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Does the uncertainty of firm-level fundamentals help explain cross-sectional differences in liquidity commonality?

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ABSTRACT

Our goal is to better understand the economic sources of commonality in liquidity. To this end, we argue that a firm with low (high) volatility in its "fundamental" profitability will have a higher (lower) liquidity commonality because it is more (less) likely to serve as reference stock in the setting of cross-asset learning about fundamentals. As predicted, we find that commonality in liquidity is negatively related to profitability volatility. This negative relation holds after controlling for correlated trading, size, book-to-market effects, idiosyncratic volatility, stock returns, and managerial income smoothing.

1. Introduction

The underlying economic forces driving liquidity commonality (i.e. the positive linkage between individual stock and market liquidity) still remains a largely open question in the finance literature (e.g., Domowitz et al. (2005)).[1] In this paper, we argue that the uncertainty of firm-level "fundamentals" (primarily operationalized as the volatility of operating profitability) is a likely intervening factor that will help resolve this liquidity commonality "puzzle". In other words, we ask the basic question: what does a firm's "profitability volatility" tell us about the cross-sectional variation in liquidity commonality. To this end, we hypothesize that firm-level fundamentals uncertainty is negatively related to a stock's liquidity commonality.

The intuition for our focus on fundamentals uncertainty draws from and distils several key considerations. Primarily, we lean on Patton and Verardo's (2012) stylized model of cross-asset learning about profitability and its implications for firm beta; Chordia's et al. (2007) empirical evidence on learning-induced trading due to fundamentals volatility; and Pastor and Veronesi's (2003) study of the implications of learning about profitability for stock valuation. The messages coming from these three sources, are further synthesized with insights from recent theories of commonality in liquidity via cross-asset learning about fundamentals (Cespa and Foucault, 2014; Liu and Wang, 2013). More specifically, if: (a) cross-asset learning about fundamentals also gives rise to commonality in liquidity (Cespa and Foucault, 2014; Liu and Wang, 2013); (b) firms whose profitability is informative about the profitability of other firms have higher return commonality with the market i.e. higher market beta (Hameed et al., 2015; Patton and Verardo, 2012); (c) firm fundamentals uncertainty leads to learning-induced trading; then the volatility of firm-level fundamentals is a highly plausible factor in and, indeed, a likely candidate for explaining cross-sectional differences in commonality in liquidity.

Using a broad US sample spanning the period 1965–2010, as predicted, we document a negative liquidity commonality-profitability volatility linkage. This key finding holds after controlling for firm size, book-to-market, firm-level correlated trading, returns, illiquidity, idiosyncratic volatility, systematic risk, managerial income smoothing, and firm-fixed effects. In sub-period analysis, we show that the profitability volatility impact is strongest in the latter part of our full sample period, i.e. 1996–2010.[2]

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[1] Liquidity commonality has important implications e.g., for portfolio diversification that challenge the simple message coming from an "idealised" Markowitz world. Indeed, it is now well recognised that in times of crisis, just when investors most need the power and benefits of diversification, "it" is very likely to abandon them (Busse et al., 2013; Roll, 2013; Arouri et al., 2014). Such effects will be amplified by the existence of (il) liquidity commonality.

[2] It is notable that over this more contemporary subperiod, multiple studies show a peak in idiosyncratic volatility, volatility in firm fundamentals, and increased numbers of volatile stocks in the market portfolio (e.g., Brandt et al., 2010; Campbell et al., 2001; Fama and French, 2004; Wei and Zhang, 2006). As such, our findings "triangulate" with the common thrust coming from this relevant empirical literature in a meaningful and reassuring way.

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Our core contribution is to provide new insights that transcend two divergent explanations that have emerged in the literature: the demand-side hypothesis and the supply-side hypothesis. On the one hand, the demand-side hypothesis attributes commonality in liquidity to correlated trading behaviour resulting from the trading activity of mutual funds (Chordia et al., 2000; Karolyi et al., 2012; Liu and Wang, 2013). On the other hand, the supply-side hypothesis argues that constraints on the funding provided by market intermediaries induce liquidity co-movement (Brunnermeier and Pedersen, 2009; Corwin and Lipson, 2011; Kyle and Xiong, 2001; Qian et al., 2014; Rosch and Kaserer, 2013). In general, the above-mentioned studies concentrate on aggregate market level commonality with little or no concern about cross-sectional differences. In contrast, our analysis pertains to the economic factors driving such "micro" variation. Based on our evidence, cross-sectional differences in commonality in liquidity partly reflect uncertainty surrounding a stock's "fundamentals" in a flight-to-quality scenario; which is neither limited to the effects of sudden hikes in speculators funding costs as Brunnermeier and Pedersen's (2009) analysis suggests, nor to the need for liquidity of institutional investors as the demand-side hypothesis implies.[3]

The remainder of our paper is organised as follows. Section 2 details our hypothesis development, while Section 3 outlines our basic research design. Section 4 presents and discusses our primary results and then Section 5 delivers robustness checking. Finally, in Section 6 we offer concluding remarks.

2. Hypothesis development

Theoretical models of how commonality in liquidity arises do not clearly pin down economic factors that explain cross-sectional differences (Brunnermeier and Pedersen, 2009; Cespa and Foucault, 2014; Kyle and Xiong, 2001; Liu and Wang, 2013). Recent theoretical work, however, shows that a phenomenon of cross-asset learning of price information gives rise to liquidity commonality. Cespa and Foucault (2014) argue that cross-asset learning about asset price information by dealers leads to liquidity co-movement across assets. Liu and Wang (2013) suggest that uninformed investors' learning about asset payoffs from the payoffs of other assets drives liquidity commonality.

As a consequence of the phenomenon of cross-asset learning about pricing information identified by Patton and Verardo (2012), firms whose earnings provide information about other firms' profitability tend to experience greater increases in market betas following earnings announcements. The intuition of Patton and Verardo's (2012) model is that cross-asset learning about firm-level fundamentals by investors ensures that firms with informative earnings information have returns that co-move strongly with the market because these stocks become reference stocks and, hence, are similar in nature to the market.

