The Effect of Liquidity on Stock Returns: A Style Portfolio Approach

KUANG-WEN CHANG
Dept. of Business Administration, Soochow University, Taiwan
kwchang@scu.edu.tw

GEORGE YUNGCHIH WANG [1]
Dept. of International Business, National Kaohsiung University of Applied Sciences, Taiwan
gwang@cc.kuas.edu.tw

CHUNWEI LU
Dept. of Japanese Language, Wenzao Ursuline College of Languages, Taiwan
wini882003@yahoo.com.tw

Abstract: - In stock market, various concepts of stocks, or investment styles, have been raised by fund managers to catch the attention of investors. Style investing was referred to as investing stocks with similar company characteristics to form a style portfolio in order to obtain abnormal returns. Since liquidity in stock trading was important information for investors in investment decision-making, this study examined whether there existed the effect of liquidity, i.e., trading turnover, on stock returns by applying the style portfolio approach to test statistical significance of short-run abnormal returns and long-run cumulative returns of several liquidity-related style portfolios. With the data of Taiwan publicly-listed companies, three findings were concluded: First, the high liquid stocks were found to have higher cumulative returns relative to those of the benchmark portfolio, the market, for the period of 1999-2008. Second, when we integrated stock liquidity into company characteristic and firm size to form two-dimensional style portfolios, stock returns of those style portfolios were significantly higher than those of one-dimensional style portfolios, meaning that the liquidity effect could amplify conventional market anomalies, such as the value effect and the size effect. Third, the returns of the liquidity-related portfolios were also significant in different market conditions. The study therefore concluded that the liquidity effect was a significant investment style in stock market.

Key-Words: investment style, style investing, style portfolio, liquidity, value effect, size effect

1 Introduction

Since the concept of investment style was first raised by Farrell (1974), style investing had been used by mutual fund managers to form investment portfolios in order to gain profits from the stock market. Investment style was referred to as gathering stocks with the same company characteristics to form style portfolios and make investments in the stock market. This concept was, in essence, in agreement with the various stock concept groupings existing in the current Taiwanese market such as China-concept stocks and Apple-concept stocks. Common style portfolios could include value stocks, growth stocks, small-cap stocks, defensive stocks and so on. Style investing aimed to target an investment at a group of stocks with specific characteristics so that a portfolio including the chosen stocks would outperform the overall market in bullish markets and decline relatively slower than the market in bearish markets; thus, investors could earn abnormal returns (*AR*) and maximize investment returns.

Style investing had not only been used by many professional investment corporations as a way of making investment decisions but it had also become the research focus in the financial literature. The style investing approach, which based itself on modern portfolio theory, had injected a new way of thinking into traditional financial theory, the efficient market hypothesis. In an efficient stock market, required returns of stocks theoretically should be equal to expected returns, but empirical evidence had revealed that an efficient market could not be immediately achieved and thus it left room for abnormal returns. Building on this idea, style investing had been a popular investment rule for some time now. In particular, the style investing

[1] Corresponding author.

approach was intended to form a style portfolio with similar company characteristics by constantly rebalancing the portfolio, in order to ensure that the constituent stocks could keep constantly the same style, thereby outperforming the market and gaining long-term cumulative returns.

The concept of style investing was not brand-new in stock market. Graham *et al*. (1934) introduced the concept of value investing in the 1930s in their famous book, Security Analysis. Graham not only successfully regained more than 70% of his loss in the Great Depression by utilizing the value investing approach but also subsequently created enormous wealth with this method for which he was acclaimed as "the father of value investing" on Wall Street. Furthermore, Babson (1962) proposed the concept of growth investing. In accordance with this concept, he established a fund company that created tremendous wealth for its clients, and was currently managing an asset base of over 20 billion U.S. dollars.

Traditional research on style investing had tended to utilize company characteristics (value and growth stocks), company size (big-cap and small-cap stocks), and other factors as the major style determinants. This study intended to explore the impact of a new investment style, liquidity, on performance of style portfolios. The liquidity style was applied as a single style as well as an additional dimension to traditional investment styles. Research on the importance of liquidity had drawn much attention in recent years, but no consistent findings had been concluded. For example, Amihud (2002) maintained that liquidity significantly affected stock returns, especially in the stock market where there was a so-called "illiquidity premium." This meant that less liquid stocks, because of their higher liquidity risks, had positive abnormal returns. Bodie *et al*. (2005) shared a similar view, claiming that ignored companies, because of less attention from the market, had lower trading volumes, but were more likely to generate abnormal returns because of price imbalances. By contrast, Chan *et al*. (2008) found that not only do less liquid stocks would generate abnormal returns but that highly liquid stocks could deliver abnormal returns as well.

With the application of style investing and the data from Taiwan's stock market, this study aimed to explore a new investment style, liquidity. Specifically, we used liquidity as a new measure to form style portfolios, based on which the significance of short-run abnormal returns and long-run cumulative returns, respectively, were both tested by conducting the pair-wise *t* testing.

In addition to this introduction section, the rest of the paper was followed by four sections: Section 2 further reviewed related literature on liquidity. Section 3 outlined research design and methodology. Section 4 provided empirical results of the study. Lastly, the conclusion was given in Section 5.

