The Exchange Rate Exposure of UK Nonfinancial Companies: Industry-Level Analysis

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Abstract

In line with the financial theory, any change in an exchange rate should affect the value of a firm or an industry. However, earlier research did not fully support this theory, which is surprising in view of the considerable exchange rate fluctuations over the last three decades. This study extends previous research on the foreign exchange rate exposure by investigating contemporaneous and lagged exchange rate exposure of UK nonfinancial companies at the industry level. The analyses are conducted over the total period from 1981 to 2001 and over three subperiods. Since the UK joined the ERM on October 8, 1990 and remained a member until September 16, 1992, the sample period is split into three subperiods: Pre-ERM, In-ERM and Post-ERM subperiods. Therefore, the study also aims to identify the sensitivity of industries' stock returns to exchange rate movements over these three subperiods. The current study is different from previous studies as it considers the impact of the actual and unexpected changes in exchange rates on industries' stock returns. The findings show that a higher percentage of UK industries are exposed to contemporaneous exchange rate changes than those reported in previous studies. There is also evidence of significant lagged exchange rate exposure. This lagged exchange rate exposure goes in line with the findings of previous studies, in that it shows some market inefficiencies in incorporating exchange rate changes into the returns of firms and industries. Generally, the sensitivities of UK industries' stock returns to exchange rate fluctuations are most evident in the period before joining the ERM and after departure from the ERM (post-ERM). The proportion of industries with a significant exchange rate exposure declined when the pound was in the ERM and increased again after the UK left it. The findings of the study have significant implications for public policy makers, investors and managers. However, there is a need for research that considers the factors or determinants that might affect a firm's or an industry's exposure to changes in exchange rates.

Keywords: exchange rate changes, foreign exchange exposure, stock returns, UK industries, subperiod analysis and ERM.

JEL Classification: F3, F31, G12.

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In line with the financial theory, any change in an exchange rate should affect the value of a firm or an industry. However, earlier research did not fully support this theory, which is surprising in view of the considerable exchange rate fluctuations over the last three decades. This study extends previous research on the foreign exchange rate exposure by investigating contemporaneous and lagged exchange rate exposure of UK nonfinancial companies at the industry level. The analyses are conducted over the total period from 1981 to 2001 and over three subperiods. Since the UK joined the ERM on October 8, 1990 and remained a member until September 16, 1992, the sample period is split into three subperiods: Pre-ERM, In-ERM and Post-ERM subperiods. Therefore, the study also aims to identify the sensitivity of industries' stock returns to exchange rate movements over these three subperiods. The current study is different from previous studies as it considers the impact of the actual and unexpected changes in exchange rates on industries' stock returns. The findings show that a higher percentage of UK industries are exposed to contemporaneous exchange rate changes than those reported in previous studies. There is also evidence of significant lagged exchange rate exposure. This lagged exchange rate exposure goes in line with the findings of previous studies, in that it shows some market inefficiencies in incorporating exchange rate changes into the returns of firms and industries. Generally, the sensitivities of UK industries' stock returns to exchange rate fluctuations are most evident in the period before joining the ERM and after departure from the ERM (post-ERM). The proportion of industries with a significant exchange rate exposure declined when the pound was in the ERM and increased again after the UK left it. The findings of the study have significant implications for public policy makers, investors and managers. However, there is a need for research that considers the factors or determinants that might affect a firm's or an industry's exposure to changes in exchange rates.

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I. Introduction

The general concept of exchange rate exposure refers to the degree to which the value of a firm or an industry is affected by exchange rate changes. Exchange rate changes can affect an individual investor who owns a portfolio consisting of securities in different currencies; a multinational company with subsidiaries and branches in foreign locations; an exporter/importer who concentrates on international trade and even a firm that has no direct international activities. Furthermore, exchange rate changes, through their impact on the costs of inputs, outputs, and substitute goods, play a significant role in determining the competitive position of domestic companies with no direct international operations relative to foreign firms (Joseph, 2002).

A number of studies provide evidence for the relationship between foreign exchange rate movements and changes in the values of firms. Nonetheless, the empirical evidence on the impact of exchange rates on firm value is not conclusive. Furthermore, the majority of the studies in the area focus on the valuation consequences of exposure to exchange rate changes. Such studies focus on the USA and other developed countries. For instance, a number of empirical studies in the UK have examined the approach of corporate treasurers in managing foreign exchange rate exposure (Collier and Davis, 1985; Belk and Glaum, 1990; Collier, Davis, Coates and Longden, 1992; Belk and Edelshain, 1997; Joseph and Hewins, 1997; Joseph, 1999, 2000; Marshall, 2000; Bradley and Moles, 2001; Belk, 2002; Bradley and Moles, 2002; Faff and Marshall, 2002; Dhanani, 2003). Few studies have investigated the relationship between exchange rate changes and the value of UK companies (Donnelly and Sheehy, 1996; Joseph, 2002). Therefore, the current study seeks to fill the gap by providing empirical evidence on contemporaneous and lagged impacts of exchange rate changes on the monthly stock returns of UK industries from January 1981 to December 2001. The central issue of this study is to estimate the sensitivity of UK industries to changes in different exchange rate measures. In addition, this paper empirically investigates the impact of lagged exchange rate exposure on stock returns (referred as mispricing hypothesis) that is discussed in Amihud (1994), Bartov and Bodnar (1994), He and Ng (1998), Chaio, Hung and Nwanna (2001), Makar and Huffman (2001). This hypothesis claims that lagged changes in the

exchange rates are more meaningful for stock returns than contemporaneous changes. To sum up, the current study focuses on the following issues:

- What is the main relationship between industries' stock returns and exchange rate changes?
- Are stock returns influenced more by unexpected exchange movements than actual ones?
- Are lagged changes in the exchange rates more meaningful for stock returns than contemporaneous exchange rate changes?

This paper is organised as follows. Section II presents a review of related literature. Section III provides more detail on data sources and methodology. The empirical results are presented in section IV. Section V sums up the research and provides some conclusions and recommendations for future research.

II. Review of Related Literature

The literature to date indicates that exchange rate exposure varies across industries. Luehrman (1991) investigates the impacts of the real exchange rate changes on industries' cash flows. He asserts that, contrary to the common line, a depreciation of home currency leads to a decline in the value of industries. Jorion (1991) investigates the sensitivity of the stock prices of US MNC to changes in dollar exchange rates. His findings show that industries, such as Chemical and Machinery, which export a significant proportion of their production or have significant foreign operations, benefit from the depreciation of the dollar and suffer from the dollar's appreciation. On the other hand, other industries such as Textiles, Apparel, and Department stores, which import a significant proportion of their production inputs, suffer from the decrease in the value of the dollar and vice versa. However, the sensitivity of stock prices to changes in exchange rate is not significant at any accepted level of significance. Hence, Jorion concludes that active hedging policies by financial managers cannot affect the cost of capital, and other reasons must explain why firms decide to hedge.

The relationship between exchange rate changes and industry portfolio returns for Canada, Japan and the United States over the period from January 1979 to December 1988 is examined by Bodnar and Gentry (1993). Less than half of the industries display significant exchange rate exposure at the 10% level in the countries mentioned. The exchange rate is an important factor for explaining industry returns at the economy-wide level in those countries. They also specified exchange rate exposure as a function of industry characteristics. Employing the market model, AlDiab, Zoubi, and Thornton (1994) examine the impact of changes in the dollar exchange rate on daily security returns of US MNCs using an event study methodology for the period from January 1, 1978 to December 31, 1987. Their results show that the stock prices of MNCs are not greatly affected by changes in exchange rates or that the relationship is so weak, it can be significant by a change in exchange rates of only very high magnitude.

Donnelly and Sheehy (1996) examine the relationship between changes in trade-weighted nominal exchange rate and the monthly abnormal returns of portfolio of the UK's 39 largest exporting firms with foreign sales at least 40% during the period 1978 to 1992. They find a negative contemporaneous relationship between the foreign exchange changes and the abnormal returns of large UK exporters. They also find a weak lagged relationship, which suggests that the stock market takes time to incorporate all of the implications of foreign exchange rate changes into share prices. Fang and Loo (1994) investigate the effect of unanticipated changes in the US trade-weighted exchange rate on 20 US industries' common stock returns over the period January 1981 to December 1990. There are significant negative betas recorded for the mining, food and beverage, chemical, petroleum, and utilities industries. The outcome of the study suggests that the common stock returns on these industries are likely to be negatively influenced by exchange rate changes. That is, common stock returns on these industries increase when the rate of the dollar depreciates, and decline when there is depreciation in the rate of the dollar. On the contrary, positive exchange risk betas are observed in textile and apparel, machinery, transportation equipment, department stores, other retail trade, banking, finance and real estate, and miscellaneous industries as well. Such a finding suggests that stock returns on these industries are substantially harmed by a depreciation of the dollar that is not expected, and vice versa when there is an

appreciation in the dollar rate.