To understand the economic sources of cross-sectional differences in commonality in liquidity, we argue that fundamentals uncertainty, proxied by profitability volatility, is a highly relevant firm-level economic construct. To predict the nature of the empirical relation between profitability volatility and commonality in liquidity in the cross-section, several considerations are important. First, Chordia et al. (2007) argue that earnings volatility induces learning-induced trading due to the estimation risk associated with earnings or profit volatility. Second, Gallmeyer et al. (2005) show that trading through a process of learning leads to endogenous co-movement in volume and aggregate market liquidity. Third, Pastor and Veronesi (2003) provide relevant theory and empirical evidence that learning about profitability has valuation implications. While Patton and Verardo (2012) relates to learning from news in earnings announcements, Pastor and Veronesi (2003) relates to long-term learning. Thus, we extend the intuition in Patton and Verardo (2012) to learning about firm fundamentals over the long-term, with a specific focus on uncertainty (i.e. the second moment).

We argue that fundamentals uncertainty creates an environment that gives importance to learning-induced trading. As such, profitability volatility should provide insights for understanding how cross-asset learning about firm-level fundamentals (by investors) is relevant for commonality in liquidity. We argue that firms with low profitability volatility i.e. low fundamentals uncertainty, would have more informative trades and hence higher liquidity, because such stocks would exhibit low estimation risk. Thus, low profitability volatility stocks are more likely to serve as reference stocks for assessing firms with more volatile profitability.

Our conjecture has support in the literature. Prior studies show that analysts prefer low earnings volatility stocks because analyst forecast errors for such stocks are lower (Brennan and Hughes, 1991; Schipper, 1991) and that low earnings volatility is positively correlated with analyst following (Lang et al., 2004). Also, low earnings volatility stocks are preferred by institutional investors (Badrinath et al., 1989). Indeed, Hameed et al. (2015) indicate that the fundamentals of firms with high analyst coverage are propagated to other firms more rapidly than is the case for zero analyst coverage firms. These empirical results present indicative evidence that low earnings volatility is a salient characteristic of a reference stock.

Ultimately, this line of argument suggests that firms with a low fundamentals uncertainty will exhibit higher liquidity commonality, consistent with the insights of Patton and Verardo (2012). In other words, the empirical implication is that low profitability volatility firms would tend to have a higher liquidity beta. Accordingly, we formulate the following hypothesis:

Hypothesis. Fundamentals uncertainty is negatively related to a stock's liquidity commonality.

In general, the phenomenon of cross-asset learning about fundamentals provides a new perspective on why firm size is positively related to commonality in liquidity (Kamara et al., 2008; Karolyi et al., 2012); why index-inclusion coincides with increased commonality in liquidity (Gorton and Pennacchi, 1993); and the relation between idiosyncratic volatility and commonality in liquidity (Karolyi et al., 2012). As such, we control for these potentially confounding variables/effects in our study.

3. Research design

3.1. Data and sampling

We use annual data on US firms drawn from CRSP and COMPUSTAT over the period 1962–2010. We exclude NASDAQ stocks for reasons related to volume counting that differ from NYSE/AMEX, in line with Kamara et al. (2008). We use the Amihud illiquidity measure as our primary liquidity proxy similar to other recent studies of commonality in liquidity (Kamara et al., 2008; Karolyi et al., 2012; Lang and Maffett, 2011). Similar to Kamara et al. (2008), we require that firms have prices above $2, nonzero returns, and volume and shares outstanding. Annual returns are cumulated from monthly returns and include delisting returns as

[3] A closely related study to ours in the accounting literature is Lang and Maffett (2011). In part, Lang and Maffett (2011) examine the effects of firm-level transparency (generally the disclosure environment of the firm) and how this affects commonality in liquidity. Specifically, they argue that transparency reduces uncertainty about intrinsic value and therefore by reducing uncertainty, transparency has the potential to affect the commonality of liquidity. Our approach is complementary to that of Lang and Maffett (2011).

in Beaver et al. (2007). Our primary proxy for the uncertainty of firm-level fundamentals is measured as the standard deviation of the ratio of income before extraordinary items (COMPUSTAT item IB) to average total assets over five years (see Pastor and Veronesi, 2003; Chordia et al., 2007; Dichev and Tang, 2009). To circumvent any major concerns about the potential undue role of outliers, we truncate earnings volatility, liquidity commonality (we discuss their measurement shortly) and returns at the top and bottom percentiles.

In line with Fama and French (1992), we use book-equity from the most recent fiscal-year end and market value at the end of December to compute book-to-market (hereafter abbreviated to *BM*). Book-equity is common equity or common equity liquidation value if common equity is missing. The accounting variables – earnings, book equity, accruals quality – are all taken at the end of a firm's fiscal year, while market-related variables are computed over the calendar year. This mismatch, especially given that firms have different fiscal year ends, acknowledges the delay between the conclusion of the fiscal year and when accounting information is publicly available to investors.

3.2. Liquidity commonality

The Amihud (2002) illiquidity measure is defined as:

$$ILLIQ_d = \frac{|r_d|}{DVOL_d} \tag{1}$$

where $|r_d|$ is the magnitude of return in percentage on day d and $DVOL_d$ is dollar volume in millions on day d. Following Karolyi et al. (2012), we use the R^2 extracted from the following model (Chordia et al., 2000; Kamara et al., 2008) as our proxy for commonality in liquidity:

$$\Delta ILLIQ_{i,d} = \alpha + \beta_L \Delta ILLIQ_{i,m,d} + \varepsilon \tag{2}$$

where $\Delta ILLIQ_{i,d}$ is the log-differenced illiquidity for firm i between trading day d and $d-1$, and $\Delta ILLIQ_{i,m,d}$ is the value-weighted market average of individual firm change in illiquidity using market value on trading day $d-1$. In line with Chordia et al. (2000) we exclude firm i when calculating market change in illiquidity, denoted by the subscript i in the market illiquidity variable in Eq. (2) above. Eq. (2) is estimated for each firm every year. Further, we use the logistic transformation $\ln\left(\frac{1}{1-R^2}\right)$ to create a variable that is not bounded between zero and one. We denote this proxy for our dependent variable, *Liqrsq*.

3.3. Empirical model

The specification of our general empirical model is an adapted version of that used by Lang and Maffett (2011) and is stated as follows:

$$Liqrsq_{it} = \alpha + \delta_1 Volroa_{it} + \sum_{k=1}^{K} \phi_k X_{k,it} + v_{it} \tag{3}$$

where *Liqrsq* is the commonality in liquidity proxy as defined above, *Volroa*, the main test variable, is operating profit volatility, and X is a set of control variables, and i and t represent firm and year, respectively. Our hypothesis predicts $\delta_1 < 0$, i.e. a negative linkage between the commonality in liquidity and volatility in operating profitability.

