

PERFORMANCE ANALYSIS FOR THE TWO-MINUTE PORTFOLIO IN BOTH CANADIAN AND U.S. STOCK MARKET

by:

Xudong (Gary) Gu

BBA, Finance & Accounting – Simon Fraser University 2009

and

Ximeng (Simon) Wang

BBA, Marketing – China Agricultural University 2012

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Approval

Name(s): Xudong (Gary) Gu
Ximeng (Simon) Wang

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Title of Project: Performance Analysis for the Two-Minute
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Supervisory Committee:

Dr. Peter Klein
Supervisor
Professor of Finance

Dr. Jijun Niu
Reader
Assistant Professor of Finance

Date Approved:

Abstract

The “Two-Minute Portfolio” was first introduced by Rob Carrick in 1999 for the Globe and Mail’s Finance Section. By using his strategy with equal weighting in each market sector, Rob claims that individual conservative long-term investors would spend little time in the portfolio selection and still outperform the market (TSX). Over time, the “Two-Minute Portfolio” evolves its strategy to improve the performance. Based on the four main characteristics of the Two-Minute Portfolio: Equal-weight strategy, Large-Cap (blue-chip) companies, Dividend-paying constraint, and Annual rebalancing schedule, we construct the Two-Minute Portfolios in both TSX and S&P 500 markets. We tested the “Two-Minute Portfolio” strategy for its long-term mean return and risk-adjusted return. We found that the Two-Minute Portfolios do not provide statistically significant excess returns. However, in terms of the risk-adjusted measurement, Two-Minutes Portfolios may perform better than benchmarks. We further found that the added Dividend-Paying constraint does not provide significant improvement to the portfolio.

Keywords: Rob; Carrick; Two Minute; Portfolio; Equal Weight; Strategy; S&P; 500; TSX; Large; Cap; Dividend; Rebalance; Return; Risk Adjusted; Anomalies

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Introduction

In 1999, Rob Carrick, the Globe and Mail's Personal Finance Columnist, dredged up an idea called the "Two-Minute Portfolio". Carrick (1999) constructed two portfolios from December 31, 1998 by investing equal amount in the largest one or two blue-chip stocks in each of the S&P/TSX's sub sectors. Based on his test, both portfolios outperformed the TSX index. He claimed such strategy improves diversification, lower the risk, creates investment discipline, and removes investors' subjectivity. Throughout the years, the strategy has been updated as well. The latest "Two-Minute Portfolio" (Carrick, 2007) tracks the more diversified version by choosing two largest market-capitalized stocks in each TSX sectors, and a dividend-paying constraint is also added. The portfolio needs to be rebalanced back to equal weight at the beginning of each year. According to Carrick (2013), the Two-Minute Portfolio data was processed by Morningstar Canada senior consultant Craig McGee, who reported an annualized total return of 10.30% by back-testing the portfolio to the beginning of 1986, compared to 8.20% for the TSX index. The portfolio was also claimed to be less risky with a beta of 0.71 compared to the market beta of 1.

We find the Two-Minute Portfolio intriguing and conclude four main characteristics: Equal-weight strategy, Large-Cap (blue-chip) companies, Dividend-paying constraint, and Annual rebalancing schedule. If such strategy outperforms the market consistently, the finding is important for long-term conservative retail investors since it is easy to implement and does not require very high technical background, and it is less expensive than investing in active management portfolios. This strategy can also be important for academics if this passive strategy could consistently outperform the

market, as the market efficiency theory would suggest the opposite. The combination of Equal-weight strategy and anomalies such as size, dividend yield, and momentum effect may explain such outperformance.

Based on these characteristics of the Two-Minute Portfolio, we review literatures around topics of portfolio performance measurement, sector allocation and equal-weight strategy, and anomalies such as size effect, dividend yields effect, and momentum effect in our paper. In order to test the Two-Minute Portfolios, we use the latest published strategy (Carrick, 2007) and test it on both Canadian and U.S. equity markets, TSX and S&P 500. Besides comparing the mean returns with the benchmarks, we also test the performances on the risk-adjusted base. Furthermore, we are interested in how the dividend-paying constraint added in 2007 would affect the portfolio performance. We test the relationship between the aggregate dividend yields and portfolio returns.

Literature Review

1. Portfolio Performance Measurement

Traditional portfolio performance evaluation such as annual return (or mean return) is widely accepted by investors and practitioner literatures (for example, Morningstar, 2004). Marcus (1990) exams the performance of a star fund Fidelity Magellan mutual fund for its outperformance against S&P 500 index in 11 of 13 years from 1977 to 1989.

As investors become more aware of the risk taking in their investments, risk-adjusted performance measurements are developed. Treynor (1965) suggests the reward-

to-volatility ratio to evaluate a portfolio's excess return over the risk-free rate to the systematic risk, which could be estimated by regressing the portfolio return to the benchmark. Sharpe (1966) introduces the reward-to-variability ratio. It measures the excess return adjusted for the degree of total risk in the portfolio or trading strategy. Jensen (1968) develops a method to exam a security's abnormal return over the theoretical expected return, and to determine whether the deviation is statistically significant. The method is used to exam whether it is managers' ability or luck that attributes to the excess return. Modigliani and Modigliani (1997) propose M-squared or RAP. It measures a portfolio's risk-adjusted return that is adjusted for the portfolio's risk relative to the benchmark. Unlike Sharpe Ratio, RAP can be easily understood by a lay investor as the measurement is in percentage, especially when there is a negative excess return.

