

Equity Factor Based Investing: Reassessment of Liquidity and Growth Signals

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Abstract:

This paper examines whether a traditional factor analysis strategy in the context of liquidity and growth generates abnormal return in excess of market. Using data from the Center for Research in Security Prices (CRSP) database and Wharton Research Data Services (WRDS) across the entire NYSE exchange, we show that neither individual factors nor their combination capture excess returns from stocks during the testing period (1995 to 2015). This finding is further reinforced through subsequent robust test on NASDAQ universe from 2016 to 2019. Through the lens of long/short strategy, we reveal that both factors fail to differentiate between winners and losers.

I. Introduction

Quantitative factor investing has long been a prevalent subject of study throughout the realm of academic and industrial research. Among those most commonly studied are the followings: Value, Growth, Momentum, Profitability and Efficiency, Investment and Financing, Uncertainty and Liquidity, and Quality and Intangible Investments. Over the years, many studies have empirically shown small-cap stocks tend to outperform their large-cap counterparts likely due to a lack of coverage by the general public. Not surprisingly, some common characteristics associated with small-cap stocks are illiquidity and growth-oriented.

Liquidity is usually defined as how readily available or how easily one could move in or out of his position in a stock. This type of market-based liquidity can expediently be measured using Turnover Ratio and Dollar Turnover. Specifically, Turnover Ratio is computed by dividing the total number of shares traded over a period of time by the average number of shares outstanding for the period. Similarly, Dollar Turnover is calculated by multiplying Turnover Ratio by Share Price as a measure for approximately how much of the stock has changed hands in dollar value over a period. To go beyond the traditional marketwise approach, we extend to include an accounting-based measuring scheme to indicate the liquidity quality of a company's financials. By doing so, it reflects how financially sound a company is in a fundamental and intrinsic way. We believe this multifaceted measurement provides comprehensive perspectives to capture a firm's liquidity quality and generate related investment strategy from market-level and firm-level.

While liquidity factor is constructed in terms of two different levels, growth factor is entirely confined to the accounting/financial area. We derive our growth numbers from the income statement and use them (i.e. Revenue Growth, COGS Growth, Operating Income Growth, Net Income Growth, and Net Operating Cash Flow Growth) as proxy for a firm's growth potential. High-growth companies generally are deemed as attractive buys because of their potential for rewarding investors with magnificent returns in the future once they cross the chasm. Additionally, high-growth companies are more so associated with small-cap stocks than it is with large-cap stocks because small companies are usually in their early stage and therefore can grow faster and more nimbly than large companies.

Without the presence of fundamental or value analysis, illiquid stocks, albeit small and high growth, are simply hard to realize profits due to inability to scale trading positions. To avoid liquidity strain, we divert our focus towards liquid and high-growth stocks. When combining liquidity and growth factors together, we hope to more effectively cherry-pick the hidden gems across the heterogeneous stock universe. It is within this particular context that we contend stocks with higher liquidity and/or high growth quality should deliver higher returns on the grounds that capital appreciation is fueled by sufficient investor recognition (liquidity) and scalability (growth).

Though much study/research has been done to test for the effectiveness of traditional factors including liquidity and growth, we believe our work nonetheless contributes to the literature through the lens of empirical analysis.

II. Methodology

II.A. Data Collection

As the first step to set forth our research, we glean data for all NYSE stocks available from the Center for Research in Security Prices (CRSP) database and Wharton Research Data Services (WRDS) database from 1995 to 2015 (test period). To purge data anomalies, we exclude from our sample all stocks with 1) price less than 5 dollars or with 2) historical information less than 3 years. In light of robustness check, we use stock data on NASDAQ from 2016 to 2019. While market-specific information such as stock price and volume have a monthly frequency, firm-specific financials like current ratio, revenue growth, etc. have a quarterly frequency. Such informational discrepancy necessitates consolidation between the two datasets in order to allow for subsequent analysis of our selected factors. For the purpose of accuracy and verisimilitude, we merge the datasets on PERMNO code and fill any missing values in a backward-looking fashion. In doing so, this study is look-ahead bias free because we populate our merged dataset retrospectively.

II.B. Data Description

Our final combined test set includes 2381 distinctive stocks on NYSE exchange ranging from 1995 to 2015. These counts include both firms that survived until 2015 and stocks that disappeared from the database due to mergers and acquisitions and/or liquidations. There are a total of 276,398 observations in our back-test sample.

