases with increasing time intervals. Differences in sensitivity can be related to differences in international activities.

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Interest Rate Risk; Exchange Rate Risk; European Financial Sector; Intervaling

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INTRODUCTION

In this study we examine the sensitivity of financial sector stock returns to two risk factors – interest rates (both long-term and short-term) and exchange rates. Our study contributes to the broad risk management literature by providing some empirical insights into the impact of the European Union and the introduction of the euro on European financial sector risk. We undertake this investigation in the framework of a comparative analysis of financial sector returns across three broad groupings (Banking, Financial Services and Insurance) for a representative group of key euro and non-eurozone countries.

The study is further enhanced in two important ways: (i) via an examination of the pre- and post-euro periods and (ii) via an investigation of the pattern of exposure across increasing time horizons. The first variation allows the examination of potential differences in the sensitivity of the selected European financial sectors to fluctuations in interest rates and exchange rates before and after the introduction of the euro in January 1999. To this end, the respective subperiods chosen are April 1991[1] to December 1998 and January 1999 to June 2004. The second enhancement allows us to assess the extent to which any risk exposure effects are more short-run or longer run in nature.[2]

Of particular interest in terms of the integration of financial markets has been the creation of the European Single Market in 1992 and the subsequent European Union (EU) and introduction of a single currency, the euro, in January 1999. The dramatic changes in European financial markets that came with both the single market project and the introduction of the single currency makes the various financial sectors a highly relevant area for a risk exposure study. Prior to the introduction of the euro, regulatory efforts had already aimed at creating a single financial market. This period was characterized by the abolition of foreign exchange and capital flow controls as well as a number of single market regulatory efforts, in particular the adoption of the principle of mutual recognition introduced in 1989 through the Second Banking Market directive. While some progress in financial market integration was made in that period, it is widely recognized that the retail banking market exhibited greater resistance to integration than initially expected (see for example Centeno & Mello, 1999; Kleimeier & Sander, 2000).

This has therefore raised the issue of exactly how the single currency will affect financial market integration and thus the risk exposure of the financial sector. Baele *et al.* (2004) find that different financial markets have attained different levels of integration. Given the adoption of the single currency, the euro-zone

money market is now highly integrated. Likewise, the bonds markets (and thus long-term interest rates) have also attained a high level of integration as bond yields have largely converged within the euro-zone. Further the equity markets have shown signs of higher integration as the dispersion of equity index returns across individual euro-zone countries is reported to be decreasing.

With respect to the banking market, integration has remained limited. Once again, different market segments exhibit different degrees of integration. While lending to the corporate sector is arguably the most integrated retail lending market, consumer credit is typically found to be least integrated, as measured by price differentials (see, for example, Baele *et al.*, 2004). Kleimeier and Sander (2003) argue that an observed high degree of convergence and co-movements of retail lending rates is often the result of a more uniform and more efficient pass-through of monetary policy changes onto retail lending rate. In this respect, the introduction of the single monetary policy plus a more competitive pass-through can create a more uniform retail lending market. As such, the euro has been found to have had some impact on lending to the corporate sector.

Other empirical studies that investigate the implication of the EU and the euro on various risk parameters of the capital markets of eurozone (as well as non-eurozone) countries are Smimou, 2011; Korkeamäki, 2011; Haq & Heaney, 2009; Francis & Hunter, 2004; Altunbas *et al.*, 2002; DeSantis *et al.*, 2003; Meon & Weill, 2004).

Smimou (2011) examines the impact of the introduction of the Euro on stock markets and on country diversification within the Eurozone. His findings do not suggest a high risk to the stock market to justify a risk premium as a result of currency union. Korkeamäki (2011) finds that while stock returns in most countries in Western Europe negatively correlate with interest rate changes prior to the euro, that correlation disappears post-euro. His results reveal that recent growth in European corporate bond markets has played an important role in enabling firms to better manage their interest rate risk. Haq and Heaney (2009) examine changes in bank equity risk following the formation of the Economic Monetary Union in 1999. With the exception of Germany, they document a decline in bank risk across euro-zone countries.

Francis and Hunter (2004) investigate the impact of the euro on the risk exposure of the world's major banking industries and compare euro-zone countries with non-eurozone countries and some non-European countries. Their results indicate a statistically significant and economically large decline in the cost of equity of the banking industry across the three groups of countries following the introduction of the euro. They attribute this finding to an economically large decline in the currency risk premium. However, Francis and Hunter (2004) find little or no change in the interest rate risk premium. Interestingly, they provide evidence that increased competition in the banking sector does not necessarily lead to an across-the-board increase in risk premiums in the sector.

These results are quite different to the findings of DeSantis *et al.* (2003) who attempt to measure how the adoption of a single currency in the European Monetary Union may affect international equity and euro-deposit markets. DeSantis *et al.* (2003) predict that although some benefits may exist (in the form of enhanced liquidity, lower transaction costs and improved transparency in cross-country investments), the adoption of a single currency would have limited impact on international asset prices, risk and expected returns. They conclude that the adoption of the euro is unlikely to have a large impact on aggregate currency risk premiums.

Given the significant liberalization (and subsequent integration) of financial markets worldwide over the past three decades, the issue of financial stock return sensitivity to various dimensions of risk has resulted in a substantial body of empirical literature. In particular, several studies have investigated the interest rate exposure of the financial sector of different countries (see, for example, Flannery & James, 1984; Akella & Chen, 1990; Neuberger, 1991; Madura & Zarruk, 1995; and Faff & Howard, 1999). The importance of interest rate risk relates to the impact that interest rate fluctuations have on the profitability of financial sector institutions and shareholder returns. The existence of such exposure has implications both from a risk management perspective at the firm level and a policy perspective at the government level.

Moreover, several studies have specifically investigated the financial sector and examined the impact of both interest rate and exchange rate changes on financial sector returns (see, for example, Choi *et al.*, 1992; Choi & Elysiani, 1997; Koch & Saporoschenko, 2001; and Joseph, 2003). In their analysis of US banks, Choi and Elyasiani (1997) find greater exchange rate sensitivity than interest rate sensitivity. Further, (i) they report that both types of exposure vary across institutions and across time and (ii) they establish a link between derivative activities and banks' interest rate and exchange rate betas. Koch and Saporoschenko (2001) examine the sensitivity of individual and portfolio stock returns for Japanese horizontal kieretsu financial firms to unanticipated changes in long-term interest rates and exchange rates. They report significant sensitivity to interest rate changes but insignificant sensitivity to exchange rate changes. Finally, Joseph (2003) reports weak evidence of both interest rate and exchange rate risk exposure in the US financial sector. He suggests that the limited impact of the variables may reflect the risk management strategies implemented by financial institutions.

The remainder of this paper is structured as follows. Section 1 outlines the empirical framework. Section 2 describes the data and the results of our analysis, while the third section presents a discussion of our findings, highlighting key insights from an overall perspective. We provide a summary and conclusion in the last section.

1. RESEARCH DESIGN

In keeping with previous investigations of both interest rate exposure and exchange rate exposure of financial sector returns (see, for example, Choi & Elyasiani, 1997), this study measures the sensitivity of European financial sector stock returns by the following augmented market model:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \gamma_i INT_t + \delta_i XR_t + e_{it} \quad (1)$$

where R_{it} is the return on the financial sector portfolio in month t, R_{mt} is the return on the relevant domestic market index in month t, INT_t is the holding period return on the domestic debt security in month t and XR_t is the return on the exchange rate factor in month t. That is, an appreciation (depreciation) of the local currency will produce a positive (negative) value for XR_t.

