Does the Foreign Exchange Market Overreact?

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ABSTRACT

This study uses a sample of 21 currencies to investigate exchange rate behaviour following extreme 1-day exchange rate movements during the period January 2000 to December 2007. Deriving evidence from a post-event cumulative average abnormal return of winners and associated losers, the results lend support to the overreaction hypothesis, underreaction hypothesis, and uncertain information hypothesis. Moreover, there is substantial evidence of investor over-optimism to negative and positive events. The efficient market hypothesis is rejected for all currencies. Contrary to prior studies, currencies of emerging markets do not overreact more than those of the developed markets. The magnitude effect is also not supported. On an aggregate basis, the currency market tends to overreact which implies that the market is not efficient.

Keyword: Currency, Efficient Market Hypothesis, Exchange Rate, Overreaction, Underreaction,
JEL Classification: G14, F31

1. Introduction

A long standing topic of interest in behavioural finance is investor overreaction. The effects of overreaction are observed and noted by various authors as far back as Keynes (1964). The overreaction hypothesis, as it is known now, is formally postulated by DeBondt and Thaler (1985). The hypothesis states that investors tend to overreact to both positive news and negative news (i.e. investors overreact in the Bayesian sense). DeBondt and Thaler's explanation of the overreaction

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effect is inspired by Kahneman and Tversky (1982)'s experimental studies, which discovered that people tend to overreact to unexpected and dramatic news events. The article stirs up controversy because it gives "evidence to support the hypothesis that a cognitive bias could produce predictable mispricing of stocks" (Thaler, 1999). This notion opposes the concept of stock market efficiency. Since the paper by DeBondt and Thaler, there has been a plethora of work on return predictability in the stock market (e.g. Ajayi & Mehdian, 1994; Atkins & Dyl, 1990; Fabozzi, Fung, Lam, & Wong, 2013; Himmelmann, Schiereck, Simpson, & Zschoche, 2012; Klößner, Becker, & Friedman, 2012; Rezvanian, Turk, & Mehdian, 2011; Savor, 2012). The studies on stock market overreaction are widely known, but there are limited studies on the overreaction of currencies.

Hence, this study focuses on the foreign exchange market, which is largely unexplored in terms of the overreaction hypothesis (OH). The foreign exchange market is the largest and most active financial market in the world (Du, 2013; Liu & Witte, 2013; Manzan & Westerhoff, 2005). Based on the large number and variety of participants and market activity, the foreign exchange market is expected to be at least weak form efficient. Findings of overreaction or underreaction in the foreign exchange market will certainly provide strong evidence against the efficient market hypothesis (EMH). Despite this, the overreaction literature on this particular market is drastically lacking. There are only a few overreaction studies done in the foreign exchange market (Larson & Madura, 2001; Parikakis & Syriopoulos, 2008). A flaw inherent in these previous studies is the lack of consideration for the exchange rate regime of the currencies under review. The effects of government intervention are difficult to identify and isolate from overreaction. Thus, the observed reversals may in fact be caused by government intervention.

To the best of the authors' knowledge, there are only two papers specifically addressing overreaction hypothesis with regard to the foreign exchange market, namely Larson and Madura (2001) and Parikakis and Syriopoulos (2008). This study contributes to the existing literature in several ways. This study takes into consideration the possibility of government intervention by limiting the sample set to currencies with pure floating exchange rate regimes to avoid any biases in the results. In addition, this study extends the event window to 15 days. Past papers have explored a relatively short event window of three days (Larson & Madura, 2001) and four days (Parikakis & Syriopoulos, 2008). Correction of overreaction (i.e. return reversals) is a gradual process (DeBondt &

Thaler, 1985). Thus, these short windows may not sufficiently capture the return reversals. Moreover, past studies have examined a relatively restricted sample. Parikakis and Syriopoulos (2008) tested only four currencies: US dollar, British pound, Turkish lira, and Brazilian real. Overreaction was documented for three of the four currencies that were examined. Larson and Madura (2001) examined 15 currencies and documented the presence of overreaction for emerging markets and underreaction for developed markets. However, the overreaction of the individual currencies was not tested. The sample was divided into two groups ('emerging currency' and 'industrial currency') and only these two groups were examined as a whole instead of assessing the overreaction of each of the individual currencies. In contrast, this study offers a broader and more comprehensive look at the topic by testing a sample of 21 individual currencies.

The aim of this study is to fill the gap identified in the literature pertaining to the overreaction hypothesis. This study seeks to determine whether the foreign exchange market overreacts. The overreaction hypothesis also posits that the greater the magnitude of initial exchange rate movement, the more extreme will be the subsequent reversals. As such, the impact, if any, of initial exchange rate movement on subsequent reversals is investigated. Moreover, subsamples of emerging and developed countries are determined, to ascertain if the currency of an emerging country overreacts more than that of a developed country. A matter of further interest is the effect of pre-event exchange rate movement on the extent of overreaction. Significant exchange rate movement prior to an event indicates information leakage, and this leakage may affect the degree of overreaction.

