Investment Memorandum

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Abstract

This study investigates whether a stock's monthly traded volume can be a utilized as a tool to time the market as well whether it can be used as an accurate predictor of stock returns after accounting for the well-known determinants of returns such as the company's beta, book-to-market, as well as the company's size. It was found that while excess returns could be achieved by investing into the bottom 20 percent of the the S&P 100 companies sorted by monthly traded volume of their stocks in the period of July 2006 to June 2007, the coefficients found were not statistically significant. This memo does not recommend that this variable be used as a robust predictor of future stock returns. Nevertheless, the method is easily replicable and therefore can be reused for other variables, stocks, and time periods resulting in a reliable approach to systematic portfolio management.

Introduction

The goal of this experiment was to find an investment strategy based on the stock's trading volume and determine whether excess returns can be reached by using the stock's monthly trading volume as a variable. The data for the execution of this experiment was sourced from WRDS database as well as CRSP database operated by University of Pennsylvania Wharton and University of Chicago Booth respectively. The data used was from July 2006 to June 2007 based on companies that were a part of the Standard and Poor's 100 in the beginning of July 2006.

Method

First of all, the return variable had to be slightly altered in order to account for the fact that there were several companies that were delisted in this sample within the ten year period. After calculating the delisting return and accounting for it in the return variable, it was possible to start the exploratory data analysis and regressions.

Predictive in-sample regression was performed on the average monthly returns achieved by the above-mentioned companies in the period of ten years. Different lags of the monthly trading volume variable were used to perform ordinary least squares regressions (OLS) with the dependent variable as monthly return minus the the risk free rate and the independent variable as the different lags of monthly traded volume (1 month lag, 3 months lag, 6 months lag, 1 year lag). (Figure 0)

Figure 0

$$r_{t+k} - r_{ft+k} = a + b \times \frac{D_t}{P_t} + \epsilon_{t+k}$$

Afterwards, a Fama French regression was performed on the 1 month lagged monthly traded volume variable and the stock return minus risk free rate. Three portfolios were created every year in June by sorting the companies by their previous month's traded volume. Four portfolios were selected and reshuffled annually: the top 20 companies with the highest trading volume, the bottom 20 companies with the lowest trading volume, a long-short portfolio where an investor would take a long position in the highest trading volume companies while shorting the bottom 20, and finally a short-long portfolio where an investor would do the reverse -- short the top 20 most traded

companies and take a long position in those less liquid.

Then, the data was aggregated with another dataset taken from WRDS that contained information on the Fama French factors which are well-known determinants of stock returns such as the stock's beta, book-to-market, as well as the company's size. Afterwards a Fama French regression was performed (Figure 1) using the Capital Asset Pricing Model (CAPM) and the Fama French Three Factor Model.

Figure 1

$$R_{it} - R_f = \alpha_i + \beta_{i1} EXM_t + \beta_{i2} SMB_t + \beta_{i3} HML_t + \varepsilon_{it}$$

Prior academic work has been done into studying liquidity and its effect on returns, also known as the liquidity premium, wherein investors demand a premium when investing into securities that are less liquid. Since illiquid assets are more difficult to turn into cash or exchanged into other assets quickly, the literature suggests that investors should be rewarded for this additional risk.[1] However, while this principle is well known in Economics, it has not received as much attention in predicting stock returns in finance as the Fama French factors mentioned above. [2]

Therefore, this served as further motivation to continue with the method in order to see if any significant alphas could be found to produce excess returns. Even though such prior assumptions about liquidity and returns exist, an inductive approach was taken in this exercise. No expectations on the direction (positive or negative) of the relationship between monthly trading volume and returns were set in advance. This is why both a long-short portfolio as well as a short-long portfolio were created to compare the results.

Finally, after acquiring the betas of all the S&P 100 companies used in this study through performing a time series regression (Figure 2), the Fama Macbeth method was continued through applying a cross sectional regression in each month was performed using the betas of each one of these stocks (Figure 3). The aim of this method was to investigate whether there is a relationship between the excess returns and monthly trading volume for these stocks each month while accounting for betas.

[1] Chen, James. "Liquidity Premium."
[2] Blitz, David, and Milan Vidojevic. "Does a Liquidity Factor Premium Exist in the Stock Market?"

