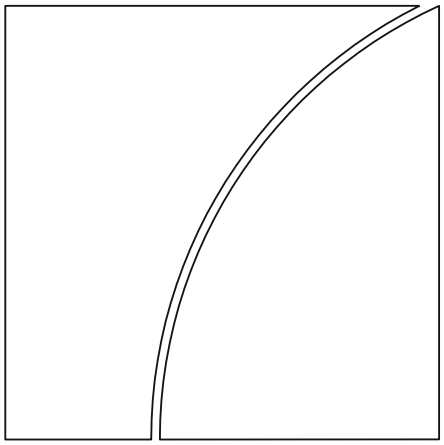
BANK FOR INTERNATIONAL SETTLEMENTS



BIS Working Papers

No 928

Debt specialisation and diversification: International evidence

by Gregory R. Duffee and Peter Hördahl

Monetary and Economic Department

February 2021

JEL classification: G30, G32.

Keywords: Corporate bonds, capital structure, firm financing, debt specialisation, debt diversification.

BIS Working Papers are written by members of the Monetary and Economic Department of the Bank for International Settlements, and from time to time by other economists, and are published by the Bank. The papers are on subjects of topical interest and are technical in character. The views expressed in them are those of their authors and not necessarily the views of the BIS.

This publication is available on the BIS website (www.bis.org).

ISSN 1020-0959 (print)
ISSN 1682-7678 (online)

Debt Specialization and Diversification: International Evidence

Gregory R. Duffee
Peter Hördahl

This version: February 2, 2021

Abstract

We uncover a strong U-shape in bond financing by US firms. Firms with total debt in the range of $10 million to $100 million tend to use much less bond financing relative to loan financing than do firms with more or less total debt. There is no corresponding U-shape in less-developed Asian markets, while the advanced markets of Hong Kong SAR and Korea are in the middle. These patterns, and more generally the cross-firm variation in firms' use of bond financing relative to financing through loan facilities, are largely unrelated to either credit quality or monitoring effectiveness. This suggests that market segmentation is more likely. Finally, we find evidence of debt diversification by highly-leveraged firms.

Affiliations: Duffee, Johns Hopkins University; Hördahl, Bank for International Settlements (BIS). Contact information: Duffee, voice 410-516-8828, email duffee@jhu.edu; Hördahl, voice +851-2982-7106, email peter.hoerdahl@bis.org.

We thank Jose Maria Vidal Pastor for excellent research assistance. We also thank Vidhan Goyal, Andrew Mackinlay, Ilhyock Shim and participants at the Bank of Korea - BIS workshop and conference on "Asia-Pacific Fixed Income Markets" and various seminars for helpful comments. Gregory Duffee thanks the Bank for International Settlements for financial support. The views expressed in this paper are personal and do not necessarily reflect those of the Bank for International Settlements.

Why do some firms borrow using only revolving credit facilities, while others borrow exclusively through privately-placed bonds? Why does bank debt comprise 90 percent of some firms' debt, while publicly-traded bonds comprise 90 percent of other firms' debt? We contribute to the large literature that asks these and similar questions, investigating debt composition of more than 100,000 firm-year observations in the US and across nine Asian markets. Our analysis allows us to contrast the debt specialization and diversification of US firms with that of firms in Asian economies – a region with rapidly growing bond markets.

Our research examines two categories of debt instruments that we label "loan facilities" and "bonds." A few decades ago in the US, the label "bank debt" was interchangeable with loan facilities, and in less-developed financial markets that phrase still applies. Loan facilities include all revolving credit facilities and term loans, regardless of the lender (i.e., including commercial banks and shadow banks.) Bond debt includes both straight and convertible bonds that are either publicly traded or privately placed. We study properties of a firm's "bond leverage ratio," defined as the ratio of the firm's bond debt to the sum of its loan and bond debt.

Figure 1 sets the stage and illustrates one dimension along which we differ from earlier research. The sample consists of firm-year observations from 2004 through 2019 for which the firm has either loan facilities or bond debt. Like much previous research, we restrict our attention to firms with publicly-traded equity. Unlike earlier work, we study the debt composition of both very large and very small borrowers; those with total debt exceeding $10 billion as well as those with total debt below $1 million. Observations for US firms are sorted into ten groups based on total debt (in 2019 dollars). We perform the same sort for firms in Hong Kong SAR and Korea, and again for firms in seven other less-developed Asian markets. The figure displays, for the observations in each decile group, the mean bond leverage ratio.

The positive relation between total debt and the mean bond leverage ratio on the right side of the figure is well-known and is consistent with standard asymmetric information theories of corporate finance. However, the broad range of total debt reveals a surprise: a strong U-shape relation for US firms. The average bond leverage ratio is lowest for firms with around $10 million to $100 million in debt. Firms with $1 million or less total debt have bond leverage ratios similar to firms with $1 billion in total debt. For most Asian markets, the share of bond debt monotonically increases in total debt. In between are the

more advanced Asian markets of Hong Kong SAR and Korea.

Theories building on Diamond (1991) and Rajan (1992) imply that the bond leverage ratio is a rough measure of the firm's reliance on debt with less intense lender monitoring. Therefore, firms with an observably high probability of default, as well as firms that are relatively easy to monitor, are more likely to have lower ratios. A simple interpretation of the right side of Figure 1 is that firms with substantial debt are necessarily large firms, and large firms are less likely to default than small firms. Thus they use more bond debt. At least at first blush, it is difficult to reconcile this logic with the figure's left side.

We use our data sample, with its broad range of both debt levels and financial environments across geographic regions, to reexamine the empirical evidence for such theories. Two other characteristics distinguish our empirical approach. First, we use double sorts by total debt and total leverage to disentangle the multiple channels by which a firm's total debt influences the bond leverage ratio. A firm's total debt conveys information about both its likelihood of default and the debt markets available to the firm. Firms with only $500,000 in debt do not borrow in the public bond market, nor do firms with $10 billion in debt sell a $500,000 convertible note to a qualified individual investor. Our approach allows us to determine how, say, observable credit quality relates to the bond/loan financing choice within a fairly small band of total debt.

Second, following the spirit of Rauh and Sufi (2010) and Colla, Ippolito, and Li (2013), we distinguish between debt specialization and diversification. How likely is a firm to use only one of these types of debt, and if so, which one? For firms that diversify their financing by using both types of debt, what determines the relative amount of bond debt?

In line with earlier research, we find a role for asymmetric information in explaining variations in capital structure across firms. However, other determinants are much more important across the the entire set of firms we consider. We argue that the amount of a firm's total debt is the most important determinant of whether the firm specializes its debt financing. For each of the three geographic regions we study, less total debt corresponds to more debt specialization. Depending on the region, between 20 and 30 percent of firms in the largest decile of total debt rely exclusively on either loans or bonds. Corresponding percentages for firms in the smallest decile exceed 80 percent. While total debt matters a great deal, observable credit quality (holding total debt constant) matters little. Our interpretation is that firms that borrow less money have fewer choices and greater costs of

searching for financing, regardless of their credit quality.

For US firms, another important determinant of whether a firm specializes its debt financing is a firm's total leverage. Fixing the amount of total debt, US firms with low total leverage are more likely to use a single type of debt than are firms with high total leverage. As with total debt, we find that this result is not driven by a connection between total leverage and credit quality. A more plausible interpretation is that US firms which rely heavily on debt financing rather than equity financing prefer to diversify their debt financing sources. Firms in Asia do not have as much access to multiple forms of financing, thus they are less likely to diversify even if they have high leverage.

We find only one debt specialization choice which is clearly linked to asymmetric information. Small and medium US borrowers with observably low credit quality, as measured by average revenue and average profits, are more likely to use solely convertible bonds rather than solely loans.

The typical firm in our sample with diversified financing uses about 75 to 80 percent of one type of debt, regardless of the firm's total debt or geographic region. Among US diversified firms, cross-firm variation in the bond leverage ratio is sensitive to measures of asymmetric information. The strongest evidence in our sample for the role of asymmetric information is the same evidence observed by many others beginning with Johnson (1997): firms with large amounts of debt and high observable credit quality concentrate their borrowing in the form of bonds.

Yet outside of this well-studied sample, there is no evidence of similar patterns in the variation in the bond leverage ratio among other firms. Medium-size US borrowers with high observable credit quality concentrate their borrowing in the form of loan facilities, while small high-quality US borrowers exhibit no preference. Among small and medium-size diversified firms in Asia, observable credit quality is largely unrelated to the bond leverage ratio.

It is worth emphasizing that our approach asks how firms' financing choices are related to firms' characteristics, taking as given the set of markets available to firms. A deeper question that we do not address is why market segmentation exists. Earlier research argues that asymmetric information may well play a prominent role in determining why, say, firms in Asia have fewer financing choices than firms in the US.

