

The Impact Of Trading Volume On Portfolios' Effective Time Formation/Holding Periods Based On Momentum Investment Strategies

Tov Assogbavi, Laurentian University, Canada
Martin Giguère, Laurentian University, Canada
Komlan Sedzro, Université du Québec à Montréal (UQAM), Canada

ABSTRACT

This paper analyzes momentum investment strategies based on past market data to evaluate the impact of trading volume on price momentum for the Canadian Stock Market. Utilizing variant models of Jegadeesh and Titman (1993) and Lee and Swaminathan (2000), we evaluate the effective time formation/holding periods of portfolios using both past price and trading volume. The findings suggest that taking high trading volume into consideration in momentum investment strategies on the TSX between 1996 to 2004 generally outperformed a strictly price-based momentum strategy for both winners ($t= 2.118, p< .05$) and losers ($t= 2.174, p< .05$). The most effective time period for a winning-high-volume portfolio was nine months of formation, starting in April and a 3-month holding period. The holding period is shorter by six months compared to what is suggested by Assogbavi, et al. (2008). In addition, high-volume portfolios consistently bettered low-volume portfolios for both winners ($t= 4.121, p< .001$) and losers ($t= 3.956, p< .001$). For investors who base their portfolio construction on momentum investment strategies, these findings suggest that it would be wise to incorporate past trading volume in their selection process.

Keywords: trading volume; time formation; holding period; investment

I. INTRODUCTION

Practitioners and academics alike are continually testing various new trading strategies on the capital markets, many of which are based on past market data. In fact, there is an extensive body of literature examining technical trading strategies that attempt to exploit recurring trends in stock market data through time. However, the validity of these strategies has been a point of great contention amongst academics from their inception due to proponents of the Efficient Market Hypothesis (EMH). According to the weak form of the EMH, it should be impossible to predict future market direction consistently based solely on historical information. Many empirical studies (i.e., DeBondt & Thaler, 1985; Jegadeesh & Titman, 1993; Schiereck, DeBondt, & Weber, 1999; Mun, Vasconcellos, & Kish, 2000) have demonstrated the complete opposite. Indeed, these studies indicate that past trading price and volume can provide valuable information about a security and thus help achieve abnormal returns.

Momentum investment strategy (also known as “relative strength”) is one such method that tries to “ride the wave” of past market information. Largely, it involves the purchase of stocks that have shown some kind of relative strength in the recent past and the sale of stocks that have performed poorly over short periods of 3-12 months. The premise is that the current trend will continue in the same direction. In other words, stock prices on the rise will continue to climb for a period of time and prices on the downfall will pursue their descent. When incorporating past trading information in a trading strategy, effectively timing the trends is of critical importance to

maximize the possible return. Concerning strictly price momentum (PM), a 9-month formation and holding period has been demonstrated to be the most effective portfolio design in the Canadian market (Assogbavi et al., 2008). However, other variables, such as trading volume, are also available to help prognosticate future stock prices.

The objective of this paper is to investigate the influence of historical trading volume on momentum investment strategies within the Canadian stock market (i.e., TSX). This will be based upon previous studies, such as those by Jegadeesh and Titman (1993), as well as Lee and Swaminathan (2000). More specifically, establishing the most effective time formation/holding periods on the Canadian stock market, using both past price and volume data, is the main purpose of this study. Effective, in this context, is defined as a combination of formation and holding periods producing the highest returns. Any seasonal effect on the formation and holding periods is also examined. The answers to these questions could be valuable to practitioners in designing portfolios that are more effective for themselves or their clients.

The remainder of the paper is structured as follows. Section II briefly reviews the related literature on the topic. In Section III, the data and methodologies are described. Section IV summarizes the empirical results. Finally, the conclusions of the study are presented in Section V.

II. LITERATURE REVIEW

The body of literature on momentum investing and trading volume are both extensive. Looking at both the NYSE and AMEX from 1965 to 1989, Jegadeesh and Titman (1993) demonstrated that a momentum strategy based on buying the last year's top stock performers, and holding them for at least three months, can yield significant abnormal returns as high as 1.49% per month. However, they also note that the momentum effect eventually reverses near the twelfth month and persists for several months afterwards. Consequently, a contrarian strategy of buying losers and selling winners is superior in a longer horizon. This occurrence is not exclusive to the American capital markets. Corresponding momentum studies have yielded similar results for other stock exchanges in Canada (i.e. Foerster et al., 1994; Kan et al., 1996; Cleary et al., 1998), in European countries (Rouwenhorst, 1998; Schiereck et al., 1999), as well as in emerging markets (Rouwenhorst, 1999). However, the presence of transaction costs can significantly reduce the prosperity of price momentum strategies to such a point, that it might be out of reach for the average investor (Pettengill et al., 2006). Regardless of the type of investor, timing is of a critical nature to achieve maximum profitability when dealing with fluctuating trends. Looking at price momentum in Canada from 1996 to 2004, Assogbavi and Leonard (2008) determined that a combination of nine months for both the formation and holding periods to be the most effective portfolio design.

As trading volume is concerned, Ying (1966) was the first to demonstrate empirically a positive correlation between volume and the change in price on the U.S. stock exchanges. His results suggest that trading volume can be an indicator to determine the subsequent rise or fall of the stock price. Many subsequent studies have confirmed this fundamental correlation via many different methods and markets. Campbell, Grossman, and Wang (1993) indicate that first daily autocorrelation of stock returns is lower on high-volume days compared to low-volume days. Blume, Easley, and O'Hara (1994) demonstrate that trading volume provides insight on the information quality and structure in a way distinct from price. Conrad et al. (1994) elaborate this further. They found evidence of a relationship between trading activity and subsequent autocovariances in weekly returns. For instance, low-transaction stocks generally experienced positive autocovariances in returns, whereas high-transaction stocks experienced price reversals. Datar, Naik, and Radcliffe (1998) for their part, demonstrated that lower volume turnover stocks commonly earn higher returns than high-turnover securities. Taken as a whole, trading activity appears to be a significant predictor of the returns of individual securities.