We measure *Volroa* as the standard deviation of operating profits (scaled by average assets), based on a rolling pre-five-year window (Dichev and Tang, 2009). The use of operating profits as our core component proxy for firm-level economic fundamentals within *Volroa*, is justified as follows. Operating profit is closely linked to the firm-level economic factors because profits reflect factors such as risk (Ball et al., 2009). Moreover, operating profit has been used in the extant literature to proxy firm-level fundamentals (e.g. Hameed et al., 2015; Wei and Zhang, 2006). Hameed et al. (2015) observe that changes in a firm's fundamentals reflect changes in technical efficiency, regulation and demand. These economic factors are generally captured by the operating profit in the financial reporting process. We use the volatility of operating cash flows, *Volcash*, as an alternative proxy for fundamentals uncertainty, measured similar to Jayaraman (2008) as the variance of operating cash flows over five years scaled by average assets.[4] The full set of right hand side control variables that we examine are discussed below.

Age is firm age measured in years, and assumes that a firm is "born" when it first appears in the CRSP database (Fama and French, 2004). We predict that Age will be positively related to commonality in liquidity in the cross-section for the following reasons. Pastor and Veronesi (2003) argue that if learning about uncertain profits is important for valuation, the natural effluxion of time would be important for valuation as it means part of the long-term uncertainty surrounding the stock's profitability could be resolved. In the current context, if the ability to use a stock's fundamentals to learn about the profitability of other stocks is a source of cross-sectional differences in liquidity commonality, all other things equal, the older a firm the more likely it has increased commonality in liquidity. In essence, our argument is that (other things equal) there is more to learn about the profitability of the aggregate economy from the profitability (fundamental values) of older firms than from the (more uncertain) profitability of younger firms.

Size is log market capitalisation (December, prior year). Large cap stocks have higher institutional ownership, and are more likely to be included in market indices. Thus, as predicted by Gorton and Pennacchi (1993) and evidenced empirically by Kamara et al. (2008), large firms have greater commonality in liquidity. This prediction would be reinforced by similar arguments discussed above for Age, given that age and size are naturally affected by many common influences.

Turnrsq is a proxy for correlated trading and is computed similar to liquidity commonality from detrended daily turnover. We follow Karolyi et al. (2012) to measure correlated trading as the commonality in turnover of a stock – a filtered value as follows:

$$Turn_{i,d} \equiv log\left(1 + \frac{VO_{i,d}}{SHROUT_{i,y}}\right) - \frac{1}{N}\sum_{k=1}^{100} log\left(1 + \frac{VO_{i,d-k}}{SHROUT_{i,y}}\right) \tag{4}$$

where $Turn_{i,d}$ and $VO_{i,d}$ are daily turnover and volume for firm i on day d, and $SHROUT_{i,y}$ is shares outstanding for firm i at the beginning of calendar year y, and k indexes the number of days prior to day d. Essentially, we de-trend turnover using a 100-day moving average of log turnover. We then run a market model type regression, using our turnover proxy. Again, as described above, we take the logistic transformation of the resulting R^2 values for the market turnover variable as our measure of correlated trading (*Turnrsq*). We repeat this estimation procedure for each firm-year. Correlated trading is expected to be positively correlated with commonality in liquidity (Kamara et al., 2008; Koch et al., 2012). Karolyi et al. (2012) empirically find a positive relation between correlated trading and commonality in liquidity in their cross-country study.

[4] We choose to scale our proxies for the uncertainty of firm-level fundamentals by average total assets, strongly guided by key papers in the literature. For example, Dichev and Tang (2009), examine the volatility of earnings, in which earnings is deflated by average total assets (i.e. ROA). See also, Pastor and Veronesi (2003) and Chordia et al. (2007). Similarly, our scaled cash flow volatility measure follows Jayaraman (2008).

Table 1
Descriptive statistics.

Variable	MEAN	STD	MIN	P25	MED	P75	MAX
Panel A: Basic descriptive statistics							
Liqrsq	0.027	0.039	0.000	0.003	0.012	0.034	0.423
Volroa	0.031	0.036	0.002	0.011	0.020	0.038	0.509
Volcash	3.620	8.300	0.000	0.290	0.972	3.128	152.933
Ret	0.161	0.420	−0.750	−0.100	0.104	0.344	2.674
Size	5.714	1.992	0.325	4.215	5.697	7.121	12.507
Age	24.433	16.789	4.000	11.000	19.000	34.000	85.000
Volty	0.022	0.010	0.008	0.015	0.020	0.027	0.093
Turnrsq	0.083	0.090	0.000	0.016	0.053	0.119	0.729
Mktbeta	0.899	0.514	−1.972	0.544	0.849	1.193	3.793
BM	0.839	0.654	0.001	0.432	0.685	1.060	21.286
Accqual	0.040	0.041	0.003	0.015	0.027	0.050	0.389
Rho	−0.941	0.222	−1.000	−0.999	−0.996	−0.975	1.000
Ilr	0.749	1.456	0.000	0.016	0.119	0.720	9.718
Roa	0.050	0.066	−0.731	0.025	0.050	0.081	0.291
Panel B: Liquidity commonality (Liqrsq) across operating profit volatility (Volroa) quintiles							
	Low	(2)	(3)	4	High	High-Low	
Mean	0.032***	0.032***	0.031***	0.028***	0.024***	−0.008***	
	(7.74)	(7.42)	(7.77)	(8.07)	(9.13)	(−4.10)	

