Aleksandra Szutenberg[365]
V rok SSM, Ekonomia
Finanse Międzynarodowe i Bankowość

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THE INFLUENCE OF VARIATIONS IN LIQUIDITY ON EXPECTED STOCK RETURNS

Introduction

The aim of this paper is to show how variations in aggregate liquidity affect asset prices and expected returns. This article reviews the relationships between time variations in liquidity, and innovations in aggregate liquidity, and their effect on the present and expected returns.

Liquidity is a complex concept. Different authors present different definitions of liquidity and formulate various measures of liquidity or illiquidity risk. The literature covering the subject of liquidity is wide thus this paper focuses on time – series effects of illiquidity and on the effects of liquidity risk on expected stock returns. Also it focuses on the influence of changes in aggregate liquidity on expected stock returns. Liquidity is risky and changes over time both from individual and aggregate point of view. In the theoretical papers authors agree that liquidity risk is an important determinant of required stock returns and over time, expected market illiquidity decreases contemporary securities' prices and positively influence future stock returns.

The paper proceeds as follows: Section 2 introduces a theoretical framework. It explains simple definition of individual asset and aggregate liquidity and presents the most common sources of illiquidity. In subsection 2.2, the relationship between time variation and changes in aggregate liquidity as well as the explanation of the 'small firm effect' are presented. Section 3 reviews different looks at liquidity pricing. Three points of view for measuring liquidity are demonstrated. The first is introduced by Amihud, who focuses on measuring illiquidity[366]. The second presents Acharya's and Pedersen's point of view, which measure the level of liquidity risk[367]. The third shows the measure introduced by Pastor and Stambaugh, which focuses on measuring of aggregate liquidity[368]. Empirical evidence by these authors is also reviewed in this section. Section 4 closes with a summary of the paper and conclusion remarks.

1. Theoretical framework

1.1. Liquidity and sources of illiquidity

Liquidity is a complex concept. There are a lot of theoretical definitions of liquidity. To use the simplest meaning, liquidity is the ease of trading the security. When considering

[365] Praca napisana pod kierunkiem dr Marii Kasch, Universität Mannheim oraz dra Sławomira Antkiewicza, Instytut Handlu Zagranicznego, Wydział Ekonomiczny Uniwersytetu Gdańskiego.
[366] Y. Amihud, *Illiquidity and stock returns: Cross-section and time-series effects*, „Journal of Financial Markets" 2002, vol. 5, s. 31 – 56.
[367] V. Acharya, L. H. Pedersen, *Asset pricing with liquidity risk*, „Journal of Financial Economics" 2005, vol. 77, s. 375 - 410.
[368] L. Pastor, R. F. Stambaugh, *Liquidity risk and expected stock returns*, "Journal of Political Economy" 2003, vol. 111, s. 642 – 685.

aggregate liquidity, consider the liquidity of the whole market. The knowledge of liquidity-based asset pricing can help to explain many financial market phenomenon, such as, time- series effect of illiquidity or how a decline in stock liquidity results in a reduction in current stock prices and an increase in expected stock returns. It can also resolve such asset pricing puzzles as the "small firm effect", and explain how small and very illiquid stocks can earn very high returns.

Liquidity varies over the time. There are a lot of reasons for non-permanent illiquidity. The main sources of illiquidity are as follows:

- transaction costs – such as brokerage fees, order- processing costs or transaction taxes,
- buyers further costs upon a future sale,
- demands pressure – not all traders are present in the market at all times, in case of necessity of a quick sale of a security, the possible buyers may not be immediately available,
- inventory risk – risk that the price of the security which is bought and held by the market maker will drop in the future – the compensation for that risk is a cost for a seller,
- private information – buyer may suspect that a seller has some fundamental information about the traded security and for that reason want to sell it,
- search frictions – difficulties with finding a counterpart who is willing to capture a reverse position for a particular security, especially relevant for a non-competitive OTC market,
- trade-off between search and quick sale at discounted prices,
- time variation of liquidity – investors require a compensation for being exposed to liquidity risk, and
- market innovations.

1.2 Time variation in aggregate liquidity

Liquidity varies over the time. Investors are uncertain what transaction costs will occur in the future while selling an asset. If investors predict higher market illiquidity, they will price their assets so they will earn higher return in the future. The risk becomes even higher when there may be a need to sell a security very quickly. If liquidity costs and risks affect the expected returns by investors, it will also affect their corporations and their cost of capital. Investors that are exposed to liquidity risk require a compensation for that risk. The compensation for the risk is called stock excess returns, also known as 'risk premium' or "premium for illiquidity'. Many studies prove that required stock excess return reflects a compensation for expected market illiquidity. The relationship between the expected excess returns and expected illiquidity is positive. Furthermore, unexpected illiquidity, considered as a prediction for future illiquidity, lowers stock prices and intensifies the effect of the increase in expected stock returns.