Although the above traditional risky-adjusted performance measures are widely accepted and used, investors should use them with care. Sharpe (1966) studies the performance of 34 equity style mutual funds from 1954 to 1963. He computes the Sharpe Ratios, and finds 19 of the 34 funds beat the Dow Jones. However, after adding the management fees and expenses, only 11 funds beat the benchmark. Jensen (1968) studied the alpha in 115 mutual funds. He also concludes that the investment ability of fund managers is not great enough to recover even brokerage commissions. Carlson (1970) studies the performance of common stocks, balanced, and income style mutual funds using Sharpe Ratio and Jensen's alpha. He finds the Sharpe Ratio of the whole portfolio lower than S&P 500. However, the Sharpe Ratio of common stock and balanced fund portfolio exceed the benchmark, while income fund's Sharpe Ratio

underperforms. He also finds the average net alpha is 0.6% per year, and the distribution of alpha across funds is positively skewed. Carlson concludes that investors must take care in generalizing from the performance results of a specific mutual fund group and a specific market index.

Above findings are important to us because transaction costs are not considered in our evaluation of the Two-Minute Portfolio. Investors must take their brokerage commissions and other management expenses into account before making investment decisions.

2. Sector Allocation and Equal-Weight Strategy

Fama (1965) suggests that there is an efficient market for securities, and the market portfolio cannot be consistently outperformed. The empirical test is conducted by Ferri et al. (1984). They compare asset composition within a portfolio to that fund prior to periods of low stock prices. They find mutual fund managers do not have consistent market timing abilities.

Under the assumption that pricing errors are short-lived and the market prices will approach their fair value, Hsu (2006) argues that cap-weighted portfolios would assign more weight to overvalued stocks and less weight to undervalued stocks. Thus, the cap-weighted portfolios are not the optimal portfolios if the market is mildly inefficient. Chen et al. (2007) also argue that the cap-weighted portfolio is not mean-variance efficient under the same assumption.

In 1998, State Street Global Advisors (SSGA) launched a set of nine ETFs, Select Sector SPDRs, which track the each S&P 500 sector returns. In 2009, an equal-weight

strategy is adopted to create the ALPS Equal Sector Weight ETF (Ticker: EQL). ALPS is an ETF of ETFs that invests in equal amount in each of the nine Select Sector SPDRs and rebalances quarterly. According to their website (Select Sector SPDR ETFs, 2013), the Equal Sector Strategy has the benefits of “Diversification, Transparency and control over sector allocations, Consistent performance (outperformed the S&P 500 over 1, 3, 5, and 10 year periods), and Lower volatility than the S&P 500.”

Sturm (2010) introduces the Sector Select ETFs. He finds the Equal Sector strategy that weights equally in nine S&P 500 Select Sectors is the only one that significantly outperforms the market, comparing with other optimal risky portfolio strategies and a market portfolio. However, transaction costs for monthly rebalancing the Equal Sector portfolio is omitted in his test. The strategy would only make sense if the transaction cost is less than the average excess return.

Conconi et al. (2013) study the Equal Sector strategy by testing the Sturm’s data period 2000-2007 and SSGA’s data period 2001-2010, and they further expand their data to a greater testing period 1989-2011. They report the same outperformance during the same periods as reported by Sturm and SSGA. However, the outperformance does not hold over the greater period. They conclude the Equal Sector strategy does not have excess returns over long term, but may outperform the market on a risk-adjusted basis, especially during volatile market periods.

Ferguson and Schofield (2010) test the equal-weight strategy by simulating an equal-weight portfolio on S&P 500 from January 1 1966 to June 30 2010. They find the

equal-weight portfolio beat the capitalisation-weighted S&P 500 benchmark by an average of about three percent annually.

Shimizu (2010) evaluates the equal-weight rebalancing strategy mathematically with all investment strategies with the following conditions:

... (1) we have a certain number of assets for investment, (2) we limit the number of times that the portfolio can be rebalanced in the time horizon, (3) the weights of assets in the portfolio at the start and after each rebalancing are given as fractions that have a common denominator, (4) the portfolio does not have any short position or leveraged position, and (5) we can trade without frictions. (p. 28)

However, Shimizu finds that the average performance of all investment strategies is equal to the performance of the equally-weight strategy under such conditions.

Urbán and Ormos (2012) tested the equally-weight portfolios in both U.S. market S&P 500 and Hungarian market Budapest Stock Exchange. They use Jensen's alphas to measure positive abnormal returns. They state that the excess returns found in the U.S. market cannot be observed in the Hungarian stock market using the same strategy.

These findings are crucial since equal-weight strategy describe the main character of the Two-Minute Portfolio.

3. Anomalies and Returns: Size, Dividend Yields, and Momentum Effect

Schwert (2003) claims that as research leads to more efficient markets, anomalies such as data snooping, the size effect, the momentum effect, dividend yields and stock return, and etc. would disappear once they have been documented. We are interested in the anomalies as they may affect the performance of the Two-Minute Portfolio.

