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Global Market Liquidity and Corporate Investments

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Global Market Liquidity and Corporate Investments

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Abstract

The dissertation consists of two essays. The first essay investigates how oil market factors impact on liquidity commonality in global equity markets. I identify two transmitting channels of the effect on liquidity commonality, namely oil price return and volatility. Using a sample of firms drawn from 50 countries spanning from Jan 1995 to Dec 2015, I find that both effects in oil explain the liquidity commonality in countries with higher integration to oil market. In addition, I show that oil volatility effect is more pronounced in net oil exporters compared to net oil importers after controlling for oil sensitivity. My findings suggest that oil volatility effect on liquidity commonality is more substantial for high oil sensitive countries than oil price return effect except five OPEC members, where liquidity commonality is highly influenced by oil the return along with volatility. These results are robust to controlling for possible sources of liquidity commonality as found in the literature. In the second essay, I study the impact of stock liquidity on firms' future investments. Since stock liquidity decreases the cost of equity, I expect firms' future investments to increase with stock liquidity. Secondly, I argue that this relation is more pronounced in more financially constrained firms because of their limited access to external capital. Using a sample of more than 9800 firms, from 21 emerging markets and spanning from 2000 to 2015, I find supportive and robust evidence of a positive association between stock liquidity and firms' future investments. Furthermore, my findings strongly suggest that the liquidity impact on corporate investments is highly influenced by the firms' financial constraint levels, using four different definitions of financial constraints. My findings are robust due to controlling for other determinants of future investment suggested in the previous literature, and due to controlling for the country and time effects. In addition, the results seem to be consistent with the use of alternative measures of corporate investments and stock liquidity and with alternative model specifications and estimation methodologies.

JEL classification: G12; G14; G15; Q43; G31

Keywords: Commonality; Stock market liquidity; International equity markets; Oil price risk; Firm investment; Emerging markets; Financial constraints.

Chapter One

Oil Market as a Source of Liquidity Commonality in Global Equity Markets

1. Overview

Stock market liquidity is defined as the easiness to buy and sell a certain stock without a loss in value. If stock markets are illiquid, investors can be expected to require compensations from taking the risk of not being able to sell out easily and inexpensively when trading stocks. Many studies have documented this pricing factor and showed that stock liquidity partially explains equity stock returns (Amihud, 2002; Chordia et al., 2001, Jones, 2002, Pastor and Stambaugh, 2003). An asset pricing model, proposed by the theoretical work of Acharya, L.H. Pedersen (2005), models liquidity as a systematic risk. They show that investors gain less when the stocks that they hold are less correlated with the overall market liquidity, indicating a less exposure to market liquidity risk. Karolyi et al. (2012) argue that, such findings imply a commonality in liquidity among stocks, at least within countries. Chordia et al. (2000) are the first to document the co-movements of market liquidity in equity markets, which has been verified by Hasbrouck and Seppi (2001) and Huberman and Halka (2001). More recently, other studies find evidence for the liquidity co-movements in other financial markets. For example, Marshall et al (2011) examine liquidity commonality in commodity future markets, and find a strong commonality in 16 different commodity futures, which also seem to be affected by the liquidity of stock markets.

Understanding what causes commonality in liquidity is crucial to predict, immune and curb the negative effects of a contagious sudden dry-up in the equity markets. In addition, pricing risk factors and their premiums requires understanding of their dynamics and components. For this, the recent studies seem to be concerned about the sources of commonality in liquidity and generally divide those sources into two sides. One side includes factors that are considered demand-side factors, such as the correlations in trading activity, structure of ownership and exchange rates (Chordia et al, 2000; Hasbrouck and Seppi, 2001; Kamara et al. 2008; Dang et al., 2015a; Koch et al., 2016). Chordia et al (2000) and Hasbrouck and Seppi (2001) find evidence for trading activity correlations as sources of such co-movements in individual stocks liquidity. Kamara et al. (2008) find a positive association between increases in institutional trading and commonality in liquidity, confirming the prediction of Gorton and Pennacchi (1993), who predict that equity basket trading increases liquidity commonality for the stocks in the basket. Dang et al. (2015a) study the effect of the U.S. and international cross-listings on liquidity commonality of the cross-listed firms. Their main finding suggests that the liquidity commonality of cross-listed firms is lower with home market and higher with host market after cross listing. Koch et al (2016) find that stocks with high mutual fund ownership have more commonality in liquidity compared to low mutual fund ownership.

The other side includes factors that are considered supply-side factors, which are related to the sources that fund investors (Coughenour and Saad, 2004; Hameed et al, 2010). Coughenour and Saad (2004) find that the co-movements of liquidity in certain stocks are caused by specialist firms that provide liquidity for certain stocks in their portfolios. Hameed et al (2010) examine the impact of negative market returns on the evidence liquidity commonality in equity markets. They find that the liquidity of individual stocks commonly drops with large negative market returns. They argue that this is because aggregate collaterals of lending agents, namely financial intermediaries, decline and are followed by a force of liquidations, which makes it less likely that those funding agents will be able to provide more liquidity to the market.

Using an intraday global data of 47 markets, Brockman et al. (2009) claim to be the first to investigate commonality in liquidity using intraday and global data as most of previous studies use a single-market data. They first document the commonality in individual stocks' liquidity with market liquidity within countries and find that Asia stock markets experience relatively the strongest commonality while Latin American markets have the lowest liquidity commonality. Furthermore, they document liquidity commonality across borders and in the regional levels though they find that local source of commonality has a more important role than global source in explaining firms' commonality in liquidity. Lastly, they examine the effect of macroeconomic announcements on commonality in liquidity across the countries in their sample and find that local and the U.S. macroeconomic announcements partially explain commonality in liquidity across countries.

In a comprehensive framework and an international setting, Karolyi et al. (2012) investigate the possible explanations of commonality in liquidity implied by the literature of asset pricing and found in studies that directly document those commonalities. They study the commonality of equity markets in a sample constructed from 40 countries. They introduce several variables to detect the sources of such commonality in cross-sectional and time-series analyses. Overall, they find supportive evidence to some of their stated hypotheses.

Most of the factors examined in the literature of commonality in liquidity are common causes in most economies. Even though economies are categorized in different levels of financial constraints, it is natural to believe that the liquidity of equity markets in almost all economies somehow suffer from increases in limited funding. Furthermore, demand-side factors, causing liquidity commonality are also common in most economies, as Karolyi et al (2012) find that demand-side factors, including institutional and foreign investors and correlated trading activity, explain the level of commonality in liquidity in most of countries in their sample.

In this study, we introduce oil market, which we hypothesize to help directly and/or indirectly explain commonality in liquidity, especially and largely in certain economies that are integrated with and sensitive to oil market. Unlike other sources, we predict that oil factors may only be relevant for economies that are oil dependent. Following Elyasiani et al (2011), we identify two channels, namely oil price returns and volatility, transmitting oil effect to the liquidity commonality in equity markets. In general, previous studies suggest that liquidity commonality in equity markets is driven by the lack of lending agents' capability to fund investors in equity market, negatively affecting the supply source, and by investors fearing uncertainty thus selling off their shares in the equity market, negatively affecting the demand source. In this study, we argue that oil market, being a major global macroeconomic force, may directly and/or indirectly prompt either or both of these two sources.

Theoretically, Brunnermeier and Pedersen (2009) model lending agents, namely financial intermediaries, as that they provide liquidity to equity markets and face funding constraints as they have capital restrictions. When the economy experiences high uncertainty, which we argue that it can be attributed to high uncertainty in oil market, lending agents encounter more restrictions on their capital, which in turn force them to liquidate some of the assets they hold and weaken their ability to provide liquidity through lending (Karolyi et al., 2012). In the demand-side, the argument is that if the economy is relatively highly integrated with the oil market and therefore exposed to its associated risk; the flow of investments in its equity markets will be commonly affected by investors' fear of uncertainty when oil market volatility increases. And, this dry-up in investment flows, caused by uncertainty, will spread across individual stocks in that economy. However, during stable oil markets, the common fear of uncertainty plays a less important role, which results in more variations in liquidity levels across individual stocks in the economy, reducing the liquidity commonality in equity markets. In general, this study attempts to investigate the extent to which oil market may explain average commonality in liquidity of individual stocks within countries. To the best of our knowledge, this study is the first to link oil market with the evident liquidity commonality in equity markets. Furthermore, we utilize a large sample comprising 50 countries to help address and investigate multiple hypotheses related to how important is oil market's role in explaining liquidity commonality in equity markets across the world.

Using a sample of 36,930 firms from 50 countries, we show that oil returns and volatility, as a transmitting channels of oil effects on liquidity commonality only explain variations in liquidity commonality for countries that are estimated to be high oil sensitive. We define oil sensitivity as the absolute value of the difference of exports and imports scaled by the country's GDP. Specifically, we show that oil volatility effect on liquidity commonality is much more statistically and economically significant than oil return effect in the case of equal coefficients restriction imposed on all equations in the high oil sensitive group. Additionally, we show that oil volatility effect is stronger in net oil exporters as opposed to net oil importers, after controlling for oil sensitivity. Furthermore, we reinvestigate the latter conclusion and relax the equal constraint and allow the coefficients to vary across 4 groups, namely low oil sensitive, high oil sensitive and OPEC net exporter, high oil sensitive non-OPEC net exporter, and high oil sensitive and net importer groups. Our findings suggest that oil return has a strong impact on liquidity commonality in only OPEC members whereas oil volatility influence liquidity commonality in both net oil exporter groups along with net oil importers. Lastly, we confirm the results that suggest a stronger effect of oil volatility on net oil exporters as opposed to net oil importers. Since market factors and oil factors may possibly be highly correlated, which may impact our conclusions, we repeat our analyses using oil factors that are orthogonal to market factors and all the results seem to hold. Finally, our results are robust to controlling for possible sources of liquidity commonality found explanatory of liquidity commonality in equity markets in previous literature.

The association between oil market and many macroeconomic variables such as economic stability, economic growth, and more recently financial markets has been extensively studied (Hamilton, 1983; Chen et al. 1986; Huang et al., 1996; Hamilton 2003; and others). Huang et al (1996) illustrate the relationship between changes in oil price and stock returns by showing how the components of stock returns are functions of oil prices. They define a stock price as the discounted cash flows of a company:

$$Stock\ Price = \frac{CF}{R} \qquad (1)$$

Where *CF* is the expected cash flow of the company, and *r* is the expected cost of capital rate. Since the stock returns is the percent change in price, it follows:

$$Stock\ Return = \frac{d(CF)}{CF} - \frac{d(R)}{R} \qquad (2)$$

Equation (2) implies that a stock return is a function of systematic changes in expected cash flow (CF) and expected cost of capital rates (R). Huang et al (1996) claim that oil prices and volatility can affect both factors. They argue that because oil is a major resource in the production process in companies, changes in oil prices and volatility may have an impact on future cash flows. They further argue that oil prices and volatility can also affect the cost of capital rate through its components, namely interest and inflation rates. Many empirical studies using a sample from U.S. stocks (Huang et al, 1996; Elyasiani et al., 2011), developed markets

(Jones and Kaul,1996; Park and Rati, 2008; Degiannakis et al., 2013), and emerging markets (Basher and Sadorsky, 2006; Basher et al., 2012), provide supportive evidence of oil risk as a systematic priced factor in stock pricing. We extend this line of literature by addressing the question, besides its direct impact on stock prices, whether oil price indirectly affects stock prices through its impact on the price of liquidity risk. Since higher commonality in liquidity implies a higher level of the systemic liquidity risk, our findings may also have a crucial implication for asset pricing through finding a statistically significant association between oil risk and liquidity commonality in equity markets.

The rest of the paper is organized as follows: In section two, we explain the sample selection, illustrate the methodology used to construct our liquidity commonality measure, oil sensitivity measure and oil factors and discuss some of the descriptive statistics. In section three, we outline the regression analysis methodology to test multiple hypotheses and show the results. Finally, in section four, we provide a summary discussion of our findings and offer concluding remarks.

2. Data and Variable Constructions

In this section, we describe our sample selection in subsection 2.1 and we show how we construct the measure of liquidity commonality in equity markets in subsection 2.2, the oil sensitivity measure and oil factors in subsection 2.3. In section 2.4, we define some variables that we use to control for demand and supply sources of commonality in liquidity. Then, we provide some descriptive statistics of our sample and preliminary analysis in subsection 2.5.

2.1. Sample Selection

Our sample comprises publicly traded firms from 50 countries and spans from Jan 1995 to Dec 2015. Namely, we collect firms daily and annual data from countries in East Asia and

Pacific region (Australia, China, Hong Kong, Indonesia, Japan, South Korea, Malaysia, New Zealand, Philippines, Singapore, Thailand and Vietnam), Europe and Central Asia region (Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Russia, Spain, Sweden, Switzerland, Turkey and United Kingdom), Latin America region (Argentina, Brazil, Chile, Mexico, and Peru), Middle East and North Africa region (Egypt, Israel, Kuwait, Qatar, Saudi Arabia and United Arab Emirates), North America region (United States and Canada), South Asia region (Bangladesh, India, Pakistan and Sri Lanka) and Sub-Saharan Africa region (Nigeria). According to World Economic Outlook (2015), published by the International Money Fund (IMF), 27 countries out of the 50 countries in our sample are classified Advanced Economies whereas 23 countries are classified Emerging Market and Developing Economies. Furthermore, our extended sample of countries include 15 oil net exporter countries, which include 6 members of the Organization of the Petroleum Exporting Countries (OPEC). Unlike previous studies, we extend the sample to cover major oil exporter countries, particularly the members of OPEC as they are clearly essential in our research question. In general, we limit our sample to those 50 countries and not include others because they lack sufficient data to construct the key variables in this study (e.g. trading volume).

We obtain daily and annual data for the firms in our sample from Global Compustat. From the 50 countries, our sample consists of 36,930 firms with the earliest starting date in Jan 1995 and the latest in Dec 2015. We include all available firms that pass our screening process, including firms whose data end before the latest date to avoid survivorship bias. We closely follow Karolyi et al (2012) in their sample screening. Specifically, we restrict the sample to stocks from major exchanges in each market. This is defined as the exchanges that most the country's firms are listed in. For the United States, we only use NYSE as it is evident in the literature that NYSE and NASDAQ are different in terms of trading volume definitions (Atkins and Dyl, 1997). Also, we follow Karolyi et al. (2012) and include Chinese firms listed in both Shanghai and Shenzhen and Japanese firms listed in both Osaka and Tokyo. To avoid including firms more than once, we make sure that we only include the firm observation that is reported in its local currency. We exclude firms with special features, namely we exclude depositary receipts (DRs), real estate investment trusts (REITs), preferred stocks, investment funds. The following screening is also applied. We exclude days on which 90% or more of the stocks listed on a given exchange have a return equal to zero as we consider them non-trading days. Also, we exclude stock-month observations if the number of zero-return days is more than 80% in the given month as we consider it a non-traded stock for that month. Finally, we drop stock-day observations with a daily return in the top or the bottom 0.1% of the cross-sectional distribution within a country to avoid outliers.

We obtain data of oil market from U.S. Energy Information Administration (EIA). We collect monthly futures oil prices (NYMEX) and spot oil prices (WTI). In this study, we use one-month crude oil futures, traded on the New York Mercantile Exchange (NYMEX). We use one-month futures prices following Sadorsky(2001) who show that spot prices are heavily affected by temporary random noise compared to futures prices[1]. In addition, we collect annual data of crude oil productions, consumptions, exports and imports for each country from the same source, EIA. From World Bank, we collect the annual GDP (constant 2005 U.S. dollar). From International Financial Statistics (IFS) by IMF, we collect data for exchange rates and Interest

[1] For robustness check, we repeat our analysis, though results are not reported, using the spot prices of Western Texas Intermediate (WTI) crude oil and the results are similar.

rates for each country. And, we acquire U.S. Interest Rates data from the Federal Reserve. Finally, we download data for international capital flow from Treasury International Capital (TIC) and U.S. Sentiment Index from Jeff Wurgler's website.[2]

2.2. Commonality Measure

Several studies use different approaches in defining liquidity commonality. For example, Chordia et al (2000), followed by Coughenour and Saad (2004), Brockman et al (2009), Hameed et al (2010), Rösch and Kaserer (2013) and Koch et al (2016), construct the liquidity commonality by estimating a regression of daily changes of individual stock liquidity, using different liquidity proxies, on equally-weighted average liquidity for all stocks. Then, they define liquidity commonality as the cross-sectional average coefficients from the time-series regressions. Another approach is used by Korajczyk and Sadka (2008), and followed by Marshall et al (2013), which define liquidity commonality based on principle component analysis. First, they calculate the average liquidity of all stocks for each day and calculate the mean and the standard deviation of this market average time series. Then, they define the liquidity commonality for each day as the difference between the market average observations and the time series mean scaled by the time series standard deviation. The third approach is used by Karolyi et al (2012), inspired by Roll (1988) and Morch et al (2000), which constructs liquidity commonality from the R^2 of a regression of individual stock liquidity on equally-weighted average market liquidity. This approach is also followed by Hameed et al (2010), Dang et al (2015a), Dang et al (2015b). However, while Hameed et al (2010), Dang et al (2015a) and Dang et al (2015b) and simply use the changes in stock

[2] For full variable definitions and data sources, see Table A1 in Appendix A.

liquidity in one step regression to compute R^2, Karolyi et al (2012) use two steps approach. First, they compute innovations (regression errors) from individual stock liquidity filtering regressions then use them to compute R^2 from the regression of stock liquidity innovations on equally-weighted average market liquidity innovations. The latter approach is used as another way to avoid the potential econometric problem of nonstationary, which might be present if liquidity measure is simply used as the dependent variable.

Given the similarities in our sample to the sample used by Karolyi et al. (2012), we choose to follow their approach in constructing our liquidity commonality measure. This may facilitate the interpretation of our results as it would allow us to compare, relate and confirm their results and findings based on a different source of data, an updated time series and a broader coverage of countries[3].

Due to the unavailability of high frequency data for most of the countries in our sample, we employ Amihud illiquidity measure since it only requires daily frequency. We add a constant and take the log of the sum to avoid outliers. Also, we multiply the logged value of the sum by minus one. This converts it to a liquidity measure as it is now increasing in liquidity:

$$Liq_{i,d} = -\log\left(1 + \frac{|R_{i,d}|}{P_{i,d}VO_{i,d}}\right) \quad (3)$$

Where *R* is the daily return of stock *i* on day *d*. And, *P* is the share price in local currency and VO is the trading volume of stock *i* on day *d*.

[3] The findings of Karolyi et al (2012) are based on a sample obtained from Datastream that covers 40 countries from Jan 1995 to Dec 2012.

Following Karoly et al (2012) approach, we use the R^2 of regressions of the innovations of individual stocks liquidity on the innovations of market liquidity to obtain a measure of commonality in liquidity. First, we estimate the residuals in liquidity for each stock based on daily observations for each month, creating a monthly-time series of residuals for each stock. We control for the lag value of liquidity, days of week in estimating residuals. Specifically, we estimate the following equation:

$$Liq_{i,t,d} = \alpha_{i,t}\, Liq_{i,d-1} + \sum_{n=1}^{5} \beta_{i,t}^{n}\, D_n + \omega_{i,t,d} \quad (4)$$

Where D_n denote five dummies for each day of the week. Then, we use the residuals from (4) to estimate the monthly measure of commonality in liquidity for each stock. Basically, we run daily regressions of each stock residuals obtained from (4) on the value-weighted average of residuals of all stocks in the same country within a month and save R^2:

$$\widehat{\omega}_{i,t,d} = \alpha_{i,t} + \sum_{j=-1}^{1} \beta_{i,t}^{j}\, \widehat{\omega}_{m,t,d+j} + \varepsilon_{i,t,d} \quad (5)$$

The subscripts *i* and *m* denote stock i and market, respectively. Following Chordia, Roll, and Subrahmanyam (2000), we include one day leading and lagging values of the value-weighted average of residuals of all stocks in the same country to capture any lagged adjustment in commonality. We require a minimum number of 15 daily observations to estimate the R^2 of a stock in a given month. Regressions in equation (5) generate a monthly time-series of the commonality in liquidity (R^2_{Amihud}) for each stock. For each country, we compute the commonality in liquidity from an equal weighted average of all commonality measures across firms in that country. From those averages, we have a monthly time-series of commonality measure for each country. The value of the commonality measure (R^2_{Amihud}) falls within zero and one, making it unsuitable to be used as a dependent variable. Therefore, to use this measure in regressions framework, we use the following logistic transformation, $\ln[\frac{R^2_{Amihud}}{1-R^2_{Amihud}}]$.

2.3. Oil Factors and Oil Sensitivity:

To investigate the relationship between oil market and commonality in liquidity in equity markets, we identify two channels, namely oil price returns and volatility, transmitting oil effect to the liquidity commonality. We expect oil volatility to have a positive effect on liquidity commonality while we expect the effect of oil returns to be mixed. Specifically, we expect oil returns to negatively affect liquidity commonality in countries whose net position in oil market is sellers (i.e. net exporters) and positively affect liquidity commonality in countries whose net position in oil market is buyers (i.e. net importers). To proxy for oil market prices, we use one-month crude oil futures, traded on the New York Mercantile Exchange (NYMEX). As mentioned earlier, this is following the suggestion of Sadorsky(2001) who show that spot prices are more heavily affected by temporary random noise compared to futures prices. To assure a long and enough number of time series observations and to more accurately estimate oil volatility, our oil data starts from Jan 1988 and ends in Dec 2015. We define the return of oil price as the log difference of the price at time (t) and (t-1). We proxy for oil volatility by allowing oil returns to follow the GARCH(1,1) process. Then, we compute the conditional variance of this process and define it as oil volatility. Based on the Akaike information criteria (AIC) and Bayesian information criteria (BIC), we find that the minimum values of AIC and BIC are in the random in the autoregressive AR(1)-GARCH(1,1) process specifications. In the chosen specification, ARCH and GARCH coefficients are positive and the sum of them is less than 1, meeting the statistical requirements. Therefore, we assume that the oil returns follow AR(1)-GARCH(1,1) process. The oil return equation with the AR(1)-GARCH(1,1) process can be written as:

$$ROIL_t = \alpha + \beta\, ROIL_{t-1} + \varepsilon_t \qquad \varepsilon_t | I_{t-1} \sim N(0, h_t) \qquad (6)$$

$$VOIL_t = h_t = \beta_0 + \beta_1 \varepsilon_{t-1}^2 + \beta_2 h_{t-1} \qquad (7)$$

Where $ROIL_t$ is oil returns at time *t* and ε_t is the error term with a conditional mean of zero and a conditional variance of h_t. $VOIL_t$ is the conditional variance of the process and used to proxy for oil volatility and shocks. The parameters in equation (6) and (7) can be estimated by maximizing the log likelihood function that takes the following form[4]:

$$ln(L) = -\frac{T}{2} ln\,(2\pi) - \frac{1}{2}\sum_{t=1}^{T} \ln VOIL_t - \frac{1}{2}\sum_{t=1}^{T} \frac{(ROIL_t - \alpha - \beta\, ROIL_{t-1})^2}{VOIL_t} \qquad (8)$$

This approach to define volatility and shocks in time-series variables has been used throughout the literature. For instance, Day and Lewis (1992) examines the effect of the implied volatility of called options of S&P 500 on stock return shocks, which they use the GARCH and EGARCH processes to proxy for. Furthermore, Karolyi (1995) utilizes the multivariate GARCH process to investigates the effect of stock returns volatility of foreign countries on stock returns volatility of the home country, using a sample from North America. A more relative example, Elyasiani et al. (2011) study the impact of oil price returns and volatility on excess stock returns across industries in the U.S. stock market. To proxy for oil volatility, they assume oil returns to follow the GARCH process and use the conditional variance from the GARCH process as a proxy for oil volatility.

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[4] For more details on GARCH, see Bollerslev (1986).

To determine the sensitivity of a country to oil market, we define the sensitivity measure as the absolute value of the difference between exports and imports of crude oil divided by GDP in U.S. Billion Dollars (constant 2005 U.S. dollar).

$$Sens_c = \frac{|Crude\ Oil\ Exports_c - Crude\ Oil\ Imports_c|}{GDP_c\ in\ U.S.Billion\ Dollars} \quad (9)$$

The subscript *c* denotes countries. Exports and Imports of crude oil are in Thousand Barrels Per Day. In the case that a country exports exactly as much as it imports of oil, their net zero position should make them the least sensitive to oil volatility thus the most hedged against oil risk. It is worth noting that we do not imply that this case is completely insensitive to oil markets, however it is relatively the least directly sensitive to oil market.

