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Analysis of Foreign Currency Exposure of the New Zealand Stock Market

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Abstract

This paper analyses the impact of foreign currency exposure on the value of the New Zealand public listed companies using the New Zealand/US exchange rate and Trade Weighted Index factor return. Augmented market model (Adler and Dumas, 1984; Di Iorio and Faff, 2000; Dominguez and Tesar, 2001) would be employed to study the relationship between exchange rate movements and firm value. Using daily data, we test the following hypotheses in this paper: a) Foreign currency exposure is a function of firm's size and its industry affiliation; b) Foreign currency exposure is a function of financial indicators, such as dividend yield, liquidities and P/E ratio. However, we find very weak and ambiguous evidence for the foreign currency exposure on the value of New Zealand companies.

Key words: Foreign Currency Exposure, New Zealand.

JEL classifications: G14, G15.

Introduction

The rapid expansion in international trade and adoption of a floating exchange rate by many countries after the 1970s led to enlarging exchange rate volatility. As a major source of macroeconomic uncertainty affecting firms, the exchange rate volatility and the impact of foreign currency exposure on the firm value have been studied extensively in some theoretical literature for several decades (Shapiro, 1975; Hodder, 1982; Adler and Dumas, 1984). Recently some empirical literature has also emerged. For example, Booth and Rotenberg (1990) analysed the relationship between the foreign currency exposure and the Canadian dollar/US dollar exchange rate using a sample of Canadian firms. A decent number of empirical studies examine the sensitivity of US firms to changes in the exchange rate. The seminal study was conducted by Jorion (1990). He investigated the sensitivity of US multinationals to changes in a trade weighted index and provided weak evidence of exchange rate exposure. Many other studies gave the similar results (see, e.g. Amihud, 1994; Bartov and Bodnar, 1994).

The empirical studies on other countries show an ambiguous picture. The Australian stock market is analysed in Loudon (1993), Khoo (1994) and Iorio and Faff (2000). Both Loudon (1993) and Khoo (1994) failed to establish a robust sensitive relationship between the stock returns and changes in the exchange rate. The results are consistent with those reporting weak evidence of exchange rate exposure in the US equities market. However, Iorio and Faff (2000) analysed the foreign exchange exposure of the Australian equities market using an augmented market model and found stronger evidence of exposure based on daily data. A stronger lagged response than contemporaneous response and some evidence of significant exchange rate exposures of the predicted sign in several industries have also been observed.

The Japan stock market has been explored by He and Ng (1998). In a sample of 171 Japanese multinationals they found that about 25 percent of their stock returns experienced economically significant positive exposure effects for the period from 1979 to 1993. They also checked the determinants of foreign currency exposure. Highly leveraged firms or firms with low liquidity are likely to have smaller exposures. Foreign exposure is found to increase with firm size.

Dominguez and Tesar (2003) find a statistically significant and robust level of exposure in their eight-country sample. Those eight industrialized and emerging markets are Chile, France, Germany, Italy, Japan, Netherlands, Thailand and UK. They also find that the exposure is more prevalent in small sized firms than in large and medium sized firms and in firms engaged in inter-

national activities, although which firms are affected by movements in the exchange rate and the direction of exposure depends on the specific exchange rate.

It is widely believed that exchange rate variation affects the competitiveness of firms engaged in international competition. Economic theory suggests that under a floating exchange rate regime, exchange rate appreciation reduces the competitiveness of export markets. It has a negative effect on the export denominated domestic public list companies. Conversely, for those import denominated companies, exchange rate appreciation may have positive affect on their value by lowering input costs.

The New Zealand exchange rate regime has been liberalised extensively since 1984¹. New Zealand now follows a floating exchange rate policy. In recent years the volatility in foreign exchange rate is tremendous and the deviation from purchasing power parity becomes persistent in the economy. The firms operating in New Zealand are affected in many ways by these economic conditions.

In this study, we aim to investigate whether the stock returns of New Zealand public listed companies are affected by exchange rate changes. We test this relationship by regressing stock returns against contemporaneous exchange changes. Using a sample of 145 New Zealand public listed companies, we find little evidence for the significant foreign currency exposure effects for the whole period of January 1990 to April 2004.

