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Liquidity and stock returns: An alternative test

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Abstract

This paper provides an alternative test of Amihud and Mendelson's (1986, Journal of Financial Economics, 8, 31–35) model using the turnover rate (number of shares traded as a fraction of the number of shares outstanding) as a proxy for liquidity. The evidence suggests that liquidity plays a significant role in explaining the cross-sectional variation in stock returns. This effect persists after controlling for the well known determinants of stock returns like the firm-size, book-to-market ratio and the firm beta. Unlike Eleswarapu and Reinganum (1993, Journal of Financial Economics, 34, 373–386), this paper finds that the liquidity effect is not restricted to the month of January alone and is prevalent throughout the year. The evidence supports Amihud and Mendelson's (1986) notion of liquidity premium and establishes its role in the overall cross section of stock returns. © 1998 Elsevier Science B.V. All rights reserved.

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1. Introduction

It is generally accepted that liquidity, marketability or transactions costs are important attributes of assets which influence investors' portfolio

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decisions.[1] Since investors care about expected holding period returns net of trading costs, less liquid (and more costly to trade) assets need to provide higher gross returns compared to more liquid assets. Amihud and Mendelson (1986), henceforth A&M, formalized this important link between market microstructure and asset pricing. A&M showed that, in equilibrium, illiquid assets would be held by investors with longer investment horizons. As a result of this horizon clientele, they argued that the observed asset returns must be an increasing and concave function of the transactions costs.[2] A&M used the quoted bid–ask spread as a measure of liquidity and tested the relationship between stock returns and liquidity during the period of 1961–1980. They found evidence consistent with the notion of liquidity premium.

Subsequent empirical evidence in support of liquidity is somewhat mixed though. Eleswarapu and Reinganum (1993), henceforth E&R, examine the 1961–1990 period using the same proxy for liquidity as A&M and find that the association between the bid–ask spread and stock returns is mainly confined to the month of January. In a recent study, Brennan and Subrahmanyam (1996), henceforth B&S, take an innovative approach and segregate the cost of transacting into a variable and a fixed component. In contrast to the results of E&R, they do not find any evidence of seasonality in liquidity premium. They find weak evidence in favor of A&M's model. In particular, B&S find the concave relationship between asset returns and transactions costs with respect to the variable cost component. However, they do not find it with respect to the fixed cost component which is inconsistent with A&M's horizon clientele effect. In summary, the question whether liquidity affects asset returns or not remains unresolved thus far. This question is important since there exists a vast literature in the area of market microstructure which argues that the liquidity has first order effect on asset returns.

This paper attempts to shed light on the relation between liquidity and asset returns using a proxy for liquidity that is different from the bid–ask spread

[1] See Demsetz (1968) and Bagehot (1971). Early researchers tried to capture transactions costs in terms of bid-ask spread and, as a result, focused on how market makers et the spread, what determines the spread, how different market structures may affect the spread and the effect of spread on asset returns. See, for example, Demsetz (1968), Bagehot (1971), Tinic (1972), Tinic and West (1972), Benston and Hagerman (1974), Garman (1976), Branch and Freed (1977), Stoll (1978), Amihud and Mendelson (1980), Ho and Stoll (1981, 1983), Copeland and Galai (1983), Glosten and Milgrom (1985), Constantinides (1986), Marsh and Rock (1986), O'Hara and Oldfield (1986), Easley and O'Hara (1987), Glosten and Harris (1988), Glosten (1989) and Chen and Kan (1989).