The implementation of equation 1 brings to the fore a number of research design issues. First, in relation to the interest rate variable, given the difference in volatility between short-term and long-term interest rates (where short-term interest rates are typically more volatile that their long-term counterparts), the choice of appropriate interest rate poses an important question (see Graddy *et al.*, 1994). As a consequence this study employs both short-term (90 Days) and long-term (10 year) interest rates.

Further, the interest rate variable can be defined in one of two ways – either based on yields or on holding period returns. Following previous studies (see Akella & Chen, 1990, and Faff & Howard, 1999) and consistent with the specification of both the dependent variable and the market rate of return, our investigation examines holding-period returns.

The interest rate variable can be examined either as actual changes in rates (or returns) or as unanticipated changes. While some studies analyze both variants (see for example Madura & Zarruck, 1995; Faff & Howard, 1999), others such as Flannery & James (1984) and Yourougou (1990) implement unanticipated changes in holding-period returns and yields (residuals from an auto-regressive model). Specifically, Flannery and James (1984: 1146, footnote 10) report that the findings of raw data analyses are marginally different to the results of an AR(3) model. Similarly, Faff & Howard (1999) find little difference between the results of their raw data analyses and their investigation implementing unanticipated changes in the interest rate holding-period return. The only difference noted is in the short-term interest rate variable examination, in which case the unanticipated return analysis yield stronger results. Consequently, we choose to confine our investigation to unanticipated changes in the interest rate factor. Consistent with the interest rate factor return, the investigation of exchange rate sensitivity is likewise performed on unanticipated changes in the exchange rate.[3]

To accommodate our analysis of lengthening time horizons, we implement the following model:

$$R_{it,t+T} = \alpha_i + \beta_i R_{mt,t+T} + \gamma_i INT_{t,t+T} + \delta_i XR_{t,t+T} + e_{it,t+T} \quad (2)$$

where $R_{it,t+T}$ is the return on the financial sector portfolio over the horizon/interval from t to t+T; $R_{mt,t+T}$ is the return on the domestic market index over the horizon/interval from t to t+T; $INT_{t,t+T}$ is the return on the domestic interest rate factor over the horizon/interval from t to t+T; and $XR_{t,t+T}$ is the return on the exchange rate factor over the horizon/interval from t to t+T. By the very nature of this analysis, to achieve adequate sample sizes, overlapping observations are constructed for return horizons greater than one month.[4] We analyze three such cases: 3-monthly; 6-monthly and 12-monthly returns.

2. DATA AND RESULTS

2.1. Data

This study employs continuously compounding monthly returns on three financial sector indices (Banks, Financial Services and Insurance) of nine European countries (five euro-zone and four non-eurozone countries) obtained from Datastream. The euro-zone countries are: Germany, France, Italy, the Netherlands and Spain, while the non-eurozone countries are the UK, Switzerland, Denmark and Sweden. The full sample period of our analysis extends from April 1991 to June 2004 for all financial sectors except the Insurance sector of Sweden that ends in April 1999. A market proxy, the ten-year government bond rates for each country and exchange rates were also obtained from Datastream. The exchange rate factor returns were based on exchange rates of home currency quoted against the US dollar in all cases.[5] Ninety-day Treasury bill rates were obtained from the International Financial Statistics of the International Monetary Fund for each country except France, Denmark and the Netherlands. These latter data were obtained from the Banque de France, the Danmarks Nationalbank and the Nederlandsche Bank, respectively. All yields were converted into an approximation of holding period returns using the conventional pricing formula.

Table 1 presents the descriptive statistics for the independent variables of four of the countries examined in this study – Germany, Italy, the UK and Switzerland.[6] The average three-month Treasury bill return is very close to zero in all cases, as is the average change in the exchange rate. Further, as expected, the extent of kurtosis is most severe for the three-month short-term bill rate. Finally, the average market and long-term bond returns all lie in the range 0.5% to 1% for all countries (with the exception of 10-year Swiss Bonds).

Table 1. **Descriptive Statistics for the independent variables – Germany, Italy, UK and Switzerland**

Panel A: Euro-Zone Countries								
	Germany				Italy			
	Market Return	3 Month Rate Return	10 Year Rate Return	Exchange Rate Return	Market Return	3 Month Rate Return	10 Year Rate Return	Exchange Rate Return
Mean	0.0059	0.0000	0.0063	-0.0004	0.0074	0.0002	0.0094	0.0014
Median	0.0075	0.0000	0.0087	0.0003	0.0013	0.0000	0.0097	-0.0004
Maximum	0.1937	0.0023	0.0415	0.0857	0.2083	0.0055	0.0917	0.1467
Minimum	-0.2933	-0.0013	-0.0340	-0.0772	-0.1715	-0.0073	-0.0448	-0.0772
Std. Dev.	0.0676	0.0005	0.0144	0.0296	0.0671	0.0013	0.0220	0.0309
Skewness	-0.7897	0.4727	-0.4678	0.0220	0.2996	-0.6372	0.3476	0.4818
Kurtosis	5.4516	5.6113	2.8555	3.0315	3.3199	12.1911	4.2479	5.3278
Panel B: Non-Euro Zone Countries								
	United Kingdom				Switzerland			
	Market Return	3 Month Rate Return	10 Year Rate Return	Exchange Rate Return	Market Return	3 Month Rate Return	10 Year Rate Return	Exchange Rate Return
Mean	0.0067	0.0000	0.0073	-0.0003	0.0085	0.0001	0.0000	0.0000
Median	0.0093	0.0000	0.0080	-0.0006	0.0165	0.0000	0.0013	-0.0006
Maximum	0.1042	0.0041	0.0588	0.1325	0.1155	0.0037	0.0443	0.0971
Minimum	-0.1254	-0.0013	-0.0513	-0.0562	-0.1993	-0.0023	-0.0478	-0.0788
Std. Dev.	0.0420	0.0005	0.0190	0.0267	0.0481	0.0007	0.0140	0.0313
Skewness	-0.5274	2.9510	-0.2592	1.1720	-0.9865	0.6345	-0.1384	0.0947
Kurtosis	3.4222	24.2332	3.3841	7.5194	5.2089	7.5469	3.6431	2.8369

2.2. Short-Run Results

The 'short-run' exposure results, based on the estimation of equation (1), are reported in Tables 2, 3 and 4.

2.2.1 Short-term Interest Rate Sensitivity

Table 2 reports the results of the short-term interest rate variable[7] for the full sample period (April 1991 to June 2004), and two sub-periods.[8] These sub-periods denote pre- and post-euro periods, divided at January 1999 when the euro was first introduced. Generally, these results provide only weak evidence of short-term interest rate sensitivity. First, as revealed in Panel A, of the euro-zone countries, only the French Banking sector exhibits some exposure to unanticipated fluctuations in returns of 90-day Treasury Bills. This negative sensitivity is significant at the 5% level for the full sample period and at the 10% level for the first subperiod from April 1991 to January 1999.

