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Stock Liquidity and Corporate Investment Policy after FTSE 100 Index Additions

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Abstract

This study falls within the literature on connections between market microstructure of firm's securities and corporate finance. We conduct an analysis on a sample of firms added to the FTSE 100, over the time-period 2005-2017, following the evidence, widely documented in literature, that additions to major indexes are exogenous liquidity-enhancing events. We study the improvement in liquidity and expansion in capital spending, either in the univariate analysis, either in multivariate analysis. Our results confirm that changes in stock liquidity are positively associated to changes in capital expenditures, especially on a 3-years horizon. Managers should consider the benefit of greater stock liquidity in order to maximize the value of the firm.

Keywords: liquidity, market microstructure, investment decision, firm value

JEL classification: G11, G12, G32

1. Introduction

In this study, we empirically analyse whether stock liquidity exerts a significant and persistent effect on capital expenditures.

Liquidity costs, namely direct and indirect trading costs (brokerage commissions and transaction taxes, bid-ask spreads, cost of acquiring information, etc.), decrease investors' net returns. This variable could be a bias in studying investors' decisions and it could influence risk return models. Therefore, investors' willingness to pay should be net of the discounted trading (or transaction) costs, both for buy and sale. Market microstructure theory suggests (market) liquidity is a priced factor in equity returns, and more broadly in any financial asset return. In particular, according to the pivotal work of Amihud and Mendelson (1986), assets with higher transaction costs (higher spreads) should have higher (gross) returns. Therefore (Amihud and Mendelson, 1986, 1988, 2015) a company can reduce its cost of equity and increase its market value, by improving the liquidity of its stocks or bonds. Thus, managers (and shareholders) should be interested in adopting corporate financial policies that increase their market negotiability and the securities' liquidity.

Following relevant literature (Becker-Blease and Paul, 2006, 2010), we investigate the link between stock liquidity and expected returns (and consequently cost of capital and firm value). Myers (1977) argues the value of a firm consists of both assets in place (or existing investments) and valuable (future) investment opportunities. Moreover, managers can create value by minimizing the cost of capital by reaching the optimal capital structure. A lower cost of capital linked to an improvement in securities liquidity could contribute to firm value by expanding the pool of positive net present value projects. In fact, a drop in trading costs could reduce the investments' hurdle rate.

We analyse the relationship between investment opportunities and stock liquidity in a sample of firms added to the FTSE 100 from 2005 to 2017 using stock addition as triggering (Baran and Dolly King, 2012; Becker-Blease and Paul, 2006; Gregoriou and Ioannidis, 2006; Gregoriou and Nguyen, 2010; Hegde and McDermott, 2003, 2004; Mazouz and Wang, 2014). FTSE 100 additions represent an exogenous liquidity shock.

Although expected returns and investment opportunity set are not directly observable, there can be corporate investment decisions in response to a drop in cost of capital. Thus, we can regress changes in capital expenditures, the proxy for realized growth (investment) opportunities, on changes in stock liquidity.

The empirical analysis is organized as follows: we first confirm index addition to be a liquidity-enhancing event by examining three liquidity proxies, namely Amihud's illiquidity ratio (Amihud, 2002), pound trading volume and (relative) effective spread. Likewise, we also show capital expenditures increase significantly from pre-addition to post-addition period. Then, we run the regression and we find a positive relationship between changes in stock liquidity and changes in capital expenditures, consistently with a decline in cost of capital. Overall, we believe this result could provide additional, even if moderate, explanation to the managerial tendency to improve the liquidity of the company financial claims.

This study complements the existing literature by providing updated results on the link between market microstructure of firm's securities and corporate investment decisions. Differently from the majority of empirical studies based on the S&P 500 and US market, we use the UK's FTSE 100, contributing to broaden the scope of the analysis to other major indexes and markets. Moreover, compared to the previous literature, we refer to a more recent time window since we investigate from 2005 to 2017, covering also the financial crisis period. Existing literature demonstrates the liquidity's beneficial effect in the entry of informed investors and in solving agency problems. Therefore, studies related to the risk-return benefits of liquidity are limited because the research is focused only on investors' behaviour and on information problems. On the other side, studies on market microstructure analyse intraday regularities in stock market but they do not consider firm level variables such as capital expenditures or revenues. Our study offers an original point of view merging two strands of literature above mentioned. In fact, we use realized investment opportunities in place of changes in the hurdle rate to examine the effect of stock liquidity change.

The paper is divided into four sections. The first section is a literature review on market liquidity studies. The second section explains the data, the variables definition and the research methodology. The third section analyses the results through determinants' univariate analysis and the firm level cross-sectional regression. At the end, we run some robustness check and value the durable effects of changing in liquidity on three years future capital expenditure. The final section provides concluding remarks with suggestions for future research.

