Liquidity and Expected Returns: Lessons from Emerging Markets

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Abstract

We show that

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1 Introduction

Evidence from various asset markets (see, for example, XXX) suggests that liquidity is priced. Illiquid assets and assets with high transaction costs trade at low prices, relative to their expected cash flows. It follows that liquidity and trading costs may contribute to both the average equity premium in stocks and to the time-variation in expected returns if there is systematic variation in liquidity. Some recent research, most notably Amihud (2000) and Jones (2001), attempts to quantify the role of liquidity in U.S. expected stock returns. Jones finds that bid-ask spreads and turnover predict U.S. stock returns one period ahead using 100 years of annual data, whereas the decline in transaction costs may also have contributed to a fall of about 1% in the equity premium. Amihud (2001) using a 1964-1997 NYSE sample finds that expected market illiquidity has a positive effect on the ex ante excess return and unexpected illiquidity has a negative effect on the contemporaneous stock return.

Our research focuses on markets where liquidity effects may be particularly acute, namely emerging markets. In a 1992 survey by Chuhan, poor liquidity was mentioned as one of the main reasons that prevented foreign institutional investors from investing in emerging markets. If the liquidity premium is an important feature of the data, the focus on emerging markets should yield particularly powerful tests and useful independent evidence. Moreover, many emerging markets underwent a structural break during our sample that likely affected liquidity, namely equity market liberalization. Liberalizations give foreign investors the opportunity to invest in domestic equity securities and domestic investors the right to transact in foreign equity securities. This provides an additional verification of the importance of liquidity for expected returns, since, all else equal (including the price of liquidity risk), the importance of liquidity for expected returns should decline post liberalization. This is important, since when focusing on the U.S. alone, the finding of expected return variation due to liquidity can always be ascribed to an omitted variable correlated with liquidity. As an important side-benefit, we can test whether improved liquidity contributes to the decline in the cost of capital post-liberalization that is documented by Bekaert and Harvey (2000) and Henry (2000). Finally, this article also contributes to the vast literature on return predictability. Jones (2001) finds that liquidity and transaction cost variables have more predictive power than dividend yields for U.S. stock returns, but a growing literature has found, somewhat surprisingly, dividend yields to be rather poor predictors of U.S. stock returns. Early work on emerging markets (see for example Harvey (1995) and Bekaert (1995)) found relatively strong predictability in emerging markets using standard predictive variables, including the dividend yield. Given the low correlation between emerging market and US returns, our analysis provides interesting independent evidence regarding return predictability.

There are some serious obstacles to our analysis. First, the data in emerging markets are of relatively poor quality and detailed transaction data (bid-ask spreads, for example) do not exist on a widespread basis. We circumvent this problem by constructing a measure that relies on the incidence of observed zero daily returns in these markets. Lesmond, Ogden and Trzcinka (1999) argue that if the value of an information signal is insufficient to outweigh the costs associated with transacting, then market participants will elect not to trade, resulting in an observed zero return. The advantage of this measure is that it requires only a time-series of daily equity returns. For emerging equity markets, we demonstrate that this measure, the proportion of zero daily returns, is highly correlated with more standard transaction cost measures for these countries and sample periods for which data are available. We investigate a number of related measures as a robustness check, and we also use turnover as a liquidity measure. Second, we have relatively short time-series samples, making pure time series tests country-by-country less useful, especially given the volatility of emerging market returns. We therefore pool the data across emerging markets.

The remainder of the article is organized as follows. Section 1 describes our data set and characterizes our liquidity measures. Section 2 surveys the literature on liquidity and outlines a simple structural VAR model that we use to interpret the results. Section 3 details the econometric models we estimate and presents the results of a Monte Carlo analysis that underlines statistical inference in this article. Some concluding remarks are offered in the final section.

2 Liquidity Measures for Emerging Markets

2.1 *Data and Summary Statistics*

Our empirical evidence focuses on 19 emerging equity markets. From Standard and Poor's Emerging Markets Database, we collect returns (US$), in excess of the one-month Euro-dollar rate, and dividend yields for the IFC Global Equity Market Indices. Summary statistics on the returns and dividend yields are presented in Table 1.

We also construct two measures of liquidity (or proxies for transaction costs) that will serve as the primary quantities of interest. First, following Atje and Jovanovic (19??), Levine and Zervos (19??), and Bekaert, Harvey and Lundblad (2002), we construct a measure of equity market turnover. For each month, we take the equity value traded for that month, divided by that month's equity market capitalization. Summary statistics are provided in Table 1. Zimbabwe exhibits the lowest level of average annualized equity market turnover at 8%, whereas Taiwan exhibits the highest level at 259%.

Second, given the paucity of realized transaction cost data for emerging equity markets, we employ a measure that reflects the effect of transactions costs directly on daily returns in these markets. Following Lesmond, Ogden and Trzcinka (1999), we construct the proportion of zero daily returns observed over the relevant month for each equity market. Daily returns data at the firm level are obtained from the Datastream research files starting from the late 1980's (see Appendix A for exact data availability). For each country, we observe daily returns (using closing prices) for a large collection of firms (see Table 1 for the number of firms employed for each country) listed on a domestic exchange. For each country, we calculate the proportion of each firm's daily returns for the previous year that are equal to zero, and average across all the firms listed in the particular country. We present summary statistics for this measure in Table 1. As can be seen, this measure of transactions cost is fairly persistent. Further, it is worth pointing out that some of these equity markets exhibit a very large number of zero daily returns; Columbia, for example, has a 77% incidence of zero daily returns, on average, across domestically listed firms, and the smallest incidence of zero daily returns is 18%, on average, in Taiwan. The cross-sectional correlation between the average turnover and the average incidence of zero daily returns across these countries is -0.52, indicating that the transaction costs measure is potentially reflecting relative liquidity across the equity markets in our study. Further, Table 2 presents correlations of these two liquidity measures *across time* within each country. On average, the correlation between the proportion of zero daily returns and equity market turnover within a country is -0.38. Further, to explore the relationship between the returns based measure of transaction costs and more standard measures, we present correlations with available bid-ask spreads and Amihud's (2000) proxy for the price impact of trading. Bid ask spreads for domestic firms are obtained from the mid to late 1990's for a few countries from the Datastream research files. We find that the proportion of daily zero returns measure is highly correlated, 67% on average, with the average bid ask spread across all countries for which bid ask spreads are available.