Table 2. Short Run Results: Short-Term Interest Rate Sensitivity

	Banks			Financial Services			Insurance		
	Full Period[a] (t statistic)	Sub-period 1[b] (t statistic)	Sub-period 2[c] (t statistic)	Full Period[a] (t statistic)	Sub-period 1[b] (t statistic)	Sub-period 2[c] (t statistic)	Full Period[a] (t statistic)	Sub-period 1[b] (t statistic)	Sub-period 2[c] (t statistic)
Panel A: Euro countries									
Germany	-6.3609 (-0.8666)	-3.4149 (-0.4706)	-19.4312 (-1.3730)	-4.4484 (-0.7375)	-0.3068 (-0.0390)	-14.0927 (-1.5920)	-4.6180 (-0.5559)	1.6973 (0.1629)	-13.9517 (-1.1409)
France	-5.7385** (-1.9631)	-6.7125* (-1.8335)	7.3128 (0.4414)	0.4174 (0.1535)	0.3397 (0.1107)	-2.5451 (-0.2356)	0.9981 (0.2258)	1.2477 (0.2849)	-7.7213 (-0.4167)
Italy	-3.4019 (-1.6290)	-2.9562 (-1.2538)	-10.2476 (-1.1047)	-1.7947 (-1.2163)	-0.9888 (-0.7274)	-9.5310 (-1.2079)	0.3128 (0.1067)	2.2053 (0.8476)	-18.6283 (-1.3430)
Netherlands	0.5478 (0.0678)	-0.1437 (-0.0165)	-0.9384 (-0.0595)	-3.2865 (-0.5382)	-0.6886 (-0.1160)	-7.4087 (-0.6330)	-4.8396 (-0.4909)	4.5437 (0.4144)	-18.2495 (-1.0435)
Spain	-4.5527 (-0.8255)	-6.1933 (-1.0455)	-2.8216 (-0.2017)	-3.8254 (-0.7402)	-5.4914 (-1.0067)	-2.3242 (-0.1758)	-5.9654 (-0.5756)	-10.2297 (-0.9762)	2.9920 (0.1216)
Panel B: Non-Euro countries									
United Kingdom	17.5012** (3.1162)	13.1509** (2.3022)	47.8884** (3.0669)	10.6329** (2.7452)	7.4228* (1.9206)	31.1930** (2.6631)	-3.6976 (-0.5420)	0.1920 (0.0342)	-32.7331 (-0.9987)
Switzerland	3.1623 (0.8666)	4.7162 (0.9429)	3.4477 (0.5973)	2.0072 (0.7415)	3.9665 (1.1944)	0.1811 (0.0517)	0.8358 (0.2095)	1.9013 (0.4532)	1.0931 (0.1654)
Denmark	1.2622 (0.9349)	0.5212 (0.3510)	-5.9554 (-0.4305)	1.6525* (1.7121)	1.1661 (1.1387)	-6.4396 (-0.5092)	3.0240 (1.4797)	2.3138 (1.1148)	2.3772 (0.1642)
Sweden	0.8599 (0.1206)	-0.4915 (-0.0867)	-13.1999 (-0.7297)	7.5058** (2.2093)	7.2250** (2.4713)	-15.7535 (-1.3631)	23.4317** (4.4361)	23.6549** (4.3941)	-

* Statistic is significantly different from zero at the 10% level
** Statistic is significantly different from zero at the 5% level
Note: [a] Full Period – April 1991 to June 2004
[b] Subperiod 1 – April 1991 to December 1998
[c] Subperiod 2 – January 1999 to June 2004

In the case of the financial sector of the four non-eurozone countries, we find some broader evidence of short-term interest rate sensitivity (Panel B of Table 2). This sensitivity is most evident in the UK analysis where both Banks and Financial Services exhibit strong evidence of positive sensitivity, both in the full sample period and the two subperiods. All these coefficients except that of Financial Services in subperiod 1 are significant at the 5% level. The Swedish financial sector also exhibits notable positive sensitivity with Financial Services and Insurance being statistically significant at the 5% level for the full sample period, as well as in the first subperiod in both cases. The only other statistically significant coefficient (at the 10% level) in Table 2 occurs for the full period Danish Financial Services sector.

2.2.2 Long-term Interest Rate Sensitivity

The short-run results for the long-term interest rate variable are presented in Table 3. Although, as in Table 2, evidence of short-run interest rate sensitivity is weak, these results show some differences in exposure of the financial sector across the various European countries investigated in this study. First, there is slightly more evidence of long-term interest rate exposure in the euro-zone countries than reported in the short-term analysis (Panel A of both tables). The Italian financial sector exhibits the most sensitivity with the coefficients of Banks and Financial Services statistically significant for the full period and the first subperiod. Although this sensitivity is negative, we observe positive sensitivity in the second subperiod for Italian Insurance at the 10% level. The Banking (Financial Services) sector coefficients are significant at the 5% (10%) level for the full period and at the 10% (5%) level for subperiod 1. The German Financial Services and Insurance sectors exhibit positive sensitivity for the full period (at the 10% level).

Table 3. Short Run Results: Long-Term Interest Rate Sensitivity

	Banks			*Financial Services*			Insurance		
	Full Period[a] (t statistic)	Sub-period 1[b] (t statistic)	Sub-period 2[c] (t statistic)	Full Period[a] (t statistic)	Sub-period 1[b] (t statistic)	Sub-period 2[c] (t statistic)	Full Period[a] (t statistic)	Sub-period 1[b] (t statistic)	Sub-period 2[c] (t statistic)
Panel A: Euro countries									
Germany	0.0778 (0.3179)	-0.0569 (-0.2075)	0.1961 (0.4273)	0.3137* (1.6446)	0.2359 (1.0856)	0.3689 (1.0293)	0.4913* (1.7047)	0.5116 (1.6435)	0.4622 (0.7740)
France	0.1671 (0.5808)	-0.3495 (-0.7353)	0.5325 (1.1364)	0.1022 (0.5113)	-0.1013 (-0.3127)	0.3210 (1.0108)	-0.1550 (-0.4758)	0.3180 (0.8161)	-0.1950 (-0.3172)
Italy	-0.2696** (-1.9885)	-0.3156* (-1.8823)	-0.2894 (-0.8705)	-0.1565* (-1.8057)	-0.2068** (-2.1584)	-0.0513 (-0.1880)	0.0596 (0.3431)	-0.1731 (-0.9508)	0.7778* (1.7109)
Netherlands	0.1237 (0.5776)	-0.0336 (-0.1108)	0.2434 (0.6065)	0.1445 (0.9573)	0.0302 (0.1577)	0.4020 (1.2295)	0.0806 (0.3028)	0.1084 (0.2745)	0.3796 (0.7230)
Spain	-0.0852 (-0.6424)	-0.1142 (-0.6504)	-0.5228 (-1.4346)	-0.0302 (-0.2373)	-0.0954 (-0.6031)	-0.4501 (-1.2910)	0.2361 (0.7653)	-0.3619 (-1.1602)	0.0965 (0.1246)
Panel B: Non-Euro countries									
United Kingdom	0.0652 (0.3951)	0.0522 (0.2110)	-0.0952 (-0.3264)	0.0053 (0.0530)	0.0651 (0.4983)	-0.0892 (-0.4314)	0.1320 (0.5682)	-0.1421 (-0.4127)	0.7205 (1.1720)
Switzerland	-0.1694 (-0.9137)	-0.2986 (-1.2087)	-0.2711 (0.8296)	0.0750 (0.5407)	0.0862 (0.4933)	0.3304 (1.3115)	0.4128* (1.8451)	0.6605** (2.9144)	0.5423 (1.1503)
Denmark	0.3664 (1.4838)	0.0535 (0.1699)	0.4779 (1.1040)	0.2491 (1.1810)	-0.0821 (-0.3140)	0.4141 (1.0585)	-0.1494 (-0.5597)	-0.3953 (-1.2342)	-0.0719 (-0.1615)
Sweden	1.1054** (3.5802)	0.9135** (2.2748)	-0.1415 (-0.2910)	0.8224** (3.7247)	0.8020** (2.8090)	0.1571 (0.4187)	0.7742* (1.8048)	0.9585** (2.4159)	-

* Statistic is significantly different from zero at the 10% level
** Statistic is significantly different from zero at the 5% level
Note: [a] Full Period – April 1991 to June 2004
[b] Subperiod 1 – April 1991 to December 1998
[c] Subperiod 2 – January 1999 to June 2004

Of the non-euro countries (revealed in Panel B of Table 3), Switzerland and Sweden exhibit some long-term interest rate sensitivity. As was the case of the short-term interest rate analysis, Sweden exhibits strong long-term interest rate sensitivity. Specifically, positive sensitivity is observed in the full period and the first subperiod for all three financial sectors – Banks, Financial Services and Insurance. All coefficients are significant at the 5% level except that reported for the full period in the Insurance sector (which is significant at the 10% level). Long-term interest rate sensitivity, however, is also noted in the Swiss Insurance sector, and again only for the full period (10% level) and the first subperiod (5% level).

