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The Year 2015 was another good year for *The Journal of Business Inquiry (JBI)*. Volume 14 published ten articles. We received many high-quality papers with a 46.1 per cent acceptance rate. The articles were written by authors, whose primary affiliations include 21 institutions from 4 countries - **Canada**, **India**, **South Korea** and the **United States**. Turnaround time took, with 7.7 per cent of the editorial decisions, less than or 30 days, 18.3 per cent between 31 and 90 days, 74 per cent, between 91 and 200 days.

The ISI Impact Factor Value of *The Journal of Business Inquiry* is 2.642 for the year 2014-15.

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The Long-Run Return Reversal Effect: A Re-Examination in the Indian Stock Market

By SUPRIYA MAHESHWARI AND RAJ S. DHANKAR*

This study evaluates the long-run reversal effect in the Indian stock market. The empirical findings add convincing evidence in favor of the long-run return reversal effect wherein past long-run loser stocks outperform past long-run winner stocks over longer investment periods, suggesting the profitability of a long-run contrarian strategy. The long-run reversal profits in the Indian market were driven by risk differential among past long-run winner and loser portfolios and can be explained by simultaneously controlling for beta, size, value, and liquidity risk. In a nutshell, the long-run reversal anomaly is not robust under a multifactor asset pricing framework, and the excess profits from long-run loser portfolios are nothing but compensation for the risk held.

Keywords: Long-Run Reversal Effect, Overreaction Hypothesis, CAPM, Multifactor Asset Pricing Model, Losers, Winners

JEL Classification: C52, G11, G12, G14

I. Introduction

The long-run reversal effect in stock returns has been a well-established phenomenon in the stock market for more than four decades. Such a long-run reversal effect is generally referred to as a phenomenon where stock returns undergo reversal over a time horizon of more than 18 months, suggesting predictability in long-run stock returns. More specifically, it has been argued that there is a tendency for stocks with past long-term poor performance to outperform past long-term good performance stocks over a longer time horizon. Such a phenomenon is generally regarded as one of the most serious violations of the Efficient Market Hypothesis (EMH) in the literature (Dimson and Mussavian, 2000).

Despite its popularity among academicians and practitioners, the long-run reversal effect has been criticized by academicians in more recent times. Fama and French (2006) argued that such long-run reversal effects, and other similar stock market anomalies, can be related to misspecification of portfolio risk. A number of other explanations have also been put forward in the literature challenging the economic profitability of the long-run reversal effect. However, varying explanations have been found to be successful in different stock markets over different time periods. Such competing views create the need for further study to examine the existence of the long-run reversal effect in various stock markets. In the spirit of these debates, the present study re-examines the performance of the long-run return reversal effect in the Indian stock market.

This study aims to contribute to the academic literature in multiple ways. The study augments the current literature by providing a fresh and comprehensive out-of-sample test of the long-run

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return reversal effect in one of the fastest growing emerging markets. The Indian stock market can be considered as a distinct market in comparison to US and other developed stock markets in terms of institutional structure, liquidity, cultural background, etc. Such differences may affect the pattern in stock returns compared with those observed in other stock markets. Moreover, a recent out-of-sample test is important as the long-run reversal effect is observed to be not so robust over time. Contrary to previous domestic studies, the present study also accounts for varying robustness checks by controlling for seasonality, size, value, and liquidity. Finally, the study tests and compares the profitability of the long-run return reversal effect after simultaneously controlling for market risk, size, value, and liquidity risk using three- and four-factor asset pricing models.

The remainder of the paper is planned as follows: Section II gives a brief review of academic literature. It is followed by Section III, which offers a detailed discussion on the data and methodology employed. Section IV provides various empirical results that are obtained by applying multiple statistical procedures, followed by discussion and conclusion in Section V.

II. Literature Review

A. Empirical Evidence of the Long-Run Reversal Effect

The long-run return reversal effect is commonly known as the 'Overreaction Effect' in academic literature, a term that was first coined by De Bondt and Thaler (1985). They evaluated monthly US stock return data for the period 1926-1982 by focusing on stocks that experienced either extreme capital gains or losses over the past three to five years. They constructed winner and loser portfolios, wherein the winner portfolio consisted of the 35 best performing stocks while the loser portfolio consisted of the 35 worst performing stocks, and analyzed the performance of these portfolios over the next 36 months. They reported superior performance of past loser stocks as compared to past winner stocks over a time horizon of 36 months. Such evidence suggested that abnormal (or excess) returns can be obtained by buying past losers and selling past winners. Such a contrarian stock selection strategy based on stock reversal is commonly known as the 'Contrarian Strategy' (Mun *et al*., 2000). The findings of De Bondt and Thaler (1985) have attracted considerable attention among academicians as the profitability of contrarian strategies represents a strong challenge to the weak form of the EMH, suggesting some predictability in stock returns.

Motivated by the study of De Bondt and Thaler (1985), various scholars re-examined the profitability of the long-run return reversal phenomenon in different stock markets. The results in favor of the long-term overreaction effect were observed in a wide range of stock markets including Stock (1990) for Germany, da Costa (1994) for Brazil, Campbell and Limmack (1997) for the UK, Swallow and Fox (1998) for New Zealand, Fung (1999) for Hong Kong, Ryan and Donnelly (2000) for Ireland, Bildik and Gülay (2007) for Turkey, Dhouib and Abaoub (2007) for Tunisia, Chou *et al.* (2007) for Japan, and Hsieh and Hodnett (2011) for South Africa. In contrast to the prevailing euphoria, Brailsford (1992), Kryzanowski and Zhang (1992), and Chaouachi and Douagi (2014) reported results inconsistent with the long-run overreaction effect in the Australian, Canadian, and Tunisian stock markets, respectively.

Although the long-run return reversal effect is well accepted abroad, empirical evidence in the Indian stock market is mixed. Sehgal and Balakrishnan (2002) were the first to evaluate the presence of the long-run return reversal effect in the Indian stock market. Using monthly stock price data from 364 companies over a sample period from July 1989 to March 1999, they observed weak evidence of return reversal in a longer time horizon. Subsequent studies by Locke and Gupta (2009), Tripathi and Aggarwal (2009), Sehgal *et al.* (2013), and Dhankar and Maheshwari (2014) reported strong evidence of long-run overreaction in the Indian stock market over different sample periods and data. Contrary to these results, Chowdhury (2010) reported no significant long-run contrarian profits for the sample period 1991 to 2006 in the Indian stock market.

B. Alternative Explanation of the Long-Run Return Reversal Effect

Two possible explanations of the long-run return reversal effect have attracted much interest in the literature. De Bondt and Thaler (1985) suggested that the results of their study show the irrationality or irrational behavior demonstrated by investors, wherein investors overreact to both positive and negative information, pushing the prices away from their fundamental values. However, over the next two to three years, prices revert back to their fundamental values generating a reversal in stock returns. Such an explanation is labeled as a behavioral based explanation. A number of other behavioral based explanations for long-run return reversal have been proposed in the academic literature.

Another explanation is a risk-based explanation that occurs due to mispricing of risk among the extreme portfolios. It has been argued in the literature (Chan, 1988; Ball and Kothari, 1989) that it is the instability of the risk among past winner and loser portfolios over a longer time horizon that generates excess contrarian profits. The profitability of the long-run return reversal effect is also associated with size risk wherein Zarowin (1990) and others argued that past loser portfolios are dominated by small size stocks with higher risk that generate higher returns in longer time horizons compared to past winner portfolios. Kaul and Nimalendram (1990) and Conrad and Kaul (1993) attempted to show that most of the long-run contrarian profits were caused by measurement errors in prices in the form of bid-ask spreads and non-synchronous trading. Others reported strong seasonality in contrarian profits. Pettengill and Jordan (1990) argued that strong contrarian profits in the US stock market can be attributed entirely to the January effect. Contrary to the above studies, a number of subsequent studies failed to corroborate a relationship between size effect (Alonso and Rubio, 1990; Chopra *et al*., 1992; Albert and Henderson, 1995; Ahmad and Hussain, 2001), seasonality (Alonso and Rubio, 1990; Campbell and Limmack, 1997), time varying risk (De Bondt and Thaler, 1987; Dissanaike, 1997), and bid-ask bias effect (Loughram and Ritter, 1996; Dissanaike, 1997) with the long-run reversal effect, providing additional support in favor of the overreaction effect.[1]

However, proponents of the EMH have proposed that evidence of stock market anomalies such as the long-run reversal effect may be interpreted as shortcomings of the underlying asset pricing model. Elaborating on the same, Fama and French (1996, 2006) claimed that much of the long-run reversal profitability can be captured by their three-factor asset pricing model. The results from their study were found to be consistent with the risk-based explanation of long-run reversal

[1] For detailed discussion on the same refer to literature survey by Maheshwari and Dhankar (2014) on the overreaction effect.

profits, suggesting contrarian profits can be explained within the framework of the multifactor asset pricing model. However, the findings of Fama and French (1996) were challenged by Chiao *et al.* (2005) who argued that the Fama and French risk factors cannot fully explain the long-run reversal effect in markets other than the US. Further research on the capacity of the multifactor asset pricing model to explain long-run contrarian profit is required as Clements *et al*. (2009) argued that recent overreaction studies ignore this work in their methodological approach to the overreaction effect. The present study tries to bridge this gap by exploring the profitability of the long-run return reversal effect even after controlling for multiple risk factors in the Indian stock market.

III. Data and Methodology

A. Data Description

For the empirical investigation, the study makes use of adjusted closing price data available for all the stocks that were continuously trading on the Bombay Stock Exchange (BSE) over a sample period from January 1997 to March 2013. The final sample consists of 470 stocks having 195 monthly observations. The data of monthly adjusted closing prices are extracted from PROWESS, a financial database offered by CMIE (Centre for Monitoring Indian Economy). In addition to the monthly adjusted closing price, the monthly market capitalization, turnover ratio, and price-to-book (P/B) ratio were also collected for each sample stock over the sample period. In agreement with the literature (Sehgal and Balakrishnan, 2002; Tripathi and Aggarwal, 2009; etc.) the implied yield on 91-day treasury bills has been used as a surrogate for the risk-free proxy and the same was collected from the Reserve Bank of India (RBI) website.

B. Methodology

To assess the long-run reversal effect on profitability in the Indian stock market, the study borrows the methodology of De Bondt and Thaler (1985) with a few modifications. Instead of the non-overlapping periods used by De Bondt and Thaler (1985), this study employed overlapping portfolios where portfolios were rebalanced at the start of each year. A similar approach was adopted by Loughran and Ritter (1996), Ahmad and Hussain (2001), Tripathi and Aggarwal (2009), and Locke and Gupta (2009). A detailed discussion on the approach adopted is as follows:

- The BSE sensitive index is used as the proxy for the return on the market portfolio. The stock price data are converted into simple percentage returns as

$$R_{i,t} = \frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}} \quad (1)$$

where $R_{i,t}$ is the monthly return, $P_{i,t}$ is the price on month t, and $P_{i,t-1}$ is the price on month t-1.

- The residual return (U_t) for each stock is calculated using the formula:

$$U_{i,t} = R_{i,t} - R_{m,t} \quad (2)$$

where $U_{i,t}$ represents the market-adjusted excess return on stock j for month t, $R_{i,t}$ is the return on stock i for month t, and $R_{m,t}$ is the return on the market index for month t.

- Beginning from January 1997 to 2007, for each stock (i), the cumulative market adjusted excess return (CU_i) is calculated over the 36-month formation period (F) where

$$CU_i = \sum_{t=1}^{36} U_{i,t} \tag{3}$$

- Based on CU_i all the stocks are ranked in descending order. Based on these rankings, the top 20per cent stocks are referred as the 'winner' (W) and the bottom 20per cent as 'loser' (L) portfolios. A similar 20per cent cut to define top and bottom stock portfolios is widely adopted in both domestic and international academic literature (Clare and Thomas, 1995; Sehgal and Balakrishnan, 2002; Mengoli, 2004; Bildik and Gülay, 2007; etc.). This procedure is repeated every year from 1997 to 2007 giving 11 pairs of winner and loser portfolios.

- For both portfolios (W and L) the average residual returns (AR) of all the portfolio securities are calculated for the next 36 month-holding period (H), for each of the 11 overlapping periods. Next, the cumulative average residual return (CAR) for both portfolios for each of the 36 months for the 11 overlapping periods is calculated as shown below:

$$CAR_{W,O,t} = \sum_{m=1}^{t} AR_{w,m} \quad ; O = 1, 2 \ldots 11;\ t = 1, 2, 3 \ldots..36\ months \tag{4}$$

$$CAR_{L,O,t} = \sum_{m=1}^{t} AR_{L,m} \quad ; O = 1,2 \ldots 11;\ t = 1, 2, 3 \ldots..36\ months \tag{5}$$

- Using CARs from all the overlapping test periods (N=11), the average CARs (ACAR) are calculated for both winner and loser portfolios for each of the 36 months.

$$ACAR_{W,t} = \frac{\sum_{j=1}^{N} CAR_{W,j,t}}{N} \ ; t = 1,2,3 \ldots..36\ months \tag{6}$$

$$ACAR_{L,t} = \frac{\sum_{j=1}^{N} CAR_{L,j,t}}{N} \quad ; t = 1,2,3 \ldots..36\ months \tag{7}$$

If the overreaction effect (or long-run return reversal effect) exists in the Indian stock market, then during the holding period (H), the ACAR of losers must be greater than zero while the ACAR of winners must generate negative returns since the overreaction effect predicts reversals in returns of past losing and winning stocks. Hence, by implication if the ACAR of the arbitrage (A) portfolio (ACAR (L) – ACAR (W)) is greater than zero then it suggests the presence of long-run contrarian profits. The profitability of contrarian strategies in the Indian stock market can be explained with the help of the average ACAR of the arbitrage portfolio ($ACAR_{A,t}$). Since contrarian strategy recommends long positions in past losers and short positions in past winners, any positive returns in the arbitrage portfolio suggest the profitability of the contrarian strategy in the Indian stock market.

