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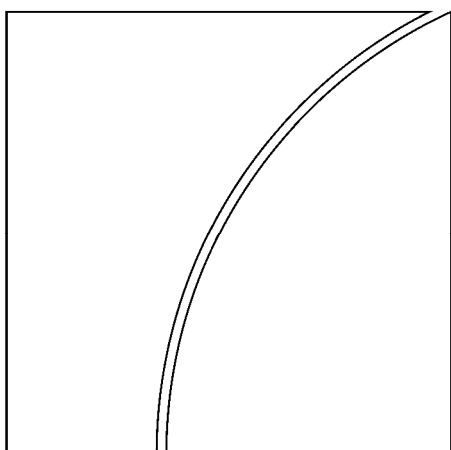
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Monetary and Economic Department

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The impact of CDS trading on the bond market: evidence from Asia*

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Abstract

This paper investigates the impact of CDS trading on the development of the bond market in Asia. In general, CDS trading has lowered the cost of issuing bonds and enhanced the liquidity in the bond market. The positive impact is stronger for smaller firms, non-financial firms and those firms with higher liquidity in the CDS market. These empirical findings support the diversification and information hypotheses in the literature. Nevertheless, CDS trading has also introduced a new source of risk. There is strong evidence that, at the peak of the recent global financial crisis, those firms included in CDS indices faced higher bond yield spreads than those not included.

Keywords: Credit default swaps, bond spreads, bond liquidity, CDS index, Asia.

JEL Classification: G12, G32.

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1 Introduction

The rise and fall of the credit derivatives market have been considered as the single most important development in the global credit market in the past decade. Before the onset of the global financial turmoil that started in mid-2007, the use of credit default swaps (CDSs) as an instrument to trade credit risk had increased exponentially. Since 2008, however, activity in the CDS market has shrunk substantially. In particular, CDS notional amounts outstanding dropped from roughly \$60 trillion at the end of 2007 to about \$33 trillion at the end of 2009 (Figure 1), reflecting severely strained credit markets and the increased multilateral netting of offsetting positions by market participants.¹

In Asia, the CDS market has also grown rapidly in the past decade, despite the fact that it is relatively small and illiquid compared to its counterparts in Europe and the United States. CDS contracts written on Asian reference entities started to be traded in the late 1990s (Remolona and Shim (2008)). In July 2004, the first CDS indices focusing on the region, iTraxx Japan and iTraxx Asia ex-Japan, started to be traded in the market. The trading was relatively limited in the first few years, and then picked up strongly after these indices were reconstituted to reflect a surge in bond issuance by new large borrowers in the region starting in the fourth quarter of 2006. The gained liquidity in the index market spilled over into single-name CDS contracts. As a result, the CDS market in Asia began to emerge as a potentially serious market in its own right.

Compared to Europe and the United States, the CDS market in Asia was introduced against the backdrop of a corporate bond market still in its infancy. In most Asian economies, the size of the bond market was quite small, the trading was not liquid, and the issuance of new bonds was largely driven by quasi-government issuers or issuers with some form of credit guarantees. Since the mid-2000s, however, the depth and breadth of the Asian bond market have improved greatly, due partly to the priority focus of Asian policymakers to develop local bond markets and partly to the positive spillover between the bond market and the

¹Duffie (2009) documents that compression trades, in which several dealers that hold redundant circles of CDS positions choose to legally cancel their offsetting obligations to each other, are responsible for the termination of approximately \$30 trillion in notional amounts of CDS positions in 2008 alone.

derivatives market (Gyntelberg et al (2005), BIS (2009)).

For policymakers, an issue of interest is the impact of the development of the CDS market on the corporate bond market. There are two approaches in the literature. One is to examine both the bond and CDS markets and draw comparisons about their roles in price discovery. The general results suggest that CDSs play a leading role in price discovery (see Blanco et al (2005), BIS (2003), Hull et al (2004), Kiff et al (2002) and Zhu (2006)), although there is a no-arbitrage relationship between the two markets in the long run.² The other approach focuses on the bond market and examines whether bond market development, eg the cost of issuing and trading bonds, is affected by the introduction of CDS markets (see Ashcraft and Santos (2009)). In this paper, we adopt the second approach and leave the first issue untouched.

The limited number of studies on the impact of CDS trading on the bond market have so far focused on the US market. However, their findings do not necessarily apply to the Asian market. One reason for this is the different stages of development between the Asian and US bond markets when CDSs were introduced. Given that the bond markets in many Asian economies were underdeveloped from the beginning, it is more likely that CDS trading will have a jump-start effect on bond market developments. Moreover, investors in Asian bond markets, especially in local currency bond markets, are predominantly domestic investors, while those in Asian CDS markets are mostly foreign investors. The different pool of investors is likely to be an important channel to enhance information transparency and improve efficiency in the credit market.

This paper attempts to investigate the empirical linkages between the bond and CDS markets in Asia during the period from January 2003 to June 2009. In particular, we address the following three questions. First, what is the impact of CDS trading on the Asian bond market in terms of issuance cost and liquidity? Second, which subset of bond issuers is most likely to benefit from the trading in the CDS markets? Third, did the impact of CDS trading on the bond market exhibit new characteristics during the recent global financial

²There are a number of reasons for the leading role of CDSs in price discovery, such as funding and short-sale restrictions that exist in the bond market.

crisis?

The main findings are as follows. First, we find strong evidence that CDS trading is associated with lower cost and higher liquidity for new bond issuance in Asia. This is consistent with the hypothesis that CDS trading helps create new hedging opportunities and improve information transparency for investors. Noticeably, this result is contrary to similar studies based on US data. This contrast provides supporting evidence for our conjecture on the jump-start effect in Asia.

Second, we find that the positive impact of CDS trading on the bond market tends to be more remarkable for smaller firms and non-financial firms. In addition, those firms with higher liquidity in the CDS market benefit more in the primary bond market in terms of cost and liquidity.

Last, we also find that the impact of CDS trading on the bond market is different during the crisis period. The global financial crisis that occurred during the sample period offers a good case study to examine the behaviour of the CDS and bond markets under distress and their linkages. Our analysis shows that, at the peak of the global financial crisis, those firms included in CDS indices had to face higher spreads than those not included in CDS indices, above and beyond the general increase in credit spreads observed in the bond market during this period. This suggests that CDS trading could be a double-edged sword: it also introduces new sources of shocks to the bond market.

The rest of the paper is organised as follows. Section 2 reviews the literature and highlights the contributions of this study. Section 3 documents the empirical methodology. Section 4 describes data, and Section 5 reports empirical results related to the above three questions. Finally, Section 6 concludes with discussion of policy implications.

2 Literature review and our contributions

From a theoretical perspective, CDS trading has both benefits and costs to the bond market. The typical framework of such analysis assumes that the bond market is inefficient for various reasons, including asymmetric information between borrowers and lenders, restrictions on

short-sales and low liquidity. The introduction of the CDS market can mitigate or aggravate some aspects of market inefficiencies in the bond market.

In terms of benefits, CDS trading can lower the cost of bond issuance and improve the liquidity in the bond market by completing the credit market and by revealing new information about firms. Duffie (2008) suggests that CDSs increase the liquidity of credit markets, lower credit risk premia and offer investors a broader menu of assets and hedging opportunities. Ashcraft and Santos (2009) summarise two channels through which trading in the CDS market can lead to a reduction in the credit spreads. The first, called the diversification or hedging channel, refers to the situation in which firms that have traded CDSs give their creditors added opportunities to hedge their risk exposures, so that they can issue bonds at lower spreads. The second channel, called the information channel, focuses on the possibility that CDSs could reveal new information about firms and thus reduce the cost of debt. Duffie and Zhou (2001) show that CDSs make it easier for banks to circumvent the “lemons” problem caused by banks’ superior information about the credit quality of their loans, because CDSs are more flexible at transferring risks than loan sales.³

In terms of costs, CDS trading can adversely affect the cost of debt financing due to agency problems associated with asymmetric information. Banks typically have informational advantages on a borrower’s credit quality. There have been concerns that banks can use CDSs to exploit sellers of credit protection, or that their incentive to monitor and mitigate the default risk of bank loans is smaller when they are able to pass on the risk to other investors via credit risk transfer instruments (Ashcraft and Santos (2009)). In addition, Allen and Carletti (2006) show that credit risk transfer can be detrimental to welfare because, under certain circumstances, it can lead to contagion between the banking and insurance sectors and increase the risk of crises.

Empirical papers have tried to investigate the different channels through which the CDS market affects the bond or loan market. Regarding the diversification channel in loan origination, Hirtle (2008) shows that the use of credit derivatives is associated with improved

³It should be noted here that the impact of credit risk transfer instruments on asymmetric information problems between borrowers and lenders applies more to the loan market than to the bond market, as information in the latter is more of a public nature (see Santos and Winton (2008)).

credit supply, in terms of longer loan maturity and lower spreads. Large corporate borrowers, which are likely to be “named credits” in the credit derivatives market, are the main beneficiaries. By contrast, Minton et al (2009) claim that the use of credit derivatives by US bank holding companies to hedge loans is limited because of adverse selection and moral hazard problems and because of the inability of banks to use hedge accounting when hedging with credit derivatives.