Figure 2

$$r_t^i - r_{ft} = \gamma_i + \beta_i \left(r_m - r_f\right)_t + \varepsilon_{it}$$

Figure 3

$$r_i^t - r_{ft} = \lambda_1^t + \lambda_2^t \beta_i + \lambda_3^t \left(your\ variable\right)_i^t + \alpha_{it}$$

Results

Predictive Regression

After running the initial Predictive Regressions on the monthly trading volume variable using various lags of the independent variable, several coefficients were observed (for different lags). However, the coefficients acquired from running these regressions were extremely low, with the highest one equal to 1.712e-09 for the 1 month lag (figure 4).

Figure 4

Dep. Variable:	y	**R-squared:**	0.012
Model:	OLS	**Adj. R-squared:**	0.004
Method:	Least Squares	**F-statistic:**	1.428
Date:	Wed, 08 May 2019	**Prob (F-statistic):**	0.235
Time:	22:17:32	**Log-Likelihood:**	179.56
No. Observations:	120	**AIC:**	-357.1
Df Residuals:	119	**BIC:**	-354.3
Df Model:	1		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
x1	1.712e-09	1.43e-09	1.195	0.235	-1.13e-09	4.55e-09

Omnibus:	18.693	**Durbin-Watson:**	1.546
Prob(Omnibus):	0.000	**Jarque-Bera (JB):**	48.285
Skew:	-0.522	**Prob(JB):**	3.27e-11
Kurtosis:	5.927	**Cond. No.**	1.00

Moreover, the significance of this result was 0.292 calculated as standard deviation of the predicted variable divided by the mean of access return. This suggests that by following the procedure implemented in this experiment as well as using the same data utilized here, monthly trading volume did not have large predictive power on the 100 S&P companies in the period of 2006 to 2016.

Fama French Method

Moreover, after performing Fama French regression for CAPM and the Three Factor Model using the method described in the introduction the following results were acquired:

For the Capital Asset Pricing Model (CAPM):
The portfolio with the top 20 companies by their prior month's liquidity observed a monthly alpha of -0.0010 with R squared of 0.810. The portfolio with the top 20 companies by their prior month's liquidity observed a monthly alpha of 0.0008 with R squared of 0.791. The, Long-Short portfolio wherein an investor would take a long position in the top 20 companies by their prior month's liquidity while shorting the bottom 20 had an alpha of - 0.0018 and R squared: 0.000. Finally, the Short-Long portfolio wherein an investor would take a long position in the bottom 20 companies by their prior month's liquidity while taking a short position in the bottom 20 had an alpha of 0.0018 and an R squared: 0.000. (Table 1).

Table 1

Portfolio	**alpha**	**R^2**	**P > |t|**
Top Long	-0.0010	0.810	0.725
Bottom Long	0.0008	0.791	0.800
Top-Bottom Long-Short	- 0.0018	0.000	0.654
Top-Bottom Short-Long	0.0018	0.000	0.654

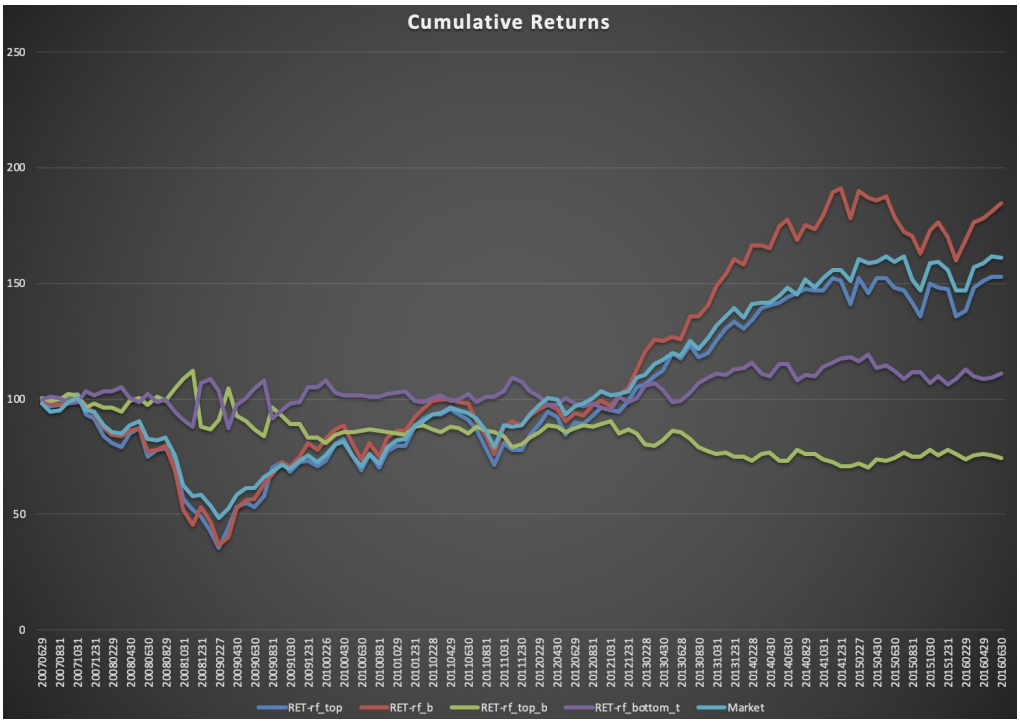
For the Fama French Three Factor Model the results are as follows:

Table 2

Portfolio	**alpha**	**R^2**	**P > |t|**
Top Long	0.0011	0.872	0.650
Bottom Long	0.0018	0.819	0.534
Top-Bottom Long-Short	-0.0007	0.158	0.849
Top-Bottom Short-Long	0.0007	0.158	0.849

After reshuffling the portfolios using the Fama French methods, the results of all the above-mentioned four portfolios were graphed against the market performance over the period of ten years that can be seen in the graph below. (Figure 5) The RET-rf_top corresponds to the return of investing in the top portfolio, meaning in the portfolio consisting of the 20 companies with the highest monthly trading volume, while the RET-rf_b corresponds to the bottom 20 companies. RET-rf_top_b corresponds to the long-short portfolio in which an investor would take a long position in the stocks that are more liquid and short the less liquid ones. The RET-rf_bottom_t corresponds to a portfolio with a long position in less liquid stocks and a short position in the top 20 of the stocks with high monthly trading volume.

Figure 5



As discussed in the introduction, the last step of this approach was performing the Fama Macbeth regressions of the form displayed in Figure 1. As can be seen in Figure 4 below, this method did not produce any significant Lambda 2 or Lambda 3 judging by the t-test. One may also notice that Standard Deviation is larger than the mean values which further suggests that there may be noise present.

Figure 6

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Lamda2 (beta coeff) Mean:  -0.00025493280510086 47
Lamda2 (beta coeff) S.D.:  0.06354610883842056
Lamda2 t-test:  0.004011776798939576
-----------------------------------------------------
Lamda3 (variable coeff) Mean:  -2.092483376921244e-10
Lamda3 (variable coeff) S.D.:  3.1426353221747667e-09
Lamda3 t-test:  0.066583715971002 43
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Conclusion

Even though it was found that excess returns could be achieved by investing into the bottom 20 percent of the the S&P 100 companies sorted by monthly traded volume of their stocks in the period of July 2006 to June 2007, there is not enough evidence to say that this results could be replicated using other stocks and other time frames. Therefore, the results shown above are specific solely to the dataset, method, and timeframe used in this study.

A weak relationship was found when looking at the predictive power of this variable using the Predictive Regression method in the first part. Moreover, low and not statistically-significant coefficients were observed in parts two and three when following the Fama French and Fama Macbeth methods.

Having tested the robustness of the monthly traded volume variable, this investment memorandum has not found sufficient evidence to use it as a reliable predictor of stock returns. Therefore, it does not recommend the investor to use such a strategy, but rather to keep searching for the suiting indicator that has a higher systematic predictive power to time the stock market and produce excess returns. The method utilized in this study is easily replicable and therefore can be reused for other variables, stocks, and time periods resulting in a reliable approach to systematic portfolio management.

Investment Advice

This memo does not recommend that the monthly trading volume variable lagged one month be used as a predictor of future stock returns, but rather use the methodology used in this study to find a more robust variable.

Works Cited

Blitz, David, and Milan Vidojevic. “Does a Liquidity Factor Premium Exist in the Stock Market?” *Robeco - The Investment Engineers*, Jan. 2008, www.robeco.com/media/3/2/a/32a85035022c381dff7d3710c7c34938_does-a-liquidity-factor-premium-exist-in-the-stock-market_tcm24-11446.pdf.

Chen, James. “Liquidity Premium.” *Investopedia*, Investopedia, 12 Mar. 2019, www.investopedia.com/terms/l/liquiditypremium.asp.