2.2.3 Exchange Rate Sensitivity

Table 4 is the final table to report 'short-run' exposures. In this case, we report the exchange rate sensitivity across our sample countries and similar to the results reported in the two previous tables, we find only weak evidence of sensitivity. As shown in Panel A, of the euro-zone countries, the banking sector of Germany, the Netherlands and Spain exhibit negative exchange rate exposure in the second subperiod, January 1999 to June 2004. Of these, the German and Dutch estimates are significant at the 5% level, while the Spanish coefficient is significant at the 10% level. Negative exchange rate exposure (at the 10% level) is also noted in the second subperiod for the Spanish Financial Services sector.

Of the non-euro countries, exchange rate exposure is uncovered only in the Swiss results (Panel B of Table 4). Each of the three financial sectors exhibits negative exchange rate risk exposure to some degree. Specifically, the following estimates are statistically significant: Banks in subperiod 1 (5% level); Financial Services in the full sample period (5% level) and subperiod 1 (10% level); and Insurance in the full sample period (5% level) and in subperiod 2 (10% level).

Table 4. Short Run Results: Exchange Rate Sensitivity

	Banks			Financial Services			Insurance		
	Full Period[a] (t statistic)	Sub-period 1[b] (t statistic)	Sub-period 2[c] (t statistic)	Full Period[a] (t statistic)	Sub-period 1[b] (t statistic)	Sub-period 2[c] (t statistic)	Full Period[a] (t statistic)	Sub-period 1[b] (t statistic)	Sub-period 2[c] (t statistic)
Panel A: Euro countries									
Germany	-0.1851 (-1.6147)	-0.0598 (-0.5142)	-0.4438** (-2.0017)	-0.1005 (-1.1253)	-0.0848 (-0.8388)	-0.2061 (-1.2690)	-0.0810 (-0.6735)	-0.0895 (-0.6971)	-0.1359 (-0.6478)
France	-0.0056 (-0.0373)	0.0230 (0.1185)	-0.0181 (-0.0818)	0.0569 (0.5418)	0.1747 (1.1545)	-0.0515 (-0.3714)	0.0952 (0.5765)	0.2450 (1.1225)	0.0129 (0.0545)
Italy	0.0367 (0.4138)	0.0918 (0.8005)	-0.0775 (-0.5104)	-0.0134 (-0.2082)	0.0727 (1.2585)	-0.1591 (-1.0948)	-0.1147 (-1.1836)	0.0244 (0.2572)	-0.2822 (1.3722)
Netherlands	-0.0502 (-0.4399)	0.1940 (1.2709)	-0.3123** (-2.1779)	0.0308 (0.3465)	0.1890 (1.5966)	-0.0749 (-0.7582)	0.0473 (0.2869)	0.1191 (0.5642)	0.0192 (0.0817)
Spain	0.0129 (0.1507)	0.1362 (1.3262)	-0.2432* (-1.6742)	0.0198 (0.2416)	0.1461 (1.5327)	-0.2341* (-1.6883)	0.2377 (1.1980)	0.2492 (1.1721)	0.3087 (0.9362)
Panel B: Non-Euro countries[d]									
United Kingdom	0.0804 (0.8313)	0.1187 (1.1886)	-0.0562 (-0.2664)	0.0682 (0.9706)	0.1039 (1.4215)	-0.0430 (-0.2762)	0.1352 (0.7231)	0.2082 (1.2130)	0.0231 (0.0483)
Switzerland	-0.1626 (-1.5996)	-0.2631** (-2.0066)	0.0064 (0.0386)	-0.1634** (-2.3693)	-0.1618* (-1.7780)	-0.1177 (-1.0745)	-0.2386** (-2.1499)	-0.0643 (-0.5229)	-0.3560* (-1.9205)
Sweden	0.0450 (0.1983)	-0.1194 (-0.3854)	-0.2064 (-1.0056)	-0.1261 (-0.8287)	-0.2542 (-1.1642)	-0.1819 (-1.2066)	-0.2942 (-1.0108)	-0.3993 (-1.4351)	-

* Statistic is significantly different from zero at the 10% level
** Statistic is significantly different from zero at the 5% level
Note: [a] Full Period – April 1991 to June 2004
[b] Subperiod 1 – April 1991 to December 1998
[c] Subperiod 2 – January 1999 to June 2004
[d] Exchange rate analysis was not undertaken for Denmark as it has a fixed exchange rate.

2.3. Long-Run Results

'Long-run' exposures results, based on the estimation of equation (2), are reported in Tables 5, 6 and 7.

2.3.1 Short-term Interest Rate Sensitivity

We present the results of the short-term interest rate variable analysis in Table 5. Clearly our findings generally show that the sensitivity of all three financial sectors across each of the nine countries increases considerably as the time interval increases. Specifically, when considering the euro countries (Panel A) we note that the strongest statistically significant impact is observed in both the Banking and Financial Services sectors. This sensitivity is negative in all cases. To begin with, the Banking sector is statistically significant for France, Italy and Spain. The sensitivity is observed in at least two time intervals in each case with statistically significant estimates for (i) France in the one, six and twelve month horizons (at the 5% level in each case); (ii) Italy in the three, six and twelve month horizons (at the 5% level in each case); and (iii) Spain in the three and twelve month horizons (at the 10% and 5% level, respectively). For all countries the magnitude of the coefficient and the degree of significance tends to increase as the time interval lengthens.

The euro-zone Financial Services sector also exhibits notable long-run, short-term interest rate sensitivity. A statistically significant impact is observed in Germany, Italy, the Netherlands and Spain. While Germany and Italy record significant coefficients for both the six and twelve month time horizons, the estimates for the three and twelve-month horizons are significant for the Netherlands and only the twelve-month horizon is significant for Spain. The impact on the Financial Services sector however is less significant than the impact on the Banking sector, with the only coefficients statistically significant at the 5% level being the six-month estimate for Germany and the twelve-month estimates for Germany and Italy.

The euro-zone Insurance sector exhibits only weak long-run, short-term interest rate exposure. The effect of this type of exposure is only statistically significant for two countries – Germany (six and twelve month time horizons significant at the 5% level in each case); and Italy (twelve month time horizon at the 5% level). Across our sample of euro-zone countries, Italy exhibits the greatest sensitivity with some impact recorded in each of the three financial sectors. Germany and Spain each record statistically significant estimates in two sectors while France and the Netherlands each record sensitivity in only one sector.

