



Liquidity Based Momentum Strategies on Dutch Stock Markets

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Submission date: 08-07-2014

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Abstract

Operating the sample of 166 stocks which were traded on the Euronext Amsterdam Exchange over a ten-year' investigating horizon starting from the January of 2003 ending up with the December of 2013, the paper investigates the profitability and persistence of multifarious kinds of liquidity based momentum trading portfolios in the Dutch stock market. This paper creates a linkage between past returns and historical liquidities, and guilds practitioners to construct profitable and stable investing strategies based on these two historical indicators simultaneously. The statistical results indicate that a trading strategy which having a long position in highly illiquid winners financed by infrequently traded losers on the basis of previous 9-month lagged compound return and average liquidity realizes an average monthly return of 1.51% following 12 months after the formation date, and profits seems to cumulate until 26.45% at the end of post-holding period (24 months). In addition, this paper confirms that the liquidity indicator contributes a return premium when pricing equities. During the economic depression, the liquidity based momentum strategies become to be more profitable than before mainly due to the enhancement of short selling highly illiquid losers. However, the author suggests that any types of liquidity based momentum strategy are not feasible and applicable in practice during that specific period by considering the restriction of short selling those illiquid equities.

Keywords: Momentum, Liquidity, Bid-Ask Spread, Investing Strategy

Introduction

Momentum anomaly was first recognized by Jegadeesh and Titman (1993), which can be summarized by the abnormal returns are strongly correlated to past performance. By rephrasing their main finding, the momentum trading portfolio which has a long position in stocks with outstanding returns over the past 1 to 4 quarters and short stocks with poor performances over the same period generates profits of around 1% monthly on average for the following year. The crucial part of this profitable and applicable trading opportunity is forecasting future payoffs based on historical information. The same principle can be applied in the stocks liquidity. Lee & Swaminathan (2000) created a trading portfolio on the basis of both previous performance and past trading volume. The statistical results from their paper demonstrated that having a long position in past high-volume winners and shorting past high-volume losers outperforms a similar strategy only formed on the basis of price momentum by 2% to 7% annually. However, they also admitted that the trading volume as measured by the turnover ratio is unlikely to be a liquidity proxy.

Referencing my previous study on momentum anomaly in the Netherlands, the momentum portfolio which constructed based on the previous 6-month lagged performance realizes an average monthly return of 1.24% following 14 months after the formation date, and it seems to have a return reversal later on.

Followed by these mentioned evidences, whether there exists a possibility to enhance the magnitude of abnormal return from momentum portfolio by adding a liquidity indicator in the Dutch stocks market seems to be an interesting direction for further research. Replicating trading volume as liquidity indicator has been rejected by Lee & Swaminathan (2000), thus determining an appropriate liquidity indicator seems to be an obstacle. Amihud & Mendelson (1986) introduced a liquidity measurement of taking the difference between quoted bid and ask price which represents the cost of immediate execution. Stocks with relative higher spread refers to lower liquid equities, on the contrary, equities with lower spread refers to those securities which were highly liquid. In addition, they detected that stocks with relative higher-spread (low liquidity stocks) yield higher future returns which indicates that liquidity might be a predictive variable for future excess return. The liquidity measuring methodology and characteristic of low liquidity equities have been confirmed by subsequent academic studies on liquidity.

The main research direction of this paper is to verify whether a trading portfolio formed on the basis of historical performance and past liquidity indicator is profitable and sustainable. This paper targets to provide the significance and magnitude of the profitability of different types of liquidity-based momentum strategies which formed by filtering all listed stocks on the Dutch stocks market. A sub-sample result of the financial crisis period is provided in order to identify the adaptability of liquidity-based momentum strategies during the economic depression.

The main findings of this paper indicate that a trading strategy which having a long position in highly illiquid winners financed by infrequently traded losers on the basis of previous 9-month lagged compound return and average liquidity realizes an average monthly return of 1.51% following 12 months after the formation date, and profits seems to cumulate until 26.45% at the end of post-holding period (24 months).

The remainder of the paper is organized as follows. Section I summarizes all those published academic papers which have direct or indirect contributions or impacts on constructing this paper. In addition, this section is divided into two parts which refer to momentum anomaly and liquidity respectively. Section II documents the data resources and the process of constructing liquidity based momentum portfolios. Section III reports the medium-term profitability of different types of liquidity based momentum portfolios (64 trading strategies in total) by extending the formation/holding period and switching the combination of longing/shorting sides simultaneously. Section IV investigates the monthly performances of two selected liquidity based momentum strategies combining with the known calendar anomalies. Furthermore, this section also reveals the long-term profitability and stability of these two particular investing rules over both the holding and post-holding period. Section V examines whether the liquidity based momentum strategy is still profitable or remains a wise choice for investors during the financial crisis. Section VI provides the final conclusions through comparing with previous empirical findings.

Section I (Part A): Literature Reviews on Momentum Anomaly

Most notably, Robert A. Levy first discovered that significant superior returns could be achieved through buying stocks with current prices that are substantially higher than their average historical prices over the past 27 weeks. This finding might be regarded as the milestone of investing in equities based on their historical performances or price movements. However, Levy realized that his paper was limited by omission of statistical tests of significance, and omission of return variability within the holding period of individual securities. To sum up, Levy's findings guided academic researchers draw their attentions on the historical performances of equities, and created space for further academic analysis. Nevertheless, suspicions were quickly raised by Jensen and Bennington (1970) who proved that Levy's trading rule performed worse than a normal buy-and-hold strategy by using the same sample period. The reason why the mentioned superior returns can be found is attributed to selection bias.

Jegadeesh and Titman (1993) discovered that, over medium-term horizons, stocks with higher returns over the past 3 to 12 months continuously outperform stocks with lower past returns over the same period. Through back-testing the sample from the American stock markets (NYSE & AMEX) over the period ranges from 1965 until 1989, a portfolio formed based on past 6 months performances and be held for another 6 months, realizes a compounded excess return of 12.01% annually on average. In addition, the zero-cost trading profits of **6x6** combination cannot be explained by differences in systematic risk between past winners and losers, or by differences in the speed of price reaction to common factors. In order to explain this phenomenon, the overreaction seems to be one plausible answer which suggests investors believing positive (negative) released information about one particular stock return indicates this stock might follow the same direction later on. Another possible interpretation for the underlying abnormal return could be investors holding winners and shorting losers are temporarily shifting stock prices away from their long-term trend. The investing framework of having a long position in the winners financed by shorting losers is employed and referenced by numerous subsequent academic papers. Even though this paper provides a comprehensive overview of the profitability of momentum strategy, one might consider only focusing on the US stock markets as the main limitation. In other words, the momentum strategy cannot be employed worldwide.

Targeting to identify whether the historical returns having predictability to future returns is due to the market's underreaction to information, the authors analyzed the sample which included primary stocks listed on NYSE, AMEX and NASDAQ over the period from January 1977 to January 1993. Chan, Jeegadesh and Lakonishok documented that sorting stocks based on previous 6-month return yields an average cumulative return of 8.8% over the subsequent 6 months. Similarly, ranking stocks on the basis of a moving average of past estimation of future earnings generates an abnormal return of 7.7% over the following 6 months. These two empirical findings indicate that the historical information has the predictive power to the future earning indeed. Remarkably, the authors summarized that the medium-term momentum profits might be partly caused by underreaction to earning information, and in general, the price momentum effect tends to be stronger and longer-lived than the earnings momentum effect. This paper may be considered as an improvement of published momentum literatures from the perspective of expanding the sample coverage and constructing the portfolios based on different historical indicators

Generally speaking, Conrad and Kaul (1998) jointly analyzed two different types of investing strategies which diametrically opposed in philosophy and execution: the contrarian strategy relies on price reversals and the momentum strategy depends on price continuations. Through back-testing two sub-samples covered NYSE/AMEX (1926 to 1946 was regarded as the first investigating period and the second period ranged from 1947 to 1989), the statistical results indicated that less than 50% of the 120 implemented strategies (55 strategies) yield significant profits and, unconditionally, the contrarian and momentum strategies are equally likely to be successful. Two systematic trends had been identified: First, the momentum strategy normally generates significant positive returns over the medium horizons. Second, the contrarian strategy performs extraordinary at long horizons. Remarkably, Conrad and Kaul presented a hypothesis which argues that the profitability of momentum strategies might be entirely due to the cross-sectional variation in expected returns rather than to any predictable time-series variations in stock returns.

To overcome the limitation from the paper of Jegadeesh and Titman (1993), Rouwenhorst (1998) expanded the sample region from the U.S. towards the European market which across 12 European countries including the Netherlands. Through replicating the portfolio formation methodology of Jegadeesh and Titman (1993) and using the data ranged from

1980 to 1995, the results demonstrated a significant difference in intermediate-term returns (more than 1% per month after correcting for risk) between past-winners and past-losers. The statistic results indicate that return continuation is present in all countries, and an internationally diversified momentum portfolio generates an average monthly return of roughly 1%. Interestingly, Rouwenhorst also found return continuation is stronger in smaller caps compared with large caps, and price momentum can be traced back to a common indicator due to the correlation between the international momentum returns and those of the U.S. Even though Rouwenhorst' study extended to the Netherlands, the profitability of momentum portfolio of a specific country was not reported in detailed and precisely in his paper. In addition, there is no other published literature of momentum anomaly for the Netherlands. Hence, this is one of the main reasons why this paper is going to be constructed. It seems that the results from European markets cannot satisfy Rouwenhorst' appetite, a comprehensive description of 20 different emerging countries including 1750 firms was provided to consolidate his findings. Rouwenhorst discovered that there exists momentum, value (value stocks outperform growth stocks), and size effects (small stocks outperform large stocks) in emerging markets. Furthermore, the paper documented the relationship between expected returns and share turnover is insignificant, and beta, size, value, and momentum are positively cross-sectionally correlated with turnover in emerging markets. Rouwenhorst' findings implied that the return premium do not simply reflect a compensation for illiquidity, which might be considered as one of the inspiration of constructing this paper.

Motivated by the paper of K.Geert Rouwenhorst (1998), Liu, Strong and Xu (1999) considered the results presented in his paper were restricted by the number of equities in UK and apart from controlling potential size effect. Aiming to provide a comprehensive and detail momentum study of UK, Liu, Strong and Xu exam the medium-term momentum strategies on a large sample of UK stocks which includes 4,182 stocks over the period from January 1977 to June 1998. As a comparison with the sample used by Rouwenhorst (494 stocks), the authors expend the sample size almost 8 times and extend the sample period simultaneously. The results suggest that significant momentum profits exist in the London Stock Exchange which strongly supported by the accessional testing on sub-sample results, seasonal effects, and the persistence of momentum profits. Furthermore, the authors

confirm that the abnormal returns of momentum portfolio cannot be explained by either serial correlation in common factor realizations or delayed stock price reaction to common factor realization. A hypothesis was raised in this paper states that the momentum anomaly is an independent phenomenon which might be plausibly explained by a delayed response to either industry- or firm-specific information. To conclude, Liu, Strong and Xu attribute the profitability of momentum strategies to serial correlation either in industry-specific or idiosyncratic component of stock returns.