The remainder of this paper is organised as follows. The focus of section 2 is the discussion of the relationship between exchange rate fluctuations and stock returns and exploration of the determinants of exposure. A basic two-step regression model is developed to investigate this relationship. The data description is contained in the same section. Section 3 displays the empirical results of the two-step regression model on New Zealand public listed companies. Empirical analysis is carried out to shed lights on the foreign currency exposure issue. Section 4 concludes the paper. Section 5 lists some limitations of this study and points out the orientation for future extension.

Exchange Rate Exposure and Stock Returns

In order to measure New Zealand firms' foreign exposure we follow the extensive literature on foreign exchange rate exposure by defining exposure as the relationship between extreme returns and the change in the exchange rate (Dumas, 1978; Adler and Dumas, 1984; Bodnar and Wong, 2000). Stock prices and exchanges are endogenously determined. However, based on partial equilibrium assumption we can see exchange rates as exogenous to the firm value and therefore measure exposure as the value of $\beta_{s,i}$ resulting from the following regression:

$$R_{i,t} = \beta_{0,i} + \beta_{m,i}R_{m,t} + \beta_{s,i}\Delta S_t + \varepsilon_{i,t}, \quad (1)$$

where $R_{i,t}$ is the rate of return on the i^{th} firm's stock at time t , $R_{m,t}$ is the rate of return on a market portfolio, which is introduced to control the common macroeconomic influences on total exposure elasticities, $\beta_{m,i}$ is the firm's market beta. ΔS_t is the change in the relevant exchange rate, or the rate of return on a bilateral or trade-weighted exchange rate index. An appreciation (depreciation) of NZ dollar will produce a positive (negative) value for ΔS_t . And coefficient $\beta_{s,i}$ is the exchange rate exposure measure, which reflects the change in returns that can be explained by movements in the exchange rate after conditioning on the market return.

The data employed are continuously daily stock returns on 145 New Zealand public listed companies, obtained from IRG database². The period of the analysis involves 3738 daily observations from January 1990 to April 2004. Data have been sorted out into 17 industries over this sample period. The proxy for the market portfolio used is the gross market index. Since real and nominal exchange rates are highly correlated according to some studies (Khoo, 1994; Bodnar and

¹ See Paul Dalziel and Ralph Lattimore (2001), "The New Zealand Macroeconomy: A Briefing on the Reforms and their Legacy".

² Investment Research Group (www.irm.co.nz).

Wong, 2000), we use nominal bilateral exchange rates and trade weighted index (TWI) instead of both nominal and real exchange rates. The exchange rate factor returns are based on New Zealand dollar/US dollar exchange rate and Trade-Weighted Index (TWI) obtained from Reserve Bank of New Zealand. Table 1 reports the TWI weights¹.

Table 1

Weight of the TWI measure of the New Zealand dollar

Currency	Symbol	Weight
United States Dollar	USD	0.3396
Euro	EUR	0.2370
Japanese Yen	JPY	0.1790
Australian Dollar	AUD	0.1771
UK Sterling	GBP	0.0673

Source: Reserve Bank of New Zealand (www.rbnz.govt.nz).

A fluctuation in exchange rates will affect the value of most firms whether or not they are directly involved in foreign operations and this impact will be reflected on the stock returns. Nevertheless, firms involved in more international activities could be more affected heavily than those who were not. In order to investigate the potential effects of an appreciation across New Zealand industries, we predict the signs for the industries dominated by merchandise trade companies according to the exports/imports ratio estimated based on the exports and imports of relevant commodities. Economic theory suggests that industries with a high exports/imports ratio, *ceteris paribus*, would experience negative exchange rate exposure relative to an appreciation of the exchange rate factor, while industries with a low exports/imports ratio would experience positive exchange rate exposure. For the service industries in which New Zealand has comparative advantage on, such as Leisure and Tourism, the currency appreciation will no wonder probably cause a negative exchange exposure to them. It should be noted that there are some industries in which it is believed that movement would be undetermined due to the offsetting effects of both export and import activities or the ambiguous response to the currency appreciation.