2.4. Sources of Liquidity Commonality

In order to address and investigate the marginal role of oil factors in explaining the variations in liquidity commonality over time and across the world, we need to take into account some factors suggested in the literature and shown to have a statistically significant association with liquidity commonality. The funding role that intermediaries play in the stock markets is arguably capable to trigger the co-movement evident in stock market liquidity. Brunnermeier and Pedersen (2009) argue that even though financial intermediaries, which might include specialists and other market makers, provide liquidity to stock market participants, they are at risk of forced liquidations of their securities that they hold as collateral. They argue that this risk increases amid large market declines and high increase in volatility. Thus, they predict that liquidity commonality is high during large market decline and high market volatility. Empirically, Coughenour and Saad (2004) find that stocks in NYSE that are handled by the same specialist experience co-movement in their liquidity. Hameed et al. (2010), using NYSE stocks, find a direct association between liquidity commonality and large market decline and high market volatility. Globally, Karolyi et al. (2012) find supportive evidence of this prediction, using a sample of 40 countries. In addition, they also incorporate several variables that may capture the time variations of funding constraints. Some of these variables include U.S. commercial paper spreads and local short-term interest rates as they both indicate the level of credit constraints.

To control for the supply effect, we include the market return and volatility in our regression equations. For each country, we define these variables as follows. The market return is defined as the value-weighted average of the return of individual stocks within the country. The market volatility is defined as the monthly standard deviation of the value-weighted market return multiplied by the square root of 22, representing the number of days in a month. Following Karolyi et al. (2012), we also control for market condition variables to capture country-specific effects. Namely, we control for Market Liquidity and Market Turnover, respectively, defined as the value-weighted average of the monthly Amihud measure and the turnover of individual stocks within the country. Also, we control for U.S. commercial paper spreads and local short-term interest rates. Additionally, we include a time trend variable as Karolyi et al. (2012) show that a negative time trend in liquidity commonality is statistically significant in about half of the countries in their sample.

The other side of the story could be labeled as the demand effect. This set of factors concerns about how stock traders' activity can lead to co-movement in market liquidity. Coughenour and Saad (2004) and Vayanos (2004) argue that, besides the effect of market volatility on the supply of funding, high market volatility may create correlated trading behavior, which in turn would trigger liquidity commonality. Empirically, Kamara et al (2008) and Koch et al (2016) find evidence to this hypothesis by observing a positive association between institutional trading and mutual fund ownership, respectively, with commonality in liquidity. To account for this effect, we follow Karolyi et al (2012) and employ the measure of commonality in turnover to proxy for correlated trading activity. This is established by repeating the approach we use in constructing our commonality in liquidity (R^2_{Amihud}). Particularly, we define Turnover as:

$$Turn_{i,d} = \log\left(1 + \frac{VO_{i,d}}{Shares_{i,y}}\right) \quad (10)$$

Where $VO_{i,d}$ is the trading volume of stock *i* on day *d*, $Shares_{i,y}$ is the number of shares outstanding at the beginning of year *y* of stock *i*. Similar to R^2_{Amihud}, we estimate the residuals in *Turnover* for each stock based on daily observations for each month, creating a monthly-time series of residuals for each stock. We control for the lag value of *Turnover*, days of week in estimating residuals. Then, we use those residuals to estimate the monthly measure of commonality in *Turnover* ($R^2_{Turnover}$). As suggested by Karolyi et al. (2012), in order to assure that $R^2_{Turnover}$ is orthogonal to the supply factors as it may be correlated with funding constraints, we use the residuals from regressions of $R^2_{Turnover}$ on the supply side factors, namely local short-term Interest Rate and U.S. Commercial Paper for each country.

In addition, we control for the effect of the presence of institutional and foreign investors, as they may increase the correlation in trading activity (Kamara et al. 2008), by including two variables. Karolyi et al. (2012) argue that exchange rate changes could create incentive for foreign institutional investors to enter the market. As the local currency depreciates, foreign institutional investors are motivated to enter or increase their holdings in the market. To control for this effect, we include exchange rate changes of local currencies relative to Special Drawing Rights (SDR). This variable is obtained from International Financial Statistics (IFS) offered by the International Monastery Fund (IMF). Second, we add a variable for net percentage equity flow using data of capital flow from and to the U.S., obtained from Treasury International Capital (TIC) of the U.S. Department of Treasury. For each country, this variable is computed as the difference of the item: "Gross purchases of foreign stock by foreigners to U.S. residents" and the item: "Gross purchases of foreign stocks b foreigners from U.S. residents" scaled by the sum of the two items. Moreover, we include a measure, suggested by Karolyi et al. (2012), to proxy for the level of capital market openness. We define capital market openness as the gross capital flow scaled by GDP, for each country. Due to the limitation in the capital flow data, some of the countries in our sample do not have available reports on cash inflows with the U.S., we omit these two variables from the regressions in such cases. Lastly, we account for investor sentiment as they may prompt the co-movement in liquidity through panic selling during times with high uncertainty (Hameed et al. 2010). To control for this effect, we use the U.S. sentiment index constructed by Baker and Wurgler (2006) and obtained from Wurgler's website.

2.5. Descriptive Statistics and Preliminary Analysis:

In Table 1, we show some descriptive statistics of the sample. For each country, we show the start and the end date of the data, number of firms included, number of monthly observations, a net exporter indicator and a high oil sensitive indicator. A country is a net exporter if, on average, it exports of crude oil more than it imports and it is a high oil sensitive if its oil sensitivity ratio is above the median of the oil sensitivity ratios of all countries. In addition, we show the value weighted averages of market return, market turnover, and market liquidity along with market volatility, which we define as the monthly standard deviation of the value-weighted

Table 1 Descriptive Statistics:

This table reports some descriptive statistics of a sample from 50 countries spanning from Jan 1995 to Dec 2015. For each country, this table reports the start and the end dates of the sample, number of firms included, total number of monthly observations, net exporter and high oil sensitivity indicators and the means of market condition variables. Net Exp indicates whether the country is a net exporter, based on the average of its oil exports and imports from 1995 to 2012. High oil sensitivity indicates whether the country's average oil sensitivity measure, from the period 1995 to 2012, is above the median. Oil sensitivity measure is defined as the absolute value of the difference in oil exports and imports scaled by GDP in constant 2005 U.S. Dollar. Market return, liquidity and turnover are, respectively, the value-weighted average of the return, the monthly Amihud measure-computed as the average over the month of the daily absolute stock return divided by local currency trading volume (multiplied by -10,0000), and the turnover of all individual stocks in each country in a given month. The market volatility is the monthly standard deviation of the value-weighted market return multiplied by the square root of 22 (the number of days in a month). Commonality measures, R^2_{Amihud} and $R^2_{Turnover}$ are defined in details in section 2.2 and 2.4, respectively. The countries are sorted by its average oil sensitivity measure, the first country has the highest average oil sensitivity and the last country has the lowest.

Country	*Start Date*	*End Date*	*No. Firms*	*No. Obs*	*Net Exp*	*High Sens.*	*Market Return*	*Market Volatility*	*Market Turnover*	*Market Liquidity*	R^2_{Amihud} *Mean*	R^2_{Amihud} *Stdev*	$R^2_{Turnover}$ *Mean*	$R^2_{Turnover}$ *Stdev*
Saudi Arabia	200203	201512	178	13813	Yes	Yes	1.12	6.79	0.31	-0.01	28.26	11.67	25.52	5.86
Nigeria	200008	201512	225	10188	Yes	Yes	1.20	4.76	0.04	-0.08	22.12	4.10	22.48	4.06
Kuwait	200403	201512	213	11260	Yes	Yes	0.20	5.06	0.13	-35.80	22.96	5.33	24.12	4.38
UAE	200602	201512	66	2138	Yes	Yes	0.86	6.05	0.05	-0.82	21.75	5.43	26.91	5.39
Qatar	200807	201512	45	2009	Yes	Yes	0.62	3.67	0.05	-0.05	21.38	4.30	27.53	5.47
Norway	199501	201512	389	24369	Yes	Yes	0.69	5.72	0.23	-0.23	20.59	3.40	21.85	3.04
Singapore	199601	201512	845	69742	No	Yes	0.45	4.92	0.14	-1.98	20.67	2.64	22.97	4.48
Russia	200205	201310	220	1926	Yes	Yes	1.05	12.42	0.01	-3.99	24.25	5.48	26.75	5.76
Thailand	199601	201512	804	72448	No	Yes	0.46	6.93	0.21	-0.35	20.30	3.00	24.59	5.61
S. Korea	199506	201512	1923	104102	No	Yes	0.47	7.38	0.48	0.00	20.85	4.78	23.44	4.58
Philippines	199502	201512	293	25369	No	Yes	0.87	5.92	0.06	-0.46	20.72	2.96	22.60	3.76
India	199707	201512	2958	125343	No	Yes	0.27	6.98	0.12	-6.55	20.68	4.72	20.40	2.74
Mexico	199608	201512	212	12166	Yes	Yes	1.24	5.69	0.11	-0.12	19.92	4.57	27.14	5.60
Netherlands	199501	201512	281	27464	No	Yes	0.63	5.47	0.36	-0.50	19.52	2.88	23.08	5.26
Greece	199501	201512	388	42244	No	Yes	-0.18	8.53	0.13	-19.65	21.84	5.22	23.18	5.02
Belgium	199510	201402	283	21047	No	Yes	0.44	4.92	0.10	-1.05	20.36	5.39	23.17	3.75
Sri Lanka	200312	201512	314	19888	No	Yes	1.54	5.27	0.04	-7.50	21.87	4.83	22.09	3.90
Israel	200206	201512	617	28791	No	Yes	0.50	4.76	0.12	-0.63	22.85	3.59	27.55	5.31
S. Africa	199607	201512	845	46710	No	Yes	0.95	4.93	0.18	-0.82	20.22	3.06	22.19	4.39
Chile	199609	201512	226	12430	No	Yes	0.98	4.03	0.05	-0.01	20.51	3.44	23.56	4.21
Malaysia	199601	201512	1135	48875	Yes	Yes	0.42	4.55	0.09	-2.66	22.10	4.81	30.24	11.61
Egypt	200210	201512	224	14741	Yes	Yes	1.53	7.80	0.14	-0.55	23.44	8.04	24.19	4.79
Portugal	199608	201512	125	8338	No	Yes	0.26	4.95	0.17	-1.86	20.62	3.94	24.49	5.67
Pakistan	199505	201512	534	35668	No	Yes	1.30	6.78	0.49	-2.63	21.54	5.18	23.66	4.16

Table 1 - Continued

Country	*Start Date*	*End Date*	*No. Firms*	*No. Obs*	*Net Exp*	*High Sens.*	*Market Return*	*Market Volatility*	*Market Turnover*	*Market Liquidity*	R^2_{Amihud} *Mean*	R^2_{Amihud} *Stdev*	$R^2_{Turnover}$ *Mean*	$R^2_{Turnover}$ *Stdev*
Finland	199501	201512	213	21928	No	Yes	0.91	7.76	0.17	-0.77	20.13	3.03	21.61	3.59
Poland	199502	201512	750	53589	No	No	0.62	6.23	0.10	-7.64	21.74	8.26	21.90	4.65
Sweden	199501	201512	829	59843	No	No	0.87	7.76	0.25	-0.13	20.06	2.61	21.00	2.76
Spain	199501	201512	291	26764	No	No	0.67	5.77	0.30	-0.12	20.37	6.15	22.04	3.83
Turkey	200502	201512	399	36622	No	No	1.10	6.86	0.37	-0.28	24.12	7.27	20.94	2.57
Italy	199501	201512	514	52057	No	No	0.53	5.60	0.24	-0.55	20.51	3.96	22.05	3.58
Japan	199501	201512	3019	175208	No	No	0.17	5.90	0.22	0.00	22.16	4.20	24.44	4.27
China	199601	201512	1748	137241	No	No	1.12	8.37	0.75	-0.01	39.45	12.30	33.12	9.01
Peru	199511	201512	144	3881	No	No	0.91	5.99	0.02	-3.69	24.09	7.43	26.42	5.52
Argentina	199501	201512	133	8575	Yes	No	0.90	8.93	0.02	-1.51	21.74	4.26	26.16	5.78
USA	199802	201512	2087	89220	No	No	0.59	4.78	0.48	-0.01	20.23	3.95	20.23	2.31
Canada	199802	201512	2536	184662	Yes	No	0.38	4.75	0.18	-0.87	19.86	2.01	21.25	2.81
France	199501	201512	1499	119596	No	No	0.70	5.28	0.20	-1.89	19.10	2.15	21.26	2.67
Germany	199501	201512	977	69248	No	No	0.47	4.12	0.06	-11.82	20.00	2.76	21.19	3.31
Indonesia	199510	201512	606	43987	Yes	No	1.16	7.99	0.12	-0.01	20.30	3.48	24.23	4.79
New Zealand	199501	201512	200	13237	No	No	0.65	3.35	0.10	-1.56	20.37	3.24	22.29	3.06
Austria	199906	201512	145	8984	No	No	0.70	5.02	0.13	-1.24	20.57	3.03	26.71	7.22
Denmark	199501	201512	305	24013	Yes	No	0.78	4.57	0.19	-0.21	20.57	2.90	21.37	3.01
Bangladish	200211	201512	322	16717	No	No	1.65	6.41	0.18	-0.08	27.51	8.20	31.51	6.35
Ireland	199502	201512	109	5113	No	No	0.90	6.64	0.11	-0.68	21.96	4.63	28.02	11.58
Switzerland	199509	201402	273	31505	No	No	0.67	10.42	0.21	-0.17	19.76	2.33	22.21	3.41
Australia	199501	201512	2709	180138	No	No	0.50	3.92	0.17	-1.39	19.81	2.37	20.76	2.36
Brazil	199501	201512	252	16096	No	No	0.76	12.05	0.06	-0.09	21.85	5.74	23.76	4.88
UK	199501	201512	2189	65313	Yes	No	0.48	4.57	0.24	-0.36	19.88	2.98	19.79	1.82
Tawian	199501	201512	1072	45906	No	No	0.08	6.08	0.53	-0.08	22.67	9.76	28.59	5.57
Hong Kong	199501	201512	266	35109	No	No	0.83	6.60	0.14	-0.04	20.46	2.91	25.38	4.99

market return multiplied by the square root of 22 (the number of days in a month). Additionally, Table 1 shows the mean and the standard deviation of the liquidity commonality measure (R^2_{Amihud}) and the commonality in turnover ($R^2_{Turnover}$). The largest number of firms in our sample is from Japan, India and Australia with 3019 firms, 2958 firms and 2709 firms, respectively. On the other hand, the lowest number of firms in our sample is from Qatar, United Arab Emirates and Ireland with 45 firms, 66 firms and 109 firms, respectively. The total number of firms included in our sample is 36,930 firms with a total of more than 2.3 million monthly observations.

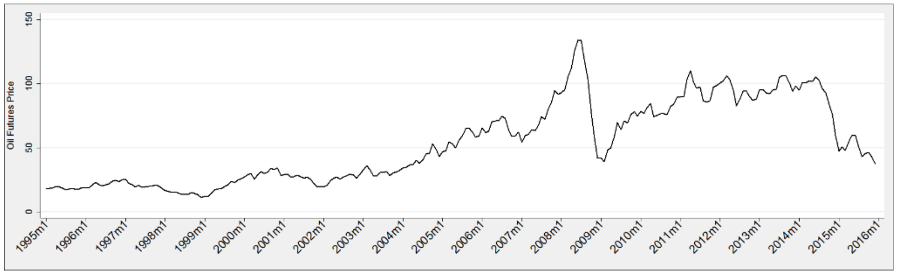
We sort countries by the oil sensitivity ratio. The highest ratio of oil sensitivity is Saudi Arabia's followed by the oil sensitive ratio of 4 OPEC members while the lowest five are Hong Kong's, Taiwan's, United Kingdom's, Brazil's and Australia's, respectively. This outcome is unsurprising since Saudi Arabia is considered the largest exporter of crude oil with an average of 6761.5 Thousands of Barrels Per Day from 1995 to 2012 compared to an average of 413.3 Thousands of Barrels Per Day for the remaining 49 countries from the same period. Furthermore, the oil production of the five OPEC members included in our sample account for more than 24% of global oil production as of 2015. Five of the net exporters in our sample, namely Argentina, Canada, Indonesia, Denmark and United Kingdom, have oil sensitive ratio lower than the median of all countries'. As of the latest data available of 2014 or 2015, the average of the ratio of oil exports as a percentage of merchandise exports in the five OPEC members, included in our sample, is about 79% whereas this ratio is 2.6%, 21.4%, 29.2%, 4.9%, 7.6% in Argentina, Canada, Indonesia, Denmark and United Kingdom, respectively. This clearly distinguishes the two groups of net exporters in terms of how their economies are dependent on oil[5].

The summary statistics of market condition and commonality variables are qualitatively similar to those documented in Karoyli (2012) paper. However, some quantitative differences are expected since we expand the time frame to cover the most recent 6 years and because the source of the financial data we use is different than theirs[6]. Table 1 shows that the monthly market return of all countries is positive except for Greece, which might be influenced by the government debt crisis that has begun in late 2009. Similar to Karolyi et al. (2012), our results document that France, Netherlands and Switzerland have the lowest liquidity commonality ratios while China has the far highest liquidity commonality ratio.

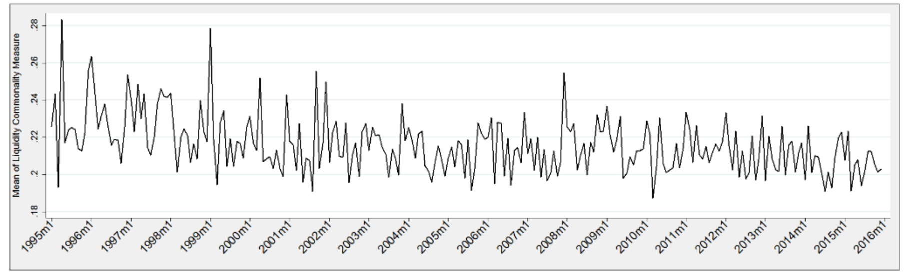
Figure 1 shows the time path of Oil Futures price (Graph A), the average liquidity commonality measure (R^2_{Amihud}) of all countries (Graph B), high oil sensitive countries (Graph C), low oil sensitive countries (Graph D), high oil sensitive and net exporter countries (Graph E), high oil sensitive and net importer countries (Graph F). In Graph A, we can clearly see three different oil shock episodes during our sample period. The first episode appears to be driven by the oil demand shock during the East Asian Financial Crisis in 1997 and 1998, causing the price of oil to reach below $12 a barrel in Dec 1998 from a price of more than $25 a barrel in Jan 1997. Secondly, the oil spike, which was followed by a dramatic oil price drop, seems to be caused by the growing demand and stagnant supply during the global financial crisis, from the

[5] Oil data and oil sensitivity ratios for all countries are reported in Table A2 in Appendix A.
[6] Karoyli (2012) use Datastream while we use Global Compustat.

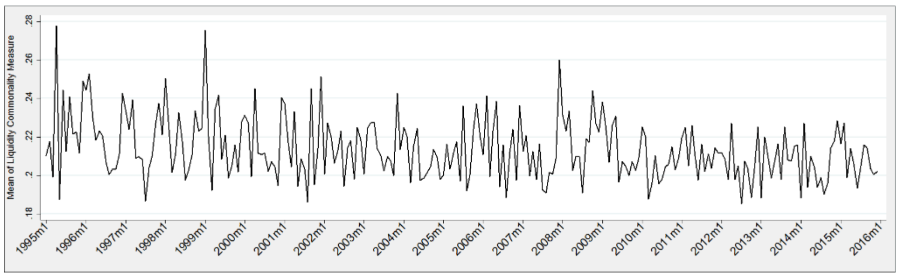
A. Oil Futures Price



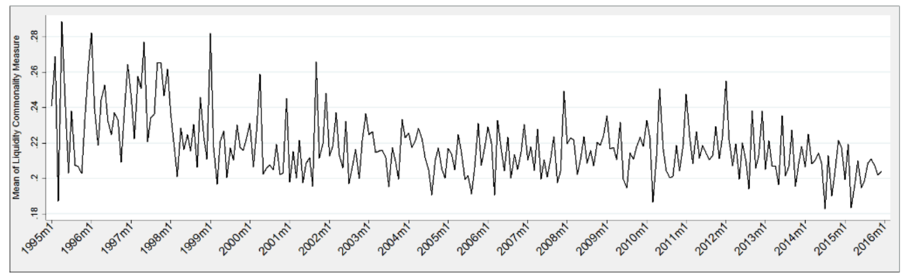
B. All Countries



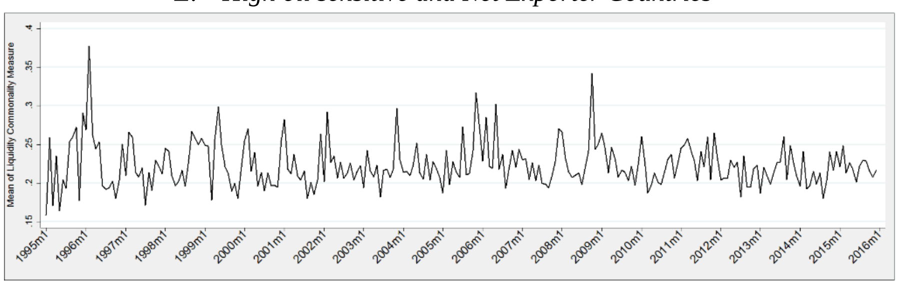
C. High oil sensitive Countries



D. Low oil sensitive Countries



E. High oil sensitive and Net Exporter Countries



F. High oil sensitive and Net Importer Countries

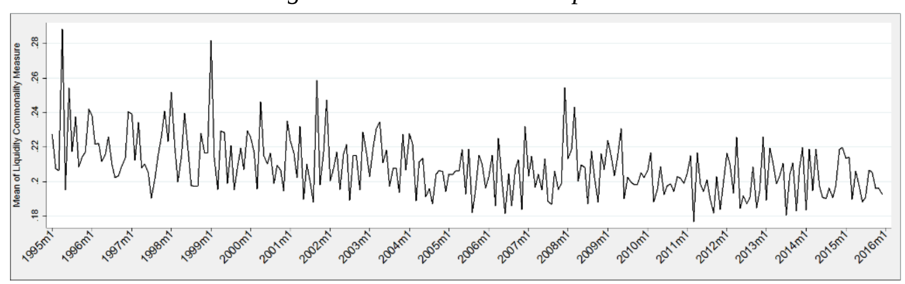


Figure 1. Time Path of Oil Price and Liquidity Commonality

These graphs show the time paths spanning from Jan 1995 to Dec 2015 of Oil Futures Price (A) and the average of Liquidity Commonality Measure (R^2_{Amihud}) of all countries (B), high oil sensitive countries (C), low oil sensitive countries (D), high oil sensitive and net exporter countries (E), high oil sensitive and net importer countries (F). Liquidity Commonality measure is defined in details in section 2.2.

beginning of 2007 to the mid of 2008. The price of oil soars to more than $133 a barrel in June 2008 compared to less than $55 a barrel in Jan 2007 (Hamilton, 2011). Then, the collapse in

demand amid the aftermath of the global financial crisis in 2007-2008 causes the price of oil to reach less than $42 a barrel in Jan 2009 (Rogoff, 2016). More recently, the third oil shock episode relates to the oil price drop that starts in June 2014, driven by a mix of supply and demand factors. The slowing growth in emerging markets, the surprise increase in oil production and OPEC decision to maintain their production level of 30 million barrels a day in spite of a perceived excess supply, caused the oil price to plunge to less than $38 a barrel from its peak of more than $105 a barrel in June 2014 (Arezki and Blanchard, 2015; Kilian, 2015).

In Table 2, we show the pairwise correlations of liquidity commonality measure (R^2_{Amihud}) across countries. In Table 2 Panel A, we show the coefficients of the correlation between the countries in the high oil sensitive group. In Table 2 Panel B, we show the coefficients of the correlation between the countries in the high oil sensitive group with the low oil sensitive group. Unsurprisingly, the result documents some positive and statistically significant correlations between liquidity commonality across countries, which may indicate some common factors that countries around the world share and cause their liquidity commonality levels co-move. Out of the 25 high oil sensitive countries, 18 countries show higher percentage of statistically significant correlations when we compare the correlation coefficients between them and the other countries in their group as opposed to the countries in the low sensitive group. Also, 8 out of 10 high oil sensitive and net exporter countries show improvement in the percentage of significant correlations when we compare their correlations with the high oil sensitive countries as opposed to the low oil sensitive countries. This preliminary result may suggest that the liquidity

Table 2: Correlation Matrix

Panel A: This table reports the pairwise correlation coefficients of liquidity commonality measure (R^2_{Amihud}) between countries in the high oil sensitive group. Bold font refers to a statistical significance at the 1 % level.