Likewise, our out-sample robust test set includes 1855 distinctive stocks on NASDAQ exchange ranging from 2016 to 2019. The total number of observations stand at 237,454 across a three-year span. Table 1 provides summary statistics of factor characteristics for

both back-test and robust periods. In general, stocks in both datasets have similar risk exposure to the market as indicated by a beta of 1. Stocks on NASDAQ have higher mean values across all factors, suggesting tech stocks have higher liquidity and are more growth-oriented.

We use two market and three accounting signals to measure a firm's liquidity soundness: Turnover, Dollar Turnover, Current Ratio, Cash Ratio, and Quick Ratio. Whereas Turnover and Dollar Turnover capture how liquid a given stock is, the others are designed to measure the company's ability to service its short-term financial obligations.

For growth performance, we use five fundamental signals to measure a firm's growth potential: Revenue Growth, COGS Growth, Operating Income Growth, Net Income Growth, EPS Growth, and Net Operating Cash Flow Growth. The rationale behind picking these signals is that income statement represents a firm's core capability to generate profits and organically expand their operations.

II.C. Research Design

Given the sheer amount of quantitative signals we identify, we decide to first test for the effectiveness of each individual signal before combining them into an overall composite signal. For each of the testing month, we rank all stocks in descending order to identify signal decile and assign ranking score to individual stocks based on their relative percentile (i.e. stocks above the 90th percentile have a score of 1; stocks below the 10th percentile have a score of 10). The lower the ranking score, the better the stock performs in terms of its underlying ranking signal. Furthermore, the prior month's signal distribution is used to classify firms into decile to avoid look-forward bias as one can only rebalance his portfolio

based on prior month's information. After the signal deciles are formed, we can then compute monthly return for the top 10% as well as the bottom 10% decile, which further enables us to evaluate signal performance.

II.D. Hypothesis and Analysis

Our hypothesis revolves around each signal being effective in singling out attractive buys and yielding positive alphas. The primary methodology of our hypothesis test is to form monthly self-balancing portfolios based on the individual signal ranking score. We expect firms with the lowest score to deliver the strongest performance/returns (positive alphas) while those with the highest score should have the worst returns if not negative alphas. We use SPY return as the benchmark to compare portfolio return against. The resultant monthly excess return series (portfolio monthly return – SPY monthly return) are then tested using t-statistics. If the t-statistics is greater than zero and the p-value is sufficiently small enough (less than 0.05 or 0.1 depending on the significant level), the signal is said to be effective in capturing alpha. Conversely, if the p-value is too large (greater than 0.1), the signal will then be perceived as a risk factor.

To confirm our thinking as well as to generate actionable trading strategies, we design three trading strategies to examine whether a given signal could generate alpha. The first strategy generates the returns earned by the top decile stocks; the second strategy generates the returns earned by the bottom decile stocks; the third strategy compares returns earned by the top decile against those of the bottom decile. The test of excess return significance for each strategy is constructed through the aforementioned t-test against the null of no-return difference.

As a complementary measure to fully gauge signal performance, we also examine signal alpha, which is defined as the excess return above the expected return in the CAPM model. Because our portfolio rebalances on a monthly basis, its alpha changes every month consequently along with its composite stocks, necessitating a rolling process to estimate portfolio monthly beta. The techniques for constructing monthly alpha is as follows: First, we run rolling regressions of monthly return against market (SPY) return on a three-year window to estimate individual stock beta. This process continues repeatedly until every single stock has a monthly beta across the entire testing period. Second, we weighted average portfolio stock betas to arrive at overall beta and this beta represents the return correlation between our monthly portfolio and the market. Finally, we derive portfolio monthly alpha using CAPM.

Following the construction of alpha, we go on to compute Information Ratio for each strategy over the twenty-year testing time span. Compared with Sharpe Ratio, information ratio is more suitable when our performance benchmark is the S&P 500 as it represents excess return above/below the market on a risk-adjusted basis.

Panel A and B in Table 2 present the performance statistics of our signals over the back-testing period. In general, a long strategy delivers significantly strong performance regardless of which decile (TOP/BOT) we invest in for both liquidity and growth styles or their combination, indicating stock selection by either one of these factors fails to differentiate between winners and losers. The ineffectiveness of these signals' screening power can be observed in the small t-statistics of DIF and Alpha DIF, measuring the return differences between the Top (top decile) and BOT (bottom decile). The only exception is found in strategy returns earned by Dollar Turnover with a -1.18% long/short alpha spread at 99%

significant level. The negative spread suggests illiquid stocks seem to outperform liquid stocks, which could potentially be supported by the claim that small stocks tend to outperform large stocks as small stocks are in general less liquid than large cap stocks. The combined signal also fails to search for the hidden gems as reflected by insignificant t-statistics for Alpha DIF. This could likely be contributed to overvaluation on growth stocks resulting from investor tendency to push the prices of glamorous growth stocks beyond their reasonable fair values.