Lee and Swaminathan (2000) combined price momentum with volume, which they referred to as volume-based price momentum¹. They determined that historical trading volume helps to predict the magnitude and persistence of price momentum in the U.S. market. They also noted that volume helps to foretell the subsequent reversal. For example, high volume winning and low volume losing stocks experience faster momentum reversals.

¹ The terminology of volume-based price momentum and price-volume momentum (PVM) are used interchangeably in this paper.

Overall, this means that trading volume can possibly serve as an indicator to effectively time the purchase and sell of securities to reap the reward of the momentum effect to its fullest. In opposition to this idea, a recent study from the Shanghai Stock Exchange (Naughton et al., 2008) sends a different message with its finding of no significant link between past volume and momentum profits.

III. DATA AND METHODOLOGY

Data Description

The data used in this study consists of daily trading volume and prices from January 1996 to December 2004 on 48 stocks that made up the S&P/TSX 60 Index during that period. The S&P/TSX 60 Index includes 60 of the largest and most actively traded stocks on the Toronto Stock Exchange. This index is composed of blue-chip companies representing over 70% of Canada's equity market capitalization. Table I below presents the listed companies of the S&P/TSX 60 Index used in the study, as well as the ending stock price, market capitalization, and standard deviation.

Table I: Summary Statistics Of The Sample

Company	Year-end Price (2004)	Market Capitalization (\$mil)	Standard Deviation (1996 - 2004)	Company	Year-end Price (2004)	Market Capitalization (\$mil)	Standard Deviation (1996 - 2004)
Abitibi-Consolidated Inc.	8.28	4,365	2.27%	IPSCO Inc.	57.31	4,900	2.29%
Agrium Inc.	20.27	2,168	2.08%	Kinross Gold Corp.	8.45	2,560	3.88%
Alcan Inc.	58.85	19,798	1.96%	Loblaw Companies Ltd.	72.15	16,812	1.45%
ATI Technologies Inc.	23.31	5,047	3.63%	Magna International Inc.	99.28	10,126	1.70%
Bank of Montreal	57.80	25,624	1.57%	MDS Inc.	16.97	3,052	2.25%
Bank of Nova Scotia	40.89	34,430	1.94%	National Bank of Canada	49.66	7,465	1.61%
Barrick Gold Corp.	29.00	13,928	2.43%	Nexen Inc.	48.72	6,500	2.15%
BCE Inc.	28.97	24,464	2.43%	Nortel Networks Ltd.	4.18	22,869	4.20%
Biovail Corp.	19.80	3,988	3.35%	NOVA Chemicals Corp.	56.72	3,040	2.63%
Bombardier Inc. (Class B)	2.38	10,182	2.84%	Petro-Canada Inc.	61.18	15,913	1.85%
CAE Inc.	5.10	2,080	2.55%	Potash Corporation	99.75	6,031	2.12%
Cameco Corp.	41.95	3,517	2.61%	Precision Drilling Corp.	75.38	3,473	2.56%
CIBC	72.35	23,681	1.78%	Quebecor World Inc.	25.85	3,568	1.64%
Canadian Natural Resources	51.39	10,481	2.07%	Rogers Communications (Class B)	31.44	5,580	2.85%
Canadian Tire Corp. (Class A)	56.32	3,562	1.95%	Royal Bank of Canada	64.18	38,807	1.45%
Cognos Inc.	52.84	4,019	3.63%	Shaw Communications (Class B)	21.93	5,126	2.40%
Cott Corp.	29.69	3,034	3.01%	Suncor Energy Inc.	42.56	15,368	1.84%
Dofasco Inc.	45.42	2,693	1.72%	Talisman Energy Inc.	32.35	10,524	2.07%
Domtar Inc.	14.50	3,606	2.02%	TELUS Corp.	36.25	8,385	2.19%
Enbridge Inc.	59.76	9,031	1.32%	Thomson Corp.	42.27	29,051	1.95%
Falconbridge Ltd.	31.02	5,304	2.21%	Toronto-Dominion Bank	49.99	28,921	1.77%
Husky Energy Inc.	34.26	10,816	2.22%	TransAlta Corp.	18.05	3,300	1.63%
Imperial Oil Ltd.	71.40	22,155	1.59%	TransCanada Corporation	29.84	13,351	1.36%
Inco Ltd.	44.05	7,877	2.37%	Zarlink Semiconductor Inc.	3.06	361	3.82%

METHODOLOGY

In this paper, the two-way classification method utilized to evaluate the performance of volume-based price momentum is inspired and adapted from previous studies. A version of the model developed by Jegadeesh and Titman (1993) is used to measure the price momentum part of the equation. It involves creating a series of equally weighted portfolios by ranking individual securities based on their past returns (formation period) and following the performance of each portfolio during multiple holding periods. For the purpose of this study, three equally weighted portfolios of 16 stocks, based on their past return, were formed from 1996-2003. These portfolios are called "Winners", "Middle", and "Losers" denoting their relative performance to each other. This procedure was taken for four formation periods (i.e., 3, 6, 9, and 12 months). The average monthly return is calculated as follows:

Equation I: Average Monthly Return

$$R_{st} = \frac{1}{N_{mt}} \sum_{m=1}^{N_{mt}} \left(\frac{P_{smE} - P_{smB}}{P_{smB}} \right) \qquad R_{pt} = \frac{1}{N_{pt}} \sum_{s=1}^{N_{pt}} R_{st}$$

where R_{st} = average monthly return for stock s during period t ,
 N_{mt} = number of months in period t ,
 P_{smE} = price of a given stock s on the last day of month m ,
 P_{smB} = price of a given stock s on the first day of month m ,
 R_{pt} = average monthly return for portfolio p during period t ,
 N_{pt} = number of stocks in portfolio p during period t .

