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Discount Rate Changes and Market Timing: A Multinational Study

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This study investigates whether discount rate changes serve as an informative signal for investors to enter or exit the stock market. Based on the signal, a market timing strategy is formulated and its performance relative to a passive buy-and-hold strategy is tested with several performance evaluation methods. Empirical evidence derived from data of seven developed countries over more than 29 years is virtually invariant to the performance measures employed and uniformly supports the superiority of the market timing strategy. However, when the full study period is divided into pre-1994 and post-1993 sub-periods, the dominance of the market timing strategy essentially vanished over the latter sub-sample period. Thus, the tactic of basing investment strategy formulation on discount rate changes has turned unproductive in recent years. There is actually weak evidence over the post-1993 time period in favor of the passive buy-and-hold strategy.

Key Words: Discount rate; Stock market; Market timing strategy; Buy-and-Hold strategy.
JEL Classification Numbers: G11, G18.

1. INTRODUCTION

Market timing strategy is frequently discussed in the finance literature (Lehman and Modest, 1987; Chen, Lee, Rahman and Chan, 1992; Grinblatt and Titman, 1994; Malkiel, 1995). Market timers use various quantitative methods, optimization models, and even public or private information to assign investment weights to their investment instruments. The norm en-

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tails allocating portfolio weights between two assets, a diversified market portfolio consisting of common stocks and a short-term risk-free investment instrument such as Treasury bills.

The conventional view posits that a relationship exists between stock returns and monetary conditions. For example, an expansive monetary environment is considered as good news since it is usually associated with lower future interest rates and thriving economic activities, and vice versa (Conover, Jensen, and Johnson, 1999). Previous research also suggests that certain monetary policy indicators have the ability to explain stock market performance (Waud, 1970; Smirlock and Yawitz, 1985; Jensen and Johnson, 1995; Patelis, 1997; Thorbecke, 1997; Durham, 2003). As a result, investors often base their investment strategies on observed monetary indicators such as money supply, bank reserves, and discount rate. Not surprisingly, monetary policy of central banks has attracted attention from market participants. In the United States, "Fed watching" has been a prevalent strategy to investment management for many years (Johnson and Jensen, 1998).

Following Prather and Bertin (1998), a market timing trading strategy based on information contained in discount rate changes is implemented in this study. Under the trading rule, discount rate changes are used as a signal to enter or exit the stock market. The main purpose of this study is to determine whether or not discount rate changes serve as a useful indicator for investors to form investment strategies. If information embedded in discount rate changes is valuable, we expect the actively managed market timing trading strategy to outperform a passive buy-and-hold strategy in terms of risk-return tradeoff. Return data from seven developed countries, Australia, Canada, Germany, Italy, Japan, the U.K., and the U.S., covering time periods of at least 29 years, are examined. For robustness, the entire sample period is further divided into two sub-sample periods, pre-1994 and post-1993 periods, and seven evaluation measures are employed for performance comparison and analysis purposes.

This research is significant from several aspects. To date, this research is the first one to examine the market timing ability on a mass multinational scale. The adoption of sample periods vastly overlapping one another for the seven developed countries studied yields comparable empirical results. In specific, the common across-board sample period for the post-1993 era strengthens the test validity of this study. Furthermore, this study employs seven performance measures to recognize their respective merits and drawbacks and guard against any potential methodology sensitive empirical outcome.

The rest of the paper is organized as follows. Section 2 covers literature review. Section 3 describes the data and methodology. Section 4 presents empirical findings. The last section concludes this study.

2. PREVIOUS STUDIES

Most previous empirical work shows that economic activities and monetary policy environments are strongly related. Jensen and Johnson (1995), Jensen, Mercer, and Johnson (1996), Thorbecke (1997), Johnson and Jensen (1998), Conover, Jensen, and Johnson (1999), Mann, Atra, and Dowen (2004), Conover, Jensen, Johnson, and Mercer (2005), and Jensen and Mercer (2006) reveal that stock returns in the U.S. and several developed countries are significantly related to monetary policy changes. Jensen, Mercer, and Johnson (1996), Johnson and Jensen (1998), and Johnson, Buetow, and Jensen (1999) use changes in discount rate implemented by the Federal Reserve to signal changes in the monetary policy and to further categorize monetary environments as either restrictive or expansive.

Investors constantly look for effective investment strategies to beat the market. Market timing is a method frequently explored and studied. In general, a market timing strategy involves holding stocks during bull markets and short-term risk-free investment vehicles such as Treasury bills during bear markets. Employing such an actively managed strategy is expected to yield a better investment performance than following a passive buy-and-hold strategy. However, empirical results from earlier market timing literature have not been conclusive.

Chen, et al. (1992), Grinblatt and Titman (1994), Malkiel (1995), Daniel, et al. (1997), Becker et al. (1999) and Goetzmann, Ingersoll, and Ivkovic (2000) find little evidence in support of the market timing ability. In contrast, Lehman and Modest (1987), Lee and Rahman (1990), Larsen and Wozniak (1995), Prather and Bertin (1998), Tezel and McManus (2001), and Conover, Jensen, Johnson, and Mercer (2008) are able to produce evidence in favor of timing the market.