Aiming to response the suspicions raised by Conrad and Kaul (1998), Jegadeesh and Titman extended their sample horizon for another subsequent 8 years based on previous paper in 1993 (from 1965 to 1998). After testing various explanations for the profitability of momentum strategies, the results consolidated their previous findings in 1993. This evidence indicated that the original interpretations were not a product of data snooping or data mining bias. Through examining the post-holding period performance, the hypothesis of momentum profits arising because of cross-sectional differences in expected returns rather than because of time-series return patterns had been rejected (Conrad and Kaul 1998). Furthermore, the reversals of momentum portfolios were consisted with the behavior models which presented by Barberis et al. (1998), Daniel et al. (1998), and Hong and Stein (1999). To sum up, a negative trend of returns generating process during the post-holding period (13 to 60 months after formation period) implied that the reason behind momentum profits is delayed overreaction.

Focusing on investigating the potential risks and the possible resources of momentum rewards, Grand and Martin back testes those equities listed on NYSE/AMEX cover the period from 1926 to 1995. The authors discovered a momentum strategy sorted on the basis of total return can earn a statistically and economically risk-adjusted return of 1.3% on average per month. The profitability of momentum portfolio cannot be entirely explained by either cross-sectional variability or as a compensation for suffering industry-specific risk. In addition, a momentum strategy formed on the basis of stock-specific return outperforms a momentum portfolio which sorted based on total historical return.

In order to verify whether the macroeconomic risks have the explanatory power to momentum profits, Griffin, Ji and Martin examined a global portfolio which includes 12,276

stocks covering 40 countries over the period of 1926 to 2000. The authors primarily confirmed that the abnormal returns of momentum portfolio are economically large and statistically reliable worldwide, and there existed a weak co-movement across countries or within regions. This finding indicates that if momentum anomaly is driven by a risk, the risk is largely to be a macroeconomic risk. However, the statistical results after two macroeconomic indicators based classifications (GDP growth/aggregate stock market movements) suggest that international momentum profits are generally positive under all macroeconomic states. Hence, it is unclear whether the macroeconomic variables can explain the excess returns of momentum strategy. Finally, Griffin, Ji and Martin discovered strong evidences to prove the momentum profits reverse quickly after the holding period and become negative over the longer investing horizon.

Section I (Part B): Literature Reviews on Liquidity

Aiming to narrow the gap between illiquidity and equity pricing, Amihud developed a model which examines the outcomes of investors with different expected holding periods trading stocks with different relative bid-ask spreads. The author confirmed the idea of measuring illiquidity by the spread between bid and ask spread which represents the cost of immediate execution. The ask price includes a premium for immediate buying, and the bid price similarly reflects a concession required for immediate sale. The statistical results suggested that stocks with relative higher-spread (low liquidity stocks) yield higher future returns and give firms an incentive to increase their liquidity, thus lead reductions in the corresponding opportunity cost of capital. Amihud built a linkage between illiquidity and equity pricing through measuring the liquidity by taking the difference between bid and ask price. This academic paper gave the initial inspiration of capturing the liquidity by using the bid-ask spread, and demonstrated an empirical characteristic of low liquidity securities.

Recognizing the historical transactions amount may contain valuable information about one particular security, Lee and Swaminathan attempted to create a linkage between “momentum” and “value” strategies through an intermediate indicator: trading volume. Through back-testing all the equities listed on the NYSE and AMEX during the period January 1965 through December 1995, the authors confirmed that stocks with high/(low) historical turnover ratios earn lower/(higher) future returns and continuously to generate

negative/(positive) earnings over the following 32 months. One might consider the stocks with high/(low) turnover ratios share the same characteristics of glamour/(value) stocks which tend to be overpriced and overestimated as the major explanation of the abnormal returns. More specifically, having a long position in past high-volume winners and shorting past high-volume losers outperforms a similar strategy only formed on the basis of price momentum by 2% to 7% annually. In addition, the authors confirmed that trading volume has the predictability to the magnitude and persistence of momentum effect, and helps to reconcile the intermediate-horizon “underreaction” and long-horizon “overreaction” effects. Remarkably, the authors documented that the trading volume as measured by the turnover ratio is unlikely to be a liquidity proxy. The correlation between trading volume and firm size or the bid-ask spread is relatively low, and the volume effect independent from the size effect. Hence, the liquidity indicator used in this paper is determined to be the bid-ask spread instead of trading volume, even though the trading volume has a higher accessibility and availability. To conclude, this paper contributes the idea of combining momentum and liquidity indicators to construct a trading portfolio, and guide later academics avoid detours of using inappropriate liquidity indicator.

Through back-testing all the stocks listed on NYSE over the period from 1963 to 1997, Amihud discovered that expected market illiquidity positively affects ex ante stock excess return over time. The illiquidity measure used in this paper is the average across stocks of the daily ratio of absolute stock return to dollar volume, which can be interpreted as the daily stock price reaction to a dollar of trading volume. This empirical finding indicated that the expected excess return partly can be explained by an illiquidity premium. In the cross-sectional estimation, the author confirmed that illiquidity has the explanatory power to the differences in expected returns across stocks which consists with earlier studies. In the time-series estimation, the statistical results indicated that the expected market liquidity has a positive and significant effect on ex ante stock excess return, and the unexpected illiquidity has a negative and significant effect on contemporaneous stock return. Interestingly, this paper documented a “small firm effect”: illiquidity affect more strongly small stocks which might be one of the explanations for the time-series variations.

Targeting to verify whether the aggregate liquidity is an asset pricing indicator, the authors investigated all the stocks listed on the NYSE and AMEX from the period over 1966 to 1999.

The statistical results implied that stocks with high sensitivities to liquidity outperform those stocks with low sensitivities by 7.5% on average per year, adjusted for exposures to the market return as well as size, value, and momentum factors. In other words, stocks which are more sensitive to aggregate liquidity generated substantially higher abnormal returns. To be mentioned also, the liquidity measurement used in this paper focuses on the dimension of liquidity associated with the strength of volume-related return reversal. This liquidity measuring methodology is unique and can be regarded as an innovation in capturing the liquidity effect. Remarkably, Pástor and Stambaugh discovered that a liquidity risk factor accounts for half of the profits to a momentum strategy over the sample period. This finding builds a bridge between the liquidity exposure and momentum trading portfolios.

The author investigated the components of liquidity risk which are important for asset-pricing anomalies. Two anomalies (Momentum & Post-Earnings-Announcement-Drift) are being tested over the sample ranges from 1983 to 2001. The statistical results suggested that the unexpected systematic variations of the variable component rather than the fixed component of liquidity are priced within the context of momentum and post-earnings-announcement drift portfolio excess returns. In other words, momentum trading portfolios generate higher returns during the periods which experience positive innovations in aggregate liquidity, and the returns generating process is relatively lower over the negative-innovation periods. Notably, the profitability of momentum strategies always depends on the levels of transaction costs, commission fees, and frequent rebalancing period in practice. Hence, the author documented that one of the limitations of constructing those tested portfolios is restricted liquidity. To conclude, Sadka confirmed the premium for bearing liquidity risk or information-asymmetry risk is associated with individuals' preferences with respect to risk in different states of the world, and proposed that the benchmark asset-pricing model should include an information-based liquidity risk factor.

Section II: Data Description & Methodology

The primary dataset is generated from DataStream by selecting all the equities have been traded or were traded on the Euronext Amsterdam Exchange. Considering Euronext Amsterdam Exchange stands for the main exchange of the Netherlands, hence, the stocks listed on that exchange are representative and reliable.

Totally 372 stocks' monthly price indexes which are all in the same currency "Euro" are obtained at the first place. Those price indexes will be used to calculate the raw returns of all equities which are the essential components of momentum indicator. Furthermore, the Amihud liquidity indicator requires both bid and ask prices as major variables to capture an approximation of the cost incurred when investors trading. Thus, the bid price and the ask price of all those 372 equities are transported from DataStream afterwards, and be considered as the main resource to form liquidity indicator. Nevertheless, some observations contain extreme values, and even some of the stocks were not available for the required investigating period. Therefore, the dataset has to be revised with the following criteria:

- The valid stock prices cannot contain extreme value above 1000 euro. (Normally, equity prices below 5 euro are excluded in academic research, however, illiquidity has to be taken into account in this paper)
- The valid stocks have to be active at least three years (36 Months) in order to cover the longest holding period and post-holding period. (12-12-12 strategy)
- The valid stocks should have a price movement within duration of 1 year (12 Months), or otherwise they are going to be considered as dead stocks.

After the mentioned adjustments and modifications, it still remains some problematic stocks which fulfill the above conditions. For instance, a stock which started to be traded at the middle the sample period cannot provide valid observations at the beginning of the sample period, and this is also applicable for those started at the beginning or three years before the end of sample period. Even though, these "trouble-make" equities have no impact on determining their corresponding liquidity, but they might have directly influences on the significance and magnitude of the monthly return of the momentum & liquidity portfolio simultaneously. Furthermore, they might also inference the process of portfolio

formation indirectly, because those stocks might be included in the winner or the loser decile after primary sorting. In order to have a sufficient and representative dataset, those problematic stocks cannot be eliminated from the sample unfortunately.

Finally, 166 stocks' monthly price indexes are identified to be the main dataset which has a ten-year' investigating horizon starting from the January of 2003 ending up with the December of 2013.

The intention of including the financial crisis in the sample period is to investigate whether the liquidity based momentum strategy remains significant profitable during the depression period. Reporting the financial crisis period separately helps the readers to understand the limits of underlying trading strategies and to learn how to behave rational during the recession.

In addition, the spread-related liquidity indicator applied in this paper requires both bid and ask price to be the ingredients. The bid price refers to the highest price that an investor is willing to purchase a particular stock, similar as the concept of "Willingness to Pay" in behavior finance. The ask price implies an amount of money that an investor would like to receive in order to abandon current long position of a particular equity, which can be interpreted as "Willingness to Accept". When subtracting bid price from ask price, positive values can be always arrived across the entire sample. This result indicates that ask price (WTA) is continuously larger than the bid price (WTP), which consists with the "endowment effect": Individuals attach a premium for the goods they own, because suffering losses results a larger utility change relative to gains.

The monthly price indexes cannot be used in the analysis directly, but there is only one simple step left between the price indexes and the raw returns of each stock. The first step has to be taken in order to generate more informative and utilized observations is to transform the price index to raw return.

The raw returns of a particular stock i are calculated as following:

$$Ret_{i,t} = (P_{i,t+1} - P_{i,t}) / P_{i,t}$$

Constructing Momentum Indicator

A momentum based trading strategy can be divided into three main components. The first component “formation period” can be regarded as the foundation (root) of the trading strategy, which aims to filter certain numbers of equities based on a historical return-related indicator.

Once investors expect the stock prices either overreact or underreact to released information, then profitable trading strategies that select stocks based on their historical performances will exist. There are several alternative methods to determine the historical performance of a particular equity, such as referring the cumulative return of past few months, the average return of past few months, and the total net return during past few months. Instead of using those methods mentioned above, the compound return of a particular stock during a specific period is considered as the historical return-related indicator in this paper.