Size Effect

Both Banz (1981) and Reinganum (1981) test the small-capitalization firms on the New York Stock Exchange. Based on the Sharpe (1964) and Lintner (1965) capital asset-pricing model (CAPM) from 1936-75, they find the small-cap firms have higher average returns than expectations. However, Schwert (2003) test the data from three subperiods, 1982-1987, 1988-1993, and 1994-2002, and find small-firm anomaly has disappeared. Ferguson and Schoefield (2010) also claim that instead of the “small-firm” effect, the outperformance of the equal-weight portfolio is explained by capturing relative volatility. Urbán and Ormos (2012) also confirm that excess returns generated by equal-weight strategy are neither caused by the small-firm effect, nor by the book-to-market equity, nor even by persistence.

This is important as the small-firm effect has often been considered in explaining the portfolio outperformance, while in our case, only large-cap (blue-chip) companies are selected in the Two-Minute Portfolio.

Dividend Yields Effect

Fama and French (1988) use CRSP data from 1927 to 1986. They argue that aggregate dividend yields predict subsequent stock returns. Schwert (2003) expands the data set to periods of 1872-1926, 1927-1986, and 1987-2000, and claims that the relation between aggregate dividend yields and subsequent stock returns is weakened both before and after the 1927-1986 period that studied by Fama and French.

This is also interesting to us as dividend-paying is added to the Two-Minute Portfolio constraints, and it is claimed to bring outperformance.

Momentum Effect

Debondt and Thaler (1985) suggest a contrarian anomaly whereby stocks with low returns in the past three to five years have higher average returns than stocks with high returns in the past three to five years. Ferguson and Schoefield (2010) also suggest that the rebalancing schedule of the equal-weight portfolio has a “buy low/sell high” character and it generates outperformance. On the contrary, Jegadeesh and Titman (1993) claim a continuation or short-term momentum effect that portfolios formed on the last year with high returns out-perform portfolios formed on the last year with low returns. Furthermore, Schwert (2003) test the momentum effects based on Fama and French (1993) three factor model. He claims that “[t]he evidence on the momentum effect seems to persist, but may reflect predictable variation in risk premiums that are not yet understood.”

We find this nontrivial since the Two-Minute Portfolio has an annual rebalancing schedule, whereas Sturm (2010) and ALPS Equal Sector Weight ETF (Select Sector SPDR ETFs, 2013) have monthly and quarterly rebalancing schedules respectively.

Methodology

With the literature challenging whether the equal-weight strategy, the main character of the Two-Minute Portfolio, yields outperformance and relations between anomalies and portfolio returns, we would like to test the Two-Minute Portfolio in the following aspects:

1. Mean Return

Hypothesis 1

To confirm the Carrick's claim that the long-term return of the Two-Minute Portfolio outperforms the benchmark, we perform a two-sided test of the null hypothesis that excess returns are equal to zero with 95% significance level:

$$H_0: ER = 0 \qquad H_A: ER \neq 0$$

Hypothesis 2

To find whether the Two-Minute Portfolio yields abnormal excess return, we also perform the second two-sided test of the null hypothesis that Jensen's Alpha is equal to zero with 95% significance level:

$$H_0: \alpha = 0 \qquad H_A: \alpha \neq 0$$

Procedure

We use the holding period return formula to calculate the mean return with the consideration of dividends and price appreciation:

$$R_i = \frac{P_i}{P_{i-1}} - 1 + \textit{Dividend Yield} \qquad (1)$$

where P_i is the portfolio value at time i .

The expected periodic return is calculated as the arithmetic average of the historically observed mean returns:

$$E[R] = \frac{1}{n} \sum_{i=1}^n R_i \qquad (2)$$

where n is the number of time periods i within a year.

For the first hypothesis test, the excess return is calculated as the difference between the periodic portfolio return R_p and benchmark return R_m :

$$ER = R_p - R_m \quad (3)$$

For the second hypothesis test, the excess abnormal return is calculated as the difference between the observed portfolio return R_p and predicted portfolio return using the CAPM model given the portfolio's volatility and market risk premium:

$$\alpha = R_p - [R_f + \beta(R_m - R_f)] \quad (4)$$

where β is the portfolio beta, and R_f is the risk-free rate¹.

2. Risk-Adjusted Return & Risk

In addition to the evaluation of the mean return, we feel it is crucial to test and compare the risk-adjusted return in today's financial environment as more and more investors begin to be aware of the risks in the stock markets, especially after the 2008 financial crisis. We use Sharpe Ratio and Treynor Ratio to measure the risk-adjusted returns. We further look at the risk factors such as portfolio standard deviation and beta. We also test the maximum periodic loss as one of the risk factors.