The trading volume component of the framework is based on Lee and Swaminathan’s (2000) independent two-way classification process. It involves subdividing the portfolios as created by Jegadeesh and Titman (1993) according to the level of trading volume. For this study, the absolute value of the period’s average daily change in trading volume was used as a measurement for the volatility of volume. Each formed portfolio was subdivided according to high or low change in volume as demonstrated below:

Equation II: Average Daily Change in Trading Volume

$$T_{st} = \frac{1}{N_{dt}} \sum_{d=1}^{N_{dt}} \left(\frac{V_{sd} - V_{sd-1}}{V_{sd-1}} \right) \qquad T_{pt} = \frac{1}{N_{pt}} \sum_{s=1}^{N_{pt}} T_{st}$$

where T_{st} = average daily change in trading volume in absolute value for stock s during period t ,
 V_{sd} = trading volume of a given stock s during day d ,
 N_{dt} = number of days in the period t ,
 T_{pt} = average daily change in trading volume for portfolio p during period t ,
 N_{pt} = number of stocks in portfolio p during period t .

After holding the securities for 3, 6, 9, and 12 months, the cumulative average return of all the securities in each portfolio is computed in a similar fashion as Equation I. This allows for a comparison of the performance among the different portfolios. Minor adjustments to the sample data were needed to take into account for stock splits, issuances, and repurchases. All the analyses presented in this paper are based on a two-way classification methodology commencing with past returns then trading volume².

IV. ANALYSIS AND RESULTS

Formation Period Starting In January

The first part of the results examines momentum strategies with a formation period beginning in January. As Table II demonstrates, there is an overall presence of price momentum (PM) during the 1996 to 2004 period. The findings suggest that a 3-month formation period with a 3-month holding from April to June is the most effective combination for the winner portfolio of a price momentum strategy. This effective time period is contradictory with outcomes from other studies. For example, Jegadeesh & Titman (1993) and Lee & Swamination (2000) both implicitly stated that a formation period of 12 months and a holding period of three months was the most effective time frame on the NYSE/AMEX using average monthly returns. Conversely, Assogbavi, et al. (2008) proposed a 9-month formation and holding period when starting from January.

² A separate analysis was also performed utilizing the same methodology however sorting first by historical trading volume and then followed by return. Since both methods yielded very similar results, only those starting with the past returns were presented in this study.

When it comes to volume-based price momentum (PVM), a 3-month formation and holding period was found to be the most effective for winning-high-volume portfolios. This time period coincides exactly with the one found for price momentum of a portfolios of winners. The effective time formation/holding period for winning-low-volume portfolios differed with a 9-month formation period instead of three. Both of these effective time frames from volume-based price momentum are inconsistent with Lee and Swamination’s (2000) 12-month formation and 3-month holding periods for a winning volume-based price momentum portfolio. The results from this study suggest shorter formation periods, but the same length of holding the portfolios. It should be noted that the effective time period for the winning-high-volume portfolio outperformed both winners and winner-low-volume portfolios in terms of return.

Table II presents returns from portfolio strategies based on past returns and change in trading volume formed from 1996 to 2003. The equally weighted portfolios are formed based on the past return of 48 stocks of the S&P/TSX 60 Index during four time frames (3, 6, 9, and 12 months) into three categories: *W* for “Winners”, *M* for “Middle”, and *L* for “Losers”. A_i represents the average monthly return for the entire sample. *Return* is measured as the monthly average return during the period. Then each of these portfolios is sub classified according to their change in volume. *Change in volume* is measured as the absolute value of the average daily percentage change in trading volume. *HV* and *LV* represent portfolios with high- and low-volume change respectively. *PVM* signifies price-volume momentum. *PM* stands for a portfolio based solely on price momentum with no volume (*NV*). Every portfolio is subsequently evaluated based on its return during its holding period of 3, 6, 9, and 12 months.

Table II: Summary Of Returns For Portfolios Based On Price Momentum And Trading Volume – Formation Period Beginning In January