Given the contradictory empirical findings noted above regarding the merit of market timing, this research attempts to provide more insight into the field. Using the framework of Prather and Bertin (1998), we evaluate a market timing strategy relative to a benchmark buy-and-hold strategy. For the market timing trading rule, an investment structure with only two assets — a diversified portfolio consisting of common stocks and Treasury bills — is assumed. For each sample country, discount rate changes implemented by its central bank are used as a signal to enter or exit the stock market. Under this trading strategy, investment decision is contingent on the movement of the discount rate. Investors, upon an initial discount rate cut, will enter and remain fully invested in the stock market until the rate cut runs its full course. As soon as the discount rate reverses its direction and starts to increase, investors will exit the stock market and instead invest fully in Treasury bills until the next round of the rate cut. In essence, the market timing portfolio will be in-the-market with a beta equal to one

during periods of credit easing and will be out-of-the-market with a zero beta during periods of credit tightening.

3. DATA AND METHODOLOGY

3.1. Data

Seven developed countries — Australia, Canada, Germany, Italy, Japan, the U.K., and the U.S. — are included in this study. Discount rate, risk-free instrument data, and stock index are needed for the implementation of the market timing strategy. An investment has to be highly liquid, short-term natured, and virtually default risk free to be considered as a risk-free instrument. Treasury bills undoubtedly are the ideal candidate and are used as the proxy for the risk-free investment vehicle when the rate information is available. For each country, the stock index is used as the proxy for the stock market. All seven countries with the exception of Italy have data available for at least 33 years. The study period for Italy, from January 1975 to August 1984, is the shortest, four months short of 30 years. All sample periods end at the same time in August, 2004, the latest time for which data are available at the onset of the study. Relevant data are obtained from various sources, including the Taiwan Economic Journal (TEJ), the AREMOS database, and Websites of central banks. Table 1 details the sample period studied and data sources for the discount rate, risk-free rate, and stock index of each sample country. The table also lists the respective proxies for the risk-free rate and the stock market.

3.2. Monetary policy: Discount rate changes

This study compares the performance of a market timing trading strategy with that of a simple buy-and-hold strategy. Discount rate changes are used to signal entering or exiting the stock market. Presumably, discount rate cuts lower financing costs and energize the economy through increased consumption and capital spending. This, in turn, drives up the stock market performance. Thus, we propose entering the stock market upon an initial discount rate cut and staying fully invested through all subsequent rate cuts. In contrast, discount rate increases lead to economic slowdown in response to curtailed consumption and capital spending. This, in turn, depresses the stock market. Therefore, we call for a complete pullout from the stock market upon an initial discount rate increase and investing fully in Treasury bills instead throughout the rate increase sequence.

In short, the market timing trading strategy demands holding the market portfolio during expansive monetary periods and switching to Treasury bills during restrictive monetary periods. Consequently, the market timing returns are calculated using the stock index returns for the expected stock market upturn periods and T-bills yields for the anticipated stock market

TABLE 1.

Data description

Country	Sample Period	Data Source[a]	Risk-free Rate	Stock Index
Australia	1/1971-8/2004	TEJ, Website[b] and AREMOS	Weighted average yield of 13-week Treasury notes	Sydney All Ordinaries Index
Canada	1/1960-8/2004	AREMOS	3-month Treasury bills rate	Toronto 300 Stock Index
Germany	1/1967-8/2004	AREMOS	3-month Treasury bills rate	Composite DAX index
Italy	1/1975-8/2004	AREMOS and Website[c]	3-month Treasury bills rate	Milan Mibtel Stock Index
Japan	1/1971-8/2004	AREMOS Website[d]	Short-term money market rates or 3-month Treasure bills rate	Tokyo TOPIX Stock Index
U.K.	1/1964-8/2004	AREMOS	3-month Treasury bills rate	London FTSE 100 Index
U.S.	1/1971-8/2004	TEJ	3-month Treasury bills rate	S&P 500 Stock Index

Notes: TEJ denotes Taiwan Economic Journal database.
[a] When applicable, data source listed is for the discount rate, risk-free rate, and stock index, respectively.
[b] The Website of Reserve Bank of Australia is http://www.rba.gov.au.
[c] The Website of Bank of Italy is http://www.bancaditalia.it.
[d] The Website of Bank of Japan is http://www.boj.or.jp.

downturn periods. For each sample country, the benchmark buy-and-hold strategy entails the purchase and continuing holding of the market portfolio throughout the entire sample period. Thus, return on the buy-and-hold strategy is equal to the market return over the sample period. For performance comparison and analysis purposes, all returns are annualized.

Before examining the market timing evidence, a simple and preliminary analysis is performed to determine if monetary policies, expansive vs. restrictive, categorized by the direction of discount rate changes indeed convey meaningful, "good" vs. "bad," news for the capital market. Based on Johnson and Jensen (1998) and Conover et al. (1999), monthly mean returns of stock indexes and Treasury bills are calculated and listed in Table 2 for all sample countries during the expansive and restrictive monetary conditions, respectively. If discount rate changes serve as an effective barometer for monetary environments and, in turn, as a good signal to enter or exit the stock market, we expect stock returns during loosening monetary periods to be on average higher than those during tightening

TABLE 2.
Mean stock returns (annualized) and T-bills rates during expansive and restrictive monetary environments

Country	Sample Period	Stock returns		T-bills rates	
		Expansive	Restrictive	Expansive	Restrictive
Australia	1/1971-8/2004	13.98	2.31	7.63	9.63
Canada	1/1960-8/2004	15.90	−0.57	5.80	7.42
Germany	1/1967-8/2004	14.91	−2.02	4.21	7.09
Italy	1/1975-8/2004	19.51	6.23	12.63	14.36
Japan	1/1971-8/2004	9.83	−4.83	3.85	9.44
U.K.	1/1964-8/2004	14.05	1.84	7.80	8.65
U.S.	1/1971-8/2004	13.74	1.49	5.12	7.76

monetary periods. In contrast, Treasury bills should in general yield more under a restrictive policy than under an expansive policy. Mean returns reported in Table 2 are in full conformity with this assertion and lends further support to the intuition of the proposed market timing strategy.