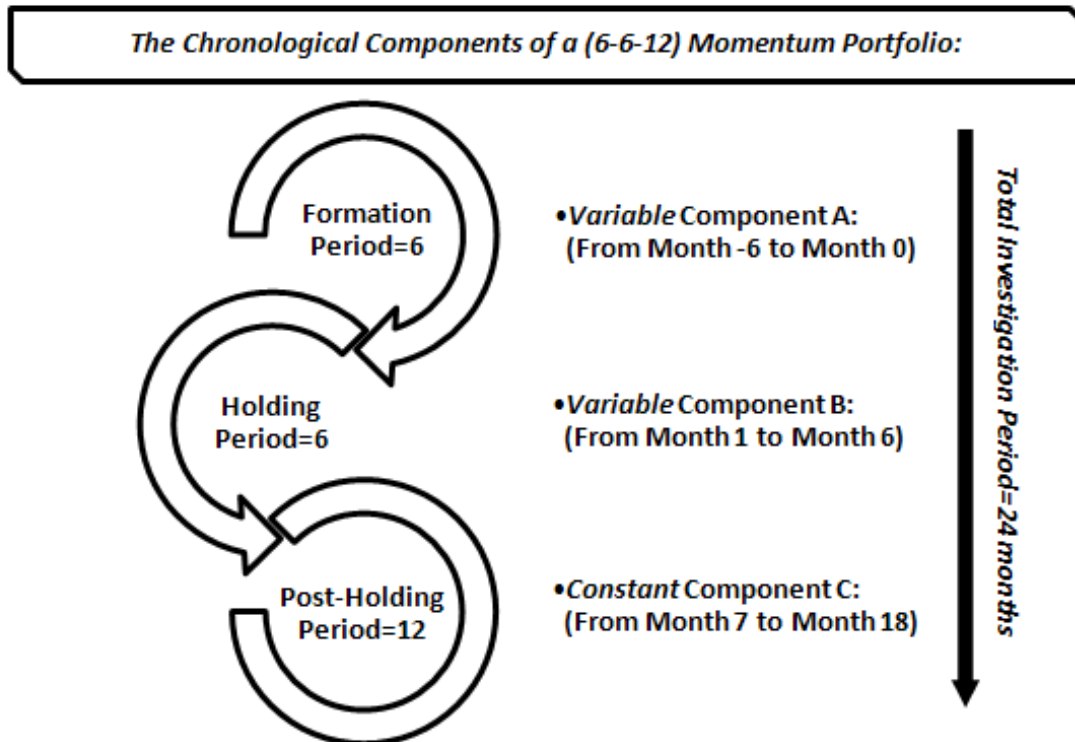
The compound return based on previous 3-month lagged monthly raw return of a particular stock “*i*” is calculated as following:

$$ComRet_{i,t} = (Ret_{i,t-(J-1)} + 1) * (Ret_{i,t-(J-2)} + 1) * (Ret_{i,t-(J-3)} + 1) - 1$$

Where “*i*” denotes a particular stock, “*t*” denotes a specific month, and “*J*” indicates the duration of formation period and takes the value of 3, 6, 9, or 12 (recall the duration of formation period will be substituted for different combinations). Note that: “*J*” also indicates the numbers of multiplying components are included in the above equation.

The second phrase known as “holding period” is targeted to observe the short-term underreactions of constructed trading strategies. The “holding period” is also varied from 3 to 12 months in order to demonstrate diversified trading combinations. To contradistinguish, the last component “post-holding period” is immobilized at 12 months which targets to analysis the long-term overreactions of corresponding trading rules.

The following sketch captures the chronological components of a 6-6-12 momentum trading strategy:



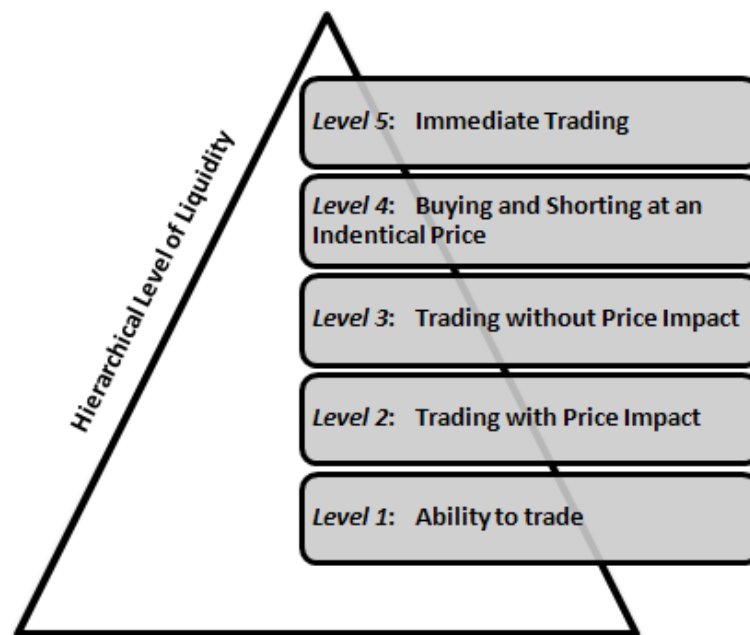
Constructing Liquidity Indicator

Liquidity is relatively hard to be captured, and due to it has multi-dimensionalities, there is no idealized definition could perfectly captures it's all characteristics. Usually, the following four dimensions are distinguished and widely used to capture liquidity:

- I. **Trading Time:** The capability to execute a transaction immediately at the prevailing price. The waiting time between subsequent trades or the inverse, the numbers of transactions per time unit are measures for trading time.
- II. **Tightness:** The capability to long and to short a specific equity at the same time point with an identical price. Tightness shows in the clearest way the cost associated with transacting or the cost of immediacy. Measures for tightness can be diversified by different versions of the spread.
- III. **Depth:** The capability to long or to short a certain quantity of a specific equity without influence on the quoted price. A sign of illiquidity is an adverse market impact for investors when they committing transactions. Market depth can be captured by the order ratio, the trading volume or the flow ratio.

- IV. **Resiliency:** The capability to long or to short a certain quantity of a specific equity with tiny influence on the quoted price. While the aspect of market depth regards only the volume at the best bid and ask prices, the resiliency dimension takes the elasticity of supply and demand into account. This characteristic of liquidity can be described by the intraday returns, the variance ratio or the liquidity ratio.

Those mentioned dimensions of liquidity could also be regrouped into five hierarchical levels, and the following sketch demonstrates a ranked or hierarchical relationship of the liquidity characteristics:



Level I: “The ability to trade”: This first level of liquidity is obvious: If the market is illiquid, no trading can take place. In a liquid market, there exists at least one bid and one ask price that commit a trade possible.

Level II: “The ability to trade equities with influence on the quoted price”: If there exists possibility to trade, the next focus point shifts on the price impact of trading. In a liquid market, it is possible to trade a certain amount of shares with infinitesimal impact on the quoted price.

Level III: “The ability to trade certain amount of equities without influence on the quoted price”: The more liquid a market becomes, the smaller difference between bid and ask quoted price. Therefore, as the liquidity increases, eventually a point will

be reached where there is no more price impact for a certain amount of shares (the bid-ask spread almost equals to zero).

Level IV: “The ability to long and to short a specific equity at the same time with an identical price”

Level V: “The ability to execute a transaction from level two to four immediately”

The ranked relationship between level one to level three is obvious, however, it seems to be ambiguous whether the level four and level five have significant priorities. Because one could imagine a market where it is possible to trade at once with a huge price influence, then the “Immediate Trading” has to be replaced at the position of level two.

To have an overview, liquidity measures are separated into one-dimensional and multi-dimensional approach: One-dimensional liquidity measures take only one of the mentioned aspects into account, whereas the multi-dimensional liquidity measures aim to capture those aspects in a single approach simultaneously.

This paper defines the spread-related liquidity measure (which belongs to one-dimensional category) as the unique liquidity indicator for the following reasons:

- I. Bid-ask spread reflect the discrepancy between the equity prices that are offered by sellers and buyers within the market
- II. Bid-ask spread reflect an approximation of the cost incurred when transactions are committed
- III. Bid-ask spread reflect the compensation which the trader has to pay for immediate execution of a trade
- IV. DataStream provide accessible and reliable bid and ask price observations

In order to make observations of different stocks comparable to each other it is always useful to rely on relative spread measures which applied in this paper. The following approach takes only the best bid and ask prices on a monthly basis into consideration:

Spread-related liquidity indicator:

$$LiD_{i,t} = (P^A_{i,t} - P^B_{i,t}) / P^M_{i,t} = 2(P^A_{i,t} - P^B_{i,t}) / (P^A_{i,t} + P^B_{i,t})$$

Where $P^A_{i,t}$ and $P^B_{i,t}$ denote the ask price and bid price of a particular stock “ i ” at period “ t ” respectively, $P^M_{i,t}$ denotes the mid-price of a particular stock “ i ” at period “ t ” which calculated as $(P^A_{i,t} + P^B_{i,t}) / 2$, this liquidity indicator is widely used not only because relatively easy to compute but also building a bridge to make different equities comparable. In addition, $LiD_{i,t}$ may be generated even if no trade takes place, in contrast to the relative spread calculated with the last trade. Note that the smaller the value of this spread-related liquidity indicator, the more liquid is the equity.

Double Sorting Approach

Targeting to verify whether adding the liquidity indicator in sorting phrase could improve the performance of contemporaneous (formed) momentum portfolio, the trading strategies in this paper are constructed by using double sorting approach.

The primary sorting process will be conducted as the same way as Jegadeesh and Titman (1993) did. All 166 stocks are ranked into deciles based on their past ***J-month*** compound returns (“ J ” takes the value of 3, 6, 9, or 12) and assigned to one of ten decile portfolios. (1 equals lowest compound returns of past *J-month*, or “***Losers***”, 10 equals highest compound returns of past *J-month*, or “***Winners***”. In this case, there are totally 16 stocks which represents ten percent of the entire sample are attributed in the “***Winners***” decile as well as the “***Losers***”.

Subsequently, the advanced sorting process will be taken place in both “***Winners***” and “***Losers***” decile based on their past ***J-month*** average liquidity indicator and categorized into two groups. (“***High Liquidity***” equals relatively lower average value of liquidity indicator of past *J-month* (“ J ” equals 3, 6, 9, or 12 as mentioned above), or “***Winners-High***” and “***Losers-High***”, “***Low Liquidity***” equals relatively higher average value of liquidity indicator of past *J-month*, or “***Winners-Low***” and “***Losers-Low***” respectively. In this case, there are totally 8 stocks which represent five percent of the entire sample are allocated in the “***Winners-High***”/“***Losers-High***” decile as well as “***Winners-Low***”/“***Losers-Low***”.