II.E. Robustness Check & Findings

To further examine our preliminary findings, we reiterate our testing methodology using monthly stock data on NASDAQ exchange from 2016 to 2019 as a robustness check. Signal effectiveness is reflected by performance statistics in Table 2 – Panel C and D. One can also read into the information ratios (IR) of TOP, BOT, and DIF for comparison between signal and market performance. Notice the t-statistics of DIF and Alpha DIF for both liquidity and growth signals are again insignificant, further reinforcing our previous finding that selection through either liquidity or growth style does nothing to separate winners from losers. Again, we see that long/short spread remains negative for Dollar Turnover at 99% significant level, lending extra credit to the idea that illiquid stocks tend to deliver stronger return than liquid stocks. When combining both signals together, the strategy disappointingly breaks down.

III. Conclusion

This paper sheds light on the effectiveness of equity investing through the use of traditional quantitative signals. In particular, we empirically examine signal performance for liquidity and growth signals with the hypothesis that liquid stocks with high growth potential should

have higher performance than those that are not. Our study shows that neither of the signals succeeds in separating winners from losers. The combined signal (liquid and growth) seems to have little screening power in the process of stock selection either. One reason could be general overvaluation – investors place too high of a price premium on liquid growth stocks such that they are susceptible to setbacks. We contend that incorporating the right valuation methodology into our model could better screen for the hidden attractive buys. Further studies could possibly test this conjecture by adding value signal to identify stocks that grow at a reasonable price.

Appendix

Table 1. Summary Statistics

This table provides summary statistics of factor characteristics. Panel A pertains to back-testing data on NYSE. Panel B pertains to robustness testing data on NASDAQ. All signals are measured on a monthly basis.

Panel A: NYSE 1995-2015 Summary Statistics

	mean	std	min	25%	50%	75%	max
Price	36.26	34.58	5.00	17.25	29.06	45.95	1075.05
Return	1.53%	11.44%	-84.84%	-4.40%	1.13%	6.81%	292.59%
Shares Outstanding	237.08	577.86	0.49	30.50	67.74	179.86	15713.67
Beta	1.05	0.94	-5.53	0.58	0.97	1.42	106.77
Alpha	0.74%	10.36%	-296.90%	-4.59%	0.30%	5.33%	274.71%
SPY Return	0.70%	4.28%	-16.94%	-1.77%	1.13%	3.58%	10.77%
Rf	0.30%	0.15%	0.05%	0.15%	0.30%	0.42%	0.63%
Turnover	1.41	1.60	0.00	0.48	1.00	1.81	88.83
Dollar Turnover	52.59	85.88	0.00	10.26	28.29	63.64	4858.66
Current Ratio	2.05	3.60	0.00	1.15	1.65	2.40	741.22
Cash Ratio	0.75	3.66	-0.17	0.09	0.26	0.66	291.01
Quick Ratio	1.52	3.58	-36.54	0.81	1.16	1.70	741.22
Revenue Growth	0.06	1.08	-18.91	-0.04	0.02	0.10	228.25
COGS Growth	0.07	2.50	-9.25	-0.05	0.02	0.10	631.70
Operating Income Growth	0.23	24.90	-503.73	-0.13	0.01	0.18	6066.69
Net Income Growth	-0.08	66.64	-14404	-0.51	-0.03	0.30	10612.33
Net Operating Cash Flow Growth	-0.60	345.34	-126789	-0.73	0.30	0.82	8538.40
<i>Number of Stocks</i>	<i>2381</i>						
<i>Number of Stocks Dropped</i>	<i>810</i>						
<i>Number of Observations</i>	<i>276398</i>						