[2] See Grossman and Miller (1988) for impact of market structure on liquidity. Transactions costs are also influenced by market imperfections like information costs, trade induced volatility, adverse selection costs all of which seem to be higher for less frequently traded or illiquid stocks. See, for example, Merton (1987), Beneish and Gardner (1995), Bailey and Jagtiani (1994), Conrad et al. (1994), Campbell et al. (1993), Easley et al. (1996) and Brennan and Subrahmanyam (1996).

measure widely used by researchers. The reason for proposing a new proxy for liquidity is two-fold. First, the data on bid–ask spread is hard to obtain on a monthly basis over long periods of time (A&M and E&R use the average of the bid–ask spread at the beginning and at the end of the year as a proxy for the liquidity of a stock through that year). Second, Peterson and Fialkowski (1994) show that the quoted spread is a poor proxy for the actual transactions costs faced by investors and call for an alternative proxy which may do a better job of capturing the liquidity of an asset.

In this paper, we propose the turnover rate of an asset as a proxy for its liquidity. We define the turnover rate of a stock as the number of shares traded divided by the number of shares outstanding in that stock and think of it as an intuitive metric of the liquidity of the stock.[3] The advantage of using the turnover rate as a proxy for liquidity is two-fold. First, it has strong theoretical appeal. A&M prove that in equilibrium liquidity is correlated with trading frequency. So, if one cannot observe liquidity directly but can observe the turnover rate, then one can use the latter as a proxy for liquidity (this is discussed in detail below). Second, the data on turnover rates is relatively easy to obtain (it can be constructed from the CRSP tapes on a monthly basis). This enables us to capture month by month variation in the liquidity of assets and allows the examination of liquidity effects across a large number of stocks over a long period of time.

Using the turnover rate as a proxy for liquidity we examine whether stock returns are negatively related to liquidity as predicted by A&M's model.[4] We investigate if this relation persists after controlling for the firm size, book to market ratio and the firm beta. In order to ensure that our findings are not driven by a few outliers, we discard the lowest 1% and highest 1% observations of turnover rate and re-examine the relationship in the trimmed dataset. Since E&R find that liquidity premium is mainly restricted to the month of January, we examine the relationship with and without the month of January. Finally, we subdivide the sample into two halves and examine the robustness of the relation between the stock returns and turnover over time.

Our results support the predictions of A&M's model. We find that the stock returns are a decreasing function of the turnover rates. This relation persists after controlling for the firm size, book to market ratio and the firm beta. We find similar results in the trimmed dataset as well which suggests that our results are not driven by a few influential outliers. In contrast to the findings of E&R,

[3] The number of shares traded by itself is not a sufficient statistic for the liquidity of a stock since it does not take into account the differences in the number of shares outstanding or the shareholder base.

[4] Our work seems to be done in parallel with that of Hu (1997), who also uses a similar proxy to test Amihud and Mendelson's (1986) model using the Tokyo Stock Exchange data.

we do not observe any evidence of January seasonality. In particular, we find that the stock returns are strongly related to the turnover rates throughout the year. Finally, when we subdivide our dataset into two halves, we observe that the liquidity effect is significant in the first as well as in the second half. In summary, we find that the liquidity effect predicted by A&M's model is robust and plays an important role in explaining the overall cross-section of stock returns.

The remainder of this paper proceeds as follows: Section 2 provides the theoretical motivation for using the turnover rate as a proxy for liquidity; Section 3 discusses the methodology; Section 4 describes the data; Section 5 highlights the empirical results and Section 6 concludes.

2. Turnover rate, liquidity and asset returns

A&M study a competitive dealership market where $N + 1$ capital assets with differing liquidity are traded at the posted bid and ask prices. In their model, there exist M types of investors who differ in terms of their expected holding periods. A type-i investor enters the market with wealth W_i and purchases capital assets at the quoted ask prices. He holds these assets for a random time T_i with mean $\mathrm{E}[T_i] = \mu_i^{-1}$. At the end of his horizon, the type-i investor sells the capital assets back to the market makers at the bid prices and leaves the market. A&M assume that the investors arrive in the market according to some Poisson distribution and hold the capital assets for a duration which has exponential distribution. These assumptions enable them to construct a statistical equilibrium of the economy under consideration.

