Liquidity in an emerging bond market: a case study of corporate bonds in Malaysia

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Abstract:

Most of what is known about the functioning of corporate bond markets is based on studies of large developed markets. Using a previously unexploited dataset, we examine the evolution of trading activity and costs in a small emerging bond market, that of Malaysia. Our results indicate that the drivers of liquidity in the Malaysian market are similar to those in larger markets. Bid-ask spreads and turnover ratios confirm that liquidity improved between 1998 and 2004 but show little change thereafter, suggesting that the importance of fragmentation as an impediment to liquidity increases as the market develops.

JEL classification: G10, G18, O16

1. Introduction

The development of post-trade reporting systems, electronic trading platforms and credit default swap markets and have shed much light on the functioning of what was historically one of the most opaque segments of financial markets: corporate bond markets. However, the light has mainly been directed at the largest corporate bond markets, in particular the US market. Much less is known about the functioning of small, emerging bond markets. This study helps to fill that gap by examining patterns of liquidity in the Malaysian corporate bond market. We use a previously unexploited dataset capturing all secondary market transactions in ringgit corporate bonds to compare trading costs and activity over the 1998-2006 period.

The Malaysian market is interesting for several reasons. First, it is a small but diverse market. The capitalisation of the ringgit corporate bond market was only $60 billion at end-2006, in contrast to the US dollar and euro markets of several trillion. Nevertheless, in terms of the heterogeneity of instruments and the sophistication of the infrastructure, the ringgit market compares more favourably with the largest markets than do most other emerging bond markets. This makes it a good test case for examining whether our understanding of the determinants of liquidity in the largest markets can help to guide the development of small emerging bond markets.

Second, two corporate bond markets co-exist in Malaysia: one for Islamic instruments and another for conventional instruments. Liquidity tends to concentrate in certain instruments and therefore such market fragmentation can have a detrimental impact on liquidity. At the same time, the growth of the Islamic bond market has the potential to increase the diversity of the investor base and thereby boost trading activity. *A priori*, it is unclear which development will dominate.

Third, the microstructure of the Malaysian corporate bond market has changed significantly over the past decade. For example, post-trade disclosure was introduced in 1997, guidelines for repurchase and securities lending agreements were clarified in 2001, and non-residents were exempted from withholding taxes on interest income in 2004. Theory and empirical evidence from other markets suggest that these changes should enhance market liquidity, but there remains uncertainty about the relative importance of different changes.

There is a growing literature examining trading costs in corporate bond markets. However, almost all prior studies focus on the US market; ours appears to be the first bond-level study of trading costs in a small emerging market. Based on a large sample of corporate bond transactions by US insurance companies, Schultz (2001) finds that trading costs decline with trade size and a customer's trading activity. Using similar data, Chakravarty and Sarkar (2003) conclude that bid-ask spreads are positively correlated with maturity and credit risk and negatively correlated with trading volume.

More recent studies examine transactions reported through the Trade Reporting and Compliance Engine (TRACE). TRACE was established in 2002 to improve the transparency of the US corporate bond market. Edwards, Harris and Piwowar (2004) report that trading costs are lower for large trades, large issue sizes, new issues, highly rated bonds, floating rate structures, complex securities and firms with listed equity. Moreover, they find that execution costs are lower for bonds whose trades are disseminated through TRACE. Bessembinder et al (2006) obtain similar results.

The size and liquidity of a market are closely correlated (McCauley and Remolona (2000)). Therefore, it is not obvious that conclusions about trading costs in the US market will also hold for small emerging bond markets. Institutional differences explain part of the variation in liquidity across markets. Using cross-country data, Asian Development Bank (2006) finds that the rule of law, the absence of capital controls, the availability of derivatives and low exchange rate volatility contribute positively to bond market liquidity.[1] But even after controlling for these differences, the size of the market also matters. Large markets enjoy economies of scale in trade processing, clearing and settlement; they are less vulnerable than small markets to anti-competitive behaviour by dealers and investors; and they are likely to trade a fuller range of instruments, especially derivatives (Bossone et al (2001)). In short, size can influence the functioning of a bond market.

Notwithstanding inherent differences between small and large markets, our results indicate that the drivers of liquidity in a small emerging bond market are

[1] Burger and Warnock (2006) and Eichengreen and Luengnaruemitchal (2006) obtain similar results, but their dependent variable is market capitalisation rather than liquidity.

similar to those in much larger markets: the riskiness of a security is a key determinant of bid-ask spreads, and trade size is more important than issue size. Changes in the microstructure of the Malaysian corporate bond market, in particular greater transparency, led to a significant improvement in liquidity. In the late 1990s and early 2000s, both conventional and Islamic instruments benefited from this improvement. However, in 2006 the improvement in liquidity was concentrated in Islamic instruments, indicating that the importance of fragmentation as an impediment to liquidity increases as the market develops.

The rest of the paper is organised as follows. Section 2 outlines the structure of the corporate bond market in Malaysia, and section 3 describes our dataset. Section 4 reviews different measures of liquidity. Section 5 offers an empirical analysis of the determinants of liquidity. Section 6 concludes.

2. The corporate bond market in Malaysia

The corporate bond market in Malaysia is one of the most advanced in Asia.[2] The so-called private debt securities (PDS) market, which encompasses ringgit-denominated issues from quasi-government entities, financial institutions and non-financial companies, is a large, diverse market supported by sophisticated reporting and settlement systems.

The outstanding stock of PDSs totalled RM223 billion at end-2006, equivalent to about US$63 billion and 41% of Malaysian GDP. Although not large in US dollar terms, relative to the size of the economy the PDS market is amongst the largest in Asia. Moreover, in contrast to most other emerging bond markets, the corporate bond market in Malaysia is as large as the government securities market (Exhibit 1).

Long-term corporate bonds account for 95% outstanding PDSs. This includes straight bonds, medium-term notes and convertible bonds. Commercial paper and asset-backed securities make up the remainder. Corporate bonds with maturities as long as 22 years have been issued, although the majority of issues are in the five to 10 year range.

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[2] For a more comprehensive discussion of the corporate bond market in Malaysia, see Ibrahim and Wong (2005) and Bank Negara Malaysia (2006).

A unique feature of the Malaysian corporate bond market is the large amount of Islamic issuance. Islamic securities are structured to comply with *Shariah* principles, in particular the prohibition on the charging of interest. The most common structure is a sale and buyback transaction, wherein instead of interest investors receive dividends generated by the underlying assets. The Islamic segment of the PDS market has grown rapidly in recent years, and at end-2006 Islamic securities accounted for almost half of outstanding PDSs.