2. Literature Review and Hypothesis

In addition to the seminal work of Amihud and Mendelson, (1986), other studies contributed to this research area, confirming the existence of a relation between market liquidity and asset returns (Acharya and Pedersen, 2005; Pástor and Stambaugh, 2019, 2003). Subsequent studies (Chordia et al., 2000; Liu, 2006) argue that liquidity risk is a systematic factor non diversifiable that should value in capital pricing models. In a study published in 1997 conducted on the Tel Aviv Stock Exchange during the period 1987-1994 (Amihud et al., 1997), authors highlight that liquidity-increasing changes in market structure (i.e., transferring a stock to continuous trading) are associated with positive abnormal returns.

From this evidence of liquidity impact on required returns stems a branch of literature based on implications for corporate management, linking corporate financial decisions to liquidity of company' securities. Firms with more liquid stocks have lower expected rates of return and higher firm values, thus management actions that increase liquidity may increase firm value. Specifically, the focus is on managerial action that increases transparency and reduces informational asymmetries. Liquidity is related to information and therefore higher are informational asymmetries and "opaqueness", lower is market liquidity. A first studied implication involves the higher informational risk linked to leverage (Lesmond, (2005). Other studies focus on implications for security design, showing that different types of equity securities (e.g., common shares, preferred shares, warrants) reduces the issue size of each category and decreases liquidity.(Amihud, 2002). A third implication regards payout policy and argues investors in illiquid shares may value dividends relatively more highly than investors in liquid stocks. This is because, selling illiquid shares is expensive and the potential role of dividends in providing cash increase for the stock's owners. Other studies (Amihud and Li, 2006; Li et al., 2014) in this field find dividend initiations of less liquid firms trigger large stock price reactions. On the other hand, firms buying back their shares incur higher liquidity costs when these shares are illiquid. Thus, firms with illiquid shares, facing higher buyback costs, should abstain from initiating repurchases. Empirical evidence shows firms with more liquid shares have a higher probability of initiating repurchases, and they repurchase more (Brockman et al., 2008). Lastly, theory suggests having more uninformed investors increases liquidity. Firms that split their shares to make them more affordable to retail investors should experience an increase in the number of shareholders, an increase in liquidity and an increase in share prices. Amihud *et al.*, (1999). (Note 1)

Therefore, managers should take the liquidity effects (and their impact on valuation) into account when making these decisions. They should analyse liquidity premium hypothesis taking index revision events as exogenous liquidity shock (Mazouz et al., 2014; Platikanova, 2016). Some authors (Becker-Blease and Paul, 2006; Gregoriou and Nguyen, 2010), use capital expenditures to investigate changes in cost of (equity) capital, arguing, respectively, that if expected returns go down (go up), one would expect an expansion (contraction) in the set of positive NPV projects, proxied by capital expenditures. Gregoriou and Nguyen (2010) find that index deletions do not have a significant impact on corporate investment opportunities, whereas Becker-Blease and Paul (2006) find strong evidence indicating post-addition changes in stock liquidity play a role in corporate investment policy. Mazouz and Wang, (2014) argue that the asymmetry between additions and deletions proves "the benefit of index membership", in improving the "stock's trading environment" and reducing the cost of capital, is "permanent" and not altered by stock deletion from the index.

Thus, we believe investors prefer liquid securities that are in major markets index like FTSE 100. Therefore, these firms have more capital to develop their investments and to finance their growth. We test the following hypothesis.

Hypothesis 1: changes in stocks liquidity implies changes in capital expenditures.

Hypothesis 2 there is a positive association between the change in stock liquidity and the change in capital spending.

This situation can be temporary or consolidated therefore, we wanted to analyse long-term effects of index revision event (addition or deletion). We try to test the following hypothesis.

Hypothesis 3: the effect of changes in stocks liquidity on investments' growth persists over the time.

3. Data, variables and methodology

3.1 Data

We relied on the revision events of the FTSE 100 index, which comprises the 100 companies with the largest market capitalization listed on the London Stock Exchange. The FTSE constituents are reviewed every quarter (Note 2).