Hence, to test the long-run reversal effect in the Indian stock market, the following hypotheses were tested:

Null Hypothesis	Alternative Hypothesis
H_{1o}: $ACAR_{W,t} = 0$	H_{1a}: $ACAR_{W,t} < 0$
H_{2o}: $ACAR_{L,t} = 0$	H_{2a}: $ACAR_{L,t} > 0$
H_{3o}: $ACAR_{A,t} = ACAR_{L,t} - ACAR_{W,t} = 0$	H_{3a}: $ACAR_{A,t} > 0$

The above hypotheses are tested using the standard *t*-test at the significance level of 5 per cent. In the case where *t*-statistics are greater than corresponding critical values, the null hypothesis can be rejected.

C. Risk-Adjusted Contrarian Profits

The above method emphasizes market-adjusted returns for long-run extreme (also known as long-run contrarian) portfolios as suggested by De Bondt and Thaler (1985). However, Chan (1988), Ball *et al*. (1995), and others argued that the long-run overreaction effect is due to manifestation of risk among extreme portfolios. Further, Fama and French (1993) argued that it is essential to test stock market anomalies, such as the long-run return reversal effect, in the context of asset pricing models as higher returns from these anomalies may be nothing but compensation for higher risk.

The study initially controls for risk using the capital asset pricing model (CAPM). The excess portfolio returns are regressed on the excess return for the market factor using the market model:

$$R_{pt} - R_{ft} = \alpha_p + \beta_M\left(R_{Mt} - R_{ft}\right) + \varepsilon_t \quad (8)$$

where, R_{pt} is the monthly return of the portfolio (either Winner or Loser), R_{ft} is the risk-free rate of return in time t, R_{Mt} is the market index return in time t, and ε is the error term. For the arbitrage portfolios (L-W) the dependent variable is obtained simply as the difference between loser and winner.

The CAPM implies that excess return on a portfolio should be fully explained by excess market return. If long-run contrarian profits are consistent with the risk explanation, then there will be significant β and insignificant α. Conversely, a positive and significant α of the arbitrage portfolio (L-W) supports the existence of long-run contrarian profits even after risk adjustments.

In addition to the single-factor CAPM, the study also implements the multifactor asset pricing models including the Fama and French (1993) three-factor model and the Chan and Faff (2005) liquidity-augmented four-factor model. The performance of extreme portfolios is considered using the following equations:

Fama and French (1993) three-factor model:

$$R_{pt} - R_{ft} = \alpha_p + \beta_M\left(R_{Mt} - R_{ft}\right) + \beta_s SMB_t + \beta_h HML_t + \varepsilon_t \quad (9)$$

Chan and Faff (2005) liquidity-augmented four-factor model:

$$R_{pt} - R_{ft} = \alpha_p + \beta_M(R_{Mt} - R_{ft}) + \beta_s SMB_t + \beta_h HML_t + \beta_i IMV_t + \varepsilon_t \quad (10)$$

where R_{pt} is the monthly return of the portfolio (Winner/Loser) in month t, R_{ft} is the risk-free rate of return in month t, R_{mt} is the market index return, and SMB_t ,HML_t and IMV_t refer to size, book-to-market ratio, and illiquidity risk factor. The loadings β_M, β_s, β_h and β_i are the slope coefficients in time-series regressions. For the arbitrage portfolios (L-W) the dependent variable is obtained simply as the difference between losers and winners.

All the additional risk factors: size (SMB), value (HML), and liquidity (IMV) are computed using the Chan and Faff (2005) 2x3x3 sort method. Before running the regression, the stationarity of the variables was tested using the Augmented Dickey-Fuller (ADF) and the non-parametric Phillips-Perron (PP) tests. Using the ADF and PP tests, all variables were found to be stationary. The results for the same are presented in Table 1. In addition, the standard errors from the regression were corrected for autocorrelation and heteroscedasticity using Newey-West standard errors.

Table 1: Testing of Stationarity Using ADF and PP Tests

Series	ADF (at level)	PP (at level)
Winner (W)	-10.553 (0.000)*	-10.550(0.000)*
Loser (L)	-11.589 (0.000)*	-11.613 (0.000)*
Arbitrage (L-W)	-10.608 (0.000)*	-10.597(0.000)*
Rm-Rf (market factor)	-12.743 (0.000)*	-11.331 (0.000)*
SMB (size factor)	-12.651 (0.000)*	-11.154 (0.000)*
HML (value factor)	-10.773 (0.000)*	-10.461 (0.000)*
IMV (liquidity factor)	-14.370 (0.000)*	-13.408 (0.000)*
Size-neutral		
Winner (W)	-10.256 (0.000)*	-10.193 (0.000)*
Loser (L)	-11.568 (0.000)*	-11.596 (0.000)*
Arbitrage (L-W)	-11.348 (0.000)*	-11.348 (0.000)*
Value-neutral		
Winner (W)	-10.578 (0.000)*	-10.589 (0.000)*
Loser (L)	-11.562 (0.000)*	-11.558 (0.000)*
Arbitrage (L-W)	-11.198 (0.000)*	-11.232 (0.000)*
Volume-neutral		
Winner (W)	-10.621 (0.000)*	-10.636 (0.000)*
Loser (L)	-11.543 (0.000)*	-11.570 (0.000)*
Arbitrage (L-W)	-11.531 (0.000)*	-11.560 (0.000)*

* Significant at 5 per cent level. Critical values of ADF and PP tests at 5 per cent level is -2.880.
Source: Authors' compilation.

IV. Empirical Results

A. Descriptive Statistics of Portfolios

Table 2 presents some statistics describing the characteristics and accounting information of extreme portfolios, i.e., winner and loser portfolios at formation. The past long-run winner portfolio represents an extreme positive return while the loser portfolio represents an extreme negative return during the formation period. Also, securities in the winner portfolio are much more diverse in their characteristics with higher standard deviation as compared to securities in the loser portfolio. The winner stocks are observed to be small in size and low in value as compared to counterpart loser stocks.

Table 2: Descriptive Statistics of the Long-Run Contrarian Portfolios

Long-Run Portfolios with 36 Month Formation Periods		
	Winner	**Loser**
Average Market Adjusted Monthly Return	0.0556*	-0.0181*
Std. Deviation	0.0224	0.0084
Avg. Market Capitalization (in Rs. Millions): Size	19891.47	22565.43
Avg. B/M ratio : Value	0.515	1.604

* Significant at 5 per cent level.
Source: Authors' compilation.

B. Market-Adjusted Returns and the Long-Run Return Reversal Effect

The results presented in Table 3 reflect the reactions of long-run past winner and loser stocks in the Indian stock market. The study evaluates the overreaction effect by studying the market-adjusted abnormal returns during the formation and holding periods. Table 3 reports the average cumulative abnormal returns data for the winner, loser, and arbitrage portfolios at the end of the formation period as well as for the holding period of 3, 6, 9, 12, 18, 24, and 36 months. For the sample of 470 stocks, the past winner portfolio outperformed the past loser portfolio when the portfolios were formed. However, a very dramatic change occurred in the following test/ holding period. As predicted by the long-run reversal effect or overreaction effect, the ACAR of arbitrage (L-W) generated positive returns over the holding period. Even though past loser outperformed past winner stocks for all the holding periods, the contrarian profits were found to be statistically significant only for a holding period of 36 months. The past 36-month loser stocks generated market-adjusted ACAR of 56.63 per cent over the next 36 months as compared to 35.30 per cent generated by past winner stocks. Thus, the arbitrage portfolio (L-W) generated a statistically significant positive ACAR of 21.33 per cent (*t*-statistics: 2.155) over 36 months. In other words, the past loser stocks outperformed past winner stocks by an average 21.33 per cent over 36 months, generating annualized contrarian profits of 7.11 per cent in the Indian stock market. Such findings are similar to the results of earlier US and other developed markets investigations (De Bondt and Thaler, 1985, 1987; Stock, 1990; da Costa, 1994; Bildik and Gülay, 2007, and Hsieh and Hodnett, 2011).

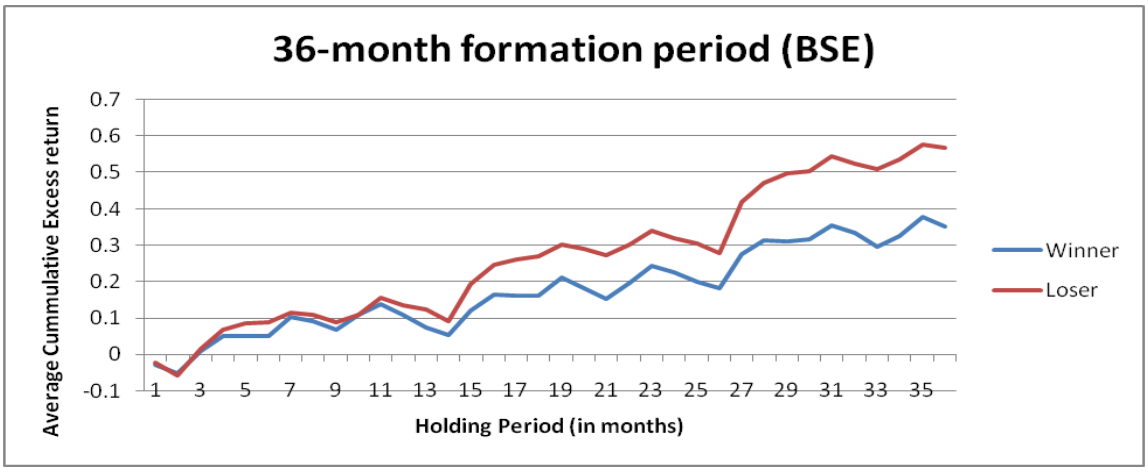
Table 3: ACAR of Long-Run Contrarian Portfolios

Formation Period: 36 Months									
Portfolio	**Cumulative Return Over Formation Period**		**Holding Period (H) Months**						
			H=3	**H=6**	**H=9**	**H=12**	**H=18**	**H=24**	**H=36**
Winner	2.0020	ACAR	0.0100	0.0511	0.0691	0.1101	0.1612	0.2270	0.3530
		Monthly (%)	0.3333	0.8517	0.7678	0.9175	0.8956	0.9458	0.9806
			(0.817)	(0.440)	(0.293)	(0.193)	(0.169)	(0.05)*	(0.02)**
Loser	-0.6530	ACAR	0.0145	0.0896	0.0888	0.1363	0.2690	0.3200	0.5663
		Monthly (%)	0.4827	1.4928	0.9862	1.1361	1.4945	1.3333	1.5731
			(0.665)	(0.161)	(0.172)	(0.055)*	(0.04)*	(0.02)**	(0.00)**
Arbitrage (L-W)	ACAR (mean)		0.0045	0.0385	0.019	0.0262	0.1078	0.0930	0.2133
	Mean Monthly Profits (%)		0.1500	0.6417	0.2111	0.2183	0.5989	0.3875	0.5917
	t-statistics		0.157	0.888	0.348	0.4462	1.4345	1.154	2.150

* Statistically significant at 5 per cent level.
** Statistically significant at 1 per cent level.
The winner and loser portfolios are formed on the basis of market-adjusted returns over the past 36 months and then held for H-holding months. The ACAR along with monthly return of both the portfolios is presented in the table. The corresponding ACAR of the arbitrage (L-W) portfolio along with monthly profits are also presented. Monthly return on the Sensex index is taken as a proxy of the market portfolio to calculate market adjusted returns. The *p*-statistics of winner and loser portfolios are reported in parentheses (). The null hypothesis of *t*-statistics is H_o: ACAR (A) = 0. All the values are rounded to four decimal places.
Source: Authors' compilation.

The presence of the long-run return reversal effect in the Indian stock market suggests that the simple contrarian strategy, i.e., buying past 36-month loser stocks and selling past 36-month winner stocks, generates statistically significant profits of 24.6 per cent over the next 36 months in the Indian stock market. The evidence of the overreaction effect in the Indian stock market is also reported by Locke and Gupta (2009), Tripathi and Aggarwal (2009), and Sehgal *et al.* (2013), although the magnitude of the contrarian profits for the Indian stock market in recent years is observed to be smaller than reported in the previous studies by Locke and Gupta (2009) and Tripathi and Aggarwal (2009), suggesting that the impact of the long-run return reversal effect has slightly decreased in recent years.

Figure 1: ACAR of the Past Long-Term Winner and Loser Portfolios in the Indian Stock Market



The current figure plots the ACAR of the winner and loser portfolios in 1 to 36-month post formation period.

There are several findings from the study that are worth reiterating. The study documents the asymmetric overreaction effect in the Indian stock market where the loser's reversal is the major source of contrarian profits. The performance of the loser's portfolio is strongly consistent with the predictions of the 'long-run return reversal effect' as a strong reversal pattern can be observed in the returns of the loser portfolio in the post formation period. The loser portfolio earned a huge positive cumulative excess return of over 56.3 per cent over the 36-month post formation period as compared to a negative cumulative return of 65.3 per cent during the 36-month formation period. In contrast, the winner portfolio exhibits a strong continuation pattern over the long horizon contradicting the prediction of a long-run return reversal effect. The overreaction hypothesis predicts a strong reversal effect in stock returns of losing as well as winning stocks. However, in the Indian stock market, past winning stocks continue to generate positive returns post formation, although a decline in returns is observed in the winner portfolios' post formation period. The huge positive cumulative return of more than 200 per cent over the 36-month formation period got reduced to a cumulative return of 35.5 per cent at the end of the holding period of 36 months in the Indian stock market. Such an asymmetric overreaction effect in the Indian stock market was also observed by Locke and Gupta (2009) and Tripathi and Aggarwal (2009). As shown in Figure 1, the ACAR of both the winner and loser portfolios is positive and increasing during the test period, although the ACAR of the loser portfolio is increasing at a higher rate as compared to the winner portfolio, generating a return differential among these extreme portfolios. Nam *et al*. (2001) also argued that reversals in stock returns are asymmetrical in nature as negative returns reverse to positive returns more quickly than positive returns reverse to negative returns. They attributed such asymmetry to the mispricing behavior of investors who overreact more to negative information. Similar conclusions can be drawn for the Indian stock market wherein investors react pessimistically to negative information.

C. Seasonality in Long-Run Contrarian Profits

The study further broadened the analysis to investigate the behavior of a long-run contrarian portfolio for all the calendar months of the year. The main rationale behind expanding the test is

to identify any January seasonality in long-run contrarian profits in the Indian stock market as documented in the US literature.