This table reports the descriptive statistics for our full sample that covers US firms listed on the NYSE or AMEX, over the period 1965–2010. Panel A reports the means and other standard descriptive statistics, while Panel B reports liquidity commonality across operating profit volatility (*Volroa*) quintiles (based on two-way clustered standard errors, by firm and year). *Liqrsq* is liquidity commonality, $\ln\left(\frac{1}{1-R^2}\right)$, where R^2 comes from a market model regression of firm changes in liquidity on value-weighted market changes in liquidity. A firm is excluded in computing market liquidity for that firm. A minimum of 100 observations are required for each firm each year. *Volroa* is standard deviation of return-on-assets (average assets) over five years. *Volcash* is measured similar to Jayaraman (2008) as variance of operating cash flows over five years scaled by average assets. *Ret* is annual returns cumulated from monthly returns (including delisting returns). *Size* is log market capitalisation (December, prior year). *Age* is firm age measured in years, and assumes that a firm is born when it first appears in the CRSP database (Fama and French, 2004). *Volty* is idiosyncratic volatility measured as the standard deviation of the residuals from a regression of daily excess returns on daily Fama–French factors by firm, each year. *Turnrsq* is a proxy for correlated trading and is computed similar to liquidity commonality from detrended daily turnover. *Mktbeta* is the market model beta from regressions of returns on value-weighted market returns by firm, each year, requiring a minimum of 100 observations for each firm each year. *BM* is book-to-market using book values from the most recent fiscal year-end and market capitalisation from December. *Accqual* is accruals quality following Francis et al. (2005) and *Rho* is the correlation coefficient of changes in operating cash flows with changes in accruals over five years. *Ilr* is the annual Amihud illiquidity ratio. *Roa* is earnings scaled by average assets (5 years). While the effective sample period is 1965–2010, we use a longer period in calculating *Volroa*, *Rho* and *Accqual*.
*** Indicates statistical significance at the 1% level of significance.

Resvolty is idiosyncratic volatility (Volty) orthogonalized to size and earnings volatility. Volty is idiosyncratic volatility measured as the standard deviation of the residuals from regressions of daily excess returns on daily Fama–French factors by firm, each year.[5] We use idiosyncratic volatility as the cross-sectional analog of fundamental volatility at the market level. The Brunnermeier and Pedersen (2009) model suggests that fundamental volatility is instrumental to financiers margin reset and, hence, speculators' funding access has implications for commonality in liquidity. In the current context, our predictions are that less volatile fundamentals means it is more likely that a stock is used as a 'reference' stock, hence, less idiosyncratic volatility implies increased commonality in liquidity in the spirit of Patton and Verardo (2012) as argued earlier. We, therefore, expect that idiosyncratic volatility would be negatively correlated with commonality in liquidity in the cross-section.

Mktbeta is the market model beta from regressions of returns on value-weighted market returns by firm, each year, requiring a minimum of 100 observations for each firm each year. This control variable is included following Chordia et al. (2000). In the cross-section we expect that market beta would be positively related to commonality in liquidity because Kamara et al. (2008) and Karolyi et al. (2012) suggest that liquidity betas increase with market volatility, and market volatility could induce correlated trading among institutional investors (Kamara et al., 2008).

Ret is annual returns cumulated from monthly returns and includes delisting returns following Beaver et al. (2007). Stock returns are expected to impact cross-sectional commonality in liquidity because as Dorn et al. (2008) observe, correlated trading among retail traders is positively related to momentum trading.

Poslagret is a dummy variable taking a value of unity if last year's returns are positive and zero otherwise. The justification for including this variable is similar to *Ret*.

BM is book-to-market using book values from the most recent fiscal year-end and market capitalisation from December, following Fama and French (1992). The inclusion of BM takes into account Asness et al. (2013) who report a positive relation between the value premium and liquidity risks. Lang and Maffett (2011) also include BM in their analysis.

Ilr is annual Amihud illiquidity ratio. We include illiquidity, taking account of Lang and Maffett (2011) and also the evidence that the illiquidity premium is positively associated with liquidity risk premiums (Hagstromer et al., 2013).

We also include two alternative income smoothing proxies relating to accruals: *Accqual*, accruals quality following Francis et al. (2005) and *Rho*, the correlation coefficient of changes in operating cash flows with changes in accruals over five years. We use income smoothing proxies for transparency as in Lang and Maffett (2011) to demonstrate that the firm-level operating profit volatility relation with stock liquidity commonality is distinct from the impact of firm income smoothing practices.

We measure income smoothing, motivated by Lang and Maffett (2011), using two alternatives: (a) the accruals quality measure of Dechow and Dichev (2002), as modified by Francis et al. (2005), and (b) the correlation coefficient over three years of changes in accruals and changes in cash flows over five years (Leuz et al.,

[5] We take into account studies that suggest that operating profit volatility is correlated with idiosyncratic volatility (Pastor and Veronesi, 2003) by orthogonalizing idiosyncratic volatility to size (given the economically important sample correlation shown in Table 2) and operating profit volatility. This orthogonalization is also necessary to allow us to obtain the individual effects of each of these three variables, which in the context of our argument should have divergent influences over commonality in liquidity.

Table 2
Sample correlation matrix.