Table 5. Long Run Results: Short-Term Interest Rate Sensitivity

	Banks				Financial Services				Insurance			
	1 month (t statistic)	3 month (t statistic)	6 month (t statistic)	12 month (t statistic)	1 month (t statistic)	3 month (t statistic)	6 month (t statistic)	12 month (t statistic)	1 month (t statistic)	3 month (t statistic)	6 month (t statistic)	12 month (t statistic)
Panel A: Euro countries												
Germany	-6.3609 (-0.8666)	-11.6933 (-1.1689)	-12.3648 (-1.2226)	-10.6345 (-1.4539)	-4.4484 (-0.7375)	-12.7660 (-1.5015)	-17.6441** (-2.3604)	-14.8351** (-2.6444)	-4.6180 (-0.5559)	-15.2881 (-1.4554)	-24.9950** (-2.9201)	-21.4801** (-2.9903)
France	-5.7385** (-1.9631)	-6.1746 (-1.4667)	-11.3297** (-2.0581)	-13.2240** (-2.2549)	0.4174 (0.1535)	-0.8332 (-0.2324)	-2.9045 (-0.7001)	-3.6954 (-0.8192)	0.9981 (0.2258)	-0.9231 (-0.1964)	-2.3000 (-0.4163)	-6.3685 (-1.2576)
Italy	-3.4019 (-1.6290)	-7.3958** (-2.1320)	-10.6344** (-2.1936)	-12.2616** (-2.8259)	-1.7947 (-1.2163)	-4.7219 (-1.4813)	-7.2203* (-1.9454)	-11.0563** (-3.9425)	0.3128 (0.1067)	-1.8655 (-0.3809)	-3.4541 (-0.6427)	-10.2959** (-2.2239)
Netherlands	0.5478 (0.0678)	-11.1085 (-1.0908)	-3.9353 (-0.3456)	-5.3061 (-0.7284)	-3.2865 (-0.5382)	-13.0463* (-1.6605)	-7.7167 (-0.8366)	-11.4509* (-1.9119)	-4.8396 (-0.4909)	-19.6479 (-1.2813)	-11.0495 (-0.6277)	-15.1159 (-1.0828)
Spain	-4.5527 (-0.8255)	-16.2537* (-1.8114)	-14.5835 (-1.3215)	-29.5722** (-2.2798)	-3.8254 (-0.7402)	-13.9313 (-1.5642)	-10.3256 (-0.9430)	-23.4044* (-1.8819)	-5.9654 (-0.5756)	-0.8245 (-0.0558)	11.0356 (0.6255)	9.3810 (0.4536)
Panel B: Non-Euro countries												
United Kingdom	17.5012** (3.1162)	18.6507** (2.0671)	26.2233** (2.1688)	18.6559 (1.5454)	10.6329** (2.7452)	9.7582 (1.5002)	11.2552 (1.2572)	3.2570 (0.3603)	-3.6976 (-0.5420)	1.5312 (0.1073)	-20.9638 (-1.2416)	-45.7611** (-3.1040)
Switzerland	3.1623 (0.8666)	-1.7773 (-0.3187)	2.7523 (0.5190)	-2.3841 (-0.3759)	2.0072 (0.7415)	-3.5307 (-0.7918)	-2.2080 (-0.5960)	-10.5644** (-2.5807)	0.8358 (0.2095)	-9.1812 (-1.5587)	-11.1404** (-2.2599)	-24.9367** (-4.1991)
Denmark	1.2622 (0.9349)	-0.9361 (-0.5040)	-0.1553 (-0.0414)	-3.4284 (-0.8871)	1.6525* (1.7121)	1.2415 (0.8574)	1.8868 (0.5406)	-2.0335 (-0.5291)	3.0240 (1.4797)	8.2917** (3.2631)	11.5682** (3.3865)	7.4067* (1.8866)
Sweden	0.8599 (0.1206)	3.1466 (0.4760)	19.2562** (2.5626)	23.5068** (3.0211)	7.5058** (2.2093)	3.0837 (0.6865)	10.8280* (1.8716)	12.3000* (1.6960)	23.4317** (4.4361)	8.6231 (1.6081)	2.3369 (0.2950)	-6.8150 (-0.6443)

* Statistic is significantly different from zero at the 10% level

** Statistic is significantly different from zero at the 5% level

With regard to the non-euro countries (as reported in Panel B of Table 5), once again each of the four countries tend to exhibit a degree of long-run, short-term interest rate exposure. The most prominent financial sector in this regard is Insurance. Denmark records (positive) statistically significant coefficients across the three (5% level), six (5% level) and twelve month (10% level) intervals, while Switzerland exhibits (negative) sensitivity across the six and twelve month time horizons (both at the 5% level). Further, while the UK also exhibits a (negative) statistically significant impact for the twelve-month horizon (5% level), Sweden's interest rate sensitivity for the Insurance sector is only statistically significant for the one-month interval (at the 5% level).

When considering the Banking and Financial Services sectors in the non-eurozone, we observe that Sweden records statistically significant positive long-run, short-term interest rate coefficients for both the six-month and twelve month time horizons in each sector. Of these two sectors, the strongest sensitivity is observed for Banks (at the 5% level). The UK banks exhibit statistically significant positive long-run exposure to short-term interest rates – for the three and six month time horizons (5% level). The only other (negative) significant estimate in the non-euro-zone countries is that exhibited by Switzerland in the Financial Services sector for the twelve month interval (at the 5% level). Interestingly, we find that although short-term interest rates have a significant positive impact on Financial Services for the UK and Denmark for the one-month period, this sensitivity is not observed for longer time horizons for either country.

2.3.2 Long-term Interest Rate Sensitivity

The long-run exposure estimates for the long-term interest rate variable are presented in Table 6. Similar to the counterpart results for the short-term interest rate variable, the long-run exposure for this variable is considerably more significant than the 'short-run exposure' reported in Table 3. When considering the euro countries (Panel A), we note that the Financial Services sector exhibits the highest number of statistically significant estimates. Notably, each of the five countries record a positive statistically significant coefficient for the twelve-month time horizon. In addition to this finding, Germany exhibits a significant positive impact across each of the time horizons (one, three, six and twelve months), and France and the Netherlands exhibit a positive impact across the three, six and twelve month horizons. All such coefficients are significant at the 5% level. Further in all cases, the magnitude of the coefficients and their significance generally increase as the time horizons increase in length.