We collected our data from Bloomberg database. We selected non-financial firms added to the FTSE 100 from January 2005 to December 2017. We follow all companies up to 2020 fiscal year, three years after the addition year. If there were multiple additions events for a firm, we kept only the oldest one. Moreover, we did not consider how long the firm has been in the index (as long as 3 months) due to deletion. In fact, the evidence from relevant literature (Gregoriou and Nguyen, 2010) suggests deletion from a major index does not influence the long-lasting effect of index membership. We were bound to discard additions for which Bloomberg data are no longer available on the database. This process produced 90 addition events. Finally, we dropped from our sample:

1) Stocks that were added due to events such as spin offs, mergers and takeovers.
2) Stocks missing sufficient historical data for the three-year period after (delisting, takeovers etc.) or before the revision date.

Our final dataset consisted of 51 added non-financial firms. The addition dates and relative corporate events have been furtherly verified with FTSE Russell documentation about historic additions and deletions (Note 3).

3.2 Variables

Following Becker-Blease and Paul, (2006), we calculate 1-year and 3-year change in capital expenditure (CAPEX) while the stock liquidity variable has multiple measures.

As suggested by several studies (Becker-Blease and Paul, 2006; Denis et al., 1994; Gregoriou and Nguyen, 2010), we consider unobservable set of investment opportunities and, therefore, we use the change in capital expenditures as an ex-post proxy for changes in the set of value-creating investment opportunities.

Referring to liquidity measures, we used three proxies for stock liquidity: Amihud's illiquidity ratio, value traded, and effective bid-ask spread, to capture the impact of index additions on different liquidity dimensions. We measured these liquidity proxies up to 36 months surrounding the addition month. We excluded the addition month and the two months surrounding it from the measurement periods, in order to avoid any temporary upward bias caused by the trading activities of index funds and arbitrageurs (Baran and Dolly King, 2012; Becker-Blease and Paul, 2006; Mazouz and Wang, 2014).

The illiquidity ratio (Amihud, 2002) is the ratio of daily (absolute) return to daily dollar trading volume. It shows

how big the price change per dollar in relation to the trading volume is big every day. Therefore, it measures the immediacy to transform stocks in liquidity. We use the following formula:

$$ILLIQ_i = \frac{1}{T_i}\sum_{t=1}^{T}\frac{|r_{it}|}{Vol_{it}}$$

Where rit is the return on stock i on day t, $Volit$ is the daily volume in dollars (Note 4), and Ti is the number of days with data available for stock i during the measurement period i (form pre-addition to post addition).

A higher ratio means larger price impact (illiquidity), namely lower liquidity. Theoretical foundation stems from Kyle's (1985) model on the daily price response to order flows. One arguable flaw is about being backward looking, unable to discern transitory and permanent price changes.

We used the average of the daily pound amount traded to capture the impact on the trading quantity (‘size’) dimension of liquidity. This measure is the daily sum of the product between price of each trade and its volume. Generally, a higher value traded imply a higher market liquidity. Sometimes volume-based measures of liquidity per se are poor proxies for liquidity: e.g., during the 2008-09 crisis, volume was very high, yet spreads were also high. Thus, it needs other measures, capturing additional dimensions of market liquidity. In any case, even taken alone, the frequency of "no trading" may still tell us something about liquidity: if trading is too costly, people will not trade. In addition, it is easy to measure, even in emerging markets.

The bid-ask spread is a key liquidity variable that market microstructure theory attempts to explain (Lesmond et al., 2011). At any time □, let □$_t$ and □$_□$ be the best bid and ask prices (Note 5), then absolute quoted bid-ask spread is:

$$AB_t = (a_t - b_t)$$

and, the midquote is

$$m_t = \frac{(a_t - b_t)}{2}$$

For a transaction at price pt we can also compute the effective spread ESt, which is the actual transaction cost incurred by the trader submitting a market order, (Note 6) as follows:

$$ES_i = 2|p_t - m_t|$$

As a rule, the higher the spread, the lower the liquidity. “*In an illiquid market the best price at which a security can be bought (ask price) is considerably above the best price at which the security can be sold (bid price)”* (Foucault et al., 2013).

Quoted spread is a forward-looking measure whereas effective spread is a backward-looking measure. Quoted spread typically overstates actual transaction costs due to market timing and to price improvements associated with hidden orders (Note 7).

On the other hand, effective spread considers price improvements. Therefore, following some authors (Mazouz and Wang, 2014), we adopt effective spread as a proxy for trading cost dimension of liquidity (Note 8). In order to compare these spread measures across securities, we expressed them in relative terms and scaled effective spread by midquote to obtain relative effective spread.

3.3 Methodology

Our empirical investigation starts on the hypothesis that there is a general significant improvement in stock liquidity following addition to FTSE 100 Index. Firstly, using three different proxies of stock liquidity, we conduct a univariate analysis of changes in stock liquidity and capital expenditures. Finally, we test the positive correlation between stock liquidity and capital expenditures arising from a firm-level regression analysis.