3.3. Risk-adjusted performance measures

Due to the lack of consensus on a generally accepted performance-evaluation method, we use several measures to examine the effectiveness of the market timing strategy relative to the buy-and-hold strategy. According to Haugen (1997), any investment performance evaluation based on purely average historical returns would be biased because risks vary among portfolios and market strength shifts over time. For example, the market timing strategy implemented in this study involves holding risk-free securities for certain periods during which the resulting portfolio risk would be lower than that associated with the buy-and-hold strategy. Therefore, investment performance must be evaluated by measures that reflect and adjust for respective portfolio risk and market performance. Five risk-adjusted indices — Sharpe ratio (Sharpe, 1966), Treynor's measure (Treynor, 1965), Jensen's alpha (Jensen, 1968), and GH measures, GH1 and GH2 (Graham and Harvey, 1997) — are then employed in this study. In addition, a two-beta regression model proposed by Merton (1981) and a nonparametric test developed by Pesaran and Timmerman (1992) are also adopted. A description of each of these performance measures is provided next.

Sharpe ratio, S_p, is a reward-to-risk ratio that captures the risk premium earned per unit of total risk. As shown in Eq. (1), S_p is derived by dividing the average excess return of a portfolio by the portfolio's standard deviation of returns.

$$S_p = \frac{(R_p - R_f)}{\sigma_p}, \tag{1}$$

where $R_p - R_f$ is the average excess return of portfolio p and σ_p is the portfolio risk measured by the standard deviation of portfolio returns. The market timing strategy is superior (inferior) to the passive buy-and-hold strategy on a risk-adjusted basis if S_p is higher (lower) than that of the buy-and-hold portfolio.

Treynor's measure, T_p, is a reward-to-risk measure that shows the risk premium earned per unit of market risk. As illustrated in Eq. (2), T_p is calculated by dividing the average excess return of a portfolio by its market risk.

$$T_p = \frac{(R_p - R_f)}{\beta_p}, \tag{2}$$

where $R_p - R_f$ is as defined earlier and β_p is the beta or market risk of the portfolio. By design, beta of the buy-and-hold strategy is equal to one. For the market timing strategy, beta is estimated from the Jensen's alpha regression model, which is to be discussed next. We would conclude that the market timing strategy outperforms (underperforms) the passive buy-and-hold strategy, if T_p for the market timing portfolio is greater (smaller) than that for the benchmark portfolio.

Jensen's alpha, unlike Sharpe ratio or Treynor's measure, allows statistically testing the performance of a portfolio relative to the overall capital market. As expressed in Eq. (3), Jensen's alpha is derived by regressing portfolio excess returns on market risk premium.

$$R_{p,t} - R_{f,t} = \alpha_1 + \beta_1(R_{m,t} - R_{f,t}) + \varepsilon_{p,t}, \tag{3}$$

where $R_{p,t} - R_{f,t}$ is the market timing portfolio's risk premium at time t, α_1, the regression intercept term, is Jensen's alpha and captures the market timing portfolio's performance, β_1 as defined before is the beta or market risk of the market timing portfolio, $R_{m,t} - R_{f,t}$ is the risk premium for the market (i.e. buy-and-hold) portfolio, and $\varepsilon_{p,t}$ is the error term. A positive α_1 would indicate that the market timing portfolio has on average generated a higher return than the buy-and-hold portfolio. On the other hand, the opposite would favor the passive buy-and-hold strategy.

Graham and Harvey's measures. Modern finance theory postulates that market risk is the only risk that investors should be compensated for. However, this does not change the fact that total risk or standard deviation is what investors bear and what matters in performance evaluation. Thus, market risk-adjusted return measures such as Treynor's measure and Jensen's alpha do not necessarily identify the portfolio that offers the highest return for any given level of risk. While Sharpe's ratio reflects the risk premium earned per unit of total risk, the investment with the highest Sharpe ratio does not necessarily carry a risk desired by investors. To address the problem, Graham and Harvey (1997) propose another two

risk-adjusted performance measures that allow a direct return comparison among investments and unambiguous identification of the optimal portfolio for any desired risk level. Graham and Harvey also present evidence that their proposed measures are superior to the Sharpe ratio for performance evaluation purpose.

The two Graham and Harvey's measures, $GH1$ and $GH2$, are similar to each other by design. Both involve matching the total risks of the portfolios under comparison. The choice of the portfolio whose total risk is the one to be matched with sets the two measures apart. For $GH1$, it is the volatility of the market timing portfolio that we intend to match with. That is,

$$\lambda_1 \sigma_m = \sigma_p, \tag{4}$$

where λ_1 is the leverage factor to force the risk of the buy-and-hold portfolio, m, to match with that of the market timing portfolio, p, and σ_m and σ_p are the respective standard deviations of the two portfolios. Solving for λ_1 in Eq. (4) yields $\lambda_1 = \sigma_p/\sigma_m$. Thus, the first measure calls for levering up or down the buy-and-hold (i.e. market) portfolio by investing σ_p/σ_m in the market portfolio and the remaining $(1 - \sigma_p/\sigma_m)$ in risk-free securities. As shown in Eq. (5), $GH1$ is then calculated as the mean return difference between the market timing portfolio and the levered buy-and-hold portfolio.

$$GH1 = R_p - [R_f + (\frac{\sigma_p}{\sigma_m})(R_m - R_f)], \tag{5}$$

A positive (negative) $GH1$ suggests the outperformance (underperformance) of the market timing strategy relative to the buy-and-hold strategy.