Given data limitations associated with the firm level daily returns, we focus on subsamples of the data, for which the precise country inclusion is detailed in Appendix A. The first two samples will form the basis of our formal empirical analysis in Section 3. The first, which we will denote Sample I, contains 15 countries and covers January 1990 to May 2001. The second, which we will denote Sample II, contains 10 countries, and covers January 1988 to May 2001. Additionally, we will also explore the key relationships for an *unbalanced* panel (denoted Sample III) that includes all 19 countries from January 1987 to May 2001.

2.2 *Equity market liberalization and liquidity*

First, we examine the relationship between both equity market turnover and the proportion of zero daily returns with equity market liberalization. Equity market liberalization takes place when a country first provides foreign investors access to the domestic equity market. Bekaert and Harvey (2000) present official equity market liberalization dates which we employ to explore the nature of the relationship between liquidity and financial liberalization. We construct an indicator of equity market liberalization that takes the value of one following liberalization and zero otherwise. In Table 3, we present pooled time-series cross-sectional regressions of the two measures of liquidity on the lagged equity market liberalization indicator. Specifically, we regress either the proportion of zero daily returns or equity market turnover on the lagged equity market liberalization indicator, allowing for fixed effects (not reported), but cross-sectionally constraining the liberalization coefficient to be identical across countries. First, the proportion of zero daily returns falls significantly, on average, following equity market liberalization for Samples I, II, and III, suggesting a strong link between liquidity and foreign investor access to the domestic equity market. For example, over the 15 countries included in Sample I, the proportion of zero daily returns is about 11% lower, on average, for those countries that underwent an equity market liberalization. Consistent with this conclusion, equity market turnover is strongly associated with equity market liberalization, on average. For Sample I, equity market turnover is about 10% higher (in annualized terms), on average, for those countries that underwent an equity market liberalization. For both measures of liquidity, these results are consistent across all three samples. This evidence suggests that financial liberalization may significantly affect the environment within which emerging equity market participants transact.

3 Liquidity and Expected returns

3.1 *A simple econometric model*

Assuming exogenously determined but proportional transaction costs as in Jones (2001), poor liquidity or high transaction costs will drive a wedge between the gross returns that we measure in the data and the actually obtained returns ("net returns"), that is:

$$r_{t+1}^{\text{net}} = \frac{r_{t+1}^{\text{gross}}}{TC_{t+1}} \tag{1}$$

where TC_{t+1} presents a transaction measure (if $TC = 1$, there are no transaction costs).

We postulate that the log of the transaction cost measure is linearly related to an illiquidity measure, $ILLIQ$, that is;

$$\ell n(TC_{t+1}) = vILLIQ_{t+1} \ (v > 0) \tag{2}$$

Note that we are implicitly assuming that everybody has the same one-year or one-month horizon in which they trade once. Of course, in reality, the trading frequency is endogenous. It is likely that an asset with the high transaction costs will be traded less frequently and held longer.[1] The total transaction cost associated with an asset could be measured as the turnover in a given year times the transaction cost, including fixed costs and the bid-ask spread (see Jones (2001)). In this paper, we will not be able to measure transaction costs that precisely since we do not have complete bid-ask spread data. Further, while these explicit costs of transacting in equity market are important, they do not reflect the implicit costs associated with trading, such as the price impact of trading. These additional costs may be particularly important in emerging equity markets. However, a zero daily return may reflect the presence of all transaction costs market participant face; further, Lesmond (2002) presents evidence that the proportion of zero daily returns in emerging markets is related to common measures of both explicit and implicit transaction costs. In our work, we consider both the proportion of zero daily returns and equity market turnover based as imperfect indications of general liquidity and transaction costs in the markets under consideration.

Even under these simple assumptions, illiquidity impacts expected returns, but it is a one for one effect and it need not lead to predictable variation in expected returns. Additionally, suppose that liquidity is priced. In this case, the expected equity premium is positively linked to illiquidity, and shocks to liquidity change expected returns and hence prices. We will formulate the model in logs and assume (see also Amihud (2000)):

$$E_t[r_{i,t+1}^{\text{net}} - r_{f,t}] = \delta_0 + \delta_1 \cdot ILLIQ_{i,t} \tag{3}$$

where $r_{i,t}$ is the net logged return and $r_{f,t}$ is the risk free rate.

Expected return variation is completely driven by variation in illiquidity, but the empirical model that we estimate also allows for other sources of predictable variation. An important hypothesis to test is whether $\delta_1 > 0$, which indicates that illiquidity is priced. If this is the case, return innovations will also be linked to illiquidity innovations. In particular, define

[1]See Amihud and Mendelson (1986) for an interesting analysis of the resulting potential clientele effects.

the unexpected net return as:

$$\epsilon_{i,t+1} = r^{\text{net}}_{i,t+1} - r_{f,t} - \delta_0 - \delta_1 \cdot ILLIQ_{i,t} \tag{4}$$

and unexpected illiquidity shocks as:

$$\eta_{i,t+1} = ILLIQ_{t+1} - \alpha_0 - \alpha_1 \cdot ILLIQ_t. \tag{5}$$

That is, we assume illiquidity to follow a simple autoregressive process. It follows that

$$\epsilon_{i,t+1} = \omega\eta_{i,t+1} + \overline{\epsilon}_{i,t+1}, \tag{6}$$

and we expect $\omega < 0$.