2 Literature Review

Half a century ago, Graham and Babson raised the concepts of value and growth respectively; however, since neither of these people were academics, these concepts attracted no academic attention. In the meantime, academics focused on the capital market theory. For example, Sharpe (1964) and Lintner (1965) proposed the capital asset pricing model (CAPM), which explained the positive correlation between stock returns and systematic risks. Ross (1976) developed the arbitrage pricing theory (APT), which applied multi-systematic factors, such as inflation rate, industrial production, the slope of the term structure of interest rates, and the yield spreads between investment-grade bonds and junk bonds, to describe the behavior of capital market. It was not until Fama and French's (1992) study that the impact of individual company's factors on returns was introduced into the model.

In regard to style investment, earlier research was initiated by Farrell (1974), who divided S&P100 companies into four groupings, namely growth stocks, stable stocks, cyclical stocks, and oil stocks, in accordance with the three factors of market, industry, and company, in order to analyze their performance differences. Sharpe (1978) formally used style to name the stock-picking method of investment portfolios. Later, Sharpe (1992) created the well-known approach of style analysis, which assumed that style factors would affect stock returns. Sharpe then developed 12 stock portfolios according to these investment styles and found that style factors did affect investment portfolios' performances. The studies by Brown and Goetzmann (1997) and Gallo and Lockwood (1997) on style analysis disclosed that mutual funds with specific styles generated better performance than did single funds.

Earlier research was inclined to construct style portfolios using a single investment style such as company characteristic and firm size to test the correlation between styles and returns. Later, scholars began attempting to form binary investment styles by integrating two different factors, as known as two-dimensional style portfolios, into the style

investing approach. For example, Sharpe (1992) studied both the size effect and the value effect by classifying stocks into big-cap value stocks, big-cap growth stocks, and mid-cap and small-cap stocks. Christopherson (1995) set up a classification system based on the eigenvalues of the funds' componential stocks and divided the sample funds into four different investment styles. Gallo and Lockwood (1997) established four mutual funds of different styles, namely big-cap growth stocks, small-cap growth stocks, big-cap value stocks, and small-cap value stocks, and tested the returns of each type of fund, the results showing statistical significance. Ahmed and Nanda (2001) extended Fama and French's (1992) three-factor model to a multi-index model and proposed that a trading strategy featuring multiple styles could generate abnormal returns.

Recent research on styles had extended its scope and added some new elements. For instance, Teo and Woo (2004) studied the kinetic energy performance of style portfolios; Massa and Zhang (2009) found that applying style analysis to business mergers could improve the acquirer's value and future performance; and Gallo *et al*. (2008) studied systematic approaches to integrating different styles in an attempt to improve the performances of investment portfolios.

Earlier research on stock liquidity was conducted from the perspective of liquidity risk by exploring its impact on stock returns. For instance, Amihud and Mendelson (1986, 1989) claimed that stock liquidity affected liquidity risk and trading costs, and that less liquid stocks might deliver additional premiums to investors as a compensation for the risks and costs they have to bear. Amihud (2002) used the cross-sectional method to examine the impact of liquidity on returns and found that the illiquidity premium existed in the stock market, i.e., less liquid stocks would generate positive abnormal returns. This was known as the liquidity effect. Goyenko (2006) also believed that the illiquidity premium could be found in equities as well as bonds.

Some studies argued that liquidity might affect stock volatility, leading to an impact on stock returns. For example, Jones *et al*. (1994) used the number of transactions to represent stock liquidity and discovered that volatility and the number of transactions were positively associated. Ding and Lau (2001) used data from the Singapore stock market and found that trading frequency not only positively influenced price fluctuations but also affected stock returns. In regard to the operational definition of liquidity, in addition to the previous trading frequency, other studies, such as Lee and Swaminathan (2000), Amihud (2002), Wongchoti and Pyun (2005), and Chan *et al*. (2008), had used trading volume or standardized trading volume (or turnover ratio) to measure liquidity.

3 Methodology

This study focused on exploring whether the liquidity effect is present in Taiwan's stock market and whether it was an illiquidity premium or high liquidity premium. Hence, this study aimed to form style portfolios based on clear operational definitions and test the statistical significances of short-run abnormal returns and long-run cumulative returns after the liquidity factor was introduced into style portfolios. The statistical significance could provide a foundation for proving the liquidity effect, which would help investors and fund managers develop a new investment style.

The liquidity effect was tested preciously in several stock markets (Gallo and Lockwood, 1997; Amihud, 2002). In Taiwan stock markets, Ma and Shaw (1990) and Ku and Lin (2002) had also examined multi-factors estimating return and risk in portfolios. While previous studies mostly applied the method of cross-sectional regression, this study intended to provide additional insight into the liquidity effect with the approach of style portfolios.

In this study, there were fourteen style portfolios under consideration based on company size, stock liquidity, or both. For single dimension style portfolios, six single style portfolios were considered: value stocks (denoted by V), growth stocks (G), big-cap stocks (B), small-cap stocks (S), highly liquid stocks (H), and less liquid stocks (L). In addition, eight two dimensional style portfolios were analyzed: highly liquid value stocks (HV), less liquid value stocks (LV), highly liquid growth stocks (HG), less liquid growth stocks (LG), highly liquid big-cap stocks (HB), less liquid big-cap stocks (LB), highly liquid small-cap stocks (HS), and less liquid small-cap stocks (LS). The market portfolio (M) was used as the benchmark portfolio to test statistical significance.