Financial institutions are the most active private sector issuers, followed by utilities and construction firms. The single largest issuer is Cagamas Berhad, the national mortgage corporation. It alone accounted for almost 10% of outstanding PDSs at end-2006. Another important issuer is Khazanah Nasional Berhad, a government-owned investment holding company. Regulations were eased in 2004 to permit selected foreign issuers to raise funds in the ringgit market, but they accounted for only 2% of bonds outstanding at end-2006.

The vast majority of issues are of high credit quality. Prior to 2000, issuance was restricted to those securities which secured a rating of BBB or higher from one of the two local credit rating agencies.[3] This minimum rating requirement has since been eliminated, although all issues must still be rated. Nevertheless, at end-2006 only 6% of the corporate bonds rated by Malaysia Rating Corporation (MARC) were rated below A; 59% were rated A and 35% were AA or AAA (MARC (2007)).

Most corporate bonds end up in the portfolios of investors who follow a buy-and-hold strategy. This includes insurance companies, asset management companies and government-controlled pension and savings funds. High net worth individuals and non-residents are also important investors. While comprehensive ownership data are not readily available for corporate bonds, they are published for Malaysian government securities (MGSs). At end-2006, pension funds held 58% of

[3] The rating categories used by Rating Agency Malaysia (RAM) and Malaysian Rating Corporation (MARC) are similar to those used by international rating agencies, although rating methodologies are not necessarily comparable across agencies. Securities rated AAA are considered by RAM and MARC to be of the highest credit quality, followed by securities rated AA, A, BBB, BB, B, C and finally D for securities in default. Securities issued or guaranteed by the Malaysian government are not rated by either RAM or MARC. At end-2006, the Malaysian government's long-term foreign currency debt was rated A- by Standard & Poor's and Fitch and A3 by Moody's.

outstanding MGSs, banks 15%, insurance companies 10%, public sector entities 8% and non-residents 8%.

Issuance in the primary market, as well as the settlement and reporting of transactions, are centralised and fully electronic. The systems underpinning the PDS market are the same as those used in the MGS market. Commercial paper and other short-term PDSs are typically tendered for sale through the Fully Automated System for Issuing/Tendering (FAST). Some corporate bonds are also tendered through FAST but most are issued as private placements. All transactions are settled through the Real Time Electronic Transfer of Funds and Securities System (RENTAS), usually two days after the trade. Information about secondary market transactions is disseminated through the Bond Information and Dissemination System (BIDS).

The impressive development of the PDS market over the past two decades was in part the result of initiatives by the central bank and other regulatory agencies. Following the Asian financial crisis of 1997-98, the Malaysian authorities stepped up their efforts to promote the bond market as an alternative source of debt finance for private sector borrowers (Ibrahim and Wong (2005)). Bank Negara Malaysia spearheaded the development of FAST, RENTAS, BIDS and other parts of the market's infrastructure. Regulations restricting market access and trading were progressively eased to provide issuers and investors with more opportunities for diversification.

3. BIDS and data description

To examine liquidity in the ringgit market, Bank Negara Malaysia (BNM) provided us with a complete record of corporate bond transactions reported to BIDS between 1 October 1997 and 31 December 2006. This is one of the most comprehensive corporate bond trading datasets ever assembled and has not been analysed in any previous study.

BIDS was launched in October 1997 to facilitate the pricing and trading of ringgit debt securities. Prior to its launch, very little information about quotes or transactions was available to market participants. Then as now, most trading took place in the over-the-counter market and quotes were typically obtained directly from

dealers over the telephone.[4] BIDS greatly enhanced the post-trade transparency of the ringgit market by providing information in almost real time about the price and volume of the latest transaction in any given bond. Financial institutions in Malaysia are required to report to BIDS all transactions in all ringgit-denominated debt securities (MGSs as well as PDSs). Trades must be reported within 10 minutes of execution. Dealers can also disseminate indicative bids and offers through BIDS but these are usually only posted for government securities; pre-trade transparency in the Malaysian corporate bond market is limited.[5]

Post-trade transparency in the ringgit market is more complete even than disclosure in the US corporate bond market. A large number of transactions in the US market are either exempt from TRACE reporting or, if reported, not disseminated.[6] Furthermore, unlike in BIDS, TRACE does not disclose the exact amount transacted for deals exceeding $5 million (or $1 million in the case of bonds rated below BBB). Finally, the time lag allowed for dealers to report trades to TRACE is 15 minutes, five minutes longer than in Malaysia.

The dataset we assemble from BIDS captures over 77,000 transactions in 1,609 different securities. Numerous details about each transaction are recorded, including the trade date and time, face value of the trade, clean price, counterparty, issuer code and credit rating, issue and maturity dates, and amount outstanding. Each financial institution participating in the transaction is identified by an anonymous code, but no distinction is made between those financial institutions which are market makers and those which are financial customers. The dataset indicates which side of the trade each financial institution was on (buyer or seller), but BIDS does not record who initiated the trade, ie whether the trade was a buy or a sell.

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[4] A small number of corporate bonds are listed on Bursa Malaysia.

[5] Other potential sources of quote data are still in their infancy in the ringgit bond market. Two electronic trading platforms were registered in 2006 but they focus mainly on foreign exchange products, money market instruments and government securities. A bond pricing agency, specialising in the estimation of the fair value of bonds, was established in 2006. Credit default swaps, which provide a reference for pricing credit risk, were authorised to be traded by licensed financial institutions in 2006.

[6] Transactions in government agency securities, mortgage- or asset-backed securities, collateralised mortgage obligations and money market instruments are not reported to TRACE, and transactions in securities sold to institutional investors under Rule 144A of US securities regulations are not disseminated.

The dataset excludes transactions in securities issued by the Malaysian government and BNM. It also excludes money market instruments (ie debt securities with an original maturity of less than 364 days) and medium-term notes. Given the incomplete coverage of money markets in our dataset, we eliminate all instruments with a remaining maturity of less than one year, ie all trades that take place within 364 days of the maturity date. In addition, we eliminate observations where the price differs from the preceding and following prices by at least 10% as well as those where the characteristics of the bond, such as the issue size and maturity date, are inconsistent across transactions. The quality of the data in the first few weeks after the launch of BIDS is especially poor, and so we exclude all transactions in 1997.