For $GH2$, the volatility of the buy-and-hold portfolio is the basis for the risk match. That is,

$$\lambda_2 \sigma_p = \sigma_m, \tag{6}$$

where λ_2 is the leverage factor to force the risk of the market timing portfolio, p, to match with that of the buy-and-hold portfolio, m. Solving for λ_2 in Eq. (6) yields $\lambda_2 = \sigma_m/\sigma_p$. Therefore, the second measure requires leveraging or unleveraging the market timing portfolio by investing σ_m/σ_p in the market timing portfolio and the remaining $(1 - \sigma_m/\sigma_p)$ in risk-free securities. As shown in Eq. (7), $GH2$ is then derived by subtracting the mean return of the buy-and-hold portfolio from the mean return of the levered (unlevered) market timing strategy.

$$GH2 = [R_f + (\frac{\sigma_m}{\sigma_p})(R_p - R_f)] - R_m, \tag{7}$$

As with $GH1$, a positive (negative) $GH2$ supports the superiority (inferiority) of the market timing strategy relative to the buy-and-hold strategy.[1]

Two-beta regression model. Following Kao, Cheng, and Chan (1998) and Tezel and McManus (2001), we also adopt the two-beta (up-market beta and down-market beta) regression model of Merton (1981) and Henriksson and Merton (1981). This model accounts for the nonstationarity of systematic risk and allows for the separation of market timing ability from skills that are not market timing related. In general, high-risk securities are more sensitive to the market movements than low-risk securities. Thus, we expect skilled market timers to predict broad market movements and adjust their portfolios accordingly. Upon prediction of an up (a down) market, their portfolio compositions would be shifted to high-risk (low-risk) securities. As a result, the portfolio beta in up markets, up-market beta, should be greater than that in down markets, down-market beta. The two-beta regression model is expressed as follows:

$$R_{p,t} - R_{f,t} = \alpha_2 + \beta_2(R_{m,t} - R_{f,t}) + \beta_3 \max[0, -(R_{m,t} - R_{f,t})] + e_{p,t}, \quad (8)$$

where $R_{p,t} - R_{f,t}$ and $R_{m,t} - R_{f,t}$ are monthly excess returns of the market timing portfolio and the buy-and-hold portfolio, respectively, α_2 is the intercept term, and $e_{p,t}$ is the error term. $R_{m,t}$ should be greater than $R_{f,t}$ for up markets. In this case, Eq. (8) degenerates to Eq. (9).

$$R_{p,t} - R_{f,t} = \alpha_2 + \beta_2(R_{m,t} - R_{f,t}) + e_{p,t}, \quad (9)$$

where β_2 is the up-market beta, β_u.

When the market is down, $R_{m,t}$ should be less than $R_{f,t}$ and Eq. (8) would then become Eq. (10).

$$R_{p,t} - R_{f,t} = \alpha_2 + (\beta_2 - \beta_3)(R_{m,t} - R_{f,t}) + e_t, \quad (10)$$

where $(\beta_2 - \beta_3)$ is the down-market beta, β_d, and β_3 represents the change in the beta when market timers adjust their portfolios in response to the downward movement of the market condition. Since β_u should be greater than β_d for a skilled market timer, a significantly positive β_3 provides evidence of effective market timing.

Pesaran and Timmerman nonparametric test. In addition to all the tests mentioned above, a nonparametric procedure developed by Pesaran and Timmerman (1992) and subsequently employed by Palaez (1998) and Tezel and McManus (2001) is implemented in this study. The procedure is fit to test the accuracy of forecasts for market conditions. Here, the

[1]When R_m in Eq. (7) is added back to $GH2$, we obtain the performance measure proposed by Modigliani and Modigliani (1997).

interest is on the difference between the observed and expected percentages of correct predictions of market conditions. The test statistic, S-statistic, is defined next in Eq. (11) and asymptotically follows the standard normal distribution.

$$S = \frac{p - p^*}{[\sigma_p^2 - \sigma_{p^*}^2]^{1/2}} \approx N(0,1), \tag{11}$$

where $p = \frac{(N_{in;up}+N_{out;down})}{N_{total}}$ represents the actual percentage of correct market predictions signaled by discount rate changes. $N_{in;up}$ ($N_{out;down}$) equals the number of months the market timing strategy calls for full (zero) investment in the market portfolio when the market is indeed in up (down) conditions and $N_{total} = N_{in} + N_{out} = N_{up} + N_{down}$ is the total number of test months. $p^* = (p_{in})(p_{up}) + (1 - p_{in})(1 - p_{up})$ denotes the predicted percentage of correct forecasts for market conditions when no market timing is involved. $p_{in} = \frac{(N_{in;up}+N_{in;down})}{N_{total}}$ yields the percentage of times that the market timing portfolio consists fully of the market portfolio, or is in-the-market.$(1 - p_{in})$ indicates the percentage of times that the market timing portfolio holds only risk-free securities, or is out-of-the-market. $p_{up} = \frac{(N_{in;up}+N_{out;up})}{N_{total}}$ calculates the proportion of times that the market is up. $(1 - p_{up})$ is the proportion of times that the market is down. $\sigma_p^2 = \frac{p^*(1-p^*)}{N_{total}}$ is the variance of p. $\sigma_{p^*}^2 = \frac{(2p_{up}-1)^2 p_{in}(1-p_{in})}{N_{total}} + \frac{(2p_{in}-1)^2 p_{up}(1-p_{up})}{N_{total}} + \frac{4p_{up}p_{in}(1-p_{up})(1-p_{in})}{N_{total}^2}$ is the variance of p^*. As noted in Pesaran and Timmermann (1992), the last term of this variance expression is asymptotically negligible. A statistically significantly positive S provides evidence in favor of market timing because it indicates that the percentage of correct predictions produced by the market timing strategy, p, exceeds the predicted proportion of accurate forecasts under the null hypothesis of no market timing, p^*.