	Saudi Arabia	*Nigeria*	*Kuwait*	*UAE*	*Qatar*	*Norway*	*Singapore*	*Russia*	*Thailand*	*S. Korea*	*Philippines*	*India*
Saudi Arabia	1.00											
Nigeria	**0.17**	1.00										
Kuwait	**0.24**	**0.27**	1.00									
UAE	-0.01	0.12	**0.21**	1.00								
Qatar	0.06	0.05	**0.37**	0.16	1.00							
Norway	**-0.17**	**0.23**	0.11	-0.03	-0.10	1.00						
Singapore	-0.01	**0.20**	0.07	**0.33**	-0.17	**0.24**	1.00					
Russia	0.08	0.01	0.08	-0.02	N/A	-0.13	0.04	1.00				
Thailand	0.01	**0.15**	-0.01	-0.03	-0.12	**0.16**	**0.17**	-0.07	1.00			
S. Korea	-0.07	0.13	-0.04	-0.06	0.03	**0.17**	**0.17**	0.06	0.09	1.00		
Philippines	-0.05	**0.16**	0.11	-0.07	0.13	**0.31**	**0.16**	-0.05	0.09	0.06	1.00	
India	0.10	0.10	0.06	0.08	-0.15	**0.13**	0.12	0.14	0.02	-0.02	0.03	1.00
Mexico	-0.07	0.11	0.07	-0.04	0.20	**0.17**	0.10	0.17	0.00	0.09	**0.17**	**0.23**
Netherlands	**0.18**	0.08	0.00	0.01	-0.10	**0.21**	**0.18**	0.00	**0.16**	**0.23**	**0.19**	**0.14**
Greece	-0.01	0.06	0.00	-0.06	-0.16	**0.13**	0.08	-0.09	0.04	0.12	-0.03	0.04
Belgium	-0.03	0.09	0.10	-0.02	0.02	**0.20**	**0.25**	0.08	0.07	**0.14**	0.05	0.10
Sri Lanka	-0.10	0.14	0.04	-0.06	-0.09	**0.28**	**0.17**	-0.06	**0.17**	0.01	0.14	0.04
Israel	0.09	0.14	0.02	0.07	0.04	**0.20**	**0.16**	0.05	0.06	0.08	0.09	0.02
S. Africa	-0.05	**0.15**	0.16	0.03	-0.18	**0.28**	**0.15**	-0.01	**0.21**	**0.23**	0.10	0.02
Chile	-0.10	0.08	0.02	-0.03	-0.02	0.12	**0.14**	0.10	-0.05	**0.18**	0.12	0.06
Malaysia	-0.05	0.13	0.15	**0.20**	0.03	**0.13**	**0.51**	0.25	**0.15**	**0.24**	0.00	0.13
Egypt	-0.07	0.03	0.06	**0.20**	0.19	-0.06	0.07	0.03	-0.09	-0.04	-0.02	-0.03
Portugal	-0.08	0.07	-0.02	0.05	0.08	**0.24**	0.09	-0.14	0.11	0.07	**0.13**	0.04
Pakistan	-0.09	0.12	0.06	0.13	-0.10	0.08	0.06	0.08	0.11	**0.22**	-0.02	0.09
Finland	0.07	0.07	0.16	0.10	-0.05	**0.26**	**0.15**	0.20	**0.26**	**0.18**	**0.28**	0.06
Average	**0.00**	**0.12**	**0.10**	**0.05**	**0.01**	**0.13**	**0.14**	**0.03**	**0.07**	**0.09**	**0.09**	**0.06**
% Sig. Corr.	**17%**	**29%**	**17%**	**17%**	**4%**	**71%**	**58%**	**0%**	**33%**	**38%**	**29%**	**13%**

Table 2 - Continued
Panel A - Continued

	Mexico	*Netherlands*	*Greece*	*Belgium*	*Sri Lanka*	*Israel*	*S. Africa*	*Chile*	*Malaysia*	*Egypt*	*Portugal*	*Pakistan*	*Finland*
Mexico	1.00												
Netherlands	0.08	1.00											
Greece	0.04	**0.13**	1.00										
Belgium	0.04	0.09	0.09	1.00									
Sri Lanka	0.03	**0.21**	**0.30**	0.14	1.00								
Israel	0.03	0.03	0.03	0.07	0.14	1.00							
S. Africa	**0.22**	**0.31**	**0.23**	**0.15**	**0.24**	0.03	1.00						
Chile	0.04	0.01	-0.01	0.09	0.04	0.13	0.05	1.00					
Malaysia	0.11	**0.15**	**0.18**	**0.24**	**0.19**	**0.21**	**0.14**	0.10	1.00				
Egypt	-0.08	-0.02	0.07	-0.03	0.06	-0.02	-0.07	0.04	0.11	1.00			
Portugal	0.01	0.12	0.08	**0.15**	**0.17**	0.13	**0.24**	0.11	**0.22**	0.06	1.00		
Pakistan	**0.29**	-0.12	-0.01	0.13	-0.08	0.05	**0.16**	**0.23**	0.07	-0.02	0.00	1.00	
Finland	0.10	**0.29**	**0.15**	**0.15**	**0.22**	**0.19**	**0.27**	0.11	0.07	-0.08	**0.14**	**0.18**	1.00
Average	**0.00**	**0.12**	**0.10**	**0.05**	**0.01**	**0.13**	**0.14**	**0.03**	**0.07**	**0.09**	**0.09**	**0.06**	**0.09**
% Sig. Corr.	**17%**	**29%**	**17%**	**17%**	**4%**	**71%**	**58%**	**0%**	**33%**	**38%**	**29%**	**13%**	**21%**

Table 2 - Continued

Panel B: This table reports the pairwise correlation coefficients of liquidity commonality measure (R^2_{Amihud}) between countries in the high oil sensitive and low oil sensitive groups. Bold font refers to a statistical significance at the 1 % level.

	Saudi Arabia	*Nigeria*	*Kuwait*	*UAE*	*Qatar*	*Norway*	*Singapore*	*Russia*	*Thailand*	*S. Korea*	*Philippines*	*India*
Poland	-0.11	**0.28**	0.02	0.08	-0.17	0.16	0.09	0.13	0.12	**0.22**	0.10	0.07
Sweden	-0.15	0.09	0.12	0.19	-0.10	**0.33**	0.14	0.09	0.12	0.15	**0.17**	0.16
Spain	-0.08	**0.21**	0.17	0.16	-0.04	0.11	**0.19**	0.20	0.08	**0.17**	0.01	0.11
Turkey	0.19	0.16	**0.29**	0.07	0.13	0.04	0.20	0.32	0.01	0.04	-0.11	-0.05
Italy	-0.02	0.18	0.02	0.12	-0.15	0.13	0.15	-0.11	0.14	**0.21**	0.06	0.04
Japan	0.17	0.06	-0.04	-0.03	-0.08	0.04	0.05	0.12	0.09	0.08	0.00	0.12
China	-0.14	0.00	0.19	0.10	0.05	0.12	0.14	0.00	0.06	**0.20**	0.04	**0.18**
Peru	-0.03	-0.08	0.01	-0.03	0.00	-0.08	0.02	0.04	0.02	0.07	0.06	-0.09
Argentina	0.00	0.05	0.04	0.04	-0.02	0.15	0.02	0.20	0.12	**0.18**	0.05	0.07
USA	-0.07	-0.09	0.15	0.02	-0.01	0.02	0.04	0.18	-0.03	-0.03	-0.02	0.14
Canada	-0.11	0.07	0.20	0.23	0.18	0.15	0.06	0.15	0.02	0.17	0.03	-0.05
France	0.11	0.10	0.08	-0.04	-0.27	**0.32**	**0.27**	0.12	0.10	**0.25**	0.10	0.08
Germany	0.12	0.15	0.11	0.09	-0.14	**0.25**	**0.17**	0.01	**0.22**	**0.20**	0.09	0.07
Indonesia	0.06	0.18	0.20	0.21	0.14	0.10	0.16	0.00	0.11	0.04	0.05	**0.19**
New Zealand	**-0.22**	0.04	-0.01	-0.07	-0.15	**0.29**	**0.22**	0.23	0.03	0.14	0.15	0.15
Austria	-0.12	0.17	-0.04	-0.14	-0.05	**0.20**	0.00	-0.11	**0.31**	0.12	**0.20**	0.16
Denmark	-0.04	0.11	0.02	0.03	-0.28	**0.34**	0.15	-0.11	**0.21**	0.08	**0.29**	0.06
Bangladesh	-0.07	0.01	0.00	0.05	0.10	0.02	0.11	0.10	-0.22	-0.01	-0.10	0.00
Ireland	0.01	0.01	0.08	-0.24	0.04	0.05	0.07	**0.42**	0.10	0.14	0.04	0.03
Switzerland	-0.08	0.10	0.16	0.12	-0.07	**0.29**	0.09	-0.11	**0.21**	**0.21**	0.14	0.05
Australia	-0.09	0.07	-0.01	-0.02	-0.13	**0.22**	0.14	0.26	**0.21**	0.15	**0.20**	0.01
Brazil	-0.06	0.06	0.16	-0.03	0.29	0.12	**0.22**	-0.07	0.11	**0.28**	0.08	**0.21**
UK	-0.02	0.10	0.16	0.05	0.09	**0.27**	0.07	0.21	**0.20**	0.15	0.16	0.14
Taiwan	-0.07	-0.04	-0.02	0.01	-0.21	0.05	**0.23**	-0.06	0.11	0.16	-0.10	0.10
Hong Kong	-0.13	0.16	-0.07	0.06	-0.24	**0.19**	**0.41**	0.03	**0.19**	**0.17**	0.15	0.06
Average	**-0.04**	**0.09**	**0.08**	**0.04**	**-0.04**	**0.15**	**0.14**	**0.09**	**0.11**	**0.14**	**0.07**	**0.08**
% Sig. Corr.	**4%**	**8%**	**4%**	**0%**	**0%**	**40%**	**28%**	**4%**	**28%**	**40%**	**16%**	**12%**

Table 2 - Continued
Panel B - Continued

	Mexico	*Netherlands*	*Greece*	*Belgium*	*Sri Lanka*	*Israel*	*S. Africa*	*Chile*	*Malaysia*	*Egypt*	*Portugal*	*Pakistan*	*Finland*
Poland	0.03	0.15	0.05	**0.23**	**0.25**	0.13	0.10	0.09	0.15	0.11	0.15	0.16	**0.30**
Sweden	**0.19**	**0.28**	0.15	**0.22**	0.20	0.16	**0.34**	0.15	**0.17**	-0.07	**0.17**	0.15	**0.30**
Spain	-0.01	0.08	-0.02	**0.66**	**0.29**	0.11	**0.18**	0.05	0.14	0.03	0.14	0.12	0.08
Turkey	-0.01	0.18	-0.16	0.01	-0.04	0.22	-0.01	-0.04	0.18	0.01	-0.07	0.03	0.05
Italy	0.10	**0.17**	**0.26**	0.17	-0.02	0.07	**0.37**	0.13	0.14	0.14	**0.33**	0.11	**0.17**
Japan	0.13	0.07	0.00	0.17	-0.10	-0.05	0.13	-0.02	0.13	-0.03	0.06	0.11	0.11
China	0.05	0.10	0.07	0.07	0.14	0.04	0.13	0.04	0.15	-0.06	0.07	0.11	0.13
Peru	0.06	0.01	0.15	0.10	-0.10	0.05	0.05	-0.02	0.16	0.11	0.03	0.04	-0.12
Argentina	0.04	0.15	0.09	0.09	0.12	0.01	0.10	0.05	0.12	-0.03	0.05	0.00	0.10
USA	**0.18**	0.08	-0.12	0.04	0.16	-0.09	-0.08	-0.09	0.01	0.11	-0.06	0.07	-0.04
Canada	**0.29**	0.12	0.08	0.09	0.08	0.08	**0.20**	**0.21**	0.15	0.10	0.12	**0.25**	**0.31**
France	0.09	**0.23**	**0.21**	**0.42**	0.19	0.12	**0.32**	**0.21**	0.14	0.00	**0.23**	**0.21**	**0.28**
Germany	**0.19**	**0.22**	0.13	**0.31**	**0.26**	0.20	**0.36**	0.08	**0.26**	-0.07	**0.17**	**0.24**	**0.23**
Indonesia	**0.20**	0.12	0.16	**0.44**	0.09	0.06	0.15	0.14	**0.22**	0.08	**0.18**	**0.27**	**0.18**
New Zealand	**0.24**	0.14	0.16	0.16	0.06	0.02	**0.22**	0.15	**0.22**	0.10	**0.23**	0.13	0.09
Austria	0.07	**0.30**	**0.19**	**0.20**	0.08	-0.07	**0.26**	0.09	0.05	0.17	0.18	0.13	0.18
Denmark	0.11	**0.27**	0.15	0.08	0.21	**0.23**	**0.27**	0.03	0.04	-0.12	**0.21**	0.11	**0.48**
Bangladesh	0.08	-0.01	-0.06	0.06	0.11	0.10	0.04	0.12	0.13	**0.27**	0.08	-0.07	-0.16
Ireland	0.15	0.06	**0.18**	0.17	-0.01	0.12	0.08	0.06	**0.18**	-0.05	0.02	0.11	0.13
Switzerland	**0.26**	**0.20**	**0.20**	**0.20**	0.22	0.04	**0.32**	0.16	0.16	0.03	**0.24**	**0.28**	**0.24**
Australia	**0.18**	0.13	**0.19**	0.15	0.17	0.05	**0.18**	0.06	0.10	0.00	**0.20**	**0.17**	**0.35**
Brazil	0.03	0.11	**0.19**	0.12	0.11	**0.22**	0.08	0.15	**0.25**	0.03	**0.18**	0.12	0.11
UK	0.17	**0.32**	**0.23**	0.12	0.15	0.08	**0.40**	0.05	0.05	-0.06	0.12	**0.21**	**0.27**
Taiwan	-0.10	0.09	**0.23**	-0.01	-0.04	-0.01	0.09	0.11	**0.26**	0.01	-0.02	0.05	0.04
Hong Kong	**0.18**	**0.25**	0.04	0.00	0.16	0.13	**0.25**	0.08	**0.21**	-0.04	**0.21**	0.11	**0.20**
Average	**0.12**	**0.15**	**0.11**	**0.17**	**0.11**	**0.08**	**0.18**	**0.08**	**0.15**	**0.03**	**0.13**	**0.13**	**0.16**
% Sig. Corr.	**36%**	**36%**	**36%**	**32%**	**12%**	**8%**	**52%**	**8%**	**32%**	**4%**	**44%**	**28%**	**48%**

commonality in the high oil sensitive countries share common factors (other than those commonly affect all countries) that make them co-move. These results are merely initial and we do not attempt to draw any conclusions out of them. Instead, we utilize a model specification that controls for other common factors, other than oil factors, that may explain variations in liquidity commonality across countries. Controlling relative explanatory variables of liquidity commonality is essential to investigate a robust effect of oil factors and crucial to avoid omitted variable biases. In the next section, we illustrate the estimation methodology and we outline the results.

3. Regressions Analysis

In this section, we introduce our model specification to investigate the over time effect of oil factors in explaining liquidity commonality across countries and show the results. In 3.1, we lay out the model and the estimation methodology. In 3.2, we present the results and discuss the findings.

3.1. Estimation Methodology

In light of the results from the correlation coefficients, presented in Table 2, and following Karolyi et al. (2012), we utilize the seemingly unrelated regressions (SUR) to estimate the effect of oil factors on liquidity commonality. This approach is advantageous as it accounts for the potential correlations in residuals of liquidity commonality across countries as opposed to estimating the effect from OLS regressions, where we would assume the correlations between the residuals to be zero. The estimated structural equation model is as follows:

$$R^2_{Amihud_{ct}} = \alpha_g + \beta_g \; Oil\ Return_{ct} \; + \; \gamma_g \; Oil\ Volatility_{ct} + \; \delta_g' Controls_{ct} + \varepsilon_{ct}$$

$$where:\ E[\varepsilon_{ct}] = 0;\ E\left[\varepsilon_{ii}'\varepsilon_{ij}\right] = 0;\ \ E[\varepsilon_{ii}'\varepsilon_{ii}] = \sigma_i^2;\ \ E\left[\varepsilon_{ii}'\varepsilon_{ji}\right] = \sigma_{ij}^2$$

And, the subscript *c* represents the 50 country equations, *t* represents the month; the dependent variable R^2_{Amihud} is transformed in the form: $ln[\frac{R^2_{Amihud}}{1-R^2_{Amihud}}]$. The coefficients α_g, β_g, γ_g, δ_g are restricted to be equal in all equations in the group g.

First, we estimate the model and restrict all coefficients to be the same in all countries in our sample. Since oil effect is hypothesized to play a more significant role in countries that are relatively more sensitive to the oil market, we allow the coefficients to change across two groups, high oil sensitive and low oil sensitive countries. In order to assure that the differences between the high and low oil sensitive countries are not driven by the inclusion of many major net exporters in the high oil sensitive group, we further relax the coefficients restrictions between net exporters and net importers and allow them to differ. In addition, this also would allow us to investigate whether the oil effect on liquidity commonality is asymmetric across net oil exporters and net oil importers, after controlling for oil sensitivity. To do so, we define three groups, namely low oil sensitive countries, high oil sensitive and net exporter countries, high oil sensitive and net importer countries, and allow the coefficients to be difference for each group.

The latter test, however, may suffer from an endogenity problem. Even though we control for oil sensitivity by restricting the countries of net exporters and net importers to be in withdrawn from the high oil sensitive classification, any asymmetric effect of oil factors on liquidity commonality can be attributed to the fact that net exporters are, on average, ranked more highly oil sensitive relative to net importers. In fact, the highest five oil sensitive countries in our sample are the net exporter members of OPEC. To address this issue and re-examine the asymmetric effect of oil factors on liquidity commonality in net exporters versus net importers, we further split the countries into 4 groups, namely low oil sensitive countries, high oil sensitive OPEC net exporter countries, high oil sensitive non-OPEC net exporter and high oil sensitive net importer.

3.2. Results

In Table 3, we show the results from the seemingly unrelated regressions where we restrict the coefficients to be equal across all countries. In Model 1, 3, 5 and 7, we show the results from the inclusions of different sets of control variables but the oil factors. Particularly, in Model 1, 3 and 5, respectively, we only include market condition variables, we include market condition and supply factors, we include market condition and demand factors and we include market condition variables, supply factors and demand factors. Conversely, in Model 2, 4, 6 and 8, we include oil factors in the equations. Consistent with Karolyi et al. (2012), we find that liquidity commonality decreases in market returns, time, capital market openness-proxied by the gross capital flow scaled GDP-and U.S. sentiment while increases in market volatility, market turnover, credit constaints-proxies by local short term interest rate-and turnover commonality ($R^2_{turnover}$). All these effects are statistically significant and have the expected signs.

More importantly, the coefficients of oil factors, namely Oil Return and Oil Volatility have the expected signs but are statistically insignificant. Intuitively, the results from Table 3 indicate that a zero effect of oil factors in explaining liquidity commonality across countries cannot be rejected. To test the explaining power of oil factors and whether it captures the variations in liquidity commonality that are not captured by the control variables, we report the adjusted R^2 from separate OLS regression for each country and compare the means and medians of the model that does not include oil factors with the one that include them. The adjusted R^2 without

Table 3: SUR regressions of liquidity commonality on commonality sources

This table reports the results from seemingly unrelated regression (SUR) of 50 equations, representing the number of countries in our sample. All equations are jointly estimated for the period Jan 1995 to Dec 2015. In each model, we restrict the coefficients to be equal across all equations. The dependent variable is a log transformed form of the liquidity commonality measure, R^2_{Amihud}. Full definitions of all variables are presented in Table A1 in Appendix A. Mean and Medians of Adjusted R^2 reported in the last two rows are taken from separate OLS regressions of all countries. ***, **, * and ˆ refer to 1%, 5%, 10%, and one-sided statistical levels, respectively.

Model	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
Market Conditions								
Market Return	-0.0291	-0.0273	-0.0644ˆ	-0.0627ˆ	-0.0871**	-0.0850**	-0.0793*	-0.0780*
	(0.5000)	(0.5282)	(0.1309)	(0.1431)	(0.0411)	(0.0474)	(0.0618)	(0.0672)
Market Volatility	0.4773***	0.4705***	0.3940***	0.3834***	0.3703***	0.3658***	0.3275***	0.3223***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Market Liquidity	-0.0003ˆ	-0.0003ˆ	-0.0002	-0.0002	-0.0004**	-0.0004**	-0.0002	-0.0002
	(0.1019)	(0.1098)	(0.2413)	(0.2686)	(0.0329)	(0.0362)	(0.2234)	(0.2416)
Market Turnover	12.8891***	12.8923***	13.8914***	13.8675***	12.8632***	12.8721***	13.5198***	13.5136***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Time Trend	-0.0004***	-0.0004***	-0.0003***	-0.0003***	-0.0004***	-0.0004***	-0.0003***	-0.0003***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Supply Factors								
Short-term Interest Rate			0.0045***	0.0044***			0.0043***	0.0042***
			(0.0000)	(0.0000)			(0.0000)	(0.0000)
U.S. Commercial Paper			-0.0095ˆ	-0.0109*			-0.0055	-0.0067
			(0.1335)	(0.0874)			(0.3217)	(0.2365)

Table 3 - Continued

Demand Factors									
$R^2_{Turnover}$						0.1376***	0.1367***	0.1383***	0.1373***
						(0.0000)	(0.0000)	(0.0000)	(0.0000)
Net % Equity Flow						0.0156ˆ	0.0155ˆ	0.0102	0.0103
						(0.1544)	(0.1560)	(0.3497)	(0.3434)
Gross Capital Flow/GDP						-0.3618***	-0.3608***	-0.2915***	-0.2906***
						(0.0000)	(0.0000)	(0.0000)	(0.0000)
Exchange rate						-0.0006	-0.0006	-0.0008	-0.0008
						(0.3697)	(0.3529)	(0.2029)	(0.1938)
U.S. sentiment index						-0.0117**	-0.0112*	-0.0135**	-0.0128**
						(0.0396)	(0.0533)	(0.0175)	(0.0270)
Oil Factors									
Oil Return			-0.0432		-0.0576ˆ		-0.0396		-0.0403
			(0.3390)		(0.1988)		(0.3285)		(0.3250)
Oil Volatility			1.1152		1.7765ˆ		0.8720		1.1969
			(0.3379)		(0.1183)		(0.4008)		(0.2501)
Intercept		-1.3153***	-1.3206***	-1.3533***	-1.3626***	-1.2995***	-1.3045***	-1.3354***	-1.3422***
		(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
# Obs.		**10681**	**10681**	**10050**	**10050**	**10000**	**10000**	**9902**	**9902**
Adjusted R^2	***Mean***	**10.98%**	**11.34%**	**11.23%**	**11.84%**	**15.32%**	**15.51%**	**16.31%**	**16.63%**
	Median	**5.86%**	**6.53%**	**5.36%**	**6.86%**	**12.98%**	**13.28%**	**13.83%**	**14.15%**

oil factors is 16.31% and it increases to 16.63% when we include oil factors, indicating less than 2% increase.

Essentially, we expect the oil factors to explain commonality in liquidity in countries that are somehow more integrated to the oil market. Therefore, we allow the coefficients to vary across two groups, namely high oil sensitive and low oil sensitive groups. Table 4 reports the results from seemingly unrelated regressions where we restrict the coefficients to be equal within each group and vary across groups. Model 1A and 1B include all control variables but oil factors whereas Model 2A and 2B include oil factors as well. Similarly, we report the mean and median of R^2 of separate regressions for each country. In addition, we report the Wald test for the difference between the coefficients in the two groups. Interestingly, the coefficient of oil volatility is positive and statistically significant at the 1% statistical level for high oil sensitive group. On the other hand, the coefficient of oil volatility is negative and highly statistically insignificant for the low oil sensitive group. This difference in the effect of oil volatility in the two groups is highly statistically significant. For oil return, the coefficient is negative and only statistically significant for the high oil sensitive group in the one-sided test. However, the difference of oil return effect on high oil sensitive group versus low oil sensitive group is statistically insignificant.