In such a framework, A&M show that 'assets with higher spreads are allocated in equilibrium to portfolios with (the same or) longer expected holding periods' (see their Proposition 1). They argue that 'in equilibrium, the observed market (gross) return must be an increasing and concave piece-wise linear function of the relative spread' (see their Proposition 2). These two propositions jointly imply that 'the observed asset returns must be an increasing and concave function of the expected holding periods'. Atkins and Dyl (1994) use the average holding period (number of shares outstanding divided by the number of shares traded) observed ex post as a proxy for investor's expected holding period and find evidence consistent with Proposition 1 of A&M's model. However, the joint implication of Propositions 1&2 described above remains untested so far.

The turnover rate measure of liquidity that we use in this paper is proportional to the variable μ in A&M's model and is the inverse of Atkins and Dyl's proxy for the expected holding period. Since A&M's model implies that the observed (gross) asset return must be an increasing function of the expected holding periods, it also implies that the observed asset return must be a decreasing function of the turnover rate of that asset. This implication of A&M's model is the basis of our investigation for the rest of the paper.

3. Econometric methodology

In this paper, we use the generalized least-squares (GLS) methodology to examine whether the observed cross-sectional variation in stock returns can be explained by the differences in the turnover rates as predicted by A&M's (1986) model.[5] We do this while controlling for the well known determinants of stock returns like the firm size, book-to-market ratio, the firm beta and the January effect. In particular, we use the methodology of Litzenberger and Ramaswamy (1979) which is a refinement of the Fama-MacBeth (1973) methodology used widely in the analysis of cross-section of stock returns.

We estimate an empirical model of the form

$$R_{it} = \gamma_{0t} + \sum_{k=1}^{K} \gamma_{kt} x_{it} + \varepsilon_{it}, \quad i = 1, 2, \ldots, N_t,\ t = 1, 2, \ldots, T, \tag{1}$$

where R_{it} is the return on security i in month t, x_{it} are attributes like the turnover rate, firm size, book to market ratio, firm beta etc. of stock i in month t, and the disturbance term represents the deviation of the realized return from its expected value. N_t denotes the number of securities in month t which can vary from month to month.

Litzenberger and Ramaswamy (pp. 174–175) show that if the monthly estimators $\hat{\gamma}_{kt}$ for γ_k, $k = 0, 1, 2, 3$ or 4 are serially uncorrelated, the pooled GLS estimator $\hat{\gamma}_k$ is found as the weighted mean of the monthly estimates, where the weights are inversely proportional to the variances of these estimates (see their Eqs. (27)–(31)).

Specifically,

$$\hat{\gamma}_k = \sum_{t=1}^{T} Z_{kt}\gamma_{kt} \quad \text{where} \quad Z_{kt} = \frac{[\mathrm{Var}(\hat{\gamma}_{kt})]^{-1}}{\sum_{t=1}^{T}[\mathrm{Var}(\hat{\gamma}_{kt})]^{-1}} \tag{2}$$

and

$$\mathrm{Var}(\hat{\gamma}_k) = \sum_{t=1}^{T} Z_{kt}^2 \,\mathrm{Var}(\hat{\gamma}_{kt}) \tag{3}$$

If, as in the Fama and French (1992) methodology, one assumes that each $\hat{\gamma}_{kt}$ is drawn from a stationary distribution, then the pooled estimate γ_k and its variance are given by

$$\hat{\gamma}_k = \frac{1}{T}\sum_{t=1}^{T} \hat{\gamma}_{kt} \quad \text{and} \quad \mathrm{Var}(\hat{\gamma}_k) = \frac{\sum_{t=1}^{T}(\hat{\gamma}_{kt} - \hat{\gamma}_k)^2}{T(T-1)}. \tag{4}$$

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[5] Shanken (1992), Kandel and Stambaugh (1994), and several others argue in favor of GLS over OLS.