The remainder of this paper is divided into five sections. Section 2 and Section 3 offer a review of the relevant literature and formulation of hypotheses respectively. Section 4 provides a description of the data and research design while the analysis of the findings is reported in Section 5. The final section summarises and concludes the paper.

2. Related Literature

Larson and Madura (2001) undertook the first study of overreaction and underreaction in the context of the currency market. Using daily exchange rate data for 15 currencies from January 1988 to December 1995, they studied the exchange rate changes following extreme 1-day fluctuations. A standardised abnormal exchange rate change which

is a modified version of Brown and Warner (1980)'s mean-adjusted returns model was used to analyse the market reaction to exchange rate changes. Extreme 1-day fluctuations are defined as those exceeding two standard deviations from the mean. Larson and Madura found overreaction for emerging market currencies, whereas underreaction prevails in developed market currencies. They conclude that efficient market hypothesis (EMH) can be rejected for the currency market. Cross-sectional regressions reveal that the findings are robust against initial exchange rate change, leakage, and day of the week effect. The results also provide evidence of a higher degree of overreaction in the emerging markets than that experienced in industrial markets. This may be attributed to a more efficient market or increased liquidity in developed markets. However, Larson and Madura's use of the standardisation procedure is questionable as it may have compromised the results of the study. Kwok and Brooks (1990) suggest that Brown and Warner (1980)'s standardisation procedure is not well suited for application in the foreign currency markets. While standardisation reduces Type II error, it also increases Type I error.

Parikakis and Syriopoulos (2008) tested currencies for two developed markets (i.e. British pound and US dollars) and two emerging markets (i.e. Turkish lira and Brazilian real) using data from January 1999 till February 2007. They identifed 904 positive events and 532 negative events. Unlike Larson and Madura's study, they set the filter at a level equal to or exceeding ± 0.6 per cent. They found underreaction for the British pound, while for the Turkish lira, the Brazilian real and the US dollar, they found overreaction. Contrarian investment strategy holds for all exchange rates as the currencies follow a different movement for at least two days after the event day. The findings of overreaction for US dollars contradict Larson and Madura's study wherein developed currencies are found to underreact rather than overreact. However, Parikakis and Syriopoulos's study is based on a limited sample of four currencies. Therefore, it is not possible to conclude on an overall basis, whether developed markets overreact or underreact. The use of log cumulative abnormal returns (LCAR) may have distorted the results. Flaws and dangers inherent in the CAR log method were highlighted by Barber and Lyon (1997), Kothari and Warner (1997) and Dissanaike and Le Fur (2003). Specifically, Kothari and Warner and Barber and Lyon show that log returns are negatively skewed, such that test-statistics are unlikely to be well specified. Dissanaike and Le Fur show that LCAR is equivalent to the log of geometric mean. As such, LCAR actually

measures the instantaneous return on a strategy involving continuous rebalancing which is unrealistic, given that it cannot be implemented literally and involves high transaction costs. Moreover, LCAR creates a bias wherein it underestimates the value of the continuously rebalanced portfolio.

A further limitation of Dissanaike and Le Fur (2003) is that the specific exchange rate regimes of these currencies are not considered. This may jeopardise the findings of the study. Turkey only floated its currency in February 2001 and yet the data on Turkish lira is from January 1999. There is a high possibility that the overreaction observed prior to February 2001 may have been the result of Government intervention. Moreover the economic crisis in 2001 may have exaggerated the level of overreaction, thereby tilting the results in favour of the overreaction hypothesis.

3. Research Hypotheses Development

3.1. Hypothesis on Exchange Rate Movement

The overreaction hypothesis as proposed by DeBondt and Thaler (1985) contends that investors overreact in the Bayesian sense. Investors overestimate the significance of positive and negative news. According to the overreaction hypothesis, extreme price movements will subsequently be followed by reversals (directional effect). The overreaction hypothesis also postulates that the more extreme the initial price change, the more extreme the subsequent price reversals. This proposition, termed as the "magnitude effect" by Brown, Harlow, and Tinic (1988), has not been frequently tested and verified in overreaction studies. In this study, both the directional effect and magnitude effect are tested to ascertain whether overreaction hypothesis holds in the foreign exchange market. From the propositions of overreaction hypotheses, two main hypotheses may be derived.

H_{1a}: There is reversal following extreme positive and negative exchange rate movement.
H_{1b}: The higher the initial exchange rate movement, the higher the subsequent reversal.