Regarding the information channel for bank loans, many papers provide evidence that the CDS market is a source of information on firms. Acharya and Johnson (2007) find significant incremental information revelation in the CDS market under circumstances consistent with the use of non-public information by informed banks, though they find no evidence that the degree of asymmetric information adversely affects prices or liquidity in either the equity or CDS markets. Norden and Wagner (2008) find that changes in CDS spreads explain about 25% of subsequent monthly changes in aggregate loan spreads for syndicated loans to US corporates during the period of 2000 to 2005.

The study most related to our analysis is Ashcraft and Santos (2009), which evaluates the impact of CDS trading on the credit spreads at bond issuance and loan origination in the United States. These authors find that an average non-financial firm has not benefited from CDS trading in terms of the cost of bond or loan funding, which contradicts the prediction from the diversification or information channel. They also find that risky and informationally opaque firms actually have been adversely affected by the CDS market in terms of the cost of corporate debt. Their explanation for this result is that syndicate participants may demand higher compensation to extend loans to these firms because banks will rely on CDSs and do less monitoring of these firms. As they point out, this channel in the loan market is likely to affect the bond market as well because bondholders appear to free-ride on bank monitoring.

Our study extends the existing literature in the following directions. First, this is the first such analysis of the Asian market. The Asian credit market has gained more and more attention from investors, in part reflecting the increasing importance of Asian economies as a driving force for the global economy. More importantly, the Asian bond market was at a relative infancy stage when CDSs were introduced, so that the balance between benefits

and costs related to CDS trading might be different from the case in advanced economies. In particular, the marginal benefits may be larger due to a jump-start effect and therefore outweigh the potential costs.

Our empirical analysis also overcomes an important caveat in the existing literature, ie endogeneity in bond issuance decisions. A firm can choose when to issue a bond. For instance, it may decide to do so only when credit market conditions are favourable, or if it observes that credit spreads in the CDS markets are at low levels or have been decreasing over time. Given that the data only include issued bonds, ignoring this endogeneity issue can cause selection bias in the empirical analysis. In this paper we use Heckman's two-step approach to control for this selection bias, and find that the results are robust to this adjustment.

Second, this paper examines not only the impact of CDS trading on the cost of debt financing but also its impact on the liquidity in the bond market. The answer to this question is interesting for researchers as well as policymakers in the region, because cost and liquidity represent two important aspects of bond market development.

Third, this paper also examines the time variation of the impact of CDS trading, particularly for those firms included in CDS indices. One would expect that such impact would be different in various stages of the credit cycle. In particular, the relative magnitude of benefits and costs associated with CDS trading or inclusion in CDS indices tends to exhibit distinctive features during a crisis period compared to normal times. Our data cover the global financial crisis that started in mid-2007, which offers a natural experiment to look into the inter-linkages between the CDS and bond markets at different phases of the credit cycle.

3 Methodology

To address the three questions as outlined in the introduction, we first conduct a cross-sectional analysis to examine the impact of CDS trading on the cost of bond issuance and the liquidity in the primary bond market in Asia, and to find out which subset of bond

issuers benefit more from CDS trading. We then adopt a panel data analysis to examine the time-varying effect of CDS trading on the bond market. Here we explain in detail the empirical methods.

3.1 The impact of CDS trading

To answer the first question on the impact of CDS trading on the primary bond market, we follow an approach used by Ashcraft and Santos (2009).⁴ We use a large cross-sectional sample of primary market data of Asian bonds. Our analysis focuses on two aspects of the impact. One is from the price perspective, ie has CDS trading helped lower the cost of bond issuance? The other is from the liquidity perspective, ie has CDS trading helped improve liquidity in the bond market?

The cross-sectional sample of bonds includes those issued by firms with corresponding contracts traded in the CDS market as well as those issued by firms without corresponding CDS trading, which are used as a control group. The model specifications, which are estimated with OLS, are:

$$BS_i = \alpha_0 + \alpha_1 TRADING_i + \beta_1 X_i + \beta_2 Y_i + \beta_3 Z_i + \beta_4 T + \varepsilon_i \quad (1)$$

$$BAS_i = c_0 + c_1 TRADING_i + \gamma_0 YTM_i + \gamma_1 X_i + \gamma_2 Y_i + \gamma_3 Z_i + \gamma_4 T + \varepsilon_i \quad (2)$$

where BS is the bond spread, defined as the yield-to-maturity (YTM) for each bond minus the Treasury rate of the issuing currency and of the same maturity at the date of issuance. BAS is the bid-ask spread for each bond at issuance, a liquidity measure widely used in the literature.

⁴Ashcraft and Santos (2009) use two approaches to identify the impact of CDS trading on the cost of bond issuance by corporate firms. The first focuses on the sample of firms that become traded in the CDS market, referred to as the *traded sample*, and compares the average bond spread before and after CDS trading. This approach is subject to the potential problem of endogeneity. The second approach identifies a sample of firms that are never traded but have similar characteristics to those that do, referred to as the *matched sample*, and compares the traded firms with the matched firms. This paper follows the second approach by looking at a large cross-section of primary market data of Asian bond issuances, with or without corresponding CDS contracts written on the issuing firms.

The explanatory variables are similar in the two equations, except that the yield-to-maturity is included as an explanatory variable in the liquidity equation. The bid-ask spread is expected to be higher for high-cost (high YTM) bonds, hence the coefficient is expected to be positive. Other explanatory variables include the following.⁵

TRADING is a dummy variable that takes the value one for bonds that a firm issues after its CDS contract starts to be traded in the derivatives market. If CDS trading helps complete the market by allowing for credit risk transfer and improving information transparency, we expect the coefficient to be negative in both equations.

X is a set of bond-specific variables that include issue amount, bond maturity, a dummy variable to identify bonds with collateral and a set of dummy variables for bond ratings. High-rating bonds are associated with lower credit risk and hence lower spreads. The effects of other bond-specific variables, however, are ambiguous. For instance, the larger issue amount or longer maturity of a bond may represent more credit risk, but at the same time it is likely to be issued by a safer firm. Similarly, the use of collateral may help reduce credit risk, but at the same time there might be selection bias in that bonds issued by low-quality firms are more likely to be required to set aside collateral (Berger and Udell (1990)).

Y is a set of firm-specific variables that include firm size and firm leverage ratio. Larger firms are typically associated with easier access to the bond market and lower cost of bond issuance. By contrast, high-leverage firms are viewed as riskier, hence the coefficient for the leverage ratio is expected to be positive.

Z is a set of macro-financial variables of the issuing firm's home country, which include the output gap, represented by the deviation of real GDP from its trend, and the term structure of interest rates. We expect the output gap to have a negative effect on the pricing of bonds, because default risk tends to be lower during the high-growth period (positive output gap). The effects of interest rates, however, are more likely to be ambiguous. A higher spot rate can be associated with a higher return in the firm value process and by extension reduces the default rate and the cost of debt financing. Nevertheless, it may also reflect a tightened

⁵The choice of explanatory variables, other than the CDS trading dummy, follows previous studies such as Elton et al (2001), Chen et al (2007) and Ashcraft and Santos (2009).

monetary policy stance and therefore is associated with a higher probability of default of issuing firms.

In addition, our sample period covers the recent global financial crisis, during which the bond market has been severely affected. Hence we also introduce two dummy variables (T) that define two phases of the crisis: one defines the period between July 2007 and 14 September 2008, the initial period of the subprime crisis; the other defines the period after the failure of Lehman Brothers on 15 September 2008, when the global crisis intensified and spilled over to Asia (see BIS (2009) and Huang et al (2010)).

3.2 Controlling for selection bias

A potential problem in existing literature, including the above analysis, is the selection bias problem. The empirical analysis focuses on bonds issued during the period of interest. However, bond issuance decision by itself is endogenous. In particular, a firm may choose to issue a bond when its financing need is high, when general financial conditions are favourable or when it expects to pay low cost on bonds (say, by observing its own credit spreads in the CDS market).

We use Heckman’s (1979) approach to control for selection bias, which consists of two steps.

In the first step, we run a probit regression to examine firms’ bond issuance decision. For all individual firms included in our sample, we construct a monthly dummy variable that indicates whether a firm issued new bonds in each month, from January 2003 to June 2009. The list of explanatory variables include some variables used in the baseline analysis (Equations 1 and 2) as well as several additional variables (the credit market and global financial market variables described below), so as to ensure that the probit analysis provides additional information.

(1) Firm-specific variables, including firm size, leverage and rating. These variables may reflect firms’ financing need and their ability to raise new funds in the bond market.

(2) Credit market variables, including the level and changes in credit spreads in national credit markets. We construct “hypothetical” national CDS indices by calculating the average

CDS spreads of firms from each economy that are included in the iTraxx Japan or iTraxx Asia ex-Japan indices. The time series of these hypothetical national CDS indices go back earlier than the official introduction of these two CDS indices on the market. The hypothesis is that firms may choose to issue bonds when credit market conditions are favourable, either at low levels or when credit spreads have been declining.