3.1 Data

The research period for this study was from 1999 to 2008 during which time Taiwan's stock market experienced all three market conditions, namely bullish, corrections, and bearish markets.[2] It was

[2] Bullish, corrections, and bearish markets are defined as $R_m > R_f$, $R_f \geq R_m \geq -R_f$, and $-R_f > R_m$, respectively.

assumed that we had made an investment into 15 style portfolios (i.e., six one-dimensional style portfolios, eight two-dimensional style portfolios, and the market portfolio) on January 1, 1999 in Taiwan's stock market and re-balanced the investment portfolios once a quarter in accordance with the adjustment mechanism for the constituent stocks of style portfolios until the end of December 2008. Then, quarterly returns (*QR*) and cumulative returns (*CR*) during the sample period were derived and made a comparison with those of the benchmark portfolio.

This study followed the style-portfolio approach, which could be divided into the following steps: collecting sample data, defining the sample period, establishing and rebalancing style portfolios, calculating *QRs* and *CRs*, constructing hypotheses, and testing statistical significance.

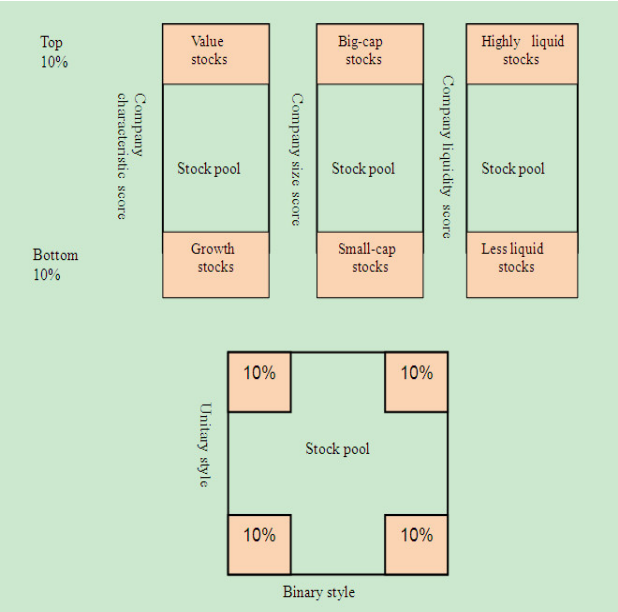

Figure 1 The Formation of Style Portfolios

Of all the research procedures, it was important to point out that style portfolios were formed on the basis of three dimensions, i.e., company characteristics, company size, and stock liquidity. The stock pool was first established and based on data availability. The next step was to choose appropriate measures in order to form a specific investment style. To characterize each style, each stock was scored from the average of percentile-ranking of each measure. Finally, the stocks with the highest scores were chosen to form a style portfolio. For two-dimensional style portfolios, the stocks were chosen from the top 10% of the average scores of two styles. The idea of the style-portfolio approach was graphically demonstrated in Figure 1.

3.2 Style Portfolios

The style portfolios were rebalanced (or re-adjusted) quarterly. This rebalancing frequency was carefully chosen to be quarter for at least two reasons. First, it was important to ensure that there was sufficient time to reflect financial information to portfolio returns of each style. According to this criterion, monthly rebalancing was too frequent. Second, investment styles might be deviated from their original spirits of characteristics if the rebalancing time was set for a longer time period. Annually rebalancing style portfolios was considered too long such that stocks in each style portfolio might not conform to each investment style. Therefore, the constituent stocks of each style portfolio were rebalanced every quarter. To be specific, we made adjustments at the end of March, June, September, and December each year, and after each adjustment, the constituent stocks of the portfolios remained unchanged in the following three months. Since the research time period was from 1999 to 2008, there were 40 adjustments of rebalancing style portfolios made within 10 years.

To construct value/growth style portfolios, each stock was percentile-ranked and scored according to six operating variables, i.e., price-to-book ratio (PBR), price-to-earnings ratio (PER), price-to-sales ratio (PSR), asset growth (AG), equity growth (EG), and sales growth (SG). Based on the average score of the six variables, a stock with a higher score was considered to be of growth style, while a stock with a lower score was more close to value style. The value and growth stocks were constructed from the top 30 stocks and the bottom stocks, respectively.[3]

For the size style, the large and small capitalization stocks were measured from the sum of percentile ranking of total assets, equity, and the number of employees. For the liquidity style, the high and low liquidity portfolios were formed according to turnover ratio, i.e., trading volume scaled by shares outstanding. To construct the two-dimensional styles, the sum of percentile ranking of two dimensions was computed and top 30 stocks in the ranking were thus selected to form the two-dimensional style portfolios.

The market portfolio was used as the benchmark, which was calculated from the TAIEX Total Return Index (TAIEX-TRI) on Taiwan Stock Exchange (TAIEX). Compared with the traditional TAIEX

[3] According to Statman (1987) and Wang (2010), a portfolio of 30 stocks was considered to be optimal for the diversification purpose.