Section 1 reviews the relevant literature. Section 2 describes our research methodology and our data sample. Section 3 discusses the determinants of a firm's choice to specialize in

one form of debt. Section 4 discusses the determinants of the bond leverage ratio for firms that choose diversified debt sources. Concluding comments are in the final section.

1 The State of the Literature

Firms borrow by establishing loan facilities and by issuing bonds. We study firms' choices of borrowing mechanisms. Because there are firms in our sample that borrow less than $1 million and firms that borrow more than $10 billion, both the underlying range of debt financing mechanisms and the relevant literature that discusses them are broad. This section describes the range of debt markets and what we know about the intensity of lender monitoring.

Before getting into the details, we note that our empirical approach that distinguishes among debt instruments (loan facilities versus bonds) takes a slightly different perspective from much of the earlier literature, which distinguishes among types of lenders. In practice this difference is not large because differences among borrowing mechanisms are closely tied to differences among the lenders.

1.1 An outline of the debt markets

Loan facilities include lines of credit and term loans. In the US, most financing for small businesses, and a substantial amount of all business lending, is done through lines of credit.[1] Large firms often borrow using syndicated loan packages that bundle multiple lending facilities. For example, a syndicated loan might include a 364-day credit line, a longer-term revolving line of credit, and one or more term loans. Term loans have a fixed loan amount and maturity. A small firm typically relies on a single lender for credit lines and term loans.

Lenders for loan facilities are concentrated, avoiding the free-rider problem of diffuse creditors described in Diamond (1984). Loan facilities involve substantial monitoring and renegotiation. For example, Roberts and Sufi (2009) estimate that nearly all loan facilities are renegotiated prior to maturity. Covenants play an important role in monitoring. Sufi (2009) documents that banks tend to restrict access to existing lines of credit when covenants are violated.

[1] Sufi (2009) estimates that three-quarters of publicly-traded US firms have lines of credit, accounting for more than a quarter of all their debt. Using a comprehensive sample of originated debt agreements, Bradley and Roberts (2015) report 60 percent are revolving lines of credit and 24 percent are term loans.

Bonds account for most of the aggregate debt financing for US nonfinancial firms.[2] Corporations outside of the US rely more heavily on loan facilities. Chui, Fender, and Sushko (2014) report that among a selection of emerging market economies, bonds on average make up less than a third of corporate sector debt in those economies. This is in line with the debt composition in our sample of firms in nine Asian economies: for FY 2018, Asian firms had a total of $1.4 trillion bond debt and $3.5 trillion loan debt.

Bonds, like term loans, have a fixed amount and maturity. Privately-placed bonds are sold directly to a single lender or a small group of lenders, while publicly-traded bonds are sold to decentralized arm's-length investors. The "private" in private placements limits our ability to study how these instruments are negotiated and placed. Private placements of bonds sold by large borrowers typically use financial intermediaries, primarily commercial and investment banks, to match borrowers with institutional lenders such as insurance companies and pension funds. Since intermediaries advertise their matching success, vendors can collect information on the transactions and make data available on platforms such as DealScan. This part of the private placement market is best known to academics. Much research follows the comprehensive survey of Carey, Prowse, Rea, and Udell (1993) by applying the term "private placement market" exclusively to this intermediated market, or somewhat more broadly to the private placements reported on DealScan or similar platforms. We note exceptions below.

This earlier research establishes that from the perspective of monitoring, privately-placed bonds lie between loan facilities and publicly-traded bonds. Kwan and Carleton (2004) examine all bonds placed with a large life insurance company over a ten-year period. They report that privately-placed bonds have tighter covenant restrictions than publicly-traded bonds. Carey et al. (1993) state that relative to loan facilities, privately-placed bonds are renegotiated less frequently and are monitored less intensively. In addition, privately-placed bonds are typically much more structured than either term loans or publicly-traded bonds. For example, in the sample of Kwan and Carleton (2010), make-whole call provisions are much more common among privately-placed bonds than publicly-traded bonds. They are also more likely to be secured and have embedded puts.

In developed capital markets such as the US, there are debt instruments that blur the lines among publicly-traded bonds, intermediated privately-placed bonds, and term loans. Two

[2]From Table L.103 of the 2019Q4 Flow of Funds, nonfinancial corporate bond liabilities totaled about $5.8 trillion and loan liabilities totaled about $3.6 trillion.

prominent examples are Rule 144A bonds and cov-lite loans. Corporate bonds issued using SEC Rule 144A are privately-placed bonds that can subsequently be registered for public trading. Fenn (2000) explains that the 144A market is used primarily by issuers of high-yield bonds who subsequently register the debt. Therefore these bonds are both privately placed and publicly traded, and structured like bonds that are originally issued on the public market. Cov-lite loans are term loans with substantially weaker covenant enforcement than standard term loans. Becker and Ivashina (2016) explain why cov-lite can be viewed as substitutes for high-yield bonds. Prilmeier and Stulz (2019) argue that privately-held firms use cov-lite loans rather than bonds to escape SEC registration requirements.

Individual transactions in this intermediated private placement market range from around $50 million to over $1 billion, and average about $300 million.[3] Many firms do not carry this much debt. As we discuss in detail in our empirical analysis, almost half of the US firms in our sample have total debt exceeding zero and less than $50 million. These firms do not use the intermediated private placement market.

One debt market for such firms is direct lending by nonbank institutional investors. An investment vehicle, such as a private credit closed-end fund, raises funds from institutional investors and lends the proceeds to small and mid-sized companies. Munday, Hu, True, and Zhang (2018) provide an overview of the market. The debt can be structured as a loan facility or a security (a bond), and can be combined with convertibility features. The term "mezzanine finance" is typically used to describe the subset of this market in which small and mid-size firms sell convertible bonds to private credit funds.

Little transaction-level data exists for the direct lending market. According to survey evidence in Alternative Credit Council (2018), a typical transaction size is around $60 million. The survey also reveals that most of the investment vehicles are based in the US and Europe, with only a small presence in Asia. Loumioti (2019) studies a sample of about 750 transactions with an average size of roughly $100 million. The data are from a vendor that specializes in extensions of credit made by private credit funds. Chernenko, Erel, and Prilmeier (2019) hand-collect data on debt agreements in SEC filings for mid-size firms. The mean transaction size in their sample is $74 million.

Although these transactions are smaller than the average intermediated private placement, they still dwarf the total debt of many firms. In our sample, nearly 30 percent of the

[3]See, e.g., the numbers reported in Sifma (2019) and Voya (2020).

US firms have total debt less than $5 million. Naturally, these firms tend to be very small. The private placement market for these firms is informal, and research is scant. Examples of private placements of bonds for these firms include promissory notes sold to wealthy individuals and convertible bonds sold to small institutional investors.

1.2 Linking firms' characteristics to financing

Researchers explain financing choices of firms with an abundant collection of theories. Much of this research explores the choice between publicly-traded bonds and all other forms of debt financing. This literature does not (and cannot) distinguish the choice of debt instrument from the choice of lender. On the other side of public bonds are near-atomistic arm's-length investors, and on the other side of all other forms of debt financing are private lending specialists.

Two key determinants of this binary choice are the magnitude of a firm's observable credit risk and the opacity of the firm's financial activities. As emphasized by Diamond (1991) and Rajan (1992), the activities of lending specialists create direct and indirect costs. Since debt of firms with low default risk is informationally-insensitive, observably low-risk firms choose to avoid paying these costs by borrowing from decentralized investors. However, firms that are observably high risk may not benefit sufficiently from screening and monitoring, thus they might also borrow from decentralized investors (if they can borrow at all).

Private lenders face capital constraints that do not bind for decentralized investors. Thus large firms are more likely to borrow from public markets. Blackwell and Kidwell (1988) note that fixed costs of debt issuance in public markets induce small firms to borrow from private firms. Fama (1985) points out that since firm size is correlated with information asymmetry, large firms (less private information, higher observable credit quality) are more likely to borrow from decentralized markets than small firms.[4]

Lines of credit, term loans, and privately-placed bonds (aside from 144A bonds) are all negotiated with specialized lenders. A large and growing literature examines variation across lenders without necessarily tying that variation to specific types of debt instruments. Much of the existing literature focuses on loan facilities. Outside of developed financial markets, the lenders behind these facilities are almost all commercial banks. Jimborean (2018) reports

[4]The literature linking financial market access to firm size dates to the 1940s. See, e.g., the references in Fazzari, Hubbard, and Petersen (1988).

that around 80% of total credit to the private non-financial sector in emerging markets is made up of domestic bank credit. Therefore research concentrates on US and European markets.