Table 6. Long Run Results: Long-Term Interest Rate Sensitivity

	Banks				Financial Services				Insurance			
	1 month (t statistic)	3 month (t statistic)	6 month (t statistic)	12 month (t statistic)	1 month (t statistic)	3 month (t statistic)	6 month (t statistic)	12 month (t statistic)	1 month (t statistic)	3 month (t statistic)	6 month (t statistic)	12 month (t statistic)
Panel A: Euro countries												
Germany	0.0778 (0.3179)	0.1228 (0.3447)	0.0967 (0.2694)	0.3633 (1.2140)	0.3137* (1.6446)	0.7269** (2.9608)	0.7247** (3.5849)	0.7991** (4.9776)	0.4913* (1.7047)	1.2753** (4.1277)	1.3307** (4.6025)	1.2669** (4.1851)
France	0.1671 (0.5808)	0.3549 (1.0495)	0.2883 (0.9152)	0.4338 (1.4673)	0.1022 (0.5113)	0.6538** (2.8773)	0.7138** (3.2478)	0.8559** (4.3872)	-0.1550 (-0.4758)	0.9264** (2.8086)	1.3043** (4.2273)	1.5391** (6.0087)
Italy	-0.2696** (-1.9885)	0.0238 (0.1115)	0.1676 (0.7315)	0.3380 (1.5551)	-0.1565* (-1.8057)	0.0692 (0.4686)	0.1713 (1.1487)	0.3097* (1.6682)	0.0596 (0.3431)	0.2283 (1.2366)	0.2405 (1.2283)	0.3249 (1.3582)
Netherlands	0.1237 (0.5776)	0.8550** (3.4848)	0.7359** (2.6806)	1.0116** (4.0355)	0.1445 (0.9573)	0.8380** (4.8101)	0.8309** (5.0481)	1.0676** (7.7338)	0.0806 (0.3028)	0.9913** (3.0721)	0.7814** (2.3728)	1.1599** (3.6565)
Spain	-0.0852 (-0.6424)	0.0789 (0.3997)	0.0357 (0.1348)	0.5070* (1.7697)	-0.0302 (-0.2373)	0.1204 (0.6231)	0.0454 (0.1775)	0.4893* (1.7668)	0.2361 (0.7653)	0.4220 (1.1331)	0.4928 (1.2423)	1.2367** (2.4138)
Panel B: Non-Euro countries												
United Kingdom	0.0652 (0.3951)	0.2921 (1.3166)	0.2178 (1.0372)	0.3452 (1.2757)	0.0053 (0.0530)	0.1201 (0.9085)	0.0816 (0.5444)	0.2157 (1.0908)	0.1320 (0.5682)	0.3661 (1.2823)	0.4861** (1.9972)	0.8515** (3.3187)
Switzerland	-0.1694 (-0.9137)	0.1476 (0.5671)	0.1003 (0.2863)	0.3413 (1.1386)	0.0750 (0.5407)	0.3951** (2.0620)	0.3207 (1.4430)	0.5364** (2.6940)	0.4128* (1.8451)	1.0944** (3.2234)	1.0099** (2.7667)	1.3706** (3.2663)
Denmark	0.3664 (1.4838)	0.8444** (3.3265)	0.8883** (3.9403)	0.9017** (3.7170)	0.2491 (1.1810)	0.6898** (2.8908)	0.6962** (3.4371)	0.6765** (2.7859)	-0.1494 (-0.5597)	0.1265 (0.3665)	0.0818 (0.2047)	0.0902 (0.2328)
Sweden	1.1054** (3.5802)	1.8625** (4.1332)	1.9982** (3.8721)	1.8529** (3.4240)	0.8224** (3.7247)	1.4585** (5.0539)	1.5415** (5.1235)	1.3612** (3.6507)	0.7742* (1.8048)	1.8741** (4.6599)	2.0915** (7.1607)	2.0471** (5.9623)

* Statistic is significantly different from zero at the 10% level

** Statistic is significantly different from zero at the 5% level

The results observed in the Financial Services sector are largely mirrored in the Insurance sector, except for Italy. Specifically, the UK, France, the Netherlands and Spain record positive statistically significant long-term interest rate sensitivity estimates in the same time horizons as their counterpart Financial Services sector. The only difference between the two sectors is that Italy does not exhibit sensitivity for any time horizon in the Insurance sector.

In contrast to the other two financial sectors, there is only weak evidence of long-run long-term interest rate sensitivity across the euro-zone countries in the Banking Sector. Although the Netherlands records significant positive estimates for the three, six and twelve month intervals (5% level), the only other country that exhibits any long-run exposure is Spain for the twelve-month time horizon – but only at the 10% level.

As revealed in Panel B of Table 6, the non-euro countries also show evidence of long-run, long-term interest rate risk exposure. Of the countries we examined, Sweden exhibits the strongest (positive) exposure – each of the time horizons in all three financial sectors is statistically significant. The three, six and twelve month intervals are all significant at the 5% level in each financial sector. Beyond these results, strong evidence of exposure is observed in both the Financial Services and Insurance sectors. While Denmark records significant positive estimates across the three, six and twelve month intervals at the 5% level in the Financial Services sector, we find that Switzerland is statistically sensitive across the same three horizons in the Insurance sector. These estimates are also positive and significant at the 5% level. Further, there is evidence of positive long-run, long-term interest rate exposure for Switzerland in the Financial Services sector although in this case the sensitivity is only observed in the three and twelve time intervals (at the 5% level). In addition to these findings, the only other positive statistically significant estimates are noted in the Insurance sector for the UK (six and twelve month intervals at the 5% level) and in the Banking sector for Denmark (three, six and twelve month time horizons at the 5% level).

2.3.3 Exchange Rate Sensitivity

Table 7 presents the findings of the long-run exposure to exchange rate changes. Once again there is some evidence that the sensitivity increases as the time horizons increase in length. However, this observation is considerably weaker than that observed in Tables 5 and 6. Of the euro-zone countries (Panel A), the three financial sectors do not exhibit any notable differences in terms of the number of significant coefficients. Although the results show evidence that the statistical impact is greater at the longer time horizons (seven significant estimates are recorded for the twelve-month horizon across the three financial sectors), very little evidence is observed in the shorter intervals.

Table 7. Long Run Results: Exchange Rate Sensitivity

	Banks				Financial Services				Insurance			
	1 month (t statistic)	3 month (t statistic)	6 month (t statistic)	12 month (t statistic)	1 month (t statistic)	3 month (t statistic)	6 month (t statistic)	12 month (t statistic)	1 month (t statistic)	3 month (t statistic)	6 month (t statistic)	12 month (t statistic)
Panel A: Euro countries												
Germany	-0.1851 (-1.6147)	-0.2129 (-1.5563)	-0.0185 (-0.0962)	0.0252 (0.1218)	-0.1005 (-1.1253)	-0.0317 (-0.2689)	0.1990 (1.4907)	0.3153** (2.4045)	-0.0810 (-0.6735)	0.0646 (0.4094)	0.3589* (1.9150)	0.5628** (3.1127)
France	-0.0056 (-0.0373)	-0.0501 (-0.2937)	0.2592 (1.2016)	0.2507 (1.3722)	0.0569 (0.5418)	0.0255 (0.1850)	0.2477 (1.3988)	0.2334 (1.2312)	0.0952 (0.5765)	0.0250 (0.1308)	0.1179 (0.4952)	1.5391** (6.0087)
Italy	0.0367 (0.4138)	0.0710 (0.7290)	0.0179 (0.1126)	-0.3401** (-2.3657)	-0.0134 (-0.2082)	0.0442 (0.5346)	0.0762 (0.5432)	-0.0238 (-0.1747)	-0.1147 (-1.1836)	-0.0119 (-0.0923)	0.1700 (0.9312)	0.3132* (1.8188)
Netherlands	-0.0502 (-0.4399)	-0.1069 (-0.7934)	0.1400 (0.8072)	0.1274 (1.0542)	0.0308 (0.3465)	0.0053 (0.0496)	0.1675 (1.2429)	0.1881* (1.7390)	0.0473 (0.2869)	0.0234 (0.1463)	0.3290 (1.3750)	0.3336 (1.3888)
Spain	0.0129 (0.1507)	0.1032 (0.9072)	0.3526** (2.4773)	0.2467* (1.8033)	0.0198 (0.2416)	0.0903 (0.7861)	0.3050** (1.9863)	0.1944 (1.3451)	0.2377 (1.1980)	-0.2684 (-1.1735)	-0.0452 (-0.1410)	-0.1506 (-0.4158)
Panel B: Non-Euro countries[a]												
United Kingdom	0.0804 (0.8313)	-0.0854 (-0.5165)	0.0624 (0.2358)	0.3436 (1.1541)	0.0682 (0.9706)	0.0077 (0.0628)	0.2006 (1.0092)	0.4840** (2.0714)	0.1352 (0.7231)	0.1966 (0.6293)	0.9041** (2.2980)	1.5667** (3.8381)
Switzerland	-0.1626 (-1.5996)	0.0338 (0.2910)	0.2280 (1.4829)	0.1383 (0.7989)	-0.1634** (-2.3693)	-0.1493* (-1.8459)	-0.0175 (-0.1861)	-0.1733* (-1.8503)	-0.2386** (-2.1499)	-0.4983** (-3.7454)	-0.3247** (-2.4557)	-0.5279** (-2.9083)
Sweden	0.0450 (0.1983)	-0.0237 (-0.0542)	-0.0263 (-0.0423)	0.3207 (0.5427)	-0.1261 (-0.8287)	-0.0029 (-0.0098)	0.0371 (0.0838)	0.1908 (0.4101)	-0.2942 (-1.0108)	0.2497 (1.1662)	0.3964 (1.6300)	0.0515 (0.1327)

* Statistic is significantly different from zero at the 10% level

** Statistic is significantly different from zero at the 5% level

Note: [a] Exchange rate analysis was not undertaken for Denmark as it has a fixed exchange rate.