Aside from overreaction, empirical findings have also revealed the existence of an underreaction effect. Overreaction and underreaction

are related concepts that deal with investor psychology. However, the concepts put forth opposite implications for price movement. In the case of overreaction, positive change in prices will be subsequently followed by a decrease in prices and negative events will trigger positive returns in the subsequent periods. This means that there is a reversal following price changes. On the other hand, underreaction is characterised by an insufficient reaction to the event, thus prompting a continuation of the movement of prices in the same direction as the initial event. An extreme negative (positive) price movement will be followed by negative (positive) price movements to correct the underreaction. In other words, there is continuation. Therefore, the second hypothesis is as follows:

H_2: There is continuation following extreme positive and negative exchange rate movement.

The third hypothesis is the uncertain information hypothesis (UIH) as proposed by Brown et al. (1988). It offers an alternative explanation for investors' reaction to unexpected news. UIH contends that investors react more strongly to unfavourable news than favourable news. The implications of UIH and overreaction hypothesis are essentially the same for negative news, but differ with respect to positive news. Whereas overreaction hypothesis suggests a reversal in prices following positive news, UIH predicts that prices continue to increase after the initial positive news. Thus, the third hypothesis is formulated as the following:

H_3: There is reversal following extreme negative exchange rate movement and there is continuation following extreme positive exchange rate movement.

The fourth hypothesis is the efficient market hypothesis (EMH) which states that there should be no significant abnormal return following the initial reaction. The unexpected information is instantaneously disseminated and incorporated into prices. Therefore, prices fully reflect all available information at any given point in time. Correspondingly, there should be no significant price changes after the event. Thus, the fourth hypothesis is stated as follows:

H_4: There is no significant price change following the initial extreme positive and negative exchange rate movement.

3.2. Hypothesis on Liquidity

The fifth hypothesis is the currency liquidity hypothesis. The findings of Cox and Peterson (1994) suggest that overreaction of stock prices is stronger in less liquid markets. Larson and Madura (2001) extend this concept of liquidity to the foreign exchange market. They argue that markets for emerging currency should have less activity (less liquid) than the markets for currency of developed countries. Therefore, the degree of overreaction should be more pronounced for currencies of emerging markets than currencies of developed markets. The hypothesis on the effect of liquidity on overreaction is stated as follows.

H_5: Currencies of emerging markets exhibit a higher degree of overreaction than currencies of developed markets.

3.3. Hypothesis on Information Leakage

Finally, the last hypothesis deals with information leakage. A puzzling pattern of significant abnormal returns is reported to occur before the event day (Larson & Madura, 2001). Information leakage has been forwarded as a possible explanation. In this case, there are two differing hypotheses with regard to the impact of leakage on the subsequent reversal (Larson & Madura, 2001). The leakage certainty hypothesis implies that the market wide leakage will reduce the level of uncertainty of investors regarding the event. In essence, the lower level of uncertainty increases investor confidence and correspondingly, investors will be less inclined to overreact. On the other hand, the private information leakage hypothesis states that pre-event leakage is caused by investors trading based on uncertain private information. These investors tend to overweigh the private information source resulting in an increase in overreaction. The higher the leakage, the higher will be the overreaction. Thus, hypothesis 6 is stated as follows:

H_6: Higher levels of information leakage affect the level of overreaction.

4. Data and Methodology

4.1. Data

The exchange rate regime purported to be followed (*de jure* regime) may drastically differ from that implemented in practice (*de facto* regime). As

noted by Calvo and Reinhart (2002) and Levy-Yeyati and Strurzenegger (2005), countries that proclaim themselves as having flexible exchange rates in fact effectively operate soft pegs (closet peggers). As such, this study relied on the *de facto* classification rather than the *de jure* classification. For this purpose, reference was made to the International Monetary Fund (IMF) *De Facto* Classification of Exchange Rate Regimes. All 26 currencies listed under independent float were selected. Due to unavailability of data, the final data set consisted of 21 currencies as enumerated alphabetically in Table 1.

Table 1: Final Sample Set of 21 Currencies and Economic Status Classification

Country	Economic Status	Currency	Alphabetic code	Numeric code
Albania	Transition countries	Lek	ALL	008
Australia	Developed	Australian Dollar	AUD	036
Brazil	Emerging	BrazilianReal	BRL	986
Canada	Developed	Canadian Dollar	CAD	124
Chile	Emerging	Chilean Peso	CLP	152
Iceland	Developed	Iceland Krona	ISK	352
Indonesia	Emerging	Rupiah	IDR	360
Israel	Developed	New Israeli Sheqel	ALS	376
Japan	Developed	Yen	JPY	392
Mexico	Emerging	Mexican Peso	MXN	848
New Zealand	Developed	New Zealand Dollar	NZD	554
Norway	Developed	Norwegian Krone	NOK	578
Philippines	Emerging	Philippine Peso	PHP	608
Poland	Emerging	Zloty	PLN	985
South Africa	Emerging	Rand	ZAR	710
South Korea	Emerging	Won	KRW	410
Sweden	Developed	Swedish Krona	SEK	752
Switzerland	Developed	Swiss Franc	CHF	756
Turkey	Emerging	New Turkish Lira	TRY	949
Uganda	Least developed countries	Uganda Shilling	UGX	800
United Kingdom	Developed	Pound Sterling	GBP	826

Note: Classifications are based on United Nations Standard Country and Area Code Classification, IMF Country Composition and FTSE Country Classification.