As can be observed from Table 4, the average monthly long-run contrarian profits for each of the 12 months appear to fluctuate considerably. Unlike the US stock market, no strong long-run contrarian profits are observed in the month of January. The highest long-run contrarian profits are observed in the months of April and June in the Indian stock market. The high contrarian profits in the month of April suggest a strong reversal effect during the month immediately after the Indian financial year end (i.e. March), providing initial support in favor of the tax-loss hypothesis. However, the tax year end is not the only possible event that may trigger a strong reversal in stock returns as the highest contrarian profits are observed in the month of June. Moreover, the difference among the monthly contrarian profits is found to be statistically non-significant as suggested by high ANOVA F-test *p* values. Hence, it can be concluded that the type of seasonal patterns observed in the US long-run contrarian profits cannot be observed in the Indian stock market.

Table 4: Average Monthly Contrarian Profits in Calendar Months

Month	**January**	**February**	**March**	**April**	**May**	**June**
Return	0.1451	0.8596	-0.0058	2.1143	1.0486	2.5478
Month	**July**	**August**	**September**	**October**	**November**	**December**
Return	0.5285	-1.1038	0.6905	1.2407	-1.6658	0.3767
F-stat(ANOVA)	0.882 (0.559)					

Source: Authors' compilation.

D. Risk-Adjusted Long-Run Contrarian Profits

D.1 Returns Using One-Factor CAPM

The previous results suggest the presence of long-run contrarian profits in the Indian stock market using market-adjusted returns. However, it is important to calculate the risk-adjusted return of the extreme portfolios. The study applies various techniques to adjust for risk. Initially, the study independently controls for four types of risk (beta, size, value, and liquidity) in a univariate approach. The study further extends to a multivariate approach using multifactor asset pricing models.

The study initially controls for beta risk by employing one-factor CAPM. The extreme portfolio returns are regressed on the excess return for the market factor using the CAPM, and the results of the same are presented in Panel A of Table 5. The one-factor CAPM failed to explain the abnormal long-run contrarian profits in the Indian stock market. The alpha values are statistically significant and higher for loser portfolios as compared to winner portfolios over a longer time horizon. The loser portfolio formed on the basis of the past 36-month return generates an extra-normal risk-adjusted monthly return of 1.24 per cent over the next 36 months as against non-statistically significant risk-adjusted monthly return of 0.53 per cent by winner portfolios over the same period. The intercept term for the arbitrage portfolio over the same contrarian strategy is found to be significantly positive with a risk-adjusted return of 0.70 per cent per month in the Indian stock market, suggesting positive risk-adjusted contrarian profits. Looking at the beta values of the winner and loser as well as the arbitrage portfolios, it is clear from the tables that the beta values of the winner portfolio is higher when compared to the loser portfolio. Hence, the extra risk-adjusted return earned by the loser portfolio over a longer time horizon does not seem to be a

compensation for carrying higher risk as measured by CAPM. Hence, it can be argued that past long-run losers significantly outperformed past long-run winners over the subsequent 36 months, and such return discrepancy cannot be explained by a beta risk differential in the Indian stock market. Such findings do not support the earlier findings of Chan (1988), Ball and Kothari (1989), and Conrad and Kaul (1993) who attributed long-term contrarian profits to risk differential among long-term winner and loser portfolios. However, results from the Indian stock market provide support to De Bondt and Thaler (1987), Zarowin (1990), Chopra *et al*. (1992), Tripathi and Aggarwal (2009), and others, that beta risk differential alone cannot explain the long-run reversal effect.

D.2 Other Sources of Risk

In addition to beta risk, the study further controls for size, value, and liquidity risk by following the Mengoli (2004) approach. To control for size, value, and liquidity effects, the past winner and loser portfolios are matched by size, value, and volume by forming size-neutral, value-neutral and liquidity- or volume-neutral portfolios. The proxy used for measuring size, value, and liquidity is market capitalization, the book to market (B/M) ratio, and the monthly turnover ratio respectively. To form a size- (value- or volume-) neutral portfolio, at the end of each formation period (F) stocks were ranked in ascending order on their average market capitalization (B/M ratio or turnover ratio). Based on the average market capitalization (B/M ratio or turnover ratio), the stocks were divided into three equally sized (value- or volume-) small, medium, and large sub-samples. The stocks within each sub-sample were further sorted on the basis of past cumulative returns over the past F months. The top 20 per cent stocks were grouped together into 'winner' and the bottom 20 per cent were referred as 'loser' portfolios. The size-neutral (value-neutral or volume-neutral) portfolios were formed by picking the stocks from the winner (loser) quintile from each size (value or volume) sub-group. Using this methodology, both winner and loser portfolios end up containing the same number of stocks from each size (value or volume) group, and are in that case size- (value- or volume-) neutral. The risk-adjusted momentum profits are calculated for size-neutral, value-neutral and volume-neutral portfolios by regressing the excess returns on the market factor using the CAPM over the holding period of 36 months.

Panel B of Table 5 presents the risk-adjusted profits of size-neutral long-run portfolios using one-factor CAPM. As is evident from the table, both long-run loser and arbitrage portfolios (L-W) generate statistically significant risk-adjusted returns. Such results suggest that both long-run good performance of loser stocks and long-run contrarian profits cannot be completely explained by size differential in the Indian stock market. These results are in line with Chopra *et al*. (1992), Albert and Henderson (1995), and Ahmad and Hussain (2001) who also suggested that both the long-run overreaction effect and the size effect are distinct phenomena.

Panel C of Table 5 presents the risk-adjusted profits of value-neutral long-run portfolios using one-factor CAPM. Even though long-run value-neutral loser portfolios generate statistically significant risk-adjusted returns, value-neutral arbitrage portfolios (L-W) generate statistically non-significant contrarian profits. Such results suggest that long-run contrarian profits are not completely independent of the value effect in the Indian stock market.

Such results are in accordance with the existing literature (Lakonishok *et al.*, 1994) that closely relates the long-run reversal effect to the value effect.[2]

Panel D of Table 5 presents the risk-adjusted profits of volume-neutral portfolios using one-factor CAPM. Similar to the value effect, liquidity risk partially explains the excess contrarian profits in the Indian stock market. After adjusting for liquidity, only long-run losers generate risk-adjusted excess returns while long-run contrarian profits are observed to be statistically non-significant. The influence of liquidity on the long-run reversal effect was also observed by Bailey and Gilbert (2007) for the South African stock exchange.

Table 5: Risk-Adjusted Monthly Contrarian Profits Using One-Factor CAPM

Portfolio	Alpha (α)	T(α)	Beta (β)	T(β)	Adj R^2
PANEL A: Risk-Adjusted Returns Using CAPM					
Winner (W)	0.0053	0.855	1.1530	14.862*	0.576
Loser(L)	0.0124	2.278*	0.9758	13.425*	0.536
Arbitrage(L-W)	0.0070	1.989*	-0.1772	-3.334*	0.061
PANEL B: Risk-Adjusted Returns of Size-Neutral Portfolio Using CAPM					
Winner (W)	0.0024	0.410	0.8803	12.422*	0.471
Loser(L)	0.0127	2.270*	0.9766	13.024*	0.521
Arbitrage(L-W)	0.0103	2.713*	0.0963	1.902**	0.016
PANEL C: Risk-Adjusted Returns of Value-Neutral Portfolio Using CAPM					
Winner (W)	0.0060	0.950	1.1579	14.918*	0.574
Loser(L)	0.0125	2.301*	0.9706	13.364*	0.533
Arbitrage(L-W)	0.0070	1.807	-0.1891	-3.584*	0.071

[2] The long-run reversal effect is generally associated with the value effect as value stocks are typically observed to be long-run loser and growth stocks as long-run winners. Moreover, Lakonishok *et al.* (1994) also argued that the extra return of the value effect is associated with investors' overreaction and not with excess risk.

Table 5: Risk-Adjusted Monthly Contrarian Profits Using One-Factor CAPM: Continues

Portfolio	Alpha (α)	T(α)	Beta (β)	T(β)	Adj R^2
PANEL D: Risk-Adjusted Returns of Volume-Neutral Portfolio Using CAPM					
Winner (W)	0.0065	1.095	1.1515	14.412*	0.571
Loser(L)	0.0130	2.373*	0.9851	13.408*	0.535
Arbitrage(L-W)	0.0067	1.714	-0.1679	-3.188*	0.05

* Statistically significant at 5 per cent level.
The period analyzed is from January 1997 to March 2013. The returns of winner, loser, and arbitrage portfolios (L-W) are regressed on the following regression: $R_{pt} - R_{ft} = \alpha_p + \beta_m (R_{Mt} - R_{ft}) + \varepsilon$. The monthly return of the Sensex index is used as a proxy for the market portfolio. The monthly equivalent on 91-day Treasury bills has been used as a proxy for the risk-free rate of return.
Source: Authors' compilation.

D.3 Multivariate Risk-Adjusted Approach

The study further evaluates the profitability of the long-run reversal effect within a multivariate risk-adjusted framework that simultaneously controls for different sources of risk. Fama and French (1993) proposed a framework to simultaneously control for market, size, and value risk using their three-factor model. Their three-factor model was further enhanced by Chan and Faff (2005) who augmented the model with the liquidity risk factor. The study implements both the Fama and French (1993) three-factor model and the Chan and Faff (2005) four-factor model to evaluate the risk-adjusted long-run contrarian profits in the Indian stock market.

Table 6 suggests that the Fama and French (1993) three-factor model does an excellent job in successfully explaining the long-run reversal effect. The return behavior of long-run contrarian portfolios is completely explained under the risk-return framework of the three-factor model. Prominently, the value factor in the three-factor model seems to explain the excess returns of long-run contrarian portfolios. The long-run loser portfolio loads heavily and positively on both the size and value factors, while the long-run winner portfolio loads positively on size but negatively on the value factor. These findings suggest that the long-run loser portfolio consists of small and distressed stocks as compared to the winner portfolio. Differently put, the results suggest that long-run past loser stocks are riskier as compared to long-run past winner stocks, and hence generate higher returns.

Table 6: Risk-Adjusted Long-Run Contrarian Profits Using the Three-Factor Model

Portfolio	Alpha(α)	β_M	β_S	β_h	Adj R^2
PANEL A: Risk-Adjusted Returns Using the Three-Factor Model					
Winner (W)	-0.0001	1.1172	1.1306	-0.4603	0.751
	(-0.018)	(16.251)*	(9.484)*	(-1.771)	
Loser (L)	0.0032	0.9235	0.0789	0.1104	0.847
	(1.024)	(22.108)*	(13.934)*	(2.514)*	
Arbitrage (L-W)	0.0333	-0.1937	-0.0303	0.5708	0.172
	(0.938)	(-3.881)*	(-0.3082)	(3.019)*	
PANEL B: Risk-Adjusted Returns of Size-Neutral Portfolio Using the Three-Factor Model					
Winner (W)	-0.0024	0.8480	1.0286	-0.4281	0.673
	(-0.492)	(12.792)*	(8.876)*	(-1.614)	
Loser (L)	0.0031	0.9217	1.1542	0.1175	0.854
	(0.952)	(20.941)*	(13.792)*	(0.888)	
Arbitrage (L-W)	0.0056	0.0737	0.1225	0.5456	0.220
	(1.528)	(1.437)	(1.294)	(2.646)*	
PANEL C: Risk-Adjusted Returns of Value-Neutral Portfolio Using the Three-Factor Model					
Winner (W)	0.0002	1.1205	1.1383	-0.4210	0.753
	(0.053)	(16.064)*	(9.763)*	(-1.598)	
Loser (L)	0.0035	0.9189	1.1016	0.0933	0.844
	(1.055)	(21.523)*	(13.544)*	(0.731)	
Arbitrage (L-W)	0.0032	-0.2016	-0.0367	0.5143	0.154
	(0.795)	(-3.439)*	(-0.382)	(2.475)*	
PANEL D: Risk-Adjusted Returns of Volume-Neutral Portfolio Using the Three-Factor Model					
Winner (W)	0.0005	1.1128	1.1541	-0.4005	0.759
	(0.1008)	(16.642)*	(10.480)*	(-1.608)	
Loser (L)	0.0039	0.9327	1.0191	0.1009	0.843
	(1.1553)	(20.525)*	(13.068)*	(0.760)	
Arbitrage (L-W)	0.0036	-0.1817	-0.0468	0.5080	0.137
	(0.923)	(-3.152)*	(-0.519)	(2.605)*	

* Statistically significant at 5 per cent level.

The period analyzed is from January 1997 to March 2013. The returns of winner, loser, and arbitrage portfolios (L-W) are regressed using the following regression: $R_{pt} - R_{ft} = \alpha_p + \beta_m (R_{mt} - R_{ft}) + \beta_s SMB_t + \beta_h HML_t + \varepsilon$.The monthly return of the Sensex index is used as a proxy for the market portfolio. The monthly equivalent on 91-day Treasury bills has been used as a proxy for the risk-free rate of return. SMB represents the small minus big size factor and HML represents the high minus low B/M ratio factor. *t*-statistics are given in ().

Source: Authors' compilation.

In addition, Table 7 also presents liquidity-augmented four-factor regression results for long-run contrarian portfolios. Since the long-run reversal effect in stock returns stands explained by the Fama and French (1993) three-factor model, the liquidity-augmented four-factor model does not have an additional role to play. Nevertheless, the long-run loser portfolio loads heavily on all the three risk factors, including the liquidity factor as compared to the long-run winner portfolio (Panel A of Table 7). These results suggest that long-run losers act as small, distressed, and illiquid stocks.

Importantly, the study also provides support in favor of the multifactor asset pricing model (both three- and four- factor models) over the one-factor CAPM in explaining the Indian stock returns. The substantial differential in the coefficient of determination (adj-R^2) suggests supremacy of multifactor model over CAPM. The adj-R^2 for the loser portfolio is observed to be 0.847 for the three-factor model, up from 0.536 obtained from CAPM. Similarly, the adj-R^2 increases from 0.576 obtained from CAPM to 0.751 from the three-factor model for the past long-run winner portfolio.