Evidence of long-run exposure to exchange rate changes is also weak for the non-euro countries (Panel B of Table 7). The strongest evidence of sensitivity is observed in the Insurance sector, with Switzerland recording negative statistically significant estimates in each of the time intervals – one, three, six and twelve (5% level). The only other country that exhibits some exposure in this sector is the UK, with positive sensitivity observed in both the six and twelve month time horizons (at the 5% level). The twelve-month time horizon is also significant for the UK (5% level) and Switzerland (10% level) in the Financial Services sector. Switzerland also records significant estimates for the one (5% level) and three (10% level) month intervals in this financial sector.

3. DISCUSSION

In summary, our results for the 'short-run exposure analysis' generally indicate (i) euro-zone countries are more sensitive to long-term interest rates than short term interest rates while non-euro countries are more sensitive to short-term interest rates (in particular the UK); (ii) while the banking sector is the only financial sector with statistically significant sensitivity for the euro countries in the case of short-term interest rates, each of the three financial sectors exhibits some sensitivity to long-term interest rates; (iii) greater sensitivity is noted in subperiod 1 (April 1991 to December 1998) than sub-period 2 (January 1999 to June 2004) for both short-term and long-term interest rates; (iv) although evidence of exchange rate risk exposure is weak across the European countries and across the financial sectors, the banking sector exhibits the strongest evidence of sensitivity (in the second period) of the euro countries, while Switzerland exhibits the greatest sensitivity of the non-euro countries.

The 'long-run exposure' results generally indicate (i) increasing the time intervals beyond one month considerably increases the sensitivity of the European financial sector to short-term interest rates, long-term interest rates and exchange rates; (ii) of the three risk factors, evidence of statistically significant sensitivity is strongest for long-term interest rates; (iii) the Financial Services sector is the most sensitive financial sector to changes in long-term interest rates; (iv) while long-term interest rate exposure is positive for both euro and non-euro countries, short-term interest rate exposure tends to be negative for euro-zone countries and positive for non-euro countries; (v) exchange rate exposure is predominantly positive for euro countries and negative for non-euro countries; (vi) the Insurance sector exhibits the strongest sensitivity to unanticipated exchange rate changes with increasing time intervals.

Finally, of all the countries examined, Sweden exhibits most sensitivity to unanticipated interest rate changes while Switzerland exhibits most sensitivity to unanticipated exchange rates.

The findings of our analysis are interesting for several reasons. First, when considering our short-term interest rate investigation 'short-run exposure', France (Banking) is the only euro-zone country to exhibit any sensitivity while the UK and Sweden exhibit the strongest sensitivity of the non-euro countries. The negative impact on French banks in the full period and the first sub-period analysis could be a consequence of the 1992/93 EMS crisis that led to a sharp increase in short-term interest rates particularly in France, Italy, Spain and Sweden. In such countries that were facing a speculative attack on their currency, higher short-term interest rates had to be used to defend the currency and may therefore have been read by the market as risk-increasing. During the run-up to the introduction of the euro and approaching "nominal convergence" as stipulated by the Maastricht criteria, lower short-term interest rates were then clearly interpreted positively.

Conversely the positive impact on UK banks in both subperiods may be due to the fact that in the UK net margins are much lower and the interest rate pass-through (from money markets rates to retail rates) are typically faster and more complete compared to other European countries. The pass-through in euro-zone countries is usually characterized by a severe short-term stickiness of retail-interest rates. Thus, an increase of short-term interest rates may lead to an incomplete adjustment of lending rates at least in the first few months and thus lead to a reduction on margins and vice versa. The pass-through in the UK is much faster however. Further, the negative impact somewhat disappearing in the EMU-phase, or at least becoming less significant for France, Italy and Spain can also be related to the pass-through. Sander and Kleimeier (2004) report that in the EMU-phase – or rather after enough nominal convergence emerged to recognize a structural break prior to the euro-introduction – the pass-through improved in some countries. They attribute this, however, not to a mysterious "EMU-effect", but to changes in structural features such as reduced money market rate volatility particularly in the former countries. However, as the latter has not dramatically changed in countries like Germany and the Netherlands the observed pattern is clearly related to the pass-through argument.

When considering the long-term interest rate 'short-run exposure' investigation, we find the greatest impact on two countries – the euro-zone country Italy and the non-eurozone country Sweden. When considering Italy, a possible explanation for the negative impact in the Banking sector in the full period and the first sub-period is that the euro-zone membership contributed significantly to stabilize and reduce long-term interest rates which may reflect inflation expectations. During the time of the first sub-period, the market regarded high and variable inflation as negative for the profitability of financial institutions. Related to the argument that the regime shift associated with the euro may explain the observed changes in exposure in the Italian Banking system are the possible explanations of (i) a more complex pass-through with respect to long-term lending rates; and (ii) the higher level of integration in bond markets and therefore the convergence of long-term interest rates.

Further, where Italy exhibits no sensitivity to short-term interest rates, each financial sector examined exhibits some sensitivity to long-term interest rates. A possible explanation for this finding may lie in the changes that have occurred in the composition of Italian financial instruments and the relative importance of the various issuers over the past 20 years.[9] While short-term securities and deposits represented more than 40% of total financial assets in the early 1980s, they represented less than 20% in 2000. Over the same period long-term securities, shares, insurance technical reserves and mutual fund shares almost doubled. Our findings of sensitivity across the three financial sectors may be further supported by the fact that the past three decades have witnessed a significant decrease in importance of banks in the Italian financial system, resulting in the increased weight of other financial institutions.

Interestingly, the Financial Services and Insurance sectors of Germany also exhibit some sensitivity to long-term interest rates. These results may be explained by the increasing importance and success of both insurance corporations and mutual funds through the 1980s and 1990s. Although banks have always played and continue to play a pivotal role in the German financial sector, intermediaries have increased their importance in recent times.

In general terms, evidence suggests that the integration of the financial sector of the euro countries is most apparent in wholesale markets rather than retail banking. This results in countries such as Italy experiencing low and stable interest rates and therefore more efficient pass-through, lower intermediation margins and greater monetary stability. The impact of such benefits is however limited in countries such as Germany. As reflected in our results, we would therefore expect greater general sensitivity in the former type of countries.

