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Do variable length moving average trading rules matter during a financial crisis period?

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When analysing the data periods including the pre-financial and financial crisis periods, the results show that investors might make profits by using Variable Length Moving Average (VMA) trading rules as buying signals rather than as selling signals shown for the Brazil, Russia, India and China (BRIC) stock markets. However, investors may find it difficult to make profits in a financial crisis period, suggesting that more detailed information should be investigated, since the significant results shown during the full period might not reveal the differences between the pre-financial and financial crisis periods.

Keywords: financial crisis; variable length MA; stock markets; BRICs

JEL Classification: G10; G14

I. Introduction

Financial crises of recent decades are issues worth investigation. For example, King and Wadhvani (1990) have examined the stock market crash in 1987; Calvo and Reinhart (1996) and Rodriguez (2007) have reviewed the Mexican Crisis; and Baig and Goldfajn (1999), Rodriguez (2007) and Chiang *et al.* (2007) have studied the Asian Crisis. Recently, Kenourgios *et al.* (2011) have examined the contagion effect of five financial crises, that is, the Asian Crisis in 1997, the Russian Crisis in 1998, the Technology Bubble Collapse in 2000, the Brazilian Stock Market Crash in 1997–98 and the Brazilian Crisis in 2002. Aloui *et al.* (2011) have examined the extent of the contagion effects in Brazil, Russia, India and China (BRIC) following the recent financial tsunami. They mainly disclose the co-movement phenomena by showing strong evidence of the time-varying dependence between each of the BRIC markets.

Most of the relevant studies investigate whether the contagion effect would transmit among countries. In

this study, we consider that investors' actions are driven by their desire to make money in the stock markets. Thus, we employ technical trading rules to approach the above issues rather than by investigating the contagion effects as financial crises erupted.

In fact, most of the technical analysis studies focus on Moving Average (MA) trading rules, such as those by Brock *et al.* (1992), Bessembinder and Chan (1995), Coutts and Cheung (2000), Kwon and Kish (2002), Chang *et al.* (2006) and Loh (2007). Brock *et al.* (1992) have indicated that the most popular MA trading rule is 1-200 (i.e. using 1 day as the Short Moving Average (SMA) and 200 days as the Long Moving Average (LMA)), and the buy (sell) signals are emitted as the 1-day MA rises above (falls below) the 200-day MA.

Additionally, the trading rules 1-50, 1-150, 5-150, 1-200 and 2-200 are investigated in relevant studies. Several of them employ MA rules including Variable Length Moving Average (VMA) and Fixed Length Moving Average (FMA), which could generate profits (Brock *et al.*, 1992; Bessembinder and Chan, 1995, 1998; Coutts and Cheung, 2000; Kwon and Kish,

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2002). The VMA trading rules employed are 1-50, 1-100, 1-150 and 1-200 (Kwon and Kish, 2002; Chang *et al.*, 2006).

Many practitioners seem to apply the 5-20, 5-60 and 20-60¹ trading rules, which are different from the trading rules proposed by relevant studies (Brock *et al.*, 1992; Bessembinder and Chan, 1995, 1998; Ranter and Leal, 1999; Coutts and Cheung, 2000; Kwon and Kish, 2002; Tian *et al.*, 2002; Chang *et al.*, 2006; Loh, 2007). In this study, we adopt the 5-20 and 5-60 MA trading rules seldom employed in previous studies, but these MA trading rules are often employed by market participants in the real world.

Furthermore, the VMA approach might be more appropriate than the FMA approach, since investors may buy shares when buying signals are shown, but sell shares when selling signals are shown. Moreover, investors buy shares as the buying signal is emitted, but they do not sell shares after holding them for a fixed period of time without any concerns if there are any selling signals shown.

In this study, several considerations are emphasized. First, we target the BRIC stock markets, which are growing fast and drawing attention from market participants. Second, we employ the 5-20, 5-60 and 20-60² VMA trading rules defined as VMA (5, 20), VMA (5, 60) and VMA (20, 60), respectively, which are often employed by market participants in the real world. Third, two sub-periods are investigated in this study: the period before tsunami, which is deemed a regular period, and that within the tsunami period, deemed a crisis period. The above issues are rarely investigated in relevant studies.