Thus, while estimating the average slope coefficient, the Fama and French (1992) methodology ignores the precision and places equal weight on all slope coefficients, whereas the GLS methodology places more (less) weight on the slope coefficients that are estimated more (less) precisely. The Fama and French methodology yields the same results as the GLS methodology under classic Gauss-Markov assumptions. However, to the extent that these assumptions are violated in practice, the GLS methodology leads to a more powerful test.

4. Description of data

Our dataset consists of all non-financial firms on the NYSE from July 31, 1962 through December 31, 1991. This time period is similar to that used by E&R and Fama and French (1992).[6] Monthly data on returns is collected from the Centre for Research in Security Prices (CRSP) and the book value is extracted from the COMPUSTAT tapes. We calculate the monthly return as a percentage change in the value of one dollar of investment in that stock during month t. In our dataset, on average there are about 880 stocks in each month.

We measure the turnover rate of every stock in the following way. For every month t, we calculate the average monthly trading volume (the average number of shares traded during the previous three months, i.e., during months $t-3$, $t-2$ and $t-1$) and divide it by the number of shares outstanding of that firm. We then express this ratio as a percentage to obtain our turnover rate variable.[7] If the number of shares outstanding in a stock changes due to stock splits etc. then we exclude that stock for a period of three months. In our dataset the turnover rate varies from 0.0013% to 110% and has a mean of 3.6 (see Table 1).

Since the range of the turnover rate variable in our sample is very large, it is possible that our estimated relationship between returns and turnover is driven by a few extreme realizations of turnover. We therefore discard the lowest 1% and highest 1% observations of turnover from the (complete) dataset and re-examine the predicted relationship in the trimmed dataset. In the trimmed dataset, the turnover rate varies from about 0.25% to 17.5% and has a mean of 3.54.

[6] The starting date is determined by availability of details of number of shares traded on the CRSP tapes. Since we lose some initial observations to estimate the turnover rate variable, we extend the dataset by one year to get broadly similar number of observations.

[7] Defining the turnover rate as the average number of shares traded over the previous month, six months, nine months and a year did not substantively alter our findings.

Table 1
Month by month variation in turnover rate variable from July 1963 to December 1991.

Realizations of the turnover rate variable are aggregated month by month for every year from July 1963 to December 1991. The mean, 1%, 5%, 50%, 95% and 99% realizations are reported from January to December.

	Mean	1%	5%	50%	95%	99%
January	3.50	0.25	0.59	2.49	9.56	16.63
February	3.59	0.26	0.61	2.58	9.67	16.88
March	3.59	0.26	0.62	2.60	9.51	16.68
April	3.70	0.27	0.64	2.68	9.88	17.10
May	3.69	0.27	0.64	2.69	9.84	16.67
June	3.74	0.27	0.65	2.71	10.08	17.00
July	3.69	0.26	0.60	2.63	10.08	17.34
August	3.61	0.26	0.59	2.57	9.85	16.92
September	3.64	0.26	0.59	2.60	9.91	17.01
October	3.54	0.26	0.58	2.52	9.67	16.77
November	3.59	0.25	0.59	2.53	9.98	17.51
December	3.56	0.25	0.58	2.52	9.77	17.18

In order to examine whether the liquidity effect persists after controlling for well-known determinants of stock returns, we also construct the firm size, book-to-market ratio and firm beta variables. We construct the book-to-market variable (natural logarithm of book value to market value for individual firms) along the lines of Fama and French (1992). In our complete dataset, the book-to-market variable at individual firm level ranges from -7.48 to 6.48 and has a mean of -0.10 (the trimmed dataset has the same range and a mean of -0.098). We define the log of firm size as the natural logarithm of total market capitalization of firm i, at the end of the prior month (month $t-1$). In our complete dataset, the size variable at the individual firm level varies from 13.02 to 26.81 and has a mean of 19.45 (trimmed dataset has same range and a mean of 19.44). In our complete dataset the correlation between size and book-to-market at a firm level is -0.373 (-0.369 in the trimmed dataset) while the correlation between size and turnover rate is about 0.11 (0.147 in the trimmed dataset).