Hence, the bivariate relation between measured gross returns and an illiquidity measure can be written as:

$$r^{\text{gross}}_{i,t+1} = \delta_0 + \alpha_0[\frac{1}{v} + \delta_1] + \alpha_1[\delta_1 + \frac{1}{v}]ILLIQ_t + \epsilon_{i,t+1} + \frac{1}{v}\eta_{i,t+1} \tag{7}$$

$$\epsilon_{i,t+1} = \omega\eta_{i,t+1} + \overline{\epsilon}_{i,t+1}, \tag{8}$$

This shows that the fact that we measure gross instead of net returns is somewhat problematic in identifying whether liquidity is priced or not, a fact also pointed out by Jones (2001). We simply cannot separately identify δ_1, ω and v. However, if we write $\epsilon_{i,t+1} = \overline{\epsilon}_{i,t+1} + [\omega + \frac{1}{v}]\eta_{i,t+1}$, we can identify $\omega + \frac{1}{v}$. If this sum is negative, there is a strong indication of illiquidity being priced. As a consequence, the first specification we estimate in our empirical work is a bivariate vector-autoregression (VAR) with excess returns and the proportion of zero daily returns.

3.2 *The role of dividend yields*

Suppose dividends are stochastic but show little or no autoregressive dynamics. In this case, the dividend yield will vary through time primarily with liquidity under the null of the model above. Returns themselves are contaminated directly by dividend innovations but dividend yields are not. Although this may be an erroneous assumption, dividend yields should provide additional information on the pricing of liquidity. In particular, we expect the innovations in illiquidity and dividend yields to be positively correlated. On the other hand, if we include dividend yields as a predictive variable, it may well help capture the predictive power of liquidity, so it should decrease the coefficient on $ILLIQ$ in the return regression.

Also, while dividend yields have been viewed as particularly strong predictors of equity returns, some recent work (e.g. Ang and Bekaert (2001), Goyal and Welch (2001)) has demonstrated that this predictive power may not be statistically robust. Investigating the relative predictive power of the dividend yield and liquidity measures for emerging markets, which show very little correlation with established markets, is therefore interesting in its own right.

Hence, this structure motivates a trivariate VAR specification, including dividend yields. We also consider additional trivariate and quadravariate VAR specifications, which include equity market turnover as an additional endogenous variable.

3.3 *A first look*

We examine the relationship between excess returns and the proportion of zero daily returns. In our estimation we will scale the proportion of zero daily returns for each country by the average proportion of daily returns observed for all the firms in the Datastream research files for the United States, 0.145, over the full sample period. This number is comparable to that observed in a longer time-series of zero daily returns for the CRSP files presented in Lesmond, Ogden, and Trzcinka (1999). In Table 4, we present pooled time-series cross-sectional regressions of excess returns on lagged illiquidity, as well as regression of excess returns on lagged equity market turnover and lagged dividend yields. In the pooled regressions, we allow for fixed country effects (not reported) and groupwise heteroskedasticity, but we cross-sectionally constrain the estimated predictability coefficient to be identical across countries. First, across Samples I, II, and III, the estimated illiquidity effects are both positive and significant. For example, in Sample I, the coefficient on lagged illiquidity is 0.117, more than two and a half standard errors from zero, suggesting a strong link between liquidity and future excess returns. For Sample III, which includes 19 emerging economies in an unbalanced panel, the estimated effect is more than 3.5 standard errors from zero, consistent with the effects observed in the smaller panels. Equity market turnover, however, does not predict excess returns for any of the samples we consider, indicating that the zero daily return measure may be capturing an important component of market illiquidity and transaction costs not captured by turnover. Importantly, the evidence on dividend yield predictability across the three samples considered is mixed. For Sample I and II, the dividend yield effect is positive, but not statistically significant; however, for Sample III, including all 19 countries under consideration, the effect is significant. First, this evidence suggests that dividend yield predictability may not extend to the emerging equity markets considered here. Second, the mixed evidence is broadly consistent with the ambiguous relationships on dividend yield predictability documented across time-periods and markets (see Ang and Bekaert (2002) and Goyal and Welch (1999)). To explore the dynamic relationship between these variables more carefully, we employ a vector-autoregressive specification. We describe the pooled time-series cross-sectional VAR estimation next.

4 Econometric methods

4.1 *Likelihood function*

We estimate the parameters describing the VAR process using a quasi-maximum likelihood (QMLE) methodology. We employ a normal log-likelihood function, and all standard errors are robust using the Bollerslev and Wooldridge (1992) methodology. Let $\mathbf{x}_{i,t} = [r_{i,t}, ILLIQ_{i,t}]$, $[r_{i,t}, ILLIQ_{i,t}, dy_{i,t}]$, $[r_{i,t}, ILLIQ_{i,t}, TURNOVER_{i,t}]$, or $[r_{i,t}, ILLIQ_{i,t}, TURNOVER_{i,t}, dy_{i,t}]$. For country i, the base VAR(1) model is as follows:

$$\mathbf{x}_{i,t} = (\alpha_{0,i} + \alpha_1 * Lib_{i,t-1}) + \mathbf{A}\mathbf{x}_{i,t-1} + \Sigma_{i,t-1}^{1/2}\epsilon_{i,t} \tag{9}$$

where $\alpha_{0,i}$ denotes a vector of country-specific fixed effects for each endogenous variable; α_1 denotes a vector of cross-sectionally restricted liberalization coefficients for each endogenous variable; and $\Sigma_{i,t}$, the VAR innovation conditional variance-covariance matrix for country

i is Σ_{before} prior to a country's equity market liberalization and Σ_{after} following a country's liberalization. Σ_{before} and Σ_{after} are restricted to be identical across countries. Finally, given the small time-series nature of our data sample, $\mathbf{A}$, the VAR matrix in companion form, is also restricted to be identical across countries. Hence, the parameters to be estimated are the country-specific fixed effects, $\alpha_{0,i}$; the liberalization effects, α_1; the cross-sectionally restricted VAR matrix, $\mathbf{A}$; and the VAR innovation variance-covariance matrices before and after financial liberalization, Σ_{before} and Σ_{after}.