4. EMPIRICAL RESULTS

Tables 3 to 9 present respective empirical results generated from the performance comparisons of the market timing strategy with the buy-and-hold strategy for the seven sample countries — Australia, Canada, Germany, Italy, Japan, the U.K., and the U.S. Each of these tables is separated into three panels to address the various performance measures adopted in this study. Panel A reports statistics generated from the five risk-adjusted performance measures — Sharpe ratio, Treynor's measure, Jensen's alpha, and the two Graham and Harvey's measures; Panel B shows the two-beta regression results; Panel C contains the nonparametric test results. To detect if the market timing strategy produces different performance outcome over time, the entire sample period for each country is divided into two

sub-sample periods, pre-1994 and post-1993 eras. Results associated with the entire sample period and both sub-sample periods are covered in every panel of the tables.

Empirical evidence revealed in Tables 3 to 9 over the full study period provides overwhelming support for the market timing strategy. For all seven countries, the market timing strategy produces higher Sharpe ratio and Treynor's measure than the buy-and-hold strategy. Jensen's alpha is significantly positive for all sample countries except Italy and the U.K. with positive but insignificant alphas. The fact that the slope coefficient, β_1, lies between zero and one for every country is consistent with the expectation of lower risk for the market timing portfolio than for the buy-and-hold portfolio. The associated coefficients of determination are above 50 percent for all countries except Canada with a coefficient of determination of 35 percent, suggesting that the regression model represents a good fit for the data. Both risk-adjusted measures of Graham and Harvey are positive for the seven sample countries.

The effectiveness of the market-timing strategy is further supported by the two-beta regression results. As explained earlier in the methodology section, a positive and statistically significant β_3 implies a successful portfolio risk escalation (reduction) in response to the market upturn (downturn) and provides evidence of superior market timing. With the exception of Australia and Italy where β_3 is positive but insignificant, the coefficient is significantly positive. The model's goodness of fit is evidenced by the associated coefficient of determinations, which, like those generated from the Jensen's alpha regressions, are all greater than 50 percent with the exception of 40 percent for Canada.

TABLE 3.

Market timing test for Australia under different performance measures

Panel A:	**Risk-adjusted performance measures**					
	Sharpe ratio			Treynor's measure		
Time period	Market timing		Buy-and-hold	Market timing		Buy-and-hold
1/1971-12/1993	8.73%	$>$	1.73%	8.86%	$>$	1.29%
1/1994-8/2004	-0.70%	$<$	-0.58%	-0.32%	$<$	-0.24%
1/1971-8/2004	6.32%	$>$	1.21%	5.50%	$>$	0.80%
	Regression for Jensen's alpha					
Time period	α_1		β_1		$\overline{R}^2$	
1/1971-12/1993	0.04 (1.75)*		0.54 (5.45)***		0.5411	
1/1994-8/2004	-0.001 (-0.05)		0.80 (10.54)***		0.7981	
1/1971-8/2004	0.03 (1.78)***		0.55 (6.45)***		0.5531	

TABLE 3—*Continued*

	Graham and Harvey's measures			
Time period	$GH1$	$GH2$		
1/1971-12/1993	$3.88\% > 0$	$5.25\% > 0$		
1/1994-8/2004	$-0.04\% < 0$	$-0.05\% < 0$		
1/1971-8/2004	$2.55\% > 0$	$3.37\% > 0$		
Panel B:	**Two-beta regression model**			
Time period	α_2	β_2	β_3	$\overline{R}^2$
1/1971-12/1993	0.04 (0.58)	0.54 (4.33)***	0.003 (0.01)	0.5394
1/1994-8/2004	0.02 (0.96)	0.73 (6.09)***	−0.12 (−0.81)	0.7982
1/1971-8/2004	0.02 (0.48)	0.58 (5.43)***	0.01 (0.03)	0.5747
Panel C:	**Nonparametric test**			
Time period	p	p^*	S	
1/1971-12/1993	0.5414	0.5016	1.3101	
1/1994-8/2004	0.5276	0.5133	0.3390	
1/1971-8/2004	0.5471	0.5019	1.8015*	

Notes: Performance measures cover the entire sample period and the two sub-sample periods of pre-1994 and post-1993. Five risk-adjusted performance measures—Sharpe ratio and Treynor's measure (for both the market timing and the benchmark buy-and-hold portfolios), Jensen's alpha, and the two Graham and Harvey's measures—are contained in Panel A. Jensen's alpha is the intercept term derived from regressing the risk premium of the market timing portfolio on the risk premium of the market portfolio. Empirical results derived from a two-beta regression model proposed by Merton (1981) are reported in Panel B where the dependent variable is the risk premium of the market timing portfolio. The independent variables are the market risk premium and a variable that equals to the maximum of zero and the negative amount of the market risk premium. The design allows β_3 to capture the beta difference between the up markets and the down markets. A significantly positive β_3 is perceived as favorable evidence for the market timing strategy. Empirical results associated with a nonparametric test developed by Pesaran and Timmerman (1992) are illustrated in Panel C where p represents the actual percentage of times that the market conditions, up vs. down, are correctly forecasted by the market timing strategy and p^* is the predicted proportion of accurate forecasts when no market timing is involved. S asymptotically follows the standard normal distribution. A significantly positive S provides support to the market timing strategy. The numbers in parentheses are the t-statistics. The asterisks *, ** and ***, if applicable, denote statistical significance at the 10%, 5%, and 1% significance levels, respectively.