Panel B: NASDAQ 2016-2019 Summary Statistics

	mean	std	min	25%	50%	75%	max
Price	46.41	88.35	5.00	12.11	25.52	52.77	2178.00
Return	1.96%	16.14%	-98.39%	-5.08%	0.91%	7.47%	890.39%
Shares Outstanding	128	436	0	20	40	85	8218
Beta	1.10	1.30	-18.42	0.48	1.04	1.64	37.12
Alpha	0.86%	15.28%	-206.56%	-5.68%	-0.02%	5.87%	888.03%
SPY Return	0.94%	3.31%	-9.18%	-0.04%	1.53%	2.97%	8.30%
Rf	0.16%	0.05%	0.08%	0.13%	0.16%	0.21%	0.25%
Turnover	2.02	4.92	0.00	0.76	1.40	2.37	645.98
Dollar Turnover	92.32	219.53	0.00	12.53	37.95	96.80	8851.13
Current Ratio	3.60	5.57	0.00	1.42	2.29	3.98	302.20
Cash Ratio	2.45	12.91	0.00	0.29	0.86	2.22	671.79
Quick Ratio	3.07	5.54	-11.58	1.08	1.75	3.20	302.20
Revenue Growth	1.07	81.72	-293.67	-0.05	0.02	0.10	11201.00
COGS Growth	0.07	1.15	-50.79	-0.04	0.02	0.10	116.08
Operating Income Growth	0.04	13.33	-1393.50	-0.21	0.00	0.21	1215.86
Net Income Growth	0.37	45.01	-1374.00	-0.69	-0.08	0.32	5409.33
Net Operating Cash Flow Growth	0.40	60.64	-4011.28	-0.70	0.30	0.75	6184.69
<i>Number of Stocks</i>	<i>1855</i>						
<i>Number of Stocks Dropped</i>	<i>944</i>						
<i>Num of Observations</i>	<i>237454</i>						

Table 2. Signal Performance

Panel A reports signal performance statistics on a monthly basis over the back-testing period from 1995 to 2015. The time-series average along with t-statistics are reported. The information ratios are computed based on CAPM on an overall basis. Panel B is constructed similar to Panel A except all performance measures are based on excess return above the market (returns in Panel A – spy monthly return). Panel C is the robust counterpart to Panel A. Panel D is the robust counterpart to Panel B.

Panel A: Performance Statistics of Monthly Return (1995-2015)

Signals	TOP %	BOT %	DIF %	T (TOP)	T (BOT)	T (DIF)	Alpha TOP %	Alpha BOT %	Alpha DIF %	T (Alpha TOP)	T (Alpha BOT)	T (Alpha DIF)	IR TOP	IR BOT	IR DIF
Turnover	1.83	1.41	0.42	4.05	5.16	1.58	0.89	0.76	0.13	3.46	5.01	0.61	0.26	0.27	-0.07
Dollar Turnover	1.07	2.31	-1.24	2.92	7.34	-5.71	0.34	1.52	-1.18	1.74	8.42	-5.88	0.12	0.51	-0.41
Current Ratio	1.47	1.36	0.11	4.37	4.70	0.74	0.69	0.64	0.06	3.92	4.21	0.40	0.27	0.25	-0.13
Cash Ratio	1.63	1.45	0.18	4.72	4.89	1.07	0.85	0.70	0.16	4.68	4.21	1.00	0.32	0.28	-0.12
Quick Ratio	1.56	1.48	0.08	4.58	4.85	0.47	0.77	0.66	0.10	4.28	3.98	0.61	0.29	0.28	-0.13
Liquidity	1.40	1.49	-0.09	3.55	5.49	-0.41	0.59	0.81	-0.22	2.84	5.36	-1.08	0.20	0.30	-0.19
Revenue Growth	0.98	0.71	-0.41	5.27	3.80	-1.43	0.98	0.71	-0.41	5.27	3.80	-1.43	0.98	0.71	-0.41
COGS Growth	0.96	0.79	-0.52	5.11	4.41	-1.89	0.96	0.79	-0.52	5.11	4.41	-1.89	0.96	0.79	-0.52
Operating Income Growth Net	1.22	1.12	-0.59	6.25	4.97	-1.92	1.22	1.12	-0.59	6.25	4.97	-1.92	1.22	1.12	-0.59
Income Growth Net	1.16	1.18	-0.71	5.66	4.91	-2.36	1.16	1.18	-0.71	5.66	4.91	-2.36	1.16	1.18	-0.71
Operating Cash Flow Growth	0.99	0.82	-0.53	5.22	4.19	-1.77	0.99	0.82	-0.53	5.22	4.19	-1.77	0.99	0.82	-0.53
Growth	0.87	0.85	-0.67	4.74	4.47	-2.18	0.87	0.85	-0.67	4.74	4.47	-2.18	0.87	0.85	-0.67
Total	0.72	0.75	-0.71	3.35	4.16	-2.58	0.72	0.75	-0.71	3.35	4.16	-2.58	0.72	0.75	-0.71