Panel A - Formation Period				Panel B - Holding Period - Return												
Portfolio	Return			3			6			9			12			
	PVM	LV	PM	PVM	LV	PM	PVM	LV	PM	PVM	LV	PM	PVM	LV	PM	
	HV		NV	HV		NV	HV		NV	HV		NV	HV		NV	
3	Jan-Mar			Apr-Jun			Apr-Sep			Apr-Dec			Apr-Mar			
	W	7.70%	5.71%	6.71%	3.21%	2.31%	2.76%	1.39%	0.64%	1.02%	1.97%	1.32%	1.65%	1.85%	1.41%	1.63%
	M	1.07%	0.93%	1.00%	1.71%	1.45%	1.58%	0.90%	0.16%	0.53%	1.49%	1.06%	1.28%	1.49%	0.79%	1.14%
	L	-4.49%	-3.31%	-3.90%	0.43%	-0.25%	0.09%	-0.36%	-0.82%	-0.59%	0.55%	0.36%	0.46%	0.74%	0.43%	0.58%
	A_i			1.27%			1.48%			0.32%			1.13%			1.12%
6	Jan-Jun			Jul-Sep			Jul-Dec			Jul-Mar			Jul-Jun			
	W	6.27%	4.37%	5.32%	-0.39%	-0.99%	-0.69%	1.29%	1.00%	1.15%	1.45%	1.26%	1.36%	1.40%	1.23%	1.31%
	M	1.35%	1.35%	1.35%	-0.29%	-0.70%	-0.50%	0.97%	1.28%	1.13%	1.00%	0.96%	0.98%	1.03%	0.98%	1.00%
	L	-2.86%	-2.28%	-2.57%	-0.58%	-2.04%	-1.31%	1.20%	-0.05%	0.58%	1.26%	0.08%	0.67%	1.53%	0.32%	0.92%
	A_i			1.37%			-0.83%			0.95%			1.00%			1.08%
9	Jan-Sep			Oct-Dec			Oct-Mar			Oct-Jun			Oct-Sep			
	W	4.51%	3.16%	3.83%	1.93%	2.54%	2.24%	1.84%	1.89%	1.87%	1.56%	1.69%	1.62%	0.69%	0.82%	0.76%
	M	0.70%	0.77%	0.74%	3.23%	2.48%	2.86%	1.87%	1.88%	1.87%	1.55%	1.60%	1.58%	1.37%	0.92%	1.15%
	L	-2.67%	-2.68%	-2.68%	2.86%	3.49%	3.17%	2.07%	2.05%	2.06%	2.30%	1.63%	1.97%	1.54%	1.01%	1.27%
	A_i			0.63%			2.76%			1.93%			1.72%			1.06%
12	Jan-Dec			Jan-Mar			Jan-Jun			Jan-Sep			Jan-Dec			
	W	4.36%	3.61%	3.98%	2.66%	1.50%	2.08%	1.66%	1.06%	1.36%	0.88%	0.13%	0.51%	1.53%	0.80%	1.16%
	M	1.18%	1.34%	1.26%	0.28%	1.58%	0.93%	1.08%	1.44%	1.26%	0.59%	0.68%	0.64%	0.93%	1.05%	0.99%
	L	-1.92%	-1.61%	-1.77%	0.78%	-0.20%	0.29%	1.69%	0.43%	1.06%	0.75%	-0.03%	0.36%	1.04%	0.58%	0.81%
	A_i			1.16%			1.10%			1.23%			0.50%			0.99%

Formation Period Starting In April

The second part of the results assesses the effect of seasonality on the effective time formation and holding periods. This will be first examined with a formation period commencing in April. Table III indicates an occurrence of price momentum during the 1996 to 2004 period when starting from April. The effective time formation/holding period is respectively nine and three months based solely on price momentum. This is a longer formation period and a shorter holding period compared to Assogbavi, et al. (2008). The effective time period remains the same for the winning-high-volume portfolio. However, for winning-low-volume portfolios, the formation period is reduced to six months. As was the case for the previous formation period, the effective winning-high-volume portfolio outclassed the return of the winners and the winning-low-volume portfolios by more than one percentage point for both situations.

Table III presents returns from portfolio strategies based on past returns and change in trading volume formed from 1996 to 2002. The equally weighted portfolios are formed based on the past return of 48 stocks of the S&P/TSX 60 Index during four time frames (3, 6, 9, and 12 months) into three categories: *W* for “Winners”, *M* for “Middle”, and *L* for “Losers”. A_i represents the average monthly return for the entire sample. *Return* is measured as the monthly average return during the period. Then each of these portfolios is sub classified according to their change in volume. *Change in volume* is measured as the absolute value of the average daily percentage change in trading volume. *HV* and *LV* represent portfolios with high- and low-volume change, respectively. *PVM* signifies price-volume momentum. *PM* stands for a portfolio based solely on price momentum with no volume (*NV*). Every portfolio is subsequently evaluated based on its return during its holding period of 3, 6, 9, and 12 months.

Table III: Summary Of Returns For Portfolios Based On Price Momentum And Trading Volume – Formation Period Beginning In April