In addition, the relationship between exchange rate movements and industry competition for stock returns is investigated by Griffin and Stulz (2001). Their study shows that common shocks to industries across countries are more important than competitive shocks, owing to changes in exchange rates. The researchers find that both industry and exchange rate shocks are more important for industries that produce internationally traded goods, but the importance of these shocks is economically less significant with regard to the industries mentioned. Krishnamoorthy (2001) examines whether the industrial structure is an important determinant of the exchange rate exposure of US industry portfolio returns over a 3-year period (1995–1997). The results indicate that industries that are classified as being globally competitive and those that primarily serve the consumer sector of the economy have significant levels of exposure. The study provides some evidence on market efficiency as it pertains to changes in the value of the dollar. Chang (2002) examines industry-level currency risk of Taiwan's stock market around the Asian financial crisis using a two-factor model, similar to that used by Jorion (1990), and Bodnar and Gentry (1993). The results show that most export-oriented industries, except for the electronics industry, are positively affected by the depreciation of the New Taiwan Dollar against the US Dollar. Thus, the study finds that the magnitude of currency risk is less for banking and electronics industries in the Taiwan Stock Exchange than for those in the over-the-counter security exchange. The results further show that there is a negative relationship between firm size and currency exposure in Taiwan's stock market. The empirical findings are in accordance with the hypothesis that the exchange risk is less for larger firms than for smaller firms and this is consistent with Nance, Smith and Smithson (1993) and Chow, Lee and Solt (1997).

The impact of foreign exchange rate changes and interest rate changes on UK firms in the chemical, electrical, engineering and pharmaceutical industries during the period 1988 to 2000 is examined by Joseph (2002). He considers two different measures of foreign exchange rate impacts, along with a measure of interest rate changes. The findings show that industry returns are more negatively affected by interest rate changes than by foreign exchange rate changes. The interest rate effect appears to be significant

for up to 34% of all firms while the short-term foreign exchange rate effect appears to affect 28.3% of all firms. The effects depend on the industrial sector of the firms. It is noted that the negative effects of interest rate and foreign exchange rate changes appear more pronounced for the electrical and engineering sectors. On the other hand, these effects tend to be positive for the pharmaceutical industry. Additionally, the results at the portfolio-level are generally similar with those based on the firm-level analysis, except that the short-term foreign exchange rate impact is very weak at the portfolio level.

A change in exchange rates, particularly the real exchange rates, are likely to affect a firm's future expected cash flows and future value, hence the impact of exchange rate movements on stock returns can extend over a number of periods. It makes economic sense since the loss or gain in international competitiveness due to real exchange rate changes affect firms' financial performance with a certain delay. Bartov and Bodnar (1994) suggest that exchange risk is priced in equity markets, but the market is not fully efficient with respect to exchange rate changes and so the market takes time to incorporate all the implications of foreign exchange rate movements. They suggest that lagged changes in the value of the home currency are more meaningful for establishing a pricing relationship than contemporaneous changes. Bartov and Bodnar (1994) cite the mispricing hypothesis as a possible explanation for the limited success of research in documenting a relationship between changes in exchange rates and stock returns. Donnelly and Sheehy (1996) find a contemporaneous as well as a weak lagged relationship between the trade-weighted nominal exchange rate and firm value. They attribute the results to their sample, which consists of only firms that export a far greater portion of their output than those used in prior US-based studies, and to the fact that the market perceives large UK exporters as being more exposed to foreign exchange risk than their US counterparts. Similarly, Krishnamoorthy (2001) finds all the exposure coefficients, obtained from regressing industries' stock prices on lagged exchange rate changes, are insignificant at conventional levels. He and Ng (1998) find no effect of lagged changes in exchange rate on Japanese industries. While Amihud (1994) is not able to realise any significant contemporaneous correlation between stock returns of thirty larger exporters and exchange rate movements, he reports that exchange rate fluctuations affect the stock returns only with lags of up to two quarters. Similarly,

Bartov and Bodnar (1994) find no relationships between firms' stock returns and contemporaneous changes in the US dollar but find a significant lagged relationship between changes in the dollar and stock returns. Di Iorio and Faff (2001) find that six industry portfolios exhibit significant contemporaneous exchange rate exposure, while eleven industries record a significant lagged exposure to the AUD/USD. On the other hand, they find only four industries that record significant contemporaneous exposure coefficients while eight industries exhibit significant lagged exposure coefficients to the AUD/JP¥. They find where five industries exhibit contemporaneous exchange rate exposure; six industries report significant lagged exposure coefficients to the trade-weighted exchange rate. They realise that the Australian equities market experiences stronger lagged, and not contemporaneous exchange rate exposure and Australian industry returns are more significantly affected by changes in the AUD/USD as compared to the AUD/JP¥.

III. Data Sources and Methodology

The data used for the study are obtained from the Datastream Database. The firms in the sample are those that have historical data available in Datastream. Thus, the data for this study covers the period from January 1981 to December 2001 and is limited to all shares listed on the London Stock Exchange during that period. The total number of firms covered by Datastream at the date of sampling (01/07/2001) is 1753[1], of which 248 are without an industrial classification, or names and industrial classification are unavailable. The elimination of such firms leaves a total of 1505 firms. Additionally, the study is restricted to all nonfinancial firms quoted on LSE. According to the industrial classification of Datastream: banks, stockbrokers, fund managers, financial and property firms, insurance firms and brokers, investment trusts, investment firms, property agencies and property developers are financial firms and hence, excluded from the sample. The decision to examine only nonfinancial firms is also based on the complexity of foreign exchange rate exposure and risk management practices used by financial firms and the prescriptions of the exchange rate exposure theory, which discusses firms as producers and consumers. This restriction also makes the study sample comparable to

[1] 900A is a programme that provides data for lists and portfolios that have been created by Datastream or users using programme 300B.

some earlier studies, which usually included only nonfinancial firms. The total firms remaining are 1286. Finally, in order to be included in the sample, the firm must have full monthly return observations for the period. Thus, the final sample consists of 364 firms[2]. Table I shows the sample selection stages and Table II presents the number of companies in each industry sector and its total assets.

Please insert Table I and Table II

Due to the fact that changes in foreign exchange rates can be measured in nominal and real terms, the choice between nominal and real exchange rate variations is discussed below. Most previous studies on the relation between stock returns and changes in exchange rates have used nominal exchange rates. Khoo (1994) argues that if the changes in exchange rates are measured in real terms, then all variables in the regression equations must also be adjusted for inflation for consistency purposes. Mark (1990) claims that the contemporaneous movements in nominal and real foreign exchange rates are almost perfectly correlated for the seven countries used in his study. In an effort to find additional empirical support for the arguments put forward by previous studies, the real and nominal foreign exchange rate exposure of UK nonfinancial firms is estimated in this study. Both nominal and real exchange rate changes are employed to determine if there is any significant difference in their impact on stock returns. This view is shared also by the assertion of Atindéhou and Gueyie (2001), that there is little difference between nominal and real exchange rates based on the assertion that these are highly correlated. Hence, if the changes for nominal and real exchange rates were almost perfectly correlated, then the use of either of them would have a similar impact on stock returns. Amihud (1994) and Choi and Prasad (1995) have examined the impact of the changes in both nominal and real exchange rates.

[2] The sample selection procedure may introduce a survivorship bias in the results. Since the sample includes firms that have survived during the entire sample period, they are likely to be firms that have effectively managed various risk exposures. There is no direct study that examines the effect of survivorship bias on the exchange risk exposure of firms. However, there are several studies that examine the effect of survivorship bias in the context of mutual fund performance (refer to Grinblatt and Titman (1989), Brown, et al. (1992), and Garcia and Gould (1993)). The general conclusion of these studies is that survivorship bias will tend to introduce a bias in favour of finding good performance. In the current study, the bias is against finding significant exposure coefficient.

For financial markets to be efficient, the use of unexpected changes in exchange rates are preferable to actual changes since the expected values of the relevant variables should have been reflected in asset prices and only the unexpected changes should affect asset returns (Choi, Elyasiani and Kopecky, 1992). Previous studies on measuring foreign exchange rate exposure imply that the important decision for measuring exchange rate exposure is the type of proxy to use for the exchange rate risk factor, to represent unexpected (or actual) exchange rate changes in the exchange rate. Those studies use the rate of actual change in the exchange rate as a proxy of the unexpected changes in the exchange rate (Jorion, 1990; Bodnar and Gentry, 1993; Bartov and Bodnar, 1994; He and Ng, 1998; Williamson, 2001). However, some empirical studies use unexpected changes in exchange rates as a proxy for the exchange rate risk factor (e.g. Harris, Marr and Spivey (1991); Choi et al. (1992); Choi and Prasad (1995), Fang and Loo (1994, 1996), and Atindéhou and Gueyie (2001)). Decomposing changes in exchange rates into expected and unexpected components is problematic without the knowledge of an accurate proxy for the expected exchange rate variable.

The unexpected changes in exchange rate can be calculated as the difference between the actual and anticipated changes in exchange rates. Harris, Marr and Spivey (1991) use the forward rate premium/discount as an appropriate exchange rate risk factor that reflects investor expectations, whereas Choi and Prasad (1995) use the forward rate or the lagged spot rate as a proxy for expected exchange rate. It is assumed that the premium or discount on forward exchange rate is approximately equivalent to the expected rate of change in exchange rate, as Choi and Prasad claim. However, various different studies measure unexpected changes in the exchange rate measures by using an autoregressive integrated moving average, ARIMA models. ARIMA models are used to extract unexpected changes in exchange rates from the series of exchange rate movements. By using ARIMA models, Fang and Loo (1994) examine the effect of current and unexpected exchange rate changes on US bank common stock returns. ARIMA residuals are used as a proxy of unexpected changes in exchange rates. They find that the unexpected changes in the exchange rates have a significant cross-sectional effect on common stock returns. To extract unexpected changes in interest rates, Bae (1990) and Dinenis and Staikouras (1998) examine the effect of unexpected changes in

interest rates on the common stock returns of portfolios of financial institutions in the US and the UK, respectively. They find a significant negative relationship between the common stock returns and the current and unexpected changes in interest rates.