One driver of lender variation for loan facilities is risk. Carey, Post, and Sharpe (1998) find that as borrower probability of default increases, the likelihood increases that the lender is a finance company rather than a commercial bank. Carey et al. (1998) suggest that bank capital regulations might drive this result. Similarly, Irani, Iyer, Meisenzahl, and Peydró (2020) attribute the growing role of nonbanks in the loan market after the financial crisis to the effect of bank capital requirements. By contrast, Kashyap, Rajan, and Stein (2002) and Gatev and Strahan (2006, 2009) argue that commercial banks dominate the market for lines of credit because they are better equipped than nonbanks to handle the associated liquidity risk.

Other research studies the type of lender without distinguishing between loan facilities and privately-placed bonds. Using financial statements of US firms, Johnson (1997) introduces a now-standard decomposition of lenders into commercial banks, other private lenders, and arm's-length investors. He concludes that borrower characteristics are strong predictors of the type of private lender. In particular, larger firms use more public bond financing, and less financing from both commercial banks and other private lenders. Denis and Mihov (2003) study new issuances rather than levels, examining a sample of firms that are relatively large. They conclude that firms with low credit risk borrow from the public, firms with medium credit risk borrow from commercial banks, and firms with high credit risk borrow from other private lenders. Arena (2011) argues that their treatment of 144A bonds drives their result. He studies similar data and concludes that the firms with high credit risk are primarily borrowing through 144A bonds.

Loumioti (2019) and Chernenko et al. (2019) examine lending to middle-market firms. Both find that firms that borrow from commercial banks are financially stronger than firms that borrow from nonbanks. Loumioti (2019) presents evidence that bank regulatory constraints drive part of this result. More importantly for our purposes, both papers also study properties of the debt instruments. They find that nonbank lenders rely less heavily on covenants and more heavily on warrants, presumably to align the borrower's and lender's incentives. Thus their evidence suggests that among middle-market borrowers, lower-quality firms are more likely to use privately-placed bonds than are higher-quality firms.

1.3 Developed and less-developed markets

As noted above, outside of the US and a few other advanced economies, firms borrow money primarily through loans from commercial banks. Bond financing is much less common.

Information-based theories have implications for variation in types of debt finance across international markets. Markets differ in the quality of public information about firms, the quality of corporate governance, and the efficiency of liquidation during bankruptcy. Becker and Josephson (2016) argue that high-risk borrowers in countries with efficient bankruptcy mechanisms such as the US will borrow from decentralized markets. The same type of borrower in a country with inefficient bankruptcy mechanisms will borrow from specialized lenders who resolve insolvency through negotiation. Fan, Wei, and Xu (2011) review the literature concerning governance and financial infrastructure of emerging market economies.

Supply-side infrastructure also matters, and varies widely across countries. For example, Chan, Chui, Packer, and Remolona (2011) discuss how primary corporate bond markets in Asia can benefit from the development of active secondary markets. Amstad, Kong, Packer, and Remolona (2016) evaluate the state of Asian markets for corporate bonds and discuss proposed initiatives to improve the markets.

Although we know differences in infrastructure drive differences in financing choices across geographic regions, theory gives us little guidance about the magnitude of the relation. Simple cross-market comparisons are misleading because other effects are at work. Borrower characteristics matter. Booth, Aivazian, Demirguc-Kunt, and Maksimovic (2001) discuss how cross-country differences in capital structure can be driven by differences in the tangibility of assets, volatility of returns on assets, and growth opportunities.

In the Asian economies that we study, corporate bond markets are still typically in the early stages of development, outside of the financial centers of Hong Kong SAR and Singapore. Korea also has a sizeable and well-developed corporate bond market, driven by its large exporters and financial firms. In discussions with market participants, we obtained confirmation that small Asian firms almost exclusively rely on banks for financing, and that as they grow, they tend to progress from typical bank facilities such as overdrafts to syndicated loans and finally to bond financing. An Asian firm with an annual turnover of around half a billion dollars would be a typical candidate to start looking at bond financing.

According to our market sources, the private bond market in Asia has seen some growth in recent years but still remains very limited. Moreover, most of the growth in this sector

has taken place in the more developed markets (Hong Kong SAR, Singapore, Korea) where private bond issuance can account for 10-15% of total bond issuance volumes. Typical investors in the private bond market includes life insurers, asset managers and specialized investors.

Finally, our market contacts confirmed that convertible bond use is not very common in Asia. Given that many Asian firms are family controlled, the equity dilution aspect of convertible bonds tends to discourage the use of such financing. The firms that do use convertible debt tend to be large ones looking for a source of cheap debt (with coupons on convertibles being lower than on non-convertible bonds). Large, sophisticated Asian firms sometimes also turn to corporate hybrid bonds for financing. These instruments combine characteristics of bonds and equity (e.g. coupon payments that may be suspended by the issuer and no or very long maturity dates), while allowing firms to avoid equity dilution. This type of financing is rare outside of Hong Kong SAR and Singapore.

In summary, despite some growth in the Asian private bond market segment and the market for non-vanilla bonds, such as convertible and corporate hybrid bonds, it is clear that these market segments do not play a large role in Asian corporate financing. Moreover, only large Asian firms have access to the public bond market. A typical Asian firm instead relies on banks for its financing.

2 Research Design

What explains differences across firms in their use of loans and bonds? We roughly follow Rajan and Zingales (1995), who take a reduced-form approach to explaining cross-firm variation in leverage. Our main object of interest is the fraction of a firm's debt financing that is in the form of bonds rather than loans. For firm i in year t, this ratio is

$$R_{i,t} \equiv \frac{\text{Bond Debt}_{i,t}}{\text{Loan Debt}_{i,t} + \text{Bond Debt}_{i,t}}. \tag{1}$$

This bond leverage ratio is inversely related to the intensity of monitoring of a firm's debt. As the literature summarized in Section 1 explains, the monitoring intensity of both loan facilities and bond debt varies across firms. Large, well-capitalized firms face low monitoring with syndicated loans, especially those sold to institutional investors. They face effectively no

monitoring with their publicly-traded bonds. By contrast, small, opaque firms are monitored by holders of their privately-issued bonds and aggressively monitored by banks that supply their lines of credit. Yet for any given firm, the numerator represents less-monitored debt relative to its overall debt.

In Rajan and Zingales (1995), total leverage for firm i at time t is specified as an affine function of firm characteristics,

$$\text{Leverage}_{i,t} = b_0 + b_1' s_{i,t} + e_{i,t}, \tag{2}$$

where $s_{i,t}$ is the vector of characteristics. An important difference between total leverage and our measure of bond leverage is that the latter is often either zero or one. Thus we can fruitfully investigate both the choice to specialize—use a single type of debt—and the choice of bond leverage ratio when using both loans and bonds. Both Rauh and Sufi (2010) and Colla et al. (2013) study debt specialization, although they take a much more disaggregated approach to debt composition than we do.

The relevant decomposition of the bond leverage ratio into specialization and diversification terms is

$$\begin{aligned} E\left(R_{i,t}|s_{i,t}\right) \equiv & \Pr\left(R_{i,t}=0|s_{i,t}\right)\cdot 0 + \Pr\left(R_{i,t}=1|s_{i,t}\right)\cdot 1 \\ & + \left(1-\Pr\left(R_{i,t}=0|s_{i,t}\right)-\Pr\left(R_{i,t}=1|s_{i,t}\right)\right) E\left(R_{i,t}|s_{i,t}, 0<R_{i,t}<1\right). \end{aligned} \tag{3}$$

The decomposition of (3) distinguishes among the cases of all loan debt, all bond debt, and a combination of the two.

Theories of debt choice imply that the bond leverage ratio depends on the magnitude of the firm's financing needs, the firm's observable credit quality, the ability of lenders to monitor the firm, and perhaps the volatility of a firm's financing requirements. As with all of the empirical work that studies these determinants, our choice of proxies is constrained by available data. We describe these data before discussing how we choose proxies.

2.1 The data sample

We require firm-level data on loan and bond debt obligations rather than simply their sum as reported in, say, Compustat. We also require international coverage of emerging markets.

The S&P Capital IQ Premium Financials database contains the relevant disaggregated debt information. Capital IQ data are from financial statements (income, balance, and cash flows) filed by firms with local regulators.

We use fiscal-year data for firms in China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Singapore, Thailand, and the United States. Since we study the choice between loan and bond financing, we include only those firm-years in which the firm has debt either in the form of loan facilities or bonds. We exclude financial firms and firms that do not have publicly-traded equity. Capital IQ's coverage of the relevant financial statement information is much less complete prior to 2003 than after. Appendix A contains details about the dataset and our methods for excluding suspicious observations.

Capital IQ provides financial statement information on a harmonized basis, making it possible to compare data reported under different accounting standards. Data for subsidiaries are consolidated with parents. We convert all local currency amounts to US dollars using the prevailing exchange rate on the financial statement date. We use the Consumer Price Index (CPI) to convert the current dollars to 2019:12 dollars.