Index, the TAIEX-TRI Index was considered to be better representative of the market, in that not only the returns on capital gain were computed but also cash dividends.

3.3 Return Measures

In the study, we used several return measures, which are discussed below:

(1) Stock returns

For individual stocks, quarterly stock return was calculated from the sum of capital gain yield and dividend yield, as shown below:

$$R_{i,t} = \frac{(P_{i,t} - P_{i,t-1}) + Div_{i,t}}{P_{i,t-1}} \quad (1)$$

where $R_{i,t}$ stands for the stock returns of stock i in quarter t; $Div_{i,t}$ stands for cash dividend of stock i in quarter t.

(2) Portfolio returns

Since style portfolios were rebalanced each quarter, portfolio returns of a style portfolio could be derived from the following equation:

$$QR_{p,t} = \sum_{i=1}^{n} W_{i,t} R_{i,t} \quad (2)$$

where $R_{p,t}$ stood for the returns of the investment portfolio p in quarter t; n stood for the number of constituent stocks in the style portfolios.

To highlight company characteristics in style portfolios, when rebalancing the portfolio, the portfolio weights were computed on the basis of the ranking of a particular investment style. Suppose there were n stocks in a style portfolio, then after ranking all the stocks according to style characteristic, the weight of the i-th stock was calculated as follows:

$$W_i = \frac{n - i + 1}{\sum_{j=1}^{n} j} \quad (3)$$

(3) Abnormal returns (AR)

In order to measure the short-term performance of style portfolios and take into consideration the systemic risk factors of them, we used the difference of the realized return and the required return from the capital asset pricing model (CAPM) to compute abnormal returns, *ARs*. The *AR* for portfolio p at time t was denoted as follows:

$$AR_{p,t} = QR_{p,t} - \left[R_{f,t} + \hat{\beta}_{p,t} \left(R_{m,t} - R_{f,t} \right) \right] \quad (4)$$

where $\hat{\beta}_p$ stood for the estimator of the β coefficient of investment portfolio p in each quarter.

(4) Cumulative returns (CR)

CR represent stock return generated on the initial \$1 investment in a style portfolio for the period from time 0 to τ. *CRs* reflected long-term performance of style investment. The *CR* for portfolio p in the τ-th period was calculated by the following formula:

$$CR_{p,\tau} = \prod_{t=1}^{\tau} (1 + QR_{p,t}) - 1 \quad (5)$$

3.4 Hypothesis Testing

Short-term returns were based on *AR* and used to test the statistical significance of style portfolios. For a style portfolio of interest, the null and alternative hypotheses were illustrated, respectively, as shown below:

$$\text{H1A}_0 : AR_V \le 0$$
$$\text{H1A}_1 : AR_V > 0$$

Long-term returns were based on cumulative returns and used to test whether the *CR* of value stocks remarkably outperform that of the benchmark portfolio (the market portfolio). Its null and alternative hypotheses were expressed as follows:

$$\text{H1B}_0 : CR_V \le CR_M$$
$$\text{H1B}_1 : CR_V > CR_M$$

Since there were 14 style portfolios (including the market portfolio), 13 hypotheses were established to test both *AR* and *CR* by regarding the market as a benchmark. For illustrative purpose, the hypotheses were exhibited in Table 1.

Table 1 The Research Hypotheses

Hypothesis	Sub-hypothesis	Null hypothesis H_0	Alternative hypothesis H_1
H1	H1A	$AR_V \le 0$	$AR_V > 0$
	H1B	$CR_V \le CR_M$	$CR_V \ge CR_M$
H2	H2A	$AR_G \le 0$	$AR_G > 0$
	H2B	$CR_G \le CR_M$	$AR_G \ge AR_M$
H3	H3A	$AR_B \le 0$	$AR_B > 0$
	H3B	$CR_B \le CR_M$	$CR_B \ge CR_M$
H4	H4A	$AR_S \le 0$	$AR_S > 0$
	H4B	$CR_S \le CR_M$	$CR_S \ge CR_M$
H5	H5A	$AR_H \le 0$	$AR_H > 0$
	H5B	$CR_H \le CR_M$	$CR_H \ge CR_M$
H6	H6A	$AR_L \le 0$	$AR_L > 0$
	H6B	$CR_L \le CR_M$	$CR_L \ge CR_M$
H7	H7A	$AR_{HV} \le 0$	$AR_{HV} > 0$
	H7B	$CR_{HV} \le CR_M$	$CR_{HV} \ge CR_M$
H8	H8A	$AR_{LV} \le 0$	$AR_{LV} > 0$
	H8B	$CR_{LV} \le CR_M$	$CR_{LV} \ge CR_M$
H9	H9A	$AR_{HG} \le 0$	$AR_{HG} > 0$
	H9B	$CR_{HG} \le CR_M$	$CR_{HG} \ge CR_M$
H10	H10A	$AR_{LG} \le 0$	$AR_{LG} > 0$
	H10B	$CR_{LG} \le CR_M$	$CR_{LG} \ge CR_M$
H11	H11A	$AR_{HB} \le 0$	$AR_{HB} > 0$
	H11B	$CR_{HB} \le CR_M$	$CR_{HB} \ge CR_M$
H12	H12A	$AR_{LB} \le 0$	$AR_{LB} > 0$
	H12B	$CR_{LB} \le CR_M$	$CR_{LB} \ge CR_M$
H13	H13A	$AR_{HS} \le 0$	$AR_{HS} > 0$
	H13B	$CR_{HS} \le CR_M$	$CR_{HS} \ge CR_M$

Note: V denotes value stocks, G growth stocks, B big-cap stocks, S small-cap stocks, H highly liquid stocks, L less liquid stocks, and M market portfolio.