Furthermore, we screen for cross trades. Securities regulations in Malaysia require that asset managers seeking to transfer securities between clients' accounts execute the transaction through a dealer at arm's length; sales and purchases cannot be conducted internally.[7] Such cross trades are typically executed at a minimal bid-ask spread, or even no spread. To control for cross trades, we eliminate all transactions where dealer A sells a bond to dealer B, who then turns around and sells the same bond in the same amount back to dealer A within a few minutes. In addition, we eliminate any back-to-back transactions that are settled at exactly the same price, ie where the bid-ask spread is zero.[8]

The final sample comprises 61,361 transactions in 1,526 different bonds. It captures 71% of total turnover over the 1997-2006 period. In 2000 and 2001 the final sample captured close to 80% of total turnover, but in 2006 it captured only 61% (Exhibit 2). The main reason for the large difference between the raw and final samples is the elimination of cross trades. Cross trades, as defined above, account for 17% of total turnover over the 1997-2006 period, and trades that take place within 364 days of the maturity date for another 5%.

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[7] See clause 4.03 of the Guidelines for Compliance Function for Fund Managers, issued by the Malaysian Securities Commission.

[8] Trading activity in Malaysia is also potentially inflated by dealers' efforts to meet their obligations under BNM's Principal Dealer system. Principal Dealers are required to maintain a minimum 5% share of secondary market activity in MGSs and PDSs combined. This creates an incentive to inflate trading volumes. Some of this activity is likely to be captured by our screen for cross trades, and so we do not control explicitly for inflated trades.

In the final sample, trading amongst financial institutions accounts for 52% of market turnover, and transactions between financial institutions and non-financial entities for the remainder.

4. Measures of liquidity

Liquidity has at least three dimensions: tightness, depth and resiliency (Committee on the Global Financial System (2000)). Tightness refers to trading costs, specifically how far transaction prices diverge from the mid-market price. Depth refers to the volume of trades possible without impacting market prices. Resiliency refers to the speed with which a market adjusts to imbalances in order flow. A variety of measures have been proposed in the literature to capture these dimensions. We focus on two: turnover and bid-ask spreads.

Turnover

Turnover, or trading volume, is closely related to the depth of the market. Volume averaged over some period indicates the order flow a market can accommodate without exacerbating price movements. For each bond in the sample, we calculate an annual turnover ratio, or ratio of total trading volume in a given year to the amount outstanding at the end of that year. To control for outliers we discard the top and bottom 1% of observations. This leaves us with a sample of 3,605 observations (Exhibit 3).

For the sample of traded bonds, the mean turnover ratio was 1.37 in 2006 and the median ratio 1.00. The distribution of trading activity is highly skewed: many bonds do not trade while a few bonds trade actively. The sample excludes bonds which do not trade, and therefore the turnover ratio for the population of corporate bonds is much lower than our estimate. The turnover ratio for the population can be approximated by dividing the annual turnover of all corporate bonds by the stock of bonds outstanding at the end of the year. For the turnover and types of instruments in our final sample, the market turnover ratio was about 0.5 in 2006 (Exhibit 4).

Consistent with the pattern in other countries, corporate bonds in Malaysia are less actively traded than government securities. The turnover ratio for the MGS market, including cross trades, was 2.6 in 2006, compared to 1.0 for the PDS market if calculated on a comparable basis (Exhibit 4).

Exhibit 4 adjusts for known differences in the compilation of turnover data across countries.[9] Trading activity in the MGS market is substantially lower than in many larger markets. In the Japanese government bond market, the turnover ratio was almost twice as high, and in the US Treasury market it was 14 times higher. In contrast to the MGS market, trading volumes in the Malaysian corporate bond market compare favourably with those in other corporate bond markets. The turnover ratio for our sample of bonds is slightly higher than for Japanese corporate bonds and not far below that of US corporate bonds. From this admittedly narrow perspective, the PDS market appears to be a relatively well developed market.

Looking at the evolution of turnover in the Malaysian corporate bond market, there was a definite improvement in the early years of the sample period. For our sample of bonds, the turnover ratio rose from 0.53 in 1998 to a peak of 2.30 in 2003 (Exhibit 3). It subsequently declined, although between 2004 and 2006 it remained significantly above its 1998-99 level.

Even though the turnover of traded bonds did not increase after 2003, the number of traded bonds rose markedly. Especially noteworthy was the increase in the number of issuers with traded bonds; bonds from more and more firms began to trade. The number of issuers with bonds that traded at least once during the year increased from 48 in 1998 to 178 in 2005 before levelling out. As a result, the concentration of secondary market activity diminished almost continuously during the sample period. Whereas in 1998 the two most actively traded issuers accounted for 85% of total turnover in the corporate bond market, by 2006 their share had dropped to 23% (Exhibit 5). The Herfindahl index of concentration declined markedly, from 0.36 in 1998 to 0.18 in 2001 and 0.03 in 2006.

The growth of the ringgit market over the sample period potentially masks underlying trends in turnover. In particular, the number of new bonds issued in a given year can have an impact on total turnover in the market. In the ringgit market, like in most bond markets, trading activity during the first few weeks after the issue

[9] Important differences across bond markets include: whether trades are counted on a one-way or a two-way basis (wherein each transaction is counted twice, as a sale plus a purchase); whether trades related to repurchase agreements are reported together with other trades; whether securities with a short remaining term maturity are distinguished from longer-term instruments; and which types of instruments are classified as corporate, financial or government bonds.

date is much higher than in later weeks. For corporate bonds issued between 1998 and 2006, the turnover ratio averaged 8.6 in the first month. It then dropped to 1.9 in the second month and around 1.0 in the third and subsequent months. This pattern mainly reflects the process of distributing new issues to end-investors.

To control for primary market activity, we eliminate all new issues. This leaves us with a sample of 2,692 bonds. As expected, the turnover ratio is lower for seasoned issues: 1.66 versus 1.82 for the full sample over the 1998-2006 period. Yet, changes in the turnover ratio and in the concentration of trading activity over time are similar. This indicates that the increase in market depth evident over the 1998-2006 period was not driven (solely) by the growth of the market.

Bid-ask spreads

To complement measures of depth, we estimate trading costs. The most comprehensive measure of trading costs is the effective spread, defined as the transaction price less the mid-point of quoted bid and ask prices. This measure incorporates price movements triggered by the trade itself. It is the measure used by Goldstein et al (2005) and Biais et al (2006). However, it is problematic to construct effective spreads for the Malaysian market because quotation data for many corporate bonds are not readily available.