Variable	*Liqrsq*	*Volroa*	*Volcash*	*Ret*	*Size*	*Age*	*Volty*	*Turnrsq*	*Mktbeta*	*BM*	*Accqual*	*Rho*	*Ilr*	*Roa*
Liqrsq	1	−0.101	0.308	−0.016	0.479	0.175	−0.231	0.519	0.439	−0.183	−0.048	0.026	−0.525	0.101
		[0.000]	[0.000]	[0.021]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Volroa	−0.082	1	0.047	−0.106	−0.250	−0.134	0.437	−0.123	0.108	−0.003	0.480	0.405	0.124	−0.117
	[0.000]		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.645]	[0.000]	[0.000]	[0.000]	[0.000]
Volcash	0.171	0.040	1	0.028	0.621	0.201	−0.100	0.442	0.312	−0.210	0.089	0.025	−0.643	0.051
	[0.000]	[0.000]		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Ret	−0.096	−0.037	0.024	1	0.125	−0.009	−0.159	0.057	0.068	−0.249	−0.050	−0.062	−0.058	0.291
	[0.000]	[0.000]	[0.000]		[0.000]	[0.214]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Size	0.406	−0.240	0.393	0.086	1	0.300	−0.453	0.647	0.326	−0.498	−0.197	0.013	−0.903	0.267
	[0.000]	[0.000]	[0.000]	[0.000]		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.060]	[0.000]	[0.000]
Age	0.178	−0.127	0.189	−0.035	0.338	1	−0.301	0.208	−0.015	−0.024	−0.156	0.052	−0.251	−0.014
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]		[0.000]	[0.000]	[0.027]	[0.001]	[0.000]	[0.000]	[0.000]	[0.046]
Volty	−0.180	0.408	−0.056	−0.104	−0.462	−0.250	1	−0.225	0.146	0.171	0.376	0.064	0.290	−0.215
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Turnrsq	0.559	−0.113	0.304	0.011	0.598	0.256	−0.201	1	0.409	−0.284	−0.056	0.023	−0.679	0.168
	[0.000]	[0.000]	[0.000]	[0.096]	[0.000]	[0.000]	[0.000]		[0.000]	[0.000]	[0.000]	[0.001]	[0.000]	[0.000]
Mktbeta	0.357	0.102	0.162	0.109	0.290	−0.003	0.120	0.314	1	−0.181	0.094	0.071	−0.441	0.047
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.650]	[0.000]	[0.000]		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
BM	−0.124	0.017	−0.084	−0.213	−0.458	−0.056	0.286	−0.200	−0.138	1	−0.042	−0.001	0.395	−0.474
	[0.000]	[0.016]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]		[0.000]	[0.908]	[0.000]	[0.000]
Accqual	−0.047	0.446	0.065	0.015	−0.191	−0.133	0.318	−0.065	0.055	0.009	1	−0.051	0.070	−0.058
	[0.000]	[0.000]	[0.000]	[0.028]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.186]		[0.000]	[0.000]	[0.000]
Rho	−0.019	0.324	0.009	−0.009	−0.052	−0.068	0.101	−0.025	0.040	0.011	0.052	1	−0.045	−0.033
	[0.005]	[0.000]	[0.183]	[0.202]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.110]	[0.000]		[0.000]	[0.000]
Ilr	−0.189	0.071	−0.137	−0.072	−0.543	−0.123	0.277	−0.256	−0.285	0.288	0.076	0.011	1	−0.169
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.099]		[0.000]
Roa	0.085	−0.315	0.031	0.245	0.279	0.016	−0.306	0.152	0.028	−0.295	−0.133	−0.117	−0.107	1
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.024]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	

This table reports the correlation coefficients and associated probability values for our full sample which covers US firms listed on the NYSE or AMEX over the period 1965–2010. The correlations above (below) the main diagonal are Spearman rank (Pearson product moment) correlations. The values in square brackets are p-values. *Liqrsq* is liquidity commonality, $\ln\left(\frac{1}{1-R^2}\right)$, where R^2 comes from a market model regression of firm changes in liquidity on value-weighted market changes in liquidity. A firm is excluded in computing market liquidity for that firm. A minimum of 100 observations are required for each firm each year. *Volroa* is standard deviation of return-on-assets (average assets) over five years. *Volcash* is measured similar to Jayaraman (2008) as variance of operating cash flows over five years scaled by average assets. Ret is annual returns cumulated from monthly returns (including delisting returns). Size is log market capitalisation (December, prior year). Age is firm age measured in years, and assumes that a firm is born when it first appears in the CRSP database (Fama and French, 2004). *Volty* is idiosyncratic volatility measured as the standard deviation of the residuals from a regression of daily excess returns on daily Fama–French factors by firm, each year. *Turnrsq* is a proxy for correlated trading and is computed similar to liquidity commonality from detrended daily turnover. *Mktbeta* is the market model beta from regressions of returns on value-weighted market returns by firm, each year, requiring a minimum of 100 observations for each firm each year. *BM* is book-to-market using book values from the most recent fiscal year-end and market capitalisation from December. *Accqual* is accruals quality following Francis et al. (2005) and Rho is the correlation coefficient of changes in operating cash flows with changes in accruals over five years. *Ilr* is the annual Amihud illiquidity ratio. *Roa* is earnings scaled by average assets (5 years). While the effective sample period is 1965–2010, we use a longer period in calculating *Volroa*, *Rho* and *Accqual*.

2003; Tucker and Zarowin, 2006). To measure accruals quality as per the Francis et al. (2005) modified version of the Dechow and Dichev (2002) model of accruals quality, we run the following regression by industry each year using the Fama–French 12 industry classification:

$$TACC = \alpha + \beta_1 CF_{t+1} + \beta_2 CF_t + \beta_3 CF_{t-1} + \beta_4 \Delta Rev + \beta_5 PPE + \mu \qquad (5)$$

where CF_k are lead $(t+1)$, contemporaneous (t) and lag $(t-1)$ cash flows, ΔRev is change in revenue, and *PPE* is gross property and plant. As in Dechow and Dichev (2002) we scale all the variables in Eq. (5) by average total assets, and we take the standard deviation of the residuals (μ) over years $t-5$ to $t-1$ as accruals quality. Higher standard deviations mean lower accruals quality, or lower transparency. Thus, relative to Lang and Maffett (2011), low accruals quality should be related to greater commonality in liquidity because low accruals quality implies lower transparency.

We estimate our main regression Eq. (3) with standard errors clustered by firm and year (Cameron et al., 2011) while controlling for firm fixed effects in all our estimations. Time fixed effects are not employed in our estimations as we do not find any significant time effects when time dummies are included. On a technical level the econometrics literature has not produced a test of the level at which to cluster as well dealing with two-dimensional fixed effects and multi-way clustering (Cameron and Miller, 2015). Moreover, we are persuaded by the observations by Cameron and Miller (2015) that, year fixed effects can absorb within-year clustering. In a nutshell our set up allows us to contain fixed effects and still mitigate inferential bias due to standard error clustering.

3.4. Descriptive statistics and univariate analysis

Table 1 reports the sample descriptive statistics and univariate tests of differences in means relating to our hypothesis. Panel A shows that the annual mean return in the sample is approximately 0.16, with a median of 0.10. The average volatility of operating profitability is approximately 0.03, with a median of 0.02 and a maximum of 0.5. The sample mean and median liquidity commonality (*Liqrsq*) is about 0.03 and 0.01, respectively.

Panel B of Table 1 reports mean liquidity commonality across quintiles of operating profit volatility, with t-statistics based on two-way clustered standard errors. High-Low in Panel B is the mean of the difference between liquidity commonality for high and low operating profit volatility stocks. Operating profit volatility ranks are constructed by sorting operating profit volatility into quintiles by year. The results in Panel B show a monotonic decline in liquidity commonality as expected, with the mean liquidity commonality for low operating profit volatility about at 0.0083 units higher than mean liquidity commonality for high operating profit volatility stocks. These differences are statistically significant (at the 1% level) indicating preliminary support for our hypothesis that commonality in liquidity decreases in profitability volatility.