Since measures of loan and bond debt are central to our analysis, it is important to understand how Capital IQ constructs and reports them. Recall that total debt is composed primarily of four types of borrowing. Firms can borrow money through loan facilities, they can issue short-term securities (original maturities less than a year) such as commercial paper, they can issue longer-term securities which are typically described as either notes or bond, and they can enter into capital leases. Total debt is reported on the balance sheet, while breakdowns by debt type are reported in the notes to financial statements.

Capital IQ collects whatever detail a firm provides about its debt composition. Actual drawdowns on lines of credit are used rather than the size of the facilities. The dataset includes flags identifying the notes and bonds as convertible, exchangeable, senior, subordinated, and secured. These flags are all based on information provided in the text of the firm's financial statements.

Capital IQ sums the debt from reported loan facilities and labels this sum as bank debt. This is our measure of a firm's debt through loan facilities. Capital IQ also sums the debt from senior bonds, and separately sums the debt from subordinated bonds. We add these sums together to produce our measure of bond debt.

The data are by no means perfect. Sometimes the detail provided by a firm in the text

of its financial statements cannot be reconciled with the firm's reported total debt on its balance sheet. For example, a firm's year-t financial statements might report \$5 million in total debt on its balance sheet, while the statement's notes might report only that the firm in year $t-1$ issued \$3 million in 5% secured bonds and \$2.5 million in 7% unsecured bonds. Presumably the firm has paid down some of this debt between years $t-1$ and t, but the notes do not mention it. Capital IQ will report \$5 million in total debt, \$5.5 million in bond debt, and since no loans are mentioned, leave blank the field for bank debt.

Firms often report more detail about a debt instrument the first time the instrument appears in the firm's financial statements. Capital IQ carries this detail forward to populate future firm-year records if subsequent financial statements provide less-detailed information. Unfortunately, sometimes this procedure results in double (or even triple) counting by Capital IQ. A small discrepancy in how a particular debt instrument is reported in the financial statements of years $t-1$ and t sometimes results in the instrument appearing twice in year t's debt breakdown.

Accounting complexities often create small wedges between the value on the balance sheet of a debt instrument and the value reported in Capital IQ's disaggregated components. For example, sometimes unamortized debt issuance costs are included in one category but not the other. From the perspective of Capital IQ, this is a feature rather than a bug. Other discrepancies arise because of apparent errors in a firm's financial statements. For example, occasionally the text in a firm's financial statement will describe a debt instrument, yet this debt instrument is not included in the debt on the firm's balance sheet. Capital IQ nonetheless reports the instrument in its detailed breakdown of the firm's debt.

A simple, somewhat crude way to judge the magnitude of these discrepancies is to compare the sum of loan and bond debt reported by Capital IQ to the total debt on the balance sheet. Table A1 in the Appendix reports statistics for this ratio for the roughly 170,000 firm-year observations from 2004 through 2019. Nearly 15 percent of the observations have a ratio greater than one. Although at first glance this statistic suggests substantial measurement error throughout the dataset, the table reports that only half of these high-ratio observations exceed 1.02. In our empirical work we exclude all firm-year observations for which this ratio exceeds 1.02, to reduce contamination from measurement error.

Some of our empirical analysis emphasizes the role of convertible bonds in firms' capital structures. Capital IQ reports the sum of a firm's convertible bond debt. However, another

"feature" of the dataset is that this sum does not include all of a firm's bonds that are convertible. We use the instrument-level data in Capital IQ to construct our own sum of a firm's convertible bond debt, replacing the one provided by Capital IQ. We use this sum only to determine whether the firm has any convertible bond debt.

Our analysis across developed and emerging markets, as well as large and small firms, prevents us from closely following techniques developed in earlier research that are appropriate for large firms and/or developed financial markets. We do not use stock returns to construct proxies for either credit quality or asymmetric information because the vast majority of firms in our sample do not have actively traded stock. For example, the sample includes pink sheet stocks in the US and B Group stocks listed on India's Bombay Stock Exchange (BSE). We do not have analyst earnings forecasts for the firms, nor do we have the age of firms. Information in financial statements is more limited for firms outside of the US than for those in the US. We do not observe equity issuance or dividends, so we cannot examine equity financing. For most of the firms we cannot calculate either EBITDA or interest coverage as proxies for observable credit quality, nor can we use expenditures on research and development as a proxy for difficulty of monitoring.

2.2 Proxies for financing requirements

Equation (3) is a tool to understand the economic determinants underlying firm i's bond leverage ratio at t. We are not interested in forecasting the bond leverage ratio for (i, t) as of $t-1$, nor are we interested in a model with the best fit. An AR(1) for a firm's bond leverage ratio is an excellent forecasting tool. Yet the fact that a firm's choice of bond leverage at $t-1$ is closely related its choice at t does not help us understand the underlying economics. Therefore we choose the explanatory variables to best capture the economic determinants underlying a bond leverage ratio at t. Some of the variables we used are realized in year t, while others are realized in year $t-1$.

A firm's choice of bond leverage in year t depends on its year-t financing requirements. For example, the fixed costs of issuing publicly-traded debt are less important for firms with a few billion dollars of debt than for firms with a few million dollars of debt. We use a firm's total debt in year t to measure the level of its funding requirements and its year-t total leverage to measure its relative funding requirements. The word "total" is redundant.

We use it to emphasize the distinction between the bond leverage ratio defined in (1) and the usual measure of leverage. Total leverage is total debt on a firm's balance sheet divided by market assets. Market assets is defined as the market capitalization of equity plus book value of liabilities.

Loan facilities, especially lines of credit, are more flexible forms of financing than bonds. We proxy for a firm's preference for flexible financing with the log of the standard deviation of net working capital divided by market assets. The standard deviation is calculated using ratios for years $t-5$ through $t-1$. This standard deviation roughly captures the volatility of the financing needs for its business activities.

Of course, total debt and total leverage both convey more information than a firm's financing requirements. Total debt is highly correlated with firm size. Both firm size and total leverage are closely tied to both observable credit quality and monitoring difficulty. Larger firms are less likely to default than smaller firms, and are less opaque than smaller firms. Activities of larger firms are easier for outsiders to observe. All else equal, greater total leverage corresponds to a greater likelihood of default. We disentangle the effects of financing requirements from the effects of credit quality by proxying for credit quality with a wider set of instruments. The next section discusses this set.

2.3 Proxies for credit quality and monitoring effectiveness

A single measure of a firm's observable credit quality helps to cleanly interpret our empirical results. In principle, a firm's credit rating for senior unsecured debt works well. It summarizes the combination of default probability and loss in the event of default. Yet credit ratings are unavailable for the large majority of firms we examine.

We therefore use an implied credit rating. Using data for US firms with credit ratings, we estimate a multinomial logit equation to explain observed credit ratings with financial statement variables. We then apply the fitted equation to all firms to produce an implied credit rating. The financial statement variables measure total leverage, mean profitability, the volatility of profits, asset composition, past growth, expected future growth, and the size of a firm's operations relative to its assets. Data details are in Appendix B.

We form six groups of observed credit ratings.[5] They are, using Moody's notation, Aaa

[5]The "credit rating" of a firm is the better of the ratings by Moody's and S&P. The S&P rating is

and Aa, A, Baa, Ba, B, and Caa through C. We denote these as categories 1 through 6. Since these categories are ranked, we use an ordinal version of a multinomial logit,

$$\log\left(\frac{\Pr(\text{rating}_{i,t} \leq j|X_{i,t})}{\Pr(\text{rating}_{i,t} > j|X_{i,t})}\right) = \beta_j + \beta' X_{i,t}, \quad j = 1, \ldots, 5, \tag{4}$$

where $X_{i,t}$ denotes the financial statement variables discussed above. Estimation results are in Appendix B.

The sensitivity of the credit rating to the explanatory variables, which we denote $IR_{i,t}$ for implied rating, is

$$IR_{i,t} = \hat{\beta}' X_{i,t}. \tag{5}$$

Higher values of IR correspond to better credit quality. Note that this implied rating is a continuous variable. We use the implied credit rating in year $t-1$ to explain a firm's bond leverage ratio in year t.

Effective monitoring requires that lenders can determine when a firm gets into financial difficulty. The higher a firm's baseline level of revenue and net income, the easier is the lender's job. If a firm's revenue and profitability are consistently low—say, a firm's line of business consists of developing a new biomedical product that is not yet on the market—lenders cannot rely on declining revenue or profitability as measures of financial difficulty. Therefore two proxies we use for monitoring effectiveness are averages, over the past five years, of revenue to market assets and net income to market assets. These are averages from year $t-5$ through year $t-1$. Monitoring is also more effective when a firm's assets are primarily tangible, and thus more valuable as collateral. Our third proxy for monitoring effectiveness is the ratio of property, plant, and equipment to the market value of assets for year $t-1$.