Some other studies develop econometric models of trading costs. Edwards et al (2004) and Bessembinder et al (2006) estimate an indicator variable regression, incorporating information about whether the dealer participated in a transaction as a buyer or a seller. Again, it is difficult to estimate such a model for the Malaysian market because BIDS contains no information about the initiator of the trade.

Instead we compute the realised spread. This is the average price of dealers' sales less the average price of dealers' purchases, where each price is weighted by the par value of the transaction. More precisely, the realised bid-ask spread is calculated as follows:

$$Spread_{i,t}^{k} = \sum_{a=1}^{N} Ask_{i,a}^{k} \frac{Trade_{i,a}^{k}}{\sum_{a=1}^{N} Trade_{i,a}^{k}} - \sum_{b=1}^{M} Bid_{i,b}^{k} \frac{Trade_{i,b}^{k}}{\sum_{b=1}^{M} Trade_{i,b}^{k}}$$

where $Ask_{i,a}^{k}$ = the price dealer k received from the sale of bond i in transaction a; $Bid_{i,b}^{k}$ = the price dealer k paid for the purchase of bond i in transaction b; $Trade_{i,a}^{k}$ ($Trade_{i,b}^{k}$) = the par value of transaction a (b); and N (M) =

the number of transactions occurring over a given period t at dealer k's ask (bid) price for bond i.

If the identity of dealer k is known, then $Spread_{i,t}^{k}$ is equivalent to the dealer round-trip spread estimated by Goldstein et al (2005). If the identity of dealer k is not known, then $Spread_{i,t}$ is equivalent to the measure used by Hong and Warga (2000) and Chakravarty and Sarkar (2003).

$Spread_{i,t}^{k}$ takes advantage of one of the unique features of our dataset: the identity of each counterparty to a trade. Furthermore, the realised spread has the advantage of simplicity. In particular, it does not depend on any assumptions about the appropriate model of transaction costs. Finally, if computed over a short time interval (eg daily), then the realised spread is unlikely to be distorted by news-driven movements in the price level. However, it requires that those sale and buy transactions which cannot be matched be disregarded. This results in the loss of about 30% of all transactions in the BIDS database. Many of the eliminated transactions relate to bonds that are not frequently traded. As a result, the sample is likely to be biased towards those bonds that trade more frequently.

We estimate $Spread_{i,t}^{k}$ over a one-day interval, ie t comprises all transactions between 9:00 and 18:00. This leaves us with a sample of 14,958 spreads (Exhibit 3).

Our estimate of the realised bid-ask spread is 0.066 for MYR 100 par value over the 1998-2006 period. In other words, for a bond valued at MYR 100, the bid price would be MYR 99.967 and the ask price 100.033. In yield terms, this is equivalent to 1-2 basis points (for bonds with a duration of 3-6 years). $Spread_{i,t}^{k}$ declined significantly in the early years of the sample, from a mean of 0.108 in 1998 to 0.048 in 2000, and fluctuated between 0.05 and 0.07 thereafter.

Our estimate of $Spread_{i,t}^{k}$ is suspiciously low. Indicative bid-ask spreads for ringgit corporate bonds are as high as 19 basis points (ADB (2006)). Even the most actively traded non-government bonds, those of Khazanah and Cagamas, are quoted at spreads no tighter than 5 to 7 basis points (Deutsche Bank (2007)). While indicative spreads are typically higher than realised spreads, ratios greater than 2:1 are exceptional.

Moreover, our estimate of realised spreads in the ringgit market is lower than similar estimates for US and European markets. For US corporate bonds, Chakravarty and Sarkar (2003) calculate that the realised spread was 0.21 per $100 par value in the mid-1990s, and Goldstein et al (2005) estimate that the one-day round-trip spread ranged between 0.50 and 2.35 in 2002-04. For European corporate

bonds, Financial Services Authority (2006) finds that the one-day round trip spread averaged 0.058 in 2005, and Biais et al (2006) estimate that the effective spread ranged between 0.10 and 0.20.

It is unlikely that competition among market makers explains our low estimate of realised spreads. In a model of search and bargaining costs in over-the-counter markets, Duffie et al (2005) show that bid-ask spreads are lower if investors have easier access to multiple market makers. Biais et al (2006) cite the high level of competition among dealers as the main explanation for their finding that spreads in the European corporate bond market are lower than in the US market. It seems implausible that competition in the Malaysian market is more intense than in the much larger European or US markets. On the contrary, market making in Malaysia appears to be relatively concentrated. About 50% of bonds are traded by only one dealer, and another 20% by no more than two dealers. The three most active financial institutions account for 29% of total turnover over the sample period, and the ten most active 56%.

An alternative explanation for the low estimate is that dealers may take negligible risks. In other words, they may act more like brokers than dealers. Whereas dealers buy and sell for their own accounts, and so are exposed to the risks associated with maintaining an inventory of bonds, brokers match buyers and sellers and do not hold any securities. In the next section, we explore this question further by analysing whether the riskiness of a security affects bid-ask spreads.

5. Determinants of liquidity

The market microstructure literature has identified a number of variables that might influence trading costs. One set of variables relates to the specific characteristics of the bond, another to the characteristics of the transaction, and a third set to the structure of the market.

Liquidity is commonly perceived to be positively correlated with the size of a bond. The rationale usually given is that the supply potentially available for trading is greater for larger issues. We define $Issue\ size_{i,t}$ as the face value of the amount outstanding for bond i on day t, measured in billions of ringgit. Another typical finding is that newly issued, on-the-run bonds are more actively traded than older issues. $New\ issue_{i,t}$ is a dummy variable equal to one if bond i was issued within three months of day t and zero otherwise.

Models of dealers' inventory costs suggest that there is a negative relationship between liquidity and the riskiness of a bond (Stoll (1978); Ho and Stoll (1981)). Interest rate risk can be proxied using maturity, and the credit quality of a bond can be captured using agencies' credit ratings. $Maturity_{i,t}$ is defined as the difference between the maturity date and day t, measured in years.[10] To allow for a non-linear relationship, we also include the square of the time to maturity, $Maturity\ squared_{i,t}$.