Panel A - Formation Period				Panel B - Holding Period - Return												
Portfolio	Return			3			6			9			12			
	PVM	LV	PM	PVM	LV	PM	PVM	LV	PM	PVM	LV	PM	PVM	LV	PM	
	HV	LV	NV	HV	LV	NV	HV	LV	NV	HV	LV	NV	HV	LV	NV	
3	Apr-Jun			Jul-Sep			Jul-Dec			Jul-Mar			Jul-Jun			
	W	6.76%	5.84%	6.30%	-0.79%	-1.62%	-1.20%	1.17%	1.17%	1.17%	1.46%	0.90%	1.18%	1.24%	1.02%	1.13%
	M	1.15%	1.10%	1.12%	-1.07%	-0.68%	-0.88%	0.55%	0.70%	0.63%	0.86%	0.77%	0.81%	1.15%	0.78%	0.96%
	L	-4.43%	-3.45%	-3.94%	-1.04%	-2.57%	-1.81%	0.62%	-0.42%	0.10%	1.23%	-0.20%	0.52%	1.70%	0.07%	0.89%
	A_i			1.16%			-1.30%			0.63%			0.84%			0.99%
6	Apr-Sep			Oct-Dec			Oct-Mar			Oct-Jun			Oct-Sep			
	W	4.40%	3.48%	3.94%	1.85%	2.23%	2.04%	2.17%	1.77%	1.97%	1.71%	1.82%	1.76%	0.91%	1.04%	0.98%
	M	0.24%	0.13%	0.18%	3.02%	2.11%	2.56%	1.71%	1.16%	1.44%	1.76%	0.89%	1.32%	1.33%	0.51%	0.92%
	L	-3.94%	-4.73%	-4.34%	2.66%	3.83%	3.24%	2.25%	2.33%	2.29%	2.11%	2.25%	2.18%	1.30%	1.07%	1.18%
	A_i			-0.07%			2.62%			1.90%			1.76%			1.03%
9	Apr-Dec			Jan-Mar			Jan-Jun			Jan-Sep			Jan-Dec			
	W	4.74%	3.65%	4.20%	3.45%	1.32%	2.39%	2.07%	1.12%	1.59%	1.17%	0.35%	0.76%	1.58%	0.89%	1.24%
	M	0.66%	0.94%	0.80%	-0.14%	1.02%	0.44%	0.72%	1.42%	1.07%	-0.02%	0.25%	0.12%	0.57%	0.95%	0.76%
	L	-2.78%	-2.29%	-2.54%	1.55%	-0.01%	0.77%	2.28%	0.42%	1.35%	1.29%	0.00%	0.64%	1.52%	0.62%	1.07%
	A_i			0.82%			1.20%			1.34%			0.51%			1.02%
12	Apr-Mar			Apr-Jun			Apr-Sep			Apr-Dec			Apr-Mar			
	W	4.47%	3.42%	3.95%	1.00%	1.08%	1.04%	0.29%	-0.10%	0.09%	1.38%	0.71%	1.05%	1.52%	1.02%	1.27%
	M	0.90%	0.93%	0.91%	2.82%	1.27%	2.05%	0.89%	-0.19%	0.35%	1.31%	0.60%	0.95%	1.27%	0.72%	0.99%
	L	-2.06%	-2.16%	-2.11%	1.58%	1.18%	1.38%	0.21%	-0.11%	0.05%	1.10%	0.71%	0.90%	1.04%	0.58%	0.81%
	A_i			0.91%			1.49%			0.17%			0.97%			1.02%

Formation Period Starting In July

Continuing with the examination of a seasonal effect, we now move to the next quarter of July. Price momentum is once again detected during the period covered by Table IV. According to the findings, a 6-month formation period and a 3-month holding period is the most effective time outline for both winners and winning-high-volume portfolios. Comparatively, the winning-low-volume portfolio experienced only a 3-month formation period,

but with the same length of time for the holding period as the other portfolios. The return during the effective time formation/holding period for the winner-high-volume portfolio surpassed those of the winners and winning-low-volume portfolios.

Table IV presents returns from portfolio strategies based on past returns and change in trading volume formed from 1996 to 2002. The equally weighted portfolios are formed based on the past return of 48 stocks of the S&P/TSX 60 Index during four time frames (3, 6, 9, and 12 months) into three categories: *W* for “Winners”, *M* for “Middle”, and *L* for “Losers”. A_i represents the average monthly return for the entire sample. *Return* is measured as the monthly average return during the period. Then each of these portfolios is sub classified according to their change in volume. *Change in volume* is measured as the absolute value of the average daily percentage change in trading volume. *HV* and *LV* represent portfolios with high- and low-volume change respectively. *PVM* signifies price-volume momentum. *PM* stands for a portfolio based solely on price momentum with no volume (*NV*). Every portfolio is subsequently evaluated based on its return during its holding period of 3, 6, 9, and 12 months.

Table IV: Summary Of Returns For Portfolios Based On Price Momentum And Trading Volume – Formation Period Beginning In July

Panel A - Formation Period				Panel B - Holding Period - Return												
Portfolio	Return			3			6			9			12			
	PVM HV	LV	PM NV	PVM HV	LV	PM NV	PVM HV	LV	PM NV	PVM HV	LV	PM NV	PVM HV	LV	PM NV	
3	Jul-Sep			Oct-Dec			Oct-Mar			Oct-Jun			Oct-Sep			
	W	5.10%	3.42%	4.26%	1.50%	2.34%	1.92%	1.89%	1.83%	1.86%	1.88%	1.75%	1.81%	1.18%	1.14%	1.16%
	M	-1.56%	-0.88%	-1.22%	2.94%	1.75%	2.35%	1.42%	1.18%	1.30%	1.51%	1.37%	1.44%	0.90%	0.78%	0.84%
	L	-6.60%	-7.26%	-6.93%	3.04%	4.12%	3.58%	2.60%	2.53%	2.57%	2.27%	1.76%	2.02%	1.33%	0.84%	1.08%
	A_i			-1.30%			2.62%			1.91%			1.76%			1.03%
6	Jul-Dec			Jan-Mar			Jan-Jun			Jan-Sep			Jan-Dec			
	W	5.00%	4.25%	4.62%	3.05%	1.33%	2.19%	1.89%	1.26%	1.58%	0.96%	0.47%	0.72%	1.61%	0.72%	1.16%
	M	0.62%	0.64%	0.63%	0.48%	1.20%	0.84%	1.24%	1.33%	1.28%	0.37%	0.47%	0.42%	0.73%	1.03%	0.88%
	L	-3.27%	-3.36%	-3.32%	0.75%	0.35%	0.55%	1.30%	1.01%	1.16%	0.50%	0.27%	0.38%	1.03%	1.01%	1.02%
	A_i			0.65%			1.19%			1.34%			0.51%			1.02%
9	Jul-Mar			Apr-Jun			Apr-Sep			Apr-Dec			Apr-Mar			
	W	4.86%	3.63%	4.25%	2.14%	1.14%	1.64%	1.10%	-0.11%	0.49%	1.94%	0.52%	1.23%	1.77%	0.86%	1.32%
	M	0.88%	0.73%	0.80%	1.90%	1.95%	1.92%	-0.18%	0.71%	0.27%	0.59%	1.45%	1.02%	0.62%	1.33%	0.97%
	L	-2.43%	-2.65%	-2.54%	1.65%	0.17%	0.91%	0.20%	-0.73%	-0.26%	1.10%	0.20%	0.65%	1.27%	0.29%	0.78%
	A_i			0.84%			0.17%			0.17%			0.97%			1.02%
12	Jul-Jun			Jul-Sep			Jul-Dec			Jul-Mar			Jul-Jun			
	W	4.48%	3.42%	3.95%	-0.75%	-0.87%	-0.81%	1.15%	0.65%	0.90%	1.55%	1.04%	1.30%	1.50%	0.76%	1.13%
	M	0.95%	1.12%	1.03%	-0.27%	-0.40%	-0.34%	0.76%	1.15%	0.95%	0.39%	1.06%	0.73%	0.29%	1.06%	0.68%
	L	-2.04%	-1.98%	-2.01%	-1.90%	-2.74%	-2.32%	1.16%	-0.64%	0.26%	1.36%	-0.17%	0.59%	1.78%	0.18%	0.98%
	A_i			0.99%			-2.32%			0.70%			0.87%			0.93%