We collect the relevant VAR innovations, $\epsilon_{i,t}$, from equation (9) for each country as follows:

$$\epsilon_t = \begin{bmatrix} \epsilon_{1,t} \\ \vdots \\ \epsilon_{N,t} \end{bmatrix} \tag{10}$$

where N denotes the number of countries in our sample. Let $\mathbf{\Omega}_t$ denote the conditional variance-covariance matrix for the entire cross-section as follows:

$$\mathbf{\Omega}_t = \begin{bmatrix} \Sigma_{1,t} & 0 & \cdots & 0 \\ 0 & \Sigma_{2,t} & \cdots & 0 \\ \vdots & & & \\ 0 & 0 & \cdots & \Sigma_{N,t} \end{bmatrix} \tag{11}$$

Given the dimensionality issues, SUR effects are ignored across countries; that is, while VAR innovations are correlated within country, innovations across countries are assumed uncorrelated. This construction is analogous to a *restricted* version of panel estimation with groupwise heteroscedasticity. The country-specific VAR innovation variance-covariance matrix, $\Sigma_{i,t}$, depends upon the liberalization indicator for that country; however, the VAR innovation variance-covariance matrices *within* each liberalization regime, Σ_{before} and Σ_{after}, are assumed constant across time and countries.

The quasi-conditional likelihood function for a single time period can be expressed as follows:

$$l_t = -\frac{k \cdot N}{2} \ln(2\pi) - \frac{1}{2} \ln |\mathbf{\Omega}_{t-1}| - \frac{1}{2} \epsilon_t' \mathbf{\Omega}_{t-1}^{-1} \epsilon_t \tag{12}$$

where k is the number of endogenous variables, and $k \cdot N$ is the number of individual equations. Thus, the log-liklihood function for the full panel $(1, \ldots, T)$ is given by:

$$L = \sum_{t=1}^{T} l_t \tag{13}$$

5 Empirical Results

5.1 *Bivariate VAR: Returns and ILLIQ*

In Table 5, we present estimation results for both Samples I and II for the bivariate VAR(1), which includes excess returns and the scaled proportion of zero daily returns as endogenous variables. First, the excess returns display positive autocorrelation, on average across the countries, for both samples, consistent with Harvey (199?). For example, the coefficient on lagged returns is 0.084 for Sample I, almost 4 standard errors from zero. Consistent with the pooled regressions presented above, excess returns are also predicted by the lagged illiquidity measure across both samples considered. The coefficients on lagged illiquidity are 0.142 (S.E. 0.047) for Sample I and 0.111 (S.E. 0.051) for Sample II, indicating significant liquidity predictability. In neither case, however, does the lagged liberalization indicator significantly affect excess returns; this stands in contrast to the evidence presented in Bekaert and Harvey, which suggests that some of the reduction in the cost of capital following liberalization that they document may in fact be due to the improved market liquidity that the liberalization facilitates.

Next, we turn to the coefficient determining the relationship between liquidity and the lagged variables. First, lagged returns significantly affect future illiquidity; the estimated coefficients are negative across both samples, and almost 4 standard errors from zero. High returns in one month predict improved subsequent market liquidity. (is there any evidence on this in the literature?) Also, the illiquidity variable displays significant autocorrelation; across both samples, the estimated coefficient on lagged illiquidity is near 0.8. Finally, consistent with the pooled regressions presented above, equity market liberalization significantly reduces market illiquidity.

To explore the contemporaneous relationships between returns and liquidity, Table 5 also displays the Cholesky decomposition of the VAR innovation variance-covariance matrix. Recall, the variance covariance matrix is allowed to differ across liberalization regimes. The off-diagonal component that effectively describes the average *within country* contemporaneous relationship between innovations in excess returns and illiquidity, $c_{2,1}$, is negative for both samples considered across both liberalization regimes. The sign of this relationship suggests that shocks to illiquidity are negatively correlated to return shocks, which in conjunction with the significantly positive lagged liquidity coefficient, is consistent with the idea that liquidity is priced in the simple model presented in the previous section. Note, it is unclear from the estimates whether the degree of correlation significantly increases or decreases following equity market liberalization. In contrast, the standard deviation of both excess returns and the illiquidity variable falls following equity market liberalization across both samples. In sum, the bivariate VAR suggests that both the degree of equity market liquidity predicts future excess returns and that shocks to returns and illiquidity are negative correlated. Next, we consider a trivariate we VAR, where we augment the current variables with equity market turnover.

5.2 *Trivariate VAR: Returns, ILLIQ, and Turnover*

In Table 6, we present estimation results for both Samples I and II for a trivariate VAR(1), which augments the set of endogenous variables with equity market turnover. For the most part the general effect documented in the bivariate case are unchanged. Interestingly, market illiquidity continues to significantly predict excess returns across both samples considered. The coefficients on lagged illiquidity are slightly reduced, at 0.137 (S.E. 0.048) for Sample I and 0.105 (S.E. 0.051) for Sample II. Also, excess returns are not predicted by lagged equity market turnover. While the signs are negative, which would suggest that increased equity market activity reduces the cost of capital, the effects are not statistically significant. Taken together, this evidence is consistent with the idea that the proportion of zero daily returns is picking up a feature of market liquidity and transaction costs not related to equity market turnover.

Examining the other estimated relationships, high turnover in one month does not suggest improved subsequent market liquidity, although the significance is not uniform across samples. Like the liquidity measure, the turnover variable displays significant autocorrelation; across both samples, the estimated coefficient on lagged illiquidity is also near 0.8. Further, high returns appear to be positively related to future turnover, and increased market liquidity appears to be negatively related to future turnover. [** check into this **???] Finally, consistent with the pooled regressions presented above, equity market liberalization significantly increases market turnover across both samples considered.

Table 6 also displays the Cholesky decomposition of the trivariate VAR innovation variance-covariance matrix. The off-diagonal component, $c_{2,1}$, retains the negative sign and significance for both samples considered, again suggesting that liquidity is priced. There also appears to be a significantly positive contemporaneous relationship between return and turnover shocks, and a negative relationship between illiquidity and turnover shocks.