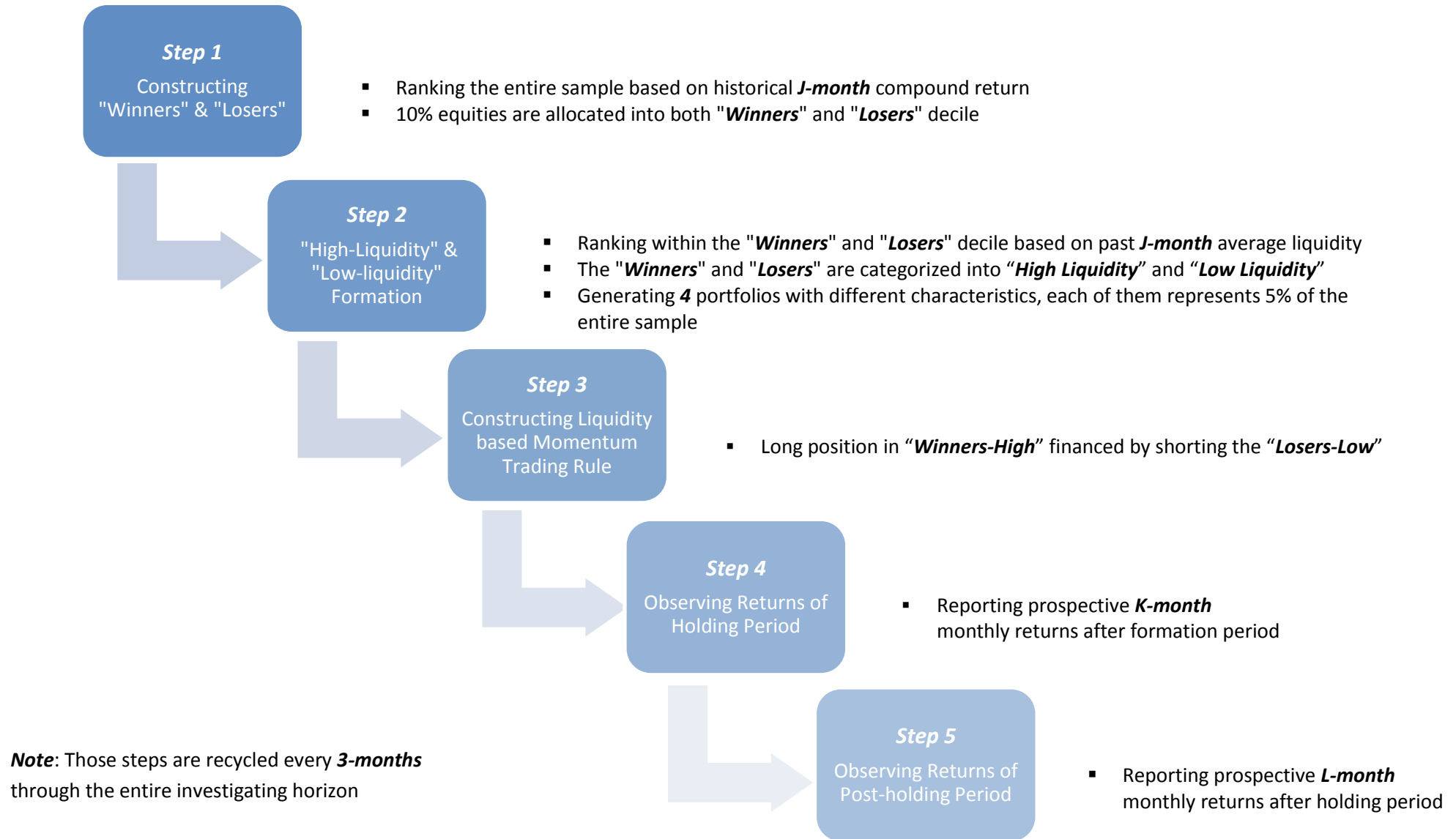
According to the above double sorting method, all 166 equities are regrouped into four categories based on their corresponding historical performances and liquidities. “**Winners-High**” refers to those equities which have outstanding performances and highly liquid during the formation period. On the contrary, “**Losers-Low**” demonstrates those stocks which have relative poorer performances and hardly to be traded within the same period. By having a long position in “**Winners-High**” and shorting the “**Losers-Low**”, the liquidity based momentum portfolio can be easily formed without any additional costs. Interestingly, it is also possible to have a long position in “**Winners-Low**” through being financed by “**Losers-Low**” which refers to a highly illiquid momentum portfolio. Through changing the “**Winners**” decile on the long position side and “**Losers**” on shorting side, it seems to have four trading possibilities (**2 x 2**) with different characteristics in total. Switching the combinations of those four mentioned groups might provide valuable information about either the momentum or the liquidity indicator results the abnormal returns.

Considering the formation period varies from the past 1-4 quarters as mentioned before, the holding period (**K-month**) also diversifies from 1 to 4 quarter. By changing the combination of formation period and holding period, there are totally 16 combinations for each those mentioned four trading possibilities. In general, there are 64 liquidity based momentum strategies (4 x 16) are being investigated in this paper in detail.

For simplification, the rolling window (rebalance period) is fixed at 3 months no matter how the formation period (**J-month**) changes. Hence, even there might exist overlapping and autocorrelation problems, the *t-statistic* calculation process will take sufficient adjustments and modifications to isolate these factitious bias.

To reveal a comprehensive process of constructing liquidity based momentum strategy, the following sketch demonstrates all the steps to form “**Winners-High**” minus “**Losers-Low**” trading combinations.

Processes of Constructing (*J-K-L*) Liquidity based Momentum Trading Strategy:



Section III: The Profitability of Liquidity Based Momentum Portfolios

This section documents the profitability of liquidity based momentum portfolio described in the above section over the period from January 2003 to December 2013 through manipulating data from the Euronext Amsterdam Exchange. All stocks with available and informative returns and average liquidities data in the J months preceding the portfolio formation date are included in the sample from which the buy and sell portfolios are constructed.

Average Monthly Performances of the “Components”

Table I reports the average monthly returns of winners and losers deciles with different characteristics from the perspective of liquidity, observing and holding period. There totally 64 deciles are described as following, and each decile includes fifteen stocks which represents 10% of the entire sample.

In general, the winner deciles with relative low liquidities provide higher returns than those highly liquid winners. Those low liquid winners contribute 1.5% excess returns per month on average with a relative stable trend while increasing the holding period. The worst scenario happens in 3-3 combination with a magnitude of 1.12%, on the contrary, the best case generates a monthly return of 1.68% on average in the 6-6 combination. Comparing with the frequently traded winners, those portfolios generate significant positive returns of 1% on average per month. The return difference between these two types of winner portfolios indicates that the liquidity indicator contributes a return premium when pricing equities.

Taking a look at the financing side of liquidity based momentum strategy, having a long position in highly liquid losers brings a significant positive monthly abnormal return of 0.8% on average, however the magnitude seems to be undermined while increasing the formation period. The illiquid losers explore negligible negative returns in most of the cases. Through fixing the holding period equals to one quarter, even the illiquid losers demonstrate positive returns ranges from 0.63% to 0.06%, this trend seems to vanish while investors having a longer observation period. Out of the expectations, the losers should provide significant negative returns which can be regarded as an enhancement of the underlying investing strategy.

Table I

Average Monthly Return of the “Components”

At the end of each month all stocks which were traded on the Euronext Amsterdam Exchange are ranked in ascending order based on previous *J-month* performances. The stocks in the bottom decile (lowest previous performance) are assigned to the *Loser* portfolio, those in the top decile (highest previous performance) to the *Winner* portfolio at the first sorting phrase. The secondary sorting stage takes place within both the *Loser & Winner* portfolios on the basis of past *J-month* average liquidities. The primary *Winner* portfolio is separated into two equally-divided deciles: *Winner-High* refers to those past winners which were highly liquid during past *J-month*, and *Winner-Low* refers to those past winners which had relatively lower liquidity. (The same principle is applied in the *Loser* portfolio) Notice that the rolling window is fixed at every three months, and each double-sorted decile contains fifteen stocks which represents 10% of the entire sample. Those portfolios are initially equally weighted and held for *K-month*. The following table gives the average monthly buy-and-hold returns on these portfolios for the period from January 2003 to December 2013. This table intends to explore the profitability of different components of the liquidity based momentum portfolios separately, and identify the source of abnormal returns is either contributed from the *Winner* or from *Loser* portfolio.

Formation Period (<i>J</i>)	Portfolio	Holding Period (<i>K</i>)			
		3	6	9	12
3	Winner (High)	0.0120	0.0112	0.0114	0.0116
	Winner (Low)	0.0112	0.0130	0.0129	0.0121
	Loser (High)	0.0131	0.0113	0.0091	0.0072
	Loser (Low)	0.0063	0.0026	0.0005	0.0000
6	Winner (High)	0.0071	0.0089	0.0095	0.0087
	Winner (Low)	0.0154	0.0168	0.0166	0.0156
	Loser (High)	0.0107	0.0084	0.0065	0.0055
	Loser (Low)	0.0036	0.0017	-0.0009	-0.0016
9	Winner (High)	0.0112	0.0110	0.0105	0.0096
	Winner (Low)	0.0161	0.0166	0.0155	0.0145
	Loser (High)	0.0083	0.0079	0.0061	0.0040
	Loser (Low)	0.0006	-0.0006	-0.0015	-0.0013
12	Winner (High)	0.0121	0.0116	0.0105	0.0093
	Winner (Low)	0.0142	0.0148	0.0136	0.0127
	Loser (High)	0.0070	0.0086	0.0057	0.0049
	Loser (Low)	0.0006	-0.0010	-0.0014	-0.0014

To conclude, a general pattern has been found in the longing side of liquidity based momentum trading portfolio. Illiquid winners explore a relative higher monthly return on average than those frequently traded winners, in addition, all these abnormal returns are stable and significant no matter how long the formation and holding period is. This empirical result indicates that liquidity indicator contribute a return premium when pricing equities. Remarkably, the financing (shorting) side reveals a contradictory trend comparing with classical findings which suggested that shorting losers can be considered as a supplementary to the magnitude of momentum profits. The frequently traded losers exploring significant positive monthly performances and illiquidity losers demonstrating negligible negative monthly returns are discovered in this paper. Most notably, the empirical results in this paper consist with the finding of Jegadeesh and Titman (1993) which reveals past winners outperformed past losers for almost each of the formation and holding periods only with the exception of the 3-3 and 6-3 case.

Average Monthly Performances of Four Types of Momentum Strategies

Table II documents the average monthly performances of totally 64 liquidity based momentum trading strategies covering the period ranges from January 2003 to December 2013. These investing strategies are categorized into four different panels through extending the formation period. This table targets to explore the profitability of different combinations of the liquidity based momentum portfolios, and identify which combination is the most successful investing rule which contributes the highest abnormal return with less volatile.

Investors forming a momentum portfolio based on those highly traded winners and losers is the worst decision in this paper. The return differences between highly liquid winners and losers are relatively low and insignificant differ from zero. Creating momentum portfolios based on recently high liquid stocks generates average monthly returns ranges from -0.36% to 0.55%. This empirical result might be linked with new-entering investors tends to create their own trading rule follows those noise traders, however those “dark-horse” or “glamour” stocks which being discussed between noise traders have already lost their arbitrage opportunities as long as more and more investors trading on them.