Table 3
Testing the impact of the uncertainty of firm-level fundamentals on liquidity commonality – main analysis.

	(1) Full Sample	(2) 1965–75	(3) 1975–85	(4) 1985–95	(5) 1995–2010	(6) Full Sample	(7) 1985–95	(8) 1996–2010
Volroa	−1.690***	1.024	1.906	−1.925*	−2.996***	−1.567**	−2.134*	−2.201**
	(−2.85)	(0.38)	(1.18)	(−1.81)	(−3.79)	(−2.25)	(−1.76)	(−2.11)
Age	0.030***	0.085***	0.000	−0.059***	0.109***	0.030***	−0.066***	0.139***
	(4.65)	(3.43)	(0.00)	(−2.60)	(3.30)	(4.01)	(−2.86)	(3.77)
Size	0.259***	0.406***	0.290***	0.232***	0.187**	0.272***	0.280***	0.279***
	(8.25)	(3.91)	(4.23)	(3.38)	(2.21)	(7.78)	(3.77)	(3.29)
Resvolty	−18.695***	−13.427	5.439	−12.835**	−25.525***	−21.102***	−16.768***	−22.789**
	(−3.21)	(−1.30)	(0.70)	(−2.53)	(−3.28)	(−3.04)	(−2.86)	(−2.57)
Mktbeta	1.093***	0.962***	0.677***	0.560***	1.297***	1.195***	0.697***	1.291***
	(10.95)	(7.00)	(7.33)	(5.97)	(9.19)	(11.05)	(6.36)	(8.06)
Poslagret	−0.063	−0.061	0.032	−0.036	−0.090	−0.062	−0.036	−0.107
	(−1.13)	(−0.71)	(0.50)	(−0.58)	(−0.88)	(−1.04)	(−0.56)	(−1.03)
BM	0.107***	0.083	0.090*	0.088*	0.181***	0.130***	0.136*	0.244***
	(3.64)	(1.36)	(1.67)	(1.80)	(2.74)	(3.39)	(1.92)	(2.64)
Trnrsq	0.117***	0.076***	0.104***	0.079***	0.091***	0.122***	0.075***	0.086***
	(8.30)	(4.07)	(6.22)	(5.34)	(4.97)	(7.60)	(4.19)	(4.02)
Accqual	−0.589	2.743	−1.622	1.119*	−0.987*	−0.670	1.208	−1.118**
	(−1.41)	(1.28)	(−1.00)	(1.73)	(−1.84)	(−1.23)	(1.17)	(−2.06)
Ilr	0.088***	0.035	0.057**	0.042	0.234***	0.072***	0.044	0.222*
	(4.77)	(1.09)	(2.10)	(0.87)	(2.80)	(3.23)	(0.72)	(1.70)
Ret	−0.190**	−0.087	−0.016	−0.142	−0.245***	−0.240***	−0.154	−0.286***
	(−2.56)	(−0.76)	(−0.16)	(−1.51)	(−2.64)	(−2.74)	(−1.37)	(−3.28)
Rho						−0.089	−0.145*	−0.088
						(−1.46)	(−1.92)	(−0.87)
N	51244	7210	15038	12954	15443	42495	11380	12304
adj. R^2	0.02	−0.19	−0.14	−0.15	0.05	0.03	−0.14	0.09

This table reports our main results from the regression of commonality in liquidity on volatility of operating profit, *Volroa* (proxying uncertainty of firm-level fundamentals) and other control variables. The regressions employ two-way clustered standard errors following Cameron et al. (2011). Our sample covers US firms listed on the NYSE or AMEX over the period 1965–2010. The dependent variable is *Liqrsq*, $\ln\left(\frac{1}{1-R^2}\right)$, our measure of liquidity commonality where R^2 comes from a market model regression of firm changes in liquidity on value-weighted market changes in liquidity. A firm is excluded in computing market liquidity for that firm. A minimum of 100 observations are required for each firm each year. *Volroa* is standard deviation of return-on-assets (average assets) over five years. *Age* is firm age measured in years, and assumes that a firm is born when it first appears in the CRSP database (Fama and French, 2004). *Size* is log market capitalisation (December, prior year). *Resvolty* is idiosyncratic volatility (*Volty*) orthogonalized to size and earnings volatility, *Volty* is idiosyncratic volatility measured as the standard deviation of the residuals from regressions of daily excess returns on daily Fama–French factors by firm, each year. *Mktbeta* is the market model beta from regressions of returns on value-weighted market returns by firm, each year, requiring a minimum of 100 observations for each firm each year. *Poslagret* is a dummy variable taking a value of unity if last year's returns are positive and zero otherwise. *BM* is book-to-market using book values from the most recent fiscal year-end and market capitalisation from December. *Turnrsq* is a proxy for correlated trading and is computed similar to liquidity commonality from detrended daily turnover. *Accqual* is accruals quality following Francis et al. (2005). *Ilr* is annual Amihud illiquidity ratio. *Ret* is annual returns cumulated from monthly returns and includes delisting returns. *Rho* is the correlation coefficient of changes in operating cash flows with changes in accruals over five years. The numbers in parentheses are t-statistics and the asterisks *, **, and *** indicate statistical significance at the 10%, 5% and 1% level of significance, respectively. The effective sample period is 1965–2010 but we use a longer period in calculating *Volroa*, *Rho* and *Accqual*.