5.3 *Trivariate VAR: Returns, ILLIQ, and Dividend Yields*

In Table 7, we present estimation results for both Samples I and II for a trivariate VAR(1), which replaces equity market turnover in the set of endogenous variables with the market dividend yield. As before, the general effects are unchanged. However, while the return coefficient on lagged illiquidity is still statistically significant, 0.146 (S.E. 0.051), for Sample I, it is no longer significant for Sample II, 0.084 (S.E. 0.055). The reduction in the estimated predictability relationship is consistent with the model presented in the previous section. If liquidity is indeed priced, then the resulting variation in the cost of capital will be incorporated into dividend yield variation. As a consequence, the inclusion of the dividend yield is likely to affect the estimated relationship. Table 7 also displays the Cholesky decomposition of the trivariate VAR innovation variance-covariance matrix. As before, the off-diagonal component, $c_{2,1}$, retains the negative sign and significance for both samples considered, still suggesting that liquidity is priced. The estimated relationship between illiquidity and dividend yield shocks, $c_{3,1}$ are positive, consistent with the model that illiquidity shocks contemporanously increase the cost of capital, but the estimates are borderline significant across the two samples only in the post-liberalization period.

The estimates are not consistent with significant dividend yield predictability. Consistent with the pooled regressions presented above, for neither sample is the return coefficient on dividend yields statistically significant, suggesting that the relationship may not extend to emerging equity markets. However, there does appear to be a strong relationship between illiquidity and future dividend yields. The estimated coefficient is positive and statistically significant across both samples; the estimated sign is consistent with an illiquidity effect on the cost of capital. Note, consistent with the evidence documented in Bekaert and Harvey (2000), dividend yields fall following equity market liberalization, but this effect is only statistically significant for Sample II.

5.4 *Trivariate VAR: Returns, ILLIQ, Turnover, and Dividend Yields*

Finally, In Table 8, we present estimation results for both Samples I and II for a quadravariate VAR(1), which includes excess return, market illiquidity, equity market turnover, and dividend yields in the set of endogenous variables. The general effects are broadly unchanged from the vector-autoregressions considered above. As in the trivarate regression with dividend yields, the return coefficient on lagged illiquidity is still statistically significant, 0.140 (S.E. 0.049), for Sample I, but it is not statistically significant for Sample II, 0.079 (S.E. 0.057). Table 8 also displays the Cholesky decomposition of the trivariate VAR innovation variance-covariance matrix. As before, the off-diagonal component, $c_{2,1}$, retains the negative sign and significance for both samples considered, consistent with the observation that market liquidity is priced. Also, the estimated relationship between illiquidity and dividend yield shocks, $c_{3,1}$ is also still positive, but not uniformly significant across the samples and liberalization regimes.

Further, the estimates are again not consistent with significant dividend yield predictability, not does it appear that equity market turnover is significantly related to future returns. However, there is still a strong relationship between illiquidity and future dividend yields, but no significant relationship between turnover and future dividend yields.

Across the four VAR specifications considered, the documented positive relationship between market illiquidity and future returns, as well as the negative relationship between return and illiquidity shocks, is consistent with the concept that liquidity is prices. Further, the positive relationship between relationship between liquidity and dividend yields, corroborates this evidence. There does not appear to be significant turnover or dividend yield effect on future returns. Note, in all estimations, we control for the fact that equity market liberalization appears to significantly affect market liquidity, turnover, and dividend yields, at least for some samples considered.

5.5 Monte Carlo

In this section, we examine the small sample properties of the pooled time-series cross-sectional VAR estimates employed above. For our largest cross-sectional sample, Sample I, of 15 countries, we conduct a Monte Carlo experiment to explore the small sample properties of our estimator and the observed liquidity effects. Given computation limitations, we focus only on the trivariate VAR, including returns, illiquidity, and dividend yields. This simulation generates observations for the three endogenous variables for each time period from the VAR, with the parameters determined by the VAR estimates presented in Table 7 for Sample I. Let the simulated series be described as follows $\tilde{\mathbf{x}}_{i,t} = [r_{i,t}, ILLIQ_{i,t}, dy_{i,t}]$. To match the frequency of the observed data, we employ the observed liberalization indicators for each replication. The base VAR(1) model we simulate is as follows:

$$\tilde{\mathbf{x}}_{i,t} = (\alpha_{0,i} + \alpha_1 * Lib_{i,t-1}) + \mathbf{A}\tilde{\mathbf{x}}_{i,t-1} + \Sigma_{i,t-1}^{1/2}\tilde{\epsilon}_{i,t} \qquad (14)$$

where $\tilde{\epsilon}_{i,t}$ is drawn from the standard normal distribution, and the first row $\mathbf{A}$ is constrained to be a row of zeros, so that under the null returns are not predicted by lagged endogenous variables. Note, in the simulation, returns are not predicted by lagged dividend yields; however, return and dividend yield innovations are allowed to be correlated as in the observed data.

For each replication, we estimate the unconstrained cross-sectionally restricted trivariate VAR(1) for returns, illiquidity, and dividend yields using the pooled MLE methodology presented above. Under the null, this procedure provides some indication of the behavior of the VAR coefficients and t-statistics for the first row of the VAR matrix describing the relationship between returns and lagged endogenous variables. We repeat this experiment 1000 times.

Table 9 presents some relevant percentiles of the empirical distribution for the coefficients comprising the first row of **A**, and for their corresponding t-statistics. First we focus on the relationship between returns and the lagged illiquidity variable. The median coefficient is 0.002, and the median t-statistic is 0.037, indicating that estimation bias is not a serious issue for the observed liquidity effect. The 97.5^{th} percentile of the distribution shows a coefficient of 0.107, well below the estimated liquidity effect of 0.146 shown in Table 7, and the corresponding t-statistic is 2.07. The t-statistics are only slightly larger than what would be implied by a standard t-distribution; however, these critical values remain well below those obtained for the estimated liquidity effect in the trivariate VAR presented for Sample I in Table 7. It is unlikely that small sample properties of the estimated standard errors for the other VAR specifications considered are qualitatively different from those presented here. In total, the Monte Carlo evidence shows that the impact of market illiquidity on future returns is not a statistical artifact.