The exchange rate data were obtained from Thomson DataStream. In this study, exchange rates are stated in terms of Sample Currency/ US dollar (USD). The USD was selected as the numeraire currency because it is a commonly used currency for the purpose of international trade. The availability of currencies quoted in terms of USD facilitates the collection of data. After examining several currencies, Kwok and Brooks (1990) found that USD is a reasonable and generally satisfactory numeraire to be selected for event study.

Data were collected for an 8-year period, from 2000 to 2007. The years 2000 through 2007 were relatively devoid of major crises and were chosen for this factor. By selecting the year 2000 as the beginning of the sample, this study effectively avoided the 1997 Asian financial crisis and provided a time period that reflected current conditions. The period after 2007 marked the advent of the global financial crisis. Thus, the period chosen avoided two major crises that could have potentially contaminated the results of this study. The only exceptions are Philippine peso and New Turkish lira where the data were collected for the period from January 2002 to December 2007. This was due to the Philippine political crisis that occurred from early 2000 until end of 2001, which effects mirrored that of the 1998 Asian crisis. Whereas Turkey floated the lira only in February 2001 and hence including data from years prior to this might compromise the data.

4.2. Methodology

The arrival of unexpected news are signaled by extreme movements in exchange rates. Hence, they are used as a proxy for arrival of news. Examination of the returns that followed these "extreme" movements will reveal any patterns of reversals or momentum. In particular, this study investigates extreme 1-day exchange rate movements where positive (negative) extreme movements are termed winners (losers).

There is no precise definition of what constitutes an "extreme" exchange rate movement. Past studies have arbitrarily assigned percentage filters ranging anywhere from 0.5 per cent to 50 per cent (Atkins & Dyl, 1990; Cox & Peterson, 1994; Lobe & Rieks, 2011; Mazouz, Joseph, & Palliere, 2009). Each currency has differing volatility levels; thus, setting a common filter level for each currency may yield a small sample for one currency and a large sample for another. Hence, rather than assigning a percentage filter, exchange rate changes exceeding two standard deviations from the mean were taken to be an "extreme"

movement (Larson & Madura, 2001; Maher & Parikh, 2011; Spyrou, Kassimatis, & Galariotis, 2007). Using this filter, this study found 2191 extreme exchange rate movements as detailed in Table 2.

Table 2: Descriptive Statistics of Extreme Exchange Rate Movement

Countries	Winners[1]				Losers[2]				Total[4]
	No[3]	Mean	Max	Min	No	Mean	Max	Min	
Albania	60	1.11	2.60	0.90	58	-1.22	-0.95	-2.26	118
Australia	68	1.84	3.61	1.38	40	-1.67	-1.40	-2.56	108
Brazil	63	3.06	8.74	2.08	50	-2.91	-2.06	-10.39	113
Canada	50	1.28	2.86	0.93	55	-1.20	-0.96	-1.78	105
Chile	61	1.47	3.65	1.10	59	-1.39	-1.11	-2.59	120
Iceland	60	2.33	7.73	1.53	48	-2.02	-1.55	-3.91	108
Indonesia	52	2.66	7.58	1.61	50	-2.45	-1.56	-8.59	102
Israel	57	1.17	3.38	0.83	56	-1.12	-0.84	-2.26	113
Japan	47	1.48	2.22	1.17	56	-1.54	-1.15	-2.25	103
Mexico	66	1.32	2.92	0.98	37	-1.23	-0.96	-3.15	103
New Zealand	74	2.01	3.48	1.51	37	-1.85	-1.57	-2.67	111
Norway	51	1.66	3.89	1.29	48	-1.62	-1.32	-3.61	99
Philippines	35	1.18	3.71	0.73	40	-1.15	-0.78	-2.04	75
Poland	60	1.88	4.54	1.38	43	-1.86	-1.43	-3.46	103
South Africa	60	3.34	8.64	2.26	43	-3.08	-2.25	-12.00	103
South Korea	63	1.04	1.93	0.75	50	-1.05	-0.77	-2.81	113
Sweden	55	1.65	2.79	1.33	53	-1.66	-1.36	-2.38	108
Switzerland	56	1.61	2.34	1.28	59	-1.66	-1.31	-2.66	115
Turkey	53	2.82	6.28	1.85	29	-2.48	-1.88	-4.18	82
Uganda	40	1.93	6.46	1.09	37	-1.70	-1.04	-5.41	77
United Kingdom	63	1.28	1.96	1.02	49	-1.28	-1.04	-2.03	112
Total	1194				997				2191

Notes: [1] Winners represent extreme positive exchange rate movement.
[2] Losers represent extreme negative exchange rate movement.
[3] Number of days with extreme exchange rate movement (i.e. event day).
[4] Total number of days with extreme exchange rate movement for each currency.