$Credit\ rating\ dummies_{i,t}$ are based on ratings from the two local Malaysian agencies. We define five dummy variables for categories AA, A, BBB, $Guaranteed$, $Foreign$ and $Unrated$. The omitted category is bonds rated AAA. Bonds guaranteed by the Malaysian government are not rated by the local agencies and so are included as a separate category. In our sample, the only issuer of guaranteed bonds is Khazanah. Similarly, bonds issued by multilateral development banks or foreign companies and rated by an international agency are exempt from the requirement to obtain a local rating. Following the easing of restrictions on ringgit-denominated borrowing by non-residents in 2004, several foreign issuers tapped the ringgit market, including the Asian Development Bank, World Bank, International Finance Company and the German development bank KfW. The category $Foreign$ equals one for bonds from these entities. In principle, $Guaranteed$ and $Foreign$ should capture all bonds not rated by the Malaysian agencies. However, they do not and so the remaining bonds are categorised as $Unrated$. There are no bonds rated below BBB in our sample. Also, all bonds have only one rating.

Turing to transaction-specific variables that might influence liquidity, one important variable is trade size. In bond markets, institutional investors trading in large amounts typically enjoy lower transaction costs than retail investors trading in small amounts. We include six $Trade\ size\ dummies_{i,t}^{k}$, for trades $\leq$1 million, >1 and <5 million, >5 and <10 million, =10 million, >10 and <20 million, and $\geq$ 20 million. The omitted category is trades equal to RM5 million. This is the standard lot in the ringgit market, as specified by the rules governing BIDS. The trade size is calculated as the average size of all transactions by dealer k in bond i on day t.

[10] Although this variable will overestimate the effective time to maturity of callable bonds, to our knowledge none of the bonds in our sample include a call option.

Access to information and trading technology often varies across counterparties, and this can impact the liquidity available to different counterparties. We distinguish three types of counterparties: dealers, financial institutions (FI) and non-financial customers (Others). Dealers are not separately identified in the dataset and so we classify the seven most active financial institutions as dealers.[11] To capture trades among different counterparties, we define five $Counterparty\ dummies_{i,t}^{k}$: Dealer-Dealer, Dealer-FI, Dealer-Other, FI-Other and Dealer-FI-Other. The omitted category is transactions between two financial institutions (FI-FI).

Dealers' trading costs are potentially affected by the level of their inventory. For example, dealers holding a large inventory of a bond might seek to reduce their holdings by tightening their spreads. The change in inventory is captured with two $Inventory\ dummies_{i,t}^{k}$: one for round-trip transactions that result in an increase in inventory on day t (a dealer's purchases exceed his sales) and a second for round-trips that reduce inventory (sales exceed purchases). Trades that have no impact on inventory equal zero.

Market conditions on day t can have an important impact on spreads. Increased uncertainty about macroeconomic or financial conditions might lead market makers to reduce their risk exposure, resulting in a deterioration in market liquidity (Committee on the Global Financial System (1999); Borio (2000)). As a proxy for market conditions, we use squared daily returns on the Kuala Lumpur equity index, $Market\ return\ squared_{t}$. A government bond index would better reflect conditions in bond markets, but daily indices for ringgit bonds start in 2001, about half way through our sample.

A final set of factors that might influence liquidity is features specific to the Malaysian market. The authorities have implemented many measures to promote the development of the ringgit market over the past decade, including the introduction of post-trade transparency and the exemption of non-residents from withholding taxes (Exhibit 6). These might have impacted liquidity and so we include eight

[11] BNM introduced a principal dealer system in 1989. It appoints, on an annual basis, 10 principal dealers. We classified as dealers those financial institutions that were ranked amongst the top 10 traders for at least five of the 10 years in our sample. There were only seven financial institutions that met these criteria, and the same institutions ranked as the top seven traders over the full sample.

$Year\ dummies_t$, for 1998, 1999, 2001, 2002, 2003, 2004, 2005 and 2006. The omitted year is 2000.

As mentioned earlier, one of the unique features of the ringgit market is the co-existence of two segments: one for Islamic instruments and another for conventional instruments. There are several reasons why the liquidity of Islamic instruments might differ from the liquidity of conventional instruments. On the one hand, the potential investor base for Islamic instruments is larger, given that non-Islamic investors can invest in both conventional and Islamic instruments but Islamic investors can invest only in the latter. On the other hand, Islamic instruments are more complex products, similar to asset-backed securities, and this might detract from liquidity. To the extent that there is any difference in the liquidity of the two instruments, this difference might have changed over time owing to the rapid growth of the Islamic segment. Therefore, a dummy variable $Islamic_{i,t}$, which equals one for Islamic bonds and zero for conventional issues, is interacted with the $Year_t$ dummies.

To explain differences in liquidity across bonds in our sample, we regress $Spread^k_{i,t}$ on all explanatory variables:

$$\begin{aligned} Spread^k_{i,t} = \quad & \alpha_0 + \alpha_1 Issue\ size_{i,t} + \alpha_2 Maturity_{i,t} + \alpha_3 Maturity\ squared_{i,t} + \\ & \alpha_4 New\ issue\ dummy_{i,t} + \alpha_5 Credit\ rating\ dummies_{i,t} + \\ & \alpha_6 Trade\ size\ dummies^k_{i,t} + \alpha_7 Counterparty\ dummies^k_{i,t} + \\ & \alpha_8 Inventory\ dummies^k_{i,t} + \alpha_9 Market\ return\ squared_t + \\ & \alpha_{10} Year\ dummies_t + \alpha_{11} Year * Islamic\ dummies_{i,t} + \varepsilon^k_{i,t} \end{aligned} \qquad (1)$$

OLS estimation results for equation (1) indicate serial correlation and heteroscedasticity in the error terms. Consequently, equation (1) is re-estimated with Newey-West standard errors. The final estimation results are reported in Exhibit 7.

To test the robustness of our results, we split the sample into two sub-groups: “benchmark” issuers and other issuers. Benchmark issuers are companies whose debt potentially serves as a reference for pricing other securities. Such companies typically copy the issuance strategy of many governments: issue in large size and at regular intervals. As a result of this strategy, benchmark issuers’ bonds are often more liquid than similar bonds from other issuers. We classify as benchmark issuers those borrowers which issued a ringgit bond in at least three of the nine years in our sample, with an average issue size of at least RM500 million.

There are only four issuers which meet both the regularity and size criteria: Cagamas; Khazanah; Prasarana, a state-owned public transportation company; and PLUS, a privately-owned highway concessionaire.