4. Results of the Empirical Analysis

4.1 Descriptive Statistics and Univariate Analysis

We calculate statistics about sample firms’ capital expenditures for the one- and three-year measurement periods. Y-1, Y-2, Y-3 refer to the (end of) fiscal years before the addition year Y, and Y+1, Y+2, Y+3 refer to the (end of) fiscal years after the addition year Y.

We do not report in the tables the two-year (Y±2) and three-year (Y±3) levels. Following Becker-Blease and Paul (2006), we standardize capital expenditures by total assets in the fiscal year preceding the index addition

year (Y-1). Moreover, we indicate the medians of three-year average capex levels as Y-1_3 and Y+1_3, for pre-addition and post-addition period, respectively. Finally, "Y-1 to Y+1" and "Y-1_3 to Y+1_3" are the medians of differences on one- and three-year levels surrounding index addition and they represent what we refer to as the one-year and the three-year change in capex, respectively.

Table 1. Changes in capital expenditures

	Y-1_3	Y-1	Y+1	Y+1_3	Y-1 to Y+1	Y-1_3 to Y+1_3
CAPEX_scaled	3.614	3.548	4.689	5.674	0.296*	**1.317*****

Notes. *p<0.1 Significant at 10%

**p<0.05 Significant at 5%

***p<0.01 Significant at 1%

The table shows the median changes in capital expenditures following the addition of 51 non-financial firms to the FTSE 100 Index between January 2005 and December 2017. Capital expenditures are scaled by total assets at Y-1 (the fiscal year preceding index addition). We conduct Wilcoxon test two-sided. Bold typeface indicates a coefficient significant at a 1% level.

Table 1 shows a moderate but significant increase in capital expenditures following index addition. We observe from the year before addition to the year after addition a median change in scaled capital expenditures of 0.296 percentage points. The one-year median increase proves to be significant both with the two-sided (10%) and the one-sided (5%) Wilcoxon test (table 2). We also find a highly significant (1%) three-year median increase of 1.317 percentage points.

Thus, we measure statistical significance of the median change using Wilcoxon Signed Rank tests that is the non-parametric version of t-test (Table 2). We conduct both the two-sided test that the median of differences is zero, and the one-sided test that the median of differences is negative (against the alternative that is positive).

Table 2. Statistics on capital expenditures

Wilcoxon Signed Rank test				
	Y-1 to Y+1		**Y-1_3 to Y+1_3**	
	two-sided	**one-sided**	**two-sided**	**one-sided**
Statistic	469.000*	857.000**	**224.0*****	**1102.0*****
p-value	(0.069)	(0.034)	(0.0)	(0.0)

Notes. *p<0.1 Significant at 10%

**p<0.05 Significant at 5%

***p<0.01 Significant at 1%.

The table shows the Wilcoxon Signed Rank test on median changes in capital expenditures following the addition of 51 non-financial firms to the FTSE 100 Index between January 2005 and December 2017. Capital expenditures are scaled by total assets at Y-1 (the fiscal year preceding index addition). We conduct both tests one-sided and two-sided. P-value is in brackets. Bold typeface indicates a coefficient significant at a 1% level.

Results show a high significance, both for the two-sided and the one-sided test, especially in the three-year median. These findings witness that added firms experience a general expansion in capital spending, mainly in the long run.

After, we calculate statistics about sample firms' liquidity for the one, two- and three-year measurement periods. Y-1, Y-2, Y-3 refer to the (end of) fiscal years before the addition year Y, and Y+1, Y+2, Y+3 refer to the (end of) fiscal years after the addition year Y. For the same reasons we do not report in the tables the two-year (Y±2) and three-year (Y±3) levels. Therefore, "Y-1 to Y+1" and "Y-1_3 to Y+1_3" are the medians of differences on one- and three-year levels surrounding index addition and they represent what we refer to as the one-year and the three-year change in liquidity, by using three different liquidity measures.

Table 3. Changes in liquidity

	Y-1_3	Y-1	Y+1	Y+1_3	Y-1 to Y+1	Y-1_3 to Y+1_3
Illiquidity Ratio (10^8)	0.192	0.155	0.120	0.134	-0.046**	-0.056**
Value_Traded (10^{-6})	10.439	10.940	15.072	13.894	**3.828*** **	3.740**
Effective_Spread(%)	0.181	0.159	0.119	0.116	**-0.036*** **	**-0.061*** **

Notes. *p<0.1 Significant at 10%

**p<0.05 Significant at 5%

***p<0.01 Significant at 1%.

The table shows the median changes in the selected three different measures of liquidity following the addition of 51 non-financial firms to the FTSE 100 Index between January 2005 and December 2017. We conduct Wilcoxon test two-sided. Bold typeface indicates a coefficient significant at a 1% level.