(3) Country-specific macro and financial market variables, including stock market returns, GDP gap and interest rates in each economy.

(4) Global financial market variables, including the implied volatility of the S&P 500 (VIX) and the Baa-Aaa spreads in the US market. A higher VIX indicates higher volatility and higher risk aversion in the financial market, and the Baa-Aaa spread is associated with the size of the risk premium.

(5) The dummy variable that indicates CDS trading reported on each firm in the current and past months.

We calculate the inverse Mills ratio based on the probit analysis. In the second step, we re-examine the impact of CDS trading on the cost and liquidity of bond issuance (Equations 1 and 2) by including the inverse Mills ratio as an additional explanatory variable.

3.3 The differential impact of CDS trading across firms

To answer the second question regarding which subset of bond issuers benefit more from CDS trading, we run a number of extended regressions by adding an interactive term:⁶

$$BS_i = \alpha_0 + \alpha_1 TRADING_i + \alpha_2 TRADING_i \cdot D_i + \alpha_3 D_i + \beta_1 X_i + \beta_2 Y_i + \beta_3 Z_i + \beta_4 T + \varepsilon_i \quad (3)$$

$$BAS_i = c_0 + c_1 TRADING_i + c_2 TRADING_i \cdot D_i + c_3 D_i + \gamma_0 YTM_i + \gamma_1 X_i + \gamma_2 Y_i + \gamma_3 Z_i + \gamma_4 T + \varepsilon_i \quad (4)$$

⁶The Heckman adjustment is also adopted here to correct for selection bias.

in which D is one of the following firm- or bond-specific variables that define a subset of the sample bonds.⁷

(1) Firm size. A possible hypothesis is that smaller firms, which probably face more constraints in credit risk transfer and information transparency, may benefit more from the introduction into the derivatives market. If that is the case, the coefficient for the interactive term is expected to be positive.

(2) Firm leverage. Firms with higher leverages are riskier. One may expect that riskier firms may benefit more from CDS trading by allowing for credit risk transfer. Therefore, the coefficient is expected to have a negative sign.

(3) A dummy for unrated bonds. Unrated bonds arguably receive less attention from rating agencies and analysts, and are more likely to have opaque information. Trading in the CDS market, in this sense, tends to reduce the information transparency problem and thus has a bigger impact on this group of bonds. Hence, we expect the coefficient for the interactive term to be negative.

(4) A dummy for financial firms (vs corporate firms). Financial firms typically behave quite differently from corporate firms. They know each other well, even without CDS trading; thus, CDS trading does not add much more information. Hence, we expect the coefficient for the interactive term to be positive.

(5) A dummy for history of bond issuance, ie whether the same firm has issued other bonds within a given time window (eg two years) before the new bond is issued. One would expect that the market would have better information on firms that have recent issuing experience. As a result, the benefit of CDS trading tends to be smaller for these firms than for those without any recent bond issuance. In other words, we expect the coefficient to be positive.

(6) A dummy variable that indicates the inclusion of a firm in the CDS indices. An index works as a performance or pricing benchmark in the equity and credit markets. There

⁷In order to see what types of borrowers are more affected by the CDS market, Ashcraft and Santos (2009) use three measures of firm risk: leverage, implied stock volatility and a dummy for investment grade or not. They also use three proxies for firm transparency: the number of stock analysts, the volatility of their earnings forecast errors and the bid-ask spread on the firm's stock prices.

has been evidence that, once a name enters an equity index, it is demanded more by many institutional investors (Denis et al (2003)). Hedge and McDermott (2003) show that the liquidity of a stock improves significantly in the three months after the stock is included in the S&P 500 index, due to an increase in trading volume that lowers the inventory costs of market makers. Similarly, Hacibedel (2008) finds supporting evidence of the investor recognition hypothesis proposed by Merton (1987), who claims that the index inclusion is associated with increases in investor awareness and decreases in shadow cost. As a result, it will cause a permanent increase in the stock price. Motivated by these findings, we examine whether the impact of CDS trading tends to be stronger for those firms included in one of the two most popular CDS indices in Asia, iTraxx Japan and iTraxx Asia ex-Japan. Importantly, the inclusion of a name in one of the two indices is based on its trading volume over the past 12 months (Markit Group Limited (2007a, 2007b)),⁸ which does not necessarily mean that the company is sound, large or reliable. However, some investors want to buy bonds issued by CDS index names as well as the CDS indices to enjoy arbitrage profits or achieve complete hedging. The increasing demand can generate more liquidity and reduce credit spreads in the bond market.⁹

(7) Liquidity in the CDS markets. For each bond issuance that has corresponding CDS contracts traded in the CDS market, we include a liquidity measure in the CDS market (which is defined in the data section). The effect of this interactive term can be ambiguous. On the one hand, high liquidity in the CDS market can imply that the positive spillover effect from the derivatives market to the bond market is more remarkable. On the other hand, CDS contracts may be more liquid if the underlying bonds are more liquid, and therefore the net information gain from the derivatives market to the bond market may not necessarily be larger for highly liquid CDS names.

⁸By contrast, the criterion for including a name in an equity index is typically based not on trading volume, but on market capitalisation, size and other factors.

⁹Moreover, CDS index inclusion can make more investors aware of a firm and thus require lower spreads on the bonds issued by the firm.

3.4 The time-varying impact of CDS trading

To answer the third question on the time-varying impact of CDS trading on the bond market, we use a different dataset. Our analysis focuses on the same set of bonds but includes price and liquidity information from the primary market (ie price and liquidity at issuance) as well as from the secondary market. That is, for each bond we retrieve monthly time series of bond spreads and bond liquidity measures after the date of issuance. In addition, we rely on another dummy variable that defines a name being included in the CDS indices. An important reason for focusing on the index inclusion dummy rather than the CDS trading dummy is that index inclusion is determined by an objective criterion that is independent of the coverage and quality of a specific database.

The analysis based on the panel data examines the time-varying impact of index inclusion on the cost and liquidity in the bond market. The model specification is:

$$Y_{it} = d_0 + d_1 TRADING_{it} + d_2 INDEX_{it} \cdot TDUMMY_t + \delta_1 X_{it} + \delta_2 Y_{it} + \delta_3 Z_{it} + \delta_4 T + \varepsilon_{it} \quad (5)$$

In the panel analysis, the dependent variables (Y_{it}) are bond spreads or bid-ask spreads, which are monthly series for all sample bonds. The right-hand variables include the same set of explanatory variables in the cross-sectional analysis, plus country fixed effects and a list of interactive terms between the monthly index inclusion dummy and time dummies (one for each quarter). Our focus is the coefficients for the interactive terms. For the regression itself, we use an OLS regression but calculate clustered standard errors by firms, following the recommendation of Petersen (2009).

4 Data

Our sample starts in January 2003 and ends in June 2009, and covers 10 Asian economies: China, Hong Kong SAR, India, Indonesia, Japan, Korea, Malaysia, the Philippines, Singapore and Thailand.¹⁰ The data consist of three levels of information: bond level, firm level

¹⁰Due to data availability, the final sample does not include bond issuance from China, Indonesia and Thailand.

and country level, which are merged together for the purpose of this study.

Bond data. The first part of our data includes information on bonds issued by Asian entities, which are retrieved from Bloomberg. The starting point of our sample is the universe of bonds issued after 1 January 2003 by entities headquartered in one of the above-mentioned Asian economies. Markit (our source of CDS data) coverage started in 2001, but our sample starts from 2003, when Markit started to have a comfortable coverage of the CDS market in Asia. Therefore, we will be more confident of the accuracy of a key variable used in this study, ie a dummy variable that indicates whether a CDS contract on the bond issuer has been traded in the derivatives market when a particular bond is issued.

When retrieving bonds, we impose the following filtering criteria. The first, and most binding, is that we only include senior bonds. A particular reason for including only senior bonds is because it is consistent with the definition used in the CDS contract. The CDS contracts considered in this study (see below) are associated with senior, unsecured bonds issued by the underlying entity. Second, we only include bonds with relatively simple structure. In particular, we exclude bonds with third-party guarantees, because the prices of those bonds largely depend on the guarantors, for which no information is available. In addition, we exclude bonds with callable options or puttable options as well as foreign bonds, which represent only a small portion of the population but for which the pricing mechanism is less clear. Third, we exclude bonds issued by sovereign or government-sponsored entities; that is, only bonds issued by corporate or financial firms are included. Fourth, a bond must be denominated in either US dollars, Japanese yen or the home country currency of the bond issuer. Last, we remove bonds with obvious input errors in the price information (eg with negative bond spreads).

Following Elton et al (2001), we use the following information on bond characteristics.

- Descriptive information of bond issuance, which includes the bond identifier, issuer, issue amount, date of issuance and maturity date, issuing currency, home country of the issuer, use of collateral and rating information.¹¹

¹¹We use the rating of bonds at issuance. For those without bond-specific ratings, we use ratings of the issuing firms instead. In order to check the accuracy of using the firm rating instead of the bond rating, we

- Bond price information, which includes bond spreads at issuance (Equations 1 to 4) and monthly time series of bond spreads for each bond (Equation 5).¹² Bond spreads are defined as the yield-to-maturity (YTM) minus the issuing currency’s Treasury rate of the same maturity.¹³
- Bond liquidity information, which is defined as the bid-ask spread of each bond (at issuance and monthly time series). The bid-ask spread is a popular measure for liquidity in the bond market (Chen et al (2007)). The smaller the bid-ask spread, the more liquid a bond is.