Although Fama and French (1992) argue that systematic risk is not priced during this period, Jagannathan and Wang (1996), Amihud et al. (1993) and Kothari et al. (1995a) note otherwise. As the debate about the significance of beta is far from over, we also control for beta in our regressions while examining the influence of the liquidity variable. Since the estimate of beta at a firm level potentially contains measurement error, we construct portfolio betas along the lines of A&M and assign the beta of the portfolio to all the stocks in that portfolio. In our complete dataset, the portfolio betas vary from 0.34 to 2.23 with a mean value of 1.11 (same for trimmed dataset).[8] The next section describes the results of our analysis.

5. Liquidity and stock returns

In this section we examine the influence of liquidity as measured by the turnover rate on the cross-section of stock returns with and without controlling for book-to-market ratio, firm size and firm beta. In each month, starting from July 1963 to December 1991, we run a cross-sectional regression (individually and jointly) of stock returns on turnover rate, book-to-market, size and beta. This gives us 342 monthly estimates of the slope coefficients along with the associated standard errors, for each of the explanatory variables. We then aggregate these slope coefficient estimates across time, using Eqs. (2) and (3).[9]

Table 2 summarizes the results of our regressions for the complete dataset (top panel) and trimmed dataset (bottom panel). We find that the turnover rate is significantly negatively related to stock returns. The negative sign on the turnover rate variable confirms that illiquid stocks offer higher average returns than liquid stocks and lends support to the prediction of A&M's model discussed in Section 2.

We examine if the liquidity effect persists after controlling for firm size, book-to-market and firm beta. For the sake of comparison, we first run univariate regressions of these well known determinants of stock returns and then numerous multi-variate regressions in combination with our proxy for liquidity. In univariate regressions, we find that the magnitude and direction of the slope coefficients on size and book-to-market ratio is consistent with the results of several other researchers. In particular, the slope coefficient on size is negative and significant (-0.06, *t*-stat. -6.17) while that on book-to-market is positive and significant (0.22, *t*-stat. 9.53) in the overall sample period. Unlike others, firm beta, however, has a significant negative coefficient (-0.49, *t*-stat. -8.84).[10] We discuss the implications of slope coefficients on beta later in the paper.

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[8] As an alternative measure of firm beta, we also calculated 'full' sample betas along the lines of Kothari et al. (1995a). We did this in two separate ways, using full sample of monthly returns and full sample of yearly returns. In either case, the results remained essentially unchanged.

[9] For the sake of comparison, we replicated the Fama and French (1992) regressions of stock returns on firm size, book-to-market ratio and firm beta using Eq. (4) and found results similar to their Table 3.

[10] Fama and French (1992) find negative slopes on beta in one time period (see their Appendix AIV). Jagannathan and Wang (1993) find negative slopes on beta in some months (see their Table. 14).

Table 2
Average slopes of monthly cross-sectional regressions of returns on turnover, book-to-market, log of size and beta. From July 1963 to December 1991 All months Including January.

Returns are regressed each month on the explanatory variables. The GLS estimates of average slopes and associated *t*-statistics (in parentheses) are calculated using Eqs. (2) and (3). The *Panel A* shows the results for the *complete dataset* while the *panel B* shows the results for the *trimmed dataset*.