In the exchange rate 'short-term exposure' sensitivity investigation we find a negative impact in the second subperiod for the Banking sector of three euro-zone countries – Germany, the Netherlands and Spain. While our findings for the Netherlands may be explained by the extensive international activities of Dutch banks, an explanation for the German results may be the increased international activities of German banks in recent times. This is reflected in the fact that external financing has grown dramatically in Germany over the past decade (the 1998-2000 average was more than double the average figure for the 1995-1997 period) due to an increase in loans to non-resident sectors and purchases of shares and other equity during that period. In addition, the investment by non-residents has been greater in German deposits and securities than German shares. Finally, Spain's subperiod 2 sensitivity for both the Banking and the Financial Services sectors may be due to the recent increase of direct investment into the European Union and Latin American countries by several Spanish economic sectors, including finance.

Consistent with previous studies, we find that the impact of interest rates and exchange rates increases for lengthening horizons. These results are consistent with

suggestion that although financial institutions manage their 'short-run exposure', they do not successfully hedge 'long-run exposure' as suggested by Chow *et al.* (1997a, b). Further, the evidence of our 'long-run exposure' analysis reinforces our short-run exposure results, that is, while the Banking sector is most sensitive to short-term interest rates for both euro and non-euro countries, the Financial Services and Insurance sectors are most sensitive to long-term interest rates. A possible explanation for this finding is that while banks in general deal in short-term deposits and securities, other financial institutions (including insurance companies) typically deal in longer term financial instruments. For example, consider Germany. While German banks do not exhibit 'long run' exposure to long-term interest rates, we document some 'long run' exposure to long-term interest rates for both the Financial Services and Insurance sectors. Although this sensitivity is noted for the Financial Services sector at the longer time horizons (six and twelve month intervals), much stronger sensitivity is observed in the Insurance sector (one, three, six and twelve month intervals).

Of the non-euro countries, 'long-run exposure' is predominantly observed in the Financial Services and Insurance sectors. An interesting result is the sensitivity of Sweden's financial system which is evident across the three financial sectors for all time horizons. A limited positive impact is also noted in the short-term analysis across the Banking and Financial Services sector. An explanation for this finding may lie in the fact that our sample period coincides with the aftermath of Sweden's severe financial crisis in 1991-1992. This crisis led to Sweden's deepest recession since the 1930s and the floating of the Krona in November 1992. A period of policy reforms and deregulations followed. Sweden subsequently experienced rapid economic growth in the period 1998-2000 that subsided from mid-2000. These events appear to be reflected in our results beginning with the sensitivity reported in Table 3 (significant short-run exposure to long-term interest rates evident for the full sample period and the first sub-period – April 1991 to December 1998 - across each of the three financial sectors) to the strong results reported in Table 6 (significant long run exposure to long-term interest rates).

Finally, when considering the 'long run exposure' to exchange rate risk, of note is the sensitivity of the Swiss Insurance sector to fluctuations in the CHFUSD. This finding may be explained by the fact that although the Swiss Insurance sector is large and has a history of strong performance, the local insurance market appears saturated and Swiss insurance companies are expanding their business abroad, particularly the US. This appears to be supported by our results in Table 4 where we note exchange rate sensitivity of the Swiss Insurance sector in the full period and in the second sub-period, possibly reflecting the recent internationalization of these institutions. Further, both short run and long run exposure to the exchange rate is noted in the Financial Services sector – Tables 4 and 7. Again, this may reflect the international orientation of major financial institutions particularly towards the US.

SUMMARY AND CONCLUSION

The investigation of both interest rate exposure and exchange rate risk exposure of financial institutions has created some interest in recent empirical literature. Although some studies have investigated interest rate sensitivity alone (see for example Madura & Zarruck, 1995), others have investigated both risk dimensions simultaneously given the importance of the impact of interest rates changes and exchange rate changes on profitability and shareholder returns (see for example Choi *et al.,* 1992; Koch & Saporoschenko, 2001). Consistent with the type of analysis conducted in the latter studies, this investigation examines the interest rate and exchange rate sensitivity of the financial sector (Banking, Financial Services and Insurance sectors) of five euro-zone and four non-eurozone countries for the period April 1991 to June 2004. Our study examines the impact of changes in short-term interest rates, long-term interest rates and exchange rates (all currencies are expressed in terms of the USD). Further, we investigate the sensitivity to these risk factors (i) across two sub-periods partitioned at December 1998/January 1999 (coinciding with the introduction of the euro), and (ii) over overlapping lengthening time horizons.

Generally, our findings suggest that while banks are more sensitive to short-term interest rates, the Financial Services and Insurance sectors are more sensitive to long-term interest rates. There is no obvious trend in sensitivity pre-/post-euro and differences in terms of the impact of interest rate changes across countries seem to suggest (i) some evidence of integration, and (ii) differences in financial structures and regulation. Moreover, consistent with the findings reported by Francis and Hunter (2004), our results seem to suggest that an increase in competition in the euro-zone financial sector (due to the introduction of the euro) has not necessarily led to an across-the-board increase in risk premiums.

In our analysis of lengthening time horizons, we find that interest rate sensitivity increases significantly with increasing time intervals. One notable result that emerged from the interest rate analysis however is that of Sweden, a country that exhibits strong interest rate sensitivity (particularly to long run exposure to long-term interest rates) across all financial sectors. This finding is consistent with the fact that during the sample period, Sweden was recovering from a deep recession and its financial sector was experiencing major policy changes and deregulation.

Interestingly, while there is significant evidence of interest rate sensitivity (in particular 'long run' exposure), evidence of exchange rate risk exposure is weak across all countries and all sectors. These findings are consistent with those of Koch and Saporoschenko (2001). It seems however the differences in sensitivity that we do observe are related to differences in international activities. Finally, as in our interest rate analysis, we find that exchange rate exposure also increases with increasing time intervals.

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[1] The analysis begins from 1991 following the inauguration of Stage 1 of European Monetary Union (EMU) in 1990, which involved the removal of all restrictions on capital movements and increased integration of economic policies and central bank cooperation.

[2] There are several existing studies that consider whether or not risk exposure changes with lengthening time horizons (see, for example, Chow *et al.*, 1997a, b; and Chow & Chen, 1998; Di Iorio & Faff, 2001). In their analysis of exchange rate exposure, Chow *et al.* (1997a, b) argue short-horizon returns contain errors made by investors in forecasting the long-term effects of current exchange rates changes and find evidence that the foreign exchange exposure of individual firms increases with lengthening return horizons. Chow & Chen (1998) also employ different time horizons to investigate foreign exchange rate exposure and find that for short-return horizons, smaller firms have smaller exposures while for the longer-return horizons, larger firms have smaller exposures. Finally, Di Iorio & Faff (2001) find considerable evidence of long-term exchange rate exposure in the Australian equities market.

[3] Modelling of the unanticipated returns follows standard ARIMA techniques. Details are not reported to conserve space.

[4] To control for induced autocorrelation and heteroskedasticity, the intervaling equations are estimated using the Newey-West HAC approach.

[5] The EuroUSD was implemented for the five Euro-zone countries from January 1, 1999, while exchange rate analysis was not undertaken for Denmark as it has a fixed exchange rate.

[6] To conserve space, only four countries were chosen as representative of the group of countries analysed in the study.

[7] An issue regarding the application of our augmented market model is that of multicollinearity. In response to this we calculated the correlation between the market return, the interest rate returns and the exchange rate return for each country over the full sample period and found the values were relatively low. Accordingly, we dismiss this issue as a serious concern.

[8] An analysis of the two interest rate variables and the exchange rate factor was undertaken (i) in separate equations and (ii) using lagged changes in each variable. The outcome of these variations confirmed the robustness of the augmented market model results reported in this paper and therefore are suppressed to conserve space. They are available from the authors on request.

[9] ECB (2002): 170.