Table 7: Risk-Adjusted Long-Run Contrarian Profits Using the Four-Factor Model

Portfolio	**Alpha(α)**	**β_M**	**β_S**	**β_h**	**β_i**	**Adj R^2**
PANEL A: Risk-Adjusted Returns Using the Four-Factor Model						
Winner (W)	0.0046	1.0894	1.1675	-0.4780	-0.1647	0.751
	(0.0870)	(14.644)*	(9.131)*	(-1.796)	(-0.759)	
Loser (L)	0.0031	0.9323	1.0887	0.1160	0.0517	0.846
	(0.958)	(19.652)*	(12.884)*	(2.531)*	(0.393)	
Arbitrage (L-W)	0.0026	-0.1570	-0.0788	0.5940	0.2164	0.177
	(0.629)	(-2.562)*	(0.694)	(2.767)*	(2.592)*	
PANEL B: Risk-Adjusted Returns of Size-Neutral Portfolio Using the Four-Factor Model						
Winner (W)	-0.0015	0.8041	1.0868	-0.4559	-0.2594	0.675
	(-0.306)	(11.112)*	(8.680)*	(-1.688)	(-1.129)	
Loser (L)	0.0027	0.9414	1.1281	0.1300	0.1164	0.854
	(0.794)	(18.847)*	(12.185)*	(0.976)	(0.855)	
Arbitrage (L-W)	0.0043	0.1373	0.0412	0.5859	0.3759	0.251
	(1.167)	(2.621)*	(0.418)	(2.836)*	(2.717)*	

Table 7: Risk-Adjusted Long-Run Contrarian Profits Using the Four-Factor Model: Continues

Portfolio	Alpha(α)	β_M	β_S	β_h	β_i	Adj R^2
PANEL C: Risk-Adjusted Returns of Value-Neutral Portfolio Using the Four-Factor Model						
Winner (W)	0.0008	1.0918	1.1763	-0.4392	-0.1695	0.752
	(0.159)	(14.781)*	(9.228)*	(-1.629)	(-0.813)	
Loser (L)	0.0032	0.9329	1.0830	0.1022	0.0831	0.843
	(0.988)	(19.521)*	(12.723)*	(0.857)	(0.627)	
Arbitrage (L-W)	0.0023	-0.1589	-0.0935	0.5414	0.2526	0.163
	(0.570)	(2.634)*	(-0.877)	(2.569)*	(1.697)	
PANEL D: Risk-Adjusted Returns of Volume-Neutral Portfolio Using the Four Factor Model						
Winner (W)	0.0010	1.0871	1.1882	-0.4168	-0.1519	0.758
	(0.218)	(15.959)*	(9.793)*	(-2.451)*	(-0.804)	
Loser (L)	0.0036	0.9483	1.0884	0.1108	0.0922	0.842
	(1.009)	(17.680)*	(11.689)*	(0.828)	(0.615)	
Arbitrage (L-W)	0.0028	-0.1402	-0.1018	0.5344	0.2454	0.145
	(0.700)	(-0.023)	(-1.032)	(2.730)*	(1.639)	

* Statistically significant at 5 per cent level.

The period analyzed is from January 1997 to March 2013. The returns of the winner, loser, and arbitrage portfolios (W-L) are regressed using the following regression: $Rpt - Rft = \alpha p + \beta M\ (RMt - Rft\ ) + \beta s\ SMBt + \beta h\ HMLt + \beta_i IMV_{t+}\varepsilon$.The monthly return of the Sensex index is used as a proxy for the market portfolio. The monthly equivalent on 91-day Treasury bills has been used as a proxy for the risk-free rate of return. SMB represents the small minus big size factor, HML represents the high minus low B/M ratio factor, and and IMV represents the illiquid minus very liquid liquidity factor. *t*-statistics are given in ().

Source: Authors' compilation.

V. Conclusion and Implications

This study revisits the long-run reversal anomaly in the Indian stock market. Identifying the causes of the long-run reversal effect has important implications for understanding the market efficiency limits and hence is considered as the core of the current study. Even though a few earlier studies have documented the profitability of the long-run reversal effect in the Indian stock market, it is still not clear what drives such profits in the Indian market. The current study sheds new light on the long-run reversal effect by focusing on long-run contrarian profits within the paradigm of various risk frameworks.

While the current study provides support in favor of the long-run reversal effect, the study does not produce risk-adjusted significant contrarian profits in the Indian stock market. The analysis was conducted in multiple steps. First, the *t*-test was used to test the statistical significance of the long-run reversal effect. Providing support to previous studies, the results support the asymmetrical long-run reversal effect in the Indian stock market. Unlike the US stock market, no strong January anomaly was observed in long-run Indian contrarian profits. Further, to evaluate

the economic profitability of the long-run reversal effect, the long-run contrarian portfolio's returns were tested using one-factor CAPM. The one-factor CAPM failed to completely explain excess long-run contrarian profits even after controlling for size, value, and liquidity independently, although both value and liquidity were found to contribute to the long-run contrarian profits. Motivated by these findings, the study simultaneously controlled for various risk factors by adopting the multivariate risk framework of the Fama and French (1993) three-factor model and the Chan and Faff (2005) liquidity-augmented four-factor model. Both the three-factor and the four-factor asset pricing models were observed to be successful in completely explaining the excess long-run reversal profits in the Indian stock market. Perhaps the most interesting finding of the study is that past long-run loser stocks load positively on size, value, and liquidity risk factors while long-run winner stocks load negatively on value and liquidity risk factors. These findings suggest that past long-run loser stocks are small, distressed, and illiquid stocks that have higher risk as compared to their counterparts. Such a risk differential among past loser and winner stocks is responsible for generating return differentials among long-run contrarian portfolios and long-run contrarian profits.

The results from the study have strong implications from both the theoretical and the practical perspectives. Institutional investors, portfolio managers, and stock market analysts, as well as retail investors, should not employ a long-run contrarian strategy in the Indian stock market despite evidence in favor of the long-run reversal effect. The long-run contrarian profits obtained from the portfolios based on the long-run contrarian strategy are nothing but compensation for bearing higher risk. The study also provides support in favor of using a multifactor risk framework as compared to traditional CAPM for considering investment decisions. From an academic point of view, the study provides support in favor of a risk-based explanation of the long-run reversal effect. In a nutshell, the long-run reversal effect cannot be regarded as a true anomaly to the EMH as the effect can be completely explained within the multifactor risk framework.

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Portfolio Rebalancing – Hype or Hope?

By AJIT DAYANANDAN* AND MINH LAM

The present study uses data from the U.S. for the 20-year period 1983-2012 to examine whether there is evidence that statistically significant value exists for various portfolio rebalancing strategies. The study found that the differences in return from various periodic-cum-threshold rebalancing strategies compared to a buy-and-hold strategy is only 11 basis points and that the mean difference of various periodic rebalancing strategies from a buy-and-hold strategy is not statistically significant except for quarterly or semi-annual portfolio rebalancing strategies. Moreover, the cost of rebalancing is substantial. Given taxes on capital gains and monitoring costs, the analysis shows that the gains from portfolio rebalancing are insignificant. The hype associated with such strategies does not withstand the test of data in the long run. There may be a case for portfolio rebalancing, especially for asset rotation during business cycles. But the evidence provided by this study does not support a case for active rebalancing, a finding which is consistent with the existing compelling evidence against active portfolio management.

Keywords: Portfolio Rebalancing, Periodic Rebalancing, Threshold Rebalancing, Sharpe Ratio

JEL Classification: C15, G11

I. Introduction

The virtue of portfolio rebalancing is one of the controversial aspects of portfolio management. In investment decisions, the primary emphasis is on asset allocation decisions. Prior research has shown that asset allocation decisions can explain a substantial portion of the long-term performance variations of funds (Brinson *et al.*, 1986, 1991, 1995; Ibbotson and Kaplan, 2000; Hood, 2005; Assoé *et al.*, 2006). However, the dynamic aspect of the investment decision is the portfolio monitoring strategy, including guidelines (how often, how far and how much) for rebalancing the portfolio when market conditions change (Perold and Sharpe, 1988).

Once the asset allocations are determined (based on the risk-tolerance level of investors), subsequent market movements may change the risk-return trade-off that was originally established by the investor. Rebalancing the portfolio could be accomplished by acquiring more of the best performing asset class at the expense of the lesser performing classes or by rebalancing back to the initial portfolio mix. Then a case for de-risking the portfolio and readjusting the allocation weights of the portfolio to the original level exists. The main virtue of portfolio rebalancing, cited

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in the literature, is the maintenance of the risk-reward profile of the investors and the ability of investors to capture buy-low/sell-high opportunities (Arnott and Lovell, 1993; Buetow *et al.*, 2002; O'Brien, 2006; Daryanani, 2008). Portfolio rebalancing is widely recommended by financial advisors as part of the paradigm of "cracking and preserving the nest egg". At the theoretical level, the efficient market hypothesis (EMH) holds that value from rebalancing is only short-lived; as stock market anomalies are identified, they would lead investors to engage in arbitrage which would result in the anomalies' disappearance over time. Malkiel and Fama's (1970) work shows that once transaction costs are considered, an individual investor cannot beat the market. Similarly, the empirical evidence provided by behavioral finance literature argues that overconfidence of investors in their investing ability and a disposition to hold losing financial assets too long and selling winners too early prevent portfolio diversification and rebalancing (Shefrin and Statman, 1985; Odean, 1998, 1999; Barber and Odean, 2000, 2001). The overconfidence of investors, it is argued, leads to excessive trading, which results in inferior returns in active portfolios; this phenomenon has been called the "active investing puzzle" (Odean, 1999, Barber and Odean, 2000; Biais *et al*. (2005); Barber *et al.*, 2009).

Since the seminal paper by Jensen (1968), academics have debated this issue and have pointed out that portfolio rebalancing results in higher transaction costs and that portfolios with high transaction levels tend to underperform those with passive investment strategies (Jensen, 1968; Malkiel, 1995, 2013; Gruber, 1996; Wermers, 2000; Pástor and Stambaugh, 2002, 2012; French, 2008; Fama and French, 2010; Del Guercio and Reuter, 2014). Given the existence of transaction costs and considerable "layer-on-layer fees" charged by fund managers/marketers/traders, it has been argued that the best way to manage a portfolio is the passive "buy-and-hold"[1] (B&H) strategy as opposed to "active"[2] portfolio management[3]. The argument for the "buy-and-hold" strategy is that active portfolio management is good for brokers and fund managers (as they can fleece the investors) but poses perils to investors. Fund managers have become wealthy mainly because of their ability to appropriate a substantial portion of their funds' annual returns and this represents the deadweight costs of active management. However, empirical studies especially from the practitioners have provided evidence to support the benefits of portfolio rebalancing (Tsai, 2001; Arnott *et al.*, 1990, 1993; Buetow *et al.*, 2002; Harjoto and Jones, 2006; Donahue and Yip, 2003; O'Brien, 2006; Jaconetti *et al.*, 2010). But at the investor (household) level, there is very little evidence that investors rebalance their portfolios. For example, a study by Calvet *et al.* (2009), based on individual households in Sweden (for 1999 and 2002), found evidence of very little rebalancing in the financial portfolios of households.

Studies have also shown that the need for and outcome of rebalancing depend on the market environment (Tokat and Wicas, 2007). In markets that are trending, portfolio rebalancing was found to yield a lower return as compared with less frequently rebalanced portfolios. On the other hand, in a mean-reverting market, the asset drift is likely to be reversed in subsequent periods, decreasing the need to rebalance (Tokat and Wicas, 2007). Given such conflicting evidence, it

[1] Under the strategy of 'buy and hold', the investor (or portfolio manager) buys a strategic portfolio at the beginning of the investment period and nothing else is done until the portfolio is liquidated at the end (see Cesari and Cremonin, 2003).

[2] Under 'active' portfolio management, the investor (or portfolio manager) chooses a tactical trading strategy of buying and selling assets (risky and risk-free assets) to rebalance assets so as to achieve an optimal portfolio for a given investor over his or her investment horizon (see Cesari and Cremonin, 2003).

[3] A recent Bloomberg study found that investors lose 89 per cent of gains from active funds management. See http://www.bloomberg.com/news/print/2013-10-07/how-investors-lose-89-percent-of-gains-from-futures-funds.html (accessed on November 7, 2013).

would be interesting to examine how a long-term investor would perform under different market conditions (business cycles) using different portfolio rebalancing strategies. The present study examines the empirical evidence for the U.S. using data for a substantial period of time (20 years from 1983 to 2012), to examine whether a statistically significant value exists for portfolio rebalancing. In contrast to the extant literature, the study examines the benefits and costs of periodic, as well as threshold, portfolio rebalancing strategies and covers both expansion and contraction periods of the business cycle.

The study is organized as follows. Section II describes the literature on the subject and develops the hypotheses for the empirical investigation. Section III discusses the database and methodology used in the study. Section IV presents the empirical results and explains some of our findings. Section V summarizes the conclusions.

II. Review of Literature and Hypothesis Development

There is considerable theoretical and empirical literature on the virtues and limitations of portfolio rebalancing. The motives for portfolio rebalancing are numerous. Financial theory suggests that an investor who chooses an asset allocation strategy that is optimal (given the investors' risk tolerance relative to the target allocation) would find changes in the weighting of each asset class in the portfolio by the end of the year due to market movements (time-variant asset returns). The realized return on financial assets results in mechanical changes in asset class weights (resulting in overweight or underweight asset classes), leading to the investor being passively exposed. This calls for "trimming" down the positions of performing assets and fortifying the gains of investment. Portfolio rebalancing allows investors to optimize the risk level and "rotate out" of certain asset classes. Thus, rebalancing is the process of buying and selling portions of one's portfolio in order to set the weight of each asset class back to its original level. In addition, if one's investment strategy or tolerance for risk has changed, rebalancing can be used to readjust the weighting of each security or asset class in the portfolio to fulfill a newly devised asset allocation (depending on the phase of the business cycle). The critics of rebalancing argue that "letting winners run" tends to produce higher returns. This may be true in bull phases of the stock market cycle, but stock market crashes like those that occurred in October 1987, in the aftermath of 9/11 and during the financial crash in 2008 have provided evidence that a secular bull phase in stock market activity is not a reality. In a world where "what goes up must come down", there is an active case for trimming a winning position before its downturn (weakness).