After investigating whether investors could avoid losses and make profits by using the VMA (5, 20), VMA (5, 60) and VMA (20, 60), we witnessed several impressive findings which might contribute to the literature. We found that market participants could make profits by employing the VMA (5, 20), VMA (5, 60) and VMA (20, 60) suggested by the practitioners' experiences. Furthermore, the results are different from previous studies, which mainly disclose the contagion effects existing during the financial crisis period (Calvo and Reinhart, 1996; Baig and

Goldfajn, 1999; Chiang *et al.*, 2007; Hon *et al.*, 2007). In addition, the results show that investors might make profits before the financial crisis period, but they might find it difficult to make profits during the financial crisis periods for the BRIC stock markets.

The rest of the article is organized as follows. Section II describes the data and methodology. Section III presents empirical results. Section IV concludes our study.

II. Data and Methodology

We collected data from 1 January 2005 to 31 December 2009 for the BRIC stock indices including the Brazil Bovesp Index (Brazil), the Russian RTS Stock Index (Russia), the Bombay 500 Stock Index (India) and the Shanghai Synthesis Index (China) from the database of DataStream. Kenourgios *et al.* (2011) have suggested that the BRIC economies will play important roles in the world economy in the next 20 years, so market participants have paid greater attention to BRIC stock markets. However, a few studies have employed technical trading strategies to examine the BRIC stock markets, although several relevant studies have investigated the cognition effects from the crisis country to other countries (Aloui *et al.*, 2011; Kenourgios *et al.*, 2011).

The goals of employing technical trading strategies are to make profits or to avoid losses, even during the recent stock market crisis period. The recent financial tsunami originated from the US subprime mortgage crisis which expanded significantly during the 2004–2006³ time frame as shown in Fig. 1. Then, the New Century Financial Corporation, the second largest US subprime mortgage company, filed for bankruptcy protection in April 2007. Thus, we define the financial tsunami period as starting from April 2007.⁴

Thus, the motivation for this study is to examine whether market participants could avoid losses, beat the market and even make profits by employing technical trading strategies while investing in the BRIC share markets. In this study, we investigate the full

¹ The 5, 20 and 60 present a week, a month and a quarter for the 5-20, 5-60 and 20-60 trading rules. In addition, the 5-20, 5-60 and 20-60 trading signals are emitted as the weekly MA rises above (falls below) the monthly MA (5-20), the weekly MA rises above (falls below) the quarterly MA (5-60) and the monthly MA rises above (falls below) the quarterly MA (20-60).

² In the 5-20 trading rules, the practitioners have selected a 5-day moving average as the SMA and a 20-day moving average as the LMA. The 5-60 trading rules indicate that practitioners have selected a 5-day moving average as the SMA and a 60-day moving average as the LMA. The 20-60 trading rules imply that practitioners selected a 20-day moving average as the SMA and a 60-day moving average as the LMA.

³ Didier *et al.* (2011) mention that the 2007–2008 financial crisis origins were in the US subprime housing finance market.

⁴ The value of the US subprime mortgages was estimated at \$1.3 trillion as of March 2007, with over 7.5 million first-lien subprime mortgages outstanding. With the availability of easy credit conditions, there is evidence that both government and competitive pressures contributed to an increase in the amount of subprime lending during the years preceding the crisis.

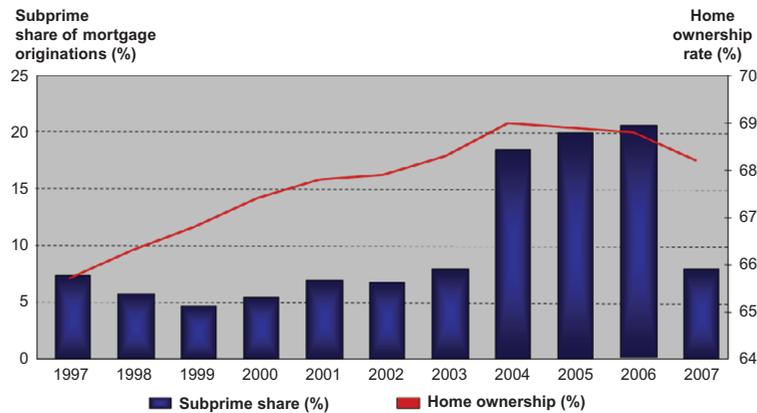


Fig. 1. US subprime lending expanded significantly 2004–06

Source: US Census Bureau; Harvard University–State of the Nation’s Housing Report 2008.