The results confirm that bid-ask spreads are positively correlated with the riskiness of a security. Considering first credit risk, spreads on A-rated bonds are significantly higher, and spreads on guaranteed bonds significantly lower, than those on AAA-rated issues (the omitted category). As for interest rate risk, spreads are a concave function of a bond's remaining maturity. Spreads increase at a decelerating rate for each year up to a maturity of about fifteen years, after which they decrease at an accelerating rate. Maturity has a smaller impact on the spreads of benchmark bonds than on those of other issuers.

However, spreads do not appear to fluctuate with market conditions. Bid-ask spreads for other issuers are positively correlated with squared equity returns, but not overwhelmingly so. For bonds from benchmark issuers, there is no significant relationship between spreads and equity returns. The results similar if equity returns are replaced with bond returns, using HSBC's Asian Local Bond Index for Malaysia from 2001 to 2006.

The relationship between issue size and bid-ask spreads is mixed. For benchmark bonds, larger issue sizes are associated with tighter spreads. However, for other bonds, the opposite is true. One way to interpret this result is that while liquid bonds are usually large issues, large issues are not necessarily liquid. This interpretation is consistent with previous studies, most of which also find a weak relationship between size and liquidity (McGinty (2001)).

As expected, spreads on newly issued bonds are tighter than on seasoned bonds. However, the significance of the $New\ issue_{i,t}$ dummy disappears when the sample is divided into benchmark and other issuers.

Turning to the transaction-specific variables, the results are somewhat puzzling. As expected, spreads for big trades are lower than those for trades of the standard lot size of RM5 million (the omitted category). The difference is particularly large for trades greater than RM10 million. Surprisingly, spreads for small trades are also lower, especially for trades less than or equal to RM1 million. One possible explanation for this latter result is that our screens did not capture all cross-trades.

There is no consistent pattern of differences in bid-ask spreads across counterparties. For all issuers and other issuers, spreads tend to be lowest for trades between dealers and non-FI (other) counterparties. Yet, for benchmark issuers, such

trades result in higher spreads. In larger markets, bid-ask spreads are typically lowest for inter-dealer trades. This is not the case in the Malaysian market, implying that the interdealer market is not well developed.

Dealers react asymmetrically to changes in their inventory. If sales on a given day exceed purchases, then they widen their spreads. But if purchases exceed sales, they leave their spreads unchanged.

The $Year\ dummies_t$ indicate a definite improvement in liquidity during the early years of the sample. In 1998-99 bid-ask spreads for bonds from all types of issuers were significantly higher than in 2000. In 2003-04 there was a further decline in spreads for all issuers. In 2005-06 spreads for other issuers remained around 2003-04 levels, but spreads for benchmark issuers returned to 2000 levels. The introduction of BIDS (in 1997) and growth of the bond market (in 1997-2000) were likely responsible for the decline of bid-ask spreads in 1998-99. The opening up of the bond market to universal brokers (in 2002) was likely responsible for the decline in 2003-04.

The absence of any further improvement in liquidity in 2005-06 appears to be at least partly related to the growth of the Islamic bond market. Islamic bonds traded at wider bid-ask spreads than conventional instruments until about 2004. In 2005 they traded at about the same bid-ask spread as conventional instruments and in 2006 at somewhat tighter spreads. So the liquidity of Islamic instruments improved in 2005-06 even though the liquidity of the overall market did not. This implies that liquidity shifted from conventional instruments to Islamic instruments. Nevertheless, the emergence of the Islamic bond market as an important source of corporate funding might have benefited issuers and investors in other ways, for example by improving the pricing of credit risk. The focus of this study is too narrow to assess the full impact of the growth of the Islamic segment.

To summarise our empirical results, the riskiness of a security is a key determinant of bid-ask spreads in the ringitt-denominated corporate bond market. Whether the security is structured as an Islamic instrument or a conventional instrument also appears to matter, even after controlling for other characteristics of the bond and the transaction. Trade size is more important than issue size; trading costs are not necessarily lower for large issues but are lower for large trades.

6. Conclusions

In the introduction, we identified three issues that a study of the Malaysian corporate bond market might help to shed light on. First, are the determinants of liquidity in a small emerging bond market the same as those in larger markets? Second, how detrimental an impact does market fragmentation have on liquidity? Third, which structural changes have done the most to promote liquidity?

The answer to the first question seems clear: the determinants are broadly the same. In the ringgit market as in the US dollar market, spreads increase with credit risk (lower credit ratings) and with interest rate risk (longer time to maturity) and decrease with trade size. Nevertheless, there are some puzzling characteristics of the Malaysian market. One is why there seems to be no systematic difference between bid-ask spreads on newly issued bonds and those on seasoned issues. Trading volumes are higher for newly issued bonds, which is consistent with patterns of liquidity in other markets, but spreads are not lower. Another puzzle is why bid-ask spreads on trades between dealers are not systematically lower than those on trades with other counterparties. A lack of competition between dealers is a possible explanation for these puzzles, but further research is needed to reach a definitive answer.

Regarding market fragmentation, the co-existence of two corporate bond markets, one for Islamic instruments and another for conventional instruments, appeared not to have a detrimental impact on liquidity during the early phases of the Islamic market's development. Between 1998-1999 and 2003-04, bid-ask spreads for all instruments declined and the turnover ratio increased significantly. After 2004, however, there was no systematic improvement in market liquidity. Instead, liquidity appeared to shift from conventional instruments to Islamic instruments. This indicates that the relative importance of fragmentation as an impediment to liquidity increases as the market develops.

The improvement in liquidity over the 1998-2004 period indicates that some of the structural changes in the ringgit market during those years had a significant impact. The introduction of post-trade transparency in 1997 is arguably the most important change, considering that the improvement in liquidity was most pronounced in 1998-99. However, owing to the absence of pre-1997 data, it is difficult to confirm this hypothesis. In particular, more research is needed to disentangle the contribution to the improvement in liquidity made by structural

reforms from the contribution made by the increase in the absolute size of the ringgit market during these years.