Table 9 also presents some relevant percentiles for the coefficient describing the relationship between returns and the lagged dividend yields. The median coefficient is 1.18, and the median t-statistic is 0.509, indicating extreme estimation bias induced by the contemporaneous correlation between return and dividend yield shocks. The 97.5^{th} percentile of the distribution shows a coefficient of 5.99, and the corresponding t-statistic is 2.52. Consistent with Ang and Bekaert (2002), this evidence suggests extreme care must be taken when evaluating the importance of dividend yield predictability.

5.6 *VAR statistics*

(more work to be done – will wait for feedback on this first)

Four matrices describe the joint VAR dynamics before and after the liberalizations. Report the following statistics, which are only a function of the VAR parameters.

Our measure of fit is

$$\frac{VAR(E_t[r_{i,t+1}])}{VAR(r_{i,t})} \tag{15}$$

which is similar to an R^2 measure. We report this at various horizons.

We also present impulse responses from liquidity shocks, variance decompositions, long-term regression coefficients.

6 Conclusions

7 Bibliography

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Table 1

Summary Statistics

Sample: 1987:01 2001:05

	ARG	BRA	CHL	COL	GRC	IND	IDO	JOR	KOR	MYS	MEX	PAK	PHL	PRT	TWN	THA	TUR	VEN	ZWE
Excess Return (US$) (annual)																			
Mean	0.367	0.224	0.169	0.122	0.183	0.034	-0.077	-0.010	0.051	0.031	0.232	0.029	0.048	0.088	0.153	0.047	0.306	0.161	0.147
Standard deviation	0.762	0.601	0.273	0.325	0.417	0.325	0.502	0.146	0.434	0.367	0.432	0.338	0.380	0.486	0.484	0.439	0.699	0.475	0.387
Autocorrelation	-0.077	-0.020	0.224	0.405	0.084	0.110	0.191	-0.034	0.014	0.102	0.270	0.081	0.262	0.289	0.050	0.118	0.091	0.037	0.190
Observations	173	173	173	173	173	173	137	173	173	173	173	173	173	148	173	173	173	173	173
Dividend Yield (annual)																			
Mean	0.025	0.036	0.046	0.044	0.041	0.017	0.014	0.034	0.015	0.021	0.019	0.050	0.012	0.024	0.008	0.027	0.039	0.024	0.052
Standard deviation	0.015	0.033	0.023	0.021	0.023	0.007	0.009	0.020	0.007	0.008	0.007	0.031	0.006	0.011	0.004	0.017	0.023	0.019	0.027
Autocorrelation	0.790	0.867	0.963	0.977	0.896	0.932	0.969	0.920	0.768	0.929	0.900	0.942	0.949	0.920	0.898	0.857	0.847	0.953	0.947
Observations	173	173	173	173	173	173	127	173	173	173	173	173	173	147	173	173	163	173	173
Turnover (Value Traded/MCAP) (annual)																			
Mean	0.386	0.575	0.113	0.082	0.422	0.816	0.509	0.154	1.496	0.299	0.465	1.819	0.289	0.330	2.591	0.712	0.934	0.225	0.075
Standard deviation	0.238	0.323	0.072	0.045	0.432	0.933	0.264	0.129	1.272	0.204	0.220	3.189	0.171	0.311	1.121	0.478	0.788	0.211	0.061
Autocorrelation	0.743	0.816	0.415	0.482	0.785	0.845	0.718	0.705	0.878	0.726	0.656	0.932	0.668	0.825	0.633	0.657	0.859	0.672	0.438
Observations	172	172	172	172	172	172	137	172	172	172	172	172	172	147	172	172	172	172	172
Zeros: Proportion of Daily Zeros in that month																			
Mean	0.402	0.491	0.701	0.773	0.309	0.448	0.665	0.583	0.248	0.322	0.593	0.678	0.599	0.603	0.175	0.431	0.312	0.426	0.711
Standard deviation	0.167	0.071	0.067	0.087	0.166	0.096	0.075	0.135	0.079	0.086	0.065	0.078	0.140	0.074	0.075	0.117	0.128	0.211	0.161
Autocorrelation	0.909	0.933	0.799	0.822	0.935	0.343	0.758	0.245	0.523	0.595	0.761	0.610	0.809	0.734	0.055	0.831	0.688	0.928	0.942
Observations	161	137	143	113	161	137	137	83	173	173	161	107	173	161	165	173	161	137	161
Number of firms	83	572	227	53	380	892	308	32	1612	815	163	240	217	110	562	401	295	53	89

Table 2

Correlations with Measured Percentage of Zero Daily Returns

	Bid ask spread	Turnover	IFC monthly zeros	GARCH conditional volatility
ARG		-0.342	0.128	-0.434
BRA	0.361	-0.356	-0.125	0.685
CHL		-0.149	0.668	0.019
COL		-0.145	0.641	-0.329
GRC		-0.584	0.822	0.391
IND		-0.269	0.250	0.374
IDO	0.688	-0.343	0.265	-0.195
JOR		-0.224	-0.191	0.052
KOR	0.731	-0.393	0.041	0.071
MYS	0.600	-0.670	0.252	-0.134
MEX	0.840	-0.477	0.204	-0.212
PAK		-0.086	0.449	0.199
PHL	0.810	-0.539	0.429	-0.247
PRT		-0.588	0.128	-0.065
TWN		-0.417	0.128	-0.080
THA		0.002	0.503	0.505
TUR		-0.636	-0.295	0.015
VEN		-0.434	-0.089	0.003
ZWE		-0.523	0.400	-0.291

Table 3
Liquidity and Liberalization

Dependent variable	*Sample I: 1990:01 2001:05* *15 countries (balanced)*	Estimate	Standard error	*Sample II: 1988:01 2001:05* *10 countries (balanced)*	Estimate	Standard error	*Sample III: 1987:01 2001:05* *19 countries (unbalanced)*	Estimate	Standard error
Zeros	Liberalization Indicator	-0.1117	*0.0058*	Liberalization Indicator	-0.0487	*0.0064*	Liberalization Indicator	-0.0572	*0.0048*
Turnover	Liberalization Indicator	0.1000	*0.0030*	Liberalization Indicator	0.0798	*0.0022*	Liberalization Indicator	0.0608	*0.0014*

Pooled regressions with fixed effects (not reported). Robust standard errors with groupwise heteroskedasticity.