Formation Period Starting In October

The evaluation of quarterly seasonal patterns concludes with October formation periods. Price momentum is present in the sample from 1996 to 2004 according to Table V. Once more, winners and winning-high-volume portfolios share the same effective time formation/holding period of 12 and three months, respectively. The formation period is the same as Assogbavi, et al. (2008) when starting from October though its holding period is longer by six additional months. Again, the effective time formation/holding period for the winning-high-volume portfolio obtained a higher return compared to the other winning portfolios by over one percentage point.

Table V presents returns from portfolio strategies based on past returns and change in trading volume formed from 1996 to 2002. The equally weighted portfolios are formed based on the past return of 48 stocks of the S&P/TSX 60 Index during four time frames (3, 6, 9, and 12 months) into three categories: *W* for “Winners”, *M* for “Middle”, and *L* for “Losers”. A_i represents the average monthly return for the entire sample. *Return* is measured as the monthly average return during the period. Then each of these portfolios is sub classified according to their

change in volume. *Change in volume* is measured as the absolute value of the average daily percentage change in trading volume. *HV* and *LV* represent portfolios with high- and low-volume change respectively. *PVM* signifies price-volume momentum. *PM* stands for a portfolio based solely on price momentum with no volume (*NV*). Every portfolio is subsequently evaluated based on its return during its holding period of 3, 6, 9, and 12 months.

Table V: Summary of Returns for Portfolios based on Price Momentum and Trading Volume – Formation Period beginning in October

<i>Panel A - Formation Period</i>				<i>Panel B - Holding Period - Return</i>												
Portfolio	Return			3			6			9			12			
	PVM	PM		PVM	PM		PVM	PM		PVM	PM		PVM	PM		
	HV	LV	NV	HV	LV	NV	HV	LV	NV	HV	LV	NV	HV	LV	NV	
3	Oct-Dec			Jan-Mar			Jan-Jun			Jan-Sep			Jan-Dec			
	W	9.09%	9.57%	9.33%	2.50%	2.03%	2.26%	1.22%	1.12%	1.17%	0.57%	-0.08%	0.24%	1.30%	0.86%	1.08%
	M	2.35%	2.33%	2.34%	0.54%	0.96%	0.75%	1.62%	1.51%	1.56%	0.63%	0.75%	0.69%	0.80%	1.18%	0.99%
	L	-4.20%	-3.45%	-3.82%	0.54%	0.62%	0.58%	1.82%	0.74%	1.28%	0.83%	0.34%	0.59%	1.57%	0.43%	1.00%
	A _i			2.62%			1.20%			1.34%			0.51%			1.02%
6	Oct-Mar			Apr-Jun			Apr-Sep			Apr-Dec			Apr-Mar			
	W	6.96%	6.32%	6.64%	2.88%	1.37%	2.13%	1.36%	-0.05%	0.65%	2.11%	0.64%	1.37%	1.87%	0.99%	1.43%
	M	1.68%	1.56%	1.62%	2.12%	0.71%	1.41%	0.52%	-0.51%	0.01%	1.07%	0.69%	0.88%	1.06%	0.69%	0.88%
	L	-3.02%	-2.06%	-2.54%	1.79%	0.06%	0.93%	0.65%	-0.98%	-0.17%	1.46%	-0.16%	0.65%	1.52%	0.02%	0.77%
	A _i			1.91%			1.49%		0.17%			0.97%				1.02%
9	Oct-Jun			Jul-Sep			Jul-Dec			Jul-Mar			Jul-Jun			
	W	5.98%	5.07%	5.52%	-0.66%	-2.08%	-1.37%	1.32%	0.06%	0.69%	1.73%	0.57%	1.15%	1.55%	0.55%	1.05%
	M	1.44%	1.67%	1.56%	0.00%	-0.67%	-0.33%	1.08%	1.19%	1.14%	0.53%	1.03%	0.78%	0.52%	1.11%	0.81%
	L	-2.05%	-1.63%	-1.84%	-1.39%	-2.27%	-1.83%	0.95%	-0.49%	0.23%	1.46%	-0.11%	0.67%	1.65%	0.10%	0.87%
	A _i			1.75%			-1.18%		0.69%			0.87%				0.91%
12	Oct-Sep			Oct-Dec			Oct-Mar			Oct-Jun			Oct-Sep			
	W	4.67%	3.53%	4.10%	3.44%	1.41%	2.43%	3.10%	1.49%	2.29%	2.37%	1.25%	1.81%	1.23%	0.36%	0.79%
	M	0.97%	1.17%	1.07%	1.83%	2.54%	2.19%	0.59%	1.57%	1.08%	0.55%	1.28%	0.92%	0.17%	0.70%	0.43%
	L	-2.04%	-2.13%	-2.09%	3.63%	2.65%	3.14%	2.85%	1.76%	2.30%	2.74%	1.55%	2.14%	1.58%	0.97%	1.28%
	A _i			1.03%			2.58%		1.89%			1.62%				0.84%