At the theoretical level, the case for active management is based on the idea that active managers are forecasters who can generate excess returns (alphas) as future information is not fully reflected in the price of stocks and that such active managers can translate these forecasts into portfolios (Waring and Siegal, 2003). An early study at the empirical level by Arnott and Lovell (1990) using actual return data (for stocks and bonds) for the U.S. during 1973-1988 found that disciplined portfolio rebalancing improves portfolio performance. Studying a long period of time (1968-1991), Arnott and Lovell (1990) found that for a 50/50 stock/bond portfolio, monthly rebalancing generates the highest return of 9.16 per cent compared with a buy-and-hold return of 9.09 per cent. Plaxco and Arnott (2002) extended their analysis to a global portfolio of 11 developed markets for the period 1968 to 2000 (21 years) and found that the return on the global portfolio based on quarterly rebalancing was the highest (10.96 per cent) compared to the U.S. domestic portfolio (10.68 per cent).

On the other hand, Stine and Lewis's (1992) study, based on different asset allocations of stocks, bonds and T-bills (40/40/20 respectively) for the U.S. during the period 1946-1989 on staggered 3-year portfolios found that the buy-and-hold strategy generates the highest return when compared to calendar and threshold rebalancing strategies. Likewise, using data for the U.S. for the period 1986 to 2000, Tsai (2001) concluded that the difference in outcome (like the Sharpe Ratio) is small for various rebalancing strategies even in a highly risky portfolio (with an equity component of 80 per cent). Subsequent studies by Harjoto and Jones (2006), O'Brien (2006), Daryanani (2008) and Jaconetti *et al.* (2010) found that various portfolio rebalancing strategies generate marginally better returns compared with buy-and-hold strategies.

On the other hand, there is a huge academic literature showing that actively managed mutual funds have underperformed those with passive investment strategies (Jensen, 1968; Malkiel, 1995, 2013; Gruber, 1996; Wermers, 2000; Pástor and Stambaugh, 2002, 2012; French, 2008; Fama and French, 2010; Del Guercio and Reuter, 2014). Malkiel and Fama (1970) and Fama (1991, 2014) argue that the stock markets are efficient and that weak and semi-strong tests of efficiency imply that market prices adjust to "publicly-traded information," while strong forms of tests evaluate the market impacts of non-public information. Their work implies that an individual investor cannot beat a market using a buy-and-hold investment strategy. Quoting Jensen's (1968) work, Malkiel and Fama (1970) note that in "89 out of 115 cases, the fund's risk-return combination for a ten-year period is below the market line and the average return over all funds is 14.6 per cent less than the market return" (p. 412). Gruber (1996) finds that the average mutual fund underperforms passive market indices by about 65 basis points per year from 1985 to 1994. Carhart (1997) finds that net returns are negatively correlated with expense levels of mutual funds and are generally higher for actively managed funds.

Malkiel (2003), while reiterating Fama's conclusions, argues that stock markets are efficient and whatever anomalous behavior of stock prices may exist does not create a portfolio of trading opportunities to earn abnormal returns. Citing numerous studies, Malkiel (2003) argues that professional mutual fund investors, on average, underperform the market and index funds. Malkiel (2003) also provides evidence that the above average returns by a portfolio manager in a given year do not guarantee similar performance in subsequent years.

French's (2008) study of all NYSE, Amex and NASDAQ stocks during 1980-2006 found that investors spend 67 basis points more for active management compared with a passive market portfolio. Similarly, the study by Fama and French (2010) of mutual fund performance in the U.S. during 1984 to 2006 also finds that the net returns of mutual funds in the U.S. underperform benchmarks by about the costs in expense ratios. However, Del Guercio and Reuter's study (2014) based on direct-sold retail mutual funds (self-directed) as compared with broker sold retail mutual funds (based on the advice of the broker) during 1992 to 2004 found persistent underperformance only in broker-sold mutual funds as compared with self-directed investor mutual funds. Given the conflicting evidence regarding the outcome of rebalancing portfolios, the present study examines whether *rebalancing strategies generate better risk-adjusted return than a buy-and-hold strategy.*

The literature also discusses various rebalancing strategies: periodic and threshold-based rebalancing (Masters, 2003). The empirical literature on rebalancing strategies are (a) *time calendar* (such as daily, weekly, biweekly, monthly, quarterly, annually, etc.), (b) *threshold strategies* (such as rebalancing whenever asset ratios drift more than 5 per cent, 10 per cent, 15 per cent, etc. from the target ratios), and (c) *time-threshold strategies*[4]. Various authors have proposed different optimal periodic rebalancing strategies based on different time periods. An empirical

[4] For a discussion of the various types of rebalancing strategies, see Daryanani (2008) and Jaconetti *et al.* (2010).

analysis of these rebalancing strategies has yielded mixed results: some have argued that an annual rebalancing strategy produces the optimal portfolio (Daryanani, 2008; Jaconetti *et al.*, 2010), while others provide evidence that a quarterly rebalancing strategy provides the best return-risk adjustment (Arnott and Lovell, 1990, 1993).

III. Database and Methodology

A. Database

The study is based on a hypothetical portfolio of financial assets invested in stocks and bonds from 1993 to 2012 in the United States. The study is cast from the point of view of institutional investors, although the household sector is normally behind much of the holdings of institutional investors. A stock index can be considered as a diversified portfolio of risky assets and hence an ideal candidate for the creation of a "hypothetical" stock portfolio. The market index used in this study is the S&P 500 which consists of large value stocks and is widely used as a benchmark in investment analysis. The portfolio of stocks measured by the S&P 500 index represents the passive component and all deviations from the index are considered as the active component (Petajisto, 2013). The daily returns from the S&P 500 index are used to calculate the returns. Similarly, the 10-year Treasury yields in the U.S. are used as a proxy for bond returns. The compounded returns are calculated from daily returns. Using actual historical data could throw light on various portfolio rebalancing strategies that have outperformed others with varying levels of statistical significance. The daily stock price index (S&P 500) and 10-year Treasury yield were downloaded from S&P Capital IQ.

B. Methodology

We consider a target portfolio with an initial investment of $10 million with various asset-class mixes of stocks and bonds (90/10, 80/20, 60/40, 50/50, 40/60, 30/70, 20/80 and 10/90). However, our baseline study is based on a 50/50 (stock/bond) portfolio[5] as this was found to be the most popular asset allocation in the U.S. (IMF, 2005, 2011). Assuming a well-diversified portfolio, we envisage limited market timing possibilities. We also rule out reinvestment of dividends and other cash flows so as to avoid complications in portfolio rebalancing strategies. We assume a trading cost of a flat $20 a trade and assume that this trading cost is independent of the size of the trade. We also do not consider bundled costs, such as soft dollars, taxes and labor costs. Similarly, we rule out investors' risk tolerance changing over time as well as investors' changing cash flows. The only dynamic component considered in the portfolio is the change in the value of portfolio over the base values. In our estimation, we consider all periodic (daily, monthly, quarterly, annually, etc.) plus various thresholds (magnitude of drift from target asset allocation) of 5 per cent, 10 per cent, and 15 per cent respectively. For each of the abovementioned rebalancing strategies, risk-adjusted returns are compared with buy-and-hold strategies.

In evaluating various portfolio rebalancing strategies, we use the geometric mean to measure return. The use of the geometric mean as opposed to the arithmetic mean is based on the argument that (a) in portfolio selection, one is interested in measuring long-run cumulative wealth effects (returns for each period are reinvested) and the geometric mean is best suited for that (Young and

[5] The most important practical guideline portfolio allocation for life-cycle investing in equities is 100-minus-age strategy (see Bodie and Crane, 1997).

Trent, 1969), and (b) the theoretical argument that a rational investor wants to choose the portfolio that has the greatest probability of being more valuable than other portfolios. Latané (1959, 1963) has shown that the portfolio that has greatest probability of more value is also the portfolio that has a probability distribution of returns with the largest geometric mean. Latané (1959, 1963) used the geometric mean (G) approximation

$$G^2 = A^2 - S^2 \quad (1)$$

where G is the geometric mean, A is the arithmetic mean and S is the standard deviation. The geometric mean is the nth root of the product of X values.

$$G = \sqrt[n]{(X_1)(X_2) \dots \dots (X_n)} \quad (2)$$

Total risk is assessed by a measure of dispersion-standard deviation. In the portfolio choice context, for any given level of expected return, the greater the standard deviation, the riskier the investment. Originating from the mean-variance framework, the most common risk-adjusted return is the "Sharpe Ratio (SR)"[6] which converts total returns into excess returns by subtracting the risk-free rate and then divides the result by the standard deviation to get a measure of "reward per unit of risk" (see Sharpe, 1964, 1966, 1994). In the literature, the SR is used not only to evaluate portfolio performance but also to test the weak form of market efficiency (see Agarwal and Naik, 2004). In our estimation, we used the U.S. one-year T-bill rate as the short-term risk-free rate. The hypothesis will be rejected if the average Sharpe Ratio for the various active rebalancing strategies over buy-and-hold strategies will be higher and statistically different over the period 1993-2012 for the U.S.

Table 1: Descriptive Statistics of Return on Stocks and Bonds in the U.S. 1993-2012

	S&P 500	10-year US Government Bond Yield
Geometric Mean (%)	6.11	4.80
Mean (%)	7.86	4.81
Median (%)	10.89	4.68
Minimum (%)	-38.49	1.89
Maximum (%)	34.11	7.84
Standard Deviation (%)	18.67	1.48

Table 1 reports the return on stocks (based on S&P 500 indices) and yields on 10-year U.S. bonds for 20 years (1993-2012). The cumulative (geometric) return on stocks of 6.11 per cent during 1993-2012 was considerably higher than the return on bonds (4.80 per cent). The variation

[6] Other portfolio evaluation metrics include Jensen's alpha (Jensen, 1968), and the Treynor Ratio (Treynor, 1966). These measures adjust excess returns for the capital asset pricing model's beta.

in return (standard deviation) was also higher for stocks (18.67 per cent) compared with bonds (1.48 per cent). Thus the risk-return profile of stocks was higher relative to bonds.

Most institutional investors such as pension funds, mutual funds, endowments and foundations set an asset allocation policy after considerable analysis and change it only episodically (Sharpe, 2010). We examine three different allocations of stocks and bonds and nine different harvesting rules beside the passive strategy of buy-and-hold, viz. (a) *time calendar* (such as daily, weekly, biweekly, monthly, quarterly, annually, etc.), (b) *threshold strategies* (such as rebalancing whenever asset ratios drift more than 5 per cent, 10 per cent etc. from the target ratios), and (c) *time-threshold strategies*. Portfolio managers generally use heuristics that are either periodic (monthly/quarterly/annually, etc.) or volatility-based such as rebalancing whenever assets ratios are more than 5 per cent from the target ratio (Donohue and Yip, 2003) and hence report threshold rebalancing for 5 per cent and 10 per cent respectively.

We studied the rebalance bands of 0, 5, 10 and 15 per cent from original target allocations. In addition, we looked at different intervals such as daily, weekly, bi-weekly, monthly, quarterly, semi-annually, annually, 2nd-yearly, 3rd-yearly, 4th-yearly, and 5th-yearly.

IV. Empirical Results

Table 2: Descriptive Statistics of Buy-and-Hold Portfolios – 1993-2012

Statistics	Portfolio (Stocks/Bonds)								
	90/10	80/20	70/30	60/40	50/50	40/60	30/70	20/80	10/90
Geometric Mean (%)	5.99	5.87	5.75	5.62	5.49	5.36	5.23	5.09	4.95
Mean (%)	7.48	7.11	6.75	6.41	6.07	5.76	5.47	5.21	4.99
Median (%)	10.30	9.70	9.07	8.32	7.53	6.87	6.36	5.63	4.86
Minimum (%)	-35.61	-32.53	-29.20	-25.61	-21.71	-17.46	-12.83	-7.75	-2.15
Maximum (%)	31.32	28.56	25.84	23.17	20.52	17.95	15.35	12.81	10.31
Standard Deviation (%)	17.28	15.83	14.31	12.71	11.00	9.19	7.25	5.17	3.00
Skewness (%)	-87.90	-89.84	-91.33	-92.20	-92.17	-90.62	-86.05	-73.58	-30.47
Kurtosis (%)	65.56	69.63	73.50	77.10	80.33	83.02	84.64	82.47	56.17

Table 2 reports the descriptive statistics of buy-and-hold portfolios for various asset allocations – stocks and bonds – based on actual return data for 1983 to 2012. Establishing an optimum portfolio is the most important strategic decision facing any investor. As is evident from Table 2, the highest geometric return was for a predominantly stock portfolio (90/10). As the allocation of bonds was increased, the return decelerated and was the lowest for an extreme bond portfolio (10/90). On the other hand, the risk (measured by standard deviation) was highest for extreme stock portfolios (90/10) and decreased as the portfolio allocation of bonds was increased. Almost all portfolio allocations have negative skewness indicating the probability of large negative

rates of return; skewness was lower for extreme bond portfolios (10/90) indicating that much of the negative returns was driven by stock allocations. The period of investigation includes many periods with extreme negative returns for stocks; during 2008, stock returns fell by 38.5 per cent (see Figure 1).