As with the five-risk adjusted performance measures and the two-beta regression model, the nonparametric test developed by Pesaran and Timmerman (1992) also lends strong support for the market-timing strategy. The associated S-statistics indicate that the market timing strategy guided by discount rate changes does a significantly better job in forecasting market upturns and downturns than what the predictions would be when no market timing is involved. The S-statistic is significantly positive for all countries except Italy with the statistic being positive but insignificant.

TABLE 4.

Market timing test for Canada under different performance measures

Panel A:	**Risk-adjusted performance measures**					
	Sharpe ratio			Treynor's measure		
Time period	Market timing		Buy-and-hold	Market timing		Buy-and-hold
1/1960-12/1993	10.50%	>	−0.27%	9.61%	>	−0.14%
1/1994-8/2004	12.84%	>	6.10%	11.86%	>	3.48%
1/1960-8/2004	11.09%	>	1.30%	10.16%	>	0.71%
	Regression for Jensen's alpha					
Time period	α_1		β_1		$\overline{R}^2$	
1/1960-12/1993	0.03 $(2.66)^{***}$		0.34 $(6.79)^{***}$		0.3465	
1/1994-8/2004	0.03 (1.25)		0.38 $(3.33)^{***}$		0.3743	
1/1960-8/2004	0.03 $(2.96)^{***}$		0.35 $(17.11)^{***}$		0.3550	
	Graham and Harvey's measures					
Time period	$GH1$		$GH2$			
1/1960-12/1993	$3.39\% > 0$		$5.77\% > 0$			
1/1994-8/2004	$2.35\% > 0$		$3.84\% > 0$			
1/1960-8/2004	$3.16\% > 0$		$5.32\% > 0$			
Panel B:	**Two-beta regression model**					
Time period	α_2		β_2	β_3		$\overline{R}^2$
1/1960-12/1993	-0.07 $(-3.66)^{***}$		0.62 $(7.17)^{***}$	0.50 $(4.15)^{***}$		0.4248
1/1994-8/2004	0.01 (0.34)		0.42 $(4.66)^{***}$	0.08 (0.58)		0.3710
1/1960-8/2004	-0.05 $(-2.66)^{***}$		0.58 $(7.43)^{***}$	0.40 $(3.40)^{**}$		0.4022
Panel C:	**Nonparametric test**					
Time period	p		p^*	S		
1/1960-12/1993	0.5394		0.4980	1.6806^{*}		
1/1994-8/2004	0.5520		0.5049	1.0660		
1/1960-8/2004	0.5386		0.4981	1.8755^{*}		

Notes: Same as those in Table 3.

Empirical results associated with the pre-1994 era, similar to those for the full sample period, strongly suggest that the market timing strategy outperforms the buy-and-hold strategy. All five risk-adjusted performance measures support the superiority of the market timing strategy. The only exception observed is the Jensen's alpha associated with Italy, which is positive but insignificant. Both the two-beta regression and nonparametric test results indicate that market timing strategy is effective in response to/in anticipation of the changes of market conditions. Both β_3 and the S-statistic are significantly positive for Canada, Germany, Japan, the U.K. and the U.S. They are also positive for Australia and Italy even though neither is significant at any conventional significance level. The coefficients

TABLE 5.

Market timing test for Germany under different performance measures

Panel A:	**Risk-adjusted performance measures**					
	Sharpe ratio			Treynor's measure		
Time period	Market timing		Buy-and-hold	Market timing		Buy-and-hold
1/1967-12/1993	24.92%	>	13.64%	9.72%	>	2.38%
1/1994-8/2004	17.58%	>	10.76%	12.35%	>	5.80%
1/1967-8/2004	20.88%	>	12.12%	9.69%	>	3.09%
	Regression for Jensen's alpha					
Time period	α_1		β_1		$\overline{R}^2$	
1/1967-12/1993	0.04 (2.39)**		0.56 (9.71)***		0.5660	
1/1994-8/2004	0.05 (1.62)		0.84 (10.50)***		0.8439	
1/1967-8/2004	0.04 (2.89)***		0.68 (15.35)***		0.6865	
	Graham and Harvey's measures					
Time period	$GH1$		$GH2$			
1/1967-12/1993	3.68% > 0		4.92% > 0			
1/1994-8/2004	5.07% > 0		5.55% > 0			
1/1967-8/2004	4.06% > 0		4.92% > 0			
Panel B:	**Two-beta regression model**					
Time period	α_2		β_2	β_3		$\overline{R}^2$
1/1967-12/1993	−0.01 (−0.81)		0.86 (20.41)***	0.24 (3.75)***		0.6955
1/1994-8/2004	0.004 (0.11)		0.92 (14.30)***	0.15 (0.90)		0.8456
1/1967-8/2004	−0.02 (−0.81)		0.81 (20.41)***	0.24 (3.75)**		0.6955
Panel C:	**Nonparametric test**					
Time period	p		p^*	S		
1/1967-12/1993	0.5469		0.5010	1.6467*		
1/1994-8/2004	0.6080		0.5299	2.3905**		
1/1967-8/2004	0.5553		0.5048	2.1973**		

Notes: Same as those in Table 3.

of determinations ranging from 35 to 70 percent with the majority being greater than 60 percent suggest that both Jensen's alpha and two-beta regressions fit the data rather well.