In order to identify the unexpected changes in exchange rates we follow a two-step procedure. The first step consists of finding an ARIMA (p,d,q) model. Autocorrelation and partial correlation structures seem to suggest ARIMA (1,1,1) for exchange rate factors[3]. The fitted values of this model correspond to the expected changes in exchange rate risk factor. The residuals are then defined as the unanticipated changes in exchange rates. The second step involves the substitution of these residuals for the exchange rate variables in regression models. The current study views foreign exchange rate exposure as the impact of unexpected or actual rate of change in exchange rates on stock returns, since the exchange rate changes equal the expected exchange rate changes plus the unexpected exchange rate changes. In terms of previous studies, such as Jorion (1990), a firm's or an industry's exchange rate exposure coefficient can be obtained using a time-series equation as follows:

$$R_{it} = \beta_{0i} + \beta_{1i} ER_t + \varepsilon_{it} \quad \text{..... (Eq. 1)}$$

where R_{it} is the return of the *ith* stock over time period t, ER_t is the percentage contemporaneous change in exchange rates over time period t, and β_{0i} and ε_{it} are respectively the intercept and random error term. In this study, the exchange rate sensitivity of 364 nonfinancial companies is estimated over the period from January 1981 to December 2001. Most studies use an alternate specification to Equation (1). This specification has the additional feature of explicitly controlling for movements in the stock market. The reason being that specific financial risk is only one part of the total risks that determine the variance in stock returns. Hence, the alternate specification is as follows:

$$R_{it} = \beta_{0i} + \beta_{1i} ER_t + \beta_{2i} RM_t + e_{it}, \qquad t = 1,...,T \quad \text{.....(Eq. 2)}$$

[3] The findings of Autocorrelation and Partial Correlation are available from the author upon request.

This equation, R_{mt} is the rate of return on the FTSE market index, which reflects important economy-wide factors[4]. e_{it} is unique to stock i. It is assumed to be uncorrelated with the common factors ER_t and R_{mt}. The two factors ER_t and RM_t are assumed to capture all risk, which systematically affects stock returns. In practice, the coefficients of exchange rate exposure, β_{1i}, estimated by equations (1) and (2) are highly correlated (Jorion, 1990). Such a model asserts the fact that returns are a function of contemporaneous changes in exchange rate and a market index with firm specific intercept and slope coefficients. The error term is the disturbance term assumed to be normally and independently distributed with mean zero and constant variance. The market variable is intended to capture the time serial influence of the general market on individual stock returns. The estimated exchange rate coefficient will provide a measure of the effect of exchange rate changes on the stock returns given its relation to the market return index (Bodnar and Wong, 2003).

However, a change in exchange rates is likely to affect future expected flows and hence, the impact of changes in exchange rates on industries' stock returns may extend over a number of months. To allow for this possibility, several lags of the exchange rate variables should be included in the regression to explore whether there are important lags in the price adjustment process that must be recognised in the estimation. In this paper, lagged changes in exchange rate variables are included as explanatory variables to examine whether a lagged relation between exchange rate movements and stock returns is present in our sample firms. Therefore, lagged exchange rate exposure of industries' stock returns is estimated as follows:

$$R_{it} = \beta_{0i} + \beta_{1i} ER_{-1} + \ldots + \beta_{ki} ER_{t-k} + \beta_{k+1i} RM_t + \varepsilon_{it}, \quad t = 1,\ldots,t \qquad \text{(Eq. 3)}$$

where R_{it} is the return on the ith firm in month t. ER_{t-1} is the lagged exchange rate changes (each lag is one month), R_{mt} is the return on the UK stock market and ε_{it}, is the random error term.

[4] The value-weighted portfolio of the Financial Times All Share Index (FTSE All-Share Index and its Datastream mnemonic is FTALLSH) is used as a proxy for the market portfolio. The analysis uses this index as a proxy for the market portfolio because it covers a large portion of the market value of public firms. This index is also the usual proxy in most current UK research.

IV. Empirical Results

1. Total period analysis

In the following section, we present the results of the impact of actual and unexpected changes in exchange rates used in the study on industries' stock returns over the whole period from January 1981 to December 2001. We observe that the market exposure is positive and significant for all industries at the convenient confidence levels employing exchange rate models.

a. Contemporaneous exchange rate exposure of UK industries

Industry-level exchange rate exposure is estimated as the slope coefficient on the exchange rate variable in two-factor regression models of industries' monthly stock returns on the monthly market returns and the monthly changes in exchange rates. The empirical analyses of the relationship between industries' stock returns and contemporaneous exchange rate changes are conducted with actual and unexpected changes in trade-weighted nominal and real exchange rates. Table III provides a summary of the actual and unexpected exposure coefficients of the exchange rates used in the study. The table also provides information on the sign and the direction of exchange rate exposure coefficients. We observe some interesting results from Table III. First: the Transport industry exhibits positive and significant exposure to the actual and unexpected changes in exchange rate factors used in the study, except for unexpected changes in the trade-weighted real exchange rate. Second: the Retail industry has positive exposure coefficients for all exchange rates (actual and unexpected) and all of its coefficients are significant, except for unexpected changes in the trade-weighted real exchange rate. Third, the Diversified industries have negative exposure coefficients for the actual and unexpected changes in exchange rates, though all exposure coefficients are statistically insignificant. Fourth: the Aerospace & Defence industries have negative exposure coefficients for the actual and unexpected changes in the exchange rates, except that they have positive exposure to the unexpected change in the trade-weighted real

exchange rate.

Please Insert Table III

Furthermore, Construction, Foods, Households, Oil and Gas, and Telecommunications industries have positive exposure to the actual and unexpected changes in exchange rates. Furthermore, the trade-weighted nominal exchange rate reports a higher exchange rate exposure (6 industries are significantly exposed to the actual changes and 5 industries are significantly exposed to the unexpected changes) and real exchange rates (5 industries are significantly exposed to the actual changes and 3 industries are significantly exposed to the unexpected changes). Finally, the majority of significant exposure coefficients are positive, indicating that the industries' stock returns benefit (harm) from an appreciation (depreciation) of the pound against the other foreign currencies.

The findings presented in Table IV show that six industries (30%) have significant and positive exchange rate exposure namely: Construction, Electronics, Household, Retail, Support Services, and Transport. We observe that all the 6 exchange rate exposure coefficients are positive, indicating that lower (higher) returns are associated with a depreciation (appreciation) of the pound. This result is inconsistent with the findings of Ceglowski (1989) since she finds that the depreciation of the US dollar increases the sales of oil extraction, industrial machinery, instruments, transportation and hotel industries, but the construction and durable goods industries are adversely affected during the sample period. Additionally, Jorion (1991) finds that industries such as Chemical and Machinery benefit from the depreciation of the dollar and suffer from the dollar's appreciation. Other industries such as Textiles, Apparel, and Department stores suffer from the decrease in the value of the dollar and vice versa. Table IV also shows that only seven industries have negative exposure to actual changes in the trade-weighted nominal exchange rate, though the coefficients are not statistically significant. Those industries with negative exposure coefficients are Aerospace and Defence, Beverage, Brewers & Tobacco, Chemicals and Pharmaceuticals, Distribution, Diversified Industrials, Health Care and Packaging, Printing and Papers.

Please Insert Table IV

Subsequently, the exposure to unexpected changes in the trade-weighted nominal exchange rate is quite similar as reported for the actual changes in the trade-weighted exchange rate. Table IV also shows that five industries (25%) have significant exposure coefficients to unexpected changes in trade-weighted nominal exchange rate namely: Construction, Food manufacturing, Retail, Support Services, and Transport. We observe that all the five foreign exchange rate exposure coefficients are positive, indicating that these industries' stock returns benefit from an appreciation of the pound. Table IV also shows that only 6 industries have negative exposure to unexpected changes in the trade-weighted nominal exchange rate compared to 7 industries that are negatively exposed to the actual changes in the trade-weighted exchange rate, though the coefficients are not statistically significant. Those industries with negative exposure coefficients are Aerospace and Defence, Beverage, Brewers & Tobacco, Distribution, Diversified Industries, Health Care and Leisure. Table V shows that, of the 45 firms of the construction industry, 9 have significant exposure coefficients (20%), most of them positive (78%). This means that most of the construction industry companies are affected by an appreciation (depreciation) of the pound, indicating that higher (lower) returns are associated with a appreciation (depreciation) of the pound. Furthermore, 18% of transport companies are significantly exposed to the trade-weighted exchange rate changes and all exposure coefficients are positive.

Please Insert Table V

Table V also shows that 8 out of the 45 construction companies have significant exposure coefficients (18%) to unexpected nominal exchange rate changes, most of them positive (75%). This result indicates that most of the construction companies are positively affected by an appreciation of the pound. Further, 9 out of the 30 transport companies are significantly and positively exposed to the unexpected changes in the trade-weighted exchange rate compared to 6 companies, which were exposed to the actual changes in the trade-weighted nominal exchange rate. The interesting result is that no one company in the Food industry is exposed to unexpected

changes in the trade-weighted nominal exchange rate, though this industry, as a portfolio of 15 companies, is significantly exposed to changes in the exchange rate. Generally, 64% of the companies are positively exposed to unexpected changes in the trade-weighted nominal exchange rate compared to 61% in the case of the actual changes in the trade-weighted nominal exchange rate.