4 Empirical Results

4.1 Descriptive Statistics

The descriptive statistics of these portfolios were shown in Table 2. Figures 2 to 5 demonstrated the performances of the style portfolios and the market portfolio during the research period. Figure 2 showed a comparison of the *CR* of value stocks, growth stocks, highly liquid stocks, less liquid stocks, and the market portfolio. Figure 3 compared the *CR* of big-cap stocks, small-cap stocks, highly liquid stocks, less liquid stocks, and the market portfolio. Figure 4 compared the *CR* of one-dimensional style portfolios (the combination of stock liquidity and company characteristics) and the market portfolio. Figure 5 made a comparison between one-dimensional style portfolios (the combination of stock liquidity and company size combined) and the market portfolio in terms of *CR*.

Table 2 Descriptive statistics

Style	Return	Mean	Median	S.D.	Max	Min
V	AR	0.0451	0.0490	0.1096	0.3040	-0.1510
	CR	1.2236	0.7330	1.0419	3.7010	0.1150
G	AR	0.0062	0.0330	0.1192	0.2780	-0.2530
	CR	-0.0505	-0.0580	0.2270	0.4260	-0.3530
B	AR	-0.0023	0.0134	0.0979	0.2601	-0.2329
	CR	-0.0820	-0.0989	0.1566	0.2485	-0.3071
S	AR	0.0108	-0.0003	0.1008	0.2419	-0.2395
	CR	0.1772	0.0671	0.2884	0.9423	-0.1822
H	AR	0.0356	0.0780	0.1284	0.2620	-0.3060
	CR	0.9291	0.3775	1.0797	3.6890	-0.1250
L	AR	-0.0080	-0.0130	0.0808	0.2400	-0.1860
	CR	-0.1276	-0.1505	0.1040	0.1730	-0.3620
HV	AR	0.0628	0.0905	0.1375	0.3390	-0.2960
	CR	3.3614	1.7000	3.3919	11.491	0.1440
LV	AR	0.0131	0.0030	0.1230	0.4460	-0.1680
	CR	0.4297	0.4515	0.1987	0.7370	-0.0940
HG	AR	0.0261	0.0705	0.1349	0.2880	-0.2890
	CR	0.4316	0.1970	0.6253	2.0810	-0.2370
LG	AR	0.0065	-0.0030	0.1373	0.5570	-0.2380
	CR	0.0948	0.0410	0.2004	0.7310	-0.1680
HB	AR	0.0274	0.0635	0.1422	0.3787	-0.2687
	CR	0.5983	0.2380	0.7340	2.3410	-0.2338
LB	AR	-0.0098	-0.0021	0.0750	0.2210	-0.1594
	CR	-0.2603	-0.3104	0.1147	0.0510	-0.4117
HS	AR	0.0685	0.0579	0.1504	0.3745	-0.3396
	CR	3.9795	1.7173	4.3179	15.051	0.2272
LS	AR	-0.0040	-0.0094	0.0775	0.1981	-0.1868
	CR	-0.1150	-0.1370	0.0886	0.0574	-0.3229
M	AR	0.0037	0.0119	0.1589	0.5263	-0.2552
	CR	0.0104	-0.0377	0.2396	0.5354	-0.4333

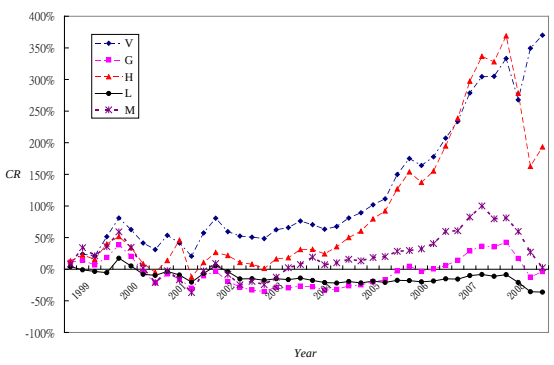

Figure 2 *CRs* of Single Style Portfolios (V, G, H, L, and M)

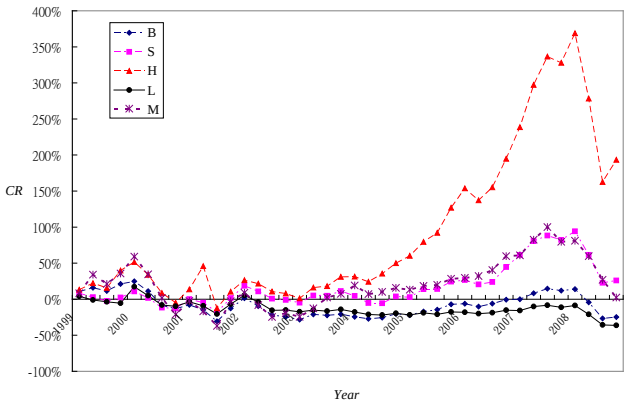

Figure 3 *CRs* of Single Style Portfolios (B, S, H, L, and M)