Constant	Turnover	Book-to-market	Log of size	Beta
Panel A				
0.73	− 0.04			
(32.51)	(− 8.86)			
0.83	− 0.04	0.21		
(34.19)	(− 9.07)	(10.15)		
2.39	− 0.05		− 0.07	
(12.32)	(− 10.58)		(− 7.48)	
1.69	− 0.05	0.16	− 0.04	
(8.09)	(− 10.56)	(6.99)	(− 3.68)	
2.30	− 0.04	0.14	− 0.05	− 0.37
(9.70)	(− 8.58)	(5.97)	(− 4.65)	(− 5.76)
Panel B				
0.77	− 0.04			
(29.45)	(− 8.73)			
0.85	− 0.04	0.22		
(30.76)	(− 9.02)	(10.42)		
2.50	− 0.05		− 0.07	
(12.62)	(− 10.57)		(− 7.6)	
1.76	− 0.05	0.16	− 0.04	
(8.28)	(− 10.5)	(7.0)	(− 3.55)	
2.30	− 0.04	0.14	− 0.05	− 0.36
(9.62)	(− 8.6)	(5.92)	(− 4.5)	(− 5.6)

We then run several ad hoc models to examine the effect of liquidity while controlling for the effects of book-to-market ratio, size and beta. We find that in each of these models, the turnover rate variable – our proxy for liquidity – retains its negative relation with returns and remains highly significant (see Table 2 first column). Further, the strength of this relationship (magnitude and significance of the coefficient) is not affected by the presence of firm size, beta, or book-to-market in the regression. More importantly, the results with the trimmed dataset (Table 2 bottom panel) are very similar to those with the complete dataset. This suggests that the results are not driven by a few influential outliers. As a result, in the rest of the paper we only report results with the complete dataset.

Table 3
Average slopes of monthly cross-sectional regressions of returns on turnover, book to market, log of size and beta. From July 1963 to December 1991. All months excluding-January.

Returns are regressed each month on the explanatory variables. The GLS estimates of average slopes and associated *t*-statistics (in parentheses) are calculated using Eqs. (2) and (3).

Constant	Turnover	Book-to-market	Log of size	Beta
0.60	− 0.04			
(25.95)	(− 8.86)			
0.61		0.10		
(35.43)		(4.39)		
0.45			0.01	
(2.25)			(0.77)	
1.18				− 0.62
(16.71)				(− 9.9)
0.68	− 0.04	0.10		
(27.12)	(− 8.87)	(4.55)		
0.54	− 0.05		0.0	
(2.70)	(− 10.04)		(1.16)	
0.13	− 0.04	0.10	0.03	
(0.61)	(− 10.02)	(4.33)	(2.88)	
0.88	− 0.04	0.08	0.02	− 0.45
(3.58)	(− 7.91)	(3.29)	(1.60)	(− 6.84)

To account for the well known January seasonality (see, e.g., Keim, 1983) and to compare our results with the findings of E&R we repeat the above exercise using data for non-January months. Table 3 shows the results when we only include months from February to December every year in our sample period. Contrary to the results of E&R (but consistent with the findings of B&S) we do not find any evidence of January seasonality in liquidity premium over a very similar sample period.[11] In particular, we find that the slope coefficient on the turnover rate remains negative and highly significant without the month of January, and both with and without the presence of firm size, book-to-market and beta. More importantly, the magnitude of the slope coefficient of our liquidity proxy does not change much by the exclusion of the month of January. This suggests that liquidity is related to returns throughout the year and, more importantly, it is not subsumed by size, book-to-market and beta.

[11] Our complete sample runs from 1962 to 1991. As mentioned earlier the starting date is determined by the time CRSP tapes started reporting the number of shares traded variable. We use the first year's data to estimate the average turnover rate over past 3, 6, 9 and 12 months. Hence the table reports results for the 1963 to 1991 period.

A potential reason for the difference in our results and E&R's results over a similar time period may be the different proxies of liquidity used in the two studies. E&R average the beginning and the end of year relative bid–ask spreads of a stock in the previous year and assign that value as the spread for that stock throughout the current year. As a result, for any given stock E&R's spread measure remains constant throughout the year. In contrast, our proxy for liquidity – the turnover rate – takes on different values in different months (see Table 1). This variation in the turnover rate measure may be the reason behind its ability to explain the cross-sectional variation in stock returns better than the quoted bid–ask spread.