The results of trade-weighted nominal exchange rate exposure are consistent with previous studies. Loudon (1993) finds that 7 out of 23 Australian (30%) industries have significant positive exposure to the trade-weighted nominal exchange rate for the period from 1980 to 1991. He concludes that the absolute values of the exchange rate exposure coefficients tend to be smaller for the floating exchange rate period, suggesting reduced foreign exchange rate exposure in the latter period. Bodnar and Gentry (1993) find that 11 out of 39 industries (28%), 4 out of 19 industries (21%) and 7 out of 20 industries (35%) exhibit significant exposure in the US, Canada and Japan, respectively. Joseph (2002) finds that industry returns are more negatively affected by interest rate changes than by foreign exchange rate changes. These effects depend on the industrial sector of the firms. Bodnar and Gentry (1993) confirm this result and claim that some industries in Canada, Japan and the United States display significant exchange rate exposure. They specify exchange rate exposure as a function of industry characteristics. Di Iorio and Faff (2001) suggest that Australian industry returns are more significantly affected by fluctuations in the Australian dollar against the US dollar as compared to the trade-weighted exchange rate. On the contrary, the industries with significant exposure to the Australian dollar against the US dollar exchange rate are Gold, Entrepreneurial Investors, Other Metals, Solid Fuels, Alcohol & Tobacco, Property Trusts; the industries with significant exposure to the trade-weighted exchange rate are Gold, Miscellaneous Services, Property Trusts, Investment and Financial Services, and Media. Martínez-Solano (2000) also finds that exporting industries experience positive returns when exchange rates depreciate whereas importing industries experience a negative effect. The findings of Chang (2002) show that most export-oriented industries, except for the electronics industry, are positively affected by the depreciation of the New Taiwan dollar against the US dollar. The study also finds that the magnitude of exchange rate risk is less for banking and electronics industries in Taiwan.

The findings of estimating trade-weighted real exchange rate exposure are summarised in Table VI. The number of industry portfolios significantly exposed to actual changes in the trade-weighted real exchange rate reduced to 5 (25%) as compared to 6 portfolios (30%) reported earlier to trade-weighted nominal exchange rate changes. The results show that 5 industries (25%) have significant foreign exchange exposure namely: Distribution, Electronics, Retail, Support Services, and Transport. It is noted that 5 industries (i.e. Electronics, Retail, Support Services, and Transport) exhibit positive foreign exchange rate exposure coefficients, indicating that higher (lower) returns are associated with an appreciation (depreciation) of the pound. However, Distribution industry exhibits negative exposure to the trade-weighted real exchange rate changes, indicating that lower (higher) returns are associated with an appreciation (depreciation) of the pound. We observe that all distribution companies exhibit negative foreign exchange rate exposure coefficients. It indicates that the Distribution industry benefits from a decrease of the real value of pound. Interestingly, Luehrman (1991) finds that, to the contrary, a depreciation of the home currency leads to a decline in the value industries' values. Amihud (1994) indicates that there is no significant contemporaneous relationship between exchange rate changes and equity returns for 32 US exporters. Allayannis and Ofek (2001) finds no evidence of a contemporaneous exchange rate exposure for the industry with the largest net exports-to-sales ratio at the 4-digit SIC level. On the other hand, Donnelly and Sheehy (1996) find a contemporaneous relation between the foreign exchange exposure and the share price of large UK exporters. Similarly, Kiymaz (2003) finds that the most exposed Turkish industries are textile, machinery, chemical and financial industries.

Please Insert Table VI

Table VI also reveals that only 9 industries have negative exposure to the trade-weighted nominal exchange rate, though the coefficients are not statistically significant. Those with negative exposure coefficients are Aerospace & Defence, Beverage, Brewers & Tobacco, Chemicals and Pharmaceuticals, Diversified Industrials, Health Care, Leisure Industry, Media, and Packaging, Printing & Papers. Krishnamoorthy (2001) indicates that industries that are classified as being globally competitive and those that

primarily serve the consumer sector of the economy have significant levels of exposure. Jain (2000) finds that the exposure of US firms in 31 industries depends upon a characteristic of the industry to which they belong, location of sales of the firms, location of value added and the degree or specialisation of the firms. Sadorsky (2001) finds that an increase in exchange rates decreases the return to Canadian oil and gas stock prices. The findings for exposure to unexpected changes in the trade-weighted real exchange rate are quite similar as reported for the actual changes in the trade-weighted real exchange rate. Table VI shows that the number of industry portfolios significantly exposed to unexpected changes in the trade-weighted real exchange rate reduced to four industries as compared to five portfolios reported earlier to the actual changes in the trade-weighted real exchange rate. The five industries with significant foreign exchange exposure are namely: Aerospace & Defence, Households, Support Services, and Telecommunications. We observe that the five industries exhibit positive foreign exchange rate exposure coefficients, indicating that lower (higher) returns are associated with a depreciation (appreciation) of the value of the pound.

The findings at the firm-level shown in Table VII report that 8 of 61 significant exposure coefficients belong to Support Services, 5 are from the retail industry, 3 are from the distribution industry, 3 are from Electrical & Electronics industries, and 2 are from the Transport industry. As reported earlier, the evidence shows a high proportion of positive correlation between industries' returns and the changes in the pound's real exchange rate.

Please Insert Table VII

Henceforth, a possible explanation of the high proportion of positive coefficients is that a rise in the pound makes raw material and intermediate inputs cheaper for manufacturers and this tends to offset the adverse impact of the pound's appreciation on their international competitiveness. From Table VII, we observe that all companies in Aerospace & Defence, Households and Telecommunications industries exhibit positive foreign exchange rate exposure coefficients. This is consistent with the results reported in Table VI. These results indicate that these industries benefit from an

increase of the real value of the pound. Generally, 53% of the companies are positively exposed to unexpected changes in the trade-weighted real exchange rate compared to 50% in the case of the actual changes in the trade-weighted real exchange rate.

b. Lagged exchange rate exposure of UK industries

Although the previous findings of the study find evidence of significant contemporaneous association between exchange rate changes and stock returns, regression analysis is conducted for the purpose of examining whether lagged exchange rate changes affect stock returns for the sample. In order to test this hypothesis, stock returns of industries are regressed on lagged exchange rate changes. Hence, the findings of the relationship between industries' stock returns and lagged trade-weighted nominal exchange rate variable are summarised in Table VIII. On the whole, the results show stronger evidence of presence of a lagged relationship between industries' stock returns and the first, third, fourth and sixth lags of the trade-weighted nominal exchange rate changes than reported for contemporaneous changes in the trade-weighted nominal exchange rate. While five industries are exposed by contemporaneous changes (TWN_0), eight industries exhibit significant exposure coefficients with the first lag of the exchange rate factor while ten industries are significantly exposed by the third lag, nine industries are significantly exposed by the fourth lag, and fifteen industries are significantly exposed by the sixth lag of exchange rate changes.

Please Insert Table VIII

Nevertheless, it is realised that the results of lagged changes in the trade-weighted nominal exchange rate are consistent with the results of lagged changes in the trade-weighted real exchange rate. Table IX shows that the number of significant exposure coefficients for the third, fourth and sixth lags in exchange rate changes is relatively greater than the number of significant exposure coefficients to the contemporaneous changes in real exchange rates.

Please Insert Table IX

Hence, there is a strong evidence of the presence of a lagged relationship between exchange rate changes and UK industries' stock returns. The lagged relationship between stock returns and exchange rate movements can be attributed to the delay in the availability to the markets of financial information regarding the extent of industry performance affected by exchange rate changes. This is consistent with the arguments posited by Bartov and Bodnar (1994) that investors have difficulties in characterising the contemporaneous association between exchange rate changes and stock returns, leading to a lagged relationship between stock returns and changes in exchange rates. Thus, knowledge of the nature of the correlation of firms' or industries financial performance and contemporaneous changes in exchange rates requires a substantial amount of information regarding the foreign activities, foreign exchange exposure and hedging strategies which is presently lacking in most financial statements of companies.

2. Subperiod analysis

Britain joined the ERM on October 8, 1990. It remained a member until September 16, 1992. About 55% of Britain exports go to ERM member countries. The sample period is split into three subperiods. The Pre-ERM subperiod begins from January 1981 to September 1990. The ERM subperiod starts from October 1990 to September 1992. The Post-ERM subperiod starts from October 1992 to December 2001. Artis and Taylor (1994) examine whether the ERM has succeeded at stabilising volatility in members' exchange rates for the period before the UK became a member of the ERM. They document a reduction in the variability of trade-weighted effective exchange rate for the German Mark, French franc, and Italian Lira for the period from March 1979 to October 1990. The converse was true for the dollar and sterling pound nominal effective exchange rates, indicating a tendency towards increased volatility. They also find a strong and significant reduction in the volatility for the French franc and Italian lira real effective exchange rates, while the dollar real effective exchange rate has shown a significant rise in the volatility after 1979. Donnelly and Sheehy (1996) find a statistically significant relationship between the sterling nominal exchange rate and the returns of export-intensive portfolio for the pre-ERM subperiod. However, they

document no relationship between the sterling exchange rate and the returns on this portfolio during the former membership of the ERM. The main objective of this section is to identify the sensitivity of industries' stock returns to exchange rate movements over these three subperiods. The subperiod analysis is conducted with the trade-weighted nominal exchange rate and the trade-weighted real exchange rate. The exchange rate exposure coefficients at the industry level for each subperiod are first estimated. Broadly speaking, the sensitivities of industries' stock returns to changes in exchange rates are most evident in the period before the sterling pound joined the ERM. The percentage of significant exchange rate exposure coefficients declined in the second period when the pound joined the ERM and increased again after the UK left the ERM. This seems to support the common belief of a reduction in the volatility of exchange rates when the pound was a member of the ERM and hence a decline in the industries' exchange rate exposure.