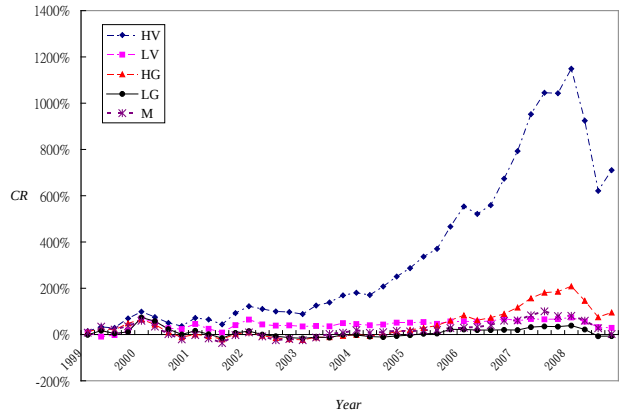

Figure 4 *CRs* of Two-Dimensional Style Portfolios (HV, LV, HG, LG and M)

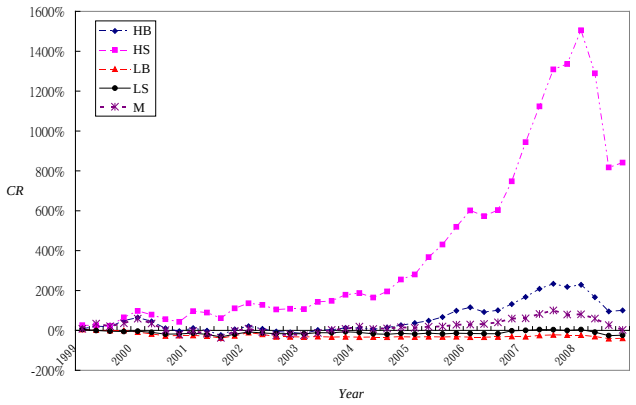

Figure 5 *CRs* of Two-Dimensional Style Portfolios (HB, LB, HS, LS and M)

Summarized from Figure 2-5, both the one and two dimensional style portfolios connected with high liquidity outperformed the market portfolio in terms of *CRs*. However, the liquidity effect was yet to be confirmed until statistical tests were conducted.

4.2 Hypothesis Testing

To test statistical significance of long-run and short-run performance of style portfolios, a pair-wise *t*-test was conducted with *AR* and *CR* as proxy variables, respectively. In order to examine whether style portfolios significantly outperformed the market portfolio, the *t* statistic must be positive and the testing must be one-tailed. The results of the hypothesis testing were displayed in Table 3.

Table 3 The Results of Hypothesis Testing

Style	Portfolio	Hypothesis		Pairwise *t*	Results
Single Style	V	H1	H1A	2.3349**	Supported
			H1B	7.8562**	
	G	H2	H2A	0.1694	
			H2B	-3.3784	
	B	H3	H3A	-0.3905	
			H3B	-4.5554	
	S	H4	H4A	0.4255	Partially
			H4B	4.5393**	supported
	H	H5	H5A	2.9151**	Supported
			H5B	6.0365**	
	L	H6	H6A	-0.6630	
			H6B	-4.1138	
2-D Style	HV	H7	H7A	4.0041**	Supported
			H7B	6.4564**	
	LV	H8	H8A	0.4979	Partially
			H8B	10.671**	supported
	HG	H9	H9A	1.4695*	
			H9B	5.4924**	Supported
	LG	H10	H10A	0.1637	Partially
			H10B	3.9215**	supported
	HB	H11	H11A	1.7439**	
			H11B	6.2282**	Supported
	LG	H12	H12A	-0.6811	
			H12B	-8.3771	
	HS	H13	H13A	3.7293**	
			H13B	5.9649**	Supported
	LS	H14	H14A	-0.4106	
			H14B	-4.4485	

Note: * $p < 0.10$; ** $p < 0.05$

According to Table 3, of all the one-dimentional style portfolios, Portfolios V and H showed a positive significance on both sub-hypotheses, with

the *t* statistics of 2.3349 ($p < 0.05$), 7.8862 ($p < 0.05$), 2.9151 ($p < 0.05$), and 2.0151 ($p < 0.05$), respectively. This meant that Portfolios V and H not only outperformed the market portfolio in the short run, but also outpeformed the market in the long run. It then followed that both the value effect and the liquidity effect were significant in the stock market. Also, portfolio S only indicated a significant cumulative return over the market with a t statistic of 4.5393 ($p < 0.05$), meaning that the small-cap stocks only beat the market in the long run while the small-cap stocks did not indicate an abnormal return.