sample period, January 2005 to December 2009, and two sub-periods, one from January 2005 to March 2007 and the other from April 2007 to December 2009, as mentioned above.

Whether investors could beat the market by making abnormal returns and cumulative abnormal returns during the event period is investigated by employing the event study approach. However, the concept of the event study approach is a relative concept rather than an absolute concept, which means that investors could beat the market, but they might not earn profits. Therefore, this study employs the zero return of returns as the benchmark instead of the market.

In this study, the Average Holding Period Returns (AR), Average AR (AAR) and t -statistics are calculated as follows:

$$AR = \frac{(\text{exit index} - \text{entry index})}{\text{entry index}} \times \frac{1}{\text{holding days}} \quad (1)$$

$$AAR = \frac{\sum_{i=1}^n AR_i}{n} \quad (2)$$

$$t = \frac{AAR - 0}{\frac{\sigma_{AR}}{\sqrt{n}}} \quad (3)$$

where σ_{AR} is the standard deviation of the AR and n is the Buy (Sell) No.

The simplest and most popular classes of technical trading rules, the VMA, was examined by Brock *et al.* (1992), Bessembinder and Chan (1998), Ranter and Leal (1999), Coutts and Cheung (2000), Kwon and Kish (2002) and Tian *et al.* (2002).

We evaluate the VMA rules⁵ employed widely by technical analysts and practitioners by taking the SMA and LMA into account, and examine whether the ARs are significant as the buy or sell signals are revealed. The buy signal is emitted when the SMA is above the LMA, and the sell signal is emitted when the SMA is below the LMA. In this study, we probe deeply into whether investors could make profits or avoid losses during the full data periods and the two sub-periods. In addition, few studies have put emphasis on the trading strategies proposed by the practitioners’ trading rules such as the VMA (5, 20), VMA (5, 60) and VMA (20, 60) for the BRIC stock markets, which is a worthwhile topic for investigation because these markets are frequently mentioned in the news.

III. Empirical Results

Descriptive statistics

In Table 1, both the mean and standard deviation for the Russian stock market are higher than for other markets. The maximum and minimum returns for these countries also occur in the Russian stock market. However, the mean and standard deviation of the China stock market are lower than the results for the other BRIC countries.

Furthermore, to understand the trends of these markets, the Brazil Bovesp Index, the Russian RTS Stock Index, the Bombay 500 Stock Index and the Shanghai Synthesis Index are illustrated in Figs 2–5.

Figures 2–5 show that the upward trends of these stock markets last about 2 years, and then these trends drop sharply resulting from the aftermath of a financial tsunami. Although the stock market trends are

⁵The VMA rules could avoid data-snooping biases as mentioned by previous studies (Brock *et al.*, 1992; Bessembinder and Chan, 1995; Ranter and Leal, 1999; Coutts and Cheung, 2000; Kwon and Kish, 2002; Tian *et al.*, 2002).

Table 1. Descriptive statistics for the BRIC stock indices from 1 January 2005 to 31 December 2009