In contrast to the empirical findings presented so far that clearly favor the market timing strategy over the buy-and-hold strategy for the overall sample period and the pre-1994 era, results covered in Tables 3 to 9 for the post-1993 era are mixed and seem to suggest that the market timing strategy has lost its steam over time. In general, the dominance of the market timing strategy noted earlier has evaporated. While empirical results shown in Tables 4, 5, and 6 for Canada, Germany, and Italy are in favor of the market timing strategy, none of the performance measures except the

TABLE 6.

Market timing test for Italy under different performance measures

Panel A:	**Risk-adjusted performance measures**					
	Sharpe ratio			Treynor's measure		
Time period	Market timing		Buy-and-hold	Market timing		Buy-and-hold
1/1975-12/1993	3.64%	>	0.14%	4.09%	>	0.11%
1/1994-8/2004	10.00%	>	6.91%	10.45%	>	4.74%
1/1975-8/2004	5.58%	>	2.00%	5.59%	>	1.51%

	Regression for Jensen's alpha		
Time period	α_1	β_1	$\overline{R}^2$
1/1975-12/1993	0.02 (0.61)	0.50 (4.96)***	0.4961
1/1994-8/2004	0.02 (0.85)	0.74 (10.96)***	0.7395
1/1975-8/2004	0.02 (0.95)	0.57 (6.71)***	0.5683

	Graham and Harvey's measures	
Time period	$GH1$	$GH2$
1/1975-12/1993	$1.96\% > 0$	$2.77\% > 0$
1/1994-8/2004	$1.84\% > 0$	$2.13\% > 0$
1/1975-8/2004	$2.04\% > 0$	$2.69\% > 0$

Panel B:	**Two-beta regression model**			
Time period	α_2	β_2	β_3	$\overline{R}^2$
1/1975-12/1993	−0.06 (−1.22)	0.61 (4.03)***	0.25 (1.13)	0.5058
1/1994-8/2004	0.01 (0.30)	0.76 (5.15)***	0.05 (0.23)	0.7377
1/1975-8/2004	−0.03 (−0.81)	0.65 (5.25)***	0.18 (0.98)	0.5731

Panel C:	**Nonparametric test**		
Time period	p	p^*	S
1/1975-12/1993	0.5022	0.4935	0.2649
1/1994-8/2004	0.5354	0.5120	0.5628
1/1975-8/2004	0.5142	0.4975	0.6437

Notes: Same as those in Table 3.

S-statistic listed in Table 4 for Canada is with any statistical significance. Empirical evidence presented in Tables 3, 8, and 9 is in fact in favor of the buy-and-hold strategy. The strongest case against the market timing strategy can be found in Table 8 for the U.K. Both Sharpe ratio and Treynors's measure are lower for the market timing portfolio than for the benchmark portfolio. Jensen's alpha, the two measures of Graham and Harvey, β_3 in the two-beta regression, and the S-statistic are all negative with β_3 being significantly negative at the 10% significance level. Evidence reported in Table 9 for the case of the U.S. against the market timing strategy is virtually equally strong except for the fact that the negative β_3 is not statistically significant. The case presented in Table 3 for Australia mirrors

TABLE 7.

Market timing test for Japan under different performance measures

Panel A:	**Risk-adjusted performance measures**					
	Sharpe ratio			Treynor's measure		
Time period	Market timing		Buy-and-hold	Market timing		Buy-and-hold
1/1971-12/1993	15.21%	>	6.83%	11.67%	>	4.22%
1/1994-8/2004						
1/1971-8/2004	8.73%	>	3.97%	6.18%	>	2.44%
	Regression for Jensen's alpha					
Time period	α_1		β_1		$\overline{R}^2$	
1/1971-12/1993	0.05 (2.38)**		0.64 (5.72)***		0.6485	
1/1994-8/2004						
1/1971-8/2004	0.03 (2.14)**		0.76 (35.13)***		0.7574	
	Graham and Harvey's measures					
Time period	$GH1$		$GH2$			
1/1971-12/1993	$4.14\% > 0$		$5.18\% > 0$			
1/1994-8/2004						
1/1971-8/2004	$2.54\% > 0$		$2.92\% > 0$			
Panel B:	**Two-beta regression model**					
Time period	α_2		β_2		β_3	$\overline{R}^2$
1/1971-12/1993	-0.02 (-0.78)		0.79 (7.15)***		0.29 (1.87)*	0.6632
1/1994-8/2004						
1/1971-8/2004	-0.02 (-1.18)		0.86 (10.61)***		0.22 (1.75)*	0.7639
Panel C:	**Nonparametric test**					
Time period	p		p^*		S	
1/1971-12/1993	0.5821		0.5205		2.3355**	
1/1994-8/2004						
1/1971-8/2004	0.5455		0.5117		1.7930*	

Notes: Same as those in Table 3.

that for the U.S. with the exception of the insignificantly positive value associated with the S-statistic. Japan, due to its prolonged rate declining environment since July 1991, market timing strategy is not applicable over the post-1993 era and thus no results are reported for this time period in Table 7.

5. CONCLUSION

This study investigates whether discount rate changes serve as an informative signal for investors to enter or exit the stock market. Based on the signal, a market timing strategy is formulated and its performance relative

TABLE 8.