2.4 Summary Statistics

Table 1 reports statistics for firm size, the bond leverage ratio, and two other debt ratios for the sample spanning 2004 through 2019. Firm size, measured by market assets, varies

the "long-term local currency issuer" rating, which reflects the firm's capacity and willingness to meet its financial commitments as they come due. The Moody's rating is the long-term "issuer rating", which reflects the ability of the firm to honor its senior unsecured debt.

widely across and within markets. Only China, which has particularly restrictive listing requirements for publicly-traded firms, does not have a substantial number of firms with less than $50 million in market assets (2019 dollars). The smallest firms are in India and the United States, and of course the largest are in the United States.

Total leverage, defined as total debt relative to market assets, also varies widely. Its average within a given market is lowest for Chinese firms (mean of 0.16) and highest for Indian firms (0.34). Aside from China, the 90th percentile of market leverage in each market is approximately 0.5. Recall that firms with zero leverage are not in the sample. Almost all of this debt is either in the form of loans or bond debt. The rows labeled "Loan + Bond Ratio" refers to the ratio of the first two components to total debt. This ratio is in the neighborhood of 0.90 to 0.95 for most firms.

The table documents the well-known fact that US firms rely much more heavily on bond financing than do Asian firms. More than one-fourth of US firm-years have only bond debt. By contrast, the typical Asian publicly-traded firm has debt only through loan facilities. The median bond leverage ratio in the US is almost 0.6, while for every Asian market, the median bond leverage is zero. More than three-fourths of the firms in each of China, India, Malaysia, and Singapore use only loan facilities.

Table 2 reports Spearman rank correlations among bond leverage ratios and explanatory variables. The timing of the explanatory variables is described in Sections 2.2 and 2.3. We split the geographic markets into three groups: the US, Hong Kong SAR and Korea, and the other Asian markets. Among Asian economies, Hong Kong SAR and Korea have relatively well-developed markets for financing corporate activities. Singapore, although an international center for financial trading, is not included in this group. According to Table 1, nonfinancial firms in Singapore are among the most reliant in our sample on loan debt.

Each pairwise correlation uses all observations for which the two variables are not missing. The implied credit rating and standard deviation of net working capital have the largest number of missing observations among those in Table 2 because they both require five previous years of financial statements. For each of the three geographic regions, these variables are available for about 68 percent of the firm-year observations summarized in Table 1.

The bond leverage ratio is positively correlated with total debt for each geographic region. This sign is not surprising, since earlier research finds that bond use increases with firm size (although Figure 1 displays substantial nonmonotonicity), and larger firms tend to borrow

more money. For each region, the bond leverage ratio is positively related to total leverage and negatively related to both the firm's average revenue/asset ratio and the firm's volatility of net working capital. There is no stable relation across the markets between the implied credit rating and the bond leverage ratio.

3 Debt Specialization Versus Diversification

Recall from Table 1 that most of the Asian firms have no bond debt. They borrow exclusively through loan facilities. Most US firms also have only one of these types of debt, but these single-source firms are split roughly evenly between bond-only firms and loan-only firms. The large number of firms that hold either no loan debt or no bond debt motivates our decomposition of the bond leverage in (3) into these two extremes and the middle ground.

In this section we argue that the choices of firms to specialize in one form of debt are largely driven by size-based market segmentation rather than asymmetric information. Market segmentation is created by costs of market participation, such as the fixed costs of issuing publicly-traded bonds and the search costs of locating a few institutional investors to collectively lend $100 million in the form of a syndicated loan or privately-placed bonds.

Two broad empirical observations support our argument. First, firms' choices are closely associated with their amount of debt, and in ways that are consistent with market segmentation. Second, for the most part, these choices are not associated with our measures of observable credit quality or monitoring effectiveness, at least in ways consistent with asymmetric information logic.

3.1 Financing requirements

We separate our sample of firm-years into four types based on their financing choices. The first three involve some type of debt specialization. One consists of firm-years that have loan debt and no bond debt. We refer to these as "only loan debt" observations, a label that ignores any debt these firms might have that is neither loans nor bonds. We split the firms that have no loan debt into two types. One has only nonconvertible bond debt. The other has some bond debt that the database flags as either convertible or exchangeable. The fourth type of firm-year uses diversified financing. These observations have both loan debt

and bond debt. We do not further distinguish these diversified financing observations by debt convertibility.

For each geographic region, we sort the firm-year observations from 2004 through 2019 into ten groups by deciles of total debt. Within each decile, we calculate the fractions of firm-years that are in each of the four types described in the previous paragraph. Figure 2 displays, for each geographic region and decile group, these fractions. The clearest message conveyed by Figure 2 is that financing patterns in the US differ widely, both across debt levels in the US and from the other geographic regions.

In both Asian regions, the fraction of firms that use entirely loan financing decreases monotonically with total firm debt. This pattern is roughly compatible with theories of debt choice in Hackbarth, Hennessy and Leland (2007) and Becker and Josephson (2016). They develop models in which most firms borrow from banks. Bank debt allows firms to take advantage of the monitoring and more flexible renegotiation associated with loan facilities. Since public debt markets are deeper than banks' pockets, firms with substantial financing requirements also borrow using bonds. In these theories the level of debt at which a firm switches from all-loan financing to a mix of loans and bonds depends on the value to the borrower of monitoring and renegotiation, as well as the borrower's bargaining power.

The only evidence about Asian firms in Figure 2 that pushes back against these theories is that the firms with the smallest amount of debt are more likely to borrow exclusively through bonds than are firms with substantially more debt. This pattern is clear for Hong Kong SAR and Korea. Only a keen eye will detect that it also holds for the other Asian markets. More importantly, these theories appear to have nothing in common with the financing patterns in Figure 2 for US firms. In the US, the fraction of firms that use only loans reaches a high of 50 percent at about the fifth decile of total debt. The fraction is close to zero for the largest debt levels and around 35 percent for very small debt levels.

Figure 2 illuminates the strong relation between the absolute level of firms' financing requirements and their choice of loan and bond financing. Figure 3 expands on this relation by displaying the roles of both total debt and total leverage. The figure is produced using a double sort. For each region, we sort the firm-year observations into 10 x 5 groups using deciles of total debt and quintiles of total leverage.[6] Panel A displays the ratio of the number

[6]Both sorts are unconditional. In other words, the leverage breakpoints are the same for each total-debt decile. Therefore the number of observations varies across the 50 groups. Since total debt and leverage are

of "only bond debt" observations to the number of all observations with at least some bond debt. Panel B displays the ratio of the number of "only loan debt" observations to the number of all observations with at least some loan debt. Thus in both cases, the ratios measure the fraction of firms that rely solely on a type of debt, among all firms that use that type of debt. The horizontal axes are the median amounts of debt for each decile of total debt.

The figure shows that higher leverage corresponds to a higher probability that a firm uses loan and bond financing relative to the probability that it uses a single source of financing, regardless of the type of sole financing. This relation is strongest for US firms. The visual evidence is also clear for firms in Hong Kong SAR and Korea that borrow through loan facilities, and firms in other Asian markets that borrow with bonds.

It is easy to use asymmetric information theories to explain particular slices of this figure, as long as we ignore other slices. Consider the top left diagram in Figure 3, which summarizes financing choices for US firms that have some bond debt. The US firms with the most total debt (decile 10) can all issue publicly-traded bonds. Of these firms that are in the lowest quintile of leverage, 55 percent rely solely on bond debt. The corresponding ratio for the highest quintile of leverage is only 11 percent. In line with the asymmetric information literature, a superficially plausible story is that large firms with high credit quality find it relatively cheaper to use arm's-length financing than do large firms with low credit quality.

However, the wedge between high-leverage and low-leverage firms is wide for all deciles of total debt, thus explanations based on arm's-length investors versus concentrated investors do not ring true. For example, the median debt of a firm in decile 3 is less than $4 million (2019 dollars). These firms are not borrowing in the public bond market. They use private placements to sell bonds to wealthy individuals or to funds that specialize in purchasing bonds of small companies. Of those firms in this decile that use some bond debt and are in the lowest quintile of leverage, more than 60 percent rely solely on bonds. The corresponding ratio for firms in the highest quintile of leverage is only 40 percent.

Again, an asymmetric information story can be told. Regardless of the type of bond debt, bond debt involves less monitoring than does loan debt. Therefore high-quality borrowers (those with little leverage) find it relatively cheaper to turn to bond debt. Yet this story

positively correlated, groups with high leverage and high debt, as well as low leverage and low debt, have more observations than groups with high (low) leverage and low (high) debt.

falls apart when we turn our attention to the top diagram on the right side. This diagram summarizes financing choices for US firms that have some loan debt. Consider firms in the third decile of total debt. Of firms in this decile that are in the lowest quintile of leverage, more than 75 percent rely solely on loans. The corresponding ratio for firms in the highest quintile of leverage is less than 25 percent. High-quality small firms are unlikely to find it cheaper to use bond debt in the diagram on the left and simultaneously find it cheaper to use loan debt in the diagram on the right.