Table II

Average Monthly Return of Four Types of Momentum Strategies

At the end of each month all stocks which were traded on the Euronext Amsterdam Exchange are ranked in ascending order based on previous *J-month* performances. The stocks in the bottom decile (lowest previous performance) are assigned to the *Loser* portfolio, those in the top decile (highest previous performance) to the *Winner* portfolio at the first sorting phrase. The secondary sorting stage takes place within both the *Loser & Winner* portfolios on the basis of past *J-month* average liquidities. The primary *Winner* portfolio is separated into two equally-divided deciles: *Winner-High* refers to those past winners which were highly liquid during past *J-month*, and *Winner-Low* refers to those past winners which had relatively lower liquidity. (The same principle is applied in the *Loser* portfolio) Through having a long position in *Winner* deciles and being financed by *Losers*, it is possible to construct four types (2×2) of investing strategies which consist with the idea of momentum portfolio in total. *Panel A* summarizes the average monthly performances of these four investing strategies which formed on the basis of past 3-month historical information. Panel B, C, and D have the same reporting structure with the only difference of extended formation period. Notice that the rolling window is fixed at three months no matter how long the formation period is, and each double-sorted decile contains fifteen stocks which represents 10% of the entire sample. Those portfolios are initially equally weighted and held for *K-month*. The following tables give the average monthly buy-and-hold returns on these investing strategies for the period from January 2003 to December 2013. This table intends to explore the profitability of different combinations of the liquidity based momentum portfolios, and identify which combination contributes a relatively significant and stable excess return. In addition, the trend of abnormal returns is demonstrated while extending the holding period. The *t*-statistic below each monthly average returns is calculated by dividing its adjusted standard deviation (control for the number of observations), and the autocorrelations has been taken into consideration during the calculating process.

Panel A. Average Monthly Performances of Investing Strategies (<i>J</i>=3)		Holding Period (<i>K</i>)			
Formation Period (<i>J</i>)	Portfolio	3	6	9	12
3	Winner (High)-Loser (High)	-0.0010	-0.0001	0.0023	0.0044
	(<i>t</i> -Statistic)	-0.19	-0.02	0.77	1.65
	Winner (High)-Loser (Low)	0.0057	0.0086	0.0109	0.0116
	(<i>t</i> -Statistic)	0.70	1.86	3.04	3.47
	Winner (Low)-Loser (High)	-0.0019	0.0017	0.0039	0.0049
	(<i>t</i> -Statistic)	-0.34	0.40	1.25	1.79
	Winner (Low)-Loser (Low)	0.0049	0.0104	0.0124	0.0121
	(<i>t</i> -Statistic)	0.73	2.21	3.51	3.66

Panel B. Average Monthly Performances of Investing Strategies ($J=6$)

Formation Period (J)	Portfolio	Holding Period (K)			
		3	6	9	12
6	Winner (High)-Loser (High)	-0.0036	0.0005	0.0030	0.0032
	(t -Statistic)	-0.63	0.12	0.87	1.09
	Winner (High)-Loser (Low)	0.0035	0.0072	0.0103	0.0104
	(t -Statistic)	0.52	1.51	2.33	2.79
	Winner (Low)-Loser (High)	0.0047	0.0085	0.0102	0.0101
	(t -Statistic)	0.75	1.94	2.93	3.15
	Winner (Low)-Loser (Low)	0.0118	0.0151	0.0175	0.0173
	(t -Statistic)	1.89	3.38	4.32	5.04

Panel C. Average Monthly Performances of Investing Strategies ($J=9$)

Formation Period (J)	Portfolio	Holding Period (K)			
		3	6	9	12
9	Winner (High)-Loser (High)	0.0029	0.0031	0.0044	0.0055
	(t -Statistic)	0.44	0.60	1.08	1.64
	Winner (High)-Loser (Low)	0.0106	0.0116	0.0120	0.0109
	(t -Statistic)	1.18	1.85	2.39	2.59
	Winner (Low)-Loser (High)	0.0079	0.0087	0.0095	0.0104
	(t -Statistic)	1.25	1.98	2.53	3.00
	Winner (Low)-Loser (Low)	0.0156	0.0172	0.0171	0.0158
	(t -Statistic)	1.84	3.09	3.76	4.04

Panel D. Average Monthly Performances of Investing Strategies ($J=12$)

Formation Period (J)	Portfolio	Holding Period (K)			
		3	6	9	12
12	Winner (High)-Loser (High)	0.0051	0.0030	0.0048	0.0044
	(t -Statistic)	0.64	0.52	1.05	1.09
	Winner (High)-Loser (Low)	0.0115	0.0126	0.0120	0.0107
	(t -Statistic)	1.28	1.98	2.41	2.41
	Winner (Low)-Loser (High)	0.0072	0.0063	0.0078	0.0078
	(t -Statistic)	1.04	1.22	1.98	2.34
	Winner (Low)-Loser (Low)	0.0136	0.0158	0.0150	0.0141
	(t -Statistic)	1.78	2.76	3.37	3.77

Through substituting the long side by past illiquid winners, the investing rule of “Winner (Low)-Loser (High)” improves its performance along with the extension of observing period. Purchasing the past 9-month illiquid winners and selling high liquid losers over the same period obtain relative stable abnormal returns within the range of 0.79% to 1.04% on average per month. The *t-statistics* below explore strong evidences that these excess returns are significant differ from zero. Notably, the positive relationship between the abnormal returns and the duration of formation period might indicate that investors require substantial historical information to make better decision and the illiquidity premium need a duration to become functional and obviously.

The combination of having a long position in frequently traded winners and financed by illiquid losers provide a relatively stable positive monthly excess return of 1% on average while fixing the observing period equals to 9 month. The “Winner (High)-Loser (Low)” trading strategy underperforms the best investing combination with a slightly lower magnitude in almost all the cases. Once investors collect sufficient historical information about equities’ past performances and liquidities, creating this type liquidity based momentum strategy yields stable and positive monthly abnormal return ranges from 1.07% to 1.26%. (J=12) This abnormal return might be partly explained by enjoy the benefits of shorting illiquidity losers, and partly resulted by momentum anomaly simultaneously.

The most successful investing decision is to replicating the momentum trading rule on the basis of highly illiquid winners and losers. Selecting stocks based on their historical compound returns over the previous 6 months within the lower liquidity deciles, and then holding the portfolio for the following 9 months. The return difference between highly illiquid winners and losers equals to 1.75% on average per month for the next 9 months after the formation date. Remarkably, the “Winner (Low)-Loser (Low)” portfolios outperform the rest investing strategies for all the cases regardless the duration of formation and holding period. Relying on pervious 9-month historical return and liquidity information, investors have the possibility to construct the most stable and profitable liquidity based momentum portfolio which generates an significant positive monthly abnormal return ranges from 1.56% to 1.72%. However, if investors lack sufficient historical information, the return generating process of this particular combination becomes to be more volatile which happens in the J=3 case. (0.49% to 1.24%) Interestingly, it seems to

have a horizontal trend that extending the holding period might improve the average monthly performance and existing a reversal during the fourth quarter.

There appears to be an increasing vertical trend which is embedded in the table through all types of liquidity based momentum strategies with several negligible exceptions. For instance, by fixing the holding period equal to 6, it is not difficult to discover that the profitability of the combination “Winner (High)-Loser (Low)” increases accompany with the extension of formation period until to a peak of 1.26% per month on average (J=12). The inverted U shape of the average monthly returns might imply that the more historical information were generated by investors the better the momentum strategy would be formed. The inverted U shape of average monthly returns is only a conjecture after observing the table carefully, and this hypothesis need to be tested and confirmed in further analysis.

The empirical results suggest that replicating momentum trading principle within illiquid winners and losers generates the highest average monthly return comparing with other combinations. The magnitude of this abnormal return (roughly 1.64% on average, J=9) is slightly higher than the finding from Jegadeesh and Titman (1993) which suggested an excess return of 1% on average for the following year. The rest strategies underperform the “Winner (Low)-Loser (Low)” portfolios regardless the duration of formation and holding period. Notably, having a long position in frequently traded winners and financed by illiquid losers explore less volatile and positive abnormal return while maintain the formation period switching from 9 to 12 months. The corresponding *t-statistics* indicate whether the average monthly return significantly differs from zero or not. Most of the values of *t-statistic* are larger than 1.96 which implies that the liquidity based momentum strategies are profitable indeed. Hence, aiming to verify the profitability and stability of liquidity based momentum strategies, both the “Winner (High)-Loser (Low)” and “Winner (Low)-Loser (Low)” portfolios are determined as the main targets in the following sections. In addition, the formation period of those two mentioned investing rules is fixed at 9 month from the perspective of the significance of magnitude.

Section IV: Calendar Monthly Performances & Long-term Performances

Calendar Monthly Performances of Two Investigated Trading Strategies

Table III describes the calendar monthly performances of Investing strategy “(Winner-High)-(Loser-Low)” which differs from the duration of formation period. An overview of the table, all types of this particular liquidity based momentum strategy yield positive returns for almost every month, and the occurrences of the negative returns or negligible positive returns depend on specific month to large extent. It seems that the profits generating process does not perform as expected with slightly lower magnitude which less than 1% on average per month at the beginning stage (*Jan & Feb*). For the next following two months, the investing portfolios yield significant positive return which ranges from 0.97% to 1.74%. A small return reversal is discovered during the May which might indirectly related with the “Koningsdag” and holidays concentrating in Netherlands during the entire month. Interestingly, June provides the highest monthly return in this case with the magnitude ranges from 1.23% to 1.92% on average. Remarkably, relative stable positive returns are generated during July and September during the second half of the year. Considering the last two months of the one-year holding period, this particular investing rule seems to be not influenced by the window dressing effect. In the paper of Jegadeesh and Titman (1993), they documented that the average return in November and December might have a relative high magnitude, and this phenomena partial caused by the fact that price pressure arising from portfolio managers selling their losers in those two months for tax deduction or window dressing reasons.

Table IV has the same reporting structure as Table III, which documents the calendar monthly performances of Investing strategy “(Winner-low)-(Loser-Low)” with the only difference of changing formation period. In general, this particular investing strategy yield positive returns with only one exception in March (J=3) regardless the duration of formation period. A “(Winner-low)-(Loser-Low)” investing portfolio which formed on the basis of past 3 month historical information generates a negligible negative return in March with the magnitude of -0.05% on average. April and July provide relative higher returns which are higher than 1.1% per month comparing with the rest of other months. Interestingly, the Investing strategy “(Winner-low)-(Loser-Low)” (J=6) enjoys the most stable return generating process which ranges from 0.84% to 1.74% during the entire year.

Table III

Monthly Performance of Investing Strategy “(Winner-High)-(Loser-Low)”

The investing strategy “(Winner-High)-(Loser-low)” are constructed on the basis of the historical previous *J-month* performances and liquidities. Through double sorting the entire sample, **Winner-High** refers to those past winners which were highly liquid during past *J-month*, and **Loser-Low** refers to those past losers which had relatively lower liquidities within the loser portfolio. The following table reports the average monthly returns of holding this particular liquidity based momentum portfolio for exactly one year with the only difference of variable formation period *J*. The calendar monthly average returns can guide readers to identify which month this particular investing strategy performed the best and which month contributed less comparing with other months. This table intends to explore whether there exists any calendar or seasonal anomaly in the profitability of liquidity based momentum portfolio. The sample period ranges from January 2003 until December 2013. The *t*-statistic below each monthly average returns is calculated by dividing its adjusted standard deviation (control for the number of observations), and the autocorrelations has been taken into consideration during the calculating process.