Procedure

We use Sharpe Ratio as a reward-to-variability measure. It is calculated as the portfolio risk premium per unit of deviation in an investment asset or trading strategy:

¹ Assumption of a constant zero risk-free rate is made for our purpose.

$$S = \frac{R_p - R_f}{\sigma} \quad (5)$$

where risk factor σ is the annualized standard deviation of the portfolio returns, which can be expressed as the following formula:

$$\sigma = \sigma_i * \sqrt{n} \quad (6)$$

Likewise, we use Treynor Ratio as a reward-to-volatility measure. It is calculated as the portfolio's excess return over the risk-free rate to the additional risk taken:

$$T = \frac{R_p - R_f}{\beta} \quad (7)$$

where risk factor β tests the sensitivity of change in portfolio's value in relation to the change in market, which can be expressed as the following formula:

$$\beta = \frac{Cov(R_p, R_m)}{Var(R_m)} \quad (8)$$

3. Dividend Yields Effect

Hypothesis 3

To test whether adding the dividend-paying constraint in the Two-Minute Portfolio creates value for investors, in another word, whether there is a relation between dividend yields and portfolio returns, we perform a test of the null hypothesis that coefficients of dividend yields δ are equal to zero at 95% significance level:

$$H_0: \delta = 0$$

$$H_A: \delta \neq 0$$

Moreover, since the Two-Minute Portfolio only asks for dividend-paying stocks, not the high dividend yields stocks, we compare the Two-Minute Portfolio returns with or

without the dividend-paying constraint in order to find whether such constraint contributes to the portfolio outperformance.

Procedure

To test the relation between dividend yields and portfolio returns, we use the equation estimated by Fama and French (1988):

$$r(t, t + T) = \alpha + \delta * Y(t) + \varepsilon(t, t + T) \quad (9)$$

where r is the portfolio return, α is the intercept, δ is the coefficient of dividend yields, and ε is the error term. Dividend yield $Y(t)$ can be expressed as the following formula:

$$Y(t) = D(t)/P(t - 1) \quad (10)$$

where $P(t)$ is the price at time t , and $D(t)$ is the dividend for the year preceding t .

Data

Carrick (2007) gives a complete instruction on how to build an improved Two-Minute Portfolio with the following steps:

1. Go to Globeinvestor.com and hold the cursor over where it says “Market Action” on the menu bar near the top of the page.
2. On the drop-down menu, click on “Market Indexes.”
3. Using Option B (index members stock report), select one of the 10 major subgroups of the S&P/TSX composite index (consumer discretionary, consumer staples, energy, financials, health care, industrials, information technology, materials, telecom services and utilities).
4. Where it says “Report Type,” select “Price Report – Quotes.”

5. When you get your search results, click the “Financial” tab at the top of the page to get view showing market capitalization for each stock.
6. Click on the “Market Cap” column heading to order the stocks in the index from highest market cap to lowest.
7. If you want to use an improved version of the original two-minute strategy that includes only dividend-paying stocks, click on the stock symbols of the largest stocks by market cap to see if they pay a dividend. (p. B16)

Based on the above steps and priorities, we construct our back-dated Two-Minute Portfolio with the following steps:

1. Equal-Weight Constraint: Depending on the number the market sectors, choose two stocks in each sector, and divide investment into equal dollar amount for each stock. The market sector is based on the ICB industry classification benchmark, which groups 10 sectors in an index.
2. Market-Cap Constraint: Sort each sector’s stocks based on their market-cap from the largest to the smallest. Choose stocks from the ones with the largest market-cap. In most cases, the selected stocks are the blue-chip companies.
3. Dividend-Paying Constraint: In each sector, choose two largest market-cap companies that pay dividends. If dividend-paying constraint cannot be satisfied, choose the largest two market-cap stocks, just like the original Two-Minute Portfolio.
4. Annual-Rebalancing Constraint: At the beginning of each year, repeat step 1, 2, and 3 to generate the new portfolio composition for the year. Calculate the weight of holding stocks and compare the composition to the new portfolio. Buy and sell stocks to bring the portfolio to match the new composition and equal weight.

We first construct the Two-Minute Portfolio on TSX index as the strategy is first introduced to be working on the Canadian stock market. We track the quarterly returns over time periods from 2002 to 2012 since it is the most data we can achieve. We notice that our time period is different than Carrick's which is back-dated to December 31, 1985 by CPMS, an equity research and portfolio analysis firm owned by Mornigstar Canada. We are not able to access CPMS's back-dated Two-Minute Portfolio composition, nor we are able to confirm whether CPMS follows the old or new strategy, or the combined old and new strategy. We think the time period we track using the improved strategy can be a reasonable comparison to Carrick's claims.

Carrick (2010) also claims that a back-testing Two-Minute Portfolio on the U.S. stock market S&P 500 conducted by CPMS does not give good performance – a 16-year average annual return of only 3.6% in Canadian dollar terms. To confirm that, we construct the Two-Minute Portfolio on S&P 500 as well based on the stated four steps. We are able to track the quarterly returns over time periods from 1991 to 2012. In order to reflect different investment timing, we separate our time periods into two subsequent for analysis:

- December 31, 1990 to December 31, 2012 (Greater Set: 22 years)
 - Herein referred to as 1991 to 2012
- December 31, 1990 to December 31, 2001 (Subset: 11 years)
 - Herein referred to as 1991 to 2001
- December 31, 2001 to December 31, 2012 (Subset: 11 years)
 - Herein referred to as 2002 to 2012

During the construction of the Two-Minute Portfolios under TSX and S&P 500, several issues come to our notice.

First of all, the dividend-paying constraint sometimes cannot be satisfied. For example, during the early years of TSX time period we track, some sectors such as Technology consist with only growth companies and they do not pay dividends. We instead choose the stocks by market-cap only.