Table 3 reports median levels and changes for the three liquidity measures in the three years surrounding index addition. Y-1, Y-2, Y-3 and Y+1, Y+2, Y+3 refer to 12 months liquidity levels for [2,13], [14,25] [26,37] windows preceding and following the event month, respectively. As above, we do not report the two-year (Y±2) and three-year (Y±3) levels. Y-1_3 and Y+1_3 correspond to the median of three-year average levels, for pre-addition and post-addition period, respectively. "Y-1 to Y+1" and "Y-1_3 to Y+1_3" indicate the medians for one-year and the three-year changes in liquidity proxies, respectively.

For the same reasons, we measure statistical significance of the median change using Wilcoxon Signed Rank tests (Table 4). We conduct both the two-sided test and the one-sided test. We use two-sided Wilcoxon Signed Rank test to prove the median of differences is significantly different from zero, and one-sided Wilcoxon Signed Rank test to confirm median change is significant in the expected direction.

The tables 4 shows a general significant improvement in stock liquidity following addition.

Table 4. Statistics on liquidity

Wilcoxon Signed Rank test				
	Y-1 to Y+1		**Y-1_3 to Y+1_3**	
	two-sided	**one-sided**	**two-sided**	**one-sided**
Illiquidity Ratio statistic	423.000**	423.000**	433.000**	433.000**
p-value	(0.024)	(0.012)	(0.031)	(0.016)
Value Traded statistic	358.000***	968.000***	395.000**	931.000***
p-value	(0.004)	(0.002)	(0.012)	(0.006)
Effective Spread statistic	354.000***	354.000***	167.0***	167.0***
p-value	(0.004)	(0.002)	(0.0)	(0.0)

Notes. *p<0.1 Significant at 10%

**p<0.05 Significant at 5%

***p<0.01 Significant at 1%.

The table shows the Wilcoxon Signed Rank test on median changes in liquidity following the addition of 51 non-financial firms to the FTSE 100 Index between January 2005 and December 2017. We conduct both tests one-sided and two-sided. P-value is in brackets.

In particular, we observe a decline in the illiquidity ratio and in the (relative) effective spread levels as supported by both significant median one-year and three-year change.

We also observe a significant positive median one-year and three-year change for value traded. Finally, there is a significant positive median one-year and three-year change for effective spread. Overall, the findings, consistently with literature, confirm that addition to a major index is a liquidity-enhancing event.

4.3 Firm Level Regressions – 1 Year vs 3 Years Windows

Relying on both analyses, we illustrated the significance of changes in stock liquidity as a determinant of future investment and growth. In order to control for multiple factors simultaneously, we test the relationship between changes in stock liquidity and change in capital expenditures, by using firm level regressions implemented in the following manner. Following previous studies (Becker-Blease and Paul, 2006), we use scaled capital expenditures as our dependent variable and we find a notable presence of outliers in the dataset. Outliers could be source of several biases in our regression analysis, reducing the accuracy of our estimates. Therefore, in order to minimize the impact of extreme values, we specify a model where the dependent variable, representing the 1-year and 3-year changes in capital expenditures, is the logarithmic change, rather than as simple difference of the scaled value. Following previous literature (Becker-Blease and Paul, 2006), we include additional control variables and we specify the following models:

$$LOG\ \ \Delta CAPEX_i = \propto + \beta_{ILL}(ILL_i) + \beta_{TA}(TA_i) + \beta_{BM}(BM_i) + \beta_{GR}(GR_i) + \beta_{EBITDA}(EBITDA_i) + \in \quad (1)$$

$$LOG\ \ \Delta CAPEX_i = \propto + \beta_{VT}(VT_i) + \beta_{TA}(TA_i) + \beta_{BM}(BM_i) + \beta_{GR}(GR_i) + \beta_{EBITDA}(EBITDA_i) + \in \quad (2)$$

$$LOG\ \ \Delta CAPEX_i = \propto + \beta_{SPR}(SPR_i) + \beta_{TA}(TA_i) + \beta_{BM}(BM_i) + \beta_{GR}(GR_i) + \beta_{EBITDA}(EBITDA_i) + \in \quad (3)$$

Where ILL is the illiquidity ratio, VT the value traded and SPR the effective spread. Control variables consist in pre-addition firm size (TA), defined as the natural log of total assets in pre-addition fiscal year. Book-to-market ratio (BM), is the ratio of book total common equity to market capitalization in the fiscal year preceding the index addition year. Capital expenditure growth rate (GR), controls for pre-existing momentum in capital expenditures and is computed in fractional terms (a one unit increase means a rise of 100 percentage points) from the fourth fiscal year preceding addition to one year prior to addition. EBITDA means the changes in EBITDA scaled by total assets in the year prior addition. It is the level of scaled EBITDA in the year after addition minus the level of scaled EBITDA in the year preceding addition.