4.2.1 Event Study

This research used event study to test H_{1a}, H_2, H_3, and H_4. Each extreme exchange rate movement was taken as an event day (Day 0). If the market

is efficient, then there should be no significant return after the event day. For the overreaction hypothesis to be supported, currencies should experience reversals for both winners and losers. However, for the underreaction hypothesis to be supported, currencies should experience continuations for both winners and losers. For the uncertain information hypothesis, there should be reversals for losers and continuation for winners. Using the standard event study method, abnormal return was computed as follows:

$$AR_{it} = R_{it} - E(R)_{it} \quad (1)$$

where AR is the abnormal return, R represents actual return and E(R) represents expected return. Given that the current spot rate is the best predictor for the spot rate for the next period, the expected return should be zero (Cheung, Chinn, & Pascual, 2005; Pierdzioch, Rülke, & Stadtmann, 2012).

Cumulative abnormal return (CAR) was computed for each individual currency as the summation of AR over *t* days. Following the initial event, CAR was calculated for *t* days to examine the pattern of reversals (if any).

$$CAR_{it} = \sum_{t=1}^{t} AR_{it} \quad (2)$$

where CAR is the cumulative abnormal return over *t* days and AR is the abnormal return. For each individual currency, cumulative average abnormal returns (CAAR) were computed as the cross-sectional average of CAR.

$$CAAR_{it} = \frac{\sum_{i=1}^{N} CAR_{it}}{N} \quad (3)$$

where CAR is the cumulative abnormal return and N is the number of observations.

A 15-day event window (*t* is 15 days) was used to capture any overreactions. In other words, returns are specifically cumulated for each individual country over a period of 15 days after the event day i.e. day 1 to 15. Previous studies on the foreign exchange market have relied on relatively short event windows of three days (Larson & Madura, 2001)

and four days (Parikakis & Syriopoulos, 2008). However, the corrections of mispricing are a gradual process and consequently the reversals may continue to occur after four days. Usage of such a short event window may possibly underestimate the level of overreaction. Therefore, this study extended the window to a period of 15 days to effectively capture any reversals. A standard *t*-test was used to determine whether the post-event returns are statistically significant.

4.2.2 Multiple Regression

Multiple regression was used to test H_{1b}, H_5, and H_6. Similar to Cox and Peterson's (1994) approach, cumulative abnormal returns (CAR) were cross-sectionally regressed on the day 0 abnormal return to test for the existence of "magnitude effect" (H_{1b}). Moreover, the relationship between overreaction and the level of economic development of countries was assessed (H_5). As in Larson and Madura (2001), the sample data were segregated into developed and emerging market currencies and a dummy variable was included in the regression model.

In addition, regression was also used to establish the effect, if any, of pre-event abnormal return on post-event CAR (H_6). The regression model is described in Equation 4. All currencies were included in the regression sample except for the currencies of Albania (transition country) and Uganda (least developed country) to avoid any distortion of the results. Two separate regressions were carried out for winners and losers respectively using Equation 4.

$$CAR_i = \beta_0 + \beta_1 PRE_i + \beta_2 INITIAL_i + \beta_3 EMERGE_i + \varepsilon \quad (4)$$

where CAR_i is the post-event 15 day cumulative abnormal return for currency *i*. PRE_i is the 15 day pre-event cumulative abnormal return. $INITIAL_i$ represents the abnormal return on the initial event day (Day 0). $EMERGE_i$ is a dummy variable which is equal to "1" if emerging country and equal to "0" if otherwise.

CAR was used as the dependent variable rather than CAAR. According to Tabachnick and Fidell (2001), a rule of thumb is to have N equal to or more than 104 + m, where m = number of independent variables. The use of CAAR would have yielded only 21 observations. By substituting CAAR with CAR, N was dramatically increased.

Larson and Madura (2001) included variables to control for calendar anomalies. However, calendar anomalies may no longer be relevant. Yamori and Kurihara (2004) examined 28 currencies and

found significant day of the week effect in the 1980's but these effects disappeared in 1990's. Their findings concur with other studies reporting disappearance of calendar anomalies in many of the equity markets around the world (see Chang, Pinegar, & Ravichandran, 1993; Dubois & Louvet, 1996; Kohers, Kohers, Pandey, & Kohers, 2004). Arguably, it is no longer necessary to adjust for calendar anomalies and as such these variables were not included in the regression.