Clearly, oil factors, and in particular oil volatility, contributes to explain liquidity commonality only in countries that are more highly oil sensitive. This evidence is supported by two other aspects. First, we see that, for high oil sensitive countries, when we include oil factors in the separate OLS regressions, the means and medians of adjusted R^2 increases 4.2% and 4.6%, respectively. On the other hand, for low oil sensitive countries, the improvement in adjusted R^2 is close to zero to less than 1%. Second, we compare the intercept of the models, for

Table 4: SUR regressions of liquidity commonality on commonality sources-high and low oil sensitive groups

This table reports the results from seemingly unrelated regression (SUR) of 50 equations, representing the number of countries in our sample. All equations are jointly estimated for the period Jan 1995 to Dec 2015. In each model, we restrict the coefficients to be equal within each group but vary across two groups. The first group includes high oil sensitive countries (countries whose oil sensitivity ratio is above the median of all countries) and the second includes low oil sensitive countries (countries whose oil sensitivity ratio is below the median of all countries). The dependent variable is a log transformed form of the liquidity commonality measure, R^2_{Amihud}. Full definitions of all variables are presented in Table A1 in Appendix A. Mean and Medians of Adjusted R^2 reported in the last two rows are taken from separate OLS regressions of all countries. In the last two columns, Wald test is reported for the difference in the coefficients between groups. ***, **, * and ˆ refer to 1%, 5%, 10%, and one-sided statistical levels, respectively.

Group	*High Oil Sensitive*		*Low Oil Sensitives*		*Wald Test*	
Model	*(1A)*	*(2A)*	*(1B)*	*(2B)*	*(1A) - (1B)*	*(2A) - (2B)*
Market Conditions						
Market Return	0.0907*	0.0892*	-0.2900***	-0.2787***	0.3807***	0.3679***
	(0.0713)	(0.0767)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Market Volatility	0.5977***	0.5496***	0.2242***	0.2340***	0.3736***	0.3155***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0002)
Market Liquidity	0.0002	0.0002	-0.0016***	-0.0018***	0.0018***	0.0020***
	(0.4628)	(0.4532)	(0.0001)	(0.0000)	(0.0002)	(0.0001)
Market Turnover	-4.9297***	-4.9242***	28.0313***	28.2520***	-32.96***	-33.18***
	(0.0014)	(0.0015)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Time Trend	-0.0004***	-0.0004***	-0.0004***	-0.0004***	0.0001	0.0001
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.3708)	(0.3470)
Supply Factors						
Short-term Interest Rate	0.0007	0.0007	0.0057***	0.0057***	-0.0050***	-0.0050***
	(0.3813)	(0.3833)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
U.S. Commercial Paper	0.0014	-0.0002	-0.0135**	-0.0140**	0.0149***	0.0138**
	(0.8208)	(0.9760)	(0.0328)	(0.0290)	(0.0077)	(0.0120)
Demand Factors						
$R^2_{Turnover}$	0.1493***	0.1460***	0.1204***	0.1215***	0.0289*	0.0244ˆ
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0945)	(0.1597)
Net % Equity Flow	0.0017	0.0041	0.0288ˆ	0.0271ˆ	-0.0271	-0.0230
	(0.8961)	(0.7600)	(0.1148)	(0.1394)	(0.2270)	(0.3055)
Gross Capital Flow/GDP	-0.4573***	-0.4594***	-0.2393***	-0.2402***	-0.2180**	-0.2192**
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0123)	(0.0117)

Table 4 - Continued

Exchange rate		-0.0004	-0.0004	-0.0008	-0.0008	0.0005	0.0005
		(0.7303)	(0.7216)	(0.2776)	(0.2751)	(0.7227)	(0.7249)
U.S. sentiment index		-0.0094ˆ	-0.0078	-0.0130**	-0.0131**	0.0036	0.0052
		(0.1416)	(0.2264)	(0.0405)	(0.0439)	(0.5214)	(0.3466)
Oil Factors							
Oil Return			-0.0661ˆ		-0.0162		-0.0499
			(0.1463)		(0.7257)		(0.2193)
Oil Volatility			3.3070***		-0.9784		4.2854***
			(0.0039)		(0.4085)		(0.0000)
Intercept		-1.3016***	-1.3201***	-1.3497***	-1.3426***	0.0480***	0.0225ˆ
		(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0008)	(0.1488)
Total System Obs.		**9902**	**9902**	**9902**	**9902**		
# Countries		**25**	**25**	**25**	**25**		
Adjusted R^2	***Mean***	**15.27%**	**15.91%**	**17.35%**	**17.36%**		
	Median	**12.04%**	**12.59%**	**14.29%**	**14.40%**		

each group, that does not include oil factors with the one that does. Before controlling for oil factors, the intercepts of high and low oil sensitive groups are economically and statistically different from each other at the 1% statistical level. However, when we control for oil factors, this difference shrinks to half and now it is statistically insignificant. This indicates that oil factors capture the variations between the average liquidity commonality across the two groups, which in turn emphasizes the importance of oil factors in explaining liquidity commonality variations in the high oil sensitive group.

Table 5 shows the results from the test of an asymmetric effect of oil factors on net oil exporters versus net oil importers. In Model 1A and 2A, we report the coefficients of the regressions that are restricted to be equal within the high oil sensitive and net exporter countries,

Table 5: SUR regressions of liquidity commonality on commonality sources-net exporters and net importers

This table reports the results from seemingly unrelated regression (SUR) of 50 equations, representing the number of countries in our sample. All equations are jointly estimated for the period Jan 1995 to Dec 2015. In each model, we restrict the coefficients to be equal within each group but vary across three groups. The first group includes high oil sensitive and net exporter countries (countries whose oil sensitivity ratio is above the median of all countries and that are net exporters), the second includes high oil sensitive and net importer countries (countries whose oil sensitivity ratio is above the median of all countries and that are net importers) and the third includes low oil sensitive countries (countries whose oil sensitivity ratio is below the median of all countries). The third group results are suppressed since they are presented in Table 4. The dependent variable is a log transformed form of the liquidity commonality measure, R^2_{Amihud}. Full definitions of all variables are presented in Table A1 in Appendix A. In the last two columns, Wald test is reported for the difference in the coefficients between groups. ***, **, * and ˆ refer to 1%, 5%, 10%, and one-sided statistical levels, respectively.

Group	*High Oil Sens./Net Exporter*	*High Oil Sens./Net Importer*	*Wald Test*
	(A)	*(B)*	*(A) - (B)*
Market Conditions			
Market Return	-0.1503ˆ	0.1468***	-0.2971***
	(0.1535)	(0.0076)	(0.0100)
Market Volatility	0.4248***	0.4549***	-0.0300
	(0.0022)	(0.0000)	(0.8506)
Market Liquidity	0.0003	-0.0002	0.0005
	(0.2696)	(0.5990)	(0.2863)
Market Turnover	42.2573***	-7.5691***	49.8263***
	(0.0000)	(0.0000)	(0.0000)
Time Trend	-0.0002*	-0.0004***	0.0002ˆ
	(0.0545)	(0.0000)	(0.1099)
Supply Factors			
Short-term Interest Rate	-0.0007	0.0026***	-0.0033**
	(0.6087)	(0.0026)	(0.0335)
U.S. Commercial Paper	-0.0183*	0.0010	-0.0193*
	(0.0799)	(0.8729)	(0.0576)
Demand Factors			
$R^2_{Turnover}$	0.2070***	0.1383***	0.0687**
	(0.0000)	(0.0000)	(0.0399)
Net % Equity Flow	0.0472	0.0017	0.0455
	(0.2178)	(0.9068)	(0.2653)
Gross Capital Flow/GDP	-6.6289***	0.0609	-6.6898***
	(0.0000)	(0.4960)	(0.0000)
Exchange rate	-0.0038ˆ	0.0004	-0.0041ˆ
	(0.1233)	(0.7547)	(0.1217)
U.S. sentiment index	0.0007	-0.0114*	0.0121
	(0.9504)	(0.0830)	(0.2748)

Table 5 - Continued

Oil Factors			
Oil Return	-0.1452*	-0.0560	-0.0892
	(0.0632)	(0.2294)	(0.2429)
Oil Volatility	6.7453***	2.8678**	3.8776**
	(0.0004)	(0.0154)	(0.0409)
Intercept	-1.3128***	-1.3336***	0.0208
	(0.0000)	(0.0000)	(0.5059)
Total System Obs.	**9902**	**9902**	
# Countries	**10**	**15**	

which includes 10 countries. In Model 1B and 2B, we report the coefficients of the regressions that are restricted to be equal within the high oil sensitive and net importer countries, which includes 15 countries. As anticipated, the effect of oil return is economically and statistically stronger in the high oil sensitive and net exporter countries. The coefficient of oil return is -0.145, statistically significant at 10% level, in the high oil sensitive and net exporter group while it is -0.056, statistically insignificant, in the low oil sensitive and net importer group. However, based on Wald test, this difference is statistically insignificant. On the other hand, the coefficient of oil volatility in the high oil sensitive and net exporter group (6.75) is more than double the coefficient in the low oil sensitive and net importer group (2.87). This difference is statistically significant at the 5% statistical level. Overall, the results suggest that the liquidity commonality in net exporters are more influenced by oil factors than net importers, after controlling for oil sensitivity.

Nevertheless, as we point out in the previous section, the latter test may suffer from an endogenity problem. This endogenity rises from the fact that we consider a country to be high oil sensitive if only its oil sensitivity ratio is higher than the median and we ignore the fact that countries in the high sensitivity group are not equally sensitive to the oil market. Arguably, the results from Table 4 could be influenced by the possibility that net exporters are more highly oil sensitive than net importers. In fact, as pointed out, the highest five oil sensitive countries in our sample are the net exporter members of OPEC. To address this issue, we further split the countries into 4 groups, low oil sensitive, high oil sensitive and OPEC members, high oil sensitive non-OPEC net exporters and high oil sensitive and net importers groups. Table 6 reports the results from the seemingly unrelated regressions where we restrict the coefficients to be the same within each group and vary across the 4 groups. Interestingly, the effect of oil return is much more economically and statistically significant for the high oil sensitive and OPEC members, with a coefficient of -0.3517, compared to the other groups, where this effect shows no statistical significance. The difference of this effect is statistically significant when compared with non-OPEC net exporters or net importers. This suggests that the liquidity commonality in OPEC members, as major oil exporters, is not only affected by oil volatility but also is highly influenced by oil price expected movements. For oil volatility, both net exporters groups show higher impact on liquidity commonality compared to net importers. The coefficient of oil volatility in non-OPEC net exporters is 7.33 compared to 2.76 in net importers, which are both statistically significant. This difference is statistically significant based on Wald test. These results confirm our initial findings of the asymmetric effect of oil factors on commonality liquidity in oil net exporters and oil net importers and verify that our findings are not influenced by the inclusion of OPEC members in the oil net exporter group.

Table 6: SUR regressions of liquidity commonality on commonality sources-OPEC, non-OPEC net exporters and net importers

This table reports the results from seemingly unrelated regression (SUR) of 50 equations, representing the number of countries in our sample. All equations are jointly estimated for the period Jan 1995 to Dec 2015. In each model, we restrict the coefficients to be equal within each group but vary across four groups. The first group includes high oil sensitive and OPEC net exporter countries (countries whose oil sensitivity ratio is above the median of all countries and that are OPEC net exporters), The first group includes high oil sensitive and OPEC net exporter countries (countries whose oil sensitivity ratio is above the median of all countries and that are OPEC net exporters), The second group includes high oil sensitive and non-OPEC net exporter countries (countries whose oil sensitivity ratio is above the median of all countries and that are non-OPEC net exporters), the third group includes high oil sensitive and net importer countries (countries whose oil sensitivity ratio is above the median of all countries and that are net importers) and the fourth group includes low oil sensitive countries (countries whose oil sensitivity ratio is below the median of all countries). The fourth group results are suppressed since they are presented in Table 4. The dependent variable is a log transformed form of the liquidity commonality measure, R^2_{Amihud}. Full definitions of all variables are presented in Table A1 in Appendix A. Wald test is reported for the difference in the coefficients between groups. ***, **, * and ˆ refer to 1%, 5%, 10%, and one-sided statistical levels, respectively.

Group	*High Oil Sens./ OPEC*	*High Oil Sens./ Net Exp.(non-OPEC)*	*High Oil Sens./ Net Importer*	*Wald Tests*		
Model	*(1)*	*(2)*	*(3)*	*(1) - (2)*	*(1) - (3)*	*(2) – (3)*
Market Conditions						
Market Return	-0.6325***	0.3400**	0.1535***	-0.9724***	-0.7859***	0.1865
	(0.0001)	(0.0166)	(0.0053)	(0.0000)	(0.0000)	(0.2054)
Market Volatility	-0.0001	0.7636***	0.4588***	-0.7638***	-0.4590*	0.3048ˆ
	(0.9995)	(0.0000)	(0.0000)	(0.0068)	(0.0525)	(0.1089)
Market Liquidity	0.0001	-0.0058	-0.0002	0.0059ˆ	0.0003	-0.0056
	(0.6785)	(0.2075)	(0.5961)	(0.1991)	(0.5047)	(0.2254)
Market Turnover	73.8709***	7.0972	-7.7031***	66.7737***	81.5740***	14.8003*
	(0.0000)	(0.4151)	(0.0000)	(0.0000)	(0.0000)	(0.0980)
Time Trend	-0.0004ˆ	-0.0004**	-0.0005***	0.0000	0.0000	0.0001
	(0.1734)	(0.0220)	(0.0000)	(0.8886)	(0.8831)	(0.5495)
Supply Factors						
Short-term Interest Rate	0.0036ˆ	-0.0013	0.0025***	0.0049ˆ	0.0011	-0.0038*
	(0.1524)	(0.4820)	(0.0037)	(0.1192)	(0.6864)	(0.0513)
U.S. Commercial Paper	-0.0169	-0.0182ˆ	0.0010	0.0013	-0.0180	-0.0193*
	(0.3295)	(0.1477)	(0.8743)	(0.9500)	(0.3196)	(0.0956)

Table 6 - Continued

Demand Factors						
$R^2_{Turnover}$	0.3335***	0.1099***	0.1388***	0.2235***	0.1946***	-0.0289
	(0.0000)	(0.0047)	(0.0000)	(0.0002)	(0.0001)	(0.4801)
Net % Equity Flow		0.0444	0.0010			0.0434
		(0.2369)	(0.9452)			(0.2791)
Gross Capital Flow/GDP		-3.1078***	0.0448			-3.1526***
		(0.0032)	(0.6179)			(0.0029)
Exchange rate	-0.0118**	0.0010	0.0003	-0.0128**	-0.0121**	0.0007
	(0.0454)	(0.7044)	(0.7854)	(0.0472)	(0.0433)	(0.8082)
U.S. sentiment index	-0.0335^	0.0077	-0.0102^	-0.0412*	-0.0233	0.0179^
	(0.1251)	(0.5607)	(0.1208)	(0.0917)	(0.2973)	(0.1376)
Oil Factors						
Oil Return	-0.3517***	0.0041	-0.0450	-0.3558**	-0.3067**	0.0491
	(0.0090)	(0.9652)	(0.3393)	(0.0247)	(0.0276)	(0.5691)
Oil Volatility	5.4398*	7.3277***	2.7569**	-1.8879	2.6829	4.5708**
	(0.0929)	(0.0021)	(0.0214)	(0.6294)	(0.4261)	(0.0391)
Intercept	-1.2780***	-1.3338***	-1.3320***	0.0558	0.0541	-0.0017
	(0.0000)	(0.0000)	(0.0000)	(0.4834)	(0.4650)	(0.9607)
Total System Obs.	**9902**	**9902**	**9902**			
# Countries	**5**	**5**	**15**			

3.3. Robustness Check

Because of the lack of the theoretical basis for the link between oil factors and stock liquidity, one may argue that the empirical findings in this paper might possibly be driven by the potential high correlations between oil factors and market factors. It has been evident by many recent studies, discussed here and including this study, that market factors play a statistically and economically significant role in liquidity commonality in equity markets. Therefore, one may suspect that the conclusions driven about the role of oil factors on liquidity commonality are merely a result of a multicollinearity issue. To address this issue, we simply use oil factors that are orthogonal to market factors in the regressions. Specifically, oil factors are orthogonalized by taking the residuals from the regressions of oil factors on market factors.

Table 7: Orthogonality Test

This table reports the results from the inclusion of orthogonal oil factors in the seemingly unrelated regressions (SUR). Oil factors are orthogonalized by taking the residuals from the regressions of oil factors on market factors. Panel A validates the results presented in Table 3. Panel B validates the results presented in Table 4. Panel C validates the results presented in Table 5. Panel D validates the results presented in Table 6. ***, **, * and ˆ refer to 1%, 5%, 10%, one-sided statistical levels, respectively.

Panel A				
Group	*All Countries*	*All Countries*	*All Countries*	*All Countries*
Model	*(1)*	*(2)*	*(3)*	*(4)*
Oil Return	$-0.0623^{\wedge}$	-0.0770^{*}	$-0.0559^{\wedge}$	$-0.0566^{\wedge}$
	(0.1645)	(0.0831)	(0.1656)	(0.1639)
Oil Volatility	-0.6209	0.3918	-0.1385	0.2148
	(0.5843)	(0.7222)	(0.8920)	(0.8327)
Market Conditions	Yes	Yes	Yes	Yes
Supply Factors	NO	Yes	No	Yes
Demand Factors	NO	No	Yes	Yes

Table 7 - Continued

Panel B			
Group	*High Oil Sensitive*	*Low Oil Sensitive*	*Wald Test*
Model	*(1)*	*(2)*	*(1)-(2)*
Oil Return	-0.0799*	-0.0282	-0.0517
	(0.0786)	(0.5388)	(0.2034)
Oil Volatility	2.4771**	-1.4479	3.9250***
	(0.0279)	(0.2138)	(0.0002)
Market Conditions	Yes	Yes	
Supply Factors	Yes	Yes	
Demand Factors	Yes	Yes	

Panel C			
Group	*High Oil Sens./Net Exporter*	*High Oil Sens./Net Importer*	*Wald Test*
Model	*(1)*	*(2)*	*(1)-(2)*
Oil Return	-0.1505*	-0.0780*	-0.0725
	(0.0544)	(0.0938)	(0.3436)
Oil Volatility	6.3837***	2.2280*	4.1557**
	(0.0009)	(0.0563)	(0.0308)
Market Conditions	Yes	Yes	
Supply Factors	Yes	Yes	
Demand Factors	Yes	Yes	

Panel D						
Group	*High Oil Sens./ OPEC*	*High Oil Sens./ Net Exp.(non-OPEC)*	*High Oil Sens./ Net Importer*	Wald Test		
Model	*(1)*	*(2)*	*(3)*	*(1) - (2)*	*(1) - (3)*	*(2) – (3)*
Oil Return	-0.3589***	-0.0143	-0.0696^	-0.3445**	-0.2893**	0.0553
	(0.0079)	(0.8773)	(0.1389)	(0.0297)	(0.0381)	(0.5208)
Oil Volatility	4.4389^	6.5319***	2.0343*	2.0930	2.4046	4.4975**
	(0.1732)	(0.0063)	(0.0844)	(0.5963)	(0.4791)	(0.0456)
Market Conditions	Yes	Yes	Yes			
Supply Factors	Yes	Yes	Yes			
Demand Factors	Yes	Yes	Yes			

In Table 7, we report the results from all our analyses using orthogonal oil factors. Panel A, B, C and D validate the results presented in Table 3, 4, 5 and 6, respectively. Generally, the results from Table 7 produce qualitatively similar results and confirm our empirical findings.

4. Conclusion

Previous studies have documented the commonality in equity market liquidity across the world. More recently, extensive research has shed some light on what might explain why equity market liquidity co-moves. In this study, we introduce oil market, which we hypothesize to help directly and/or indirectly explain commonality in liquidity, especially and largely in certain economies that are integrated with and sensitive to oil market. We use a sample of 36,930 firms from 50 countries and show that the transmitting channels of oil factors, namely oil returns and volatility only explain variations in liquidity commonality for countries that are somehow more oil sensitive. We define oil sensitivity as the absolute value of the difference of exports and imports scaled by the country's GDP. Specifically, we show that oil volatility effect on liquidity commonality is more substantial than oil return effect, when we restrict the coefficients of its effect to be equal for all countries that are considered high oil sensitive. In addition, we show that oil volatility effect is more pronounced in net oil exporters as opposed to net oil importers, after controlling for oil sensitivity.

The asymmetric effect of oil factors in net oil exporters and net oil importers is re-examined by allowing the coefficients to vary across OPEC members and non-OPEC net exporter members. The findings suggest that oil returns influence liquidity commonality in only OPEC members whereas oil volatility influence liquidity commonality in both net oil exporters groups along with net oil importers. Lastly, we confirm the results that suggest a more pronounced effect of oil volatility on net oil exporters as opposed to net oil importers. Our results are robust to controlling for possible sources of liquidity commonality suggested in the literature.

The implications of the findings can be summarized into two aspects. First, the establishment of a statistical association between oil market and liquidity commonality in equity markets help anticipate and mitigate the negative impact of a contagious shock in liquidity in the equity markets, especially in economies that are highly integrated with oil markets. For investors, our findings also have a vital implication as it suggests a causality effect of oil factors on the price of liquidity risk, which increases in the level of liquidity commonality. For future research, we recommend to study the effects of oil shocks on commonality in liquidity by separating the sources of shocks and its directions. Killian (2009) study the dynamic effect of oil shocks on a set of economic factors and find that the effect of oil shocks is asymmetric in terms of whether they are driven by demand or supply sources. Possible research questions can be: whether the effects of different sources of oil shocks on liquidity commonality are asymmetric? And, whether positive shocks and negative shocks effect on commonality in liquidity differ? Answers to similar questions are highly important to anticipate and mitigate or limit the risk of contagious sudden dry-up in the equity markets, accelerated by the high levels of commonality in liquidity.

References

Acharya, V., & Pedersen, L, 2005. Asset pricing with liquidity risk. Journal of Financial Economics 77, 375-410.

Amihud, Y., 2002. Illiquidity and stock returns: Cross-section and time-series effects. Journal of Financial Markets 5, 31–56.

Amihud, Y., & Mendelson, H., 1986. Asset pricing and the bid-ask spread. Journal of Financial Economics 17, 223-249.

Arezki, Rabah, and Olivier Blanchard, 2014. Seven questions about the recent oil price slump. IMFdirect-The IMF Blog

Atkins, A.B. and Dyl, E.A., 1997. Market structure and reported trading volume: NASDAQ versus the NYSE. Journal of Financial Research, 20(3), pp.291-304.

Basher, Syed A., and Perry Sadorsky, 2006. Oil price risk and emerging stock markets. Global Finance Journal 17, 224-251.

Basher, Syed Abul, Alfred A. Haug, and Perry Sadorsky, 2012. Oil prices, exchange rates and emerging stock markets. Energy Economics 34, 227-240.

Bollerslev, Tim, 1986. Generalized autoregressive conditional heteroscedasticity. Journal of Econometrics 31, 307-327.

Brockman, Paul, Dennis Y. Chung, and Christophe Pérignon, 2009. Commonality in liquidity: A global perspective. Journal of Financial and Quantitative Analysis 44, 851-882.

Brunnermeier, Markus K., and Lasse Heje Pedersen, 2009. Market liquidity and funding liquidity. Review of Financial studies 22, 2201-2238.

Chen, N., Roll, R., Ross, S.A., 1986. Economic forces and the stock market. The Journal of Business 59, 383–403.

Chordia, T., Subrahmanyam, A., & Anshuman, V. R., 2001. Trading activity and expected stock returns. Journal of Financial Economics 59, 3–32.

Chordia, Tarun, Richard Roll, and Avanidhar Subrahmanyam, 2000. Commonality in liquidity. Journal of Financial Economics 56, 3-28.

Coughenour, Jay F., and Mohsen M. Saad, 2004. Common Market Makers and Commonality in Liquidity. Journal of Financial Economics 73, 37-69.

Dang, T. L., Moshirian, F., Wee, C. K. G., & Zhang, B, 2015a. Cross-listings and liquidity commonality around the world. Journal of Financial Markets, 22, 1-26.