Table X shows that the number of significant exposure coefficients to trade-weighted nominal exchange rate changes decreases from the pre-ERM to the In-ERM periods, and then increases again in the post-ERM period at the convenient significance levels. In general, the percentage of significant contemporaneous relationships between industries' stock returns and exchange rate changes has decreased from 15% (3 industries) for the pre-ERM period to 5% (only 1 industry) in the In-ERM period, and increased again to 20% (4 industries) in the post-ERM period. The results are consistent with those reported for the firm level results, which show lower exposure to exchange rate changes when the UK was a member of the ERM. The industries with significant exposure coefficients in the first subperiod are Distribution, Retail and Transport. The Distribution industry exhibits negative exposure coefficient, indicating a lower (higher) return with an appreciation (depreciation) of the pound. The Retail and Transport industries report positive exposure coefficients indicating a higher (lower) return with an appreciation (depreciation) of the pound. Guo and Wu (1998) indicate that the Taiwanese financial liberalization that took place in July 1987 has introduced an important structural break to firms' foreign exchange exposure. In the pre-liberalization period, no industry shows significant exposure to changes in the exchange rate. By contrast, in the post-liberalization period, exchange rate movements exert significant

contemporaneous and lagged impacts on the value of firms, particularly those with high involvement in international trade.

In fact, there are 9 industries with negative exposure coefficients, though they are statistically insignificant. Those industries are Aerospace & Defence industry, Beverage, Brewers & Tobacco industry, Chemical & Pharmaceutical industries, Diversified Industrials, Health Care, Leisure Industry, Media Agencies, Oil & Gas, and Telecommunication industries. The number of significant exposure coefficients reduced to only one industry (Chemicals & Pharmaceuticals) in the In-ERM period. It seems that an appreciation (depreciation) of the pound has a favourable (adverse) impact on the Chemical & Pharmaceutical industries' returns. On the other hand, the number of negative coefficients has increased to 10 industries. As for the third subperiod (Post-ERM), 4 industries have significant exposure coefficients, and all of them are positive. These industries are Retail, Support Services, Telecommunications and Transport. The number of negative coefficients has now decreased to 6 industries. On the whole, the number of negative relationships between industry returns and changes in the trade-weighted nominal exchange rate is higher for the second subperiod as compared to the first and the third subperiod. The results can be explained as an increase in the number of exporting companies that benefit from a depreciation of the pound. The results for exposure to unexpected changes in the trade-weighted nominal exchange rate are quite similar as reported for the actual changes in the trade-weighted exchange rate. Table X shows that the number of significant exposure coefficients decreases from three industries in the pre-ERM to only one industry in the In-ERM subperiod, and then increases again to five industries in the post-ERM period. The results are consistent with those reported for the actual changes in the trade-weighted nominal exchange rate with one exception for the third subperiod since there are five industries with significant exposure rather than four industries as compared to the results for the actual changes in trade-weighted nominal exchange rate. Table XI presents a comparison between the results of actual and unexpected changes in the trade-weighted nominal exchange rates.

On the whole, Table XII shows that the proportion of significant relationships between industries' stock returns and nominal exchange rate changes has decreased from

10% (2 out of 20 industries) and the pre-ERM period to 10% (2 out of 20 industries) in the In-ERM period, and increased again to 25% (5 out of 20 industries) in the post-ERM period. In the first subperiod, the industries with significant exposure coefficients are Distribution and Transport. The Distribution industry exhibits a negative exposure coefficient, indicating a lower (higher) return with an appreciation (depreciation) of the pound. The Transport industries report a positive exposure coefficient indicating, a higher (lower) return with an appreciation (depreciation) of the pound. In the second subperiod, the industries with significant exposure coefficients are Aerospace & Defence and Construction. Both portfolios exhibit negative exposure coefficients, indicating a lower (higher) return with an appreciation (depreciation) of the pound. On the other hand, the industries with significant exposure coefficients in the third subperiod are Electrical & Electronics, Packaging, Printing & Papers, Retail, Support Services, Telecommunications, and Transport. All industry portfolios exhibit positive exposure coefficients, indicating a higher (lower) return with an appreciation (depreciation) of the pound. Additionally, there are 13 industries with negative exposure coefficients, though they are statistically insignificant in the Pre-ERM period. Those industries are Aerospace & Defence, Beverage, Brewers & Tobacco, Chemical & Pharmaceutical, Diversified Industrials, Food manufacturing, Health Care, Leisure, Media Agencies, Oil & Gas, Packaging, Printing & Papers, Support Services and Telecommunication. On the other hand, the number of negative coefficients has increased to 17 industries in the In-ERM subperiod, though they are not significant. As for the third subperiod (Post-ERM), the number of negative coefficients has now decreased to 6 industries. On the whole, the number of negative relationships between industry returns and changes in the trade-weighted real exchange rate is higher for the second subperiod as compared to the first and the third subperiod.

The results can be explained as an increase in the number of exporting companies that benefit from a depreciation of the pound. Kiymaz (2003) finds that firms are less exposed to exchange rate risk after the crises than before the crises. This means that firms likely pay more attention to their exchange exposure following the crises. The results for exposure to unexpected changes in the trade-weighted real exchange rate are quite similar as reported for the actual changes in the trade-weighted real exchange rate.

Table XII shows that the number of significant exposure coefficients decreases from 2 out of 20 industries in the pre-ERM to only 1 industry in the In-ERM periods and then increases again to 8 industries in the post-ERM period. The results are consistent with those reported for the actual changes in the trade-weighted nominal exchange rate with one exception that the third subperiod reports 8 industries with significant exposure. Table XIII presents a comparison between the results of actual and unexpected changes in the trade-weighted real exchange rates.

V. Conclusion

It can be concluded that the empirical evidence supports the view that UK industries' stock returns are affected by foreign exchange rate exposure. A higher percentage of significant foreign exchange rate exposure is documented for the trade-weighted nominal exchange rate. Similarly, the number of significant correlations between industries' stock returns and changes in trade-weighted real exchange rate is relatively lower than the movements in trade-weighted nominal exchange rates. On average, the findings provide a stronger support for the trade-weighted nominal and real exchange rates being an economic variable which affect industries' stock returns. The findings of this piece of research and literature review show a high number of positive exposure coefficients among industries with significant exchange rate exposure, indicating a higher proportion of industries benefit as the pound appreciates.

The Transport industry exhibits positive and significant exposure to the actual and unexpected changes in exchange rate measures, except for unexpected changes in the trade-weighted real exchange rate. In addition, the Retail industry has positive exposure coefficients for all exchange rates (actual and unexpected) and all of its coefficients are significant except for unexpected changes in the trade-weighted real exchange rate. Furthermore, the Diversified Industries have negative exposure coefficients for the actual and unexpected changes in exchange rates, though all exposure coefficients are statistically insignificant as well. Additionally, the Aerospace & Defence Industries have negative exposure coefficients for the actual and unexpected changes in exchange rates, except for unexpected change in the trade-weighted real exchange rate, though its

exposure coefficients are insignificant. Meanwhile, Construction, Foods, Households, Oil and Gas and Telecommunications have positive exposure to the actual and unexpected changes in exchange rates. Finally, the majority of significant exposure coefficients are positive, indicating that the industries' stock returns benefit from an appreciation of the pound against the other foreign currencies. It can also be noted that there is a statistically significant lagged relationship between changes in the trade-weighted nominal and real exchange rates. The findings provide a stronger evidence of the presence of a lagged association between industries' stock returns and the first, third, fourth and sixth monthly lag in exchange rate changes than the contemporaneous changes in exchange rates.

Moreover, the sensitivities of industries' stock returns to exchange rate fluctuations are most evident in the period before joining the ERM and after departure from the ERM (post-ERM). The proportion of industries with a significant exchange rate exposure declined in the second subperiod when the pound was in the ERM and increased again after the UK left it. The percentage of significantly positive exchange rate exposure coefficients is higher among industries in the third subperiod for different exchange rate series. The analysis also shows that the percentage of significantly positive exchange rate exposure coefficients is higher in the third subperiod compared to the first and second subperiods. The analysis also indicates that the percentage of significantly negative exchange rate exposure coefficients is higher in the second subperiod compared to the first and third subperiods. This is evidence that there are more industries, which are more positively affected by a depreciation of the pound during joining the ERM.

This study provides important implications for public policy makers who wish to understand links between policies that affect exchange rates and relative wealth. Nevertheless, the findings of this study assert that it is worth considering the effect of exchange rate movements in portfolio optimisation, value-at-risk, performance attribution, and other analyses that seek to understand the sources of co-variation among stock returns. The empirical results of this study should help investors to examine how common stock returns of various sectors react to exchange rate fluctuations when making

financial decisions and prove useful for financial managers when measuring exposure to foreign exchange rate changes. Future research in the area should consider additional factors that might affect a firm's and an industry's exposure to exchange rate changes. One potential idea is to find a way to segregate the oligopolistic vs. competitive group into four distinct categories: oligopolistic, perfectly competitive, monopolistically competitive, and monopoly. If a way to segregate industries in this manner was available, the results of this particular analysis might be more insightful than they are in this study. Another issue is the impact of regulation on the exposure of an industry's exchange rate. In other words, future research needs to examine whether regulated industries, such as commercial banks and public utilities are less exposed to exchange rate changes than those industries that are largely unregulated. Additionally, this type of study could be expanded to other countries with similar institutional and/or accounting factors. These replications are expected to enhance the understanding of the role of accounting-related factors in exchange rate exposure. Finally, there is a need for more research to determine exchange rate exposure of UK companies at the firm level and at the industry level alike.