The effects of market illiquidity on expected stock returns vary between stocks that differ on an individual level of liquidity. The high increase in expected illiquidity can cause two effects[369]:

- as written above – rise in expected return and drop in present stock prices, or
- 'flight to liquidity' – replacement of less liquid stocks with more liquid.

These two effects affect high-liquidity stock in the same direction, that means the effect of market illiquidity becomes stronger. However the higher demand for liquid stocks, as well as

[369] Y. Amihud, op. cit.

the substitution of less liquid, mitigates their price decrease and weakens the effect of market illiquidity. Empirical support of that effect is provided by Amihud, who found that: "as a result, small, illiquid stocks should experience stronger effects of market illiquidity – a greater positive effect of ex ante return and a more negative effect of unexpected illiquidity on contemporaneous return. For large stocks both effects should be weaker, because these stocks become relatively more attractive in times of dire liquidity[370]."

2. Models and empirical evidence of liquidity pricing

In an economy with frictions, the price of a security is a function of the following: the security's cash flows, the cash flows of other securities, the utility function of all agents, agents' endowments, and additionally security's liquidity and aggregate liquidity of the market. There are a lot of studies trying to find the best measure of liquidity risk. They vary in terms of methodology which is used and the subject of the measurement. Some economists try to find a measure for liquidity, others focus on illiquidity measures while others work on finding the best measure for liquidity risk. However all authors agree that liquidity is an important part of expected exceed returns. In this section, different measures of (il)liquidity and their influence on required stock returns are discussed.

There are authors that measure liquidity as a bid-ask spread, and others that measure the stock illiquidity by the price impact, that being the response in price to the order size and by the fixed cost of trading. These measures, however, require microstructure data on transactions that are not available in most markets. For that reason Amihud formulated a simple measure of illiquidity, calculated from daily data on returns and volume that are easy available for most markets over long time periods.

2.1. Amihud's measure of illiquidity

Amihud's measure of illiquidity, called $ILLIQ_{iy}$ is defined as the average ratio of the daily absolute return to the trading volume, in dollars, of the day:

$$ILLIQ_{iy} = 1/D_{iy} \sum_{t=1}^{D_{iy}} |R_{iyd}| / VOLD_{ivyd} \qquad (1),$$

where R_{iyd} is the return on stock i on day d of year y and, $VOLD_{iyd}$ is the respective daily volume in dollars and D_{iy} is the number of days for which data are available for stock i in year y. The ratio gives the absolute price change per dollar of daily trading volume and can be interpreted as the daily response of the price to order flow. If the value of ILLIQ is high, the stock is illiquid. Amihud provides to the model also a measure of stock total risk – SDRETiy – which is a standard deviation of the daily return on stock i in year y. The correlation between ILLIQ and SDRET is positive, but low. Theoretically, it can be interpreted that stock price variance has a positive effect on the required stock return.

[370] Ibidem.

Amihud conducts the examination for stocks traded in the New York Stock Exchange in the years 1963-1997[371]. The results presented by Amihud strongly support the hypothesis that illiquidity is priced. New tests of the influence of illiquidity over time conducted by him show that expected market illiquidity positively affects ex ante stock excess returns and unexpected illiquidity negatively influence present stock returns. Both effects are significant and sufficient.

Examination conducted by Amihud also explains the 'small firm effect'. The effects of both expected an unexpected liquidity risks are greater on the returns of small, illiquid stocks. The 'small firm effect' appears due to changes in aggregate liquidity, especially in the times of dire illiquidity, when we can observe a 'flight to liquidity'. Larger, more liquid stocks are more attractive to investors. Small shares are exposed to greater illiquidity risk, and what should result in higher premium for illiquidity, means higher excess returns. This situation models the October 1987 crash. Aggregate liquidity plummeted and investors decided to focus on more liquid stocks to minimize the high risk. Price changes presented in historical data prove a great 'flight to liquidity'.

Amihud in his findings came to the conclusion that stock excess returns reflect both the higher risk and the lower liquidity of stock compared to Treasury securities[372].

2.2 Liquidity risk pricing by Acharya and Pedersen

Acharya and Pedersen in their studies present a liquidity- adjusted asset pricing model. They assume that liquidity is risky and has commonality, meaning it varies over time, not only for individual stocks but also for the market as a whole. Liquidity- adjusted asset pricing model helps explain[373]:

- how asset prices are influenced by liquidity risk and commonality in liquidity,
- that return sensitivity to aggregate liquidity and average liquidity are also priced,
- that liquidity is correlated with returns and can predict ex ante returns.