Firms’ balance sheet data. The second data source is issuers’ balance sheet information, which is also from Bloomberg. We include two firm-specific variables in the analysis: firm size and firm leverage. Firm size, which is in US dollars, is transformed using its log term. Firm leverage is defined as the debt/asset ratio. For each period, we use the last observed balance sheet information (ie in the previous calendar year) as the relevant firm-specific information for each bond.

Combining bond-specific and firms’ balance sheet information, we have 1091 bonds issued by 236 firms. Table 1 summarises the characteristics of the sample bonds. The majority of bonds have investment-grade ratings (BBB and above). Almost 70% of the bonds are issued by corporate firms, with the rest issued by financial firms. 234 (21%) bonds are collateralised. In terms of the maturity structure, almost half of the sample bonds have a maturity shorter than five years, around 30% have a maturity between five and 10 years and the rest (20%) have a maturity longer than 10 years.

In terms of the distribution of sample bonds by the issuer’s home country and the issuing currency, the majority (about 97%) of sample bonds are local currency bonds issued by Japanese and Korean firms. This is consistent with the fact that Japan and Korea have the two largest corporate bond markets in Asia, while in many other Asian economies

looked at bond issuances in our sample with both bond and firm ratings. About 20% of such bond issuances had discrepancies between bond and firm ratings, most of which by one or two notches.

¹²We use end-of-month observations in the monthly series of bond yields and bid-ask spreads.

¹³We use linear interpolation to derive the Treasury rate of the same maturity.

(such as China), sovereign bonds or bonds issued by government-sponsored entities are the predominant part of the bond markets.

CDS data. The other type of firm-level information is CDS data, which are provided by Markit. Markit is one of the leading providers of the pricing information in the CDS market. It supplies daily quotes of CDS spreads for a wide range of CDS contracts, along different dimensions including the underlying entity, maturity, currency and restructuring clause. Each daily quote (called a composite quote) is calculated based on contribution quotes reported by a number of participating institutions who contribute the price information.

For this study, we examine CDS contracts written on Asian entities since January 2003. We restrict ourselves to the most popular types of CDS contracts, ie five-year maturity, denominated in either US dollars or Japanese yen, written on senior bonds and without restrictions on restructuring clause (see Packer and Zhu (2005)). In total, 683 non-sovereign entities from the aforementioned 10 Asian economies have been included in the Markit data since 2003. Figure 2 plots the monthly time series of the number of Asian entities included in the Markit data, and the number of contribution quotes written on these entities in each month. It is obvious that, based on the Markit coverage, the CDS market in Asia expanded rapidly in the period of 2003 to 2007. The market has shrunk dramatically since the inception of the global financial crisis, which is consistent with the survey results in Figure 1.

We match each sample bond to the CDS data and create a dummy variable to indicate whether a CDS contract on the bond-issuing company was quoted in the Markit database within a time window of 30 business days before the bond was issued.¹⁴ We treat this as equivalent to whether the CDS contract on the issuing company was traded in the CDS market. Out of the 1091 bonds, 643 bonds had corresponding CDS trading when the bonds were issued, representing 116 out of the 236 firms.

The information on the underlying contribution quotes that are used to calculate daily composite quotes allows us to create a liquidity measure for each CDS name at any particular time. In this study, we calculate the standard deviation of all contribution quotes on each

¹⁴As a robustness check, we also set different time windows of 20 or 60 business days, and another dummy variable indicating that there was at least one CDS quote before the bond was issued. The results remain almost the same.

day for each CDS name, and use its average over a given time horizon (eg one month) to represent the liquidity of a CDS contract during that period.¹⁵ If the value of this liquidity measure is greater, it implies a higher degree of disagreement among market participants regarding the credit risk of the underlying entities, and, by extension, lower market liquidity as it tends to be more costly or time-consuming to find the right counterparties to trade on the credit risk instrument.

Figure 3 plots the daily (cross-sectional) averages of the liquidity measure for the 116 CDS names. There was an obvious trend of increasing liquidity between 2003 and 2007. Entering 2008, the liquidity in the CDS market generally dried up, as shown in the spike of the liquidity measure.

The CDS market has also traded a family of CDS index products, which are constructed based on a set of rules with the overriding criterion being that liquidity of the underlying CDS contract. In Asia, the most widely traded CDS indices are the iTraxx Japan (which consists of Japanese entities only) and iTraxx Asia ex-Japan indices. The first series of both groups of indices were introduced in July 2004; since then, the constituents of the indices have been updated every September and March, a process known as “rolling the index”. The latest series in our sample period was released in March 2009 (Series 11).¹⁶

We create a dummy variable indicating the inclusion of an entity in one of the two iTraxx Asia indices at each point of time (every month). The index inclusion dummy can be a useful substitute for the CDS trading dummy, because the indices are updated on a regular basis and are publicly observable. In other words, the accuracy of time variation of this dummy is independent of the quality of coverage of any particular database. Therefore, we include the

¹⁵Alternatively, we also tried two other liquidity measures in the CDS market: one is the total number of contribution quotes for a CDS contract during a given time horizon (as used in Ashcraft and Santos (2009)); the other is similar to the benchmark liquidity measure except that the range (maximum minus minimum quotes), rather than the standard deviation, is calculated on each day for each CDS contract. The results remain robust by using either of the two alternative liquidity measures. In a recent study, Tang and Yan (2008) also proposed other liquidity measures in the CDS market, such as the ratio of spread volatility to the number of quotes and trades, the number of contracts outstanding, the ratio of quotes over trades and the bid-ask spread. Unfortunately, it is not possible to construct similar measures based on the Markit data.

¹⁶The number of constituent entities in each of the two indices has changed over time. For the iTraxx Japan indices, the number of constituent entities varied between 50 (Series 1, 10 and 11) and 87 (Series 7). For the iTraxx Asia ex-Japan indices, the number of constituent entities was 30 for the first three series, 50 for Series 4 to 7, and 70 for Series 8 to 11.

index inclusion dummy variables in the panel data analysis. Out of the total of 236 firms, 71 have been included in the CDS indices, or 326 of the 1091 sample bonds.

Macro-financial data. The final part of the data is macro-financial variables of the issuers' home country, which include the output gap (measured as the deviation of real GDP from its trend using the HP filter) and the term structure of interest rates (one-year swap rate and the term spread between 10- and one-year swap rates).

5 Empirical results

5.1 The impact of CDS trading on the cost and liquidity of bond issuance

We first examine the impact of CDS trading on the cost and liquidity of bonds in the primary market, using the cross-sectional data at issuance and the models as specified in Equations 1 and 2. The estimation results are reported in Table 2.

The most interesting result is the impact of CDS trading. We find a negative impact of CDS trading on the bond spread as well as the bid-ask spread. The impact is statistically and economically significant. In particular, if a firm is traded in the CDS market, its cost of issuing new bonds will be lower by 18 basis points on average. This amount is economically significant considering the average bond spread of 151 basis points. The new bonds also tend to be more liquid, in that the average bid-ask spread of the bonds issued by CDS names is 2.1 basis points lower than that of the bonds issued by non-CDS names. The difference is non-trivial relative to the average bid-ask spread of 14.5 basis points. These results suggest that, for Asian entities, CDS trading has a sizeable benefit for the issuers in the bond market.

Our result is in sharp contrast to that of Ashcraft and Santos (2009), who find no significant impact of CDS trading based on US data. A possible explanation is the different degree of financial market development in Asia and the United States. In particular, the bond market is relatively less developed in Asia (Gyntelberg et al (2005) and BIS (2006)). Therefore, the introduction of the credit derivatives market is more likely to have a jump-start effect. Firms traded in the CDS market are likely to receive more attention from bond

market participants, including analysts, rating agencies and institutional investors; hence, new information might become available. In addition, by allowing for credit risk transfer, the demand for the bonds issued by firms whose CDS contracts are traded might have increased, therefore bond liquidity improving. Of course, we cannot exclude the possibility of a signalling effect, in that the market may view those firms traded in the CDS market as more creditworthy. Moreover, once CDS spreads become available, bond issuers have an incentive to pick the “right” timing to issue new bonds, ie when the CDS spread of the issuer stays low or has been going down for some time. This endogenous timing of bond issuance can affect the relationship between CDS trading and lower bond spreads in our findings.

The impact of other explanatory variables is largely consistent with economic intuitions. For firm-specific variables, larger firms have better access to the primary bond market by paying relatively lower cost. High-leverage (debt to asset ratio) firms are riskier and thus are priced higher and less liquid.