Dang, Tung Lam, Fariborz Moshirian, and Bohui Zhang, 2015b. Commonality in news around the world. Journal of Financial Economics 116, 82-110.

Day, Theodore E., and Craig M. Lewis, 1992. Stock market volatility and the information content of stock index options. Journal of Econometrics 52, 267-287.

Degiannakis, Stavros, George Filis, and Christos Floros, 2013, Oil and stock returns: Evidence from European industrial sector indices in a time-varying environment, Journal of International Financial Markets, Institutions and Money 26, 175–191.

Elyasiani, Elyas, Iqbal Mansur, and Babatunde Odusami, 2011, Oil price shocks and industry stock returns, Energy Economics 33, 966–974.

Filis, George, Stavros Degiannakis, and Christos Floros, 2011, Dynamic correlation between stock market and oil prices: The case of oil-importing and oil-exporting countries, International Review of Financial Analysis 20, 152–164.

Frino, Alex, Vito Mollica, and Zeyang Zhou, 2014. Commonality in Liquidity Across International Borders: Evidence from Futures Markets. Journal of Futures Markets 34, 807-18.

Gorton, Gary B., and George G. Pennacchi., 1993. Security baskets and index-linked securities. Journal of Business 66,1-27.

Hameed, Allaudeen, Wenjin Kang, and S. Viswanathan, 2010. Stock Market Declines and Liquidity. The Journal of Finance 65, 257-93.

Hamilton, James D, 1983. Oil and the macroeconomy since World War II. The Journal of Political Economy, 228-248.

Hamilton, James D., 2003. What is an oil shock? Journal of econometrics 113, 363-398.

Hasbrouck, J. Seppi, D.J., 2001. Common Factors in Prices, Order Flows, and Liquidity. Journal of Financial Economics 59, 383-411.

Huang, R.D., Masulis, R.W., Stoll, H.R., 1996. Energy shocks and financial markets. Journal of Futures Market 16, 1–27.

Huang, Roger D., Ronald W. Masulis, and Hans R. Stoll. "Energy shocks and financial markets." Journal of Futures markets 16.1 (1996): 1-27.

Huberman, Gur, and Dominika Halka, 2001. Systematic Liquidity." Journal of Financial Research 24, 161-78.

Jones, Charles M., and Gautam Kaul, 1996. Oil and the stock markets. The Journal of Finance 51, 463-491.

Kamara, Avraham, Xiaoxia Lou, and Ronnie Sadka, 2008. The divergence of liquidity commonality in the cross-section of stocks. Journal of Financial Economics 89, 444-466.

Karolyi, G. Andrew, Kuan-Hui Lee, and Mathijs A. Van Dijk, 2012. Understanding Commonality in Liquidity around the World. Journal of Financial Economics 105, 82-112.

Karolyi, G. Andrew., 1995. A multivariate GARCH model of international transmissions of stock returns and volatility: The case of the United States and Canada. Journal of Business & Economic Statistics 13, 11-25.

Kilian, Lutz, 2009. Not All Oil Price Shocks Are Alike: Disentangling Demand and Supply Shocks in the Crude Oil Market. The American Economic Review 99, 1053-69.

Kilian, Lutz, 2015. Why did the price of oil fall after June 2014?, VoxEU.org, link: http://voxeu.org/article/causes-2014-oil-price-decline

Koch, Andrew, Stefan Ruenzi, and Laura Starks, 2016. Commonality in liquidity: a demand-side explanation. Review of Financial Studies 29, 1943-1974.

Korajczyk, Robert A., and Ronnie Sadka, 2008. Pricing the commonality across alternative measures of liquidity. Journal of Financial Economics 87, 45-72.

Marshall, Ben R., Nhut H. Nguyen, and Nuttawat Visaltanachoti, 2013. Liquidity commonality in commodities. Journal of Banking & Finance 37, 11-20.

Morck, Randall, Bernard Yeung, and Wayne Yu, 2000. The Information Content of Stock Markets: Why Do Emerging Markets Have Synchronous Stock Price Movements?" Journal of Financial Economics 58, 215-60.

Park, J, and R Ratti, 2008, Oil price shocks and stock markets in the U.S. and 13 European countries, Energy Economics 30, 2587–2608.

Pastor, L., and Stambaugh, R. F, 2003. Liquidity Risk and Expected Stock Returns. Journal of Political Economy 111, 642-685.

Rogoff, Kenneth, 2016. What's behind the drop in oil prices? World Economic Forum, link: https://www.weforum.org/agenda/2016/03/what-s-behind-the-drop-in-oil-prices/

Roll, Richard, 1988. R^2. The Journal of Finance 43. 541-566

Rösch, Christoph G., and Christoph Kaserer, 2013. Market liquidity in the financial crisis: The role of liquidity commonality and flight-to-quality. Journal of Banking & Finance 37, 2284–2302.

Sadorsky, Perry, 2001. Risk Factors in Stock Returns of Canadian Oil and Gas Companies. Energy Economics 23, 17-28.

Vayanos, Dimitri, 2004. Flight to quality, flight to liquidity, and the pricing of risk. Unpublished Working Paper. National Bureau of Economic Research.

Chapter Two

Corporate Future Investments and Stock Liquidity: Evidence from Emerging Markets

1. Introduction

One essential factor that affects firms' investment growth is the rate of the cost of capital. Since capital consists of debt and/or equity, the cost of capital can be defined as the weighted average of the required rate of return on equity and the cost of debt. Intuitively, firms assess their future projects using this rate to determine the set of positive NPV projects that are available to undertake. The seminal work of Modigliani and Miller (1958) shows that, in the presence of uncertainty, the market value of a firm is determined by the risk of the assets it holds. Therefore, firms evaluate their future assets, purchases and investments by estimating the risk involved. One critical issue is how to determine the risks involved in estimating the cost of capital. Many asset pricing theories have been modelled and developed to identify factors that are involved in pricing equities. In earlier work, Jack Treynor (1961), William F. Sharpe (1964), John Lintner (1965) and Fischer Black (1972) independently introduce and develop the capital asset pricing model (CAPM). In their model, they price securities, or determine the cost of equities, based on their exposures to the market as a single systematic risk factor that investors cannot diversify away from thus be compensated for.

Many studies have investigated the validity of CAPM and have proposed risk factors that are claimed to explain stock returns more accurately. Recently, the influential work of Fama and French (1992) introduce a three-factor model, and this shows that the model, which accounts for risks related to size and market-to-book ratio, better explains the variations in stock returns. In addition, a major price factor examined in the literature is the liquidity effect, which is examined empirically (i.e. Amihud, 2002; Chordia et al., 2001**,** Jones, 2002, Bekaert et al., 2007, Pastor and Stambaugh, 2003) as well as theoretically (i.e. Amihud and Mendelson, 1986, Constantinides, 1986, Huang, 2003, Acharya and Pedersen, 2005).

Stock liquidity can be defined as the flexibility to buy and sell stocks without experiencing a negative impact on price. Several methods for quantifying the liquidity of a stock have been proposed and analyzed in the literature. Bid-ask spread is argued to be a natural or an ideal proxy for liquidity costs **(**Amihud and Mandelson, 1986**).** However, due to the limitations in global data, many studies use proxies that only require daily frequency data, such as Amihud and Turnover (e.g. Amihud et al., 2015**).** Empirically, evidence suggests that stock liquidity has a negative effect on stock returns; when liquidity is low, shareholders demand higher returns to compensate for the risk of being unable to rapidly sell the stock at a relatively low cost.

This liquidity effect is shown by Amihud and Mendelson (1986) to have a positive effect on market capitalization growth as well. They argue that when liquidity is high, the cost of capital will decrease, resulting in a lower discounting rate used to discount firms' new investments. Therefore, this liquidity effect is predicted to have an impact on the future growth of a firm. Myer (1977) defines the value of a firm as the present value of assets already held, and the present value of future growth opportunities. The present value is calculated using, again, the cost of capital rate; therefore, when the cost of capital decreases as a result of an increase in liquidity, we should expect the future investment opportunity set to expand. In other words, some negative NPV projects will become positive after a decrease in the discount rate, which will enlarge the set of positive NPV projects that a firm is willing to undertake and will eventually undertake, holding the financial constraints constant.

The linkage between corporate decisions and stock market liquidity is an ongoing debate in the corporate finance literature. Concerning a payout policy, Banerjee et al. (2007) find that less liquid stocks are more likely to pay cash dividends to their shareholders. Their results suggest that the declining propensity of firms to pay dividends over time is related to the dramatic changes in the liquidity of the U.S. stock market. Consistent with this, Brockman et al. (2008) show that firms with higher liquidity are encouraged more towards the use of repurchases rather than cash dividends. Concerning capital structure, Lipson and Mortal (2009) argue that a reduction in the cost of equity encourages managers to use equity more so than debt. Their findings show a significant negative association between a firm's leverage and stock liquidity. Similarly, Stulz et al. (2013) find evidence for an association between equity issuance and aggregate stock market liquidity; mainly, they show that firms are more likely to go public or offer new equity issues when aggregate market liquidity is high. With regard to corporate investment decisions, a handful of studies have examined the impact of stock liquidity on firms' future investments and whether the reduction in cost of equity encourages investment growth at the microeconomic level. Later on, an extended discussion on this matter in the literature will be provided, as it is more related to this paper.

In this paper, we study the impact of stock liquidity on firms' future investments. We argue that, since the cost of equity is used by managers to discount the future cash flows of future investments, it is reasonable to expect that a reduction in the cost of equity caused by an increase in stock liquidity would eventually cause growth in future investments. In addition, we investigate whether this stock liquidity effect on future investments, if it holds, varies across firms with different levels of financial constraints. Since liquidity positively affects the cost of equity, a firm that is more financially constrained and has limited access to external capital should be more sensitive to what affects the cost of equity, which in this case stock is liquidity. This argument is inspired by two recent studies that show how the level of financial constraints and development determine how much benefit a firm can gain from an increase in liquidity through U.S. cross listings (Lins et al., 2005; Hail and Leuz, 2009). Lins et al. (2005) show that the investment-cash sensitivity of non-U.S. firms is low after U.S. listings only for emerging markets, which tend to have less relaxed capital access. Similarly, Hail and Leuz (2009) find that firms with cross-listings on U.S. exchanges experience a decrease in their cost of capital, however there are smaller reductions for cross-listings in countries with stronger legal institutions, which tend to have less limited access to capital. Our two main hypotheses can be stated as:

H1: Holding other factors constant, a firm's future investments increase in its stock liquidity because of the reduction in the cost of equity.

H2: Holding other factors constant, the effect of stock liquidity on future investments is more pronounced in more financially constrained firms due to the limited access for other external capital.

Very few studies in the literature have examined a similar research question. Butler et al. (2005**)** examine a U.S. sample of seasoned equity offerings (SEOs) and found that the cost of issuing new equity is higher for most illiquid stocks as opposed to the most liquid stocks. Becker-Blease and Paul (2006), using a U.S. sample of firms and exploiting the additions in S&P 500 as positive liquidity shock, show that stocks that are added to S&P 500 experience an increase in future investments, and describe how this increase is partially explained by the increase in stock liquidity. They use capital expenditures and other alternative measures to proxy for future investments and Amihud, Volume and Turnover to proxy for stock liquidity. In addition, Baran and King (2012) present results consistent with those of Becker-Blease and Paul (2006) by explicitly examining the change in the cost of equity surrounding the index addition and deletions, as in Butler et al. (2005), instead of using future investments as the dependent variable, as in Becker-Blease and Paul (2006)**.** In contrast, Gregoriou and Nguyen (2010) use a sample of UK firms and utilized deletions from the FTSE 100, a negative liquidity shock, and find that there is no effect of liquidity on future investments, using the same measures as in Becker-Blease and Paul (2006). They argue that firms should still be able to borrow at the same cost of capital even after the negative liquidity shock (i.e. being deleted from the FTSE 100). More recently, Muñoz (2013) uses a sample from Latin American countries, namely Argentina, Brazil, Chile and Mexico, to show that liquidity positively affects future investments. Furthermore, he shows that this effect is less pronounced in large size firms, higher book-to-market firms, and is more pronounced for share issuer firms.

We extend this line of studies and contribute towards the literature in two different ways. First, a common factor in the previous studies that investigate similar research questions, is that they use relatively small samples, which may impose some constraints on addressing the heterogeneity of the liquidity effect on future investments across firms. The number of firms included in previous studies that examine the relation between investment and liquidity ranges from 185 to 370 firms while the sample in this study covers more than 9800 firms. Such a large sample allows us to exhibit more variations in financial constraints across firms. Moreover, the samples used in previous studies are drawn from a single market or a region, which may not allow controlling for country effects. In addition, except for Muñoz (2013), previous studies base their findings on samples drawn from highly developed markets, namely the U.S. and the U.K., where liquidity is arguably far less significant when compared to less developed markets. In fact, Bekaert et al. (2007) predict that any supportive evidence for a liquidity effect on a highly developed market could be attributed to an omitted variable correlated with the liquidity proxy. On the other hand, evidence against a liquidity effect cannot be generalized and used to rule out the possibility of the presence of liquidity effect in less developed markets. Bekaert et al. (2007) argue that a highly developed stock market such as the U.S. stock market tends to be very large in terms of trades, and to have an ownership structure that is highly diversified, combining long-term investors, who are less subject to liquidity risk, with short-term investors. In fact, such characteristics are lacking in emerging markets, which makes them much more sensitive to liquidity effect. For this, we obtain a sample from 21 emerging markets from widely different regions. Another reason why we opt to draw our sample from firms operating in emerging markets is because we intend to examine the extent to which financial constraints influence the liquidity effect on future investments, and as such firms are expected to suffer more from financial constraints and arguably exhibit higher variations in their financial constraint levels.

Second, we attempt to go one further step and shed light on the impact of financial constraints on the investment liquidity relation. We identify several determinants of financial constraints at the firm level, while we control for the country effects. Since stock liquidity is crucial in emerging markets, this has a vital implication for both firms' managers and policymakers as it would enable them to understand more about how important market liquidity it is and when it is important the most for firms' growth.

Using a sample of more than 9800 firms, from 21 emerging markets and spanning from 2000 to 2015, we find supportive and robust evidence of a positive association between stock liquidity and firms' future investments. Furthermore, our findings strongly suggest that the liquidity effect on corporate investments is highly influenced by firms' financial constraint levels, using four different definitions of financial constraint. These results are robust due to controlling for other future investment determinants suggested in the previous literature, and due to controlling for the country and time effects. In addition, the results seem to be consistent with the use of alternative measures for corporate investment and stock liquidity and alternative model specifications.

The remaining sections of the paper are organized as follows: In section two, the empirical methodology and model specifications are outlined. In section three, the construction of the sample is described along with discussing some preliminary results. In section four, the empirical findings are presented, and finally, in section six, the main findings are highlighted with some concluding remarks offered.

2. Methodology

In this section, we outline the regression methodology that allows us to test our two main hypotheses. We set the main equations to be estimated, the estimation procedure used for both hypotheses and we identify the expected outcome of the results in accordance with the stated hypotheses.

2.1. Corporate Investment and Stock Liquidity

To test the sensitivity of corporate investments to stock liquidity, we follow the traditionally estimated investment equation (Fazzari et al., 1988; Hoshi et al. 1991; Lang et al., 1996; Lins et al., 2005 and others), however we adjust it to fit with the nature of our hypotheses. Particularly, we estimate the following equation:

$$\frac{I_{t+j}}{K_t} = \alpha + \beta_1\, Liquidity_t + \beta_2\, \frac{FCF_{t+j}}{TA_t} + \beta_3\, Leverage_t + \beta_4\, Sales_t + \beta_5\, Cash_t + \beta_6\, q_t + \varepsilon_t \qquad (1)$$

The dependent variable (*I*) is the firm's capital expenditure at time *t+1* or *t+2* scaled by beginning period capital (*K*). Following Love (2003), we define capital (*K*) as the sum of net property, plant and equipment and depreciation minus capital expenditure. We use different future periods (*j*=1, 2) since investment may not be carried out immediately. Lins et al (2005) note that international firms are more likely to be consistent in reporting total assets than capital. For this, we use both capital and total assets in scaling the investment variable for robustness. Because the dependent variable is almost always between 0 and 1 and to make more suitable for a regression framework, we use the logistic transformation $\ln[y/(1-y)]$, where *y* is the dependent variable (Morck et al., 2000; Karolyi et al., 2012)[7].

Our key variable is *Liquidity*, which is a proxy for the firm's stock liquidity. Due to data limitations, we use two proxies of liquidity that only require daily frequencies, namely *Amihud* and *Turnover*, following previous studies that employ international data (e.g. Karolyi et al., 2012; Amihud et al., 2015). We include in the regressions the log value of the average from daily liquidity values for each firm-year. We expect the coefficient β_1 to be positive in accordance with our first hypothesis that expects stock liquidity to increase future investments. *Amihud* is defined as:

$$Amihud_{i,d} = -\log\left(1 + \frac{|R_{i,d}|}{P_{i,d} VO_{i,d}}\right)$$

[7] For robustness, we use the actual value of the dependent variable, though unreported, and the results are very similar.

Where *R* is the daily return in U.S. dollars, *P* is the daily price converted to U.S. Dollars and *VO* is the daily volume. We add the constant one and take the log to avoid outliers (Malmendier and Tate, 2005; Karolyi et al., 2012). In addition, we multiply the outcome with minus one to convert the measure to be increasing in liquidity thus comparable with *Turnover*.

Similarly, *Turnover* is defined as:

$$Turnover_{i,d} = \log\left(1 + \frac{VO_{i,d}}{Shares_{i,y}}\right)$$

Where *Shares* is the annual number of shares outstanding.

To avoid an omitted variable bias, we identify several variables that shown in previous studies to capture some of corporate investment variations over time and in the cross sectional. One of the most important variables studied is cash flow (*FCF*). Farazzi et al. (1988) argue that firms' corporate investment is positively related to their internal financing capability because external financing is costly. Many studies, including Farazzi et al. (1988), Hoshi et al. (1991), Lang et al. (1996), Lins et al. (2005) and others, find supportive evidence to this prediction. We define *FCF* as the sum of earnings before interest and tax and deprecation minus dividends at time *t+1 or t+2*. We scale this variable by the beginning period total assets. We expect the coefficient β_2 to be positive consistent with the investment-cash sensitivity hypothesis.

In addition, we include *Leverage* and define it as total debt divided by total assets. The higher the leverage, the lower the debt capacity or the lower ability to raise capital when needed. Lang et al. (1996) and Hovakimian (2009) show negative relation between leverage and future investments. Therefore, we expect β_3 to be negative.

Hoshi et al. (1991) and Lins et al. (2005), among others, include sales in the corporate investment equation as a proxy for production. Hoshi et al. (1991) argue that sales could possibly be an accelerator effect for corporate investments. Firms are likely to invest more when their production strongly increases. We define *Sales* as revenues scaled by total assets. According to the previous studies, we expect β_4 to be positive.

In addition to *FCF*, we include cash holdings at time *t* to account for the firm's financial slack. Myers and Majluf (1984)'s model predicts that, under information asymmetry, firms with more financial slack are more likely to be able to undertake positive NPV projects. Love (2003) and Lins et al. (2005), among others, find results that are consistent with this prediction. We define *Cash* as cash holdings divided by total assets. Accordingly, we expect β_5 to be positive.

To account for the variations in growth opportunities, we include Tobin's q (*q*) in the regression equation. The higher Tobin's q, the higher growth opportunities a firm has. Many studies, including previously discussed, find a positive association between Tobin's q and future investments. Following Lins et al(2005), we use Market-to-Book value ratio as a proxy for Tobin's q. Specifically, we define *q* as the sum of market value of equity and book value of debt divided by total assets. Consistent with previous literature, we expect β_6 to be positive.

To avoid outliers, we take the natural logarithm of the variable plus one for all variables. We choose the logarithmic transformation to avoid outliers over other approaches (e.g. winsorizing or trimming) to avoid discarding information as argued by Malmendier and Tate (2005). In addition, following Lins et al. (2005), we use U.S. Dollar converted values of the variables to avoid biases triggered by inflationary effects.

We estimate Equation (1) with two alternative approaches, cross sectional and two-stage panel regressions. First, we perform cross-sectional regressions for each year and report the coefficients' averages and statistics across years. In this approach, we include country dummies to control for country effects. In addition, we use Huber-White standard errors to account for the possible presence of heteroscedasticity. We use this approach for multiple reasons. First, it allows us to exploit larger number of firms, as the alternative approach requires firms to have more annual observations. The maximum number of firms in the cross-sectional approach is 9909 firms while it is 6811 firms in the alternative approach. Second, since firms with very few annual observations are not included in the two-stage panel approach, using cross sectional regressions may better account for the possible survivorship bias that the two-stage panel approach may suffer from. Third, the estimates of the standard errors, under the cross-sectional approach, are likely to be more accurately stated with the potential of serially correlated errors.

The second approach is based on two-stage panel regressions. This approach is beneficial in two different ways. First, it allows us to control for the time variations in our sample that are ignored in the cross-sectional regressions. Second, it addresses the potential endogeneity problem, discussed in the recent literature (Erickson and Whited, 2000; Bond and Van Reenen, 2008; Almeida et al., 2010; Munoz 2013), which arises from the inclusion of Tobin's q in the corporate investment equation. Bond and Van Reened (2008) and Almeida et al. (2010) show that when Tobin's q, as measured in our study, is included in the corporate investment equation, an endogeneity problem may be present due to measurement errors. They propose different approaches to solve this issue. Almeida et al. (2010) find that a simple framework of OLS with instrumental variables (i.e. two-stage least squares) outperforms more complicated solutions, examined in their study. Following Almeida et al. (2010) and Munoz (2013), we keep the equation in level and instrument q with two lags of q's first difference. We perform two instrumental variable tests, namely Kleibergan-Paap and Hansen J, to assure the validity of the instrumental variables used[8]. To account for the serial dependence at the firm level and heteroskedasticity, we use standard errors that are Huber-White corrected and clustered at the firm level. Furthermore, we include year dummies to account for business cycle effects (Lang et al., 1996). Lang et al. (1996) argue that if investment is high in a given year because of the business cycle and leverage happens to be low, we end up with a conclusion that is influenced by the business cycle effects. In fact, we show, in a later section, how investments and liquidity were both significantly affected by the 2008 credit crisis. If the surrounding years of the 2008 credit crisis are not controlled for, any supportive evidence to our hypotheses may be attributed to an omitted variable bias. Finally, we use firm fixed effects to capture the heterogeneity across the firms in our sample.

2.2. The Role of Financial Constraints

To investigate our second hypothesis in which we expect a higher stock liquidity effect on corporate investment for more financially constrained firms, we first introduce several determinants of financial constraints. Particularly, we use firm size, firm leverage, firm payout ratio and Kaplan and Zingales (1997)'s index (KZ index, hereafter). We choose to use different financial constraint determinants to assure that our results are not sensitive to the choice of a single determinant. Since our data covers a large number of firms from a broad set of different

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[8] The under identification test (Kleibergan-Paap) tests the null hypothesis that the correlation between the endogenous variable (q) and the instruments is zero. The over identification test (Hansen J) tests the null hypothesis that the correlation between the instruments and the error terms is zero. The validity of our estimation procedure requires the former to be statistically significant and the latter to be statistically insignificant. These two requirements hold for all results.

countries, we are able to separate the firm level effect from the country effect. Even though the set of countries considered in our sample are emerging markets, it is still natural to expect that financially constrained firms could be concentrated in less financially developed countries. To capture the country effect, we sort firms based on the financial determinants within each country. That is, firms are sorted every year into four quartiles using different break points for each country.

Firm Size has been used throughout the literature to proxy for the level of financial constraints (Gilchrist and Himmelberg, 1995; Erickson and Whited, 2000; Almedia et al., 2004; Acharya et al. 2007; Denis and Sibilkov, 2009). Almedia et al. (2004) argue that small firms tend to be younger and less well known, which result in making them more vulnerable to capital market imperfections. On an annual basis, we rank firms by total assets within each country into four quartiles. Then, we create a dummy variable that takes one if the firm is assigned in the top quartile and zero otherwise. This dummy represents firms with the least financial constraints, controlling for country effects.

Firm Leverage ratio is also another proxy for financial constraints (e.g. Greenaway et al. 2007). Intuitively, we expect firms with high leverage outstanding to have a lower debt capacity or ability to raise additional capital to finance new investments. We define leverage ratio as long-term debt divided by total asset. Annually, we rank firms within each country by the leverage ratio into four quartiles. Similarly, we construct a dummy variable that takes one if the firm is assigned in the top quartile and zero otherwise. This dummy represents firms with the most financial constraints, controlling for country effects.