In the liquidity- adjusted asset pricing model conducted by Acharya and Pedersen required excess return is a sum of expected relative illiquidity cost and the four betas (covariances) imply four different risk premiums. Betas are dependent on the security's payoff and liquidity risks.

Behind the first beta, there is a covariance between the asset's return and market's return. The required return on a security increases linearly with market returns, that is, the stock expected return reaction to the growth in market returns is positive. The second beta, which is the first liquidity beta, implies a covariance between the asset's illiquidity and the market illiquidity. The relationship is positive for majority of securities because of commonality in liquidity. Expected stock returns increases with this covariance. The explanation of this phenomenon is that investors want to be compensated for having an asset in their portfolio which becomes illiquid when the market becomes illiquid in general. The second liquidity beta measures the exposure of assets to market illiquidity. This beta, for the most securities, is negative because an increase in market illiquidity generally reduces asset prices. Investors can accept lower returns on a stock with a higher return in times of aggregate illiquidity. It implies that, the more negative the exposure of the asset to market illiquidity is, the higher the expected and required returns are. The last, but not least, liquidity beta is a sensitivity of security's

[371] The methodology may be seen: Y. Amihud, *Illiquidity and stock returns: Cross-section and time-series effects*, „Journal of Financial Markets" 2002, vol. 5, s. 31–56.
[372] Y. Amihud, op. cit.
[373] V. Acharya, L. H. Pedersen, op. cit.

illiquidity to market conditions and is also generally negative. It means that required return becomes higher it the sensitivity is more negative. It follows that investors are ready to accept a lower return on an asset which is liquid in a bear market, because in down markets, the ability to sell security easily is especially valuable[374].

In their empirical evidence Acharya and Pederson use the Amihud's measure of illiquidity presented in section 3.1. Their empirical example shows an interesting finding that securities, when they are illiquid, they also tend to have high liquidity risk and high liquidity betas, those being: high commonality in liquidity with the market liquidity, high return sensitivity to market liquidity and high liquidity sensitivity to market returns. Here appears the question, what influences expected returns most significantly: liquidity, liquidity risk or market risk? There is some evidence that the total effect of three liquidity risks affects expected returns over the market risk and the level of liquidity.

As stated in Amihud this model also presents that if liquidity is persistent, it helps predict future returns and liquidity co-moves with present returns. A high illiquidity shock today predicts high ex ante illiquidity, which increases future expected returns and declines today's prices[375].

The liquidity-based asset pricing model derived from Acharya and Pedersen is used by Amihud, Mendelson and Pedersen in the article 'Liquidity and Asset Prices, Foundation and Trends in Finance' 2006. The reasons for that can be that it explain data better than the standard CAPM with the same degrees of freedom. It also fits better for portfolios arranged by liquidity, liquidity variation and size. It still can be exploited, because it does not explain the book- to-market effect.

2.3 Pricing of aggregate liquidity by Pastor and Stambaugh

In their studies Pastor and Stambaugh present one more, different approach of liquidity pricing. They are interested in pricing the aggregate liquidity and focus on liquidity risk which is considered as the sensitivity of returns to fluctuations in market wide liquidity. They give a definition of the liquidity, smoothly different than stated before: liquidity "denotes the ability to trade large quantities quickly, at low costs, and without moving the price". It seems reasonable for these authors that a lot of investors would like to earn higher expected returns on assets whose returns are more sensitive to changes in aggregate liquidity. Basic idea of the model constructed by Pastor and Stambaugh is the response of current stock prices to the volume order (order flow). They question whether the stock's expected return is related to the sensitivity of its return to innovations in aggregate liquidity. As the measure of liquidity in the empirical studies they use an equal – weighted average of the liquidity measures of individual shares on the New York Stock Exchange and American Stock Exchange, using daily data at a monthly frequency from over 34 years from the period of January 1966 – December 1999. A long period of time affords the measure to indicate the commonality in liquidity, which shows that aggregate liquidity is a priced unit of a risk.

As supported by the empirical evidence, Pastor and Stambough found the liquidity factor to be priced. They observed a strong positive relation suggesting positive premium for liquidity risk. The interpretation follows that securities with higher sensitivity to market wide liquidity

[374] Y. Amihud, H. Mendelson, L. H. Pedersen, *Liquidity and Asset Prices*, "Foundation and Trends in Finance" 2005, vol. 4, s. 269-364.
[375] Y. Amihud, op. cit.

shocks earns higher future returns and represents lower individual liquidity. It was also observed that aggregate liquidity measures decreases dramatically in bear markets. The sharpest drops in market wide liquidity were observed in months of the biggest economic crises: October 1987 crash,1973 oil crisis, the 1997 Asian financial depression as well as the 1998 crash of Long-Term Capital Management (LTCM).