Table 2

Sign predictions of the extra market sensitivity to foreign exchange movements across New Zealand industry classifications

Industry Classification	HS code and Commodity	Exports/Import ratio	Prediction with an appreciation of NZD
Primary (18)			Negative
Agriculture & Fishing (7)	Milk power, butter and cheese (0401-0406), Fish, crustaceans and molluscs (03)	21.13	Strongly negative
Building (3)			Undetermined
Forestry (6)	Logs, wood and wood articles (44)	16.97	Strongly negative
Mining (2)	Iron and steel and articles (72-72), Aluminium and aluminium articles (76)	1.35	Negative
Energy (9)			Undetermined
Energy (9)	N/A	N/A	Undetermined

¹ The latest weight of the Trade-Weighted Index (TWI) measure of the New Zealand dollar took effect from 23 December 2003.

Table 2 (continuous)

Industry Classification	HS code and Commodity	Exports/Import ratio	Prediction with an appreciation of NZD
Goods (17)			
Food (3)	Beverages, spirits and vinegar (22)	1.19	Negative
Intermed & Durables (12)	Mechanical machinery and equipment (84)	0.56	Positive
Textiles & Apparel (2)	Textiles and textile articles (50-63)	0.37	Positive
Property (13)			Undetermined
Property (13)	N/A	N/A	Undetermined
Services (51)			
Consumer (16)	N/A	N/A	Undetermined
Finance & Other Services (11)	N/A	N/A	Negative
Leisure & Tourism (6)	N/A	N/A	Strongly negative
Media & Comms (8)	N/A	N/A	Undetermined
Ports (6)	N/A	N/A	Negative
Transport (4)	N/A	N/A	Negative
Investment (18)			Undetermined
Investment (18)	N/A	N/A	Undetermined
Other (21)			Undetermined
Other (21)	N/A	N/A	Undetermined

Source: Statistics New Zealand (www.stats.govt.nz).

Explaining exposure: the determinants

In this section we attempt to link the foreign exchange exposure estimates we have documented in the previous section to firm and industry specific characteristics. We test a series of hypotheses by running a second-stage regression that takes the estimated exposure betas from equation (1) and runs the regression of exposure betas on a variety of potential explanatory variables.

Nance *et al.* (1993) found that corporations can relieve their financial distress by maintaining a lower dividend yield (DY) and a larger short-term liquidity position. To test the hypothesis that liquidity is negatively related to hedging activities, we use DY as a proxy for liquidity. Nance *et al.* (1993) also argued that firm size is related to hedging incentives. Larger firms are more likely to hedge than smaller firms because the economies of scale in hedging cost. Therefore the larger firms should be less exposed to exchange rate risk. The turnover by volume (VO) and the market value (MV) will be used as a proxy of firm size. A firm's growth opportunities would be another determinant of foreign currency exposure. We use the price to earning ratio (PE) as a proxy for it. PE is calculated as the ratio of a firm's share price over the earning. The lower the PE, the greater a firm's incentive to employ more currency derivatives to hedge in order to reduce the underinvestment cost¹.

The above hypotheses are examined by running the following cross sectional regression,

$$\hat{\beta}_{s,i} = \gamma_0 + \gamma_1 DY_i + \gamma_2 VO_i + \gamma_3 MV_i + \gamma_4 PE_i + \varepsilon_i, \quad (2)$$

¹ The underinvestment cost hypothesis suggests interaction between growth opportunities and costly external financing and their predicted relationship should be negative (Froot *et al.*, 1993).

where $\hat{\beta}_{s,i}$ is estimated from Eq. 1, DY_i denotes the sample average of a firm's dividend yield. VO_i and MV_i represent the sample average of market turnover and market value respectively. PE_i denotes the price to earning ratio. All the above variables are obtained from the Datastream database.

Empirical Results

In the following section the results of the exchange rate sensitivity of New Zealand companies are reported. We apply two approaches, individual regression and pool data regression. The sample is divided into 17 sectors as listed below. In Table 3 the results of the first stage model outlined in Eq. (1) are reported on the firm level for the period from January 1990 to April 2004. In the sample 145 companies are included while 18 companies are in primary sector, 9 in energy sector, 17 in goods sector, 13 in property sector, 51 in services sector, 18 in investment sector and 21 in other sectors.