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Table I: The sample selection stages

Datastream Firms	Number of Firms Included	Total Number of Firms
Total number of extracted firms from Datastream Firms without name and unclassified Firms without industrial classification	1753 (229) (19)	
Total firms		1505
Financial firms	(219)	
Total firms remaining		1286
Total number of firms without full monthly data on return index Total number of firms without data on total sales and total assets	(885) (37)	
Total number of firms qualified for final inclusion		364

Table II: The number of companies in each industry sector according to the Industrial Classification

			Log (Total Assets)						
Industry	MNEM	No	Mean	Min	1Q	Median	3Q	Max	Std
Aerospace & Defence	AERSP	7	11.7	8.0	10.8	11.9	12.6	15.0	1.4
Automobiles	AUTMB	6	11.4	9.0	9.8	11.3	12.3	15.2	1.8
Beverage, Brewers & Tobacco	BEVES	9	12.9	9.3	10.9	11.9	15.4	17.8	2.4
Chemicals & Pharmaceuticals	CHMCL	13	12.5	8.2	10.8	12.8	14.1	16.9	2.2
Construction	CNSBM	45	11.6	3.8	10.2	11.6	13.1	17.0	1.9
Distribution	DISTR	23	10.5	7.0	9.5	10.4	11.6	15.3	1.7
Diversified Industrials	DIVIN	9	11.3	8.1	9.7	10.4	11.4	16.4	2.4
Electrical & Electronics	ELTNC	18	10.6	7.7	9.1	10.3	11.8	16.0	1.8
Engineering - General	ENGEN	51	10.7	7.0	9.5	10.6	11.9	15.2	1.7
Food manufacturing	FOODS	15	12.3	5.8	10.2	13.2	14.2	17.4	2.6
Households	HHOLD	36	10.2	5.7	9.1	10.0	11.2	15.0	1.7
Health Care	HLTHC	5	10.1	7.3	8.6	9.7	11.3	13.9	2.0
Leisure Industry	LESUR	25	11.3	6.3	9.4	11.2	13.1	16.0	2.3
Media Agencies	MEDIA	22	11.9	7.8	10.1	11.8	14.0	16.1	2.2
Oil & Gas	OILGS	4	13.9	8.3	9.8	15.0	17.2	18.4	3.6
Packaging, Printing & Papers	PCKGN	6	11.6	7.9	10.4	11.3	12.5	15.2	1.7
Retail	RTAIL	30	11.8	7.2	10.2	11.5	13.7	16.3	2.1
Support Services	SUPSV	24	11.1	6.7	10.2	11.2	12.4	15.2	1.6
Telecommunications	TELEQ	5	12.0	7.0	10.8	11.5	13.6	16.3	2.4
Transport	TRNSP	11	12.0	6.2	10.7	11.9	13.3	15.8	2.0
Total		364							

Note: the table provides information about Datastream Mnemonic (MNEM) and number of companies in each industry and its total assets.

Table III: **A Summary of industries' exposure to actual and unexpected changes in foreign exchange rates of the total sample period from January 1981 to December 2001**

Industry	TWN		TWR	
	Actual	Unexpected	Actual	Unexpected
Aerospace & Defence	N	N	N	P
Automobiles & Auto Parts	P	P	P	N
Beverage, Brewers & Tobacco	N	N	N	P
Chemicals & Pharmaceuticals	N	P	N	N
Construction	PS	PS	P	P
Distribution	N	N	NS	P
Diversified Industrials	N	N	N	N
Electrical & Electronics	PS	P	PS	N
Engineering – General	P	P	N	P
Food manufacturing	P	PS	P	P
Households	PS	P	P	PS
Health Care	N	N	N	P
Leisure	P	N	N	N
Media Agencies	P	P	N	N
Oil & Gas	P	P	P	P
Packaging, Printing & Papers	N	P	N	P
Retail	PS	PS	PS	P
Support Services	PS	PS	PS	PS
Telecommunications	P	P	P	PS
Transport	PS	PS	PS	P

Note: N is negative exchange rate exposure coefficient, P is positive exchange rate exposure coefficient, NS is negative and significant exchange rate exposure, and PS is positive and significant exchange rate exposure coefficient. TWN is the trade-weighted nominal exchange rate. TWR is the trade-weighted real exchange rate.

Table IV: Exposure to actual and unexpected changes in trade-weighted nominal exchange rate and industry's stock returns

Industry	TWN Coef.		Market Coef.		R^2		DW	
	Actual Changes	Unexp. Changes	Actual Changes	Unexp. Changes	Actual Changes	Unexp. Changes	Actual Changes	Unexp. Changes
Aerospace and Defence	-0.113	-0.101	0.99***	0.98***	26.8%	22.7%	1.96	1.96
Automobiles and Auto Parts	0.075	0.126	1.04***	1.03***	23.1%	22.1%	2.07	2.07
Beverage, Brewers & Tobacco	-0.041	-0.002	0.82***	0.81***	28.9%	27.9%	2.11	2.11
Chemicals and Pharmaceuticals	-0.051	0.085	1.05***	1.04***	35.4%	35.4%	2.18	2.18
Construction	0.109*	0.123*	1.00***	0.99***	55.8%	42.8%	2.09	2.09
Distribution	-0.109	-0.177	0.93***	0.92***	21.4%	26.4%	2.01	2.01
Diversified Industrials	-0.175	-0.222	0.94**	0.94***	10.6%	10.6%	2.02	2.02
Electrical & Electronics	0.184*	0.168	0.98***	0.97***	22.2%	27.2%	2.02	2.02
Engineering – General	0.029	0.048	0.92***	0.91***	52.1%	40.1%	2.04	2.04
Food manufacturing	0.108	0.214*	0.95***	0.94***	22.6%	26.7%	1.93	1.93
Households	0.121*	0.121	0.89***	0.88***	31.4%	29.3%	1.99	1.99
Health Care	-0.175	-0.037	0.89**	0.88**	8.8%	9.8%	1.89	1.89
Leisure	0.051	-0.034	0.86***	0.85***	21.5%	23.5%	1.99	1.99
Media Agencies	0.047	0.038	1.02***	1.01***	35.7%	28.7%	2.09	2.09
Oil & Gas	0.122	0.059	0.86***	0.85***	11.6%	12.5%	2.10	2.09
Packaging, Printing and Papers	-0.099	0.065	0.87***	0.86***	22.5%	19.5%	1.88	1.88
Retail	0.256**	0.224**	0.93***	0.92***	42.2%	26.1%	2.00	2.00
Support Services	0.322**	0.358**	0.96***	0.95***	21.7%	11.7%	1.96	1.95
Telecommunications	0.287	0.318	1.20***	1.17***	24.4%	26.4%	1.96	1.96
Transport	0.447**	0.502**	1.08***	1.07***	23.3%	29.3%	2.08	2.08

Note: TWN Coef refers to the Trade-weighted nominal exchange rate exposure coefficient for each industry estimated from the regression model 2; Sig refers to the significant level, Market Coef refers to market return exposure, R^2 refers to the adjusted R^2 and DW refers to the Durbin-Watson statistic. * Significant at the 10% confidence level, ** Significant at the 5% confidence level, and *** Significant at the 1% confidence level.

Table V: Exposure coefficients of actual and unexpected changes in trade-weighted nominal exchange rate at industry level

Industry	No	% Sig.		% Positive		Sig. at 10%	
		Actual Changes	Unexp. Changes	Actual Changes	Unexp. Changes	Actual Changes	Unexp. Changes
Aerospace & Defence	7	29%	14%	50%	100%	100%	100%
Automobiles	6	0%	0%	0%	0%	0%	0%
Beverage, Brewers & Tobacco	9	33%	22%	33%	50%	100%	50%
Chemicals & Pharmaceuticals	13	0%	0%	0%	0%	0%	0%
Construction	45	20%	18%	78%	75%	56%	50%
Distribution	23	9%	13%	0%	0%	100%	67%
Diversified Industrials	9	0%	0%	0%	0%	0%	0%
Electrical & Electronics	18	33%	28%	83%	60%	50%	20%
Engineering – General	51	16%	20%	63%	60%	25%	60%
Food manufacturing	15	0%	0%	0%	0%	0%	0%
Households	36	11%	11%	75%	100%	75%	75%
Health Care	5	0%	0%	0%	0%	0%	0%
Leisure Industry	25	20%	24%	60%	33%	80%	83%
Media Agencies	22	18%	14%	50%	67%	100%	33%
Oil & Gas	4	0%	25%	0%	0%	0%	100%
Packaging, Printing & Papers	6	33%	17%	0%	0%	50%	100%
Retail	30	20%	30%	50%	67%	67%	89%
Support Services	24	13%	21%	67%	80%	0%	100%
Telecommunications	5	0%	40%	0%	0%	0%	100%
Transport	11	18%	9%	100%	100%	50%	0%
Total	364	16%	17%	61%	64%	61%	67%

Note: No refers to the number of companies in each industry sector, % Sig refers to the percentage of significant exposure coefficients in each industry, % Positive means the percentage of positive exposure coefficients to total significant exposure coefficients in each industry, and Sig. at 10% refers to the percentage of exposure coefficients to total significant exposure coefficients in each industry at 10% confidence level.