What is more, authors found their empirical evidence very interesting concerning the "small firms effect". They assumed that the smallest, illiquid firms tend to have higher liquidity risk and be more affected by declines in aggregate liquidity. Surprisingly they found that in down markets the price reaction of small illiquid stocks is not that great as the more liquid one. The explanation is that in the bear markets when investors replace stocks with bonds, they not only buy but also prefer to sell more liquid assets to avoid the higher transaction costs. It leads to "higher-beta stocks" sometimes being less sensitive to the innovations on the market.

Pastor and Stambourg, as well as the economists stated above, proved that liquidity risk is a significant determinant of the expected stock returns. However, measures introduced by them do not capture time-series effects of illiquidity[376].

Conclusions

The paper has reflected upon the literature that studies the relationships between time variations in liquidity, innovations in aggregate liquidity and how they affect the present and expected returns. There are presented different measures of liquidity, illiquidity as well as liquidity risk.

Liquidity, explained in the simplest way, is the ease of trading the security, while the aggregate liquidity is defined as the possibility to trade large quantities of stocks quickly, at low costs, and without changing the price level. It is risky and varies over time. The most important predictor of the future liquidity is the historical and present liquidity level. Despite liquidity being measured by different authors in different ways, they all agree that liquidity risk is an economically significant determinant of expected asset returns. Expected illiquidity causes a reduction in current securities' prices and positively influence required stock returns. Surplus asset returns are considered as a compensation for the risk and called 'risk premium' or 'premium for illiquidity'.

Not only expected illiquidity is a determinant of liquidity risk. Correlation between liquidity risk and market returns is also a significant indication. It is empirically proved that in bear markets aggregate liquidity measures plummet. In dire liquidity times the 'small firm effect' can be observed. Investors prefer more liquid stocks to avoid higher liquidity risk. Smaller, more illiquid securities are more exposed to market wide liquidity fluctuations. However, Pastor and Stambaugh found an exception to the rule. Sometimes investors want to lower their transaction cost, so they sell the more liquid assets in the first instance. In such case price reaction of small, illiquid stocks is not that great as observed in Amihud's evidence. In the liquidity- adjusted asset pricing model, conducted by Acharya and Pedersen, required excess return is a sum of expected relative illiquidity cost and four betas (covariances) implying four different risk premiums. These betas are: covariance between asset returns and market returns, covariance between asset illiquidity and market illiquidity, the exposure of assets to market wide illiquidity and a

[376] L. Pastor, R. F. Stambaugh, op. cit.

sensitivity of security's illiquidity to market conditions. Relationship between these betas and expected returns is positive in the first two cases and negative in the other.

Authors have implemented their liquidity measures into asset pricing model and found that correlation between liquidity risk and stock markets returns is greater than this between liquidity risk and factors typically used in asset pricing studies. To summarize, liquidity risk is an important determinant of expected asset returns.

Summary

The paper has reflected upon the literature that studies the relationships between time variations in liquidity, innovations in aggregate liquidity and how they affect the present and expected returns. There are presented different measures of liquidity, illiquidity as well as liquidity risk. The liquidity measures were implemented into asset pricing model. The correlation found between liquidity risk and stock markets returns was greater than the one between liquidity risk and factors typically used in asset pricing studies. To summarize, liquidity risk is an important determinant of expected asset returns.

Streszczenie

Opracowanie przedstawia, istniejące w literaturze światowej, rozmaite podejścia do zmienności płynności aktywów w czasie, jak też innowacje w pojęciu płynności zagregowanej oraz ich wpływ na rzeczywiste i oczekiwane wyniki z inwestycji. Przedstawione zostały różne miary płynności, a także ryzyka płynności. W opisywanej literaturze, miary płynności zostały wprowadzone przez autorów do modelu wyceny aktywów. Udowodniono, że korelacja między ryzykiem płynności i wynikami inwestycyjnymi jest wyższa niż w przypadku korelacji wyników z inwestycji z innymi czynnikami, często branymi pod uwagę w procesie wyceny wartości inwestycji. Ryzyko płynności jest więc istotną determinantą oczekiwanych wyników inwestycyjnych.

References

1. Acharya, V. and L. H. Pedersen, *Asset Pricing with liquidity risk*, *"Journal of Financial Economics"* 2005, vol. (77) 2.
2. Amihud, Y., *Illiquidity and stock returns: Cross-section and time-series effects*, *"Journal of Financial Markets"* 2002, vol. 5.
3. Amihud, Y., Mendelson, H., and L. H. Pedersen, *Liquidity and Asset Prices*, *"Foundation and Trends in Finance"* 2005, vol. 4, 269-364.
4. Pastor, L. and R. F. Stambaugh, *Liquidity risk and expected stock returns*, *"Journal of Political Economy"* 2003, vol. 111.