In order to test the robustness of our results, we divided our sample into two non-overlapping sub-periods of about equal length. The first sub-period spans July 1963 to September 1977 and the second sub-period spans October 1977 to December 1991. The results for both the sub-periods, with and without the month of January, are shown in Tables 4 and 5. In both tables, the panel A (panel B) shows the results of regressions when the month of January is included (excluded). We find that the turnover rate variable exhibits a reliable negative relation with returns in both the sub-periods. This relation persists even after controlling for size, book-to-market and beta and is not affected by inclusion or exclusion of the month of January. Overall the relation between turnover rate and returns is stable across sub-periods and across all models with a statistically significant coefficient.

For the overall sample period, the mean slope coefficient on turnover rate variable across different models is about -0.045 (see first column of Table 2). This implies that across stocks, a drop of 1% in turnover rate is associated with a higher return of about 4.5 basis points per month, on average. In order to examine the magnitude of illiquidity premium implied by our results, we subtracted the turnover rate of an illiquid stock (the 10th percentile) from that of a liquid stock (the 90th percentile) and found the difference to be around 6%. A slope coefficient of 4.5 basis points per month implies that in our sample the illiquid stocks earned a higher return of 27 basis points per month or about 3.25% per annum as compared to the liquid stocks.

The bi-variate regressions containing size and turnover help us in distinguishing the size effect from the liquidity effect. In these regressions, a pure variation in turnover rate (unrelated to variation in size) shows a fairly stable relationship with returns, (see Tables 2–5). In contrast, the size effect seems to be restricted to the first half on the sample period only (compare the slope coefficients on size in Tables 4 and 5). This finding is consistent with E&R, Table 4 Regression (D), during the 1981–1990 sub-period. Thus, our study distinguishes the size effect from the liquidity effect and the evidence seems to support liquidity more than size.

Having examined the cross-sectional relationship between stock returns and liquidity after controlling for size and book-to-market, we come back to the

Table 4
Subperiod 1, average slopes of monthly cross-sectional regressions of returns on turnover, book-to-market, size and beta from July 1963 to September 1977. Panel A corresponds to all months Including January. Panel B corresponds to all months Excluding January.

Returns are regressed each month on the explanatory variables for the first subperiod. The GLS estimates of average slopes and associated t-statistics (in parentheses) are calculated using Eqs. (2) and (3). Panel A corresponds to the results for all months including January while the Panel B corresponds to all months from February to December (January Excluded).

Constant	Turnover	Book-to-market	Log of size	Beta
Panel A				
0.31	– 0.024			
(10.54)	(– 3.49)			
0.22		0.22		
(8.93)		(7.97)		
2.37			– 0.11	
(8.55)			(– 7.60)	
0.61				– 0.4
(6.27)				(– 4.66)
0.40	– 0.025	0.23		
(12.27)	(– 3.71)	(6.29)		
2.78	– 0.031		– 0.12	
(9.80)	(– 4.45)		(– 8.35)	
1.67	– 0.031	0.17	– 0.07	
(5.28)	(– 4.42)	(5.37)	(– 4.15)	
2.28	– 0.023	0.16	– 0.08	– 0.39
(6.51)	(– 3.23)	(5.22)	(– 4.79)	(– 4.32)
Panel B				
0.15	– 0.026			
(4.89)	(– 3.63)			
0.03		0.10		
(1.12)		(3.31)		
0.25			– 0.02	
(0.88)			(– 0.79)	
0.61				– 0.56
(6.14)				(– 6.38)
0.19	– 0.03	0.10		
(5.63)	(– 3.65)	(3.60)		
0.57	– 0.03		– 0.02	
(1.95)	(– 3.94)		(– 1.33)	
– 0.15	– 0.028	0.10	0.01	
(– 0.45)	(– 3.90)	(3.21)	(0.81)	
0.60	– 0.02	0.10	0.004	– 0.47
(1.66)	(– 2.63)	(3.01)	(0.03)	(– 5.07)

Table 5
Subperiod 2, average slopes of monthly cross-sectional regressions of returns on turnover, book-to-market, size and beta from October 1977 to December 1991. Panel A corresponds to all months Including January. Panel B corresponds to all months Excluding January.