For both Canadian and U.S. market, some holding companies in the portfolios change their ticker names. We made the changes respectively.

Moreover, for both markets, occasionally a holding company is acquired during the year and left only one stock in that sector. We then allocate the proceeds to the next best fit company in that sector based on our portfolio selection process.

A sample Two-Minute Portfolios of TSX and S&P 500 of year 2012 that we constructed is listed in Exhibit 1.

We have obtained the stock prices and sector classification information, and constructed the Two-Minute Portfolios using the Bloomberg Professional service.

Exhibit 1: Sample Two-Minute Portfolios in 2012

| Sector | TMP on TSX | TMP on S&P 500 |
|-------------------|------------|----------------|
| Utility | FTS | D |
| | CU | SO |
| Materials | G | FCX |
| | ABX | DD |
| Consumer Goods | SAP | KO |
| | MG | PG |
| Consumer Service | L | MCD |
| | TRI | WMT |
| Financials | TD | JPM |
| | RY | WFC |
| Health Care | CLC | PFE |
| | VRX | JNJ |
| Industrial | CP | UPS |
| | CNR | GE |
| Energy | CNQ | CVX |
| | SU | XOM |
| Technology | GIB | MSFT |
| | BB | IBM |
| Telecommunication | RCI | VZ |
| | BCE | T |

Empirical Results

Our main test result of Two-Minute Portfolios can be concluded as Exhibit 2. In our test, we conduct all t-test at significant level of 0.05. Overall, as shown in Exhibit 3, portfolios applying the Two-Minute Portfolio strategy have 115.38% long-term return over 2002-2012 in Canadian market, and 415.29% long-term return over 1991-2012 in U.S. market. Specifically for S&P 500 Two-Minute Portfolio, it has a 538.36% long-

term return starting for period 1991-2001, whereas a -8.21% long-term return starting for 2002-2012.

1. Mean Return

Hypothesis 1

As shown in Exhibit 2, the expected excess returns of the Two-Minute Portfolios are close to 0 for both TSX and S&P 500 indices over the whole testing period. The respective p-values show that we cannot reject the hypothesis that excess returns are 0 for all testing periods. However, interestingly, the excess returns of sub-periods test on S&P 500 are noticeable. For period 1991-2001, the Two-Minute Portfolio has a positive mean excess return of 1.08% over the benchmark, whereas for period 2002-2012, the Two-Minute Portfolio has a negative excess return of -1.59%, which roughly offset the excess return gained during the first period. Moreover, the p-value of the 2002-2012 period excess return t-test is 0.0657, which is very close to 0.05. In another word, the t-test would fail if we take confidence level at 90%.

Hypothesis 2

As the t-test result shows in Exhibit 2 (row 5) , only the Two-Minute Portfolio on S&P 500 index over period 1991-2001 has a statistically significant alpha of 2.14% with its p-value of 0.0012 smaller than 0.05. In other portfolios, there is no significant Jensen's alpha.

2. Risk-Adjusted Return & Risk

As we take risk-free rate as 0, we both calculate the Sharpe Ratio and Treynor Ratio of the Two-Minute Portfolios and benchmarks. Over all the testing periods, the Sharpe

Ratio of the Canadian benchmark is 0.2594, smaller than the TSX Two-Minute Portfolio Sharpe Ratio of 0.2676. The Sharpe Ratio of the U.S. benchmark is 0.3108, smaller than the S&P 500 Two-Minute Portfolio Sharpe Ratio of 0.322. However, for sub-period 2002-2012, the S&P 500 Two-Minute Portfolio has a smaller Sharpe Ratio of 0.007 than its benchmark's Sharpe Ratio of 0.1594.

The Two-Minute Portfolios have better Treynor Ratios than those of the benchmarks through all periods in both markets. However, for sub-period 2002-2012, the portfolio has a smaller Treynor ratio (0.034) than that of the benchmark (0.0139).

Though all periods in both markets, the adjusted standard deviations of the Two-Minute Portfolios' quarterly returns are smaller than those of the benchmarks' quarterly returns. More importantly, for both periods of the S&P 500 Two-Minute Portfolios, the volatilities of the portfolio returns (0.108 and 0.1312 in each sub-period) are smaller than the benchmark volatilities (0.145 and 0.1768 respectively).

Noticeably, the beta of the portfolio is always below 1. However, in sub-period 2002-2012, the beta of the S&P 500 Two-Minute Portfolio is not statistically significant, with its coefficient t-stats 1.1781 is smaller than 2.

In order to understand how the strategy works during financial crisis, we check the worst quarterly loss in 2008. Compare to the benchmarks' maximum quarterly loss in 2008, -21.07% in S&P 500 index and -22.48% in TSX index, the Two-Minute Portfolio strategy gives the maximum quarterly loss of -18.73% and -17.31% respectively.

3. Dividend Yields Effect

Hypothesis 3

As shown in Exhibit 2 (row 21), we find that there is no significant relation between the Two-Minute Portfolio returns and dividend yields. The p-values of the regression coefficient are not small enough in general. We cannot reject the hypothesis that the coefficient is not significant.

We further look at the portfolio performance with and without the dividend-paying constraint. As shown in Exhibit 2, the excess returns of the portfolios are still not significant. We then have to compare other statistics to value the strategies.