For bond-specific variables, the yield-to-maturity has a significant positive effect on the bid-ask spread, suggesting that high-risk bonds are more likely to be less liquid. The larger amount of bond issuance seems to be associated with higher risk, and thus higher prices and larger bid-ask spreads. Longer maturity is associated with improved liquidity in the primary market, but has no impact on bond spreads. The use of collateral appears to favour the hypothesis of lowering credit risk rather than the screening hypothesis under which the issuers of higher-risk bonds are more likely to be required to put aside collateral. This is consistent with the observation in Table 1 that the use of collateral is highly concentrated in the highest rating group.

Bond (firm) rating is important in determining the cost of raising debt. In general, highly rated firms pay lower issuance cost on the primary bond market. Surprisingly, the yield spreads of speculative-grade bonds are lower than those of BBB-rated bonds. This is probably due to the fact that speculative-grade issuers were shut off in the bond market after the peak of the global financial crisis (the failure of Lehman Brothers). In other words, they issued bonds only when the credit market conditions were favourable.

The impact of interest rates, both the short-term swap rates and the term spread, is

statistically significant and positive. This seems to suggest that an increase in interest rates, or expected increases in future interest rates, are viewed as a signal of tightened monetary policy. Borrowers will face a higher cost of financing and their default risk will increase. As a result, the cost of bond issuance will be higher.

The coefficients of the two time dummy variables are also interesting. During the first phase of the global financial crisis (from July 2007 to September 2008), Asian bond markets appeared to be less affected. Indeed, the cost of bond issuance was lower and the liquidity higher during this period than in normal times, after controlling for other effects. By contrast, in the second phase of the global financial crisis (after the failure of Lehman Brothers), the bond market in Asia was severely affected. Bond spreads in the primary market increased on average by 121 basis points relative to normal times. Liquidity also dried up quickly: average bid-ask spreads increased by 5.7 basis points. Recent studies such as BIS (2009) suggest that the Asian markets were affected via two channels during this period. On the financial side, the failure of Lehman Brothers triggered a loss of confidence in the financial market, causing a hike in risk aversion and a drying-up of market liquidity. On the real side, since the fourth quarter of 2008 the economic prospects of Asian economies have deteriorated significantly due to the large drop in global demand and exports by Asian economies.

The baseline analysis, however, is subject to the selection bias critique. A Heckman two-step approach, as described in the methodology section, can correct for selection bias. The first-step probit analysis examines the bond issuance decision. The results are reported in Table 3. Most coefficients are quite intuitive. Highly rated firms are more likely to issue bonds than low-rated ones. Firms are more likely to issue new bonds when the average cost in the local credit market goes down, when the economy is in the expansion phase, and when global financial market conditions improve. Also, interestingly, the fact that a firm is traded in the CDS market tends to increase the likelihood of new bond issuance by that firm.

The second-step regression including the inverse Mills ratio, which is calculated from the probit analysis, adjusts for the selection bias problem. The results are reported in Table 4. The Heckman adjustment does not change the baseline results. Trading in the CDS market continues to play a significant role in lowering the cost of bond issuance and improving the

liquidity in the primary bond market. Indeed, its economic significance even increases. In addition, the statistical and economic significance of other explanatory variables is relatively robust. It is worth noting that the inverse Mills ratio has a significantly negative impact in both equations. This validates the selection bias: when a firm chooses to issue new bonds, it appears that the timing of issuance is deliberately chosen so as to enjoy lower costs and higher liquidity in the bond market.

Overall, the Heckman correction analysis suggests that there are direct and indirect impacts of CDS trading and other explanatory variables on the cost and liquidity of bonds in the primary markets. The indirect impact comes through the decision of bond issuance, and the direct impact affects the cost and liquidity after controlling for this selection bias.

5.2 Which borrowers are more affected?

Our evidence supports the view that the CDS market provides a new way for investors to trade on credit risk and to improve information transparency of underlying entities. The magnitude of such impact, however, can be different across firms. In this section, we extend the baseline study in the previous section and investigate which subset of bond issuers benefit the most from the positive spillover from the derivatives market to the bond market.

We run extended regressions as specified in Equations 3 and 4, with an additional interactive term that reflects the differential impact of CDS trading. To control for selection bias we also apply the Heckman adjustment as in Tables 3 and 4. The results are reported in Tables 5 and 6.

We first examine whether the effect of CDS trading differs between large and small firms. The results suggest that larger firms benefit less from CDS trading, in that the reduction in bond spreads is smaller and the improvement in bond liquidity is also less remarkable. This seems to be consistent with the view that larger firms have better access to the bond market from the beginning, and therefore the jump-start effect associated with CDS trading is smaller.

We also examine whether the effect of CDS trading differs between high- and low-leverage firms. Ashcraft and Santos (2009) find that following the onset of CDS trading there is an

increase in bond spreads of high-leverage firms. Our analysis of the Asian market shows the opposite, although both coefficients are statistically insignificant.

The third regression includes an interactive term with a dummy variable that distinguishes between rated and unrated firms. Unrated firms tend to be associated with opaque information. Therefore, the introduction of CDS contracts should have a larger impact by improving information transparency. However, we do not find strong supportive evidence for this hypothesis: the coefficient for the interactive term has the right sign but is only borderline statistically significant in the cost equation, and is insignificant in the liquidity equation.

The fourth regression examines the differential impact of CDS trading on financial firms and corporate firms. The result shows that the CDS trading effect on bond spreads is much smaller for financial firms and the differences are statistically significant, although the same effect on bond liquidity is not statistically significant. A possible explanation is that financial firms know each other well, so CDS trading does not add much more new information.

The fifth regression investigates the differential impact of CDS trading on firms with and without recent bond issuances. When bonds are issued, ample information about the issuer is provided to market participants. Therefore, the additional benefit of CDS trading should be smaller for firms with recent issuing experience. The hypothesis, however, is not supported by the regression results in that the coefficients for the interactive terms in both equations are statistically insignificant.

The sixth regression examines the impact of CDS index inclusion in addition to CDS trading. Note here that those firms included in the CDS indices represent a subset of firms with corresponding CDS contracts and therefore the coefficient for the index inclusion dummy is equivalent to the coefficients for the interactive terms in the other equations. We find that the firms included in the CDS indices enjoy higher liquidity but face higher yield spreads in the bond market. Because the inclusion of an entity in a CDS index mainly depends on its trading volume in the previous year, it is intuitive that it is likely to command lower bid-ask spreads in the bond market. It is not so easy to understand why those firms in the CDS indices are subject to higher bond yields. A possible explanation is the following: many

bonds issued during the crisis period are attached to CDS index names and, as we show in the next section, they were charged higher bond spreads when the credit market was in distress.

Last, we examine whether CDS trading had different impacts on relatively liquid and illiquid CDS names. This regression includes only bonds associated with CDS trading and hence has a smaller number of observations. The hypothesis is that the more liquid a CDS contract is, the easier it is to trade on its credit risk and the higher the informational gains. Hence, the coefficients for the interactive terms in both equations should be positive.¹⁷ Indeed, we find strongly supportive evidence of this hypothesis. Within the subset of bonds that have corresponding CDS trading, those firms that are highly liquid in the CDS market have lower costs and higher liquidity in the primary bond market.

In sum, our analysis suggests that the impact of CDS trading on the bond market is more remarkable for smaller firms, non-financial firms and those firms with high liquidity in the CDS market.

5.3 The impact of CDS trading during the crisis

Another question of interest is whether the impact of CDS trading varies over time, particularly during the crisis period. The introduction of the CDS market is an important step to complete the credit market by allowing for trading on credit risk, and it leads to the integration of various segments of the credit market. One possible side effect of such integration is that it may introduce a new source of market volatility. Disruptive events in the derivatives market may spill over to the bond market and cause the malfunctioning of the whole credit market, as many have argued in the current global financial crisis of which the CDS market has been at the epicentre.

Figure 4 plots the monthly time series of average bond spreads in our panel data that includes information from both the primary and secondary markets. The sample bonds are divided into three rating groups (AAA and AA, single-A and triple-B) and also into two

¹⁷Notice that our liquidity measure has the property that a value of the higher measure implies lower liquidity.

groups depending on whether there are CDS contracts written on the issuing firms or not. There are a few general observations. First, across the rating groups, low-rated bonds have higher bond spreads. Second, bond spreads increased substantially during the crisis period. Third, those bonds with traded CDS contracts have lower spreads for most of the period under review, with the important exception of the first half of 2009, when they have higher spreads.

To address this issue, we run panel regressions (with country fixed effects) as described in Equation 5. We use OLS and calculate the t -statistics using clustered standard errors by firms as suggested by Petersen (2009). A major extension in the panel regressions is the inclusion of a list of interactive terms between index inclusion and a series of time dummy variables (one for each quarter). The coefficients for these interactive terms provide helpful insights on the time variation in the impact of index inclusion on the bond market. As in the previous regressions, we also include a dummy variable for CDS trading.¹⁸

Figure 5 plots the coefficients for the interactive terms, as well as their confidence intervals (95%).¹⁹ Before discussing the results from the two panel regressions, it is important to note that, in both regressions, the two dummy variables that indicate the two phases of the global financial crisis have positive and significant effects on bond spreads and bid-ask spreads. In addition, the magnitude of the coefficient for the second phase of the crisis is much larger than that for the first phase of the crisis. Therefore, the coefficients for the interactive terms indicate any *additional* time effects associated with those firms that are included in the CDS indices.