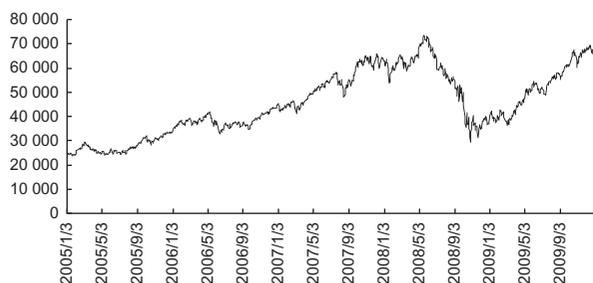
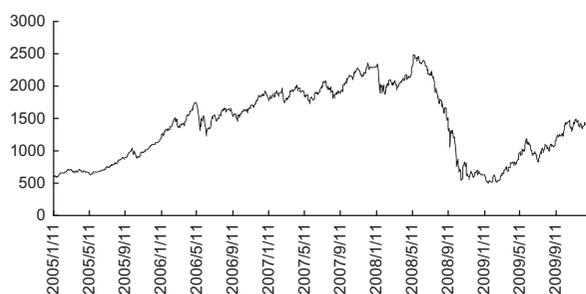
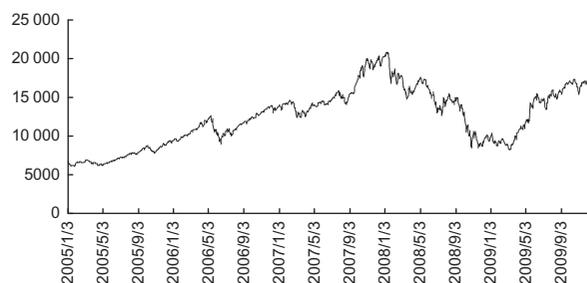
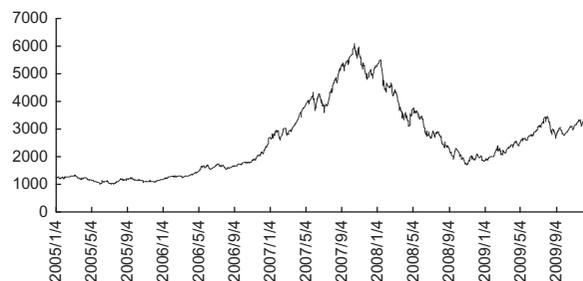
	Number	Mean	SD	Min.	Max.
Brazil	1236	0.00088	0.02013	-0.11393	0.14656
China	1213	0.00076	0.01953	-0.08841	0.09455
India	1231	0.00093	0.01842	-0.10956	0.17339
Russia	1172	0.00109	0.02545	-0.19103	0.2239

quite similar, the reverse points from the peak occurred differently for these stock markets.

The results of employing the VMA trading rules for the full period

Table 2 shows that the Buy No is greater than the Sell No for each country, which might indicate that the upward trends are longer than the downward trends during the data period as illustrated in Figs 2–5.

Columns 3 and 5 show that the ARs of the buy signals are much higher than the ARs of the sell signals in the cases of VMA (5, 20), VMA (20, 60) and VMA (5, 60) for each country. The results show that investors might make profits by employing the VMA trading strategies as buying signals are emitted, especially for the stock markets in China, India and Russia, which are consistent with the results of several studies (Ito, 1999; Gunasekarage and Power, 2001; Kang *et al.*, 2002; Tian *et al.*, 2002).

**Fig. 2. Brazil Bovesp Index (Brazil)****Fig. 3. Russian RTS Stock Index (Russia)****Fig. 4. Bombay 500 Stock Index (India)****Fig. 5. Shanghai Synthesis Index (China)**

However, market participants, on the contrary, find it difficult to make profits by short selling stocks, since the ARs of sell signals are statistically insignificant for the BRIC stock markets, consistent with the results of Tian *et al.* (2002) and McKenzie (2007).

The VMA trading rules for two sub-periods

Similarly, the results of Table 3 are almost consistent with the full sample results. The Buy No is greater than the Sell No. The ARs of the buy signals are higher than the ARs of the sell signals for every country. All the ARs of the buy signals are positive, and the ARs for Chinese, Indian and Russian stock markets are positive, statistically significant at about the 5% level. It could be inferred that market participants might make profits as buy signals are shown. However, the ARs of buy signals in the Brazilian stock market are positive. It means that investors might not have the opportunity to make profits in the Brazilian stock market compared with the stock markets of China, India and Russia.