Firstly, in the analysis implementing pool data regression, little evidence of a contemporaneous relationship is found between industry returns and the exchange rate factor return. Of the 17 industries, 5 industries (Agriculture and Fishing, Energy, Consumer Service, Leisure and Tourism, Media and Communication and Ports Service) have a statistically significant positive sensitivity to fluctuations of the NZD/USD exchange rate. While no relationship is of the predicted sign (see Table 1), it is contrary to the prediction for three industries. They are Agriculture and Fishing, Leisure and Tourism, and Ports Service. The pool data regression based on TWI shows the similar pattern. 6 industries' coefficients are significant at 1% level and 3 at 5% level.

Table 3

Estimation of an exchange rate factor market model (pool data)

Sector	Bilateral Rate	TWI
Primary (18)		
Agriculture & Fishing (7)	0.0811 (3.23)***	0.1053 (3.26)***
Building (3)	0.0782 (2.33)**	0.1307 (3.06)***
Forestry (6)	0.0565 (2.13)**	0.0790 (2.29)**
Mining (2)	0.0710 (1.06)	0.0126 (0.15)
Energy (9)		
Energy (9)	0.0544 (2.69)***	0.0685 (2.62)***
Goods (17)		
Food (3)	-0.0422 (-1.05)	-0.0279 (-0.55)
Intermed & Durables (12)	0.0212 (0.71)	0.0789 (2.04)**
Textiles & Apparel (2)	0.0797 (1.98)**	0.0683 (1.34)
Property (13)		
Property (13)	0.0109 (0.68)	0.0293 (1.38)

Table 3 (continuous)

Sector	Bilateral Rate	TWI
Services (51)		
Consumer (16)	0.0835 (3.86)***	0.0941 (3.34)***
Finance & Other Services (11)	0.0054 (0.26)	0.0029 (0.11)
Leisure & Tourism (6)	0.1059 (3.58)***	0.1692 (4.43)***
Media & Comms (8)	0.0432 (1.89)*	0.0875 (2.82)***
Ports (6)	0.1226 (5.58)***	0.1513 (5.33)***
Transport (4)	0.0684 (1.91)*	0.1163 (2.50)**
Investment (18)		
Investment (18)	0.0277 (1.27)	0.0544 (1.82)*
Other (21)		
Other (21)	-0.0009 (-0.05)	0.0127 (0.56)

Note: The sector classification is obtained from www.nzx.com, the New Zealand Security Exchange (NZSE) website.

Note: Two companies involve double counting problem. Rubicon is included in both Energy and Investment sector. Pyne Gould is included in both Agriculture & Fishing and Finance & Other Service sector.

Secondly, for those industries were unable to make a definite sign prediction, 7 record a negative coefficient based on TWI estimation. They are Building, Energy, Property, Consumer, Media & Communications, Investment and Other. Among them, Building, Energy, Consumer and Media & Communications are significant at 1% level.

In the analysis based on individual regression, insignificant evidence of a contemporaneous response to fluctuations in the exchange rate factor return in 3 goods industries is found. However, few firms in goods industry have statistically significant coefficients.

It is apparent from the findings that there remains relatively little evidence of significant contemporaneous sensitivity to the exchange rate factor return at the individual firm level. Other than food industry, only the property industry has a negative sign for both bilateral rate and TWI, and finance and other services have a negative sign for bilateral rate estimation. The result of the property industry contradicts with the pool data result reported in Table 3. One plausible reason is that a couple of large firms with statistically significant negative signs dominate the property industry.

Among the industries with positive sign, the percentage of individual firms with statistically significant coefficient in certain industry shows is pretty high. For instance, there are 2 out of 3 firms in building industry, 3 out of 6 in forestry industry, 3 out of 6 in leisure and tourism industry, and 4 out of 6 in ports service industry.