5. Analysis of Findings

5.1. Results of Event Study

Table 3 presents the cumulative average abnormal return (CAAR) results for the 21 currencies. The currencies of Brazil, Iceland, and Sweden experience significant negative CAAR for winners and significant positive returns for losers. As there are reversals for both losers and winners, the evidence concurs with the overreaction hypothesis. As such, H_{1a} is supported for these currencies. On the other hand, CAAR for winners (losers) are significantly positive (negative) for currencies of Australia and South Korea. In other words, these currencies experience continuations for winners and losers. Therefore, this confirms the existence of underreaction hypothesis (i.e. H_2 is supported). Currencies of Chile, Indonesia, Poland, South Africa, Turkey, Uganda, and United Kingdom appear to experience reversals for losers, but tend to have continuations for winners. This falls within the dictates of uncertain information hypothesis (H_3).

For the currencies of Albania, Israel, Mexico, Norway, Philippines, and Switzerland, the post-event return is negative and significant for both negative and positive events. In other words, the currencies are found to overreact for winners and underreact for losers. While this observation does not comply with any of the hypotheses set out in this study, it might arise from over-optimism (optimism bias) of investors in assessing the impact of positive or negative news. Optimism bias occurs when individuals believe that their own probability of facing a bad outcome is lower than the actual probability. Due to over-optimism, investors may have a tendency to overweigh positive events and underweigh the impact of negative events.

As can be observed in Table 3, the New Zealand dollar does not have any reversals or continuations subsequent to positive events (winners) as the CAAR is economically and statistically insignificant. Viewed in isolation, this suggests support for efficient market hypothesis, however

Table 3: Post-Event 15-day CAAR (%) for Each Currency

Country of Currency's origin	Winners			Losers		
	CAAR	*t*-stat	Sig.	CAAR	*t*-stat	Sig.
Albania	-0.69	-41.27	***	-0.53	-40.46	***
Australia	0.38	12.34	***	-0.47	-17.34	***
Brazil	-0.16	-2.57	**	0.84	25.79	***
Canada	0.03	1.32		0.13	4.85	***
Chile	0.44	20.34	***	0.42	18.14	***
Iceland	-0.22	-6.02	***	1.12	36.61	***
Indonesia	0.29	5.18	***	0.06	1.83	*
Israel	-0.21	-10.32	***	-0.22	-11.96	***
Japan	-0.10	-4.89	***	0.05	1.65	
Mexico	-0.04	-2.20	**	-0.44	-18.83	***
New Zealand	0.03	1.15		-0.66	-22.22	***
Norway	-0.37	-17.02	***	-0.16	-8.19	***
Philippines	-0.61	-25.96	***	-0.51	-23.15	***
Poland	0.20	6.68	***	0.36	14.16	***
South Africa	0.78	11.51	***	0.61	10.84	***
South Korea	0.52	27.97	***	-0.18	-12.09	***
Sweden	-0.61	-31.04	***	0.37	13.93	***
Switzerland	-0.79	-26.24	***	-0.18	-5.45	***
Turkey	0.09	1.74	*	0.91	14.18	***
Uganda	0.53	13.76	***	0.91	21.62	***
United Kingdom	0.17	11.95	***	0.11	5.82	***

*, ** and *** indicate significance at the 10%, 5% and 1% levels respectively.

the New Zealand dollar displays reversals for negative events as evidenced by the significant CAAR of -0.66 per cent. This asymmetrical underreaction is puzzling. For the Canadian dollar, post-event CAAR for winners is not significant in both economic and statistical terms. Nevertheless, there are significant reversals for losers. Taken together, the non-negative post-event returns for winners and positive returns for losers may lend support to the uncertain information hypothesis (H_3).

On the other hand, the Japanese yen experiences reversals for winners, but there is no significant post-event CAAR for losers. Arguably, this may be construed as evidence in support of optimism bias with

investors overweighing the impact of positive events. However, the insignificant post-event returns for losers indicate that investors correctly gauged the impact of negative events. Given the ambiguity, the Japanese yen does not provide any conclusive evidence.

Table 4 (Panel A) reports the CAAR for the overall currency market. On an aggregate basis, there is significant negative CAAR at the 5 per cent level on Days 2, 3 and 6 for winners. The negative CAAR of 0.11 per cent for Day 4 is significant at the 10 per cent level. The trend of negative returns begins on Day 1, though it is not significant, and lasts until Day 15. For negative events, the reversals are much more pronounced. Significant CAAR is noted for the first eight days immediately after the event. This indicates a violation of the weak form efficient market hypothesis, thus rejecting H_4. CAAR for Days 1, 2, 3 and 4 are significant at the 1 per cent level. Days 6 and 7 experience significant positive CAAR based on a 5 per cent level of significance whereas Days 5 and 8 are marginally significant at the 10 per cent level. In addition to the standard *t*-test, the Wilcoxon signed rank test[1] generally affirms the significance of the returns. The positive returns persist for the entire 15 days post-event period, but are not significant after Day 8.