The upper panel of Figure 5 shows a significant spillover impact from the CDS to the bond market at the peak of the crisis. In the fourth quarter of 2008, those firms included in the CDS indices faced an extra cost of approximately 100 basis points on average in the bond market, after adjusting for other effects (including the crisis dummy variables). This is consistent with the view that the loss of confidence was particularly remarkable for those

¹⁸We did not use interactive terms between the CDS trading dummy and time dummies, mainly because it is crucial to have the correct information on when a CDS contract was first traded in the market. However, the accuracy of such information is questionable in the commercial database. By contrast, inclusion in CDS indices is subject to more objective criteria.

¹⁹The results of the panel regressions are not reported here but are available upon request.

names attached to the derivatives market. Market investors were highly risk averse to those entities, and additional cost was charged for bearing the risk. Another possible explanation is that, during the crisis period, there was a surge in demand for CDS index products for hedging or risk management purposes, which increased CDS spreads of the index names and in turn caused the corresponding bond spreads to widen.

The lower panel of Figure 5, however, shows that there is no significant time variation in the impact of the CDS market on bond market liquidity. Importantly, this does not contradict the liquidity dry-up phenomenon, which is supported by the significantly positive coefficients of the two time dummies of the crisis. What it suggests is that the drying-up of liquidity seems to be a general phenomenon in the bond market, irrespective of the degree of involvement of the underlying entity in the CDS market.

6 Conclusion

This paper shows that in Asia, CDS trading has had positive impacts on bond market development in terms of lowering average spreads and enhancing the market liquidity before and in the early stage of the recent international financial crisis. This finding supports the diversification and information hypotheses, and justifies continued development of active CDS markets in the region.

For financial regulators, the sequencing problem, ie the order in which various financial markets should be developed, is an important issue (Chami et al (2010)). Historically, derivatives markets have been introduced well after the development of the market for the underlying securities. Once derivatives become available, dealers and bond holders can hedge their exposures much more easily and efficiently. In addition, derivatives facilitate the pricing of instruments by making it easier to repackage risks and exploit arbitrage opportunities. This makes the holding of bonds more attractive and contributes to the development of secondary markets in the underlying bonds. Also, as the experience of derivatives on US government bonds shows, the existence of derivatives can significantly increase the liquidity of the market for the underlying bonds and encourage their development. Regulators might

consider promoting development of the CDS market, so that the CDS market continues to lower the costs and increase liquidity in the bond market.

However, we also found that at the peak of the financial crisis the CDS market contributed to higher spreads in the bond market. Given that the CDS market played the role of shock amplifier during the crisis, it is important to make sure that policymakers introduce measures to mitigate the negative spillover effect from the CDS market to the bond market.

Rapid growth and lax supervision of the CDS market up to 2007 have raised a number of policy concerns. The current regulatory reform initiatives on the CDS market aim at reducing systemic risk and providing additional transparency in the credit derivatives market. Most discussions have focused on how to reduce systemic risk stemming from the widespread use of CDS contracts traded in the over-the-counter (OTC) market. The Financial Stability Board and the Group of Twenty have picked up this issue, and agreed to require that all standardised CDS contracts trade in principle through central counterparties (CCPs) or exchanges. The US Treasury Department decided to require all standard credit default swaps to be traded through a CCP, and a similar undertaking is being contemplated in Europe. The current discussion seems to focus on financial stability benefits.

Trading through CCPs has certain advantages over trading in OTC markets. Counterparty risk and settlement risk are important considerations in OTC markets, whereas CCPs can limit delivery failures by requiring accounts to be marked-to-market and by enforcing margin or collateral requirements. Nevertheless, as Stulz (2010) suggests, the use of clearing houses is not a panacea for eliminating systemic risk associated with OTC trading of derivatives. Also, clearing houses are inefficient at dealing with most new financial products and customised derivatives. The OTC market is better at enabling innovation, at addressing specific derivatives requirements from end-users, and at finding counterparties when liquidity for a derivative on an exchange is low. By contrast, exchanges are more efficient when there is a large volume of trading for standardised contracts.

In this sense, as emphasised by Duffie (2009), it is important to improve price transparency and efficiency in the credit derivatives market. Trading through CCPs could be helpful in achieving this objective. However, given that the credit market, including the

CDS market, is relatively less developed in Asia, the optimal strategy for setting up CCPs remains an open issue. To this end, a continued discussion is warranted to strike the right balance between maintaining the stability of the CDS markets and promoting efficient and liquid CDS markets in Asia.

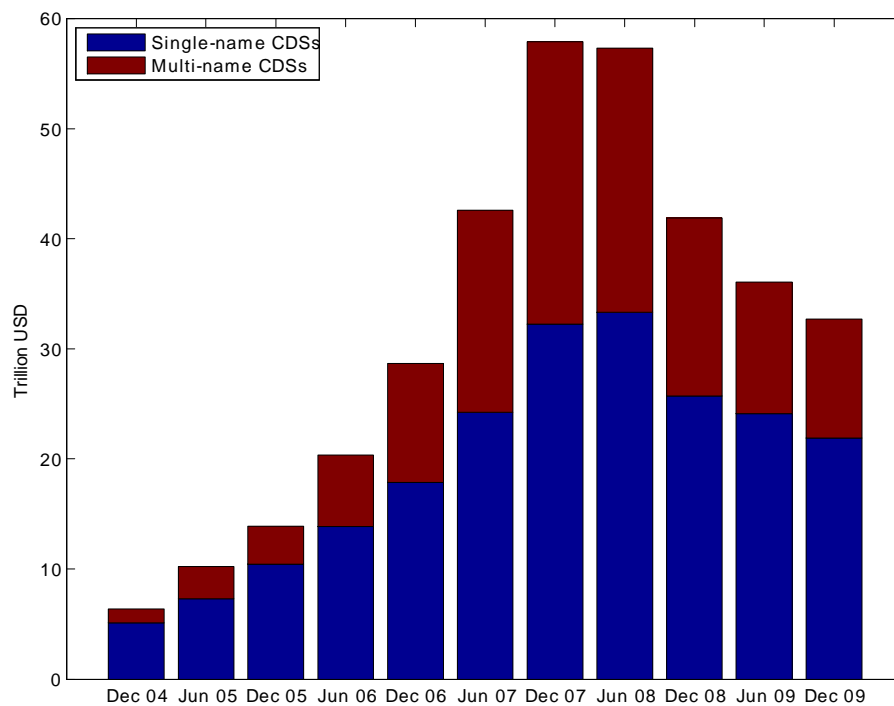
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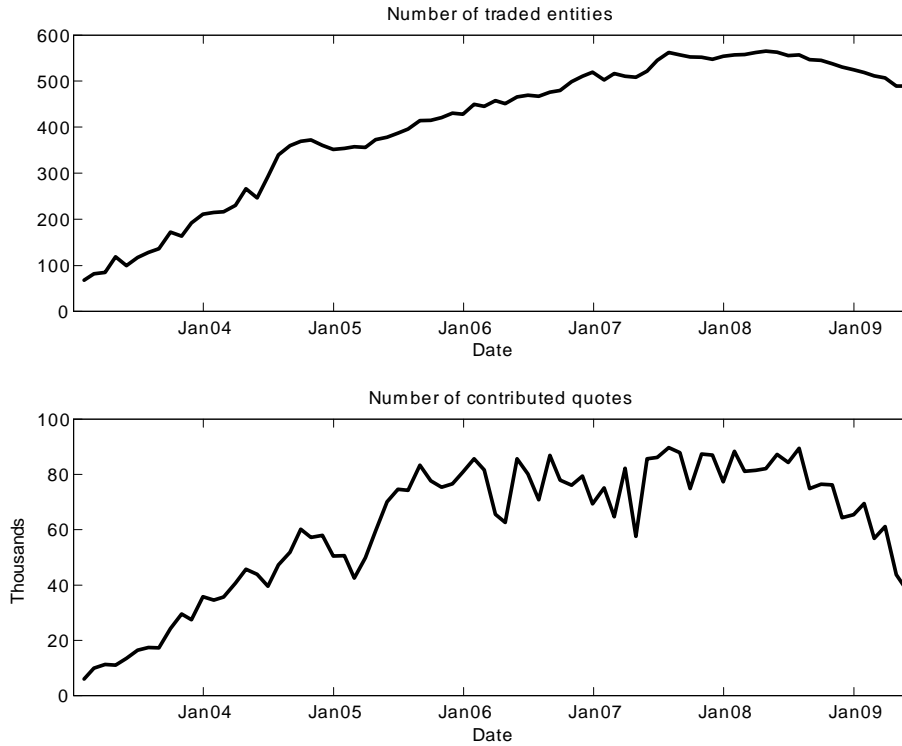
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Figure 1: Global CDS markets: notional amounts outstanding



Source: BIS.