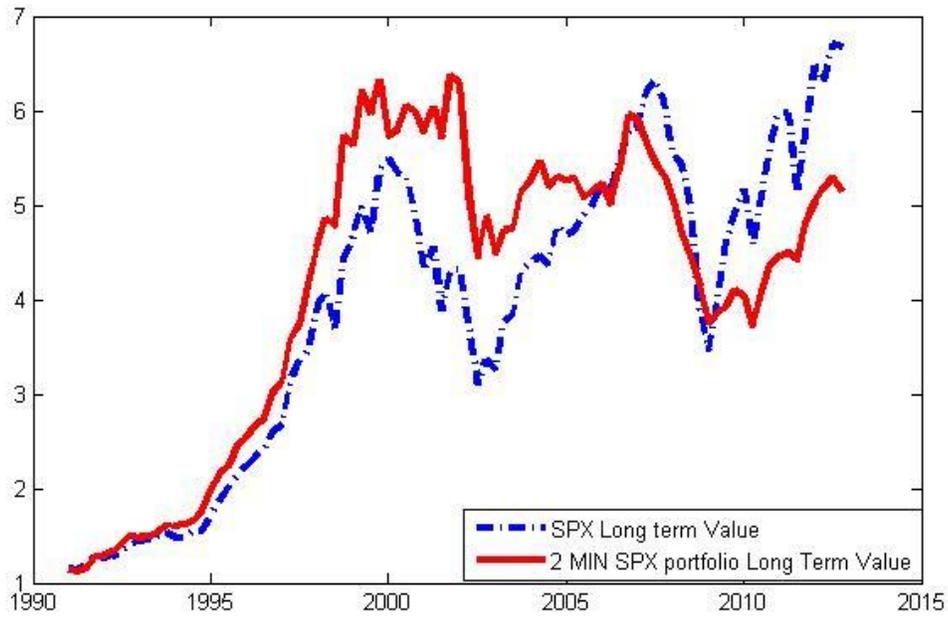
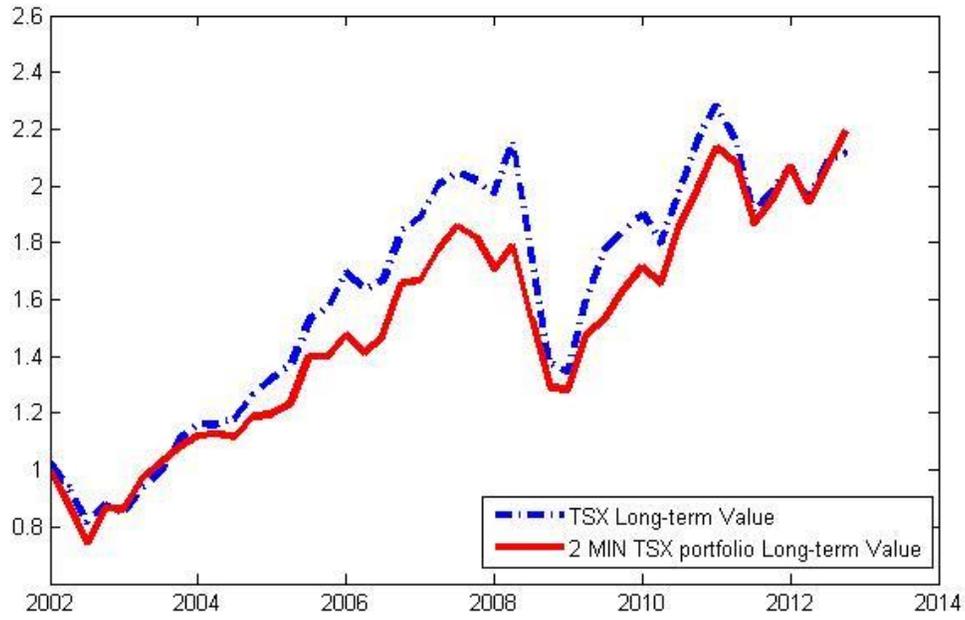
For the Canadian market, the Two-Minute Portfolio with a dividend-paying constraint has a better long-term return of 115.38% compared to 108.21% without it. Same for the risk-adjusted return, the Two-Minute Portfolio with the dividend-paying constraint yields a higher Sharpe Ratio.

However, for the U.S. Market, the Two-Minute Portfolio without dividend-paying constraint has a higher long-term return of 439.32% compared to 415.29% with it. Same for the risk-adjusted return, the Two-Minute Portfolio without the dividend-paying constraint yields a higher Sharpe Ratio.