Payout Ratio is one of the most commonly used variables to proxy for financial constraints (Fazzari et al., 1988; Lamont et al., 2001; Almeida et al., 2004; Acharya et al. 2007; Denis and Sibilkov, 2009; and others). The intuition is that low dividend firms have less internal financing capacity, which make them more in need of external capital to finance new investments (Hennessy and Whited, 2007). Therefore, Fazzari et al. (1988) predict that financially unconstrained firms are more likely to have higher payout ratios. We define payout ratio as the sum of cash dividends and stock repurchases divided by income before extraordinary items. For each year, we rank firms within each country by all positive payout ratios into four quartiles. We define a dummy variable that takes one if the firm is in the top quartile or has a negative payout ratio[9]. This dummy represents firms with the least financial constraints, controlling for country effects.

KZ index is introduced by Kaplan and Zingales (1997) and has been used to proxy for financial constraints in many related studies (Lamont et al. 2001; Almeida et al., 2004; Hennessy and Whited, 2007; and others). Kaplan and Zingales (1997) utilize the annual reports of the constrained firms in Farazzi et al. (1988) and construct a scale variable that ranks firms by their financial constraints. Then, they estimate an ordered logit regression of this scale variable on several firm characteristics. The KZ index is constructed from the following equation:

$$KZ = -1.002 * FCF + 0.283 * q + 3.139 * Leverage - 39.368 * Dividends/TA - 1.315 * Cash$$

[9] A negative payout ratio indicates that the firm pays dividends or repurchases stocks while reporting negative income before extraordinary items.

Where *FCF* is the sum of earnings before income and tax and depreciation minus dividends divided by total assets, *q* is market value of assets (price times shares outstanding plus book value of total debt) divided by total assets, *Leverage* is total debt divided by total assets, *Dividends/TA* is cash dividends divided by total assets, and *Cash* is cash holdings divided by total assets.

Initially, we independently rank firms based on those financial constraint determinants. However, from the independent rankings, it turns out that the large size dummy is positively correlated with the high leverage dummy with a correlation of 0.3, which is statistically significant at the 1% level. Nevertheless, we expect high leverage firms to be more financially constrained and large size firms to be less financially constrained. This positive and high correlation indicates that a considerable portion of large firms in our emerging market sample also happen to maintain high leverage, which may offset the benefits they get from being well known and older. To solve this issue, we pre-rank firms into two quantiles within each country based on total assets and leverage ratio. Then, we rank firms in each of these two quantiles in each country into four quartiles by total assets and leverage ratio. Doing so, we have two dummies based on double rankings that indicate large size firms, controlling for leverage effect and high leverage firms, controlling for large size effect[10]. For the other financial constraint determinants, there is no indication of such an issue.

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[10] This is analogous to the formation of HML in Fama and French (1993) where they first rank stocks by size then in each size quantile they rank firms by BM. This captures the BM effect, controlling for the size effect. Similarly, Amihud et al. (2015) construct IML by first ranking firms by volatility then in each volatility quintile they rank firms by stock illiquidity. Likewise, this captures the illiquidity effect, controlling for volatility effect. The large size effect from the independent ranking is statistically insignificant. However, the leverage effect from the independent ranking yields very similar results to the double ranking results.

To account for the expected variations in the stock liquidity effect on corporate investment, we adjust Equation (1) to include an interaction variable that allows the slope of *Liquidity* to vary across the level of financial constraints. Specifically, we estimate the following equation:

$$\frac{I_{t+1}}{K_t} = \alpha + \beta_1\, Liquidity_t + \beta_2\, FC_t + \beta_3\, Liquidity_t * FC_t + \beta_4\, \frac{FCF_{t+1}}{TA_t} + \beta_5\, Leverage_t$$
$$+ \beta_6\, Sales_t + \beta_7\, Cash_t + \beta_8\, q_t + \varepsilon_t \qquad (2)$$

Where *FC* is the financial constraint indicator that can be *Large Size*, *High Leverage*, *High Payout* or *High KZ Index*. We include *FC* because our financial constraint determinants are time-variant (i.e. assigned on annual basis). Similarly, we estimate Equation (2) using IV-OLS with firm fixed effect, year dummies and standard errors that are Huber-White corrected and clustered at the firm level. They key estimate for our second hypothesis is β_3. For *Large Size and High Payout*, we expect β_3 to be negative. This implies that the effect of stock liquidity on future investments is lower in the least financially constrained firms. For *High Leverage* and *High KZ Index*, we expect β_3 to be negative. This, on the other hand, implies that the effect of stock liquidity on future investment is more pronounced in the most financial constrained firms.

3. Data and Preliminary Analysis

We use a sample of firms drawn from 21 emerging markets, namely Brazil, Chile China, Colombia, Czech Republic, Egypt, Greece, Hungary, India, Indonesia, Malaysia, Mexico, Morocco, Peru, Philippines, Poland, Russia, South Africa, Taiwan, Thailand, and Turkey. The sample period is from 2000 to 2015. Our main source of daily security data and annual accounting data is obtained from Global Compustat.

We begin by processing the daily security data for each firm to construct our liquidity measures from annual averages of firm daily liquidity. Specifically, we compute daily *Amihud* measure, using U.S. dollar return and volume and daily *Turnover* measure. Annual currency exchange rates for each country relative to the US are obtained from the Federal Reserve Economic Data (FRED) and the World Bank. Initially, we have a total of 17248 firms with reported daily data. Following previous studies that deal with large international data (e.g. Karolyi et al. 2012), we apply the following filtering criteria to the daily prices data: we drop observations that are reported in a currency other than the country's local currency and we only keep observation for common stocks. This reduces the total number of firms by 632 firms. We exclude observations with missing the close price variable. After calculating daily returns, we exclude observations with missing the trading volume variable. This reduces the total number of firm by 163 firms. Following Karolyi et al. (2012), we exclude days with 90% or more of the stocks have a return of zero in a given year, representing non-trading days. Furthermore, we exclude stocks with zero daily returns for more than 80% in a given year, representing non-traded stocks. This excludes 29 firms and makes the final number of firms from the daily data drop to 16424 firms. Because we only need annual observations for each firm in order to merge it with the annual accounting data, we calculate annual liquidity measure from averages of the daily liquidity for each firm. Then, we keep only one observation for each firm-year.

Similarly, we construct the key accounting variables for each firm from Global Compustat (Fundamentals Annual). We use U.S. converted data to construct our key variables, as mentioned before. Initially, there are 15587 firms from the 21 emerging markets in our sample that have reported observations in the annual data. We exclude financials firms (SIC 60-67) due to the differences in its nature compared to other industries. This yields a total number of 13244 firms. Then, we merge the file that contains the annual liquidity measure, previously constructed from the daily data, with the annual accounting data file. The number of firms that have annual observations in both files is 12574. Finally, we require annual observations to have available data in the following key variables: *Amihud*, *Turnover*, Earnings before income and tax (EBIT), Depreciation (DP), Dividends (DV), Total Assets (TA), Total Debt (LT), Revenues (REVT) and Cash (CH). Because our regression specifications require at least two observations for each firm, we exclude stocks with only one annual observation. Our final sample consists of 9898 firms with 71314 annual observations.

In Table 1 Panel A, we report the summary statistics of the key variables in the study. Namely, we report means, medians, standard deviations and bottom and top 1 percentile of the investment measures, liquidity measures, and other firm characteristics. The average and median CAPX scaled by K is 0.24 and 0.15 respectively, while the average and median CAPX scaled by total assets is 0.07 and 0.04, respectively. These are comparable to the sample of Love (2003) whose means and medians of CAPX/K, based on 36 countries, were 0.26 and 0.19, respectively. Our sample means of cash flow to total assets, leverage ratio, sales to total assets, cash to total asset and q are 0.08, 0.37, 0.59, 0.12 and 0.97, respectively. These statistics are also comparable to studies that use U.S. samples (e.g. Malmendier and Tate, 2005).

Table 1: Descriptive and Preliminary Analysis

Panel A presents the means, medians, standard deviations and the 1st and 99th percentiles for each variable included in the study. $CAPX_{t+j}/K_t$ is defined as the capital expenditures in period t+j, where j is equal one or two, divided by K in period t, which is defined as net property plant and equipment minus capital expenditure plus depreciation. $CAPX_{t+j}/TA_t$ is defined as the capital expenditures in t+j, where j is equal one or two, divided by total assets (TA) in t. Amihud is the annual average of the daily Amihud measure. Daily Amihud measure is defined as the absolute daily returns divided by the U.S. dollar volume. We take the log of Amihud measure plus one to avoid outliers and multiply it by minus one to convert it to a liquidity measure. Turnover is the annual average of the daily Turnover measure. Turnover measure is defined as the daily volume divided by shares outstanding. Likewise, we take the log of Turnover measure plus one to avoid outliers. FCF is defined as the sum of earnings before interest and tax and deprecation minus dividends scaled by the beginning period total assets. Leverage is defined as total debt divided by total assets. Sales is defined as revenues scaled by total assets. Tobin's q is computed as the sum of market value of equity and book value of debt divided by total assets. Panel B shows the pairwise Pearson's correlation between variables included in the study. Definitions of all variables are provided in Panel A. For each correlation coefficient, the table reports the level of the statistical significance. The superscripts a, b, and c refer to 1%, 5% and 10% statistical significance level, respectively. Panel C reports the means and medians of investment and liquidity measures for one-year or two-year window before and during the credit financial crisis. The definitions of the investment and liquidity measures are provided in Panel A. For each variable, the mean is reported in the first row and the median is reported in brackets in the second row. The differences between the means and the medians are also reported in the last column for each window. For each mean difference, a t-test is conducted of a zero mean difference. Similarly, Wilcoxon rank sum test is used to test the median equality for each median difference. The superscripts *, **, ***, and ^ refer to 1%, 5%, 10%, and one-tail statistical significance level.

Panel A: Summary statistics

				Percentiles	
Variable	Mean	Median	Standard Deviation	1st	99th
Investment					
$CAPX_{t+1}/K_t$	0.236	0.147	0.331	0.001	1.487
$CAPX_{t+2}/K_t$	0.254	0.152	0.365	0.000	1.663
$CAPX_{t+1}/TA_t$	0.065	0.042	0.074	0.000	0.352
$CAPX_{t+2}/TA_t$	0.074	0.044	0.102	0.000	0.448
Liquidity					
Amihud	-0.154	0.000	5.715	0.000	-2.328
Turnover	0.007	0.003	0.013	0.000	0.044
Controls					
FCF	0.075	0.069	0.099	-0.179	0.332
Leverage	0.371	0.379	0.161	0.050	0.698
Sales	0.588	0.555	0.293	0.063	1.471
Cash	0.115	0.082	0.111	0.001	0.493
Tobin's q	0.968	0.787	0.768	0.283	5.103

Table 1 - Continued

Panel B: Pairwise correlation matrix									
	$CAPX_{t+1}/K_t$	$CAPX_{t+1}/TA_t$	Amihud	Turnover	Cash Flow	Leverage	Sales	Cash	Tobin's q
$CAPX_{t+1}/K_t$	1								
$CAPX_{t+1}/TA_t$	0.556[a]	1							
Amihud	0.007[c]	0.010[a]	1						
Turnover	0.040[a]	0.081[a]	0.014[a]	1					
Cash Flow	0.325[a]	0.171[a]	0.026[a]	-0.078[a]	1				
Leverage	-0.020[a]	-0.077[a]	-0.013[a]	-0.014[a]	-0.047[a]	1			
Sales	-0.018[a]	0.035[a]	-0.004	-0.080[a]	0.189[a]	0.137[a]	1		
Cash	0.007[c]	0.223[a]	0.017[a]	0.200[a]	-0.053[a]	-0.342[a]	-0.025[a]	1	
Tobin's q	0.085[a]	0.098[a]	0.013[a]	0.070[a]	0.115[a]	0.005	-0.010[a]	0.123[a]	1

Panel C: Impact of the credit crisis of 2008 on Variable Means and Medians						
	One-Year Window			Two-Year Window		
Variable	2007	2008	*Difference*	2006-2007	2008-2009	*Difference*
Investment						
$CAPX_{t+1}/K_t$	0.270 [0.167]	0.235 [0.128]	*0.034**** *[0.039]****	0.267 [0.165]	0.242 [0.135]	*0.025**** *[0.03]****
$CAPX_{t+1}/TA_t$	0.075 [0.046]	0.066 [0.035]	*0.070**** *[0.011]****	0.079 [0.048]	0.068 [0.038]	*0.011**** *[0.01]****
Liquidity						
Amihud	-0.044 [0.000]	-0.183 [-0.001]	*0.140^* *[0.001]****	-0.031 [0.000]	-1.129 [-0.001]	*0.098** *[0.001]****
Turnover	0.010 [0.004]	0.006 [0.002]	*0.004**** *[0.002]****	0.0087 [0.004]	0.0085 [0.002]	*0.0002* *[0.002]****

In Table 1 Panel B, we show the pairwise correlation between the key variables. The correlation between the two investment measures is 0.56 and statistically significant at 1% level. Furthermore, the correlation between the two liquidity measures is 0.014 and statistically significant at the 1% level. In the relation between future investments and current liquidity, all measures yield positive correlations, which are also statistically significant at the 1% (except CAPX/K with Amihud where the correlation is positive but only significant at the 10% level). In addition, *Leverage* seems to negatively correlate with all variables except Tobin's q, which has a correlation that is statistically indifferent from zero.

In Table 1 Panel C, we show the impact of the credit crisis of 2008 on the means and medians of the key variables in the study. We consider one-year and two-year windows to examine different timings of the effect. Interestingly, there is a statistically significant drop in both future investment (one year lead) and liquidity between one year prior the crisis (2007) and one year during the crisis (2008) or two years prior the crisis (2006-2007), and two years during the crisis (2008-2009). We report the p-value from t-tests to examine the difference between the two periods' means and we report the p-value from Wilcoxon Rank-sum Tests to examine the difference between the two periods' medians. Moreover, Figure 1 plots the time path of the medians of those key variables. Consistent with the mean and median analysis, we clearly see a drop in the time path of these variables surrounding the credit crisis of 2008. In fact, the time path of the liquidity measures and future investments seem to correspond with each other, which may indicate the causality effect that we intend to test in a regression framework. However, as the credit crisis effect on investments and liquidity may indicate, those key variables may be correlated because of a time effect rather than a causality effect. Therefore, as mentioned before, we control for the time effect or business cycle effect by including year dummies to control for a possible omitted variable bias.

In Table 2, we show some key statistics for each country in our sample. For each country, we report the data start year, the data end year, number of firms and observations and means of

Table 2: Summary Statistics by Country

This table reports key statistics for all countries in the sample. For each country, it reports the start year, end year, number of firms, proportion of total firms, number of annual observation, proportion of total annual observations, and means of investments measures and liquidity measures. The full definitions of the investment and liquidity measures are provided in Table 1 Panel A.

							Investment Measures				Liquidity Measures	
Countries	Start Year	End Year	No. Firms	% Firms	No. Obs.	% Obs.	$CAPX_{t+j}/K_t$		$CAPX_{t+j}/TA_t$		Amihud	Turnover
							j=1	j=2	j=1	j=2		
Brazil	2000	2015	242	2.4	1560	2.2	0.243	0.261	0.065	0.073	-0.058	0.003
Chile	2000	2015	152	1.5	1361	1.9	0.145	0.165	0.058	0.068	-1.042	0.001
China	2000	2015	2464	24.9	21223	29.8	0.274	0.301	0.071	0.083	0.000	0.014
Colombia	2002	2015	31	0.3	186	0.3	0.167	0.203	0.051	0.060	-0.010	0.001
Czech Republic	2000	2015	24	0.2	122	0.2	0.131	0.141	0.071	0.075	-0.167	0.001
Egypt	2000	2015	106	1.1	445	0.6	0.170	0.197	0.059	0.066	-0.003	0.003
Greece	2000	2015	225	2.3	1330	1.9	0.167	0.160	0.048	0.048	-0.268	0.002
Hungary	2000	2015	23	0.2	136	0.2	0.191	0.210	0.088	0.095	-0.052	0.002
India	2000	2015	1790	18.1	10520	14.8	0.303	0.328	0.087	0.098	-0.452	0.003
Indonesia	2000	2015	334	3.4	2206	3.1	0.223	0.244	0.068	0.078	-0.436	0.002
Malaysia	2000	2015	959	9.7	7144	10.0	0.164	0.175	0.048	0.053	-0.036	0.002
Mexico	2000	2015	87	0.9	652	0.9	0.152	0.165	0.056	0.062	-0.036	0.001
Morocco	2003	2015	50	0.5	254	0.4	0.265	0.295	0.074	0.081	-0.030	0.005
Peru	2000	2015	71	0.7	524	0.7	0.152	0.165	0.061	0.069	-0.010	0.002
Philippines	2000	2015	155	1.6	1084	1.5	0.208	0.240	0.057	0.066	-0.282	0.001
Poland	2000	2015	319	3.2	1331	1.9	0.254	0.261	0.063	0.070	-0.078	0.002
Russia	2002	2015	135	1.4	542	0.8	0.213	0.291	0.110	0.161	-2.346	0.000
S. Africa	2000	2015	269	2.7	1813	2.5	0.308	0.333	0.070	0.080	-0.330	0.002
Taiwan	2000	2015	1780	18.0	14254	20.0	0.194	0.202	0.049	0.053	-0.036	0.008
Thailand	2000	2015	511	5.2	3875	5.4	0.206	0.228	0.067	0.075	-0.078	0.006
Turkey	2005	2015	171	1.7	752	1.1	0.224	0.244	0.060	0.065	-0.003	0.007
All	**2000**	**2015**	**9898**	**100%**	**71314**	**100%**	**0.236**	**0.254**	**0.065**	**0.074**	**-0.154**	**0.007**

the investment measures and liquidity measures. Except for Colombia, Morocco, Russia and Turkey, the data of all countries in our sample start in 2000 and end in 2015. The reason those four countries' starting years range from 2002 to 2005 is because we do not have sufficient data for prior years. Table 2 shows that the largest number of firms comes from China (24.9% of all firms) followed by India and Taiwan with 1790 firms (18.1% of all firms) and 1780 firms (18% of all firms), respectively. Whereas, Colombia, Czech Republic and Hungary have only 78 firms combined (about 1% of all firms). The total number of annual observations in our sample is 71314 observations corresponding to 9898 firms. In addition, Table 2 reports the averages of investments and liquidity across countries. China, India, Indonesia, Morocco and Russia are among the highest ten countries in terms of investment ratios across all measures. On the other hand, Chile, Colombia, Egypt, Greece, Malaysia, Mexico and Taiwan are mong the lowest test countries in terms of investment ratios across all measures. We refrain from comparing liquidity levels across countries because of the differences in trading volume definitions across stock exchanges (Karolyi et al., 2012).

4. Main Findings

In this section, we provide a detailed discussion of the results from the regression analyses. We begin with the results from the cross sectional regressions and then the two-stage panel regressions. Later, we show the findings for the role of financial constraints on the investment and liquidity relation.

4.1. Cross Sectional Regressions

As previously outlined, we estimate Equation (1) from cross sectional regressions on an annual basis where we include country dummies to capture the heterogeneity across countries.

Table 3 shows the results from the averages of time-series coefficients and R-squares from those cross sectional regressions where the dependent variable is CAPX/K. We report four different models. Namely, we report the results of two models where we include Amihud as the liquidity measure and consider 1-year or 2-year investment lead. Alternatively, we use Turnover as the liquidity measure in the other two models. To individually test the null hypothesis that the independent variable coefficients are equal zero, we report the p-value from t-tests of zero means. In addition, we report, for each independent variable, the number of coefficients with an expected sign and the number of statistically significant coefficients across years (equations). We use Huber-White corrected standard errors when computing the p-values, to account for the possible presence of heteroskedasticity. Also, we report the minimum, maximum and unique number of firms included in all models. Similarly, Table 4 reports same results, however we use CAPX/TA as the dependent variable. As shown, the lowest minimum number of firms, included in the cross sectional equations, is 1516 firms while the highest maximum number is 6464. Moreover, the minimum number of unique firms appear in all equations is 9131 while the maximum number of unique firms is 9909.

In Table 3, *FCF* appears to positively affect future investments with 1-year and 2-year leads, which show as well statistically significant coefficients at the 1% level. This is expected since firms' investments, in emerging markets, are more likely to be sensitive to their free cash flows as they have less access to external capital. Apparently, this is consistent with the previous findings on the investment-cash sensitivity (e.g. Love (2003) and Lins et al., 2005, among others). When we look at each year separately, FCF effect is positive and statistically significant always. Likewise, the coefficients of *Sales* are positive, as expected, and statistically significant at the 1% level across all models, and this is also true when we look at each year separately. This

Table 3: Cross Sectional Regressions of Future Investments Scaled by Capital on Liquidity

This table reports the average estimates along with the means and medians of R^2 across years from annual cross sectional regressions of Equation (1). For each model, the table reports the minimum, maximum, and unique number of firms included in the estimation. In the second column, the table states the expected sign for each independent variable. In addition, it reports the number of expected signed and statistically significant (in parenthesis) coefficients across equations for each independent variable. The dependent variable is log transformed in the following form: $\ln[y/(1-y)]$, where y is the dependent variable. The log values of *Amihud* and *Turnover* are included in the regressions. The estimated equation is: $\frac{I_{t+j}}{K_t} = \alpha + \beta_1\, Liquidity_t + \beta_2\, \frac{FCF_{t+j}}{TA_t} + \beta_3\, Leverage_t + \beta_4\, Sales_t + \beta_5\, Cash_t + \beta_6\, q_t + \varepsilon_t$, where the dependent variable (I) is the firm's capital expenditure at time t+1 or t+2 scaled by the beginning period capital (K). Full definitions of the variables appearing in the equation above are provided in Table 1 Panel A. Also, country dummies are included in each of the cross sectional regression. The p-values of the zero mean t-test are reported in parenthesis. The subscripts *, **, *** refer to 1%, 5%, and 10% statistical significance levels, respectively.

Dependent Variable		$CAPX_{t+j}/K_t$			
	E[sign]	Amihud		Turnover	
		j=1	j=2	j=1	j=2
$Liquidity_t$	+	0.075***	0.073***	0.085***	0.077***
		(0.000)	(0.000)	(0.000)	(0.000)
# >0 (# sig)		15(15)	14(14)	15(15)	14(13)
FCF_{t+j}	+	3.757***	4.171***	4.006***	4.319***
		(0.000)	(0.000)	(0.000)	(0.000)
# >0 (# sig)		15(15)	14(14)	15(15)	14(14)
$Leverage_t$	-	-0.602***	-0.674***	-0.661***	-0.732***
		(0.000)	(0.000)	(0.000)	(0.000)
# <0 (# sig)		15(12)	14(10)	15(9)	14(10)
$Sales_t$	+	0.797***	0.872***	0.756***	0.837***
		(0.000)	(0.000)	(0.000)	(0.000)
# >0 (# sig)		15(15)	14(14)	15(15)	14(14)
$Cash_t$	+	3.188***	3.146***	3.220***	3.171***
		(0.000)	(0.000)	(0.000)	(0.000)
# >0 (# sig)		15(15)	14(14)	15(15)	14(14)
q_t	+	-0.018	-0.011	0.045***	0.053***
		(0.192)	(0.484)	(0.000)	(0.000)
# >0 (# sig)		5(4)	7(3)	14(5)	13(6)
Country Dummies		Yes	Yes	Yes	Yes
R^2	*Mean*	0.223	0.238	0.214	0.229
	Median	0.231	0.241	0.217	0.230
# Years (Eqs)		15	14	15	14
# Firms	*Min*	1527	1516	1534	1522
	Max	6055	5651	6059	5652
	Unique	9721	9131	9731	9138

is consistent with the hypothesis that expects sales to play an accelerator effect for corporate investments (Hoshi et al., 1991; and Lins et al., 2005). Again, the coefficient of *Sales* has the expected sign and statistically significant in all years. Similarly, the coefficient of *Cash* has the expected positive sign in all models and statistically significant at 1% level, which is also the case when the results from the separate regressions are considered. This supports the argument that firms with more financial slack are more likely to be able to undertake positive NPV projects (e.g. Love, 2003; Lins et al., 2005; among others). On the other hand, we find *Leverage* to be negatively associated with future investments with statistically significant coefficients at the 1% level in all models. The expected sign in *Leverage* is evident in all years, yet in a few years, the coefficient is not statistically significant at the 10% level. The findings of the negative association between Leverage and future investment provide confirmatory evidence to the prediction that firms with high level of leverage have lower ability (due to less debt capacity) to raise additional capital when needed (Lang et al., 1996; and Hovakimian, 2009). For *q*, its expected effect on future investment is positive, as argued and evident in many previous studies. The results hold as expected when *Turnover* is used however in models where *Amihud* is included, the coefficient of *q* is negative though statistically highly insignificant.