Tables 5 and 6 report the findings of the determinants of the exchange rate exposure (Eq. 2) employing daily data and using both bilateral exchange rate and TWI. More specifically, Table 5 contains estimates of Eq. 2 for the entire sample period based on bilateral exchange rate, and the signs of the coefficients are ambiguous.

The results show that the bigger the dividend yield, the larger the exchange rate exposure. The positive DY coefficient suggests that a firm having a high dividend yield, has less of an incentive to hedge. Among 7 major sectors, three sectors have positively significant coefficient at 5% level. They are energy, property and services sector.

Table 4

Estimation of an exchange rate factor market model (individual regression)

Sector	Bilateral Rate	TWI
Primary (18)		
Agriculture & Fishing (7)	0.0808 N (1, 0) P (6, 2)	0.1430 N (0, 0) P (7, 1)
Building (3)	0.0608 N (1, 0) P (2, 2)	0.1053 N (1, 0) P (2, 2)
Forestry (6)	0.0740 N (1, 0) P (5, 3)	0.1083 N (1, 0) P (5, 3)
Mining (2)	0.1663 N (0, 0) P (2, 1)	0.1336 N (1, 0) P (1, 0)
Energy (9)		
Energy (9)	0.0526 N (2, 0) P (7, 3)	0.0614 N (2, 0) P (7, 3)
Goods (17)		
Food (3)	-0.0427 N (3, 0) P (0, 0)	-0.0733 N (3, 0) P (0, 0)
Intermed & Durables (12)	0.0026 N (4, 2) P (8, 1)	0.0790 N (3, 1) P (9, 2)
Textiles & Apparel (2)	0.0593 N (0, 0) P (2, 1)	0.0761 N (0, 0) P (2, 0)
Property (13)		
Property (13)	-0.0692 N (7, 1) P (6, 0)	-0.0510 N (6, 1) P (7, 0)
Services (51)		
Consumer (16)	0.1104 N (0, 0) P (16, 2)	0.1143 N (1, 0) P (15, 2)
Finance & Other Services (11)	-0.0135 N (4, 0) P (7, 0)	0.0942 N (4, 0) P (7, 0)
Leisure & Tourism (6)	0.1063 N (0, 0) P (6, 3)	0.1731 N (1, 0) P (5, 3)
Media & Comms (8)	0.0364 N (1, 0) P (7, 1)	0.0563 N (1, 0) P (7, 1)
Ports (6)	0.1094 N (0, 0) P (6, 4)	0.1387 N (0, 0) P (6, 4)
Transport (4)	0.0841 N (0, 0) P (4, 1)	0.1665 N (0, 0) P (4, 1)
Investment (18)		
Investment (18)	0.0167 N (8, 1) P (10, 2)	0.0991 N (7, 1) P (11, 1)
Other (21)		
Other (21)	0.0064 N (12, 1) P (9, 2)	0.0388 N (12, 1) P (9, 3)

Source: The sector classification is obtained from http://www.nzx.com/market/price_by_sector, the New Zealand Security Exchange (NZSE) website.

Note: Two companies involve double counting problem. Rubicon is included in both Energy and Investment sector. Pyne Gould is included in both Agriculture & Fishing and Finance & Other Service sector.

Economic theory suggests that firm size is also an important determinant of exposure. But the estimated results for New Zealand companies in Tables 5 and 6 show the inconsistent and ambiguous pattern. None of the coefficients is significant and most of the coefficients are very small. The probable explanation is that the average size of New Zealand public listed companies is much smaller than the size of multinational firm in other countries, such as US and Japan. They may have less incentive to hedge the exchange rate exposure risk. Further study on the hedging activities of New Zealand firms needs to be conducted to provide convincing interpretation of this interesting phenomenon.

The PE effect on exposure also seems to be weak. It is positively insignificant in primary, energy, services and other sectors. The property sector has a strong negatively significant coefficient in both Tables 5 and 6, while goods and investments sectors have negatively insignificant coefficient. The significant negative coefficient in the property sector shows that for New Zealand property companies the lower the PE ratio, the larger the exchange rate exposure. This finding also needs to be further studied.