Exhibit 2: Statistics of Two-Minute Portfolios (TMP) in both Markets & without Dividend-Paying Constraint

| | TMP on TSX | No Div. Constraint | TMP on S&P 500 | No Div. Constraint | Sub-period 1 | Sub-period 2 |
|-----------------------------------|------------|--------------------|----------------|--------------------|--------------|--------------|
| Period | 2002-2012 | | 1991-2012 | | 1991-2001 | 2002-2012 |
| Rp | 2.06% | 2.00% | 2.09% | 2.15% | 4.47% | 0.05% |
| Rm | 2.06% | 2.06% | 2.48% | 2.48% | 3.63% | 1.39% |
| Excess Return | 0.03% | -0.03% | -0.42% | -0.37% | 1.08% | -1.60% |
| <i>p-value</i> | 0.987 | 0.986 | 0.707 | 0.745 | 0.504 | 0.066 |
| Alpha (Jensen) | 0.26% | 0.16% | 0.54% | 0.58% | 2.13% | -0.15% |
| <i>p-value</i> | 0.544 | 0.766 | 0.255 | 0.225 | 0.001 | 0.890 |
| Long-term Return Portfolio | 115.38% | 108.21% | 415.29% | 439.32% | 538.36% | -8.21% |
| Long-term Return Benchmark | 111.99% | 111.99% | 567.00% | 567.00% | 330.57% | 54.94% |
| Mean Annualised Cumulative Return | 1.85% | 1.77% | 1.96% | 2.01% | 4.36% | -0.12% |
| σ_p | 15.76% | 16.10% | 13.06% | 13.19% | 10.80% | 13.12% |
| σ_m | 16.36% | 16.36% | 16.16% | 16.24% | 14.50% | 17.68% |
| β | 0.875 | 0.896 | 0.620 | 0.625 | 0.645 | 0.133 |
| <i>t-stats</i> | 15.133 | 14.297 | 11.213 | 11.208 | 8.447 | 1.178 |
| Max. Quarterly Loss Portfolio | -15.87% | -15.87% | -18.73% | -18.73% | -9.58% | -18.73% |
| Max. Quarterly Loss Benchmark | -22.48% | -15.87% | -21.07% | -18.73% | -14.64% | -21.07% |
| Sharpe Ratio Portfolio | 0.268 | 0.252 | 0.322 | 0.328 | 0.766 | 0.007 |
| Sharpe Ratio Benchmark | 0.255 | 0.255 | 0.311 | 0.311 | 0.506 | 0.159 |
| Treynor Ratio Portfolio | 0.024 | 0.022 | 0.034 | 0.034 | 0.069 | 0.003 |
| Treynor ratio Benchmark | 0.021 | 0.021 | 0.025 | 0.025 | 0.036 | 0.014 |
| Div. Yield – Return Coefficient | -0.509 | -0.509 | -0.955 | -0.955 | 8.536 | -1.193 |
| <i>p-value</i> | 0.903 | 0.903 | 0.419 | 0.419 | 0.021 | 0.420 |
| N | 44 | 44 | 88 | 88 | 44 | 44 |

Exhibit 3: TMP Long-term Portfolio Value in both Canadian and U.S. market



Discussion

1. Mean Return

Excess Return

Based on the opposite empirical results for the S&P 500 Two-Minute Portfolios excess returns during both sub-periods (1.08% and -1.58%), it is essential to test whether both excess returns belong to the same distribution, or it is the positive and negative excess returns in the sub-periods cause the zero excess return over the greater period.

In order to check the significance of the excess returns in the two sub-periods, we further apply t-test. Our hypothesis here assumes that excess returns during the two sub-periods have the same mean and variance. As the test result shows in Exhibit 4, we cannot reject the hypothesis. The two sets of excess returns can still be regarded as from the same distribution, with mean equals to 0.

Exhibit 4: t-test on the TMP Excess Returns in two S&P 500 sub-periods

| h | p-value | t-stats | df | std |
|---|---------|----------|----|-------|
| 0 | 0.1432 | -1.47739 | 87 | 0.172 |

Thus, we can conclude the Two-Minute Portfolio does not yield significant excess returns in the U.S. market.

Furthermore, with the result that there is no significant excess return in the Canadian market as well, we conclude that the Two-Minute Portfolio may not give investors significant excess returns over benchmarks.

2. Risk-Adjusted Return & Risk

Risk-Adjusted Return

From our empirical result, we can find that Sharpe Ratios of the Two-Minute Portfolios for both markets generally are higher than those of the benchmarks, except that S&P 500 Two-Minute Portfolio in sub-period 2002-2012 has a lower Sharpe Ratio.

We can find the same results for the Treynor Ratio.

Therefore, we can say that the Two-Minute Portfolio may outperform the benchmark on a risk-adjusted basis.

Beta

From our test, we find the Two-Minute Portfolios in both markets and in all time periods have beta less than 1. We also suggest there may be momentum effect across sub-periods that causes the insignificance of the simple CAPM beta in sub-period 2002-2012.

However, we believe it is less important and can still conclude that the Two-Minute Portfolio strategy result in lower beta, meaning the portfolio has less exposure to the systematic risk.

Volatility and Mean-Variance

As we can observe from the Exhibit 2, the adjusted standard deviations of the Two-Minute Portfolios in both markets are always smaller than those of the benchmarks. Because the excess return is statistically zero, the Two-Minute portfolio is expected to have the same return as benchmark. However, portfolios with lower volatilities are more Mean-Variance efficient when expected returns are the same. Such advantage in the