We report sample correlations between our variables in Table 2. The values lying above (below) the diagonal are Spearman rank (Pearson) correlation coefficients, with p-values in brackets. Commonality in liquidity is negatively correlated with operating profit volatility (*Volroa*), illiquidity level (*ilr*), idiosyncratic volatility (*volty*), BM and accruals quality (*Accqual*) and positively correlated with size, correlated trading (*Turnrsq*), and systematic risk (*Mktbeta*). The p-values suggest that these correlations are all statistically significant. Other correlations of interest are between idiosyncratic volatility and operating profit volatility ($\rho = 0.437, p value < 0.01$), and between size and idiosyncratic volatility ($\rho = -0.453, p value < 0.01$), based on Spearman rank correlations. These high correlations have implications for our regression tests since theoretical studies suggest size and volatility of fundamentals as the sources of commonality in liquidity (Brunnermeier and Pedersen, 2009). As such, we take steps to reliably isolate the individual effects of these variables in our regressions.[6]

4. Main empirical results

Table 3 reports our main set of empirical findings for various specifications of Eq. (3). We first present results for the full sample, and then results for each decade from 1965, until we reach the final fifteen years, 1996–2010, which is treated as one final subperiod. In columns (1)–(5), we control for accruals quality, *Accqual*, to take on board the results of Lang and Maffett (2011) regarding transparency and liquidity commonality. In columns (6)–(8) we also include *Rho* (correlation coefficient of changes in accruals and operating cash flows) as an additional proxy of income smoothing, thereby capturing two of the dimensions of transparency used in Lang and Maffett (2011).[7]

Most notably in Table 3, we observe that the estimated coefficient on *Volroa* is negative and statistically significant in the full sample, as well as in the sub-periods between 1985 and 2010. Moreover, the finding seems strongest in the final sub-period, 1996–2010. Hence, we have evidence supporting our

[6] In the context of our argument that cross-asset learning about fundamentals underlies cross-sectional differences in commonality, these variables predict commonality in liquidity in opposite directions. Following conventional practice with regard to the general concern about multicollinearity, in untabulated analysis, we also calculate variance inflation factors (VIFs). The VIFs produce values in the range 1–8, with only a few cases exceeding 5.

[7] The other dimensions of transparency considered by Lang and Maffett are auditor type and adoption of International Financial Reporting Standards, IFRS. While we do not directly account for auditor type, we argue that by estimating our regressions with firm fixed effects indirectly mitigates its omission, since auditor type is somewhat time-invariant. Our firm fixed effects and two-way clustering is implemented based on Schaffer (2010).

Table 4
Robustness checks – Testing the impact of the uncertainty of firm-level fundamentals on liquidity commonality for the period 1996–2010.

	Panel A: Cash flow volatility		Panel B: −(1/(1 + Age))		Panel C: lnAge	
	(1)	(2)	(3)	(4)	(5)	(6)
Volroa			−2.154***	−1.983**	−2.135***	−2.068**
			(−2.66)	(−1.98)	(−2.65)	(−2.06)
Age	0.140***	0.141***				
	(19.96)	(18.96)				
Size	0.268***	0.310***	0.455***	0.483***	0.347***	0.366***
	(5.91)	(6.12)	(9.93)	(9.36)	(7.58)	(7.09)
Resvolty			−23.207***	−24.668***	−21.527***	−23.192***
			(−9.00)	(−8.56)	(−8.44)	(−8.18)
Mktbeta	1.240***	1.289***	1.502***	1.537***	1.390***	1.416***
	(24.40)	(23.16)	(29.16)	(27.53)	(27.08)	(25.52)
Poslagret	−0.107***	−0.103***	−0.161***	−0.141***	−0.140***	−0.119***
	(−3.12)	(−2.78)	(−4.66)	(−3.80)	(−4.06)	(−3.22)
BM	0.218***	0.255***	0.390***	0.418***	0.297***	0.317***
	(3.68)	(3.62)	(5.73)	(5.10)	(4.79)	(4.31)
Trnrsq	0.083***	0.084***	0.118***	0.115***	0.103***	0.100***
	(6.78)	(6.24)	(9.64)	(8.54)	(8.48)	(7.46)
Accqual	−0.753	−1.127*	0.139	−0.132	−0.029	−0.426
	(−1.30)	(−1.69)	(0.23)	(−0.19)	(−0.05)	(−0.62)
Ilr	0.251***	0.226**	0.224***	0.218**	0.235***	0.231**
	(3.50)	(2.32)	(3.40)	(2.33)	(3.52)	(2.43)
Ret	−0.242***	−0.279***	−0.395***	−0.410***	−0.327***	−0.339***
	(−6.05)	(−6.42)	(−10.06)	(−9.52)	(−8.29)	(−7.89)
Rho		−0.086		−0.018		−0.036
		(−0.94)		(−0.19)		(−0.39)
Volcash	−0.007***	−0.006***				
	(−3.18)	(−2.73)				
Cresvolty	−20.626***	−22.389***				
	(−8.16)	(−7.90)				
TransAge			12.606***	23.493***		
			(10.18)	(10.68)		
LnAge					1.643***	2.249***
					(14.88)	(14.84)
N	13771	12091	14037	12304	14037	12304
adj. R^2	0.08	0.09	0.05	0.07	0.06	0.08

This table reports robustness checks for the regression testing the linkage between commonality in liquidity and the uncertainty of firm-level fundamentals. The regressions employ two-way clustered standard errors following Cameron et al. (2011). Here the sample covers US firms listed on the NYSE or AMEX over the period 1996–2010. The dependent variable is *Liqrsq*, $\ln\left(\frac{1}{1-R^2}\right)$, our measure of liquidity commonality where R^2 comes from a market model regression of firm changes in liquidity on value-weighted market changes in liquidity. A firm is excluded in computing market liquidity for that firm. A minimum of 100 observations are required for each firm each year. *Volroa* is standard deviation of return-on-assets (average assets) over five years. *Volroa* is the proxy for uncertainty of firm-level fundamentals used in Panels B and C. Panel A substitutes cash flow volatility (*Volcash*) in place of profit volatility, to proxy for uncertainty of firm-level fundamentals. *Volcash* is measured similar to Jayaraman (2008) as the variance of operating cash flows over five years scaled by average assets. *Age* is firm age measured in years, and assumes that a firm is born when it first appears in the CRSP database (Fama and French, 2004). *Size* is log market capitalisation (December, prior year). *Resvolty* is idiosyncratic volatility (*Volty*) orthogonalized to size and earnings volatility, *Volty* is idiosyncratic volatility measured as the standard deviation of the residuals from regressions of daily excess returns on daily Fama–French factors by firm, each year. *Mktbeta* is the market model beta from regressions of returns on value-weighted market returns by firm, each year, requiring a minimum of 100 observations for each firm each year. *Poslagret* is a dummy variable taking a value of unity if last year's returns are positive and zero otherwise. *BM* is book-to-market using book values from the most recent fiscal year-end and market capitalisation from December. *Turnrsq* is a proxy for correlated trading and is computed similar to liquidity commonality from detrended daily turnover. *Accqual* is accruals quality following Francis et al. (2005) and *Rho* is correlation coefficient of changes in operating cash flows with changes in accruals over five years. *Ilr* is annual Amihud illiquidity ratio. *Ret* is annual returns cumulated from monthly returns and includes delisting returns. *Cresvolty* is *Volty* orthogonalised to size and cash flow volatility. Panels B and C provide robustness checks with respect to the role of *Age*. The columns indicate the manner in which the age variable is transformed. *TransAge* is defined as $-\left(\frac{1}{1+Age}\right)$ based on the Pastor and Veronesi (2003) model. *LnAge* is natural log of age. The numbers in parentheses are t-statistics and the asterisks *, **, and *** indicate statistical significance at the 10%, 5% and 1% level of significance, respectively.