Although the results seemingly vary from country to country, on an aggregate basis there are persistent reversals for both winners and losers for the 21 currencies. Assuming the 21 currencies provide an adequate representation of the currency market, this provides evidence that the currency market as a whole overreacts to unexpected information. On average, there is substantial evidence in support of the overreaction hypothesis (H_{1a}).

Pre-event returns are also reported in Panel B of Table 4. This study finds that winners tend to exhibit significant positive CAAR from Days -7 to -1. In particular, the return on the day immediately preceding the event is statistically and economically significant with CAAR of 0.58 per cent. The positive returns prior to the event day suggest information leakage. As in winners, losers also experience significant CAAR from Days -7 to -1. In terms of losers, pre-event returns are surprisingly positive. The direction of the pre-event returns is different from that of event day return. As such, the pre-event CAAR cannot be attributed to information leakage. The cause of the significant pre-event CAAR is a puzzle and requires further examination.

[1] It could be requested from the authors.

Table 4: Aggregate CAAR for Winners and Losers

Panel A: Post-Event

Day	Winners			Losers		
	CAAR	*t*-stat	Sig.	CAAR	*t*-stat	Sig.
1	-0.03	-0.85		0.15	3.43	***
2	-0.14	-2.64	**	0.18	3.52	***
3	-0.11	-2.07	**	0.15	2.72	***
4	-0.11	-1.75	*	0.14	2.72	***
5	-0.11	-1.49		0.11	2.02	*
6	-0.14	-2.04	**	0.15	2.07	**
7	-0.11	-1.64		0.20	2.60	**
8	-0.06	-0.83		0.16	1.85	*
9	-0.05	-0.62		0.15	1.63	
10	-0.01	-0.07		0.16	1.66	
11	-0.03	-0.31		0.16	1.51	
12	-0.07	-0.78		0.15	1.40	
13	-0.07	-0.81		0.14	1.26	
14	-0.05	-0.53		0.13	1.06	
15	-0.02	-0.17		0.12	1.04	

Panel B: Pre-Event

Day	Winners			Losers		
	CAAR	*t*-stat	Sig.	CAAR	*t*-stat	Sig.
-15	0.04	1.43		0.05	1.59	
-14	0.05	1.23		0.05	0.93	
-13	0.09	1.82		0.08	1.20	
-12	0.10	1.57		0.12	1.48	
-11	0.05	0.75		0.10	0.95	
-10	0.09	1.01		0.13	1.22	
-9	0.13	1.13		0.21	1.68	
-8	0.18	1.54		0.26	1.55	
-7	0.28	2.05	**	0.33	1.86	*
-6	0.26	1.88	*	0.39	1.76	*
-5	0.29	1.81	*	0.39	1.72	*
-4	0.35	1.97	*	0.47	1.87	*
-3	0.46	2.16	**	0.53	2.04	*
-2	0.52	2.23	**	0.73	2.33	**
-1	0.58	2.35	**	0.94	2.61	**

*, ** and *** indicate significance at the levels of 10%, 5% and 1% respectively.

Overall, this study finds support for the overreaction hypothesis, underreaction hypothesis, and also uncertain information hypothesis. In addition, the evidence also seems to suggest the existence of investor over-optimism. The presence of reversals and continuations in post-event CAAR seems to be dependent on the currency. However, this study finds that, on average, the foreign exchange market overreacts. This suggests that investors tend to overestimate the impact of positive and negative news, thereby causing overreaction and subsequently reversals to occur. The findings provide evidence against the efficient market hypothesis (EMH) and adds to the existing evidence on overreaction.

5.2. Results of Multiple Regression

Table 5 provides the results of multiple regression using equation 4 for the total sample of winners (excluding Albania and Uganda). The adjusted R^2 value indicates that the model can only account for about 0.8 per cent of the variation in post-event CAR. The significant *F* value of 3.823 indicates that the model is significant, at 1 per cent level. The *F* value and R^2 value taken together provide indications of a weak, albeit statistically significant regression model.

The coefficients of PRE and EMERGE are both statistically significant. The coefficient of PRE is negative which indicates that higher levels of leakage lead to a higher level of overreaction. Hence, there is support for the private information leakage hypothesis. Contrary to expectations, the EMERGE dummy variable has a positive coefficient. The coefficient of 0.485 is statistically significant at the 5 per cent level. This suggests that currencies of emerging countries experience a lower post-event reversal than that of developed countries. As such, H_5 (currency liquidity hypothesis) is not supported for winners. The coefficient of INITIAL is negative, but is not statistically significant. Therefore it can be concluded that initial price change does not affect post-event CAR. The magnitude effect (H_{1b}) is rejected for winners.