However, market participants, on the contrary, may find it difficult to make profits by short selling stocks, since the ARs of sell signals are statistically insignificant for the BRIC stock markets, which are consistent with the results of Tian *et al.* (2002) and McKenzie (2007). A worse situation occurs in the VMA (20, 60) of the Russian stock market. The results show that investors would suffer losses by short selling stocks as selling signals are shown. Furthermore,

Table 2. Results of the full period

Country	(1) Buy No	(2) Sell No	(3) Buy AAR	(4) <i>t</i> -Statistics	(5) Sell AAR	(6) <i>t</i> -Statistics
Panel A: VMA (5, 20)						
Brazil	769	467	0.00089	1.47703	0.00128	1.01593
Russia	735	436	0.00216**	2.86628	-0.00051	-0.30227
India	794	436	0.00136*	2.39980	0.00029	0.24331
China	731	481	0.00168*	2.50487	-0.00003	-0.02430
Panel B: VMA (5, 60)						
Brazil	880	356	0.00127*	2.27699	0.00045	0.28656
Russia	784	387	0.00196**	2.77474	-0.00044	-0.23330
India	850	380	0.00119*	2.19817	0.00050	0.36742
China	708	504	0.00237**	3.54961	-0.00092	-0.87840
Panel C: VMA (20, 60)						
Brazil	903	333	0.00126*	2.21885	0.00043	0.26001
Russia	764	407	0.00151*	2.06892	0.00053	0.29066
India	872	358	0.00125*	2.22928	0.00032	0.23727
China	705	507	0.00201**	2.81028	-0.00040	-0.40377

Notes: Panels A, B and C depict the results for the VMA (5, 20), VMA (5, 60) and VMA (20, 60) by employing data from January 2005 to December 2009. The Buy (Sell) No is the number of the buy (sell) signals reported during the sample period, which are shown in columns 1 and 2. Columns 3 and 5 are the average returns of the Buy (Sell) signals, and the *t*-statistics are calculated as presented in columns 4 and 6. The results for the BRIC countries are shown in each panel for Brazil, Russia, India and China. * and **Significant at the 5% and 1% levels, respectively.

Table 3. Results for the pre-financial tsunami period

Country	(1) Buy No	(2) Sell No	(3) Buy AAR	(4) <i>t</i> -Statistics	(5) Sell AAR	(6) <i>t</i> -Statistics
Panel A: VMA (5, 20)						
Brazil	349	207	0.00085	1.10162	0.00168	1.34206
Russia	357	139	0.00261**	3.06891	0.00223	1.13325
India	408	148	0.00160**	2.86019	0.00018	0.10964
China	354	185	0.00235**	2.83893	0.00105	0.98515
Panel B: VMA (5, 60)						
Brazil	409	147	0.00086	1.20768	0.00197	1.25301
Russia	390	106	0.00221*	2.48130	0.00357	1.76845
India	430	126	0.00141*	2.49649	0.00059	0.31703
China	358	181	0.00295**	3.60426	-0.00018	-0.16483
Panel C: VMA (20, 60)						
Brazil	423	133	0.00088	1.18650	0.00202	1.35123
Russia	386	110	0.00180	1.82556	0.00495**	3.81138
India	453	103	0.00130*	2.18071	0.00090	0.46118
China	338	201	0.00264**	3.05121	0.00066	0.67219

Notes: Panels A, B and C are the results for the VMA (5, 20), VMA (5, 60) and VMA (20, 60) by employing data from January 2005 to March 2007. The Buy (Sell) No is the number of the buy (sell) signals reported during the sample period, which are shown in columns 1 and 2. Columns 3 and 5 are the average returns of the buy (sell) signals, and the *t*-statistics are calculated in Equations 2 and 3 as presented in columns 4 and 6. The results for the BRIC countries are shown in each panel for Brazil, Russia, India and China with the order of B (Brazil), R (Russia), I (India) and C (China).

* and **Significant at the 5% and 1% levels, respectively.

panels B and C reveal that the Chinese stock market has the highest returns of buy signals, but panel A reveals that the Russian stock market has higher ARs of buy signals.