Effective Time Formation/Holding Periods based on Seasonal Formations

The paper in question focused its attention primarily on effective time formation/holding periods for winners according to price momentum (PM) and volume-based price momentum (PVM). It should be recognized that, on occasion, losers outperformed winners during their respective effective time frames. Table VI summarizes the effective time periods for winner portfolios.

It is interesting to note that all the effective holding periods for winners, middle, and losers are three months in length for both price momentum and volume-based price momentum, unlike the formation periods which fluctuate greatly among the different portfolio types. This suggests that holding the various portfolios for three months might be more important than the length of the formation period. All the losers, according to price momentum and volume-based price momentum, demonstrate a seasonal pattern by having the same effective holding period of October to December and formation periods ending in September.

Table VI presents the effective time formation/holding periods for each type of portfolio using price momentum (PM) and volume-based price momentum (PVM) according to different seasonal/quarterly starting points. *Effective* in this context is defined as the combination of formation and holding periods producing the highest average monthly returns. *W* stands for “Winners”. *HV* and *LV* represent portfolios with high- and low-volume change respectively. The numbers in parentheses are *t*-statistics.

Table VI: Summary Of Effective Time Formation/Holding Based On Seasonal Formation Periods

<i>Panel A - Price Momentum for Winners</i>								
Effective Formation/Holding Periods						Comparison		
Portfolio Type	Formation Period	Length Months	Holding Period	Length Months	Portfolio Return	Average Return	W-HV Return	W-LV Return
Winners	Jan-Mar	3	Apr-Jun	3	2.76%	1.48%	3.21% (0.48)	2.31% (0.59)
Winners	Apr-Dec	9	Jan-Mar	3	2.39%	1.20%	3.45% (0.87)	1.32% (1.26)
Winners	Jul-Dec	6	Jan-Mar	3	2.19%	1.19%	3.05% (0.78)	1.33% (0.96)
Winners	Oct-Sep	12	Oct-Dec	3	2.43%	2.58%	3.44% (0.80)	1.41% (0.78)
<i>Panel B - High Volume-Based Price Momentum for Winners</i>								
Effective Formation/Holding Periods						Comparison		
Portfolio Type	Formation Period	Length Months	Holding Period	Length Months	Portfolio Return	Average Return	W-LV Return	Winners Return
W-HV	Jan-Mar	3	Apr-Jun	3	3.21%	1.48%	2.31% (0.91)	2.76% (0.48)
W-HV	Apr-Dec	9	Jan-Mar	3	3.45%	1.20%	1.32% (1.77)*	2.39% (0.87)
W-HV	Jul-Dec	6	Jan-Mar	3	3.05%	1.19%	1.33% (1.49)	2.19% (0.78)
W-HV	Oct-Sep	12	Oct-Dec	3	3.44%	2.58%	1.41% (1.37)	2.43% (0.80)
<i>Panel C - Low Volume-Based Price Momentum for Winners</i>								
Effective Formation/Holding Periods						Comparison		
Portfolio Type	Formation Period	Length Months	Holding Period	Length Months	Portfolio Return	Average Return	W-HV Return	Winners Return
W-LV	Jan-Sep	9	Oct-Dec	3	2.54%	2.76%	1.93% (0.50)	2.24% (0.29)
W-LV	Apr-Sep	6	Oct-Dec	3	2.23%	2.62%	1.85% (0.32)	2.04% (0.19)
W-LV	Jul-Sep	3	Oct-Dec	3	2.34%	2.62%	1.50% (0.67)	1.92% (0.40)
W-LV	Oct-Dec	3	Jan-Mar	3	2.03%	1.20%	2.50% (0.38)	2.26% (0.23)

* $p < .1$

Winners and winning-high-volume portfolios were always grouped in the same effective time formation/holding for a given starting point while winning-low-volume portfolios frequently differed. All the loser portfolios under price momentum or volume-based price momentum were always grouped in the same effective formation and holding periods for a given seasonal formation. The highest return for any winning portfolio was achieved with a 9-month formation period starting in April and a 3-month holding for winner-high-volume. This shares the same formation length as for the most effective portfolio as documented by Assogbavi and Leonard (2008). The return during the effective time frame for winning-high-volume portfolios always bettered those of the winners and winning-low-volume portfolios regardless of when the formation period began; however none of the values proved to be statistically significant. If the same methodology was used on a larger sample, the results might prove to be statistically significant.