Table 4
Returns and Liquidity

	Sample I: 1990.01-2001.05 15 countries (balanced)		*Sample II: 1988.01-2001.05 10 countries (balanced)*		*Sample III: 1987:01 2001:05 19 countries (unbalanced)*	
	Estimate	Standard error	Estimate	Standard error	Estimate	Standard error
ILLIQ	0.1174	*0.0462*	0.1100	*0.0473*	0.0858	*0.0239*
ILLIQ	0.1246	*0.0922*	-0.0044	*0.0663*	0.0334	*0.0485*
Liberalization indicator	0.0826	*0.3910*	-0.5376	*0.2399*	-0.3293	*0.2040*
ILLIQ*Liberalization indicator	0.0011	*0.0873*	0.1599	*0.0643*	0.0606	*0.0492*
Turnover	-0.0352	*0.0495*	0.0032	*0.0565*	-0.0165	*0.0208*
Turnover	-0.1805	*0.1806*	0.0505	*0.1005*	0.0749	*0.0904*
Liberalization indicator	-0.0594	*0.1159*	-0.0641	*0.1235*	-0.0804	*0.0409*
Turnover*Liberalization indicatoı	0.1527	*0.1775*	-0.0532	*0.0976*	-0.0911	*0.0903*
Dividend yield	2.6998	*2.9027*	4.4140	*2.5492*	2.1560	*0.9599*
Dividend yield	-1.6812	*7.3380*	-1.3094	*3.7243*	0.3583	*1.1687*
Liberalization indicator	-0.2829	*0.2462*	-0.2828	*0.1579*	-0.1774	*0.0777*
Dividend Yield*Liberalization inc	4.5432	*7.3639*	8.8340	*4.2756*	2.9803	*2.0790*

The dependent variable is returns.
Pooled regressions with fixed effects (not reported). Robust standard errors with groupwise heteroskedasticity.

Table 5

Vector Autoregression

Bivariate: Returns and ILLIQ

	Sample I		*Sample II*	
Dependent variable: Returns	Estimate	Standard error	Estimate	Standard error
Returns	0.0840	*0.0219*	0.0708	*0.0250*
ILLIQ	0.1421	*0.0469*	0.1108	*0.0510*
Official liberalization indicator	0.2129	*0.1448*	-0.0576	*0.1377*
Dependent variable: ILLIQ				
Returns	-0.0251	*0.0063*	-0.0276	*0.0069*
ILLIQ	0.7993	*0.0133*	0.8050	*0.0147*
Official liberalization indicator	-0.1221	*0.0455*	-0.0947	*0.0344*
Cholesky decomposition of VAR-COV matrix: Pre liberalization				
c_11	1.6350	*0.0922*	2.1770	*0.0983*
c_21	-0.0337	*0.0428*	-0.1136	*0.0301*
c_22	0.5347	*0.0302*	0.4615	*0.0210*
Cholesky decomposition of VAR-COV matrix: Post liberalization				
c_11	1.5190	*0.0248*	1.5500	*0.0300*
c_21	-0.0772	*0.0099*	-0.0748	*0.0123*
c_22	0.4253	*0.0069*	0.4475	*0.0087*

Table 6

Vector Autoregression

Trivariate: Returns, ILLIQ, and Turnover

	Sample I		*Sample II*	
Dependent variable: Returns	Estimate	Standard error	Estimate	Standard error
Returns	0.0893	*0.0221*	0.0736	*0.0252*
ILLIQ	0.1373	*0.0482*	0.1047	*0.0510*
Turnover	-0.0276	*0.0584*	-0.0252	*0.0659*
Official liberalization indicator	0.2068	*0.1441*	-0.0573	*0.1471*
Dependent variable: ILLIQ				
Returns	-0.0264	*0.0064*	-0.0291	*0.0677*
ILLIQ	0.8010	*0.0138*	0.8114	*0.0070*
Turnover	0.0238	*0.0168*	0.0298	*0.0029*
Official liberalization indicator	-0.1264	*0.0457*	-0.0979	*0.0345*
Dependent variable: Turnover				
Returns	0.0193	*0.0053*	0.0233	*0.0062*
ILLIQ	0.0325	*0.0116*	0.1721	*0.0898*
Turnover	0.7852	*0.0143*	0.7672	*0.0169*
Official liberalization indicator	0.0944	*0.0292*	0.0636	*0.0312*
Cholesky decomposition of VAR-COV matrix: Pre liberalization				
c_11	1.6350	*0.0922*	2.1780	*0.0984*
c_21	-0.0334	*0.0427*	-0.1137	*0.0301*
c_22	0.5353	*0.0302*	0.4614	*0.0210*
c_31	0.0124	*0.0245*	0.0527	*0.0276*
c_32	-0.0904	*0.0240*	-0.1346	*0.0269*
c_33	0.2925	*0.0167*	0.4066	*0.0185*
Cholesky decomposition of VAR-COV matrix: Post liberalization				
c_11	1.5210	*0.0249*	1.5500	*0.0300*
c_21	-0.0772	*0.0100*	-0.0747	*0.0123*
c_22	0.4262	*0.0070*	0.4471	*0.0087*
c_31	0.0879	*0.0086*	0.1099	*0.0109*
c_32	-0.1068	*0.0083*	-0.1296	*0.0104*
c_33	0.3512	*0.0058*	0.3664	*0.0071*