	Formation Period (<i>J</i>)			
	<i>J</i> =3	<i>J</i> =6	<i>J</i> =9	<i>J</i> =12
Jan.	0.0046 <i>0.53</i>	0.0021 <i>0.28</i>	0.0083 <i>1.01</i>	0.0076 <i>0.89</i>
Feb.	-0.0033 <i>-0.49</i>	-0.0039 <i>-0.49</i>	0.0020 <i>0.22</i>	0.0007 <i>0.08</i>
Mar.	0.0174 <i>2.17</i>	0.0133 <i>1.86</i>	0.0114 <i>1.61</i>	0.0122 <i>1.66</i>
Apr.	0.0102 <i>1.40</i>	0.0097 <i>1.34</i>	0.0129 <i>1.68</i>	0.0105 <i>1.35</i>
May	-0.0025 <i>-0.40</i>	-0.0010 <i>-0.13</i>	-0.0003 <i>-0.04</i>	-0.0011 <i>-0.13</i>
June	0.0192 <i>2.94</i>	0.0189 <i>2.72</i>	0.0145 <i>2.08</i>	0.0123 <i>1.64</i>
July	0.0109 <i>1.55</i>	0.0140 <i>1.86</i>	0.0121 <i>1.57</i>	0.0104 <i>1.51</i>
Aug.	0.0009 <i>0.13</i>	-0.0017 <i>-0.21</i>	-0.0013 <i>-0.17</i>	0.0020 <i>0.27</i>
Sept.	0.0186 <i>3.00</i>	0.0148 <i>2.48</i>	0.0080 <i>1.11</i>	0.0139 <i>1.97</i>
Oct.	0.0193 <i>2.59</i>	0.0061 <i>0.96</i>	0.0048 <i>0.69</i>	0.0046 <i>0.63</i>
Nov.	-0.0029 <i>-0.34</i>	0.0022 <i>0.35</i>	0.0055 <i>0.79</i>	0.0035 <i>0.54</i>
Dec.	0.0178 <i>3.03</i>	0.0086 <i>1.45</i>	0.0095 <i>1.57</i>	0.0073 <i>1.05</i>

Table IV

Monthly Performance of Investing Strategy “(Winner-Low)-(Loser-Low)”

The investing strategy “(Winner-Low)-(Loser-low)” are constructed on the basis of the historical previous *J-month* performances and liquidities. Through double sorting the entire sample, **Winner-Low** refers to those past winners which were highly illiquid during past *J-month*, and **Loser-Low** refers to those past losers which had relatively lower liquidities within the loser portfolio. The following table reports the average monthly returns of holding this particular liquidity based momentum portfolio for exactly one year with the only difference of variable formation period *J*. The calendar monthly average returns can guide readers to identify which month this particular investing strategy performed the best and which month contributed less comparing with other months. This table intends to explore whether there exists any calendar or seasonal anomaly in the profitability of liquidity based momentum portfolio. The sample period ranges from January 2003 until December 2013. The *t*-statistic below each monthly average returns is calculated by dividing its adjusted standard deviation (control for the number of observations), and the autocorrelations has been taken into consideration during the calculating process.

	Formation Period (<i>J</i>)			
	<i>J</i> =3	<i>J</i> =6	<i>J</i> =9	<i>J</i> =12
Jan.	0.0046 <i>0.54</i>	0.0100 <i>1.25</i>	0.0104 <i>1.28</i>	0.0127 <i>1.64</i>
Feb.	0.0126 <i>1.76</i>	0.0087 <i>1.17</i>	0.0146 <i>1.72</i>	0.0141 <i>1.60</i>
Mar.	-0.0005 <i>-0.08</i>	0.0084 <i>1.26</i>	0.0062 <i>0.86</i>	0.0026 <i>0.36</i>
Apr.	0.0110 <i>1.42</i>	0.0174 <i>2.36</i>	0.0192 <i>2.82</i>	0.0183 <i>2.37</i>
May	0.0115 <i>1.55</i>	0.0108 <i>1.26</i>	0.0095 <i>1.04</i>	0.0138 <i>1.63</i>
June	0.0128 <i>1.98</i>	0.0109 <i>1.66</i>	0.0124 <i>1.66</i>	0.0088 <i>1.18</i>
July	0.0126 <i>1.71</i>	0.0175 <i>2.37</i>	0.0150 <i>1.90</i>	0.0150 <i>2.04</i>
Aug.	0.0060 <i>0.80</i>	0.0120 <i>1.34</i>	0.0091 <i>1.13</i>	0.0103 <i>1.30</i>
Sept.	0.0116 <i>1.85</i>	0.0162 <i>2.16</i>	0.0090 <i>1.05</i>	0.0109 <i>1.25</i>
Oct.	0.0138 <i>2.29</i>	0.0103 <i>1.43</i>	0.0083 <i>1.26</i>	0.0054 <i>0.81</i>
Nov.	0.0044 <i>0.56</i>	0.0127 <i>2.14</i>	0.0117 <i>1.68</i>	0.0161 <i>2.75</i>
Dec.	0.0140 <i>1.89</i>	0.0093 <i>1.37</i>	0.0091 <i>1.18</i>	0.0064 <i>0.83</i>

Long-term Performances of Two Investigated Trading Strategies

The aim of extending another twelve months as post-holding period is to track the average returns followed by the holding period, and those numbers might help the reader to recognize the further performance and stability of the liquidity based momentum strategy. A cumulative return will be presented also which targets to report the total cumulative profits that an investor could receive during any specific time period (2 years).

Table V explores both the long-term performances with duration of 24 months and the monthly cumulative profits of the Investing Strategy “(Winner-High)-(Loser-Low)” which formed on the basis of 9-months lagged returns and average liquidity. An overview of the table, this investing strategy yield positive returns during the holding period with the only exception of the third month which contributes a negligible loss of -0.68%. At the end of holding period, the total cumulative return equals to 12.84% which consists with the finding of Jegadeesh and Titman (1993) which claims that the J=6 portfolio will generate an average return of 12% annually. Remarkably, the most outstanding performance occurs in the 7th month after the formation date with a magnitude of 2.59% per month on average which compensates the loss made in the 3rd month. During the post-holding period, several return reversals uniformly distribute over the later return generating process. In addition, the average monthly returns underperform than those returns generated in previous twelve months with relative large magnitude. At the end of post-holding period, the total cumulative return arrives at the peak of 17.08% as a compensation for investor holding this liquidity based momentum strategy for 24 months. It is obviously that the return generating process during the later twelve months is slower than the previous twelve months, which can be entirely explained by the return reversals during the post-holding period. Table VI demonstrates the average monthly returns including both holding period and post-holding period of the Investing Strategy “(Winner-Low)-(Loser-Low)”. This trading rule yields significant positive returns during the entire holding period, and the most extraordinary performance occurs in the 4th month with a magnitude of 3.51% per month on average. A cumulative return of 18.14% can be achieved during the first twelve months, and profits remains to aggregate until 26.45% at the end of post-holding period. Comparing with previous finding, this investing strategy outperform the “(Winner-High)-(Loser-Low)” by 9.37% within duration of 24 months.

Table V

Long-term Performance of Investing Strategy “(Winner-High)-(Loser-Low)” (J=9)

The investing strategy “(Winner-High)-(Loser-low)” applied in the following table is constructed based on the previous 9-month historical information ($J=9$). Through double sorting the entire sample based on past performances and liquidities, **Winner-High** refers to those past winners which were highly liquid during past J -month, and **Loser-Low** refers to those past losers which had relatively lower liquidities within the loser portfolio. The following table reports the average monthly returns including both holding period and post-holding period of this particular investing rule. The first twelve months are regarded as the holding period and the following twelve months are regarded as the post-holding period. This table aims to explore the long-term performance and persistence of this particular portfolio. The cumulative return intends to explore the total profits generating process and structure during a specific period (**24 months**). The sample period ranges from January 2003 until December 2013. The t -statistic below each monthly average returns is calculated by dividing its adjusted standard deviation (control for the number of observations), and the autocorrelations has been taken into consideration during the calculating process.

<i>t</i>	Monthly Return	Cumulative Return	<i>t</i>	Monthly Return	Cumulative Return
1	0.0109 <i>0.81</i>	0.0109	13	0.0055 <i>0.59</i>	0.1339
2	0.0045 <i>0.28</i>	0.0154	14	-0.0008 <i>-0.10</i>	0.1331
3	0.0164 <i>1.66</i>	0.0318	15	0.0059 <i>0.58</i>	0.1390
4	0.0259 <i>2.18</i>	0.0577	16	-0.0014 <i>-0.16</i>	0.1376
5	-0.0068 <i>-0.45</i>	0.0509	17	0.0069 <i>0.86</i>	0.1444
6	0.0182 <i>2.05</i>	0.0691	18	0.0104 <i>0.95</i>	0.1549
7	0.0257 <i>2.29</i>	0.0948	19	-0.0030 <i>-0.29</i>	0.1519
8	0.0038 <i>0.30</i>	0.0987	20	-0.0070 <i>-0.84</i>	0.1449
9	0.0097 <i>0.93</i>	0.1083	21	0.0062 <i>0.62</i>	0.1511
10	0.0071 <i>0.70</i>	0.1155	22	0.0023 <i>0.24</i>	0.1534
11	0.0041 <i>0.40</i>	0.1195	23	0.0071 <i>0.74</i>	0.1605
12	0.0088 <i>1.01</i>	0.1284	24	0.0103 <i>1.21</i>	0.1708

Table VI

Long-term Performance of Investing Strategy “(Winner-Low)-(Loser-Low)” (J=9)

The investing strategy “(Winner-Low)-(Loser-low)” applied in the following table is constructed based on the previous 9-month historical information ($J=9$). Through double sorting the entire sample based on past performances and liquidities, **Winner-Low** refers to those past winners which were highly illiquid during past J -month, and **Loser-Low** refers to those past losers which had relatively lower liquidities within the loser portfolio. The following table reports the average monthly returns including both holding period and post-holding period of this particular investing rule. The first twelve months are regarded as the holding period and the following twelve months are regarded as the post-holding period. This table aims to explore the long-term performance and persistence of this particular portfolio. The cumulative return intends to explore the total profits generating process and structure during a specific period (**24 months**). The sample period ranges from January 2003 until December 2013. The t -statistic below each monthly average returns is calculated by dividing its adjusted standard deviation (control for the number of observations), and the autocorrelations has been taken into consideration during the calculating process.

t	Monthly Return	Cumulative Return	t	Monthly Return	Cumulative Return
1	0.0123 <i>1.06</i>	0.0123	13	0.0083 <i>0.72</i>	0.1897
2	0.0147 <i>1.05</i>	0.0271	14	0.0145 <i>1.56</i>	0.2042
3	0.0196 <i>2.19</i>	0.0467	15	-0.0086 <i>-0.76</i>	0.1956
4	0.0351 <i>3.86</i>	0.0818	16	0.0017 <i>0.18</i>	0.1973
5	0.0029 <i>0.20</i>	0.0847	17	0.0167 <i>1.74</i>	0.2140
6	0.0156 <i>1.98</i>	0.1003	18	0.0089 <i>0.67</i>	0.2230
7	0.0305 <i>2.70</i>	0.1309	19	-0.0021 <i>-0.20</i>	0.2209
8	0.0107 <i>0.84</i>	0.1416	20	0.0074 <i>0.76</i>	0.2282
9	0.0082 <i>0.66</i>	0.1498	21	0.0099 <i>0.83</i>	0.2381
10	0.0080 <i>0.79</i>	0.1578	22	0.0087 <i>1.02</i>	0.2468
11	0.0178 <i>1.69</i>	0.1755	23	0.0051 <i>0.56</i>	0.2519
12	0.0059 <i>0.52</i>	0.1814	24	0.0126 <i>1.22</i>	0.2645

Section V: The Profitability of Liquidity Based Momentum Portfolios during Financial Crisis

This section documents the profitability of liquidity based momentum portfolio described in section II over the financial crisis period which defined from January 2007 to December 2008. All stocks with available and informative returns and average liquidities data in the J months preceding the portfolio formation date are included in the sample from which the buy and sell portfolios are constructed.