Table 5 also provides the results of multiple regression on the total sample of losers (excluding Albania and Uganda). The adjusted R^2 value indicates that the model explains 1.2 per cent of the variations in dependent variable. Analysis of variance (ANOVA) reveals that the overall regression model is statistically significant at the 1 per cent level of significance. There is a positive relationship between PRE and the dependent variable CAR. This appears to be in accordance with

Table 5: Multiple Regression for Aggregate Sample

Variables		Winners	Losers
Intercept	Coefficients	-0.114	0.044
	t-stat	-0.512	0.198
	p	0.609	0.843
PRE	Coefficients	-0.069**	0.086***
	t-stat	-2.531	3.407
	p	0.012	0.001
INITIAL	Coefficients	-0.034	0.027
	t-stat	-0.315	0.213
	p	0.753	0.832
EMERGE	Coefficients	0.485**	0.085
	t-stat	2.433	0.419
	p	0.015	0.675
R^2		0.008	0.012
F-Value		3.823***	4.529***
N		1095	1095

*, ** and *** indicate significance at the 10%, 5% and 1% levels respectively.

H_6, that is, a higher level of leakage affects the level of overreaction. The coefficient of PRE, 0.086, is statistically significant at the 1 per cent level of significance. The findings corroborate those of Larson and Madura (2001). However, the pre-event returns are not in the same direction as the event (as indicated in Table 4). The significant pre-event returns cannot be attributed to information leakage. Hence, the leakage certainty hypothesis and private information leakage hypothesis are not supported. Nevertheless, the impact of pre-event returns on overreaction is undeniable given the statistical significance of the coefficient of PRE. The sign of the coefficient of INITIAL and EMERGE are both positive. The sign of EMERGE is as expected, but not for INITIAL. However, neither variable has any significant impact on the dependent variable.

Given that INITIAL and EMERGE variables are statistically insignificant, H_{1b} and H_5 are rejected for losers.

Overall, this study finds no evidence of magnitude effect; initial return does not influence the degree of overreaction. Moreover, currency liquidity hypothesis (H_5) is also rejected for winners and losers. Not only is H_5 not supported for winners, surprisingly, evidence to the contrary is found. Emerging market currencies tend to overreact to a lesser extent to positive events than developed market currencies. Similar to Larson and Madura (2001), this study finds that pre-event returns do dictate the level of overreaction. For losers, pre-event returns lead to lower level of overreaction. On the other hand, pre-event leakage leads to a higher level of overreaction for winners.

6. Conclusion

With reference to the 15-day CAAR of individual currencies, this study finds a preponderance of support for uncertain information hypothesis and to a lesser extent underreaction hypothesis and overreaction hypothesis. There is no support for the efficient market hypothesis. This study finds that seven currencies exhibit overreaction for winners and underreaction or non-negative returns for losers. This indicates over-optimism of investors when assessing favourable (positive) and unfavourable (negative) events.

The aggregate foreign exchange market data provides evidence in support of the overreaction hypothesis. However, results of cross-sectional regression negate the magnitude effect which contends that higher levels of initial price change results in higher levels of overreaction. In terms of overreaction hypothesis, directional effect is supported, but the magnitude effect is rejected.

An interesting and perhaps disturbing revelation, as in previous studies such as Larson and Madura (2001), is the presence of significant abnormal returns on days antecedent to the initial event. Information leakages prior to the event have been suggested as a cause of the observed abnormal returns. However, this study finds that pre-event returns are surprisingly positive for losers. As such, the pre-event CAAR is not attributed to information leakage. Further investigation reveals a significant relationship between pre-event returns and post-event reversals. For winners, the private information leakage hypothesis is supported. Higher pre-event returns are associated with higher overreaction. In contrast, higher pre-event returns are associated with

lower degree of overreaction for losers. However, this does not offer support for the leakage certainty hypothesis as the pre-event returns are not in the same direction as the event. This study also finds that emerging markets do not overreact more than developed markets. Thus, the liquidity hypothesis is not supported. Less liquid currencies do not exhibit a greater degree of overreaction.

Implications of this study are immense. They provide evidence that overreaction occurs not only in the stock market but also in the currency market. Investors dealing in the currency market are equally susceptible to behavioural biases. Evidence of overreaction refutes even the weak form of efficient market hypothesis (EMH). Evidence presented in this and other studies such as Cox and Peterson (1994) and Parikakis and Syriopoulos (20008), suggests that prices have significant information content, making it worth examining past price data. Return predictability may be profitably exploited by forming a trading strategy that incorporates both momentum and contrarian strategies. Though short-term predictability is established, it is pertinent to note that transaction costs may erode any abnormal profit and thus making it uneconomical to arbitrage. Further studies may need to be conducted to examine whether profits of the trading strategy will diminish substantially after incorporating transaction costs. Although calendar anomalies may not have much influence, researchers may need to ascertain whether these variables truly do not have a bearing on the returns.

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