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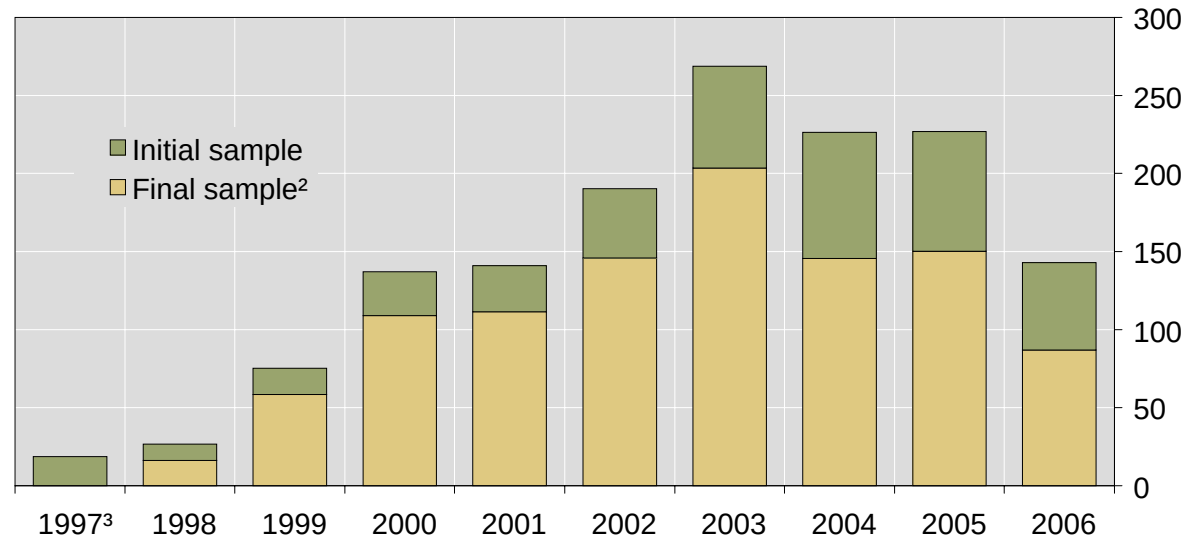
Malaysian money and bond markets

Amount outstanding at end-December 2006	Billions of ringgit			% of PDS
	Conventional	Islamic	All	All
Total debt securities	306.3	146.1	452.4	
Public debt securities	190.1	39.0	229.1	
Short-term debt securities	15.8	11.6	27.4	
Long-term debt securities	174.3	27.4	201.7	
Malaysian government	174.3	19.6	193.9	
Khazanah Nasional	0.0	7.4	7.4	
Other issuers	0.0	0.4	0.4	
Private debt securities (PDS)	116.1	107.1	223.3	100
Short-term debt securities	5.8	5.9	11.7	5
Long-term debt securities	110.3	101.2	211.6	95
Cagamas securities	14.5	6.1	20.6	9
Bonds	62.7	64.9	127.7	57
Medium-term notes	10.9	27.0	37.9	17
Asset-backed securities	10.6	3.2	13.8	6
Other securities	11.6	0.0	11.6	5

Source: FAST website. Exhibit 1

Turnover of corporate bonds[1]



[1] Annual turnover, in billions of ringgit, measured on a two-way basis (buys plus sells); turnover of all PDSs with an original maturity of greater than one year as well as bonds issued by Khazanah Nasional. [2] After screening for short-term instruments, cross trades and erroneous data. [3] Annualised data, based on turnover between October and December 1997.

Source: Bank Negara Malaysia; authors' calculations. Exhibit 2

Indicators of liquidity

	Turnover ratio				Realised bid-ask spread			
	n	Mean	Standard deviation	Median	*n*	Mean	Standard deviation	Median
1998-06	3,605	1.82	1.82	1.33	14,958	0.066	0.132	0.010
1998	53	0.53	0.80	0.30	214	0.108	0.182	0.050
1999	96	1.13	1.87	0.67	894	0.058	0.104	0.013
2000	231	1.99	2.24	1.68	1,575	0.048	0.106	0.010
2001	293	1.83	2.40	1.11	1,336	0.075	0.142	0.020
2002	457	1.85	1.57	1.50	1,873	0.079	0.147	0.020
2003	635	2.30	2.02	1.98	2,774	0.077	0.141	0.020
2004	584	1.69	1.60	1.22	2,400	0.054	0.120	0.010
2005	706	1.95	1.72	1.57	2,336	0.068	0.144	0.010
2006	550	1.37	1.36	1.00	1,556	0.051	0.110	0.010

Exhibit 3

Turnover in selected bond markets

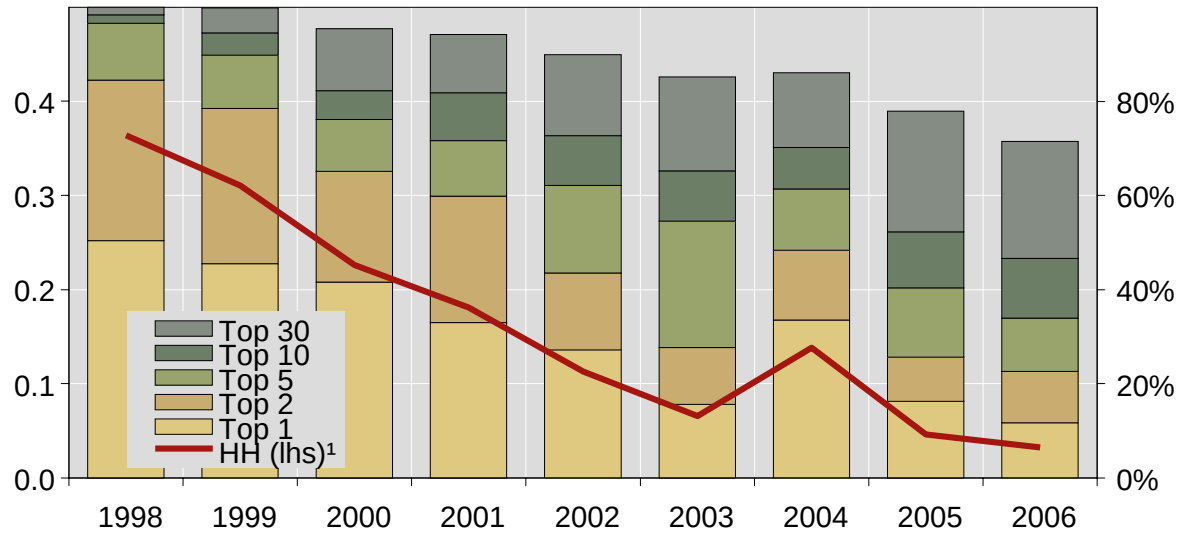
	Annual turnover[1,2]	Amount outstanding[1,3]	Turnover ratio[4]
Government bonds			
Japan	17 664	3 869	4.6
Malaysia[5,6]	144	55	2.6
United Kingdom	5 993	672	8.9
United States	119 753	3 352	35.7
Agency bonds			
Japan[7]	172	284	0.6
Malaysia[8]	2	2	1.1
United States[9]	4 023	2 634	1.5
Corporate bonds and asset-backed securities			
Japan[10]	246	615	0.4
Malaysia (final sample)[11]	25	51	0.5
Malaysia (PDSs)[5,12]	60	60	1.0
United States (corporate bonds)	5 904	8 159	0.7
United States (GSE-backed mortgage pools)	68 539	3 965	17.3