More interestingly, the coefficient of liquidity is positive and statistically significant at 1% level, indicating that future investment increases in stock liquidity. In fact, when we look at each equation separately, we find this positive relation to be present and statistically significant in all equations[11]. This is consistent whether we use *Amihud* or *Turnover* as a proxy for stock liquidity, or whether we use 1-year or 2-year investment leads. This finding is supportive evidence to our

[11] The only exception is when 2-year lead of investment measure and Turnover are used in which liquidity loses its statistical significance in only one year.

Table 4: Cross Sectional Regressions of Future Investments Scaled by Total Assets on Liquidity
This table is similar to Table 3. However, the dependent variable (*I*) is the firm's capital expenditure at time t+1 or t+2 scaled by total assets at time t.

Dependent Variable		$CAPX_{t+j}/TA_t$			
	E[sign]	Amihud		Turnover	
		j=1	j=2	j=1	j=2
$Liquidity_t$	+	0.067***	0.068***	0.032***	0.027***
		(0.000)	(0.000)	(0.000)	(0.002)
# >0 (# sig)		15(15)	14(14)	15(8)	12(6)
FCF_{t+j}	+	4.897***	4.890***	5.102***	5.005***
		(0.000)	(0.000)	(0.000)	(0.000)
# >0 (# sig)		15(15)	14(14)	15(15)	14(14)
$Leverage_t$	-	-0.693***	-0.772***	-0.707***	-0.785***
		(0.000)	(0.000)	(0.000)	(0.000)
# <0 (# sig)		15(14)	14(14)	15(13)	14(14)
$Sales_t$	+	0.255**	0.331***	0.211*	0.294***
		(0.022)	(0.003)	(0.051)	(0.008)
# >0 (# sig)		12(8)	12(9)	8(8)	11(9)
$Cash_t$	+	0.052	0.021	0.119	0.092
		(0.807)	(0.912)	(0.594)	(0.638)
# >0 (# sig)		5(6)	4(7)	5(6)	5(5)
q_t	+	-0.032**	-0.019	0.021*	0.038***
		(0.027)	(0.217)	(0.070)	(0.002)
# >0 (# sig)		4(6)	5(2)	11(3)	13(5)
Country Dummies		Yes	Yes	Yes	Yes
R^2	*Mean*	0.209	0.231	0.197	0.220
	Median	0.221	0.254	0.203	0.235
# Years (Eqs)		15	14	15	14
# Firms	*Min*	1587	1628	1594	1635
	Max	6460	5885	6464	5886
	Unique	9898	9341	9909	9349

first hypothesis, which states that stock liquidity reduces the cost of equity, therefore increases future investments.

As early mentioned, international firms are more likely to accurately report total assets as opposed to capital employed (Lins et al., 2005). Therefore, we find it necessary to reassure our findings by considering investments relative to total assets rather than relative to capital employed. Nevertheless, the results in Table 4 produce very similar conclusions.

4.2. Two Stage Panel Regressions

This approach helps account for time variations and address the potential endogeneity issue, caused by measurement errors in *q* (Bond and Van Reenen, 2008; Almeida et al., 2010). Table 5 reports the estimation results of Equation (1) from two-stage regressions. As discussed before, we simply use firm fixed effects to capture heterogeneity across firms, include year dummies to account for possible time and business cycle effects, and instrument *q* with two lags of *q*'s first difference. We perform two instrumental tests to test the validity of the approach, namely Kleibergan-Paap and Hansen J. Kleibergan-Paap tests the null hypothesis that the correlation between the endogenous variable (q) and the instruments is zero (i.e. under identification). Hansen J, on the other hand, tests whether the correlation between the instruments and the error terms is zero (i.e. over identification). The validity of our estimation procedure requires the former to be statistically significant and the latter to be statistically insignificant. Apparently, these two requirements hold for all the results.

Because this approach requires firms to have more annual observation in order to be included, the highest number of firms included in all model is 6940 whereas the lowest number of firms is 5936, which both are far less than those used in the cross sectional approach. In Table 5, the coefficients of all control variables have their expected signs and statistically significant at 1% level. Surprisingly, *q* also appears to have positive and statistically significant coefficient in all models as opposed to the mixed results found in the cross sectional regressions. More importantly, both liquidity measures in all models have positive and statistically significant

Table 5: Two-Stage Panel Regressions of Future Investments Scaled by Capital on Liquidity
This table reports the results from the two-stage panel regressions. The equation estimated and variables included are the same as those in Table 3. However, two-stage panel regression with firm fixed effects and year dummies is adopted. The variable *q* is instrumented with two lags of *q*'s first difference. Standard errors used are Huber-white corrected for heteroscedasticity and clustered at the firm level. P-values of zero coefficient hypothesis are reported in parentheses for each independent variable. The last two rows report two instrumental variables tests. The under identification test (Kleibergan-Paap) tests the null hypothesis that the correlation between the endogenous variable (q) and the instruments is zero. The over identification test (Hansen J) tests the null hypothesis that the correlation between the instruments and the error terms is zero. The subscripts *, **, *** refer to 1%, 5%, and 10% statistical significance levels, respectively.

Dependent Variable		$CAPX_{t+j}/K_t$			
	E[sign]	Amihud		Turnover	
		j=1	j=2	j=1	j=2
$Liquidity_t$	+	0.070^{***}	0.036^{***}	0.036^{***}	0.047^{***}
		(0.000)	(0.000)	(0.000)	(0.000)
FCF_{t+j}	+	2.558^{***}	2.784^{***}	2.526^{***}	2.756^{***}
		(0.000)	(0.000)	(0.000)	(0.000)
$Leverage_t$	-	-1.405^{***}	-2.014^{***}	-1.508^{***}	-2.058^{***}
		(0.000)	(0.000)	(0.000)	(0.000)
$Sales_t$	+	0.406^{***}	0.561^{***}	0.426^{***}	0.567^{***}
		(0.000)	(0.000)	(0.000)	(0.000)
$Cash_t$	+	2.345^{***}	2.370^{***}	2.372^{***}	2.392^{***}
		(0.000)	(0.000)	(0.000)	(0.000)
q_t	+	0.272^{***}	0.327^{***}	0.332^{***}	0.346^{***}
		(0.000)	(0.000)	(0.000)	(0.000)
Firm FE		Yes	Yes	Yes	Yes
Year Dummies		Yes	Yes	Yes	Yes
R^2		0.087	0.115	0.080	0.114
# Firms		6811	5935	6811	5936
# Observations		43866	36709	43869	36713
IV tests					
Kleibergan-Paap		(0.000)	(0.000)	(0.000)	(0.000)
Hansen J		(0.5506)	(0.2881)	(0.7554)	(0.1519)

Table 6: Two-Stage Panel Regressions of Future Investments Scaled by Total Assets on Liquidity
This table is similar to Table 5. However, the dependent variable (*I*) is the firm's capital expenditure at time t+1 or t+2 scaled by total assets at time t.

Dependent Variable		$CAPX_{t+j}/K_t$			
	E[sign]	Amihud		Turnover	
		j=1	j=2	j=1	j=2
$Liquidity_t$	+	0.044***	0.013*	0.020**	0.029***
		(0.000)	(0.051)	(0.014)	(0.002)
FCF_{t+j}	+	2.728***	3.217***	2.703***	3.205***
		(0.000)	(0.000)	(0.000)	(0.000)
$Leverage_t$	-	-1.055***	-1.338***	-1.117***	-1.355***
		(0.000)	(0.000)	(0.000)	(0.000)
$Sales_t$	+	0.535***	0.736***	0.549***	0.734***
		(0.000)	(0.000)	(0.000)	(0.000)
$Cash_t$	+	1.203***	1.153***	1.219***	1.162***
		(0.000)	(0.000)	(0.000)	(0.000)
q_t	+	0.233***	0.292***	0.272***	0.291***
		(0.000)	(0.000)	(0.000)	(0.000)
Firm FE		Yes	Yes	Yes	Yes
Year Dummies		Yes	Yes	Yes	Yes
R^2		0.1064	0.1574	0.1036	0.1575
# Firms		6948	6066	6948	6067
# Observations		45334	38230	45337	38234
IV tests					
Kleibergan-Paap		(0.000)	(0.000)	(0.000)	(0.000)
Hansen J		(0.478)	(0.919)	(0.636)	(0.879)

estimates, confirming our previous results.

For robustness check, we re-run the two-stage regressions of Equation (1) using total assets as a scaling factor. In Table 6, we report the results from the regressions where the dependent variable is capital expenditure scaled by total assets reports the results, which are very similar to those reported in Table 5 and deliver consistent conclusions.

4.3. The Interaction with The Levels of Financial Constraints

The remaining of our findings is concerned with our second hypothesis. Essentially, we expect more financially constrained firms to exhibit more pronounced effect of stock liquidity on their investment due to their limited access to other external financing. Following previous studies, we employ four different determinants of financial constraints, namely size, leverage ratio, payout ratio and KZ index, to shed light on the issue. In Table 7, we show the medians of the key variables in the study across financial constraint leverage. In Panel A, we rank firms by total assets, in the same manner discussed in the methodology section. For each determinant, we report the medians of the determinant its self, investment measures and liquidity measures for each quartile. For Size and Payout ratios, we report the p-value from the Wilcoxon rank-sum test of median equality between the least constrained or most constrained firms and all firms in the other quartiles. For Leverage ratio and KZ index, the median equality test is between the most constrained or most constrained firms and all firms in the other quartiles.

Based on Size ranking, the median total assets of the least constrained group is 770 U.S. million dollars and steadily decreases to 23.5 U.S. million dollars in the most constrained group. Similarly, based on Payout ratio ranking, the median payout ratio of the least constrained group is 68.6% while it gradually reaches zero payout ratio in the most constrained group. Likewise, based on Leverage ratio, the median leverage ratio of the least constrained group is about zero (all-equity firms) while it is 3%, 9.4% and 22.3% for the higher quartiles. Interestingly, Table 7 shows that when firms ranked by Size or Payout ratio, investment levels and liquidity measures

Table 7: Medians of Key Variables Across Financial Constraint Levels

This table reports the medians of the financial constraint variable, investment measure and liquidity measures across four financial constraint levels. Panel A, B, C and D rank firms within each country based on Total assets, Leverage ratio, Payout ratio and KZ index, respectively. Least Constrained represents firms in the bottom quartile and Most Constrained represents firms in the top quartile. In addition, the table report the p-values from Wilcoxon rank-sum test of median equality. For Size and Payout ratios, the table reports the p-value from the Wilcoxon rank-sum test of median equality between the least constrained or most constrained firms and all firms in the other quartiles. For Leverage ratio and KZ index, the median equality test is between the most constrained or most constrained firms and all firms in the other quartiles. Full definitions of the variables included in the table are provided in Table 1 Panel A.

Quartiles:	Least Constrained	2	3	Most constrained	Wilcoxon rank-sum test
A. Ranked by Size					
Total Assets (Million USD)	770.090	186.475	73.821	23.418	(0.000)
$CAPX_{t+1}/K_t$	0.161	0.145	0.134	0.120	(0.000)
$CAPX_{t+1}/TA_t$	0.044	0.039	0.036	0.031	(0.000)
Ln(Amihud)	17.645	15.268	13.613	11.955	(0.000)
Ln(Turnover)	-6.089	-6.114	-6.194	-6.241	(0.024)
B. Ranked by Leverage ratio					
Long-term Debt/TA	0.000	0.030	0.094	0.223	(0.000)
$CAPX_{t+1}/K_t$	0.151	0.153	0.142	0.122	(0.000)
$CAPX_{t+1}/TA_t$	0.030	0.038	0.042	0.045	(0.000)
Ln(Amihud)	15.514	14.326	14.796	15.114	(0.053)
Ln(Turnover)	-5.966	-6.401	-6.210	-6.082	(0.001)
C. Ranked by Payout ratio					
Payout ratio	0.686	0.421	0.248	0.000	(0.000)
$CAPX_{t+1}/K_t$	0.112	0.178	0.221	0.126	(0.000)
$CAPX_{t+1}/TA_t$	0.034	0.048	0.056	0.033	(0.000)
Ln(Amihud)	16.286	16.576	16.907	14.985	(0.614)
Ln(Turnover)	-5.966	-5.962	-5.801	-5.835	(0.000)
D. Ranked by KZ index					
Kaplan-Zingales Index	-0.456	0.200	0.556	0.896	(0.000)
$CAPX_{t+1}/K_t$	0.195	0.173	0.146	0.104	(0.000)
$CAPX_{t+1}/TA_t$	0.050	0.048	0.042	0.028	(0.000)
Ln(Amihud)	16.714	16.339	16.208	15.899	(0.000)
Ln(Turnover)	-6.031	-5.895	-5.815	-5.777	(0.000)

are consistently decreasing with the level of financial constraints. However, based on Leverage ratio and KZ index, the patterns of investment levels and liquidity measures are mixed.

Table 8: Financial Constraints and The Investment-Liquidity Sensitivity - Firm Size

This table reports the results from estimating Equation (2) with two-stage panel regressions with firm fixed effects and year dummies. The variable q is instrumented with two lags of q's first difference. In the second column, the table states the expected sign for each independent variable. The dependent variable is log transformed in the following form: $\ln[y/(1-y)]$, where *y* is the dependent variable. The log values of *Amihud* and *Turnover* are included in the regressions. The estimated equation is: $\frac{I_{t+1}}{K_t} = \alpha + \beta_1\, Liquidity_t + \beta_2\, Large_t + \beta_3\, Liquidity_t * Large_t + \beta_4\, \frac{FCF_{t+1}}{TA_t} + \beta_5\, Leverage_t + \beta_6\, Sales_t + \beta_7\, Cash_t + \beta_8\, q_t + \varepsilon_t$, where the dependent variable (*I*) is the firm's capital expenditure at time t+1 scaled by the beginning period capital (K) in the first two models and scaled by the beginning period total asset (TA) in the last two models. *Large* is a financial constraint dummy that takes one if the firm is assigned in the top size quartile within its country and zero otherwise. The size rank is based on total assets and conducted on an annual basis. *Liquidity* * *Large* is an interaction variable between *Liquidity* and the dummy variable *Large*. Full definitions of the variables appearing in the equation above are provided in Table 1 Panel A. Standard errors used are Huber-white corrected for heteroscedasticity and clustered at the firm level. P-values of zero coefficient hypothesis are reported in parentheses for each independent variable. The last two rows report two instrumental variables tests. The under identification test (Kleibergan-Paap) tests the null hypothesis that the correlation between the endogenous variable (q) and the instruments is zero. The over identification test (Hansen J) tests the null hypothesis that the correlation between the instruments and the error terms is zero. The subscripts ***, **, * refer to 1%, 5%, and 10% statistical significance levels, respectively.

Dependent Variable		$CAPX_{t+1}/K_t$		$CAPX_{t+1}/TA_t$	
	E[sign]	Amihud	Turnover	Amihud	Turnover
$Liquidity_t$	+	0.073^{***}	0.043^{***}	0.048^{***}	0.030^{***}
		(0.000)	(0.000)	(0.000)	0.001
$Liquidity_t * Large_t$	-	-0.013^{*}	-0.021^{*}	-0.013^{**}	-0.031^{***}
		(0.062)	(0.076)	(0.022)	(0.003)
FCF_{t+1}	+	2.561^{***}	2.534^{***}	2.724^{***}	2.703^{***}
		(0.000)	(0.000)	(0.000)	(0.000)
$Leverage_t$	-	-1.402^{***}	-1.503^{***}	-1.053^{***}	-1.116^{***}
		(0.000)	(0.000)	(0.000)	(0.000)
$Sales_t$	+	0.404^{***}	0.425^{***}	0.533^{***}	0.547^{***}
		(0.000)	(0.000)	(0.000)	(0.000)
$Cash_t$	+	2.342^{***}	2.365^{***}	1.206^{***}	1.220^{***}
		(0.000)	(0.000)	(0.000)	(0.000)
q_t	+	0.273^{***}	0.335^{***}	0.231^{***}	0.272^{***}
		(0.000)	(0.000)	(0.000)	(0.000)
Firm FE		Yes	Yes	Yes	Yes
Year Dummies		Yes	Yes	Yes	Yes
R^2		0.0867	0.0806	0.1066	0.1038
# Firms		6811	6811	6948	6948
# Observations		43866	43869	45334	45337
IV tests					
Kleibergan-Paap		(0.000)	(0.000)	(0.000)	(0.000)
Hansen J		(0.544)	(0.746)	(0.470)	(0.628)

Table 8 shows the results from the inclusion of the variable that represents the interaction between liquidity and a dummy for large firms. The large firm dummy takes one if the firm is in the top size quartile within its country, based on total assets, and zero otherwise. We include year dummies and the large size dummy in the regressions to control for the time variant effects on future investments. Consistent with the second hypothesis, the coefficient of the interaction term is negative and statistically significant across all models. That is, future investments of large size firms are less affected by stock liquidity. This provides evidence to the hypothesis that less financially constrained firms have more access to capital, therefore their future investments are more likely to depend less on how liquid their stocks are.

In Table 9, we estimate a similar regression, however we instead include an interaction variable between liquidity and an indicator for high leverage firms. The indicator of high leverage firms takes one if the firm is assigned in the top leverage ratio quartile within its country and zero otherwise. Again, year dummies and the financial constraint indicator are included to capture the time variations in investment measures. The estimates of the interaction variable are positive and statistically significant in all models. In fact, we see, in most cases, the coefficient of the interaction variable is as large as the coefficient of the liquidity variable, indicating a double effect of liquidity on future investments for firms in the top high leverage quartile. This is consistent with our second hypothesis where we expect that high leverage firms, being more financially constrained, are more sensitive to their stock liquidity when it comes to making investment decisions.

Similarly, we present in Table 10 the results from using payout ratio as an indicator for financial constraints. *High_Payout* is a dummy that indicates firms that are ranked in the top payout ratio quartile within each country. The coefficient of the interaction variable between

Table 9: Financial Constraints and The Investment-Liquidity Sensitivity - Leverage Ratio

This table reports the results from estimating Equation (2) with two-stage panel regressions with firm fixed effects and year dummies. The variable q is instrumented with two lags of q's first difference. In the second column, the table states the expected sign for each independent variable. The dependent variable is log transformed in the following form: $\ln[y/(1-y)]$, where *y* is the dependent variable. The log values of *Amihud* and *Turnover* are included in the regressions. The estimated equation is: $\frac{I_{t+1}}{K_t} = \alpha + \beta_1\ Liquidity_t + \beta_2\ High\_Lev_t + \ \beta_3\ Liquidity_t * High\_Lev_t + \ \beta_4\ \frac{FCF_{t+1}}{TA_t} + \beta_5\ Leverage_t + \beta_6\ Sales_t + \ \beta_7\ Cash_t + \ \beta_8\ q_t + \varepsilon_t$, where the dependent variable (*I*) is the firm's capital expenditure at time t+1 scaled by the beginning period capital (K) in the first two models and scaled by the beginning period total asset (TA) in the last two models. *High_Lev* is a financial constraint dummy that takes one if the firm is assigned in the top leverage quartile within its country and zero otherwise. The leverage rank is based on long-term debt scaled by total asset and conducted on an annual basis. *Liquidity* * *High_Lev* is an interaction variable between *Liquidity* and the dummy variable *High_Lev*. Full definitions of the variables appearing in the equation above are provided in Table 1 Panel A. Standard errors used are Huber-white corrected for heteroscedasticity and clustered at the firm level. P-values of zero coefficient hypothesis are reported in parentheses for each independent variable. The last two rows report two instrumental variables tests. The under identification test (Kleibergan-Paap) tests the null hypothesis that the correlation between the endogenous variable (q) and the instruments is zero. The over identification test (Hansen J) tests the null hypothesis that the correlation between the instruments and the error terms is zero. The subscripts ***, **, * refer to 1%, 5%, and 10% statistical significance levels, respectively.

Dependent Variable		$CAPX_{t+1}/K_t$		$CAPX_{t+1}/TA_t$	
	E[sign]	Amihud	Turnover	Amihud	Turnover
$Liquidity_t$	+	0.065^{***}	0.029^{***}	0.038^{***}	$0.013^{\wedge}$
		(0.000)	(0.003)	(0.000)	(0.114)
$Liquidity_t$ * $High\_Lev_t$	-	0.019^{***}	0.030^{***}	0.022^{***}	0.030^{***}
		(0.003)	(0.010)	(0.000)	(0.004)
FCF_{t+1}	+	2.556^{***}	2.525^{***}	2.725^{***}	2.701^{***}
		(0.000)	(0.001)	(0.000)	(0.000)
$Leverage_t$	-	-1.439^{***}	-1.544^{***}	-1.096^{***}	-1.161^{***}
		(0.000)	(0.000)	(0.000)	(0.000)
$Sales_t$	+	0.420^{***}	0.441^{***}	0.552^{***}	0.566^{***}
		(0.000)	(0.000)	(0.000)	(0.000)
$Cash_t$	+	2.359^{***}	2.384^{***}	1.219^{***}	1.233^{***}
		(0.000)	(0.000)	(0.000)	(0.000)
q_t	+	0.275^{***}	0.334^{***}	0.237^{***}	0.274^{***}
		(0.000)	(0.000)	(0.000)	(0.000)
Firm FE		Yes	Yes	Yes	Yes
Year Dummies		Yes	Yes	Yes	Yes
R^2		0.087	0.0808	0.1075	0.1043
# Firms		6810	6810	6948	6948
# Observations		43863	43866	45331	45334
IV tests					
Kleibergan-Paap		(0.000)	(0.000)	(0.000)	(0.000)
Hansen J		(0.502)	(0.688)	(0.413)	(0.557)

Table 10: Financial Constraints and The Investment-Liquidity Sensitivity - Payout Ratio

This table reports the results from estimating Equation (2) with two-stage panel regressions with firm fixed effects and year dummies. The variable q is instrumented with two lags of q's first difference. In the second column, the table states the expected sign for each independent variable. The dependent variable is log transformed in the following form: $\ln[y/(1-y)]$, where *y* is the dependent variable. The log values of *Amihud* and *Turnover* are included in the regressions. The estimated equation is: $\frac{I_{t+1}}{K_t} = \alpha + \beta_1\, Liquidity_t + \beta_2\, High\_Payout_t + \beta_3\, Liquidity_t * High\_Payout_t + \beta_4\, \frac{FCF_{t+1}}{TA_t} + \beta_5\, Leverage_t + \beta_6\, Sales_t + \beta_7\, Cash_t + \beta_8\, q_t + \varepsilon_t$, where the dependent variable (*I*) is the firm's capital expenditure at time t+1 scaled by the beginning period capital (K) in the first two models and scaled by the beginning period total asset (TA) in the last two models. *High_Payout* is a financial constraint dummy that takes one if the firm is assigned in the top payout quartile or has a negative payout ratio within its country and zero otherwise. The payout rank is based on the sum of cash dividends and stock repurchases scaled by income before extraordinary items and conducted on an annual basis. *Liquidity * High_Payout* is an interaction variable between *Liquidity* and the dummy variable *High_Payout*. Full definitions of the variables appearing in the equation above are provided in Table 1 Panel A. Standard errors used are Huber-white corrected for heteroscedasticity and clustered at the firm level. P-values of zero coefficient hypothesis are reported in parentheses for each independent variable. The last two rows report two instrumental variables tests. The under identification test (Kleibergan-Paap) tests the null hypothesis that the correlation between the endogenous variable (q) and the instruments is zero. The over identification test (Hansen J) tests the null hypothesis that the correlation between the instruments and the error terms is zero. The subscripts ***, **, * refer to 1%, 5%, and 10% statistical significance levels, respectively.