Panel B: Performance Statistics of Monthly Excess Return

Signals	TOP %	BOT %	DIF %	t(TOP)	t(BOT)	t(DIF)
Turnover	1.14	0.72	-0.27	4.06	4.27	-1.05
Dollar Turnover	0.38	1.62	-1.93	1.85	8.16	-6.44
Current Ratio	0.78	0.67	-0.58	4.20	3.99	-2.11
Cash Ratio	0.94	0.76	-0.51	5.01	4.41	-1.84
Quick Ratio	0.87	0.79	-0.61	4.63	4.43	-2.09
Liquidity	0.71	0.80	-0.78	3.22	4.80	-3.03
Revenue Growth	0.55	0.19	-0.35	1.37	0.48	-1.07
COGS Growth	0.49	0.33	-0.56	1.19	0.85	-1.73
Operating Income Growth	0.70	0.23	-0.25	1.73	0.55	-0.75
Net Income Growth	0.55	0.54	-0.71	1.37	1.28	-2.20
Net Operating Cash Flow Growth	0.60	0.40	-0.52	1.48	0.97	-1.64
Growth	0.64	0.44	-0.52	1.60	1.09	-1.51
Total	0.58	0.24	-0.38	1.32	0.66	-1.03

Panel C: Performance Statistics of Monthly Return (2016-2019)

Signals	TOP %	BOT %	DIF %	T (TOP)	T (BOT)	T (DIF)	Alpha TOP %	Alpha BOT %	Alpha DIF %	T (Alpha TOP)	T (Alpha BOT)	T (Alpha DIF)	IR TOP	IR BOT	IR DIF
Turnover	2.28	2.29	-0.01	2.85	4.89	-0.01	1.06	1.50	-0.44	2.02	4.57	-0.89	0.35	0.54	-0.20
Dollar Turnover	1.01	4.10	-3.09	1.73	8.12	-7.55	0.12	3.13	-3.00	0.42	8.63	-8.26	0.09	1.14	-1.06
Current Ratio	2.20	1.93	0.27	2.71	3.49	0.51	1.02	1.13	-0.11	1.93	3.34	-0.22	0.32	0.42	-0.12
Cash Ratio	2.85	1.42	1.43	3.03	2.55	2.09	1.62	0.57	1.04	2.36	1.57	1.61	0.37	0.22	0.12
Quick Ratio	2.43	1.54	0.89	2.85	2.86	1.43	1.22	0.80	0.42	2.11	2.14	0.72	0.35	0.25	0.02
Liquidity	1.66	2.31	-0.65	1.99	4.67	-1.10	0.49	1.44	-0.95	0.90	4.55	-1.81	0.19	0.58	-0.34
Revenue Growth	2.79	2.10	0.69	3.49	2.85	2.05	1.65	1.05	0.60	3.18	2.44	1.87	0.473	0.358	-0.028
COGS Growth	2.23	2.22	0.01	3.21	3.17	0.03	1.27	1.19	0.08	3.12	2.72	0.23	0.429	0.402	-0.185
Operating Income Growth Net	2.22	2.16	0.06	3.65	3.24	0.21	1.31	1.16	0.15	3.48	2.80	0.50	0.486	0.421	-0.168
Income Growth Net	1.90	2.24	-0.34	3.13	3.46	-1.05	1.04	1.16	-0.12	3.03	3.04	-0.39	0.401	0.475	-0.263
Operating Cash Flow Growth	1.70	1.92	-0.22	2.77	3.20	-0.72	0.73	1.02	-0.30	2.19	2.78	-0.97	0.346	0.389	-0.269
Growth	1.63	1.29	0.34	2.68	2.28	1.17	0.78	0.34	0.44	2.37	1.08	1.54	0.32	0.20	-0.12
Total	1.58	1.78	-0.20	1.98	3.60	-0.38	0.51	0.90	-0.39	1.04	3.08	-0.82	0.19	0.41	-0.25

Panel D: Performance Statistics of Monthly Excess Return (2016-2019)

Signals	TOP %	BOT %	DIF %	t(TOP)	t(BOT)	t(DIF)
Turnover	1.47	1.47	-0.82	2.66	4.16	-1.56
Dollar Turnover	0.20	3.29	-3.90	0.66	8.73	-8.14
Current Ratio	1.39	1.11	-0.54	2.46	3.22	-0.93
Cash Ratio	2.04	0.61	0.62	2.82	1.66	0.89
Quick Ratio	1.62	0.73	0.08	2.65	1.93	0.12
Liquidity	0.85	1.50	-1.46	1.46	4.43	-2.60
Revenue Growth	1.98	1.28	-0.12	3.64	2.75	-0.22
COGS Growth	1.42	1.40	-0.80	3.29	3.08	-1.42
Operating Income Growth	1.41	1.34	-0.75	3.73	3.23	-1.29
Net Income Growth	1.09	1.42	-1.15	3.08	3.65	-2.02
Net Operating Cash Flow Growth	0.89	1.10	-1.03	2.66	2.98	-2.07
Growth	0.82	0.48	-0.47	2.42	1.50	-0.96
Total	0.76	0.96	-1.01	1.45	3.18	-1.93