core hypothesis – namely, that there is an inverse relation between profitability volatility and liquidity commonality. Given that our key finding is driven by the most recent 15-year interval, (1996–2010), to conserve space and focus reader attention, all remaining analysis is confined to this narrower time period.[8]

The coefficient estimates on *Age* (measured in calendar years) in Table 3 is positive and statistically significant as expected, except for the sample period 1985–95 for which the coefficient is negative and statistically significant. Among the control variables, *Size* has the expected positive coefficient, which is significant in the full sample and across all the sub-periods. As such, size is a critical variable. This makes intuitive sense since size here captures factors such as index-inclusion and high institutional ownership. Size, however, also embodies investor expectations of future cash flows given it is a market-based measure. Such expectations are likely informed by operating profit (fundamentals) stability and predictability.

Other control variables that are significant in Table 3 are: *Turnrsq* or correlated trading (positive in all estimations); *BM* (positive in all estimations except the 1965–75 period); and *Ilr*, the annual illiquidity ratio (positive and significant in all estimations except 1965–75 and 1985–95). *Ret* has a negative coefficient which is significant in the full sample and in the last sub-period. Idiosyncratic volatility, *Resvolty*, has the expected negative coefficient that is statistically significant in all estimations except the period 1965–85. *Mktbeta* has the expected positive coefficient and is statistically significant in all estimations, which is consistent with

[8] The results for the full sample period on all ensuing analyses are available from the authors upon request.

Kamara et al. (2008). For the two income smoothing proxies, *Accqual* and *Rho*, neither is statistically significant in any estimations, except *Accqual* that is negative and significant at the 5% level in the last sub-period.

5. Robustness checking

5.1. An alternative empirical proxy for fundamentals uncertainty

To this point, we exclusively proxy "fundamentals" uncertainty with "operating profit" volatility. A reasonable question to ask is whether there are other reliable proxies that could meaningfully challenge the robustness of our main finding? To this end, we use cash flow volatility in place of operating profit volatility.[9] Specifically, similar to *Volroa*, *Volcash* is measured as the variance of operating cash flows (extracted from the cash flow statement) over the prior 5 years, scaled by total assets, consistent with Jayaraman (2008).

We re-estimate the models reported in Table 3, restricted to the latter part of our sample period i.e. 1996–2010 (since it is shown above that our main findings are driven by this part of our sample). The results are reported in Panel A of Table 4. As columns (1) and (2) of the table show, similar to our main results presented and discussed above, a negative and statistically significant relation between cash flow volatility and commonality in liquidity is obtained. Also, all other variables generally continue to have similar coefficient signs and significance as in the earlier estimation.[10] Overall, these results buttress our proposition that fundamentals uncertainty is the source of cross-sectional differences in liquidity commonality.

5.2. Alternative age proxy transformations

Panels B and C of Table 4 present results for alternate transformations of the age proxy. Specifically, similar to Pastor and Veronesi (2003), in addition to "raw" age as used in the primary analysis, we also consider (a) the natural log of age and (b) the negative of the reciprocal of age plus one, $\left(-\frac{1}{(1+AGE)}\right)$. The results documented in these panels demonstrate that neither of these alternative transformations of the age proxy impact the (negative) coefficient sign nor the statistical significance of the key test variable. Hence, again our primary findings remain intact.

5.3. Other robustness analysis

We also conduct a range of additional unreported robustness tests.[11] First, we perform portfolio-based analysis across size dimensions to clarify the intrinsic role played by this financial characteristic on the cross-sectional variation of liquidity risk. Specifically, we independently sort stocks into size quintiles and then run cross-sectional regressions within these quintile groups. This allows us to assess whether the marginal effect of operating profit volatility on commonality in liquidity depends on firm size. This analysis shows that the estimated earnings volatility coefficient is only statistically significant in the largest size quintile. This is to be expected since it is likely that larger firms tend to have more stable earnings and, hence, their lower fundamentals uncertainty could provide more information about other firms in line with the main theme of our study.

Second, we alternatively conduct our analysis based on the liquidity beta from the market model in Eq. (2) as a measure of liquidity commonality. As it turns out, the results reported earlier in this paper are found to somewhat understate the thrust of the fundamentals uncertainty effect compared to the liquidity beta based analysis, which strongly confirms our main findings.

Third, also in the liquidity beta-based setting, we test for implications of infrequent trading. One implication is that perhaps our results are biased towards frequently traded stocks. Accordingly, we re-estimate the commonality in liquidity measures using the Dimson (1979) correction (with one lead and one lag term). These results also corroborate our main findings.

6. Conclusion

This paper investigates the cross-sectional influence of uncertainty about firm fundamentals on commonality in liquidity. More specifically, we use the volatility of operating profit to proxy for fundamentals uncertainty and argue that a firm with low (high) volatility in its "fundamental" profitability will have a higher (lower) liquidity commonality because it is more (less) likely to serve as reference stock in the setting of cross-asset learning about fundamentals. Our analysis supports this cross-sectional prediction that commonality in liquidity is negatively related to operating profitability volatility. Moreover, the results are strongly robust to a large battery of alternative factors and tests including: managerial earnings smoothing, firm-fixed effects, and infrequent trading.

[9] We thank an anonymous referee for suggesting this general direction as an additional robustness check.

[10] A notable difference to the earlier analysis is that the role of Poslagret, a dummy variable indicating that prior year returns are positive. The estimated coefficient on this variable is negative and statistically significant in the current robustness analysis, while it is not statistically significant in the primary analysis. We attribute this minor difference in our results to random statistical variation.

[11] Results pertaining to all this extra unreported analysis, briefly discussed in the remainder of this section, are available from the authors upon request.

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