Table VI: Exposure to actual and unexpected changes in trade-weighted real exchange rate and industry's stock returns

Industry	TWR Coef.		Market Coef.		R^2		DW	
	Actual Changes	Unexp. Changes	Actual Changes	Unexp. Changes	Actual Changes	Unexp. Changes	Actual Changes	Unexp. Changes
Aerospace and Defence	-0.204	0.211**	0.987***	1.108***	22.8%	29.2%	1.96	2.08
Automobiles and Auto Parts	0.047	-0.161	1.038***	0.980***	22.1%	22.8%	2.07	1.96
Beverage, Brewers & Tobacco	-0.079	0.120	0.822***	1.029***	27.9%	22.1%	2.11	2.07
Chemicals and Pharmaceuticals	-0.070	-0.022	1.046***	0.814***	35.4%	27.9%	2.18	2.11
Construction	0.042	0.123	0.997***	1.040***	42.8%	35.5%	2.09	2.18
Distribution	-0.182*	0.107	0.924***	0.988***	26.4%	42.8%	2.01	2.09
Diversified Industrials	-0.204	-0.189	0.941***	0.915***	10.6%	26.4%	2.02	2.01
Electrical & Electronics	0.140*	-0.222	0.981***	0.932***	27.2%	10.6%	2.02	2.02
Engineering – General	-0.028	0.174	0.919***	0.971***	40.1%	27.2%	2.04	2.02
Food manufacturing	0.057	0.032	0.948***	0.910***	26.6%	40.1%	1.93	2.04
Households	0.042	0.217*	0.891***	0.940***	29.3%	26.7%	1.99	1.93
Health Care	-0.244	0.077	0.885**	0.881***	9.9%	29.3%	1.89	1.99
Leisure	-0.025	-0.092	0.861***	0.880**	23.5%	9.8%	1.99	1.89
Media Agencies	-0.042	-0.021	1.016***	0.851***	28.7%	23.5%	2.09	1.99
Oil & Gas	0.056	0.014	0.857***	1.008***	12.5%	28.7%	2.09	2.09
Packaging, Printing and Papers	-0.089	0.019	0.866***	0.846***	19.5%	12.5%	1.88	2.09
Retail	0.190**	0.071	0.933***	0.860***	26.1%	19.5%	2.00	1.88
Support Services	0.192*	0.184**	0.964***	0.921***	11.6%	26.1%	1.95	2.00
Telecommunications	0.162	0.283**	1.199***	0.954***	26.4%	11.7%	1.96	1.95
Transport	0.382**	0.272	1.086***	1.189***	29.2%	26.4%	2.08	1.96

Note: TWR Coef refers to the Trade-weighted real exchange rate exposure coefficient for each industry estimated from the regression model (2); Sig refers to the significant level, Market Coef refers to market return exposure, R^2 refers to the adjusted R-squared and DW refers to the Durbin-Watson statistic. * Significant at the 10% confidence level, ** Significant at the 5% confidence level, and *** Significant at the 1% confidence level.

Table VII: Summary of exposure to actual and unexpected changes in trade-weighted real exchange rate at industry level

Industry	No	% Sig.		% Positive		Sig. at 10%	
		Actual Changes	Unexp. Changes	Actual Changes	Unexp. Changes	Actual Changes	Unexp. Changes
Aerospace & Defence	7	0%	14%	0%	100%	0%	100%
Automobiles	6	17%	17%	100%	0%	0%	0%
Beverage, Brewers & Tobacco	9	44%	33%	25%	33%	75%	67%
Chemicals & Pharmaceuticals	13	0%	0%	0%	0%	0%	0%
Construction	45	18%	20%	50%	67%	38%	44%
Distribution	23	13%	17%	0%	0%	67%	50%
Diversified Industrials	9	0%	11%	0%	0%	0%	0%
Electrical & Electronics	18	17%	28%	67%	80%	0%	20%
Engineering - General	51	20%	20%	60%	50%	30%	20%
Food manufacturing	15	13%	7%	50%	100%	50%	0%
Households	36	19%	6%	43%	100%	57%	100%
Health Care	5	0%	0%	0%	0%	0%	0%
Leisure Industry	25	20%	20%	60%	40%	40%	40%
Media Agencies	22	5%	0%	0%	0%	100%	0%
Oil & Gas	4	0%	0%	0%	0%	0%	0%
Packaging, Printing & Papers	6	17%	17%	0%	0%	0%	100%
Retail	30	17%	17%	60%	60%	80%	60%
Support Services	24	33%	21%	50%	60%	75%	80%
Telecommunications	5	0%	20%	0%	100%	0%	100%
Transport	11	18%	9%	100%	100%	0%	100%
Total	364	17%	15%	50%	53%	48%	47%

Note: No refers to the number of companies in each industry, % Sig refers to the percentage of significant exposure coefficients in each industry, % Positive means the percentage of positive exposure coefficients to total significant exposure coefficients in each industry, and Sig. at 10% refers to the percentage of exposure coefficients to total significant exposure coefficients in each industry at 10% confidence level.

Table VIII: Exposure to lagged changes in the trade-weighted nominal exchange rate

Industry	TWN_0	TWN_{-1}	TWN_{-2}	TWN_{-3}	TWN_{-4}	TWN_{-5}	TWN_{-6}
Aerospace & Defence	-0.113	-0.002	-0.083	-0.279*	-0.285*	0.034	-0.017
Automobiles	0.075	-0.136	-0.050	-0.264	-0.235	-0.125	-0.432**
Beverage, Brewers & Tobacco	-0.041	-0.075	-0.109	0.119	0.189**	0.145*	-0.225**
Chemicals & Pharmaceuticals	-0.051	-0.278**	-0.280***	-0.074	-0.147	0.117	-0.337***
Construction	0.109*	0.128*	-0.080	-0.244***	-0.042	0.051	-0.331***
Distribution	-0.109	0.117	-0.049	-0.091	-0.407***	-0.079	-0.335**
Diversified Industrials	-0.175	-0.086	-0.192	0.027	-0.318	-0.237	-0.205
Electrical & Electronics	0.184*	0.090	-0.120	-0.284**	-0.147	-0.045	-0.221**
Engineering - General	0.029	0.037	-0.121**	-0.285***	-0.314***	-0.002	-0.272***
Food manufacturing	0.108	-0.262**	-0.155	0.025	-0.094	-0.079	-0.133
Households	0.121*	0.135*	0.031	-0.134*	-0.229**	-0.017	-0.206**
Health Care	-0.175	-0.484*	-0.231	0.201	-0.104	0.156	-0.016
Leisure Industry	0.051	0.215**	0.037	-0.146*	-0.030	0.073	-0.253**
Media Agencies	0.047	0.043	-0.204**	-0.087	-0.269**	-0.089	-0.323***
Oil & Gas	0.122	0.268	0.196	0.068	-0.325*	-0.143	-0.496**
Packaging, Printing & Papers	-0.099	-0.183	-0.036	-0.247*	-0.327**	0.037	-0.274**
Retail	0.256**	0.228**	0.012	-0.258**	0.057	0.000	-0.190**
Support Services	0.322**	0.211*	-0.056	-0.188*	-0.101	0.137	-0.272**
Telecommunications	0.287	0.118	0.047	-0.123	0.019	-0.051	-0.158
Transport	0.447**	0.060	0.020	-0.258*	-0.265*	-0.309**	-0.531***

Note: TWN_0 refers to the actual changes in the trade-weighted nominal exchange rate in month t, TWN_{-1} refers to the actual changes in the trade-weighted nominal exchange rate with 1-month lag, TWN_{-2} refers to the actual changes in the trade-weighted nominal exchange rate with 2-month lag and so on, * Significant at the 10% confidence level, ** Significant at the 5% confidence level, and *** Significant at the 1% confidence level.

Table IX: Exposure to lagged changes in the trade-weighted real exchange rate

Industry	TWR_0	TWR_{-1}	TWR_{-2}	TWR_{-3}	TWR_{-4}	TWR_{-5}	TWR_{-6}
Aerospace & Defence	-0.204	-0.143	-0.054	-0.275*	-0.382**	-0.015	-0.058
Automobiles	0.047	-0.198	-0.005	-0.277	-0.283	-0.124	-0.356*
Beverage, Brewers & Tobacco	-0.079	-0.127	-0.108	0.133	0.160*	0.159*	-0.215**
Chemicals & Pharmaceuticals	-0.070	-0.375***	-0.225**	-0.052	-0.228**	0.074	-0.335***
Construction	0.042	-0.013	-0.071	-0.232***	-0.130**	0.032	-0.336***
Distribution	-0.182*	-0.059	-0.062	-0.120	-0.483***	-0.102	-0.356**
Diversified Industrials	-0.204	-0.139	-0.179	0.008	-0.371	-0.270	-0.223
Electrical & Electronics	0.140*	-0.074	-0.054	-0.285**	-0.221**	-0.090	-0.251**
Engineering - General	-0.028	-0.083	-0.106*	-0.268***	-0.394***	-0.032	-0.291***
Food manufacturing	0.057	-0.352***	-0.136	0.020	-0.175*	-0.101	-0.151
Households	0.042	-0.005	0.013	-0.152*	-0.298***	-0.066	-0.242**
Health Care	-0.244	-0.560**	-0.256	0.136	-0.200	0.066	-0.060
Leisure Industry	-0.025	0.070	0.056	-0.112	-0.099	0.052	-0.258**
Media Agencies	-0.042	-0.129	-0.108	-0.083	-0.346***	-0.137	-0.348***
Oil & Gas	0.056	0.169	0.209	-0.026	-0.380**	-0.162	-0.491**
Packaging, Printing & Papers	-0.089	-0.331**	-0.063	-0.245*	-0.385**	-0.014	-0.287**
Retail	0.190**	0.090	0.042	-0.251***	-0.013	-0.018	-0.206**
Support Services	0.192*	0.054	-0.072	-0.144	-0.183*	0.124	-0.287**
Telecommunications	0.162	-0.093	0.208	-0.183	-0.078	-0.090	-0.209
Transport	0.382**	-0.063	0.000	-0.234	-0.369**	-0.330**	-0.531***

Note: TWR_0 refers to the actual changes in the trade-weighted real exchange rate in month t, TWR_{-1} refers to the actual changes in the trade-weighted real exchange rate with 1-month lag, TWR_{-2} refers to the actual changes in the trade-weighted real exchange rate with 2-month lag and so on, * Significant at the 10% confidence level, ** Significant at the 5% confidence level, and *** Significant at the 1% confidence level.