As known to all, the 2008 financial crisis has tremendous negative impacts on the stock markets across the world. These mentioned profitable financial instruments and optimal strategies become to be liabilities to investors and portfolio managers. The purpose of writing this section is to identify whether the liquidity based momentum strategy still works or remains a wise choice for investors under the pressure of depression.

Average Monthly Return of the “Components” during the Financial Crisis

Table VII demonstrates the average monthly returns of the different components of the liquidity based momentum portfolios during the financial crisis period, totally 64 portfolios are summarized in the table separately. All treatment procedures are similar with methodology in section III, except sample range, current table are investigated between January 2007 to December 2008. Results are compared with the entire investigating horizon in order to identify whether economic distress have impacts on the overall outcomes.

As is well known that stock prices dramatically declined during financial crisis period, thus, it is not extraordinary that all the signs of average monthly returns in financial depression period are negative, without any exception. In general, illiquid winners have a relative better performance than those frequently traded winners regardless the duration of formation and holding period. Winners with relative low liquidities moderate approximately -1.18% excess losses per month with a diminishing trend when widening the holding period. The best scenario in financial crisis period happens in 9-6 combination, which minimizes a monthly loss of -0.88%. Contrarily, the worst case is 3-3 combination, which suffering a monthly loss of -1.79%. Comparing with highly liquid winners portfolios which incur significantly negative returns of -1.32% on average per month. Existing return difference of

these two types of winner portfolios implies that having a long position in highly illiquid winners is an optimal decision for investors.

Considering the shorting side of liquidity based momentum strategy, having a shorting position in highly liquid losers generates a positive return of 1.93% on average. However, the magnitude of returns appears to abate while increasing the holding period and keeping formation period constant. Comparing between these two loser portfolios, it is obviously that losers with relative low liquidities underperform approximately twice as much as the same combination in highly liquid loser deciles. Shorting illiquidity loser deciles contribute to a significant average positive return of 4.14% per month.

On the whole, the general trend has been found in the longing side of liquidity based momentum strategy. Low liquid winners tend to outperform than those frequently traded winners, and most of these abnormal losses appear to be lessened irrespective of changing in formation or holding period. Consistent with previous literatures, the empirical results indicate that shorting losers can be regarded as a complementary strategy to the magnitude of momentum profits. The illiquid losers underperform significantly than those frequently traded losers, therefore, this paper discover shorting losers with relative low liquidities is the most optimal strategy within financial crisis period.

Average Monthly Return of Four Types of Momentum Strategies during the Financial Crisis

Table VIII manifests the average monthly performances of totally 64 liquidity based momentum trading strategies covering the financial crisis period which defined from January 2007 to December 2008. In addition, each double-sorted decile contains fifteen stocks which represents 10% of the entire sample. By widening formation period, these investing strategies are classified into four panels. This table aims to investigate whether different combination of liquidity based momentum portfolios would have effect on its profitability, and the most profitable investing strategy which generates highest abnormal return with less volatile.

Table VII

Average Monthly Return of the “Components” during the Financial Crisis

At the end of each month all stocks which were traded on the Euronext Amsterdam Exchange are ranked in ascending order based on previous *J-month* performances. The stocks in the bottom decile (lowest previous performance) are assigned to the *Loser* portfolio, those in the top decile (highest previous performance) to the *Winner* portfolio at the first sorting phrase. The secondary sorting stage takes place within both the *Loser & Winner* portfolios on the basis of past *J-month* average liquidities. The primary *Winner* portfolio is separated into two equally-divided deciles: *Winner-High* refers to those past winners which were highly liquid during past *J-month*, and *Winner-Low* refers to those past winners which had relatively lower liquidity. (The same principle is applied in the *Loser* portfolio) Notice that the rolling window is fixed at every three months, and each double-sorted decile contains fifteen stocks which represents 10% of the entire sample. Those portfolios are initially equally weighted and held for *K-month*. The following table gives the average monthly buy-and-hold returns on these portfolios for the financial crisis period which defined from January 2007 to December 2008. This table intends to explore the profitability of different components of the liquidity based momentum portfolios during the economic depression period as a comparison with the entire sample, and identify whether those deciles will deviate in direction or magnitude.

Formation Period (<i>J</i>)	Portfolio	Holding Period (<i>K</i>)			
		3	6	9	12
3	Winner (High)	-0.0178	-0.0148	-0.0122	-0.0096
	Winner (Low)	-0.0179	-0.0124	-0.0096	-0.0118
	Loser (High)	-0.0285	-0.0198	-0.0131	-0.0118
	Loser (Low)	-0.0430	-0.0364	-0.0357	-0.0322
6	Winner (High)	-0.0142	-0.0149	-0.0105	-0.0120
	Winner (Low)	-0.0141	-0.0102	-0.0109	-0.0089
	Loser (High)	-0.0279	-0.0197	-0.0157	-0.0116
	Loser (Low)	-0.0408	-0.0377	-0.0367	-0.0331
9	Winner (High)	-0.0134	-0.0137	-0.0135	-0.0139
	Winner (Low)	-0.0090	-0.0088	-0.0116	-0.0114
	Loser (High)	-0.0267	-0.0210	-0.0158	-0.0124
	Loser (Low)	-0.0521	-0.0464	-0.0434	-0.0381
12	Winner (High)	-0.0099	-0.0126	-0.0138	-0.0149
	Winner (Low)	-0.0133	-0.0113	-0.0142	-0.0131
	Loser (High)	-0.0310	-0.0239	-0.0170	-0.0129
	Loser (Low)	-0.0545	-0.0488	-0.0435	-0.0402

It is apparent that the momentum portfolio formed by highly traded winners and losers is the worst decision in this paper. As can be seen from the table, return differences between highly liquid winners and losers are relatively low and almost insignificantly deviate from zero. Interestingly, the worst investing strategy decision generates average monthly returns range from -0.2% to 2.11%, in addition, the best and worst are appeared when keeping formation period constant as 12 and increasing holding period.

Moreover, substituting the long side by past illiquid winners, the investing scenario of “Winner(low)-Loser(high)” improves the performance by widening the observing period. In general, the average returns generated from creating investing portfolio based on longing in past illiquid winners and selling highly liquid losers has a diminishing trend along with the extension of holding period regardless of formation period.

The combination of having a long position in frequently traded winners and financed by illiquid losers provide a relatively stable positive monthly excess return of 2.82% on average. While switching the observing period from 9 to 12, the monthly average returns of investing scenario “ Winner(high)-Loser(low)” seems to have a decreasing trend accompany with the extension of holding period. In approximately all the cases, the “Winner (High)-Loser (Low)” trading strategy underperforms the best investing combination with a slightly lower magnitude. However, selecting stocks based on their historical compound returns over the previous 12 months within the “Winner(High)-Loser(Low)” trading strategy, and then holding the portfolio for the following 3 months generates to the highest return of 4.46%. This abnormal return might be partly explained by enjoy the benefits of shorting illiquidity losers, and partly resulted by momentum anomaly simultaneously.

Replicating the momentum trading rule on the basis of highly illiquid winners and losers can be regarded as the most successful investing decision. Selecting stocks based on their historical compound returns over the previous 9 months within the lower liquidity deciles and then holding the portfolio for the following 3 months. The return difference between highly illiquid winners and losers equals to 4.31% on average per month for the next 3 months after the formation date. Remarkably, the “Winner (Low)-Loser (Low)” portfolios outperform the rest of investing strategies scenarios, with the only exception of the 12-3 combination in “Winner(High)-Loser(Low)” portfolios. However, it is contradictory with the

empirical finding discovered in table IV which indicates the return generating process of this particular combination becomes to be less volatile when investors has more valuable information. It seems that the most stable return generating process occurs when investors constructing their portfolios on the basis of semi-annual.

The empirical results in previous section suggest that replicating momentum trading principle within illiquid winners and losers generates the highest average monthly return comparing with other combinations during the normal economic condition. However, this section found inconsistent result that the highest magnitude of abnormal return (roughly 4.46% per month on average) occurs in the investing rule “Winner(High)-Loser(Low)”. The rest strategies underperform the “Winner (Low)-Loser (Low)” portfolios regardless the duration of formation and holding period. Notably, having a long position in frequently treaded winners and financed by illiquid losers explore less volatile and positive abnormal return while maintain the formation period switching from 3 to 6 months. The corresponding *t-statistics* indicate whether the average monthly return significantly differs from zero or not. Most of the values of *t-statistic* are larger than 1.96 which implies that the liquidity based momentum strategies are profitable indeed.

Table VIII

Average Monthly Return of Four Types of Momentum Strategies during the Financial Crisis

At the end of each month all stocks which were traded on the Euronext Amsterdam Exchange are ranked in ascending order based on previous *J-month* performances. The stocks in the bottom decile (lowest previous performance) are assigned to the *Loser* portfolio, those in the top decile (highest previous performance) to the *Winner* portfolio at the first sorting phrase. The secondary sorting stage takes place within both the *Loser & Winner* portfolios on the basis of past *J-month* average liquidities. The primary *Winner* portfolio is separated into two equally-divided deciles: *Winner-High* refers to those past winners which were highly liquid during past *J-month*, and *Winner-Low* refers to those past winners which had relatively lower liquidity. (The same principle is applied in the *Loser* portfolio) Through having a long position in *Winner* deciles and being financed by *Losers*, it is possible to construct four types (2×2) of investing strategies which consist with the idea of momentum portfolio in total. *Panel A* summarizes the average monthly performances of these four investing strategies which formed on the basis of past 3-month historical information. Panel B, C, and D have the same reporting structure with the only difference of extended formation period. Notice that the rolling window is fixed at three months no matter how long the formation period is, and each double-sorted decile contains fifteen stocks which represents 10% of the entire sample. Those portfolios are initially equally weighted and held for *K-month*. The following tables give the average monthly buy-and-hold returns on these investing strategies for the financial crisis period which defined from January 2007 to December 2008. This table intends to explore the profitability of different combinations of the liquidity based momentum portfolios, and identify which combination contributes a relatively significant and stable excess return during the economic depression period. The main purpose to construct this table is to compare the average monthly performances of different combinations with the normal economic environment. In addition, the trend of abnormal returns is demonstrated while extending the holding period. The *t*-statistic below each monthly average returns is calculated by dividing its adjusted standard deviation (control for the number of observations), and the autocorrelations has been taken into consideration during the calculating process.