Figure 1: Stock Market Returns (S&P 500) – 1993-2012

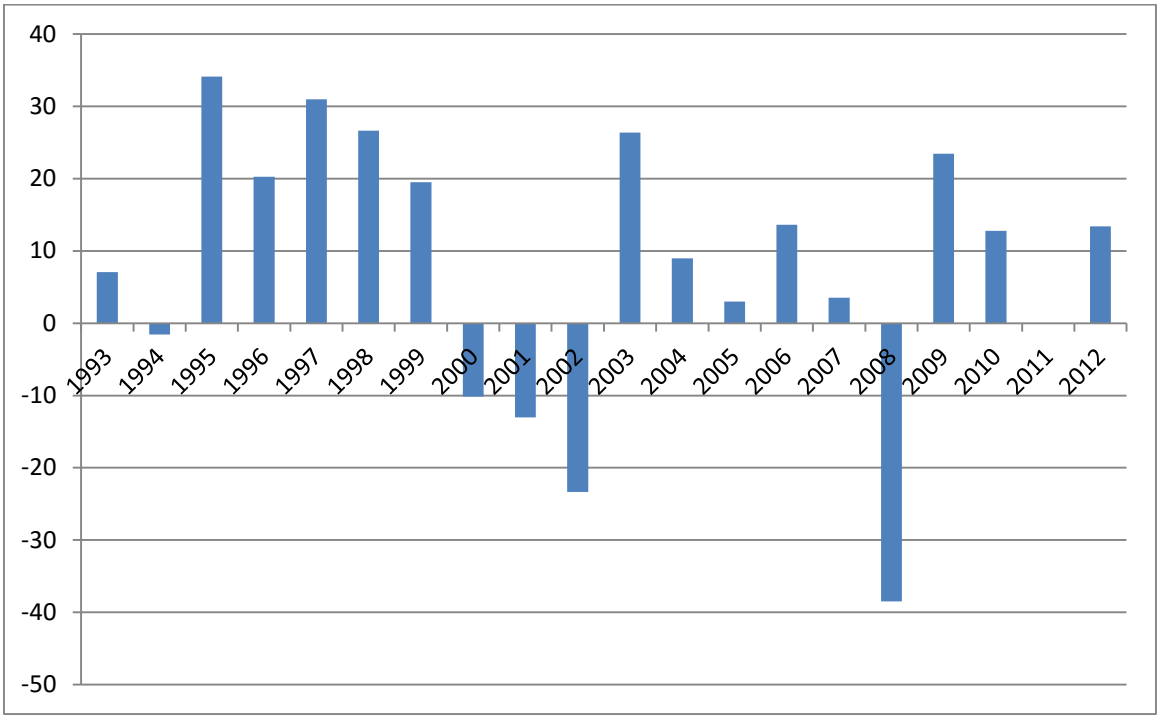


Table 3 (a) to (d) report the results of periodic rebalancing strategies for the period 1993-2012 for different thresholds. For simple periodic rebalancing [Table 3(a)], annual and 2nd yearly rebalancing had the highest reward-risk (Sharpe Ratio). For 5 per cent thresholds, again 2nd year rebalancing was found to have the highest (0.28) Sharpe Ratio [Table 3(b)]. Similar results were found for 10 per cent threshold rebalancing [Table 3(c)]. For 15 per cent rebalancing, however, annual rebalancing was found to have the highest Sharpe Ratio [Table 3(c)].

Table 3 (a): The Effect of Portfolio Rebalancing – 1993-2012

Investment Strategy	Rebalance Band 0%			
	Geometric Mean (%)	Arithmetic Mean (%)	Risk (%)	Sharpe Ratio
Buy-and-hold	5.97	6.54	10.87	0.28
Daily	5.87	6.31	9.57	0.30
Monthly	5.73	6.18	9.73	0.28
Quarterly	5.78	6.23	9.71	0.29
Semi-annually	5.71	6.15	9.65	0.28
Annually	5.78	6.21	9.60	0.29
2nd-yearly	5.86	6.31	9.78	0.29
3rd-yearly	5.46	5.89	9.53	0.26
4th-yearly	5.40	5.90	10.16	0.24
5th-yearly	5.27	5.73	9.86	0.23

Table 3 (b): The Effect of Portfolio Rebalancing – 1993-2012

Investment Strategy	Rebalance Band 5%			
	Geometric Mean (%)	Arithmetic Mean (%)	Risk (%)	Sharpe Ratio
Buy-and-hold	5.97	6.54	10.87	0.28
Daily	5.84	6.29	9.67	0.29
Monthly	5.76	6.22	9.75	0.28
Quarterly	5.74	6.19	9.65	0.28
Semi-annually	5.73	6.16	9.58	0.28
Annually	5.83	6.26	9.46	0.30
2nd-yearly	6.08	6.50	9.44	0.32
3rd-yearly	5.55	5.97	9.43	0.27
4th-yearly	5.40	5.90	10.16	0.24
5th-yearly	5.27	5.73	9.86	0.23

Table 3 (c): The Effect of Portfolio Rebalancing – 1993-2012

Investment Strategy	Rebalance Band 10%			
	Geometric Mean (%)	Arithmetic Mean (%)	Risk (%)	Sharpe Ratio
Buy-and-hold	5.97	6.54	10.87	0.28
Daily	5.98	6.42	9.68	0.31
Monthly	5.86	6.32	9.76	0.29
Quarterly	5.77	6.21	9.67	0.28
Semi-annually	5.84	6.27	9.56	0.29
Annually	5.82	6.25	9.51	0.29
2nd-yearly	6.08	6.50	9.44	0.32
3rd-yearly	5.72	6.16	9.67	0.28
4th-yearly	5.40	5.90	10.16	0.24
5th-yearly	5.27	5.73	9.86	0.23

Table 3 (d): The effect of Portfolio Rebalancing – 1993-2012

Investment Strategy	Rebalance Band 15%			
	Geometric Mean (%)	Arithmetic Mean (%)	Risk (%)	Sharpe Ratio
Buy-and-hold	5.97	6.54	10.87	0.28
Daily	5.98	6.44	9.83	0.30
Monthly	5.85	6.30	9.65	0.29
Quarterly	5.64	6.10	9.77	0.27
Semi-annually	5.65	6.11	9.82	0.27
Annually	6.28	6.68	9.26	0.35
2nd-yearly	6.30	6.77	9.99	0.33
3rd-yearly	5.98	6.41	9.55	0.31
4th-yearly	6.02	6.45	9.62	0.31
5th-yearly	5.40	5.85	9.74	0.25

Table 4: Difference in Mean Returns of Various Investment Strategies from Buy-and-Hold – 1993-2012

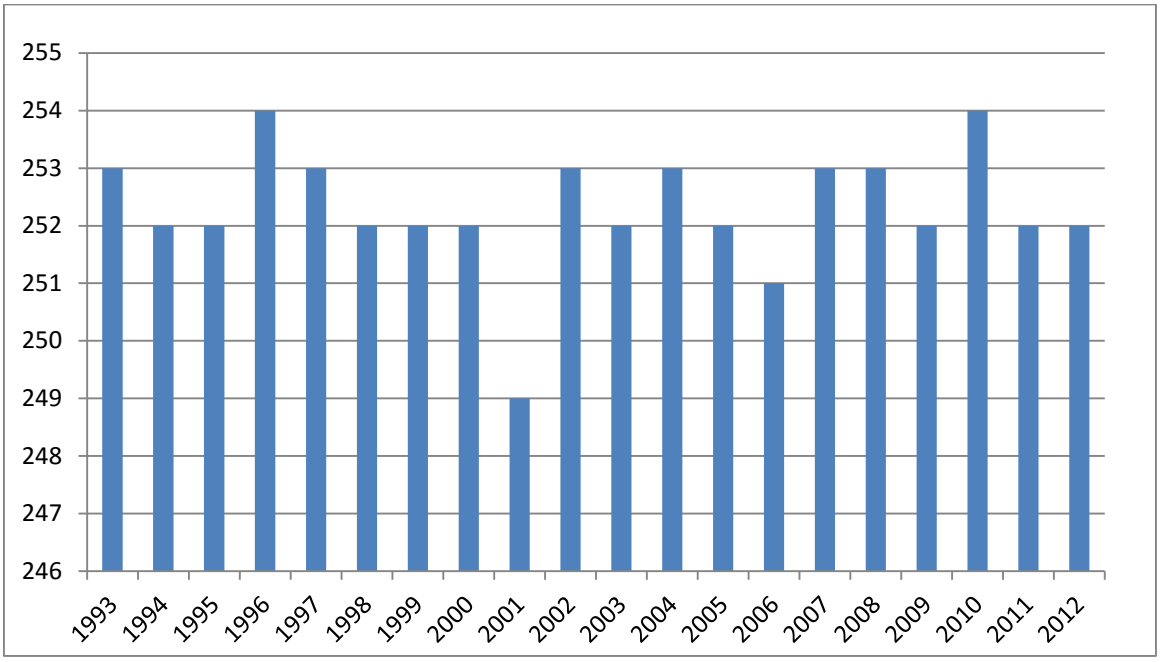
Investment Strategy	Mean Difference	*p*-values
Daily	0.0020	
	(1.34)	0.18
Monthly	0.0543	
	(2.09)	0.03
Quarterly	0.1538	
	(1.93)	0.06
Semi-annually	0.2997	
	(4.20)	0.00
Annually	0.679	
	(1.98)	0.06
2nd-yearly	1.299	
	(1.43)	0.18
3rd-yearly	3.57	
	(2.76)	0.03
4th-yearly	4.53	
	(2.53)	0.06
5th-yearly	6.41	
	(2.94)	0.06

Note: Figures in brackets are *t*-values.

An interesting result reported in Table 3 (a) to (d) is that the difference in return from various periodic-cum-threshold rebalancing strategies compared with buy-and-hold was only 11 basis points except for the 15-per cent threshold, where the difference was 33 basis points. Table 4 shows whether the mean difference of various periodic rebalancing strategies from the buy-and-hold are statistically significant or not. These results showed that for the majority of periodic strategies, the mean differences are not statistically significant except for quarterly or semi-annual portfolio

rebalancing strategies. Moreover, the cost of rebalancing is also substantial; Figure 2 displays the number of rebalancing transactions for a daily rebalancing strategy which was the highest among other periodic and periodic-cum-threshold strategies. On average around 240 rebalancing transactions were involved; for annual rebalancing, the number is around 20. Given the taxes and monitoring costs, the analysis shows that the gains from pursuing rebalancing are minuscule or absent.

Figure 2: Number of Rebalancing Transactions for Daily Rebalancing – 1993-2012



V. Conclusions

The virtue of portfolio rebalancing is one of the controversial issues in portfolio management. Proponents argue for it on the grounds that it de-risks the portfolio and brings value to investors. On the other hand, the critics of portfolio rebalancing argue against it both theoretically and empirically. At the theoretical level, the EMH argues that stock return anomalies are short term and that in the long term, once investors realize the existence of short-term anomalies they will trade on these anomalies and the anomalies will disappear. The argument of the behavioral school is couched on the assertion that overconfidence of investors and a disposition to hold losing assets and sell winners prevent portfolio diversification and constrain portfolio rebalancing. At the empirical level, it provides evidence of behavioral biases leading to "too much trading" which creates layer-on-layer fees for the portfolio managers at the expense of investors. Apart from the existence of transaction costs and considerable layer-on-layer fees charged by fund managers/marketers/traders, it has been argued that the best way to manage one's nest egg (savings) is the passive "buy-and-hold" strategy.

The present study re-examines the evidence for the U.S. using data for a substantial period of time (20 years – 1983 to 2012), to establish whether a statistically significant value exists for portfolio rebalancing strategies. The study found that the difference in return from various periodic-cum-threshold rebalancing strategies compared with buy-and-hold is only 11 basis points

and that the mean difference of various periodic rebalancing strategies from buy-and-hold is not statistically significant except for a quarterly or semi-annual portfolio rebalancing strategy. Moreover the cost of rebalancing is also substantial. Given taxes on capital gains and monitoring costs, the analysis shows that the gains from portfolio rebalancing appear to be insignificant. The hype associated with such strategies does not withstand the test of data in the long run. There may be a case for portfolio rebalancing especially for asset rotation during business cycles. But the evidence provided by this study does not support a case for active rebalancing, a finding that is consistent with the existing compelling evidence against active portfolio management and the increased flow of funds to passive investment vehicles such as exchange traded funds and index funds.

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Continuous Improvement in an Emerging Market: Findings from Vietnam

By PHUONG ANH NGUYEN*

This study investigates the factors underpinning continuous improvement (CI) effectiveness in Vietnam. Based on survey data collected from 490 participants plus interviews and discussions with 130 business professionals with extensive knowledge of Vietnam, it identifies top management commitment as a major factor critical to the success of CI in that country. In addition, the paper highlights change agent participation as well as management and employee development as critical in facilitating CI practices in Vietnamese companies. Reward systems – though common in Vietnam – did not affect CI outcomes in the study. The reasons for this apparent anomaly need further research.

Keywords: Continuous Improvement, Quality Management, Vietnamese Management, Emerging Market Economy

JEL Classification: M1, L100

I. Introduction

Since the new millennium, Southeast Asia has had some of the fastest growing economies in the world. Among them Vietnam generated an impressive 7 per cent average growth rate between 2002-2010, and has had over 5 per cent growth every year since 2011 (Wilson, 2014). This notable growth accrues from the advantages the country offers to foreign investors. They include a young and vibrant workforce, a domestic market of over 93 million consumers, and low-cost production sites. But as Vietnam is being transformed from one of the world's poorest nations to a middle-income country, its business organizations struggle to win out against Southeast Asian economies with even lower wages while at the same time making headway against high-skill, productivity-driven growth industries in advanced economies (Berliner *et al.*, 2013). The challenge Vietnamese businesses face is to move up the production value-chain rather than lingering at the bottom as mere providers of low-cost labor.

One major route upwards is the adoption of continuous improvement (CI) practices. Broadly defined as a set of principles and activities aimed at raising the level of organization-wide performance through ongoing, systematic, and cumulative improvements (Bessant and Caffyn, 1997; Lillrank *et al.*, 2001), CI has already created tremendous value and driven competitive advantage in many companies around the world. Having long proven their worth and becoming well-established in the U.S., Japan, and Europe, CI practices have recently taken root in developing Asian countries (see, e.g., Giroud, 2007; Sohal *et al.*, 1989; Yeung *et al.*, 2005). The experience there suggests that the adoption and skillful management of CI by Vietnamese organizations will

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be critical to their future success in avoiding the twin economic threats from lower-cost firms in newly developing nations and competitive improvement-oriented companies elsewhere. As Philip Crosby has noted, "Nothing is more important to the prosperity of a developing nation than quality" (Djerdjour and Patel, 2000, p. 25).

The study reported here investigated the management of CI in Vietnam with the aim of examining the factors that led to its effectiveness. The research and its analysis are based on 490 questionnaires of managers, supervisors, and employees plus interviews and discussions with 130 executives, managers, and individuals who have extensive knowledge of the country.