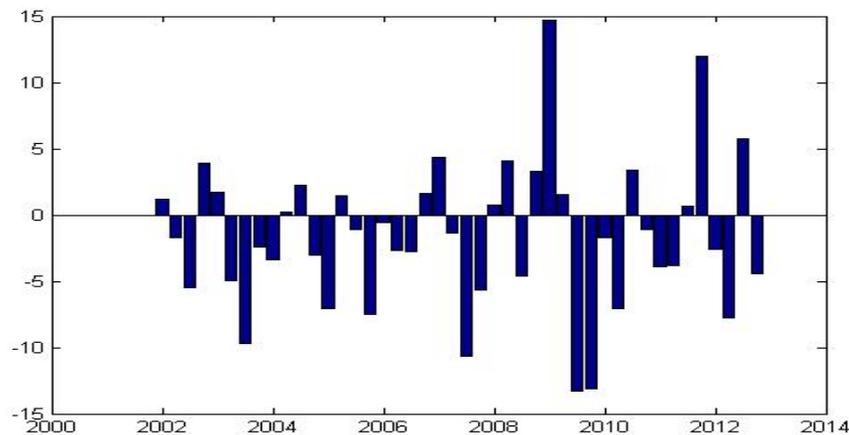
volatility may make the Two-Minute Portfolio more appealing to long-term Mean-Variance investors.

Maximum Quarterly Loss

It is clear from the empirical results that during financial crisis, the Two-Minute Portfolios experience lower quarterly loss. We believe that the equal-weight strategy helps to explain this outperformance. For example, if an investor holds an S&P 500 market portfolio in 2008, he would have 13.3% of his investment in the Financial Sector, which suffers a significant loss during the financial crisis. However, if he holds a Two-Minute Portfolio at that time, only 10% of his investment is exposed to the Financial Sector because of the equal-weight strategy. Thus, the Two-Minute Portfolio is less volatile during the financial downturn.

Moreover, as Exhibit 5 shows, the Two-Minute Portfolio usually outperforms the market during the financial crisis, but underperforms the market in the first recovering year after financial crisis.

Exhibit 5: TMP Excess Returns in Sub-Period 2



3. Dividend Yields Effect

Dividend-Paying Constraint

As our test results show, removing the dividend-paying Constraint can neither generate excess returns, nor cause underperformance over benchmarks. In terms of the risk-adjusted performance, adding the dividend-paying constraint leads to opposite performance in the two markets. Therefore, we do not have enough evidence to support that the dividend-paying constraint adds value to the Two-Minute Portfolio. We then believe it is not efficient to incorporate dividend-paying constraint into Two-Minute portfolio.

Limitation

We use different testing time period (2001-2012) to test the Two-Minute Portfolio on the TSX index than Carrick's testing period (1986-2012). That is the longest time period we could get for TSX index from the Bloomberg Professional service. The difference in the testing time period may affect our results. However, we feel the 11 years data in the Canadian market has a reasonable comparison to Carrick's claim as both are considered to be long term. Moreover, we are able to implement the Two-Minute Portfolio to the U.S. market and obtain a longer testing period to test the strategy. We can reasonably rely on that test result.

We are not able to obtain Carrick's portfolio composition for the back-testing periods. We are not sure which of the exact strategies Morningstar uses for Carrick to

calculate the returns. Moreover, we find our portfolio composition is different than Carrick's in some years, which may cause different results. We think the following two reasons may explain such difference.

Firstly, the difference may be due to using different sector classification method. To be consistent, we use ICB industry classification benchmark for the ten sectors in both Canadian and U.S. market. However, Carrick does not specify his method. We sometimes find different holdings in the TSX Consumer Goods, Consumer Services, and Health Care sectors. Based on different indices and classification methods, the Two-Minute Portfolio strategy may generate different results.

Secondly, Carrick does not provide a solution for some unexpected situations such as when a holdings stock is acquired during the year and we are forced to trade. We use the assumption as a rational conservative investor would do to have a portfolio as close as to Carrick's Two-Minute Portfolio strategy, but it may still cause our holdings to be different. The extra transaction cost may also affect the total return.

Moreover, similar to Carrick's approach, we do not include the transaction costs when evaluating portfolio performance since transaction costs are very different across different investors. Carrick suggest the average trading commission in Canada ranges from 9 to 29 dollars depending on different brokerage firms, portfolio sizes, and average number of trades. Our result could be different as well if cost factor is considered.

Furthermore, we have not fully tested all the anomalies that we have reviewed in the past literature. For example, we have not tested the size effect affects the return, since the Two-Minute Portfolio prefers large-cap blue-chip companies. We have not

tested whether adding more holdings in each sector or holding equal weight sector ETFs would result better performance. In addition, we have not fully tested the momentum effect. It could be interesting to test whether increasing the rebalance schedule from annually to quarterly or monthly, which essentially is increasing the frequency to catch the momentum effect, could improve the performance. These can be our interest for further studies in the future.

Conclusion

Carrick's Two-Minute Portfolio combines the equal-weight strategy and anomalies such as size, dividend yields, and momentum effects. Although for the long-term cumulative return, the Two-Minute Portfolio may outperform the benchmark as Carrick claims, statistics shows that the strategy does not generate statistically significant excess returns.

On the other hand, the Two-Minute Portfolio does seem to be less volatile than the market portfolio. It performs better during the market downturn but does not outperform when the market recovers. Thus, the Two-Minute Portfolio may have better performance than the market on a risk-adjusted basis in periods of heightened market volatility.

Last but not least, statistics show that adding the dividend-paying constraint may not yield significant excess returns over benchmark, or better risk-adjusted returns. Thus, we conclude such constraint does not add value to the portfolio

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