		Panel A. Average Monthly Performances of Investing Strategies (<i>J</i> =3)			
		Holding Period (<i>K</i>)			
Formation Period (<i>J</i>)	Portfolio	3	6	9	12
3	Winner (High)-Loser (High)	0.0107	0.0050	0.0009	0.0022
	(<i>t</i> -Statistic)	1.27	0.57	0.12	0.29
	Winner (High)-Loser (Low)	0.0252	0.0216	0.0235	0.0226
	(<i>t</i> -Statistic)	2.98	3.55	4.53	4.89
	Winner (Low)-Loser (High)	0.0106	0.0075	0.0035	0.0001
	(<i>t</i> -Statistic)	1.43	1.06	0.59	0.01
Winner (Low)-Loser (Low)	0.0251	0.0240	0.0261	0.0204	
(<i>t</i> -Statistic)	2.62	3.40	5.75	5.01	

Panel B. Average Monthly Performances of Investing Strategies ($J=6$)

Formation Period (J)	Portfolio	Holding Period (K)			
		3	6	9	12
6	Winner (High)-Loser (High)	0.0137	0.0049	0.0052	-0.0004
	(t -Statistic)	1.45	0.52	0.65	-0.06
	Winner (High)-Loser (Low)	0.0267	0.0229	0.0262	0.0210
	(t -Statistic)	2.92	3.10	3.45	3.53
	Winner (Low)-Loser (High)	0.0138	0.0095	0.0048	0.0027
	(t -Statistic)	1.64	1.14	0.61	0.41
	Winner (Low)-Loser (Low)	0.0268	0.0275	0.0258	0.0241
	(t -Statistic)	2.51	3.82	3.75	4.44

Panel C. Average Monthly Performances of Investing Strategies ($J=9$)

Formation Period (J)	Portfolio	Holding Period (K)			
		3	6	9	12
9	Winner (High)-Loser (High)	0.0132	0.0072	0.0023	-0.0015
	(t -Statistic)	1.54	0.63	0.23	-0.24
	Winner (High)-Loser (Low)	0.0387	0.0326	0.0299	0.0242
	(t -Statistic)	2.66	3.17	4.16	5.36
	Winner (Low)-Loser (High)	0.0177	0.0121	0.0041	0.0010
	(t -Statistic)	2.48	1.62	0.42	0.19
	Winner (Low)-Loser (Low)	0.0431	0.0376	0.0317	0.0267
	(t -Statistic)	2.90	3.62	4.29	5.89

Panel D. Average Monthly Performances of Investing Strategies ($J=12$)

Formation Period (J)	Portfolio	Holding Period (K)			
		3	6	9	12
12	Winner (High)-Loser (High)	0.0211	0.0113	0.0031	-0.0020
	(t -Statistic)	1.95	1.00	0.33	-0.28
	Winner (High)-Loser (Low)	0.0446	0.0362	0.0297	0.0253
	(t -Statistic)	3.99	4.53	4.38	4.23
	Winner (Low)-Loser (High)	0.0177	0.0127	0.0028	-0.0002
	(t -Statistic)	1.79	1.46	0.30	-0.04
	Winner (Low)-Loser (Low)	0.0412	0.0376	0.0294	0.0271
	(t -Statistic)	3.31	3.80	3.76	4.75

Long-term Performances of Two Investigated Trading Strategies during Financial Crisis

Table IX explores both the long-term performances with duration of 24 months and the monthly cumulative profits of the Investing Strategy “(Winner-High)-(Loser-Low)” which formed on the basis of 9-months lagged returns and average liquidity during the economic depression period. During the first quarter of the holding period, this investing strategy performs outstandingly and cumulates an abnormal return of 11.6% which implies an average monthly return of approximately 3.86% is obtained. Remarkably, the most outstanding performance occurs in the 1st month after the formation date with a magnitude of 4.05% per month on average. The cumulative return climbs from 11.6% to 26.9% within the following 6 months after the first quarter, and the return generating process slows down during the later holding period finally ends up with a magnitude of 29.07% at the end of holding period. Referring the post-holding period, the worst performance occurs in the 19th month of the entire life cycle which suffers a loss of -2.98% on average. The return accumulating speed decreases during the post-holding period which indicates that the marginal return is diminishing during the second twelve months. Eventually, the cumulative return ends up at 39.36% which is approximately 2 times larger than the normal case (17.08%). Table X demonstrates the average monthly returns including both holding period and post-holding period of the Investing Strategy “(Winner-Low)-(Loser-Low)” during the financial crisis. This trading rule yields significant positive returns during the entire holding period, and the most extraordinary performance occurs in the 5th month with a magnitude of 4.85% per month on average. The first quarter contributes a cumulative return of 12.93% which implies that an average monthly return of 4.31% can be generated within the first months. A cumulative return of 32.09% can be achieved during the first twelve months, and profits remains to aggregate until 52.39% at the end of post-holding period. Comparing with previous finding, this investing strategy outperforms the “(Winner-High)-(Loser-Low)” during the crisis (39.36%) by 13.03% within duration of 24 months.

Hence, all the evidences from those two tables illustrated above suggest that the liquidity based momentum strategy become to be more profitable during the economic downturns. This result is mainly due to shorting the worse loser portfolios during the crisis directly enhances the profitability of the underlying investing strategy regardless the length of the formation period.

Table IX

Long-term Performance of Investing Strategy “(Winner-High)-(Loser-Low)” (J=9) during the Financial Crisis

The investing strategy “(Winner-High)-(Loser-low)” applied in the following table is constructed based on the previous 9-month historical information ($J=9$). Through double sorting the entire sample based on past performances and liquidities, **Winner-High** refers to those past winners which were highly liquid during past J -month, and **Loser-Low** refers to those past losers which had relatively lower liquidities within the loser portfolio. The following table reports the average monthly returns including both holding period and post-holding period of this particular investing rule during the economic depression period. The first twelve months are considered as the holding period and the following twelve months are regarded as the post-holding period. This table aims to compare the long-term performance and profit accumulating trend of this particular portfolio with the normal case. The cumulative return intends to explore the total profits generating process and structure during a specific period (**24 months**). The sample period ranges from January 2007 to December 2008. The t -statistic below each monthly average returns is calculated by dividing its adjusted standard deviation (control for the number of observations), and the autocorrelations has been taken into consideration during the calculating process.

<i>t</i>	Monthly Return	Cumulative Return	<i>t</i>	Monthly Return	Cumulative Return
1	0.0405 2.20	0.0405	13	0.0377 1.70	0.3284
2	0.0351 1.24	0.0756	14	0.0013 0.07	0.3297
3	0.0404 3.18	0.1160	15	-0.0060 -0.20	0.3237
4	0.0157 0.57	0.1317	16	0.0014 0.06	0.3251
5	0.0301 1.27	0.1617	17	0.0148 1.00	0.3398
6	0.0340 2.26	0.1957	18	0.0114 0.29	0.3513
7	0.0340 1.62	0.2298	19	-0.0298 -1.17	0.3215
8	0.0116 0.46	0.2414	20	-0.0087 -0.63	0.3128
9	0.0276 1.88	0.2690	21	0.0179 0.57	0.3307
10	0.0140 0.60	0.2830	22	0.0114 0.50	0.3421
11	0.0025 0.08	0.2855	23	0.0129 1.09	0.3550
12	0.0051 0.20	0.2907	24	0.0385 1.98	0.3936

Table X

Long-term Performance of Investing Strategy “(Winner-Low)-(Loser-Low)” (J=9) during the Financial Crisis

The investing strategy “(Winner-Low)-(Loser-low)” applied in the following table is constructed based on the previous 9-month historical information (J=9). Through double sorting the entire sample based on past performances and liquidities, **Winner-Low** refers to those past winners which were highly illiquid during past **J-month**, and **Loser-Low** refers to those past losers which had relatively lower liquidities within the loser portfolio. The following table reports the average monthly returns including both holding period and post-holding period of this particular investing rule during the economic depression period. The first twelve months are considered as the holding period and the following twelve months are regarded as the post-holding period. This table aims to compare the long-term performance and profit accumulating trend of this particular portfolio with the normal case. The cumulative return intends to explore the total profits generating process and structure during a specific period (**24 months**). The sample period ranges from January 2007 to December 2008. The *t*-statistic below each monthly average returns is calculated by dividing its adjusted standard deviation (control for the number of observations), and the autocorrelations has been taken into consideration during the calculating process.

<i>t</i>	Monthly Return	Cumulative Return	<i>t</i>	Monthly Return	Cumulative Return
1	0.0409 2.22	0.0409	13	0.0462 1.24	0.3671
2	0.0454 2.17	0.0863	14	0.0176 1.19	0.3847
3	0.0430 3.12	0.1293	15	-0.0126 -0.33	0.3721
4	0.0278 1.42	0.1571	16	0.0233 0.88	0.3954
5	0.0485 2.17	0.2055	17	0.0439 1.58	0.4393
6	0.0198 1.00	0.2253	18	-0.0005 -0.01	0.4388
7	0.0457 1.80	0.2710	19	-0.0089 -0.26	0.4299
8	0.0096 0.32	0.2807	20	0.0362 1.36	0.4660
9	0.0049 0.21	0.2855	21	0.0161 0.58	0.4822
10	0.0265 0.80	0.3120	22	0.0061 0.34	0.4883
11	0.0008 0.03	0.3129	23	0.0107 0.57	0.4990
12	0.0080 0.28	0.3209	24	0.0249 1.48	0.5239

Section VI: Conclusion

This paper documents the profitability and persistence of multifarious kinds of liquidity based momentum trading portfolios during the period 2003 to 2013 within a specific country: the Netherlands. In addition, this paper creates a linkage between past returns and historical liquidities, and guides practitioners to construct profitable and stable investing strategies based on these two historical indicators simultaneously.

Two liquidity based momentum portfolios: “(Winner-High)-(Loser-Low)” and “(Winner-Low)-(Loser-Low)” which constructed based on the previous 9-month past returns and historical average liquidities are investigated in detail through the research.

The statistical results indicate that the best investing strategy “(Winner-Low)-(Loser-Low)” realizes an average monthly return of 1.51% following 12 months after the formation date, and profits seems to continuously accumulate until 26.45% at the end of post-holding period (24 months). Comparing with the finding of Jegadeesh and Titman (1993), they documents that the strategy which selects stocks based on their past 6-month returns and holds them for 6 months, realizes an excess return of 1% per month on average. The return difference of 0.51% per month on average can be explained by adding liquidity indicator during the sorting phrase. Notably, even there exists an observable return reversal within the post-holding period, the profit generating process continue to accumulate profits with a relative lower speed comparing with previous 12 months. This phenomenon might be partial driven by enjoying an illiquid premium. This result confirms the finding introduced by Amihud & Mendelson (1986) which suggests that our predetermined liquidity indicator: bid-ask spread is an equity pricing indicator indeed.

Remarkably, this paper also explores the performance of liquidity based momentum strategy during the 2008 financial crisis, and the evidences suggest that our investing strategy will become more profitable during the economic downturns comparing with the normal situation. However, considering the restrictions and limits of short selling illiquid stocks, the introduced investing rule cannot be constructed during such horrible time and only seems to be applicable and feasible in the theoretical framework.

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