Regression results are reported in Table 5. Value traded shows a significant coefficient with the expected sign while Change_in_Effective_Spread and Illiquidity ratio are not significant. Our results can be interpreted as follows: a 1% improvement in Value Traded generates an increase in capital expenditures of 0.28%, holding other variables constant.

Table 5. Multiple Linear Regressions -1-year window

Dependent variable: Change_in log. CAPEX			
	(1)	(2)	(3)
Change_in_Illiquidity_Ratio	-0.1255		
Change_in_Value_Traded		**0.2813****	
Change_in_Effective_Spread			-0.0984
TOT_ASSET	0.0740	0.0767	0.0637
Book_to_Market	-0.2880	-0.3179	-0.2319
CAPEX_GROWTH_RATE	**-0.0529***	**-0.0513***	-0.0473
Change_in_SCALED_EBITDA	1.4142	1.1281	**1.8257***
Intercept	-0.4215	-0.4684	-0.3892
Observations	51	51	51
R^2	0.2056	0.2431	0.1889
Adjusted R^2	0.1173	0.1590	0.0988
Residual Std. Error	0.5760 (df=45)	0.5623 (df=45)	0.5821 (df=45)
F Statistic	1.3227 (df=5; 45)	1.8862 (df=5; 45)	1.1978 (df=5; 45)

Notes. *p<0.1; **p<0.05; ***p<0.01.

The table presents the regression coefficient estimates for the regression between stock liquidity and capital expenditures. The sample consists of non-financial firms added to the FTSE 100 index between January 2005 and December 2017. The dependent variable, Change in log of Capital Expenditures, is the change in the

difference for capital expenditures for the fiscal year following addition minus the fiscal year before addition. The illiquidity ratio is the natural log of the average of the absolute value of the daily return divided by the daily volume in dollars. Change in Illiquidity Ratio is the change in the difference for the 12-month period following index addition compared to the 12-month period before index addition, excluding the event month and the two months surrounding it. Value traded is the natural log of the total amount traded in the security's currency. It represents the sum of all trades prices, multiplied by the number of shares relating to each price in a day. Effective spread is twice the absolute value of the difference between the execution price and the midpoint of the closing bid and ask quotes. We compute change in value traded and change in effective spread in the same way as the change in the illiquidity ratio.

TOT_ASSET is the log of Total asset in the fiscal year preceding the index addition year. Book-to-Market is the ratio of book value of equity in the fiscal year preceding the index addition year. Capital expenditure growth rate is the difference in the three-year growth rate of capital expenditures, from the four fiscal years preceding addition to one year prior to addition. Change in Scaled_EBITDA means the changes in EBITDA scaled by total assets in the year prior addition. The table presents the average coefficients of the regressions and the corresponding p-value. Bold typeface indicated a coefficient significant at 5% level or 1% level.

Among control variables, only the pre-addition capital expenditure growth rate, in Model 1 and 2, and the changes in operating performance (EBITDA) in model 3, show little significance (10%) in predicting changes in capital spending. Overall, our empirical findings on a 1-year basis do not provide enough support for the expected positive association between changes in stock liquidity and changes in investment opportunities, when controlling for other possible explanatory factors.

Similar to previous literature, we test our hypothesis using the 3-year change in capital expenditures. Table 6 presents the OLS coefficient estimates for three-year log changes in capital expenditures on three-year log changes in stock liquidity. We use the same control variables as in Table 5.

Table 6. Multiple Linear Regressions - 3-years window

Dependent variable: Change_in log. CAPEX			
	(1)	(2)	(3)
Change_in_Illiquidity_Ratio	**-0.2432*****		
Change_in_Value_Traded		**0.2824****	
Change_in_Effective_Spread			**-0.3395****
BS_TOT_ASSET	**-0.2343***	-0.2131	**-0.3097****
Book_to_Market	0.2076	0.0845	0.5363*
CAPEX_GROWTH_RATE	0.0269	0.0242	0.0304
Change_in_SCALED_EBITDA 0.3604		0.7570	1.1012
Intercept	1.8553**	1.7020*	2.1514**
Observations	51	51	51
R^2	0.4353	0.3832	0.3671
Adjusted R^2	0.3725	0.3147	0.2967
Residual Std. Error	0.5469 (df=45)	0.5715 (df=45)	0.5790 (df=45)
F Statistic	9.5767*** (df=5; 45)	9.2567*** (df=5; 45)	9.6268*** (df=5; 45)

Notes. *p<0.1; **p<0.05; ***p<0.01.