Table X: A Summary of exposure coefficients of actual and unexpected changes in the trade-weighted nominal exchange rate of the subperiod analysis at the industry level

Industry	Pre-ERM (Jan. 1981 to Sep. 1990)		In-ERM (Oct. 1990 to Sep. 1992)		Post-ERM (Oct. 1992 to Dec. 2001)	
	Actual Changes	Unexp Changes	Actual Changes	Unexp Changes	Actual Changes	Unexp Changes
Aerospace & Defence	-0.149	-0.193	-1.375	-1.106	-0.126	-0.098
Automobiles	0.186	0.271	0.698	0.670	-0.087	-0.087
Beverage, Brewers & Tobacco	-0.080	-0.052	-0.130	-0.236	0.019	0.060
Chemicals & Pharmaceuticals	-0.062	0.050	1.223*	1.224*	-0.114	0.021
Construction	0.101	0.093	-0.745	-0.551	0.125	0.145
Distribution	-0.306*	-0.436**	0.922	0.915	0.100	0.068
Diversified Industrials	-0.037	-0.043	0.102	-0.804	-0.407	-0.477
Electrical & Electronics	0.114	0.083	-0.163	0.163	0.276	0.246
Engineering - General	0.089	0.124	0.106	-0.078	-0.065	-0.078
Food manufacturing	0.040	0.129	0.261	0.508	0.199	0.313**
Households	0.055	0.044	0.714	0.411	0.204	0.210
Health Care	-0.371	-0.122	-1.481	-0.513	0.136	0.086
Leisure Industry	-0.021	-0.005	-0.213	0.156	0.082	-0.050
Media Agencies	-0.052	-0.082	0.115	-0.372	0.168	0.195
Oil & Gas	-0.003	-0.117	0.249	-0.628	0.192	0.215
Packaging, Printing & Papers	0.077	0.133	-0.374	-0.275	-0.152	0.012
Retail	0.245**	0.204*	0.060	-0.333	0.260**	0.238*
Support Services	0.144	0.106	-0.258	0.569	0.527***	0.592***
Telecommunications	-0.111	-0.043	-0.138	-0.115	0.842**	0.836*
Transport	0.365**	0.348*	-0.475	-0.457	0.573**	0.715**

Note: Pre-ERM refers to the period before the UK joined the ERM, In-ERM refers to the period when the UK was a member in the ERM, and Post-ERM refers to the period after the UK departure from the ERM.

Table XI: A Summary of the results of actual and unexpected changes in the trade-weighted nominal exchange rate

Industry	Pre-ERM (Jan.1981 to Sep.1990)		In-ERM (Oct.1990 to Sep.1992)		Post-ERM (Oct.1992 to Dec.2001)	
	Actual	Unexp	Actual	Unexp	Actual	Unexp
Aerospace & Defence	N	N	N	N	N	N
Automobiles	P	P	P	P	N	N
Beverage, Brewers & Tobacco	N	N	N	N	P	P
Chemicals & Pharmaceuticals	N	P	PS	PS	N	P
Construction	P	P	N	N	P	P
Distribution	NS	NS	P	P	P	P
Diversified Industrials	N	N	P	N	N	N
Electrical & Electronics	P	P	N	P	P	P
Engineering – General	P	P	P	N	N	N
Food manufacturing	P	P	P	P	P	PS
Households	P	P	P	P	P	P
Health Care	N	N	N	N	P	P
Leisure Industry	N	N	N	P	P	N
Media Agencies	N	N	P	N	P	P
Oil & Gas	N	N	P	N	P	P
Packaging, Printing & Papers	P	P	N	N	N	P
Retail	PS	PS	P	N	PS	PS
Support Services	P	P	N	P	PS	PS
Telecommunications	N	N	N	N	PS	PS
Transport	PS	PS	N	N	PS	PS

Note: P is positive exposure coefficient, N is negative exposure coefficient, PS is positive and significant exposure coefficient and NS is negative and significant exposure coefficient. Pre-ERM refers to the period before the UK joined the ERM, In-ERM refers to the period when the UK was a member in the ERM, and Post-ERM refers to the period after the UK departure from the ERM.

Table XII: A Summary of exposure coefficients of actual and unexpected changes in the trade-weighted real exchange rate of the subperiod analysis at the industry level

Industry	Pre-ERM (Jan. 1981 to Sep. 1990)		In-ERM (Oct. 1990 to Sep. 1992)		Post-ERM (Oct. 1992 to Dec. 2001)	
	Actual Changes	Unexp Changes	Actual Changes	Unexp Changes	Actual Changes	Unexp Changes
Aerospace & Defence	-0.259	-0.306	-1.679*	-1.366	-0.174	-0.080
Automobiles	0.113	0.189	-0.071	-0.022	-0.078	-0.027
Beverage, Brewers & Tobacco	-0.167	-0.114	-0.431	-0.355	0.036	0.069
Chemicals & Pharmaceuticals	-0.108	0.035	0.363	0.703	-0.102	0.111
Construction	0.001	-0.002	-1.392**	-1.103*	0.114	0.247**
Distribution	-0.386**	-0.506**	0.077	0.472	0.041	0.140
Diversified Industrials	-0.102	-0.090	-0.148	-0.920	-0.435	-0.468
Electrical & Electronics	0.035	0.024	-0.649	-0.164	0.279	0.338*
Engineering - General	0.001	0.047	-0.595	-0.406	-0.098	-0.058
Food manufacturing	-0.056	0.073	-0.003	0.227	0.188	0.380**
Households	-0.074	-0.068	-0.076	-0.033	0.183	0.230
Health Care	-0.491	-0.239	-1.720	-0.428	0.136	0.073
Leisure Industry	-0.091	-0.050	-0.660	-0.215	0.100	0.027
Media Agencies	-0.166	-0.182	-0.776	-0.826	0.142	0.309*
Oil & Gas	-0.006	-0.088	-0.487	-0.937	0.083	0.132
Packaging, Printing & Papers	-0.003	0.062	-1.135	-0.753	-0.163	0.109
Retail	0.130	0.067	-0.491	-0.419	0.261**	0.315**
Support Services	-0.034	-0.058	-0.907	0.117	0.495**	0.671***
Telecommunications	-0.170	-0.085	-0.827	-0.711	0.733*	0.941**
Transport	0.292*	0.300*	-1.286	-1.157	0.551**	0.781**

Note: Pre-ERM refers to the period before the UK joined the ERM, In-ERM refers to the period when the UK was a member in the ERM, and Post-ERM refers to the period after the UK departure from the ERM.

Table XIII: A Summary of the results of actual and unexpected changes in the trade-weighted Real exchange rate

Industry	Pre-ERM (Jan. 1981 to Sep. 1990)		In-ERM (Oct. 1990 to Sep. 1992)		Post-ERM (Oct. 1992 to Dec. 2001)	
	Actual	Unexp	Actual	Unexp	Actual	Unexp
Aerospace & Defence	N	N	NS	N	N	N
Automobiles	P	P	N	N	N	N
Beverage, Brewers & Tobacco	N	N	N	N	P	P
Chemicals & Pharmaceuticals	N	P	P	P	N	P
Construction	P	N	NS	NS	P	PS
Distribution	NS	NS	P	P	P	P
Diversified Industrials	N	N	N	N	N	N
Electrical & Electronics	P	P	N	N	PS	PS
Engineering - General	P	P	N	N	N	N
Food manufacturing	N	P	N	P	P	PS
Households	N	N	N	N	P	P
Health Care	N	N	N	N	P	P
Leisure Industry	N	N	N	N	P	P
Media Agencies	N	N	N	N	P	PS
Oil & Gas	N	N	N	N	P	P
Packaging, Printing & Papers	N	P	N	N	N	P
Retail	P	P	N	N	PS	PS
Support Services	N	N	N	P	PS	PS
Telecommunications	N	N	N	N	PS	PS
Transport	PS	PS	N	N	PS	PS

Note: P is positive exposure coefficient, N is negative exposure coefficient, PS is positive and significant exposure coefficient and NS is negative and significant exposure coefficient. Pre-ERM refers to the period before the UK joined the ERM, In-ERM refers to the period when the UK was a member in the ERM, and Post-ERM refers to the period after the UK departure from the ERM.