Table 5

Cross sectional estimation based on bilateral rate

Sector	DY	VO	MV	PE
Primary (18)	0.0119 (1.42)	-8.76E-06 (-0.05)	2.07E-05 (0.26)	0.0010 (1.17)
Energy (9)	0.0165 (2.15)**	-8.34E-05 (-0.99)	-1.27E-05 (-0.27)	0.0002 (0.08)
Goods (17)	0.0204 (1.83)*	-0.0003 (-1.07)	-0.0001 (-0.63)	-0.0006 (-0.76)
Property (13)	0.0198 (2.76)**	0.0005 (0.79)	-0.0006 (-0.72)	-0.0070 (-6.04)***
Services (51)	0.0119 (2.19)**	0.0001 (0.67)	-4.05E-05 (-0.67)	6.66E-05 (0.96)
Investment (18)	0.0171 (0.26)	-0.0002 (-0.42)	0.0006 (0.32)	-0.0007 (-0.73)
Other (21)	0.0282 (0.73)	0.0001 (0.17)	-0.0005 (-1.18)	6.57E-06 (0.12)

Table 6

Cross sectional estimation based on TWI

Sector	DY	VO	MV	PE
Primary (18)	0.0201 (1.95)*	1.68E-05 (0.08)	8.37E-06 (0.09)	0.009 (0.88)
Energy (9)	0.0088 (0.87)	-7.47E-05 (-0.68)	7.3E-06 (0.12)	0.0018 (0.72)
Goods (17)	0.0338 (1.85)*	-0.0003 (-0.61)	-0.0002 (-0.78)	-0.0004 (-0.36)
Property (13)	0.0336 (3.30)***	0.0015 (1.59)	-0.0020 (-1.73)	-0.0085 (-5.18)***
Services (51)	0.0099 (1.25)	0.0004 (1.62)	-0.0001 (-1.52)	0.0001 (1.08)
Investment (18)	0.0298 (0.28)	9.81E-05 (0.16)	0.0002 (0.06)	(-0.0007) (-0.47)
Other (21)	0.0318 (0.55)	0.0003 (0.26)	-0.0005 (-0.83)	9.77E-07 (0.01)

Conclusion

Foreign currency exposure of New Zealand public listed companies was investigated in this study. A two-step analysis was conducted. In the first step we studied the link between the stock returns of New Zealand companies and exchange rate factor return. Then we attempted to link the foreign exchange exposure to the firm's characteristics. Both bilateral NZD/USD exchange rate and TWI have been used and two-step regressions were estimated by ordinary least squares method.

In the analysis implementing pool data regression, little evidence of a contemporaneous relationship is found between industry returns and the exchange rate factor return. Some industries have a statistically significant positive sensitivity to the fluctuations of the bilateral exchange rate and TWI, but very few are of the predicted sign.

The findings of the determinants of the exchange rate exposure provide weak evidence for the dividend yield (DY) and price to earning ratio (PE) effect on the exposure. None of the coefficient of volume of turnover (VO) and market value (MV) is significant and most of them are very small. This contradicts with the economic theory which suggests that firm size is an important determinant of exposure.

Limitations and Future Extension

Ordinary least square has been used to estimate the foreign exchange exposure and the determinants of exposure. Although OLS is a commonly used regression method in the previous literature, its power has been limited in the cross sectional analysis in this paper due to the small sample size for some sectors. Other advanced econometric methods would be implemented in the future study on this issue. For example, the dummy variable method incorporating asymmetric foreign exchange exposure effect (Di Iorio and Faff, 2000) could be a good orientation to head for.

In this paper we only study the link between contemporaneous exchange rate fluctuations and the stock returns of New Zealand public listed companies. It hasn't caught the lagged effect of exchange rate exposure as He and Ng (1998) studied in their article. Not only current but also the lagged changes in the exchange rate would be incorporated into the next step study.

Dividend yield, volume of turnover, market value and price to earning ratio have been analysed as the determinants of New Zealand firms' foreign exchange exposure. These four factors represent some of the firm characteristics, but not very comprehensive. In the next step extension we will attempt to include some more features of the New Zealand firms, such as the multinational status and firm's activities in international markets.

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