[1] Excluding money market instruments; in billions of US dollars; local-currency amounts are converted to US dollars at end-2006 exchange rates. [2] Turnover in 2006 measured on a two-way basis; excluding transactions related to repurchase agreements. [3] At end-2006. [4] Annual turnover of all bonds divided by the amount outstanding. [5] Turnover data are not screened for cross trades, money market transactions and erroneous entries. [6] Including Government Investment Issues (Islamic securities). [7] Government-guaranteed and FILP agency bonds. [8] Khazanah Nasional bonds. [9] Federal agency and GSE securities, excluding GSE-backed mortgage pools. [10] Corporate straight bonds plus interest-bearing bank debentures. [11] PDSs, excluding medium-term notes, plus Khazanah bonds; turnover data are screened for cross trades, money market transactions and erroneous entries. [12] PDSs, including medium-term notes.

Source: Bank Negara Malaysia; Japan Securities Dealers Association; UK Debt Management Office; US Federal Reserve; authors' calculations.

Exhibit 4

Concentration of trading activity, by number of issuers



[1] Herfindahl-Hirschman index of market concentration; normalised.

Exhibit 5

Selected measures to promote the development of the PDS market, 1997-2006

		Measure
1997	Sep	establishment of BIDS
2000	Jan	waiver of stamp duty for the issuance and transfer of private debt securities
2001	Feb	launch of the Capital Market Master plan to promote the development of the ringgit bond market
	Dec	issuance of Guideline on Securities Borrowing and Lending Programme and Guidance Notes on Repurchase Agreement Transactions
2002	Oct	admittance of universal brokers as participants in the bond market and members of FAST, BIDS and RENTAS
2004	Apr	liberalisation of foreign exchange regulations to allow multilateral development banks and multilateral financial institutions to issue ringgit bonds
	Sep	revision of the regulatory treatment of Cagamas securities
	Sep	partial abolishment of the withholding tax on interest income earned by non-residents
	Oct	expansion of the use of repos for monetary policy operations by Bank Negara Malaysia
2005	Apr	complete abolishment of the withholding tax on interest income earned by non-residents

Source: Bank Negara Malaysia.

Exhibit 6

Determinants of realised bid-ask spreads[1]						
Dependent variable $Spread_{i,t}^{k}$	All issuers		Benchmark issuers		Other issuers	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
Bond-specific variables						
Constant	0.005	0.928	0.001	0.105	0.076***	4.749
Issue size	0.001	0.529	0.007***	3.799	-0.008**	-2.291
Maturity	0.019***	10.139	0.007*	2.719	0.019***	8.795
Maturity squared	-0.001***	-6.122	0.000	-0.007	-0.001***	-5.522
New issue	-0.015***	-5.277	-0.003	-1.334	-0.009	-1.552
AA	0.027***	5.782			0.007	1.183
A	0.053***	8.394			0.029***	4.306
BBB	0.129*	2.613			0.080	1.502
Guaranteed	-0.042***	-7.608	-0.044***	-4.171		
Foreign issuer	0.021**	2.302			-0.003	-0.317
Unrated	0.004	0.487			-0.011	-1.247
Transaction-specific variables						
Market return squared	5.161	1.079	1.774	0.405	21.992*	1.673
Trade size <=1	-0.032***	-5.350	-0.060***	-4.816	-0.028***	-4.271
Trade size >1 and <5	-0.017***	-4.226	-0.006	-0.613	-0.021***	-4.619
Trade size >5 and <10	-0.017***	-4.688	-0.007**	-2.413	-0.022**	-3.067
Trade size =10	-0.018***	-5.429	-0.007**	-2.112	-0.030***	-5.975
Trade size >10 and <20	-0.027***	-7.194	-0.013***	-3.926	-0.045***	-6.069
Trade size >=20	-0.026***	-6.508	-0.008**	-2.347	-0.049***	-6.474
Dealer-dealer	0.016	1.584	-0.003	-0.372	-0.011	-0.238
Dealer-FI	-0.016***	-5.089	-0.010***	-3.873	0.011	1.080
Dealer-Other	-0.024***	-5.270	0.008*	1.664	-0.038***	-5.779
FI-Other	-0.006	-1.543	0.001	0.134	-0.018***	-2.817
Dealer-FI-Other	0.006	1.118	-0.001	-0.167	0.008	0.766
Inventory up	0.005	1.135	-0.002	-0.617	0.021**	1.804
Inventory down	0.029***	5.431	0.014***	3.336	0.083***	5.110
Market-specific variables						
1998	0.084***	3.333	0.097***	3.870	0.184**	1.991
1999	0.022**	2.982	0.023***	3.677	0.046**	2.027
2001	0.000	-0.035	0.003	0.755	-0.010	-0.543
2002	-0.006	-1.216	-0.010**	-2.360	-0.025	-1.622
2003	-0.018***	-3.266	-0.008*	-1.681	-0.049***	-3.470
2004	-0.014**	-2.798	-0.007**	-2.260	-0.048***	-3.388
2005	-0.003	-0.425	0.009	1.031	-0.041***	-2.844
2006	-0.008	-0.946	0.025*	2.609	-0.053***	-3.365
1998*Islamic	-0.011	-0.366	-0.019	-0.757	0.022	0.184
1999*Islamic	-0.006	-0.632	0.024*	1.889	-0.044*	-1.655
2000*Islamic	0.012	1.404	0.048***	3.762	-0.040**	-2.051
2001*Islamic	0.042***	4.659	0.045***	3.848	0.049**	2.471
2002*Islamic	0.032***	4.205	0.062***	3.944	0.013	1.180
2003*Islamic	0.012*	1.826	0.040***	3.541	0.002	0.202
2004*Islamic	0.002	0.267	0.047***	4.702	-0.013	-1.444
2005*Islamic	-0.007	-0.855	0.013	0.972	-0.009	-1.035
2006*Islamic	-0.034***	-3.814	-0.024**	-2.021	-0.033***	-3.648
Adjusted R^2	0.131		0.136		0.123	
n	14'958		6'607		8'351	

[1] OLS estimation with Newey-West standard errors.

Exhibit 7