Table 7

Vector Autoregression

Trivariate: Returns, ILLIQ, and Dividend Yield

	Sample I		*Sample II*	
Dependent variable: Returns	Estimate	Standard error	Estimate	Standard error
Returns	0.0892	*0.0221*	0.0759	*0.0252*
ILLIQ	0.1457	*0.0512*	0.0844	*0.0554*
Dividend yield	-0.2106	*2.6770*	3.7460	*3.1170*
Official liberalization indicator	0.1921	*0.1434*	-0.0141	*0.1536*
Dependent variable: ILLIQ				
Returns	-0.0206	*0.0063*	-0.0250	*0.0069*
ILLIQ	0.7742	*0.0143*	0.7872	*0.0157*
Dividend yield	3.5320	*0.7446*	2.6670	*0.8563*
Official liberalization indicator	-0.0868	*0.0458*	-0.0679	*0.0354*
Dependent variable: Dividend yield				
Returns	-0.0001	*0.0001*	-0.0002	*0.0001*
ILLIQ	0.0005	*0.0002*	0.0044	*0.0002*
Dividend yield	0.9008	*0.0098*	0.8549	*0.0128*
Official liberalization indicator	-0.0005	*0.0011*	-0.0019	*0.0007*
Cholesky decomposition of VAR-COV matrix: Pre liberalization				
c_11	1.6340	*0.0922*	2.1810	*0.0987*
c_21	-0.0357	*0.0425*	-0.1114	*0.0298*
c_22	0.5309	*0.0301*	0.4579	*0.0208*
c_31	-0.0081	*0.0012*	-0.0017	*0.0007*
c_32	0.0016	*0.0011*	0.0011	*0.0007*
c_33	0.0142	*0.0008*	0.0103	*0.0005*
Cholesky decomposition of VAR-COV matrix: Post liberalization				
c_11	1.5190	*0.0248*	1.5490	*0.0300*
c_21	-0.0773	*0.0098*	-0.0763	*0.0123*
c_22	0.4231	*0.0069*	0.4463	*0.0086*
c_31	-0.0023	*0.0001*	-0.0025	*0.0002*
c_32	0.0003	*0.0001*	0.0003	*0.0002*
c_33	0.0045	*0.0008*	0.0057	*0.0001*

Table 8

Vector Autoregression

Quadravariate: Returns, ILLIQ, Turnover, and Dividend yield

	Sample I		*Sample II*	
Dependent variable: Returns	Estimate	Standard error	Estimate	Standard error
Returns	0.0943	*0.0222*	0.0785	*0.0252*
ILLIQ	0.1404	*0.0489*	0.0785	*0.0566*
Turnover	-0.0276	*0.0579*	-0.0110	*0.0601*
Dividend yield	-0.0978	*1.6730*	4.0800	*3.1280*
Official liberalization indicator	0.1874	*0.1438*	-0.0088	*0.1282*
Dependent variable: ILLIQ				
Returns	-0.0221	*0.0064*	-0.0267	*0.0070*
ILLIQ	0.7762	*0.0146*	0.7940	*0.0160*
Turnover	0.0274	*0.0167*	0.0373	*0.0189*
Dividend yield	3.5390	*0.7434*	2.8570	*0.8621*
Official liberalization indicator	-0.0918	*0.0459*	-0.0700	*0.0351*
Dependent variable: Turnover				
Returns	0.0180	*0.0054*	0.0215	*0.0063*
ILLIQ	0.0403	*0.0124*	0.0391	*0.0143*
Turnover	0.7843	*0.0142*	0.7612	*0.0168*
Dividend yield	-1.0650	*0.5714*	-2.2150	*0.7773*
Official liberalization indicator	0.0838	*0.0300*	0.0417	*0.0324*
Dependent variable: Dividend yield				
Returns	-0.0001	*0.0001*	-0.0002	*0.0001*
ILLIQ	0.0004	*0.0002*	0.0006	*0.0002*
Turnover	0.0000	*0.0002*	-0.0003	*0.0003*
Dividend yield	0.8993	*0.0092*	0.8521	*0.0129*
Official liberalization indicator	-0.0005	*0.0011*	-0.0019	*0.0007*
Cholesky decomposition of VAR-COV matrix: Pre liberalization				
c_11	1.6340	*0.0921*	2.1830	*0.0988*
c_21	-0.0352	*0.0426*	-0.1113	*0.0298*
c_22	0.5320	*0.0302*	0.4578	*0.0208*
c_31	0.0128	*0.0245*	0.0497	*0.0277*
c_32	-0.0925	*0.0242*	-0.1337	*0.0270*
c_33	0.2932	*0.0168*	0.4078	*0.0186*
c_41	-0.0081	*0.0012*	-0.0017	*0.0007*
c_42	0.0016	*0.0011*	0.0011	*0.0007*
c_43	0.0003	*0.0011*	0.0001	*0.0007*
c_44	0.0142	*0.0008*	0.0103	*0.0005*
Cholesky decomposition of VAR-COV matrix: Post liberalization				
c_11	1.5210	*0.0249*	1.5490	*0.0300*
c_21	-0.0772	*0.0099*	-0.0762	*0.0123*
c_22	0.4238	*0.0069*	0.4456	*0.0086*
c_31	0.0880	*0.0086*	0.1113	*0.0108*
c_32	-0.1053	*0.0083*	-0.1271	*0.0103*
c_33	0.3512	*0.0058*	0.3655	*0.0071*
c_41	-0.0023	*0.0001*	-0.0025	*0.0002*
c_42	0.0003	*0.0001*	0.0003	*0.0002*
c_43	0.0001	*0.0001*	0.0002	*0.0002*
c_44	0.0045	*0.0001*	0.0057	*0.0001*

Table 9

Monte Carlo Evidence

	Returns on ILLIQ			Returns on Dividend yield	
	Coefficient	T-statistic		Coefficient	T-statistic
Median	0.002	0.037	Median	1.179	0.509
Mean	0.003	0.062	Mean	1.239	0.526
2.5%	-0.093	-1.877	2.5%	-3.169	-1.457
97.5%	0.107	2.075	97.5%	5.990	2.523