Table 4 shows that the Buy No is greater than the Sell No for each country, but selling trading signals happened more often, compared to Table 3. In addition, there are no significant ARs of the buy and sell

signals. This indicates that investors might find it difficult to make profits as trading stocks during the financial crisis periods in the cases of VMA (5, 20), VMA (5, 60) and VMA (20, 60). Furthermore, the results show that investors might make profits by employing the VMA trading strategies as buying signals shown for the full periods, including the pre-financial and financial tsunami periods. However,

Table 4. Results for the financial tsunami period

Country	(1) Buy No	(2) Sell No	(3) Buy AAR	(4) <i>t</i> -Statistics	(5) Sell AAR	(6) <i>t</i> -Statistics
Panel A: VMA (5, 20)						
Brazil	420	260	0.00092	1.02808	0.00097	0.47541
Russia	378	297	0.00174	1.41756	-0.00179	-0.77856
India	386	288	0.00110	1.09641	0.00035	0.21700
China	377	296	0.00105	1.00584	-0.00070	-0.43336
Panel B: VMA (5, 60)						
Brazil	471	209	0.00163	1.93772	-0.00061	-0.24700
Russia	394	281	0.00171	1.56330	-0.00196	-0.78055
India	420	254	0.00098	1.04095	0.00045	0.25080
China	350	323	0.00177	1.67355	-0.00134	-0.87868
Panel C: VMA (20, 60)						
Brazil	480	200	0.00160	1.88660	-0.00063	-0.24966
Russia	378	297	0.00121	1.12290	-0.00111	-0.45889
India	419	255	0.00120	1.23013	0.00009	0.05162
China	367	306	0.00142	1.27323	-0.00109	-0.72507

Notes: Panels A, B and C are the results for the VMA (5, 20), VMA (5, 60) and VMA (20, 60) by employing data from April 2007 to December 2009. The Buy (Sell) No is the number of the buy (sell) signals reported during the sample period, which are shown in columns 1 and 2. Columns 3 and 5 are the average returns of the Buy (Sell) signals, and the *t*-statistics are calculated in Equations 2 and 3 as presented in columns 4 and 6. The results for the BRIC countries are shown in each panel for Brazil, Russia, India and China.

* and **Significant at the 5% and 1% levels, respectively.

when we look closely at the results of the financial tsunami period, we find that the trend we forecast does not exist.

IV. Conclusion

We take into account several concerns in this study. In the beginning, we investigate the BRIC stock markets because of fast growth of the BRIC countries in this decade. Next, we employ the VMA (5, 20), VMA (5, 60) and VMA (20, 60) trading rules often employed by market participants. Furthermore, the full period and the two sub-periods deemed as regular and crisis periods are examined. These issues are seldom investigated in previous studies.

In this study, several significant findings are disclosed, which may contribute to the relevant literature. First, we find that investors might make profits by employing these VMA trading rules as buying signals are emitted rather than as selling signals are emitted, which is different from contagion effects existing during the financial crisis period (Calvo and Reinhart, 1996; Baig and Goldfajn, 1999; Chiang *et al.*, 2007; Hon *et al.*, 2007). Second, investors could make profits before the financial crisis period, but they find it difficult to make profits during the financial crisis periods for the BRIC stock markets. Furthermore, evidence shows that investors may make profits for the full periods, but they might not make profits during the financial crisis period. Third,

the VMA technical trading rules seem to be ineffective as selling signals are shown during the full period and for the two sub-periods.

The Efficient Market Hypothesis (EMH) asserts that technical analysis is useless, which suggests that market participants barely beat the markets by using technical analyses. In this study, we find that investors could make profits for market participants by employing VMA trading rules that contradict the EMH.

In addition, there are several studies that suggest that investors might take selected technical trading rules into account. Moreover, technical analysis seems to be somewhat related to behavioural finance, which could explain why the markets are deemed inefficient, since some technical trading rules formed are combined with psychological factors.

Furthermore, even though the evidence shows that investors could make profits as buying signals are emitted by using the full period data, they still find it difficult to reap profits during the financial crisis periods. Investors should collect more detailed information instead of general information when investing in the BRIC stock markets.

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