The table presents the regression coefficient estimates for the regression between stock liquidity and capital expenditures. The sample consists of non-financial firms added to the FTSE 100 index between January 2005 and December 2017. The dependent variable, Change in log of Capital Expenditures, is the change in the difference for capital expenditures for the fiscal year following addition minus the fiscal year before addition. The illiquidity ratio is the natural log of the average of the absolute value of the daily return divided by the daily volume in dollars. Change in Illiquidity Ratio is the change in the difference for the 12-month period following index addition compared to the 12-month period before index addition, excluding the event month and the two months surrounding it. Value traded is the natural log of the total amount traded in the security's currency. It represents the sum of all trades prices, multiplied by the number of shares relating to each price in a day.

Effective spread is twice the absolute value of the difference between the execution price and the midpoint of the closing bid and ask quotes. We compute change in value traded and change in effective spread in the same way as the change in the illiquidity ratio.

TOT_ASSET is the log of Total asset in the fiscal year preceding the index addition year. Book-to-Market is the ratio of book value of equity in the fiscal year preceding the index addition year. Capital expenditure growth rate is the difference in the three-year growth rate of capital expenditures, from the four fiscal years preceding addition to one year prior to addition. Change in Scaled_EBITDA means the changes in EBITDA scaled by total assets in the year prior addition. The table presents the average coefficients of the regressions and the corresponding p-value. Bold typeface indicated a coefficient significant at 5% level or 1% level.

All three liquidity proxies are highly significant with the expected sign and appear to be able to explain part of dependent variable variability. Holding other variables constant, a 1% improvement in stock liquidity increase is associated with a larger rise in capital spending varying from 0.2432% to 0.3395%. The only one control variables that shows a significant effect on changes in capex is firm size (TOT_ASSET) in Model (1) and (3), consistently with what observed in Table 10. A 10% significant book to market ratio is reported in Model (3), but the result proves not to be robust to other specifications. All the three regressed models are highly significant.

Overall, all things considered, taking into account both the little evidence from one-year analysis and the stronger three-year evidence, the results may indicate that changes in stock liquidity are positively related to changes in capital expenditures, as a result of an exogenous liquidity shock (mainly on a long-term horizon). Thus, the findings, although not fully robust, provide to some extent appreciable additional support for the hypothesis that improvements in stock liquidity may translate into greater capital investment. The interpretation is that as the liquidity premium in equity returns decreases, cost of capital decreases and the pool of positive net present value projects increases.

5. Conclusions

This study falls within the literature framework investigating connections between market microstructure of firm's securities and corporate finance. Market microstructure issues have important implications. They affect expected returns and, correspondingly, the cost of capital. They affect firm values and even operating performance. They are interrelated with various corporate financing decisions.

We perform the empirical analysis specifically on the link between stock liquidity and corporate investment decisions. We do not examine directly cost of equity (or cost of capital). We use realized investment opportunities in place of changes in the hurdle rate set by the company when evaluating new projects. We conduct this analysis on a sample of firms added to the FTSE 100, over the time-period 2005-2017, following the evidence, widely documented in literature, that additions to major indexes are exogenous liquidity-enhancing events.

By regressing changes in capital expenditures on changes in stock liquidity, along with control variables, we confirm the positive association between the change in stock liquidity and the change in capital spending (especially in 3-years window). Our findings are consistent with the hypothesis that corporate managers increase capital investment intensity because of a reduction in the cost of capital. In a broad sense, in line with the existing theory and empirical evidence, this paper confirms with an updated analysis in the period 2005-2017 that market microstructure matters, and especially "frictions" in company's securities trading environment matter. Managers should be aware of the benefit of greater stock liquidity and they should consider adopting liquidity-increasing actions to maximize the value of the firm.

We are aware that our analysis could be affected by several limitations. The first refers to the sample that is not global, so there could be a country effect. With larger samples, the analysis could detect the different impacts of country risk effect. Moreover, we could enlarge the regressions with other control variables or enlarge the period of analysis. Finally, we could consider in our models the effect of the dummy of financial crisis period.

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Notes

Note 1. Nevertheless, an atomistic shareholder structure with many small, uninformed shareholders may well increase the liquidity of the shares, but it should be considered it may reduce monitoring incentives and cause agency problems.