An interpretation consistent with the top row of diagrams is that US firms which are heavy users of debt financing choose to diversify their sources of debt. This holds for both total debt and relative debt (leverage). The role of total debt is captured by the negative slope of the lines in the diagrams. The role of leverage is captured by the dispersion across the lines, with low-leverage lines above high-leverage lines.

Suitably modified, the same interpretation explains the patterns for Hong Kong SAR/Korea and other Asian markets. Firms that use loan financing in Hong Kong SAR and Korea tend to diversify into bonds when they have either high leverage or high total debt. Firms that use bond financing in these markets almost all choose to also issue loan debt. The small number that do not are mostly low-leverage firms with total debt less than $10 million. In other Asian markets, diversification is almost impossible for the vast majority of firms. We saw in Figure 2 that only the largest firms with substantial amounts of total debt have bond debt. These firms have access to the market for publicly-traded bonds. Smaller firms with some loan debt almost all rely solely on loan debt, as shown in the bottom right diagram of Figure 3. In the bottom left diagram of the figure, the relatively small number of firms with bond debt can choose to diversify into loans. As with Hong Kong SAR and Korea, the only firms that do not are mostly low-leverage firms with total debt less than $10 million.

3.2 Logistic regressions

We use logistic regressions to disentangle the role of total leverage from the role of observable credit quality. Recall from Figure 2 that we consider four types of financing choices: all loans, all non-convertible bonds, all bonds of which some are convertible, and a mix of loans and bonds. Use the financing index $\mathcal{T}_{i,t}$ to specify firm i's type in fiscal year t. This is a number between one and four. Consider all firms i at t that have $\mathcal{T}_{i,t} = n$ or $\mathcal{T}_{i,t} = m$. In other words,

consider all firms that have either of two specific financing types. Express the probability that the firm has financing type n relative to the probability that it has financing type m as

$$\log\left(\frac{\Pr(\mathcal{T}_{i,t}=n|\mathcal{T}_{i,t}\in\{n,m\},s_{i,t})}{\Pr(\mathcal{T}_{i,t}=m|\mathcal{T}_{i,t}\in\{n,m\},s_{i,t})}\right)=\gamma_{0,1}+\gamma_{1,1}'s_{i,t}, \tag{6}$$

where $s_{i,t}$ is a vector of variables we use to interpret firms' financing choices.

Because of the nonmonotonicity in total debt that is apparent for US firms in Figure 2, we include dummy variables for deciles of total debt in the vector of explanatory variables rather than the level (or the log) of total debt. To further separate results by size (of total debt), we estimate (6) separately for three size-sorted groups. The break points correspond roughly to points of market segmentation for US firms.

The logistic regressions are estimated separately for the three geographic regions and use all observations from 2004 through 2019. All explanatory variables other than the dummy variables are winsorized at the 1st and 99th percentiles, then standardized to mean zero and variance one. The dummy variables for total debt are defined separately for each geographic region, using decile break points for the region-specific samples.

Statistical inference must recognize that a firm in our sample in, say, 2015, is also likely to be in our sample both before and after 2015. Therefore the assumption of independent draws is untenable. We use an ad hoc method to correct for this dependence by first calculating standard errors as if all of the observations are independent, then multiplying these standard errors by four. Our adjustment would be exact if, for a total number of firm-year observations N in the 16 years from 2004 through 2019, our sample consisted of observations of $N/16$ firms sampled in each of the 16 years, where firm-year observations are independent across firms and perfectly correlated for a single firm across time.

Results are in Table 3. Panels A, B, and C contain results for the US, Hong Kong SAR/Korea, and other Asian markets, respectively. Each row is a single regression. The first three columns determine the sample: size (by total debt), and the two types of financing choices that are studied in the regression. Coefficients on the dummies for total debt are not reported because Figure 2 conveys that information just as well.[7]

[7]Our proxy for firm demand for financial flexibility, the log standard deviation of net working capital to market assets, is not included in any of the regressions. A set of regressions that included all the variables, including the net working capital variable, did not produce any coefficient estimate on net working capital that was statistically significant at the 10% level. Thus we dropped the variable and reestimated the equations

First consider Panel A, for US firms. We draw three main conclusions from the results. First, the visual evidence in Figure 3 is confirmed. Market leverage is a major driver of the choice between using a single type of financing, whether loans or bonds, and using both types of financing. It is not simply proxying for credit quality or asset tangibility. The relevant regressions are the first six in the panel, which all characterize the choice between either a single type of financing or the combination of loan and bond financing. Market leverage is statistically significant in all but one of the six. The lone regression for which it is insignificant has too few firms with only loan debt (211 across all 16 years) to pin down the determinants of this choice.

Second, outside of the largest firms, there is some mixed evidence that credit quality and monitoring effectiveness also matter when choosing between one or both types of financing. There are no consistent patterns across these first six regressions, but on balance, higher credit quality and higher monitoring effectiveness raise the probability that a firm uses loan debt. For example, small borrowers are more likely to use just loans, rather than loans and bonds, when their credit quality is higher. The point estimate in the third regression of Panel A implies that (all else equal) a one standard deviation increase in the implied credit rating raises the probability that a firm uses only loans from 0.63 to 0.74. Yet the implied credit rating is insignificant at the five percent level in the other five of the first six regressions. Medium-size borrowers are more likely to use a combination of loans and bonds, rather than just bonds, when their past average revenues and profits are higher. But again, these variables are statistically insignificant at the five percent level in the other five regressions.

The third conclusion is that credit quality and monitoring effectiveness are economically important determinants of the choice between loans and convertible bond financing, but not between loans and non-convertible bond financing. Regressions seven and eight in Panel A estimate the choice between using only loan facilities and using only non-convertible bonds. Only one coefficient is statistically different from zero at the five percent level, and the estimated coefficient is not economically large.[8] By contrast, the final two regressions show that firms with relatively high credit quality, revenue, profitability, and tangible assets are

with the smaller set of variables reported in Table 3.

[8]Holding all else equal, a one standard deviation increase in PPE/assets raises the probability of using non-convertible bonds rather than loans from 0.25 to 0.30.

more likely to use only loan facilities rather than bonds with some convertibility.

The economic significance of these conclusions is best conveyed visually, comparing the financing choices of firms that are financially stronger with those that are financially weaker. Consider all US firm-year observations with implied credit ratings, average revenue/assets, average profitability/assets, and PPE/assets all in the top halves of their respective distributions. We call these "high-quality" firm-year observations. Symmetrically, we label as "low-quality" those firm-year observations with each of these four variables in the bottom halves of their respective distributions. Approximately 13 (11) percent of the sample consists of high-quality (low-quality) observations.

Focus on the high-quality firms that use a single type of financing; either all loans, all non-convertible bonds, or all bonds and some convertibility features. Thus we are excluding all observations for which a firm has both loan and bond debt. Figure 4 displays with red lines the fractions of high-quality firms that use each source, broken down by deciles of total debt. The blue lines in Figure 4 are the fractions of low-quality firms that use each source. The red lines sum to one across the three panels, as do the blue lines.

The most striking feature of Figure 4 is the large gap between high-quality and low-quality use of convertible debt financing. Almost none of the high-quality firms use any convertible bonds, regardless of the decile of total debt. About 40 percent of the low-quality firms use them, a fraction that varies substantially with total debt. This result is similar to evidence in Loumioti (2019) and Chernenko et al. (2019), noted in Section 1.2, that low-quality middle-market firms tend to borrow from non-banks in the form of structures with substantial covenants and warrants.

Firms that specialize in either loan facilities or bonds, and do not use convertible bonds, must use either all loans or all nonconvertible bonds. Since low-quality firms use more convertible bond financing than do high-quality firms, they use less financing from nonconvertible bonds and loans. The second and third panels of Figure 4 show that these low-quality firms use less of both types of financing. In other words, low-quality firms are not more likely than high-quality firms to choose nonconvertible bond financing over loan financing. These two panels tell us that the choice between nonconvertible bond financing and loan financing is closely tied to the amount of total debt, reproducing the same pattern seen in Figure 2.

We now turn to the choice of debt specialization for Asian firms. Our discussion is brief because, as Figure 2 reveals, there is only one debt specialization choice for which we

have enough observations to study. There are too few firms that choose all-bond financing to examine what characteristics drive this choice. Therefore we examine only the choice between all-loan financing and a mix of loans and bonds.

The only firm conclusion we draw from the results in Panels B and C of Table 3 is that there are no strong patterns in the determinants of this debt specialization choice. Some of the estimated coefficients are statistically different from zero, but there is no coherent story to tell. For example, in Hong Kong SAR and Korea, large borrowers with high average revenue are less likely to use only loan financing. However, the sign is reversed for both medium and small borrowers. The sign is also reversed for large borrowers in other Asian markets. For medium-size borrowers in Hong Kong SAR and Korea, high average profit corresponds to a higher probability of using loan financing. Switching to other Asian markets switches the sign on average profit.