Performance

One way to measure success is by the frequency of outperforming the other portfolios during the same given period. According to the values in Table VII, the S&P/TSX 60 Index experienced price momentum during the period of 1996 to 2004. On average, winners outperformed middle level portfolios and losers 47% of the time based on price momentum. Winning-high-volume performers generally bettered all other portfolios according to a volume-based price momentum strategy ($t= 3.534, p< .001$). Concerning the level of change in volume, the high-volume portfolio overwhelmingly surpassed its low-volume counterpart for winners ($t= 4.121, p< .001$) as well as losers ($t= 3.956, p< .001$). When comparing volume-based price momentum (PVM) to price momentum (PM), the evidence proposes that considering high-volume in momentum investment strategies between 1996 to 2004 was very beneficial. High-volume portfolios generally outperformed at a rate of 67% of that of a strictly price-based momentum strategy for both winners ($t= 2.118, p< .05$) and losers ($t= 2.174, p< .05$). The aggregate of these results might suggest that trading volume accounts for a large portion of the success behind price momentum. Unlike the effective time formation/holding periods discussed earlier, most of the values regarding this performance measure were statistically significant.

Table VII presents the winning percentages during all annual holding periods of various portfolio types based on price momentum (PM), volume-based price momentum (PVM), and trading volume change. *Winning* in this context represents the portfolio with the highest return compared to the other portfolios in the same holding period. This was tabulated for each formation/holding period combinations (3, 6, 9, and 12). *W*, *M*, and *L* stand for “Winners”, “Middle”, and “Losers” respectively. *HV* and *LV* represent portfolios with high- and low-volume change respectively. The *t*-statistics presented in Panels A and B compare the mean return during holding periods for each portfolio to the entire sample. The *t*-statistics in Panel C compare the mean return during holding periods for high-volume portfolios to low-volume portfolios. The *t*-statistics in Panel D compare the mean return during holding periods for price momentum to volume-based price momentum portfolios with all the formation periods combined.

Table VII: Comparison Of Portfolios' Winning Percentages

<i>Panel A - Price Momentum (PM)</i>						
Portfolio Type	Formation Period Start				Average	t-statistic
	January	April	July	October		
Winners (W)	51%	41%	47%	49%	47%	(1.455)
Middle (M)	21%	20%	22%	21%	21%	(0.415)
Losers (L)	28%	39%	30%	30%	32%	(0.891)
<i>Panel B - Volume-Based Price Momentum (PVM)</i>						
Portfolio Type	Formation Period Start				Average	t-statistic
	January	April	July	October		
W-HV	38%	18%	31%	34%	30%	(3.534) ***
W-LV	11%	13%	9%	11%	11%	(0.741)
M-HV	20%	19%	13%	10%	15%	(0.312)
M-LV	4%	5%	12%	9%	7%	(0.490)
L-HV	18%	25%	20%	22%	21%	(1.592)
L-LV	10%	21%	16%	14%	15%	(2.927) **

Table VII: Comparison Of Portfolios' Winning Percentages (Continued)

<i>Panel C - High volume (HV) vs Low volume (LV)</i>						
Portfolio Type	Formation Period Start				Average	t-statistic
	January	April	July	October		
W-HV	63%	57%	70%	79%	67%	(4.121) ***
W-LV	38%	43%	30%	21%	33%	
M-HV	54%	52%	46%	47%	50%	(0.148)
M-LV	46%	48%	54%	53%	50%	
L-HV	65%	63%	69%	75%	68%	(3.956) ***
L-LV	35%	38%	31%	25%	32%	
<i>Panel D - Price Momentum (PM) vs High Volume (HV)</i>						
Portfolio Type	Formation Period Start				Average	t-statistic
	January	April	July	October		
Winners	38%	43%	31%	22%	33%	(2.118) *
W-HV	63%	57%	69%	78%	67%	
Middle	46%	48%	54%	53%	50%	(0.074)
M-HV	54%	52%	46%	47%	50%	
Losers	34%	38%	33%	25%	33%	(2.174) *
L-HV	66%	62%	67%	75%	67%	

* $p < .05$; ** $p < .01$; *** $p < .001$

V. CONCLUSION

This study attempts to further the knowledge of momentum investment strategies by incorporating trading volume into the equation as well as looking at various seasonal patterns. The results of the study, in part, support the notion of the significance and informational content of trading volume. Specifically, a volume-based price momentum (PVM) strategy of high-volume portfolios from 1996 to 2004 on the S&P/TSX 60 Index outperformed portfolios based solely on price momentum (PM), which was statistically significant in many respects.

The most effective time period for a winning-high-volume portfolio was a formation period of nine months commencing in April with a 3-month holding period. The holding period is shorter by six months than what is suggested by Assogbavi, et al. (2008). In fact, the effective time frames for all portfolios included a 3-month holding period. This demonstrates the importance of holding the stocks for a shorter length of time than what is often recommended. Furthermore, the effective formation period varies greatly depending on the seasonal start of the formation period. Yet, it should be noted that the findings concerning the effective time formation and holding periods were not strongly significant according to a *t*-test.

One interesting finding of this study is that high-volume portfolios consistently outperformed low-volume portfolios for both winners and losers. These results could theoretically have implications for other trading strategies. For example, since contrarian strategies take the opposite position of momentum followers (i.e., losers on a longer horizon), the results of losing-high-volume portfolios might suggest that high trading volume also improves a contrarian investment strategy. Further research with longer holding horizons would be necessary to determine the effectiveness of trading volume for a contrarian strategy. Finally, for practitioners of momentum investment strategies, these findings suggest that, in general, it would be wise to incorporate past trading volume, specifically those stocks with high volume in their portfolio construction, in order to achieve a higher return.

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