In regard to the two-dimensional portfolios, the result indicated that the liquidity effect became more significant when the characteristic of liquidity was added into other style portfolios. For instance, both *ARs* and *CRs* were significant in Portfolios HV, HG, HB, and HS. It could be inferred that liquidity amplified not only the vale effect, but also the growth effect. Furthermore, both the size effect and the inverse size effect were reinforced by the characteristic of high liquidity, revealing that the liquidity effect was significant not only in the one-dimensional style portfolios, but also in liquidity-related two-dimensional style portfolios.

One finding could be derived was that the value effect was especially significant for single investment style, V, and also for two-dimensional investment styles, HV and LV. On the other hand, the characteristic of low liquidity was less significant as only Portfolios LV and LG were significant in the long run with *t* statistics of 10.6710 ($p < 0.05$) and 3.9215 ($p < 0.05$), respectively.

The effects were especially significant when liquidity was combined with the small-cap stocks and the value stocks. Hence, if the characteristic of liquidity was integrated into the value stocks and the small-cap stocks, their portfolio returns would be amplified in the long run. As indicated in Table 2, the CRs for Portfolio H and S were 92.91% and 17.72%, respectively. When high liquidity was added into stock selection, the CRs for Portfolio HV and HS became 336.14% and 397.95%, respectively. As indicated in Table 3, the four style portfolios, V, S, HV, and HS were significant in both the short run and the long run, but the magnitude of the CRs were much greater in two-dimensional portfolios, HV and HS, than those in on-dimensional portfolios, V and S.

4.3 Robustness Check

To further check the robustness of statistical significance of the liquidity effect, this study adopted the idea of quantile portfolios proposed by Fama and French (1992). Specifically, stocks in the data pool were classified into quantiles according to the liquidity score and ten style portfolios of liquidity were then constructed within each quantile. The CRs were computed for a pairwise *t* testing. The results for significance testing were listed in Table 5.

As shown in Table 5, the mean CR of the first three liquidity-related portfolios were 0.0356, 0.0216, and 0.0133, respectively; those of the other portfolios decreased gradually. It was also obvious that the *t* statistics decreased with quantiles of liquidity. Of the 10 liquidity portfolios, only the first three quantile portfolios showed positive statistical significance, suggesting that the liquidity effect did exist in the stock market.

Table 5 The *t*-Test Results of the Liquidity-StylePortfolios

Style portfolio	Quantiles	Mean returns	Standard deviation	*t* Statistic
Liquidity ⌒ From high to low ⌣	90%-100%	0.0356	0.1284	2.9151**
	80%-90%	0.0216	0.1249	2.0764**
	70%-80%	0.0133	0.1201	1.8490*
	60%-70%	0.0109	0.1163	1.1273
	50%-60%	0.0093	0.1086	0.8865
	40%-50%	0.0090	0.1151	0.7693
	30%-40%	0.0092	0.1087	0.7997
	20%-30%	0.0056	0.0907	0.6774
	10%-20%	-0.0026	0.0916	-0.7221
	0-10%	-0.0080	0.0808	-0.6630

In summary, both the liquidity effect and the value effect were significant in Taiwan's stock market. Secondly, both abnormal return and cumulative return reached a higher level when liquidity was combined into single investment style, such as the size effect and the value effect. In short, this study found that liquidity could be significant and thus become a new investment style for stock selection.

5 Conclusion

This study investigated whether the liquidity effect existed in Taiwan's stock market by involving publicly listed companies in Taiwan from 1999 to 2008 as the study sample. One-dimensional style portfolios with stock liquidity as the core and binary style portfolios combining stock liquidity with company characteristics and company size were then established before a comparison of returns

among these style portfolios was conducted to ascertain whether there were anomalies regarding *CR* occurring in the market.

The results showed that the liquidity effect occurred in Taiwan's stock market both in the short-term and in the long-term when no distinction was made between bullish markets and bearish markets. In the 10-year research period, highly liquid stocks produced significant *CR* compared with the market portfolio. When the liquidity effect was integrated into the size effect and the value effect, the liquidity-related two-dimensional style portfolios performed much higher than the one-dimensional style portfolios. This finding implied that the liquidity effect could amplify the conventional size and value effects. Of all the style portfolios, highly liquid small-cap stocks and highly liquid value stocks generated the highest cumulative returns of 869.94% and 738.97%, respectively.

In comparison to the literature on liquidity, this study found that the stock-picking rule favoring stocks with high trading turnover had more significant *AR* than did stocks with low trading turnover. It can thus be inferred that highly liquid stocks are likely to show better performances, a finding corresponding to Lee and Swaminathan's (2000) findings, which claimed that stocks with high trading turnover might reflect the characteristics of glamour stocks, which have a stronger momentum or energy in the short-term and show more persistence in returns in the long-term, and thus produce significant *AR* and *CR*. This point coincides with the well-known securities analyst, Granville Joe's viewpoint, "trading volume may precede price", i.e., trading volume provided an insight into observing price momentum.

Much of the literature on style investing had studied the style investing effect using regression analysis. In contrast, an analysis of investment performance returns by adopting the style investing approach was conducted in the study. The style investment approach was shown to be consistent with the concept of style analysis adopted by professional investment corporations. Furthermore, we contributed to establish a set of simple and clear-cut stock selecting rules based on style classifications, based on which investors and professionals might conveniently formulate easy-to-follow investment strategies.