II. Literature Review

CI comprises approaches such as quality control circles, total quality management (TQM), and six sigma, as well as productivity improvement mechanisms such as lean and employee idea systems. CI practices have been fundamental to building and sustaining competitive advantage (Garvin, 1987), improving product and service quality (Nair, 2006; Naveh and Erez, 2004; Rungtusanatham, 2001; Schroeder *et al.*, 2005), and enhancing operational performance (Anderson *et al.*, 1995; Choi and Eboch, 1998; Dow *et al.*, 1999; Samson and Terziovski, 1999).

The literature review identified a number of frameworks established by eminent researchers in quality and CI. Saraph *et al.* (1989) developed an instrument to measure critical constructs of quality management: role of management leadership and quality policy, role of the quality department, training, product/service design, supplier quality management, process management, quality data and reporting, and employee relations. Building on Saraph *et al.*'s (1989) work, Flynn *et al.* (1994) identified seven dimensions of quality management including top management support, quality information, process management, product design, work force management, supplier involvement, and customer involvement. Ahire *et al.* (1996) determined that quality management can be viewed as a combination of top management commitment, customer focus, supplier quality management, design quality management, benchmarking, statistical process control usage, internal quality information usage, employee empowerment, employee involvement, employee training, product quality, and supplier performance. These three studies provided a strong composite set of constructs and associated scales for further research in quality and CI.

Building on prominent studies (Ahire *et al.*, 1996; Benson *et al.*, 1991; Black and Porter, 1996; Flynn *et al.*, 1994; Saraph *et al.*, 1989), Jain and Tabak (2002) elicited a common set of quality constructs that represents an integrated and holistic approach to TQM in India. They found significant differences in perceptions of TQM implementation across managerial levels in Indian firms (Jain and Tabak, 2002). While top and middle managers focused on employee training, employee empowerment and relations, and teamwork, junior managers perceived that top management commitment was the most important element in successful implementations.

Based on these same studies (e.g., Ahire *et al.*, 1996; Benson *et al.*, 1991; Black and Porter, 1996; Flynn *et al.*, 1994; Saraph *et al.*, 1989), Brah *et al.* (2000) determined eleven constructs of TQM implementation in service firms in Singapore. The authors suggest that while customer focus and quality improvement rewards can be attributed to some TQM tools, the key to TQM success lies in top management support, employee empowerment, and employee involvement (Brah *et al.*, 2000). Similarly, Sohail and Hoong (2003) investigated six constructs of TQM implementation used in Malaysia and identified customer management and satisfaction as most important to the

success of TQM in ISO 9000-registered firms and strategy planning as critical to non-registered firms (Sohail and Hoong, 2003).

From self-assessment programs including the European Business Model of Excellence, the Malcolm Baldrige National Quality Award (MBNQA), the Asia-Pacific Business Excellence Standard, and the Vietnam Quality Award, Hoang *et al.* (2006) identified eleven factors to measure the implementation of TQM and its relationship to innovation in Vietnam. They concluded that top management commitment, employee involvement, employee empowerment, process management, and an open, trusting organizational culture positively impacted innovation performance in the Vietnamese companies they surveyed (Hoang *et al.*, 2006).

The frameworks developed by Saraph *et al.* (1989) and MBNQA (Steeples, 1993) led Rao *et al.* (1997) to identify eight constructs of quality, which they used to compare quality management practices in China, India, and Mexico. The authors found that irrespective of the country and length of the organization's quality experience, top management support is a significant factor influencing strategic quality planning, human resource development, supplier quality, quality results, and customer orientation practices (Rao *et al.*, 1997).

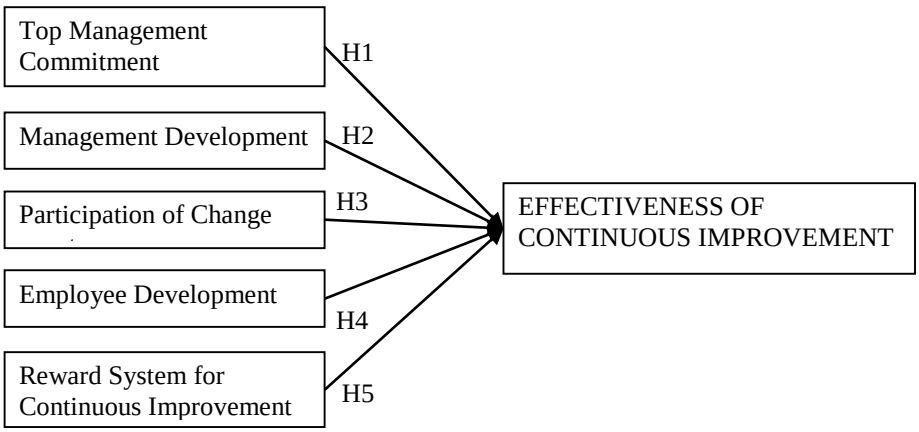
These researchers have emphasized somewhat different sets of organizational requirements for effective CI depending on the context in which they worked; however, all agree on people-based requirements: top management (e.g., commitment, support), employees (e.g., education, training, involvement, empowerment, relations), and customers (e.g., focus, orientation, involvement, satisfaction). The research suggests that a people-related subset of critical factors promoting CI effectiveness holds across cultures.

The analyses of CI effectiveness reviewed above served as the theoretical foundation for the research model in this study, while interviews and discussions with 130 business, management, and cultural experts in Vietnam helped to narrow the focus of the study in order to identify the factors most relevant to this country.

This study proposes a theoretical framework to explain CI in Vietnam (see Figure 1). The premise of this framework is that top management commitment is necessary for CI effectiveness. Deming (1986), Juran (1986), and Garvin (1983) have stressed the importance of senior management commitment in achieving high levels of CI and quality performance. The study divided human resource development into two factors: management development and employee development. Management development – for supervisors as well as for managers at all levels – is highly important for CI implementation and equally for sustainability (Jørgensen *et al.*, 2007). Researchers (Gryna, 1991; Leonard and Sasser, 1982; Steeples, 1993) have found that in addition to forming a solid base for CI, education and training – if consistently updated and reinforced – give employees the knowledge, information, and skills to meet their overall work and personal objectives. In addition, the study included a factor only occasionally recognized in the literature: the participation of change agents or steering committees to lead and facilitate CI initiatives. Striving to implement and maintain high levels of CI depends not only on developing managers, but also on forming a multilevel steering committee or guiding coalition with interlinked memberships to coordinate the direction of CI initiatives (Anand *et al.*, 2009; Goetsch and Davis, 1995; Kotter, 1995). Huang and Lin (2002) found that quality steering teams in Taiwanese companies played a critical role in planning, directing, and managing the implementation of TQM. Sohal *et al.*'s study (1989) indicated that steering committees, composed of senior managers from each functional group, ensured a strong backing for total quality control programs. Success depends also on the extent of the reward system for continuous improvement. Rewards help rally

employees' commitment and participation in CI, provide momentum and enthusiasm for CI initiatives, and positively affect a firm's performance (Crosby, 1979; Dale, 2003).

Figure 1: Research Framework of Continuous Improvement



The hypotheses are as follow:
H1: The level of top management commitment is positively associated with CI effectiveness.
H2: The level of management development is positively associated with CI effectiveness.
H3: The level of participation of change agents is positively associated with CI effectiveness.
H4: The level of employee development is positively associated with CI effectiveness.
H5: The extent to which structured rewards are used for continuous improvement is positively associated with CI effectiveness.

III. Methodology

To test the hypotheses, a survey was administered to middle managers, supervisors, and frontline employees in six leading companies that have implemented one or more CI practices. Based on the interviews and discussions with 130 executives, managers, and other knowledgeable people in Vietnam, the author compiled a list of potential companies. A number of business leaders, the Vietnam Chamber of Commerce and Industry, and the FPT School of Business (formerly known as the Hanoi School of Business), the author's host institutions, helped provide introductions to these companies which are located in two of Vietnam's biggest business hubs, Ho Chi Minh City and Hanoi.

The unit of analysis was the individual level because employees, supervisors, and middle managers are the most directly affected by CI practices and so are likely to be most knowledgeable about their organization's CI efforts, and to have information and opinions about constructs in this study. It would have been ideal to study a random selection of individuals. However, a convenience sample was used for three main reasons. First, Vietnamese people are highly unlikely to answer a questionnaire unless they know the researchers and understand how the information will be used (Hoang *et al.*, 2010; Nguyen and Bryant, 2004). Second, it is very difficult to directly contact frontline employees in any company in Vietnam because these firms are more accustomed to operating in an extremely guarded and secretive manner (Nguyen and Robinson, 2015). The author's host institutions therefore provided high-level official endorsement of the research, which encouraged senior managers to allow access to their employees. The third advantage of this particular convenience sample is that the participants were generally knowledgeable about their

own organization's CI efforts. They had information and opinions on the issues directly and indirectly affecting the quality of implementation and its ultimate sustainability.

Whenever possible, the study instrument relied upon measures adapted from previously tested scales (Ahire *et al.*, 1996; Jain and Tabak, 2002; Saraph *et al.*, 1989). (See Appendix A for a list of the items.) The scale for measuring reward systems for continuous improvement was developed from Robinson and Schroeder's (2006) work on high-performance idea systems. The scale for participation of change agents was based on the works of Kotter (1995) and Sohal *et al.* (1989). The questionnaire also included five items of CI effectiveness adapted from Choi and Liker (1995).

The survey was written in English and then translated into Vietnamese. Standard Vietnamese is based on the dialect of Hanoi, but the country also has several regional dialects. To prevent respondents from outside Hanoi misunderstanding the survey, great care was taken to involve translators who spoke the three most distinct dialects of Vietnam (those from the north, south, and central regions). The survey was first translated by a native Vietnamese English teacher living in the Ho Chi Minh City area (southern region). This version was then edited for clarity and accuracy by a native Vietnamese academic from Hanoi (northern region). Finally, this version was edited again by a Vietnamese-American who spoke the dialect of the central region. The Vietnamese version of the survey was then refined by a panel of ten CI experts, five from Ho Chi Minh City and five from Hanoi, who reviewed it for understandability and clarity. There were minor changes and corrections to the survey such as grammatical errors.

The location of the organization was one of the two measured control variables because the northern and southern regions of Vietnam differ considerably. They have long been divided by war and foreign occupation, so their managerial values, modes of operation, work attitudes, and behaviors vary in ways that could create disparities in the implementation, sustainment, and effectiveness of CI (Ralston *et al.*, 1999). The other measured control variable was the type of business ownership (state-owned enterprise, non-state enterprise, or foreign-invested enterprise). This variable is potentially important because management systems may vary greatly across different forms of business ownerships, which in turn can affect a firm's CI practices.

The items used a six-point Likert scale where respondents were asked to give their perception of CI at their organization ranging from 1 (strongly disagree) to 6 (strongly agree) or to give their perception of the level of CI effectiveness at their organization on a scale of 1 to 6 (1 is least favorable and 6 is most favorable). Like other Asian respondents in China, Hong Kong, and Japan (Gehrt *et al.*, 2007; Shiomi and Loo, 1999; Si and Cullen, 1998), Vietnamese respondents are more likely to choose the middle response categories than Western respondents, so this study used an even number scale to dissuade Vietnamese respondents from giving neutral opinions.

The preparation and planning for the survey took one year including meeting with senior managers to get permissions, developing and translating the survey, sending a draft of the survey for review by the quality or lean manager, and ironing out the details of when and how the survey would be administered to the respondents. At each company, hard copies of the survey were given to the quality or lean manager, who then administered it to 100 line employees and supervisors, and to 10 managers. A total of 660 surveys were given out, and 490 people responded (a response rate of 74 percent). The high response rate may be on account of the firms' lean/quality managers being the ones to administer the questionnaire, thus providing official endorsement of the research and an empowering environment that encouraged employees to participate and respond candidly. It took over one month to administer and collect the surveys.

IV. Analysis

To ensure the unidimensionality of the scales, an exploratory factor analysis (principal components method with varimax rotation) for each construct was performed. An indicator item was deleted if (1) it loaded on more than two factors or its factor loadings were smaller than 0.5 (Johnson and Wichern, 1998); (2) if there were cross-loadings higher than 0.40 (Hair *et al.*, 1998); or (3) if it did not load on the factor it was designed to measure (Chen and Paulraj, 2004). For one or more of these reasons six items were removed – the fourth and fifth items of Management Development; the second item of Employee Development; the first item of Reward System for Continuous Improvement; and the first and third items of Continuous Improvement Effectiveness (refer to Appendix A). This analysis is consistent with other studies including those of CI and quality (see, e.g., Hoang *et al.*, 2006; Hoang *et al.*, 2010; Flynn *et al.*, 1994; Lemieux-Charles *et al.*, 2002; Olatunji *et al.*, 2007). While the removal of these items did not significantly alter the content of the scale in this study, it is important to refine the instrument in future studies.

The internal consistency was satisfactory for the six dimensions. All alpha measures were larger than the threshold value recommended by Nunnally (1978) and Flynn *et al.* (1990), suggesting that the constructs are reliable. (See Appendix B.)

Following the suggestion of O'Leary-Kelly, we assessed the convergent validity by using confirmatory factor analysis (CFA). The model fit the data well based on threshold values suggested by Hu and Bentler (1998) ($\chi^2/_{df}$ = 1032.5, *TLI* = 0.936, *RMSEA* = 0.054, *CFI* = 0.944). All factor loadings in the CFA model are greater than 0.5 and the t-values are significantly greater than 2.0, ensuring convergent validity.

Hierarchical multiple regression was used to examine the effects of top management commitment, management development, participation of change agents, employee development, and reward system for continuous improvement on CI effectiveness (see Table 1).

Hypothesis 1 predicted a positive relationship between top management commitment and CI effectiveness. Consistent with this prediction, this hypothesis was supported ($\beta = 0.15$, $p < 0.01$).

Hypothesis 2 predicted a positive association between management development and CI effectiveness. The regression results support this prediction ($\beta = 0.20$, $p < 0.001$).

Hypothesis 3 predicted a positive relationship between the participation of change agents and CI effectiveness. This hypothesis was supported ($\beta = 0.26$, $p < 0.001$).