This evidence does *not* mean that we cannot explain debt specialization choices for Asian firms. Figure 2 establishes that an Asian firm's specialization choices (primarily the choice between all loan debt and a mix of loan and bond debt) is closely connected to the firm's total amount of debt. The logistic regression evidence says that neither observable credit quality nor monitoring effectiveness are systematically relevant. Thus the theories of Hackbarth et al. (2007) and Becker and Josephson (2016), in which asymmetric information plays a dominant role, are not supported by the results here.

The simplest explanation for both the cross-sectional importance of total debt and the cross-sectional irrelevance of firm quality is market segmentation. Asian firms that borrow substantial amounts of money are able to use public bond markets. Access to these public bond markets dries up for firms borrowing smaller amounts. Hong Kong SAR and Korea have better-developed capital markets, thus fixing the amount of debt, a firm in one of these markets is more likely to use the public bond market than is a firm in another Asian market. Firms shut out of this market must turn to the loan market because markets for privately-placed bonds are limited.

Market segmentation also exists in the US, but bond markets are available for all firms, regardless of their total debt. US firms that borrow substantial amounts of money use public bond markets. Firms that borrow less money can use either loans or bonds that are privately placed with large financial institutions. Firms can choose to issue bonds that are convertible into equity. The firms that borrow only a few million dollars can also place convertible and

nonconvertible bonds privately, although not with large institutions. Firms that rely heavily on debt financing (high total leverage) tend to diversify across the types of debt.

To reiterate one of our main conclusions, asymmetric information appears to affect only one debt specialization choice: whether a firm issues convertible bonds. Aside from this effect, no clear, economically important roles for credit quality or monitoring effectiveness show up in our data sample.

4 Debt composition of diversified borrowers

Equation (3) decomposes a firm's bond leverage ratio into its the probabilities of debt specialization using loans and bonds and the expected bond leverage ratio for firms with diversified debt financing. This section investigates conditioning information for this latter expectation.

To preview our results, we find evidence that for large borrowers, higher observable credit quality corresponds to greater use of bonds relative to loans. This evidence is consistent with the debt decomposition literature dating back to Johnson (1997). For small and medium borrowers, observable credit quality is irrelevant; only the magnitude of a firm's total debt conveys substantial information about the firm's bond leverage ratio.

4.1 Overall properties

By definition, firms with diversified financing do not specialize completely in either loan or bond financing. However, the term "diversified" is inappropriate if these firms typically concentrate almost all of their financing in one of these two channels. Panel A of Figure 5 shows that is not the case. Recall that $R_{i,t}$ is the bond leverage ratio for firm i in year t. We define the magnitude of concentration for (i, j) as the maximum of the firm's bond and loan debt, divided by the sum of its bond and loan debt. In the notation of Equation (1), concentration is $\max(R_{i,t}, 1 - R_{i,t})$. The figure shows that across all three regions and the entire range of total debt, the typical firm splits its debt around 25–75 or 20–80 between loans and bonds (not necessarily respectively).

Section 3.1 documents that a firm's total leverage is closely associated with its choice to specialize in one form of debt. Panels B through D in Figure 5 help evaluate whether total leverage plays a similar role for firms with both loans and bonds. The figure shows that

total leverage is related to debt concentration only for the largest US firms. Large US firms with low total leverage use more concentrated debt financing than do firms with high total leverage. This evidence introduces a theme in this section. Among firms with both bond and loan debt, the largest US firms are those for which firm characteristics are most strongly associated with the bond/loan choice.

We now turn to the expected bond leverage ratio for firms with diversified financing. Motivated by the results of debt specialization in Section 3.1, we calculate sample means of firms' bond leverage ratios for groups of firms sorted by total debt. The left panel of Figure 6 includes all firms with diversified debt financing. The figure's right panel excludes all firms that have some convertible bond debt.

The left panel shows a sharp U-shaped pattern in bond leverage of US firms, reminiscent of the pattern that appears in Figure 1. Mean bond leverage peaks at close to 80 percent for the largest firms, drops to about 35 percent for firms in the fifth decile of total debt, and is around 55 percent for firms in the smallest deciles of total debt. Firms in Hong Kong SAR and Korea exhibit a more muted U-shape. Firms in other Asian markets with both bond and loan debt have an average bond leverage ratio between 30 and 40 percent, regardless of total debt. The right panel shows that the patterns do not change when convertible bond issuers are excluded.

We are now in a position to put some structure on the patterns in Figure 1, which displays mean bond leverage ratios for groups of firms sorted by total debt. These mean ratios are determined by a combination of firms' choices to specialize in either loans or bonds, as well as expected bond leverage ratios for firms that diversify their debt into both loans and bonds. The U-shape for US firms in Figure 1 is created by similar shapes in debt specialization (Figure 2) and choices of diversified firms (Figure 6). The fraction of US firms that use only loans reaches a high of 50 percent at the bottom of the U.

For Asian firms other than those in Hong Kong SAR and Korea, the monotonic relation in Figure 1 is driven entirely by debt specialization (Figure 2) rather than the choices of diversified firms (Figure 6). Firms in Hong Kong SAR and Korea exhibit the debt specialization behavior of firms in other Asian markets, while the choices of diversified firms in these markets are similar to those exhibited by US firms.

4.2 Economic interpretations

What economic forces create the U shapes in Figure 6? The theories of Diamond (1991) and Rajan (1992) suggest a possible asymmetric information story. In both theories, the monitoring and renegotiation features of loan debt can be more valuable for moderately-risky firms than for either low-risk or high-risk firms. Empirical evidence in Denis and Mihov (2003), mentioned in Section 1.2, can be interpreted as supporting this non-monotonic pattern.

That same section noted an earlier literature documenting that smaller firms are, on average, riskier than larger firms. Smaller firms have less debt than larger firms. Thus the U shape in Figure 6, and the corresponding U shape in Figure 1, may simply reflect a non-monotonic relation between the value of monitoring and credit quality.

If so, the highest-quality and lowest-quality firms will have higher bond leverage ratios than medium-quality firms. This pattern should hold regardless of a firm's total debt. A double sort helps evaluate this interpretation. For each region, we sort the firm-year observations into 10 x 5 groups using deciles of total debt and quintiles of implied credit ratings. (We employ a similar double sort with total leverage in Section 3.1.) Figure 7 displays the means, across observations in each cell, of the bond leverage ratio.

Figure 7 makes clear that credit quality is associated with the bond leverage ratio, but not in a way consistent with this asymmetric information story. We highlight three features of this figure. First, firms in the largest two deciles exhibit an economically significant positive relation between observable credit quality and the bond leverage ratio. Holding total debt constant, there is no U shape associated with credit quality. This is especially true for US firms, where the mean bond leverage ratio of the largest decile of borrowers ranges from 0.62 for the lowest quintile of credit quality to 0.88 for the highest. Corresponding means for Hong Kong SAR and Korea are 0.38 and 0.45, and 0.25 to 0.36 for other Asian markets, respectively.

Second, this positive relation dissipates, and is even reversed, for firms with less total debt. Again, this is easiest to see with US firms. For example, the mean bond leverage ratio of firms in decile three of total debt ranges from 0.56 for the lowest quintile of credit quality to 0.39 for the highest. (Deciles one and two do not have enough high-quality firms for this calculation to be informative.) Again, holding total debt constant, there is no evidence of a U shape associated with credit quality.

Third, for firms in the United States, Hong Kong SAR, and Korea, the U shape relation between total debt and the bond leverage ratio in Figure 6 is not related to credit quality. Similar U shapes are displayed in the first panel of Figure 7 for each quintile of credit quality. Similar U shapes are seen in the second panel of Figure 7, although there are too few observations for high-quality small borrowers to see the U shapes for these firms.

Section 3.1 argues that in the US, firms with high total leverage are more likely than firms with low total leverage to borrow using both loans and bonds. One possible interpretation of results for US firms in Figure 7 is that the desire for diversification also varies systematically across firms with both loans and bonds. Note that across the total-debt spectrum, low-quality firms (which also tend to be the firms with high total leverage) have bond leverage ratios closer to 1/2 than do high-quality firms. As in Section 3.2, we use regressions to attempt to disentangle the role of credit quality from the role of total leverage.

Table 4 contains ordinary least-squares regression results. A firm's bond leverage ratio is regressed on listed firm-specific explanatory variables, as well as dummies for deciles of total debt. We use univariate regressions with implied credit ratings and total leverage, as well as multivariate regressions using our full set of explanatory variables. Standard errors are corrected for generalized heteroskedasticity, then multiplied by four to correct for serial correlation as in Section 3.2.