Market timing test for United Kingdom under different performance measures

Panel A:	**Risk-adjusted performance measures**					
	Sharpe ratio			Treynor's measure		
Time period	Market timing		Buy-and-hold	Market timing		Buy-and-hold
1/1975-12/1993	7.88%	$>$	2.33%	5.94%	$>$	1.45%
1/1994-8/2004	−8.81%	$<$	−4.88%	−4.80%	$<$	−1.91%
1/1975-8/2004	4.78%	$>$	0.81%	3.36%	$>$	0.46%
	Regression for Jensen's alpha					
Time period	α_1		β_1		$\overline{R}^2$	
1/1975-12/1993	0.03 (2.02)**		0.68 (9.25)***		0.6844	
1/1994-8/2004	−0.02 (−0.93)		0.53 (4.15)***		0.5242	
1/1975-8/2004	0.02 (1.58)		0.67 (31.00)***		0.6659	
	Graham and Harvey's measures					
Time period	$GH1$		$GH2$			
1/1975-12/1993	$2.86\% > 0$		$3.46\% > 0$			
1/1994-8/2004	$-1.13\% < 0$		$-1.54\% < 0$			
1/1975-8/2004	$1.86\% > 0$		$2.28\% > 0$			
Panel B:	**Two-beta regression model**					
Time period	α_2		β_2	β_3		$\overline{R}^2$
1/1975-12/1993	−0.04 (−1.30)		0.83 (7.53)***	0.32 (1.80)*		0.7031
1/1994-8/2004	0.05 (1.97)*		0.26 (1.80)*	−0.46 (−1.92)*		0.5583
1/1975-8/2004	−0.04 (−2.13)**		0.79 (22.95)***	0.28 (4.69)***		0.6798
Panel C:	**Nonparametric test**					
Time period	p		p^*	S		
1/1975-12/1993	0.5642		0.5057	2.2594**		
1/1994-8/2004	0.4720		0.4970	−0.5651		
1/1975-8/2004	0.5404		0.5027	1.6655*		

Notes: Same as those in Table 3.

to a passive buy-and-hold strategy is tested with five risk-adjusted performance measures, a two-beta regression model, and a nonparametric test. Empirical evidence derived from data of seven developed countries over more than 29 years is virtually invariant to the performance evaluation methods employed and uniformly supports the superiority of the market timing strategy. However, the same conclusion cannot be drawn when the full study period is divided into pre-1994 and post-1993 sub-sample periods. While test results associated with the former sample period indicate that the market timing strategy outperforms the benchmark buy-and-hold strategy, dominance of the market timing strategy has essentially vanished over the latter sub-sample period. Thus, the tactic of basing investment

TABLE 9.

Market timing test for United States under different performance measures

Panel A:	**Risk-adjusted performance measures**					
	Sharpe ratio			Treynor's measure		
Time period	Market timing		Buy-and-hold	Market timing		Buy-and-hold
1/1971-12/1993	16.18%	$>$	1.78%	13.26%	$>$	0.97%
1/1994-8/2004	5.08%	$<$	10.76%	3.13%	$<$	5.77%
1/1971-8/2004	11.76%	$>$	4.61%	8.72%	$>$	2.47%
	Regression for Jensen's alpha					
Time period	α_1		β_1		$\overline{R}^2$	
1/1975-12/1993	0.05 $(3.35)^{***}$		0.42 $(4.93)^{***}$		0.4266	
1/1994-8/2004	-0.02 (-1.04)		0.76 $(8.63)^{***}$		0.7572	
1/1975-8/2004	0.03 $(2.40)^{**}$		0.52 $(6.80)^{***}$		0.5256	
	Graham and Harvey's measures					
Time period	$GH1$		$GH2$			
1/1975-12/1993	$4.95\% > 0$		$7.73\% > 0$			
1/1994-8/2004	$-2.67\% < 0$		$-3.05\% < 0$			
1/1975-8/2004	$2.78\% > 0$		$3.83\% > 0$			
Panel B:	**Two-beta regression model**					
Time period	α_2		β_2	β_3		$\overline{R}^2$
1/1975-12/1993	-0.06 $(-2.56)^{**}$		0.70 $(6.20)^{***}$	0.55 $(4.16)^{***}$		0.5077
1/1994-8/2004	0.02 (0.65)		0.66 $(4.64)^{***}$	-0.17 (-1.13)		0.7592
1/1975-8/2004	-0.03 (-1.42)		0.70 $(7.66)^{***}$	0.33 $(2.21)^{**}$		0.5467
Panel C:	**Nonparametric test**					
Time period	p		p^*	S		
1/1975-12/1993	0.5709		0.5007	2.3480^{**}		
1/1994-8/2004	0.5317		0.5370	-0.1292		
1/1975-8/2004	0.5586		0.5074	2.0949^{**}		

Notes: Same as those in Table 3.

strategy formulation on discount rate changes has turned unproductive in recent years. There is actually weak evidence over the post-1993 time period in favor of the passive buy-and-hold strategy. Based on empirical findings of this study, several potential research avenues are noted next.

First, this study focuses its market timing examination on seven developed countries. Thus, observations drawn from this study may not be readily applicable to developing or emerging countries. Future research addressing this issue is warranted. Second, intensified globalization over the past decade or so might be the culprit for the noted disappearance of market timing strategy's dominance. The clout that local government's monetary policy used to have on its economy and financial markets is likely

undermined by factors beyond its sovereignty. If so, market timing based on monetary policy variables other than discount rate changes may turn out to be just as futile. Researchers may want to further explore the association between globalization and market timing. Lastly, three of the seven developed countries studied — Germany, Italy, and the U.K. — are European Union member states. Market conditions of the three countries after 1998 are expected to be influenced by the monetary policy set by the European Central Bank for EU members located in the Eurozone. This noted linkage might be partially responsible for the empirical results derived for these three countries over the post-1993 era. Thus, the impact of the European Central Bank's monetary policy on the economic condition and financial market performance of European Union members should be closely examined.

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