Hypothesis 4 predicted a positive association between employee development and CI effectiveness. This hypothesis was supported ($\beta = 0.21$, $p < 0.001$).

Hypothesis 5 predicted a positive relationship between reward system for continuous improvement and CI effectiveness. This hypothesis was *not* supported ($\beta = 0.07$, ns).

Table 1: Regression Analysis with CI Effectiveness as the Dependent Variable

Variables	Model 1	Model 2
Controls		
D1	**.29*****	.07
D2	**.33*****	**.17*****
Location	**-.30*****	-.06
Main Effects		
Top Management Commitment		**.15****
Management Development		**.20*****
Participation of Change Agents		**.26*****
Employee Development		**.21*****
Reward System for Continuous Improvement		.07
R^2 *(adjusted)*	.08	.60
R^2	.09	.60
F-value change	15.75	90.91

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

To investigate the effect of the control variables, dummy variables were created as suggested by Aiken and West (1991). For type of business ownership, state-owned enterprise was used as the control group. The dummy variables were coded as D1 equals 1 for non-state enterprise, 0 otherwise; D2 equals 1 for foreign-invested enterprise and 0 otherwise. For location, Hanoi was coded as 0, and Ho Chi Minh City was coded as 1. This study found that respondents from foreign-invested enterprises (FIE) were more likely than respondents from state-owned enterprises to find CI effective.

V. Discussion

The issue of CI performance is important to both academics and practitioners. This research has argued that Vietnamese organizations should adopt CI to avoid the business and economic consequences of continuing to be no more than a provider of low-cost labor. We identify the theoretical implications for academics investigating the application of CI techniques in Asian emerging market economies, and offer recommendations for practitioners who are grappling with the issue of designing effective CI practices in Vietnam.

Regarding control variables, this study found that respondents from foreign-invested enterprises (FOE) rather than those from state-owned enterprises were more likely to find CI effective. This result supported the argument that the type of business ownership highly impacted CI effectiveness in Vietnamese organizations. FOEs have considerable exposure to global best practices, and they have the resources to transfer these practices to emerging markets. Foreign partners in FOEs are often the backbone of joint-ventures in transitional economies, providing the necessary knowledge and skills to compete in international markets (Dhanaraj *et al.*, 2004; Lane *et al.*, 2001). In Vietnam's garment industry, for example, foreign partners have facilitated international market access and transmitted fashion and design know-how to Vietnamese exporters

(Hill, 2000). Moreover, China's huge inflow of FOEs has brought modern technology into the country as well as management expertise in fields such as TQM (Tuan and Ng., 1998).

This research tested five hypotheses, and found four that were supported. The results showed that top management commitment has a positive effect on CI effectiveness, suggesting that senior managers are critical to promoting an organization-wide CI culture, establishing and communicating clear CI objectives, encouraging employee participation in CI, guiding CI through personal involvement, and allocating resources to support CI initiatives throughout the organization. This finding was not a surprise: previous researchers have identified the importance of top managers' commitment to the successful implementation of TQM in Vietnamese firms (Hoang *et al.*, 2010). However, the interviews and discussions revealed that Vietnam's strong top-down culture obstructs any organization's CI efforts unless senior managers approve and facilitate CI. For example, the interviewees asserted that the level of top management's commitment, involvement, and skills and the resources senior managers provide to drive initiatives were the most important success factors of the Factory Improvement Programme, which was established in 2002 by the International Labour Organization (ILO) to help manufacturers improve compliance and working conditions and promote competitiveness. (The Factory Improvement Programme was replaced in 2009 with Better Work Vietnam, a partnership program between the ILO and the International Finance Corporation with similar objectives.)

While top management commitment is necessary, in Vietnam it is not a sufficient condition for CI effectiveness. Success also depends on the participation of change agents, the level of management development, and the level of employee development. The participation of change agents is especially important in Vietnamese companies because the Vietnamese sense of self is tied to family, friends, and society rather than to work, and Vietnamese culture values harmony and favors consensus-oriented decision making (Shultz *et al.*, 2000). Moreover, past economic and political systems have created a culture of collectivism and hierarchy, so people rarely take independent action and usually conform to avoid conflict. For these reasons, in Vietnam two to three respected change agents who are well-liked, respected, influential, and persuasive are needed to serve as liaisons between senior managers, middle managers, and frontline employees. Their functions are to communicate the objectives, delegate the work, enforce the initiatives, and ease any anxiety regarding the change effort. Furthermore, the interviewees suggested that change agents can help overcome the unwillingness of frontline employees to offer improvement ideas that implicitly suggest that management has not done its job. Change agents provide not only a forum for dialogue and cooperation, but also implement improvement initiatives – an outcome realized because they have the authority to approve recommended changes.

The study also found that management development has a positive influence on CI effectiveness. This was corroborated by the interviewees who asserted the importance and value of managers who have extensive knowledge of and training in CI principles and techniques, and who are committed to ongoing improvement by actively coaching, promoting, and sustaining CI initiatives. The interviews also suggest that CI education and training would give Vietnamese managers the knowledge and skills to operate their companies in a global economy and help move their firms up the production value-chain.

This study found that employee development positively influences CI effectiveness. The interviews and discussions suggest that to get excellent CI results employees should be given work-skills training to help them do their jobs. Also, an employee idea system that encourages staff members to find and fix problems by offering improvement suggestions should be developed. This research contributes by looking into the multiple facets of employee development, such as

employee idea systems, which impact CI effectiveness. According to Liker (2004), all manufacturing and service companies that want long-term success must become learning enterprises. To do so, they have to expand their employees' thinking beyond the specific tools (e.g. 5S, just-in-time) and develop a world-class workforce of knowledgeable, creative, and active problem-solvers who are capable of implementing world-class processes.

Reward systems are common in Vietnam. Employers regularly use them to increase company morale and productivity as well as to promote employee attendance, punctuality, skills, and retention. Management often uses rewards to encourage employees to put their improvement ideas in suggestion boxes, which are long-established and widespread in Vietnam. A committee picks out ideas good enough to implement, assigns staff members to carry out the implementation, and gives the employee a reward if the idea is accepted. This tradition of rewarding employees for their suggestions indicated that a reward system would be necessary to promote continuous improvement, hence our initial prediction. On the contrary, however, a reward system did not significantly influence CI effectiveness. One reason for this discrepancy could be that the reward systems in the respondents' companies were often poorly conceived and might therefore have caused problems that undermined CI efforts. For example, during the interviews and discussions, a number of executives mentioned that while employees could earn a monetary reward if management liked their ideas, they could also be punished for ideas that management regarded as "bad."

Yet considering that rewards are engrained in the Vietnamese work environment, this research finding should not suggest that firms avoid rewarding their people for their ideas or other contributions to CI. As Robinson and Schroeder (2014) recommend, organizations should not set up a separate system of rewards for individual ideas – as many suggestion-box systems do – because it misaligns management's objectives and employees' goals. Rather, they note that in a high-performance organization, improvement ideas are a part of everyone's job and are treated as any other important aspect of performance. Ideas should therefore be evaluated using the organization's existing mechanisms for rewarding its people. One example is linking employees' bonuses to their idea performance.

While it was surprising not to observe a positive relationship between a reward system for CI and its effectiveness, this is a significant finding. Future research could explore this dimension by including other tests to better understand how CI effectiveness changes depending on the type and management of the reward system in Vietnamese organizations.

VI. Conclusion and Future Research Directions

The paper contributes to the understanding of CI by identifying the crucial importance of change agent participation as well as top management commitment, together with management and employee development, in facilitating CI practices. The findings of this study highlight the factors that appear to influence successful CI sustainability, in some instances confirming that factors potentiating CI in Vietnam are similar to those identified in studies of other emerging Asian economies. Broadening this research to cover other emerging market economies in Southeast Asia would enable scholars to build theories and develop new models of international business management.

This study has two main limitations. First, the study used a convenience sample based on the approachability of the businesses. While a convenience sample was not the ideal, it was the best option for this study in Vietnam, where having a personal relationship is crucial for gaining access

to companies and obtaining a sufficient number of responses. Even though the interviews, discussions, and survey responses enabled the triangulation of the data, the findings must be interpreted with caution because they derive from a convenient sample. Finally, given the multiple facets of CI, it is not possible to include all factors that determine its effectiveness in a single model. However, limitations related to missing variables could be addressed in future studies. Future research should also empirically conduct a longitudinal study of CI to evaluate the effect of time on the factors affecting CI sustainability.

As practitioners grapple with the issue of designing effective CI practices in Vietnam, they urgently need an improved understanding of what *works*, what *does not*, and *why*. The findings of this study clarify the use and effectiveness of CI in Vietnamese companies and suggest ways in which they can enhance their CI efforts. As companies in Vietnam open up more in the coming years, further research on the efforts of Vietnamese management to introduce CI and other quality initiatives will be valuable to both Vietnamese organizations and the international business community.

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Appendix A: List of items

Top Management Commitment (Ahire *et al.*, 1996; Jain and Tabak, 2002)

1. Top management (e.g., general manager, deputy, director, senior manager) promotes an organization-wide culture that is committed to continuous improvement.
2. Top management establishes and communicates clear continuous improvement objectives.
3. Top management is personally involved in guiding continuous improvement throughout the organization.
4. Top management allocates resources (e.g., financial, human) to support CI initiatives.
5. Top management encourages employee involvement in continuous improvement.

Management Development (Jain and Tabak, 2002; Saraph *et al.*, 1989)

1. Managers in the organization have extensive knowledge of continuous improvement principles and techniques.
2. Managers are committed to ongoing improvement by actively coaching, encouraging, and promoting continuous improvement initiatives.
3. Continuous improvement-related training is given to managers and supervisors throughout the organization.
4. When frontline employees have work problems, managers and supervisors are readily available to help employees solve them.
5. When frontline employees have work problems, managers and supervisors are effective in solving them.

Participation of Change Agents (Kotter, 1995; Sohal *et al.*, 1989)

1. Managers who lead continuous improvement initiatives are well-liked, respected, and influential.
2. Managers who lead continuous improvement initiatives enhance the communication among people in different levels of the organization (e.g., senior managers, middle managers, and frontline employees).
3. Managers who lead continuous improvement initiatives are effective in delegating the continuous improvement work.
4. Managers who lead continuous improvement initiatives are effective in promoting continuous improvement throughout the organization.
5. Managers who lead continuous improvement initiatives are effective in facilitating improvement programs.

Employee Development (Ahire *et al.*, 1996; Jain and Tabak, 2002)

1. Frontline employees are provided with work-skills training necessary to help them effectively do their jobs.
2. Frontline employees are provided with continuous improvement-related training.
3. The organization has an effective employee idea system or suggestion system.
4. Frontline employees are encouraged to give improvement suggestions.
5. Frontline employees are encouraged to find and fix problems.

Reward System for Continuous Improvement (Robinson and Schroeder, 2006)

1. Rewards are based on performance measures reflecting the organization's continuous improvement objectives.
2. Rewards are given equitably according to the collective impact of everyone's ideas.
3. Rewards are distributed to employees according to clear and publicly-stated rules.
4. The reward system is integrated into the way the organization is run.
5. The organization has a reward system based on plant productivity.
6. The reward system is effective in achieving continuous improvement.

Continuous Improvement Effectiveness (Choi and Liker, 1995)

1. Level of continuous improvement accomplishment.
2. Level of continuous improvement philosophy taking hold.
3. Level of waste elimination.
4. Level of sustainability of continuous improvement.
5. Overall impact of continuous improvement.

Appendix B: Alpha Measures

Factor analysis for top management commitment.	Cronbach's Alpha = 0.912
1. Top management promotes an organization-wide culture that is committed to continuous improvement.	0.723
2. Top management establishes and communicates clear continuous improvement objectives throughout the organization.	0.720
3. Top management is personally involved in guiding continuous improvement initiatives throughout the organization.	0.706
4. Top management allocates resources to support continuous improvement initiatives throughout the organization.	0.682
5. Top management encourages employee involvement in continuous improvement.	0.671

Factor analysis for management development.	Cronbach's Alpha = 0.836
1. Managers in the organization have extensive knowledge of continuous improvement principles and techniques.	0.737
2. Managers are committed to ongoing improvement by actively coaching, encouraging, and promoting continuous improvement initiatives.	0.633
3. Continuous improvement-related training is given to managers and supervisors throughout the organization.	0.645

Factor analysis for participation of change agents.	Cronbach's Alpha = 0.928
1. Managers who lead continuous improvement initiatives are well-liked, respected, and influential.	0.652
2. Managers who lead continuous improvement initiatives enhance the communication among people in different levels of the organization.	0.678
3. Managers who lead continuous improvement initiatives are effective in delegating the CI work.	0.657
4. Managers who lead continuous improvement initiatives are effective in promoting CI throughout the organization.	0.701
5. Managers who lead continuous improvement initiatives are effective in facilitating improvement programs.	0.683

Factor analysis for employee development.	Cronbach's Alpha = 0.827
1. Frontline employees are provided with work-skills training necessary to help them effectively do their jobs.	0.561
2. The organization has an effective employee idea system or suggestion system.	0.721
3. Frontline employees are encouraged to give improvement suggestions.	0.842
4. Frontline employees are encouraged to find and fix problems.	0.708

Factor analysis for reward system for continuous improvement.	Cronbach's Alpha = 0.878
1. Rewards are given equitably according to the collective impact of everyone's ideas.	0.693
2. Rewards are distributed to employees according to clear and publicly-stated rules.	0.753
3. The reward system is integrated into the way the organization is run.	0.708
4. The organization has a reward system based on plant productivity.	0.731
5. The reward system is effective in achieving continuous improvement.	0.654

Erratum: The Impact of Religion on Corruption

By Leila Shadabi

In Shadabi (2013), it was cited on p. 103 that North *et al.* (2013) rejected the theoretical finding of La Porta *et al.* (1999) and that Triesman (2000) stated that corruption is increased in Islam and Catholicism because of their harmful effects on democracy and equality. In fact, they did not reject that finding and found that "corruption levels are lower in countries that were historically Protestant or are currently Asian ethnic religion" (p. 761). The levels of corruption were measured by the World Bank's Control of Corruption index.

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