Dependent Variable		$CAPX_{t+1}/K_t$		$CAPX_{t+1}/TA_t$	
	E[sign]	Amihud	Turnover	Amihud	Turnover
$Liquidity_t$	+	0.068^{***}	0.042^{***}	0.042^{***}	0.027^{***}
		(0.000)	(0.000)	(0.000)	(0.002)
Liquidityt * $High\_Payout_t$	-	-0.012^{***}	-0.044^{***}	-0.008^{*}	-0.030^{***}
		(0.009)	(0.000)	(0.060)	(0.000)
FCF_{t+1}	+	2.411^{***}	2.367^{***}	2.613^{***}	2.583^{***}
		(0.000)	(0.000)	(0.000)	(0.000)
$Leverage_t$	-	-1.323^{***}	-1.406^{***}	-1.057^{***}	-1.104^{***}
		(0.000)	(0.000)	(0.000)	(0.000)
$Sales_t$	+	0.347^{***}	0.357^{***}	0.477^{***}	0.481^{***}
		(0.000)	(0.000)	(0.000)	(0.000)
$Cash_t$	+	2.254^{***}	2.266^{***}	1.123^{***}	1.130^{***}
		(0.000)	(0.000)	(0.000)	(0.000)
q_t	+	0.274^{***}	0.331^{***}	0.238^{***}	0.273^{***}
		(0.000)	(0.000)	(0.000)	(0.000)
Firm FE		Yes	Yes	Yes	Yes
Year Dummies		Yes	Yes	Yes	Yes
R^2		0.0903	0.0854	0.1075	0.1054
# Firms		6565	6565	6671	6671
# Observations		41508	41511	42579	42582
IV tests					
Kleibergan-Paap		(0.000)	(0.000)	(0.000)	(0.000)
Hansen J		(0.999)	(0.721)	(0.798)	(0.981)

Table 11: Financial Constraints and The Investment-Liquidity Sensitivity - Kaplan-Zingales Index

This table reports the results from estimating Equation (2) with two-stage panel regressions with firm fixed effects and year dummies. The variable q is instrumented with two lags of q's first difference. In the second column, the table states the expected sign for each independent variable. The dependent variable is log transformed in the following form: $\ln[y/(1-y)]$, where *y* is the dependent variable. The log values of *Amihud* and *Turnover* are included in the regressions. The estimated equation is: $\frac{I_{t+1}}{K_t} = \alpha + \beta_1\ Liquidity_t + \beta_2\ High\_KZ_t + \beta_3\ Liquidity_t * High\_KZ_t + \beta_4\ \frac{FCF_{t+1}}{TA_t} + \beta_5\ Leverage_t + \beta_6\ Sales_t + \beta_7\ Cash_t + \beta_8\ q_t + \varepsilon_t$, where the dependent variable (*I*) is the firm's capital expenditure at time t+1 scaled by the beginning period capital (K) in the first two models and scaled by the beginning period total asset (TA) in the last two models. *High_KZ* is a financial constraint dummy that takes one if the firm is assigned in the top KZ index quartile within its country and zero otherwise. The KZ index rank is conducted on an annual basis. *Liquidity* * *High_KZ* is an interaction variable between *Liquidity* and the dummy variable *High_KZ*. Full definitions of the variables appearing in the equation above are provided in Table 1 Panel A. Standard errors used are Huber-white corrected for heteroscedasticity and clustered at the firm level. P-values of zero coefficient hypothesis are reported in parentheses for each independent variable. The last two rows report two instrumental variables tests. The under identification test (Kleibergan-Paap) tests the null hypothesis that the correlation between the endogenous variable (q) and the instruments is zero. The over identification test (Hansen J) tests the null hypothesis that the correlation between the instruments and the error terms is zero. The subscripts ***, **, * refer to 1%, 5%, and 10% statistical significance levels, respectively.

Dependent Variable		$CAPX_{t+1}/K_t$		$CAPX_{t+1}/TA_t$	
	E[sign]	Amihud	Turnover	Amihud	Turnover
$Liquidity_t$	+	0.061***	0.023**	0.034***	0.009
		(0.000)	(0.028)	(0.000)	(0.290)
$Liquidity_t$ *	-				
$High\_Lev_t$		0.020***	0.038***	0.021***	0.038***
		(0.001)	(0.003)	(0.000)	(0.001)
FCF_{t+1}	+	2.516***	2.484***	2.667***	2.645***
		(0.000)	(0.000)	(0.000)	(0.000)
$Leverage_t$	-	-1.272***	-1.367***	-1.052***	-1.116***
		(0.000)	(0.000)	(0.000)	(0.000)
$Sales_t$	+	0.380***	0.393***	0.499***	0.505***
		(0.000)	(0.000)	(0.000)	(0.000)
$Cash_t$	+	2.270***	2.283***	1.090***	1.096***
		(0.000)	(0.000)	(0.000)	(0.000)
q_t	+	0.295***	0.353***	0.254***	0.289***
		(0.000)	(0.000)	(0.000)	(0.000)
Firm FE		Yes	Yes	Yes	Yes
Year Dummies		Yes	Yes	Yes	Yes
R^2		0.0868	0.0810	0.1071	0.1054
# Firms		6594	6594	6690	6690
# Observations		42126	42129	43086	43089
IV tests					
Kleibergan-Paap		(0.000)	(0.000)	(0.000)	(0.000)
Hansen J		(0.559)	(0.779)	(0.312)	(0.424)

liquidity and this indicator is negative and statistically significant in all models. Earlier, we introduce payout ratio as a determinant of financial constraint that decreases in the level of financial constraints. Therefore, the negative signed coefficient of the interaction variable provides more evidence to our second hypothesis that the impact of stock liquidity on future investment is weaker on less financially constrained firms.

Lastly, Table 11 shows the results from Kaplan and Zingales (1997)'s index. As point out earlier, KZ index increases with the financial constraint level. Like leverage ratio, we expect the interaction variable to have a positive coefficient, indicating a stronger effect of liquidity of future investments for more financially constrained firms. Indeed, our estimates of the interaction variable are positive and statistically significant in all models. Finally, these results are indicators of the robustness of our findings, which suggest that the effect of stock liquidity on future investments is more prominent in the more financially constrained firms.

5. Conclusion

In this study, we investigate the relation between stock liquidity and firms' future investments. We hypothesize that firms' investment growth is influenced by the potential reduction in cost of equity as a result of increases in stock liquidity. In addition, we shed light on the impact of financial constraints on the liquidity and future investment relation. We argue that the effect of stock liquidity on future investments is more pronounced in more financially constrained firms due to the limited access for other external capital.

Using a sample of more than 9800 firms, from 21 emerging markets and spanning from 2000 to 2015, we find supportive and robust evidence to both hypotheses. Our findings are robust due to using alternative measures of investments and liquidity, alternative robust model specifications and controlling for time and country effects. In addition to finding a positive relation between stock liquidity and future investments, our findings highly suggest that the liquidity effect on future investments is more prominent in more financially constrained firms, using size, leverage ratio, payout ratio and Kaplan and Zingales (1997)'s index as alternative determinants of financial constraints.

Our findings have implications for both managers and policymakers. For managers seeking growth, our findings indicate how important it is to boost market liquidity through different strategies (e.g. splits, cross-listing, meeting index criteria. etc). In addition, as our findings suggest that more financially constrained stocks benefit more from stock liquidity increases, firms with more financial constraints should be more encouraged to find ways to boost its stock liquidity to achieve growth objectives. Similarly, policymakers, in relatively less liquid markets like emerging markets, should realize the importance of finding ways to enhance the aggregate market liquidity to help stimulate growth in the capital market, especially low growth firms whose growth is essentially constrained by limited access to capital. Policymakers could pursue liquidity enhancing strategies to achieve such objectives (e.g. liberalize/open capital market for foreign investors and relax regulations for entry in the market etc.)

References

Acharya, V., & Pedersen, L. (2005). Asset pricing with liquidity risk. Journal of Financial Economics.

Almeida, H., Campello, M., & Galvao, A. F. (2010). Measurement errors in investment equations. Review of Financial Studies, 23(9), 3279-3328.

Almeida, H., Campello, M., & Weisbach, M. S. (2004). The cash flow sensitivity of cash. The Journal of Finance, 59(4), 1777-1804.

Amihud, Y. (2002). Illiquidity and stock returns: Cross-section and time-series effects. Journal of Financial Markets, 5, 31–56.

Amihud, Y., & Mendelson, H. (1986). Asset pricing and the bid-ask spread. Journal of Financial Economics.

Amihud, Y., Hameed, A., Kang, W., & Zhang, H. (2015). The illiquidity premium: International evidence. Journal of Financial Economics, 117(2), 350-368.

Banerjee, S., Gatchev, V. A., & Spindt, P. A. (2009). Stock Market Liquidity and Firm Dividend Policy. Journal of Financial and Quantitative Analysis, 42, 369.

Baran, L., & Dolly King, T.-H. (2012). Cost of Equity and S&P 500 Index Revisions. Financial Management, 41, 457 481.

Becker-Blease, J. R., & Paul, D. L. (2006). Stock liquidity and investment opportunities: Evidence from index additions. Financial Management, 35, 35–51.

Bekaert, G., Harvey, C. R., & Lundblad, C. (2007). Liquidity and expected returns: Lessons from emerging markets. Review of Financial Studies, 20, 1783–1831.

Black, F. (1972). Capital market equilibrium with restricted borrowing. The Journal of Business, 45(3), 444-455.

Bond, S., Van Reenen, J. (2008). Microeconometrics Models of Investment and Employment. Handbook of Econometrics, vol. 6A. Elsevier, Amsterdam, Chapter 65.

Brockman, P., Howe, J. S., & Mortal, S. (2008). Stock market liquidity and the decision to repurchase. Journal of Corporate Finance, 14, 446–459.

Butler, A. W., Grullon, G., & Weston, J. P. (2005). Stock market liquidity and the cost of issuing equity. Journal of Financial and Quantitative Analysis, 40(02), 331-348.

Chordia, T., Subrahmanyam, A., & Anshuman, V. R. (2001). Trading activity and expected stock returns. Journal of Financial Economics, 59, 3–32.

Claessens, S., Tong, H., & Wei, S. J. (2012). From the financial crisis to the real economy: Using firm-level data to identify transmission channels. Journal of International Economics, 88, 375–387.

Constantinides, G. M. (1986). Capital Market Equilibrium with Transaction Costs. Journal of Political Economy.

Denis, D. J., & Sibilkov, V. (2009). Financial constraints, investment, and the value of cash holdings. Review of Financial Studies, hhp031.

Erickson, T., & Whited, T. M. (2000). Measurement error and the relationship between investment and q. Journal of political economy, 108(5), 1027-1057.

Fama, E. F., & French, K. R. (1992). The cross- section of expected stock returns. the Journal of Finance, 47(2), 427-465.

Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. Journal of financial economics, 33(1), 3-56.

Fazzari, S. M., Hubbard, R. G., Petersen, B. C., Blinder, A. S., & Poterba, J. M. (1988). Financing constraints and corporate investment. Brookings papers on economic activity, 1988(1), 141-206.

Gilchrist, S., & Himmelberg, C. P. (1995). Evidence on the role of cash flow for investment. Journal of monetary Economics, 36(3), 541-572.

Greenaway, D., Guariglia, A., & Kneller, R. (2007). Financial factors and exporting decisions. Journal of international economics, 73(2), 377-395.

Gregoriou, A., and Nguyen, N. D. (2010). Stock liquidity and investment opportunities: New evidence from FTSE 100 index deletions. Journal of International Financial Markets, Institutions and Money, 20, 267–274.

Hail, L., & Leuz, C. (2009). Cost of capital effects and changes in growth expectations around US cross-listings. Journal of financial economics, 93(3), 428-454.

Hennessy, C. A., & Whited, T. M. (2007). How costly is external financing? Evidence from a structural estimation. The Journal of Finance, 62(4), 1705-1745.

Hoshi, T., Kashyap, A., & Scharfstein, D. (1991). Corporate structure, liquidity, and investment: Evidence from Japanese industrial groups. The Quarterly Journal of Economics, 33-60.

Hovakimian, G. (2009). Determinants of investment cash flow sensitivity. Financial management, 38(1), 161-183.

Huang, M. (2003). Liquidity shocks and equilibrium liquidity premia. Journal of Economic Theory, 109, 104–129.

Jones, C. M. (2002). A century of stock market liquidity and trading costs. Columbia University Working Paper.

Kaplan, S. N., & Zingales, L. (1997). Do investment-cash flow sensitivities provide useful measures of financing constraints?. The Quarterly Journal of Economics, 169-215.

Karolyi, G. A., Lee, K. H., & Van Dijk, M. A. (2012). Understanding commonality in liquidity around the world. Journal of Financial Economics, 105(1), 82-112.

Lamont, O., Polk, C., & Saaá-Requejo, J. (2001). Financial constraints and stock returns. Review of financial studies, 14(2), 529-554.

Lang, L., Ofek, E., & Stulz, R. M. (1996). Leverage, investment, and firm growth. Journal of Financial Economics, 40, 3–29.

Lins, K. V., Strickland, D., & Zenner, M. (2005). Do non-US firms issue equity on US stock exchanges to relax capital constraints? Journal of financial and quantitative analysis, 40(01), 109-133.

Lintner, J. (1965). The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. The review of economics and statistics, 13-37.

Lipson, M. L., & Mortal, S. (2009). Liquidity and capital structure. Journal of Financial Markets, 12, 611–644.

Love, I. (2003). Financial development and financing constraints: International evidence from the structural investment model. Review of Financial studies, 16(3), 765-791.

Malmendier, U., & Tate, G. (2005). CEO overconfidence and corporate investment. The journal of finance, 60(6), 2661-2700.

Modigliani, F., & Miller, M. H. (1958). The cost of capital, corporation finance and the theory of investment. The American economic review, 48(3), 261-297.

Morck, R., Yeung, B., & Yu, W. (2000). The information content of stock markets: why do emerging markets have synchronous stock price movements?. Journal of financial economics, 58(1), 215-260.

Muñoz, F. (2013). Liquidity and firm investment: Evidence for Latin America. Journal of Empirical Finance, 20, 18-29.

Myers, C. (1977). Determinants of corporate borrowing. Journal of Financial Economics, 5, 147–175.

Myers, S. C., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. Journal of financial economics, 13(2), 187-221.

Pastor, L., & Stambaugh, R. F. (2003). Liquidity Risk and Expected Stock Returns. Journal of Political Economy, 642 685.

Schaffer, M. E. (2015). xtivreg2: Stata module to perform extended IV/2SLS, GMM and AC/HAC, LIML and k-class regression for panel data models. Statistical Software Components.

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. The journal of finance, 19(3), 425-442.

Stulz, R. M., Vagias, D., & Van Dijk, M. A. (2013). Do firms issue more equity when markets are more liquid? (No. w19229). National Bureau of Economic Research.

Treynor, J. L. (1961). Toward a theory of market value of risky assets. Unpublished manuscript, 6.

Vayanos, D. (1998). Transactions Costs and Asset Prices: A Dynamic Equilibrium Model. Review of Financial Studies, 11, 1–58.

Appendix A

Table A1: Variable Descriptions
This table describes the variables used in chapter one.

Variable	Description
Market Return	the value-weighted average of the return of all individual stocks in each country in a given month. Data is obtained from *Global Compustat.*
Market Volatility	the monthly standard deviation of the value-weighted market return multiplied by the square root of 22 (the number of days in a month). Data is obtained from *Global Compustat.*
Market Liquidity	the value-weighted average of the monthly Amihud measure-computed as the average over the month of the daily absolute stock return divided by local currency trading volume (multiplied by -10,0000) of all individual stocks in each country in a given month. Data is obtained from *Global Compustat.*
Market Turnover	the value-weighted average of the turnover-defined as the average daily trading volume divided by the number of shares outstanding at the beginning of year- of all individual stocks in each country in a given month of all individual stocks in each country in a given month. Data is obtained from *Global Compustat.*
Short-term Interest Rate	For each country, the local short term interest rate is defined as the 3-month treasury bills. If not available, we use the money market rate, deposit rate or the lending rate. Data is obtained from *International Financial Statistics of IMF.*
U.S. Commercial Spread	The difference between the percentage 90-day AA nonfinancial commercial paper interest rate and the 3-mnth T-bill rate. Data is obtained from *the Federal Reserve*.
$R^2_{Turnover}$	Computation is similar to the liquidity commonality measure R^2_{Amihud}, which is described in details in section 2.2. It is orthognolized to supply side factors by computing the residuals from a regression of it on supply factors, namely local short-term Interest Rate and U.S. Commercial Paper for each country. Data is obtained from *Global Compustat*.
Net % Equity Flow	For each country, it is the difference of the item: "Gross purchases of foreign stock by foreigners to U.S. residents" and the item: "Gross purchases of foreign stocks b foreigners from U.S. residents" scaled by the sum of the two items. Data is obtained from *Treasury International Capital (TIC).*
Gross Capital Flow/GDP	For each country, it is the sum of the item: "Gross sales of long-term domestic and foreign securities by foreigners to U.S. residents and the item:" Gross purchases of long-term domestic and foreign securities by foreigners from U.S. residents" scaled by GDP. Data is obtained from *Treasury International Capital (TIC).*
Exchange rate	For each country, it is the changes of local currencies relative to Special Drawing Rights (SDR). Data is obtained from *International Financial Statistics of IMF.*
U.S. sentiment index	Constructed by Baker and Wurgler (2006) and obtained from Wurgler's website
Oil Return	Log difference of oil futures price in t and t-1. Data is obtained from *U.S. Energy information administration.*
Oil Volatility	The conditional variance of the GARCH process of Oil Return. Details on computations can be found in section 2.3. Data is obtained from *U.S. Energy information administration*

Table A2: Oil data by country

This table reports the country medians of GDP (in constant 2005 billion $US), production, consumption, exports and imports of crude oil (in thousands barrels per day), over the period 1995 to 2012. It also reports the median of the oil sensitivity ratio, which is defined as the absolute value of the difference in oil exports and imports scaled by GDP in constant 2005 Billion U.S. Dollar. The last 6 columns are indicators of the variables, production, consumption, export, import, and oil sensitivity ratio that are set to "Yes" if the country median of the variable is above the median of all countries for that variable; they are set to "No" otherwise. The indicators net producer and net exporter are reported "Yes" if the country is a net producer and net exporter by median, respectively, and "No" otherwise..

Country	*GDP*	*Prod.*	*Cons.*	*Exports*	*Imports*	*Oil Sens. Ratio*	*High Prod.*	*High Cons.*	*High Export*	*High Import*	*High Oil Sens.*	*Net Producer*	*Net Exporter*
Saudi Arabia	314.18	10195.76	1829.50	6693.25	0.00	21.30	Yes	Yes	Yes	No	Yes	Yes	Yes
Nigeria	105.92	2236.80	281.13	2092.27	0.00	19.75	Yes	Yes	Yes	No	Yes	Yes	Yes
Kuwait	72.32	2358.71	291.57	1354.14	0.00	18.72	Yes	Yes	Yes	No	Yes	Yes	Yes
UAE	168.99	2713.79	469.59	2122.80	0.00	12.56	Yes	Yes	Yes	No	Yes	Yes	Yes
Qatar	60.80	1090.35	77.36	683.23	0.00	11.24	Yes	No	Yes	No	Yes	Yes	Yes
Norway	297.15	3062.36	221.55	2692.84	18.58	9.00	Yes	No	Yes	No	Yes	Yes	Yes
Singapore	121.46	9.90	776.82	0.70	975.04	8.02	No	Yes	No	Yes	Yes	No	No
Russia	716.23	8904.27	2767.98	4663.78	78.26	6.40	Yes	Yes	Yes	No	Yes	Yes	Yes
Thailand	180.77	259.84	961.01	37.71	786.06	4.14	Yes	Yes	Yes	Yes	Yes	No	No
S. Korea	856.13	17.08	2165.25	1.99	2382.05	2.78	No	Yes	No	Yes	Yes	No	No
Philippines	99.23	19.20	330.52	0.00	244.60	2.46	Yes	Yes	No	Yes	Yes	No	No
India	792.38	826.41	2488.29	0.00	1850.33	2.34	Yes	Yes	No	Yes	Yes	No	No
Mexico	838.96	3441.01	2069.42	1707.55	8.59	2.03	Yes	Yes	Yes	No	Yes	Yes	Yes
Netherlands	659.44	49.88	933.26	23.22	1282.84	1.91	No	No	Yes	Yes	Yes	No	No
Greece	222.42	7.11	401.30	0.10	409.80	1.84	No	Yes	No	Yes	Yes	No	No
Belgium	376.02	11.34	625.27	62.02	717.84	1.74	No	No	Yes	Yes	Yes	No	No
Sri Lanka	23.69	-0.52	79.63	0.00	40.33	1.70	No	Yes	No	Yes	Yes	No	No
Israel	138.88	3.81	244.11	0.00	232.22	1.67	No	Yes	No	Yes	Yes	No	No
S. Africa	246.17	201.97	497.06	1.00	411.85	1.67	Yes	Yes	No	Yes	Yes	No	No
Chile	118.44	17.16	262.20	0.00	192.22	1.62	No	Yes	No	Yes	Yes	No	No
Malaysia	136.70	766.00	493.95	365.04	147.80	1.59	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Egypt	87.61	738.85	584.31	139.15	0.00	1.59	Yes	Yes	Yes	No	Yes	Yes	Yes
Portugal	193.39	3.97	305.36	0.00	270.85	1.40	No	No	No	Yes	Yes	No	No
Pakistan	102.20	63.85	358.60	1.55	144.68	1.40	Yes	Yes	Yes	Yes	Yes	No	No
Finland	195.15	9.16	212.15	0.00	234.12	1.20	No	No	No	Yes	Yes	No	No
Poland	297.31	26.53	442.40	4.28	359.36	1.19	No	No	No	Yes	No	No	No
Sweden	372.99	4.03	365.02	8.97	408.27	1.07	No	No	Yes	Yes	No	No	No
Spain	1098.61	28.33	1454.26	0.00	1165.66	1.06	No	No	No	Yes	No	No	No

Table A2 - Continued

Turkey	449.45	53.01	658.54	0.00	470.70	1.05	No	No	No	Yes	No	No	No
Italy	1802.45	147.15	1831.73	16.68	1813.94	1.00	No	No	No	Yes	No	No	No
Japan	4446.03	122.23	5293.08	0.00	4275.99	0.96	No	No	No	No	No	No	No
China	2152.96	3623.83	6007.80	147.37	2127.35	0.92	Yes	Yes	Yes	Yes	No	No	No
Peru	72.73	117.49	159.58	20.33	87.05	0.92	Yes	Yes	Yes	Yes	No	No	No
Argentina	214.77	811.80	543.18	206.17	14.20	0.89	Yes	Yes	Yes	No	No	Yes	Yes
USA	12438.81	9028.10	19508.65	127.45	10267.64	0.82	Yes	No	No	No	No	No	No
Canada	1111.31	3104.97	2192.24	1722.36	849.22	0.79	Yes	Yes	Yes	No	No	Yes	Yes
France	2139.42	89.15	1984.17	5.59	1684.36	0.78	No	No	No	No	No	No	No
Germany	2848.20	135.33	2663.63	14.62	2125.58	0.74	No	No	No	No	No	No	No
Indonesia	278.17	1214.35	1187.62	504.07	307.32	0.71	Yes	Yes	Yes	Yes	No	Yes	Yes
New Zealand	109.22	47.82	147.90	27.62	97.62	0.64	Yes	No	Yes	No	No	No	No
Austria	306.18	26.64	268.07	0.47	166.77	0.54	No	No	No	No	No	No	No
Denmark	255.21	296.55	190.54	188.79	79.03	0.43	Yes	No	Yes	No	No	Yes	Yes
Bangladish	66.64	5.05	83.32	0.00	25.02	0.38	No	No	No	No	No	No	No
Ireland	194.60	-0.24	168.99	0.00	63.04	0.32	No	No	No	No	No	No	No
Switzerland	398.52	2.60	267.34	0.00	101.07	0.25	No	No	No	No	No	No	No
Australia	666.39	616.96	934.72	275.75	418.79	0.21	Yes	No	Yes	No	No	No	No
Brazil	875.49	1843.19	2126.56	238.34	409.55	0.20	Yes	Yes	Yes	No	No	No	No
UK	2320.06	100.09	1762.40	1436.75	1111.29	0.14	No	No	Yes	No	No	No	Yes
Tawian	10587.58	9.48	932.42	0.00	835.50	0.08	No	No	No	No	No	No	No
Hong Kong	171.63	0.00	295.83	0.00	0.00	0.00	No	No	No	No	No	No	No
Mean	**1055.99**	**1169.25**	**1423.94**	**551.76**	**793.85**	**3.12**							
Median	**278.17**	**100.09**	**497.06**	**14.62**	**270.85**	**1.19**							

Vita

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