References:

[1] Y. Amihud, Illiquidity and Stock Returns: Cross-Section and Time-Series Effects, *Journal of Financial Markets* 5, 31–56, 2002.

[2] Y. Amihud and H. Mendelson, Asset Pricing and the Bid-Ask Spread, *Journal of Financial Economics*, 17, 223–249, 1986.

[3] Y. Amihud and H. Mendelson, The Effect of Beta, Bid-Ask Spread, Residual Risk, and Size on Stock Returns, *Journal of Finance*, 2, 479–486, 1989.

[4] P. Ahmed and S. Nanda, Style Investing: Incorporating Growth Characteristics in Value Stocks, *Journal of Portfolio Management*, 27, 3, 47–59, 2001.

[5] R. W. Babson, Growth Stocks Discussed by Roger Babson, *Times Daily*, Section 2, Oct. 4, 1962.

[6] Z. Bodie, A. Kane and A. J. Marcus, *Investments*, 6th ed., McGraw-Hill: New York, 2005.

[7] S. J. Brown and W. N. Goetzmann, Mutual Fund Styles, *Journal of Financial Economics*, 43, 3, 373–399, 1997.

[8] J. S. P. Chan, D. Hong, Marti G. Subrahmanyam, A Tale of Two Prices: Liquidity and Asset Prices in Multiple Markets, *Journal of Banking & Finance*, 32, 947–960, 2008.

[9] J. A. Christopherson, Equity Style Classifications, *Journal of Portfolio Management*, 21, 3, 32–44, 1995.

[10] D. K. Ding and S. T. Lau, An Analysis of Transactions Data for the Stock Exchange of Singapore: Patterns, Absolute Price Change, Trade Size and Number of Transactions, *Journal of Business Finance & Accounting*, 28, 151–174, 2001.

[11] E. F. Fama and K. R. French, The Cross-Section of Expected Stock Returns, *Journal of Finance*, 47, 427–465, 1992.

[12] J. L.Farrell, Analyzing Covariation of Returns to Determine Homogeneous Stock Groupings, *Journal of Business*, 47, 2, 186–208, 1974.

[13] J. G. Gallo and L. Lockwood, Benefits of Proper Style Classification of Equity Portfolio Managers, *Journal of Portfolio Management*, 23, 3; 47–56, 1997.

[14] J. G. Gallo, C. Phengpis and P. E. Swanson, Institutional Flows and Equity Style Diversification, *Applied Financial Economics*, 18, 1441–1450, 2008.

[15] R. Goyenko, Liquidity and Asset Pricing, PhD Thesis, Indiana University, 2006.

[16] B. Graham, D. L. Dodd, S. Cottle and C. Jr Tatham, *Security Analysis*, McGraw Hill, New York, 1934.

[17] C. Jones, G. Kaul and M. Lipson, Transactions, Volume, and Volatility, *Review of Financial Studies*, 7, 4, 631–651, 1994.

[18] K. P. Ku and W. T. Lin, Important Factors of Estimated Return and Risk: The Taiwan Evidence, *Review of Pacific Basin Financial Markets and Policies*, 5, 1, 71-92, 2002.
[19] M. C. C. Lee and B. Swaminathan, Price Momentum and Trading Volume, *Journal of Finance*, 55, 2017–2069, 2000.
[20] J. Lintner, The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets, *Review of Economics and Statistics*, 47, 13–37, 1965.
[21] T. Ma and T. Y. Shaw, The Relationships between Market Value, P/E Ratio, Trading Volume, and the Stock Return of Taiwan Stock Exchange, *Pacific-Basin Capital Markets Research*, 1, 1, 313-335, 1990.
[22] M. Massa and L. Zhang, Cosmetic Mergers: The Effect of Style Investing on the Market for Corporate Control, *Journal of Financial Economics*, 93, 400–427, 2009.
[23] S. A. Ross, "The Arbitrage Theory of Capital Asset Pricing," *Journal of Economic Theory*, 13, 341–360, 1976.
[24] W. F. Sharpe, Capital Asset Prices: A Theory of Market Equilibrium under Conditional of Risk, *Journal of Finance*, 19, 425–442, 1964.
[25] W. F. Sharpe, Major Investment Styles, *Journal of Portfolio Management*, 4, 2, 68–80, 1978.
[26] W. F. Sharpe, Asset Allocation: Management Style and Performance Measurement, *Journal of Portfolio Management*, 18, 2, 7–19, 1992.
[27] M. Statman, How Many Stocks Make a Diversified Portfolio? *Journal of Financial and Quantitative Analysis*, 22 (1987), 353-363.
[28] M. Teo and S. Woo, Style Effects in the Cross-Section of Stock Returns, *Journal of Financial Economics*, 74, 2, 367–398, 2004.
[29] G. Y. Wang, Portfolio Diversification and Risk Reduction- Evidence from Taiwan Stock Mutual Funds, *Proceedings of the 4th International Conference on Management and Service Science (MASS), 2010*, (ISBN: 978-1-4244-5326-9).
[30] U. Wongchoti and C. S. Pyun, Risk-Adjusted Long-Term Contrarian Profits: Evidence from Non-S&P 500 High-Volume Stocks, *Financial Review*, 40, 335–359, 2005.