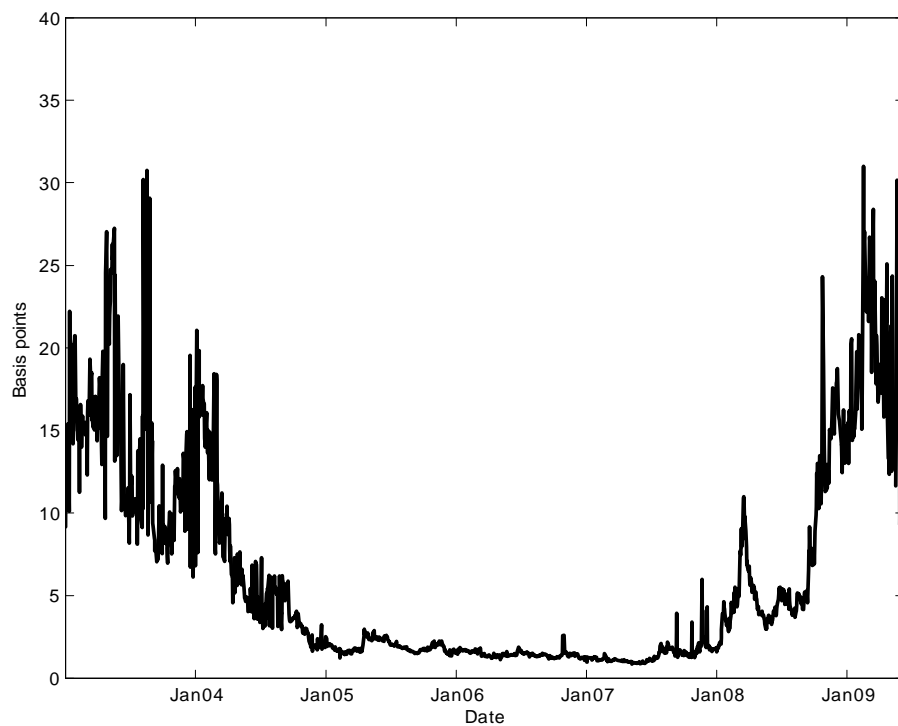
Figure 2: Quotations of CDS contracts in Asia



Sources: Markit; authors' calculations.

Note: The figure summarises the coverage of the Markit database on CDS quotes of non-sovereign Asian entities (including China, Hong Kong SAR, India, Indonesia, Japan, Korea, Malaysia, the Philippines, Singapore and Thailand), which totals 683 entities in the sample. The upper panel plots the number of entities that have valid CDS quotes in each month. The lower panel shows the total number of contribution quotes on Asian entities provided by market participants in each month.

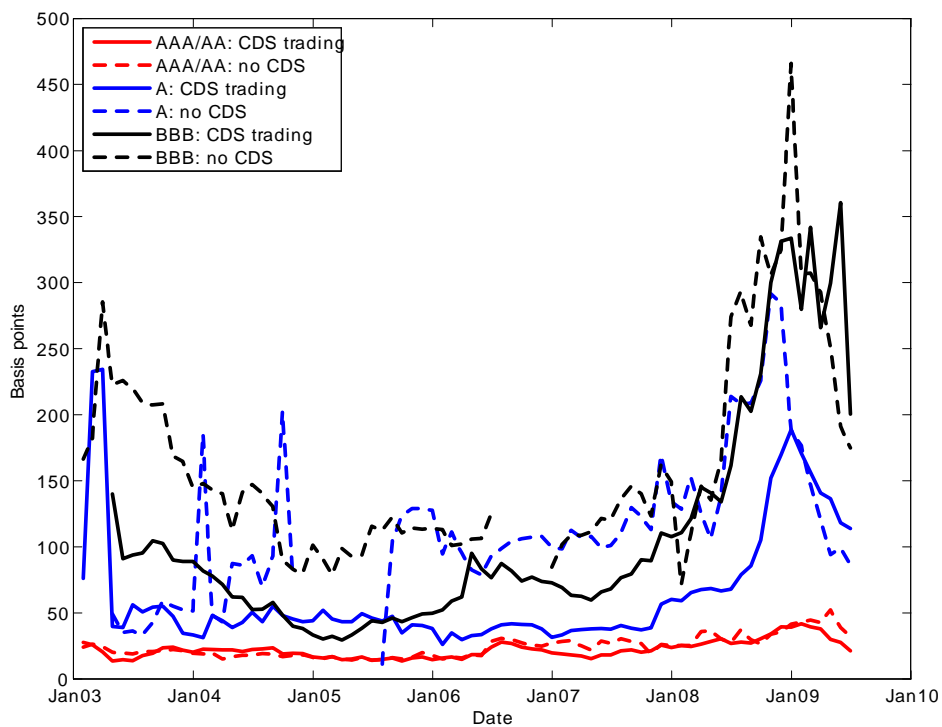
Figure 3: Liquidity in the CDS market



Sources: Markit; authors' calculations.

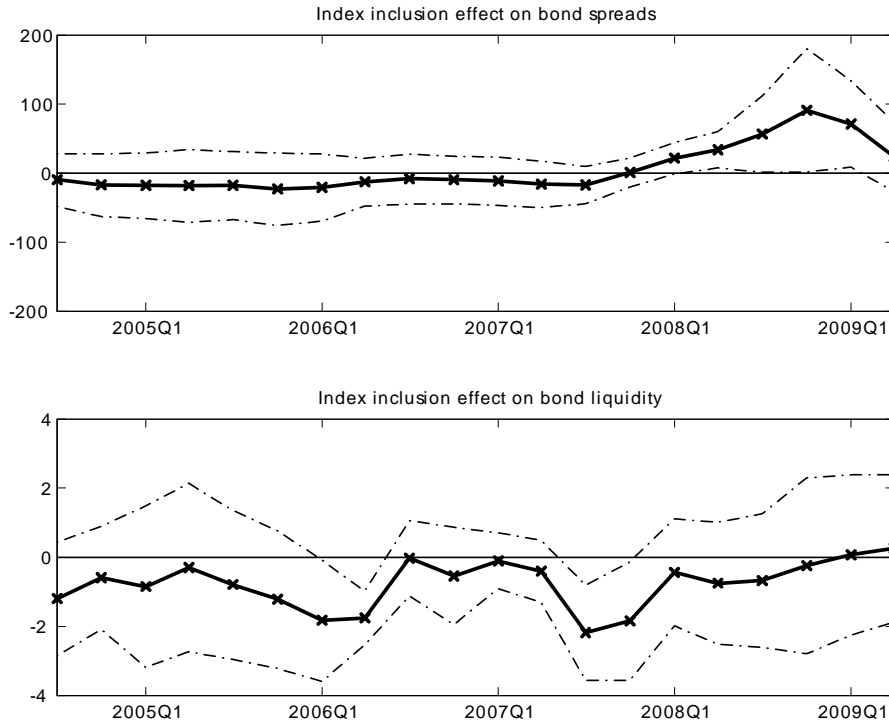
Note: The figure reports a liquidity measure in the CDS market. In total, 116 Asian entities are included in the sample. The liquidity measure is the standard deviation of contributed quotes on each entity on each day. The figure plots the time series of the average of the liquidity measure for the 116 sample entities.

Figure 4: Average bond spreads by rating, with and without CDS trading



Note: The figure plots the time series of average bond spreads by rating groups, for firms with and without CDS trading in each month. We impose a requirement that there be a minimum of 10 bonds in each subgroup when calculating the averages, so as to minimise the impact of outlier errors in a small sample. This requirement explains the missing observations in some of the time series.

Figure 5: Time-varying index inclusion effect on the bond market



Note: We run a panel regression that uses monthly data for the list of sample bonds. The dependent variable is the bond spread in the upper panel and the bid-ask spread in the lower panel. The explanatory variables include: (1) bond characteristics, including remaining maturity, issuance amount, a dummy for bond with collateral and bond ratings; in the bond liquidity equation, the bond's YTM is also included as an explanatory variable; (2) issuing firms' balance sheet information, including firm size and the debt/asset ratio; (3) macro-financial variables, including the output gap, one-year swap rate and term spread (10-year minus one-year swap rates) of the home country; (4) two time dummies indicating the two phases of the global financial crisis; (5) a dummy variable for CDS trading; (6) country fixed effects; and (7) interactive terms between quarterly time dummies and a dummy variable indicating inclusion in the iTraxx CDS indices. The figure plots the coefficients of interactive terms between time dummies and index inclusion dummies. In both panels, the dotted lines plot the 95% confidence interval of the coefficients, using clustered standard errors by firms as suggested in Petersen (2009).