Note 2. "*The index is part of the FTSE UK Series and is designed to measure the performance of the 100 largest companies traded on the London Stock Exchange that pass screening for size and liquidity*" Source: FTSE Russell as at 29 January 2021, FTSE 100 Index - FTSE Publications.

Note 3. https://research.ftserussell.com/products/downloads/ftse_100_constituent_history.pdf

Note 4. Pound trading volume in our case, being analyzed companies traded on the London Stock Exchange.

Note 5. The highest price, available in the market, a liquidity supplier is willing to buy is the *best bid*. The lowest price a liquidity supplier is willing to sell is the *best ask.*

Note 6. A market order instructs the broker to trade a quantity at the best price currently available in the market (no price indication).

Note 7. In dealer markets, quoted spread may also understate transaction costs if dealer quotes are indicative.

Note 8. For the sake of completeness, we should mention another possible spread-based measure of liquidity: the realized spread. It estimates the gross return of the supplier of liquidity after eliminating losses due to adverse selection (price impact). Realized and effective spread are equal when the quotation midpoint does not change over the measurement interval.

Appendix

Appendix 1. The Sample

Security
AGK LN Equity
AHT LN Equity
AMFW LN Equity
ARM LN Equity
BAB LN Equity
BBY LN Equity
BDEV LN Equity
BKG LN Equity
BRBY LN Equity
CNE LN Equity
COB LN Equity
CRDA LN Equity
CRH LN Equity
DCC LN Equity

DMGT LN Equity
EZJ LN Equity
FERG LN Equity
FGP LN Equity
FLTR LN Equity
FRAS LN Equity
GFS LN Equity
GKN LN Equity
HIK LN Equity
HMSO LN Equity
IMI LN Equity
INF LN Equity
INTU LN Equity
ISAT LN Equity
ISYS LN Equity
ITRK LN Equity
LMI LN Equity
MAB LN Equity
MGGT LN Equity
MNDI LN Equity
PFC LN Equity
PNN LN Equity
PSN LN Equity
PUB LN Equity
RRS LN Equity
RTO LN Equity
SGC LN Equity
SGRO LN Equity
SRP LN Equity
TATE LN Equity
TLW LN Equity
TPK LN Equity
TW/ LN Equity
WEIR LN Equity
WG/ LN Equity
WMH LN Equity
WTB LN Equity

Appendix 2. Correlation matrix in one-year window

	Change In Scaled Capex	Change In Illiquidiy Ratio	Change In Value Traded	Change In Effective Spread	Change In Scaled Ebitda	Capex Growth Rate	Bs Tot Asset	Book to Market
Change In Scaled Capex	1.000	-0.278	0.346	-0.050	0.308	0.109	-0.194	-0.066
Change in Illiquidiy Ratio	-0.278	1.000	-0.795	0.735	-0.589	-0.207	0.314	0.081
Change in Value Traded	0.346	-0.795	1.000	-0.520	0.554	0.133	-0.273	-0.069
Change in Effective Spread	-0.050	0.735	-0.520	1.000	-0.362	-0.060	0.284	0.089
Change In Scaled Ebitda	0.308	-0.589	0.554	-0.362	1.000	0.136	-0.527	-0.338
Capex Growth Rate	0.109	-0.207	0.133	-0.060	0.136	1.000	-0.087	-0.061
Bs Tot Asset	-0.194	0.314	-0.273	0.284	-0.527	-0.087	1.000	0.715
Book to Market	-0.066	0.081	-0.069	0.089	-0.338	-0.061	0.715	1.000

Appendix 3. Correlation matrix in three-year window

	Change In Scaled Capex	Change In Illiquidiy Ratio	Change In Value Traded	Change In Effective Spread	Change In Scaled Ebitda	Capex Growth Rate	Bs Tot Asset	Book to Market
Change In Scaled Capex	1.000	-0.471	0.436	-0.321	0.490	0.374	-0.517	-0.178
Change in Illiquidiy Ratio	-0.471	1.000	-0.779	0.744	-0.570	-0.181	0.393	0.069
Change in Value Traded	0.436	-0.779	1.000	-0.398	0.490	0.190	-0.340	0.110

Change in Effective Spread	-0.321	0.744	-0.398	1.000	-0.417	-0.104	0.378	0.262
Change In Scaled Ebitda	0.490	-0.570	0.490	-0.417	1.000	0.287	-0.580	-0.375
Capex Growth Rate	0.374	-0.181	0.190	-0.104	0.287	1.000	-0.159	-0.106
Bs Tot Asset	-0.517	0.393	-0.340	0.378	-0.580	-0.159	1.000	0.655
Book to Market	-0.178	0.069	0.110	0.262	-0.375	-0.106	0.655	1.000