Returns are regressed each month on the explanatory variables for the second subperiod. The GLS estimates of average slopes and associated t-statistics (in parentheses) are calculated using Eqs. (2) and (3). Panel A corresponds to all months including January while Panel B corresponds to February to December months (January Excluded).

Constant	Turnover	Book-to-market	Log of size	Beta
Panel A				
1.34	− 0.05			
(38.15)	(− 8.73)			
1.15		0.19		
(51.58)		(6.04)		
2.15			− 0.05	
(8.10)			(− 3.45)	
1.65				− 0.51
(17.30)				(− 6.02)
1.33	− 0.05	0.19		
(37.18)	(− 8.82)	(5.93)		
2.05	− 0.06		− 0.03	
(7.70)	(− 10.13)		(− 2.52)	
1.70	− 0.06	0.15	− 0.02	
(6.13)	(− 10.15)	(4.49)	(− 1.31)	
2.32	− 0.05	0.11	− 0.03	− 0.35
(7.19)	(− 8.58)	(3.13)	(− 2.00)	(− 3.82)
Panel B				
1.26	− 0.05			
(34.79)	(− 8.62)			
1.08		0.10		
(46.66)		(2.87)		
0.63			0.02	
(2.28)			(1.79)	
1.72				− 0.67
(17.43)				(− 7.62)
1.26	− 0.05	0.10		
(34.06)	(− 8.61)	(2.81)		
0.52	− 0.06		0.04	
(1.88)	(− 9.87)		(2.80)	
0.35	− 0.06	0.10	0.05	
(1.20)	(− 9.89)	(2.92)	(3.09)	
1.11	− 0.05	0.06	0.03	− 0.42
(3.34)	(− 8.23)	(1.57)	(2.10)	(− 4.60)

issue of controlling for the systematic risk. When we control for beta in our regressions, we find that the average slope coefficients on turnover rate are not affected. The negative sign on beta is troublesome at first sight, but it is the only variable that is estimated by us from the data (unlike turnover, size or book-to-market ratio variables for which data is directly read from CRSP or Compustat tapes). The measurement of beta contains error which depends on the efficiency of the market proxy used (Kandel and Stambaugh, 1994) as well as the length of the measurement interval and procedure (Handa et al., 1989). As a further check, we calculated beta in several different ways: security betas; portfolio beta; measured it with respect to value weighted as well as equally weighted market return. In each case, the magnitude and the significance of the coefficient on turnover was not affected by the inclusion or the exclusion of the beta variable in the regression and the negative slope coefficient on beta persisted. Since the focus of this paper is to provide an alternative test of A&M's model, we simply note that the liquidity variable remains significant in the presence of firm size, book-to-market ratio as well as firm beta and direct the readers to Roll and Ross (1994), Cadogan (1994), Fama and French (1995) and Kothari et al. (1995b) for interpretation of the slope on the beta, the estimation of the security market line, and related issues.

6. Concluding remarks

In this paper, we provide an alternative test of A&M's model using the turnover rate as a proxy for liquidity and found strong support for A&M's model. In particular, we find that the stock returns are strongly negatively related to their turnover rates confirming the notion that illiquid stocks provide higher average returns. In general, we find that a drop of 1% in the turnover rate is associated with a higher return of about 4.5 basis points per month, on average. This relation between stock returns and liquidity remains significant after controlling the firm size, book-to-market ratio, beta and the January effect, and it is prevalent in the first as well as the second half of our sample. In contrast to the findings of E&R but consistent with the findings of B&S, we do not find any January seasonality. In our sample, liquidity explains the cross-sectional variation in the month of January as well as during the rest of the year. Overall, the results support the relation between liquidity and stock returns predicted by A&M's model.

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