Table 1: **Summary statistics: bond characteristics**

	AAA /AA	A	BBB	BB and below	Unrated	Total
Bonds	287	377	351	40	36	1091
Corporate	283	239	179	26	36	763
Financial	4	138	172	14	0	328
CDS trade	249	223	118	37	17	643
iTraxx inclusion	118	114	65	25	4	326
Collateral	226	0	0	0	8	234
Maturity structure						
(0, 5)	45	236	264	3	6	554
[5, 7)	34	69	38	13	8	162
[7, 10)	68	40	22	14	9	153
[10,30]	140	32	27	10	13	222

Table 2: **Effects of CDS trading on the cost and liquidity of bonds: benchmark**

	Bond spread		Bid-ask spread	
	coef	<i>t-stat</i>	coef	<i>t-stat</i>
Constant	248.46	<i>4.3</i>	-19.70	<i>7.4</i>
Dummy (CDS trading)	-17.96	<i>2.4</i>	-2.12	<i>6.4</i>
Bond yield-to-maturity (%)			1.35	<i>10.5</i>
Maturity	0.60	<i>0.6</i>	-0.86	<i>18.8</i>
Log(bond amount)	4.64	<i>1.8</i>	0.74	<i>6.5</i>
Collateral	-27.63	<i>2.2</i>	-1.56	<i>3.0</i>
AAA/AA	36.24	<i>2.0</i>	-0.17	<i>0.2</i>
A	22.09	<i>1.3</i>	-0.09	<i>0.1</i>
BBB	75.13	<i>4.4</i>	-0.70	<i>1.0</i>
BB and below	52.21	<i>2.4</i>	-1.13	<i>1.3</i>
Log(firm size)	-43.83	<i>16.9</i>	0.51	<i>3.9</i>
Debt/asset ratio	120.82	<i>7.9</i>	3.92	<i>5.7</i>
GDP gap (%)	27.34	<i>5.0</i>	1.01	<i>4.2</i>
1-year swap rate (%)	29.00	<i>9.0</i>	2.46	<i>10.2</i>
Term spread (%)	28.75	<i>3.7</i>	4.75	<i>12.7</i>
Time dummy (July 2007 to Lehman)	-44.69	<i>4.1</i>	-1.35	<i>2.7</i>
Time dummy (Post Lehman)	120.64	<i>12.5</i>	5.73	<i>12.2</i>
<i>Adjusted R²</i>		<i>0.70</i>		<i>0.91</i>
<i>No of observations</i>		<i>1091</i>		<i>1005</i>

Notes: This table examines the impact of CDS trading on the cost and liquidity of bonds at the date of issuance. It reports OLS regression results, and *t*-statistics are included in parentheses. Dependent variables are bond spreads (yields-to-maturity minus Treasury rates of the same maturity) and bid-ask spreads, respectively, both in unit of basis points. Explanatory variables include: (1) a dummy variable that indicates the trading of the issuing company at the CDS market when the bond is issued; (2) bond characteristics, including bond maturity, issuance amount (in US dollars) and a dummy variable indicating the use of collateral; (3) the rating of bonds at issuance; (4) balance sheet information, including firm size (in US dollars) and debt/asset ratio; (5) macro-financial variables; including the output gap, one-year swap rate and term spread (defined as 10-year minus one-year swap rates) at date of issuance; and (6) two dummy variables indicating two phases of the recent global financial crisis.

Table 3: **Probit regression explaining bond issuance decision**

	coef	<i>t-stat</i>
Constant	-4.57	31.8
Log(firm size)	0.28	22.8
Debt/asset ratio	0.01	19.4
Rating single-A and above	0.10	2.6
Rating BBB and below	-0.05	1.3
CDS index level	0.38	11.8
CDS index change	-0.18	4.1
Equity return	0.00	1.4
GDP gap	0.20	9.8
1-year swap rate	0.15	12.5
Term spread	-0.19	4.4
VIX	-0.02	4.5
Baa-Aaa Spread	-0.14	2.8
Dummy (CDS trading)	0.29	7.3

Notes: The probit regression examines the determinants of bond issuance decision. The dependent variable is a dummy variable that indicates bond issuance by each firm in each month from January 2003 to June 2009. The explanatory variable includes: (1) firm-specific variables such as firm size, firm leverage and firm ratings (investment grade or speculative grade); (2) credit market variables such as the level and month-over-month changes of CDS indices (proxied by the names included in iTraxx Japan and iTraxx ex-Japan for each economy); (3) country-specific variables such as monthly stock market returns, GDP gap and interest rates; (4) global financial condition variables such as VIX, Baa-AAA spread in the US market; (5) a dummy variable for CDS trading in the past two months (current month inclusive).

Table 4: **Effects of CDS trading on the bond market: Heckman correction**

	Bond spread		Bid-ask spread	
	coef	<i>t-stat</i>	coef	<i>t-stat</i>
Constant	883.64	8.8	23.14	5.0
Dummy (CDS trading)	-31.23	4.0	-2.84	8.1
Bond yield-to-maturity (%)			0.98	7.4
Maturity	1.57	1.6	-0.76	19.2
Log(bond amount)	0.68	0.3	0.47	4.4
Collateral	-18.69	1.6	-0.99	2.3
AAA/AA	13.26	0.8	-0.71	1.1
A	1.37	0.1	-0.28	0.4
BBB	58.51	3.8	-0.43	0.6
BB and below	42.99	2.2	-0.57	0.7
Log(firm size)	-68.22	16.0	-1.31	5.9
Debt/asset ratio	-12.49	0.5	-4.28	4.1
GDP gap (%)	23.74	4.2	0.89	3.6
1-year swap rate (%)	10.56	2.6	1.60	6.1
Term spread (%)	27.62	3.4	4.95	11.8
Time dummy (July 2007 to Lehman)	-57.78	5.2	-2.26	4.7
Time dummy (Post Lehman)	80.15	7.3	3.77	7.8
Inverse Mills ratio	-112.55	7.5	-7.59	10.4
<i>Adjusted R²</i>		0.72		0.92
<i>No of observations</i>		1080		993

Notes: This table examines the impact of CDS trading on the cost and liquidity of bonds at the date of issuance. The models used are similar to those in Table 2 but correct for selection bias using the Heckman correction method. The additional explanatory variable is the inverse Mills ratio from a probit regression that explains the bond issuance decision, as shown in Table 3. *t*-statistics are calculated based on the asymptotic covariance matrix of the coefficients.

Table 5: **Who is affected? Impact of CDS trading on bond spreads**

Variables	1	2	3	4	5	6	7
	<i>SIZE</i>	<i>LEV</i>	<i>UNRATED</i>	<i>FIN</i>	<i>BONDHIST</i>		
<i>TRADING</i>	-320.91 (6.5)	-24.97 (1.7)	-28.85 (3.6)	-57.31 (6.6)	-40.01 (2.9)	-35.39 (4.4)	
<i>TRADING</i> × <i>D</i>	29.38 (5.9)	-14.14 (0.5)	-49.23 (1.8)	53.72 (4.2)	10.52 (0.8)		
<i>D</i>	-76.79 (17.3)	-6.53 (0.3)	917.53 (8.9)	-62.11 (5.6)	-8.48 (0.8)		
Index inclusion dummy						14.88 (2.2)	
<i>CDS LIQUIDITY</i>							1.30 (2.5)
<i>Adjusted R</i> ²	0.73	0.72	0.72	0.73	0.72	0.72	0.58
<i>No of observations</i>	1080	1080	1080	1080	1080	1080	640

Notes: The dependent variable is bond spreads at date of issuance (in basis points). The model is estimated using OLS with *t*-statistics reported in the parentheses. Explanatory variables are the same as those used in Table 4 (with Heckman correction), except with an additional interactive term between the dummy variable of CDS trading (*TRADING*) and firm- or bond-specific variables *D*. By columns the *D* variable refers to firm size (*SIZE*), firm leverage (*LEV*), a dummy for unrated bonds (*UNRATED*) a dummy for financial firms (*FIN*), a dummy of *BONDHIST* that indicates bond issuance history of the the same issuer in the past two years and a dummy variable that indicates firm inclusion in the iTraxx Japan or iTraxx Asia ex-Japan indices. In regression 7, *TRADING* and the interactive term are replaced by a liquidity measure in the CDS market, which is defined as the average standard deviation of all dealer quotes on a CDS contract during the 30-business-day window before the bond issuance. The table only reports coefficients on *TRADING*, the variable of interest and the interactive term.

Table 6: **Who is affected? Impact of CDS trading on bond liquidity**

Variables	1	2	3	4	5	6	7
	<i>SIZE</i>	<i>LEV</i>	<i>UNRATED</i>	<i>FIN</i>	<i>BONDHIST</i>		
<i>TRADING</i>	-8.17 (3.7)	-2.43 (3.9)	-2.86 (7.9)	-2.80 (8.1)	-2.06 (3.9)	-2.32 (6.6)	
<i>TRADING</i> × <i>D</i>	0.54 (2.4)	-0.88 (0.7)	0.34 (0.3)	0.73 (1.4)	-0.93 (1.7)		
<i>D</i>	-1.52 (6.5)	-3.89 (3.4)	22.89 (4.9)	2.73 (6.1)	0.99 (2.3)		
Index inclusion dummy						-1.53 (5.5)	
<i>CDS LIQUIDITY</i>							0.16 (5.5)
<i>Adjusted R</i> ²	0.92	0.92	0.92	0.93	0.92	0.92	0.89
<i>No of observations</i>	993	993	993	993	993	993	586

Notes: See Table 5. The dependent variable is a liquidity measure of bonds at issuance, defined as the bid-ask spreads (in basis points).