Univariate regression results in Table 4 confirm the visual evidence in Figure 7 that across all geographic regions, large borrowers with high implied credit ratings use more bond debt than large borrowers with low implied credit ratings. The same result holds (with a sign change) for total leverage; low-leverage firms use more bond debt. Results for medium-size and small borrowers are mixed. In the United States, Hong Kong SAR, and Korea, neither implied credit ratings nor leverage matter much for these firms. Only one of the eight univariate coefficients is statistically significant at the five percent level. In other Asian markets, higher credit quality and lower leverage for medium-sized firms are strongly associated with higher bond leverage ratios.

Results from the nine multivariate regressions in Table 4 allow us to conclude little. Various individual coefficients are statistically significant, but not in any systematic way. For example, the estimated coefficient on PPE/Assets is positive and significant at the five percent level for large US borrowers. Yet for six of the other eight regressions, the estimated coefficient on PPE/Assets is negative, and one of those six is significant at the five percent

level. Only one of the coefficients for small borrowers is statistically significant for any of the three geographic regions.

Our analysis raises more questions about firms with both loan and bond debt than it answers. Large firms with high leverage use more bank financing than do large firms with low leverage. Is this because their credit quality is lower or because they prefer greater diversification of funding sources? Neither answer can explain why medium-size borrowers with similar high credit quality borrow mainly from banks, nor why (in the US, Hong Kong SAR, and Korea) small borrowers with similar high credit rating rely less on banks than do medium-size borrowers.

5 Concluding Comments

A large, detailed, and deep literature establishes that firms' financing choices are influenced by asymmetric information problems. Nothing in our research here contradicts this view. Instead, we take a bird's eye view. We ask what firm-level characteristics are the most important in explaining the magnitude of cross-firm variation in the use of loan facilities and bonds. In a nutshell, we argue that debt composition across a wide range of firms and geographic markets is not driven largely by firm-level informational considerations.

Across the range of total debt, the strongest evidence for the role of asymmetric information is concentrated among the largest borrowers. Yet even for these firms, it is difficult to disentangle an asymmetric information argument based on high monitoring costs for firms with low credit quality from a diversification argument based on the desire of highly-leveraged firms to spread their financing out among bonds and loan facilities.

We end where we began, with a look at Figure 1. What explains the U-shape in the bond leverage ratio among US firms? Why is there no similar shape among less-developed Asian markets? Why are the more-developed markets of Hong Kong SAR and Korea in between? We argue that market segmentation drives these shapes. The largest borrowers can issue publicly-traded bonds, and place bonds directly with major institutional investors such as insurance companies and pension funds. A characteristic of a developed financial market is a robust industry that specializes in lending to small and medium-size borrowers using bonds tailored to the borrower, such as convertible bonds. The U-shape in Figure 1 is not explained by the use of convertible bonds. Instead, the active use of such bonds by small

borrowers in the US is simply an indicator of the tailored bonds available to US borrowers that are less available to borrowers in Hong Kong SAR and Korea, and unavailable in the other markets we examine.

References

Alternative Credit Council, 2018, Financing the Economy 2018, ACC White Paper.

Amstad, Marlene, Steven Kong, Frank Packer, and Eli Remolona, 2016, A Spare Tire for Capital Markets: Fostering Corporate Bond Markets in Asia, BIS Papers 85.

Arena, Matteo P., 2011, The Corporate Choice Between Public Debt, Bank Loans, Traditional Private Debt Placements, and 144A Debt Issues, *Review of Quantitative Finance and Accounting* 36, 391–416.

Becker, Bo, and Victoria Ivashina, 2016, Covenant-Light Contracts and Creditor Coordination, Sveriges Riksbank Working Paper 325.

Becker, Bo, and Jens Josephson, 2016, Insolvency Resolution and the Missing High-Yield Bond Markets, *Review of Financial Studies* 29, 2814–2849.

Blackwell, David W., and David S. Kidwell, 1988, An Investigation of Cost Differences Between Public Sales and Private Placements of Debt, *Journal of Financial Economics* 22, 253-278.

Booth, Laurence, Varouj Aivazian, Asli Demirguc-Kunt, and Vojislav Maksimovic, 2001, Capital Structures in Developing Countries, *Journal of Finance* 56, 87-130.

Bradley, Michael, and Michael R. Roberts, 2015, The Structure and Pricing of Corporate Debt Covenants, *Quarterly Journal of Finance* 5, 1-37.

Carey, Mark, Mitch Post, and Steven A. Sharpe, 1998, Does Corporate Lending by Banks and Finance Companies Differ? Evidence on Specialization in Private Debt Contracting, *Journal of Finance* 53, 845–878.

Carey, Mark, Stephen Prowse, John Rea, and Gregory Udell, 1993, The Economics of Private Placements: A New Look, *Financial Markets, Institutions, and Instruments* 2, 1-66.

Chan, Eric, Michael Chui, Frank Packer, and Eli Remolona, 2011, Local Currency Bond Markets and the Asian Bond Fund 2 Initiative, Report prepared for the EMEAP Working Group on Financial Markets.

Chernenko, Sergey, Isil Erel, and Robert Prilmeier, 2019, Nonbank Lending, Fisher College of Business Working Paper 2018-03-013.

Chui, Michael, Ingo Fender, and Vladyslav Sushko, 2014, Risks Related to EME Corporate Balance Sheets: The Role of Leverage and Currency Mismatch, *BIS Quarterly Review* September, 35-47.

Colla, Paolo, Filippo Ippolito, and Kai Li, 2013, Debt Specialization, *Journal of Finance* 68, 2117–2141.

Denis, David J., and Vassil T. Mihov, 2003, The Choice Among Bank Debt, Non-Bank Private Debt, and Public Debt: Evidence from New Corporate Borrowings, *Journal of Financial Economics* 70, 3–28.

Diamond, Douglas W., 1984, Financial Intermediation and Delegated Monitoring, *Review of Economic Studies* 51, 393–414.

Diamond, Douglas W., 1991, Monitoring and Reputation: The Choice Between Bank Loans and Directly Placed Debt, *Journal of Political Economy* 99, 689–721.

Fama, Eugene F., 1985, What's Different About Banks? *Journal of Monetary Economics* 15, 29–39.

Fan, Joseph P.H., K.C. John Wei, and Xinzhong Xu, 2011, Corporate Finance and Governance in Emerging Markets: A Selective Review and an Agenda for Future Research, *Journal of Corporate Finance* 17, 204-2014.

Fazzari, Steven M., R. Glenn Hubbard, and Bruce C. Petersen, 1988, Financing Constraints and Corporate Investment, *Brookings Papers on Economic Activity* 1:1988, 141-195.

Fenn, George W., 2000, Speed of Issuance and the Adequacy of Disclosure in the 144A High-Yield Debt Market, *Journal of Financial Economics* 56, 383–405.

Gatev, Evan, and Philip E. Strahan, 2006, Banks' Advantage in Hedging Liquidity Risk: Theory and Evidence from the Commercial Paper Market, *Journal of Finance* 61, 867–892.

Gatev, Evan, and Philip E. Strahan, 2009, Liquidity Risk and Syndicate Structure, *Journal of Financial Economics* 93, 490–504.

Hackbarth, Dirk, Christopher A. Hennessy, and Hayne E. Leland, 2007, Can the Trade-off Theory Explain Debt Structure? *Review of Financial Studies* 20, 1389–1428.

Irani, Rustom M., Rajkamal Iyer, Ralf R. Meisenzahl, and José-Luis Peydró, 2020, The Rise of Shadow Banking: Evidence from Capital Regulation, Gies College of Business Working Paper.

Jimborean, Ramona, 2018, What Drives Private Non-Financial Sector Borrowing in Emerging Market Economies?, *Economie et Statistique/Economics and Statistics*, 503-504, 143–161. https://doi.org/10.24187/ecostat.2018.503d.1962.

Johnson, Shane A., 1997, An Empirical Analysis of the Determinants of Corporate Debt Ownership Structure, *Journal of Financial and Quantitative Analysis* 32, 47–69.

Kashyap, Anil K., Raghuram Rajan, and Jeremy C. Stein, 2002, Banks as Liquidity Providers: An Explanation for the Coexistence of Lending and Deposit-Taking, *Journal of Finance* 57, 33–73.

Kwan, Simon, and Willard T. Carleton, 2004, Financial Contracting and the Choice Between Private Placement and Publicly Offered Bonds, Federal Reserve Bank of San Francisco Working Paper 2004-20.

Kwan, Simon, and Willard T. Carleton, 2010, Financial Contracting and the Choice Between Private Placement and Publicly Offered Bonds, *Journal of Money, Credit, and Banking* 42, 907–929.

Loumioti, Maria, 2019, Direct Lending: The Determinants, Characteristics, and Performance of Direct Loans, Naveen Jindahl School of Management Working Paper.

Munday, Shawn, Wendy Hu, Tobias True, and Jian Zhang, 2018, Performance of Private Credit Funds: A First Look, Institute for Private Capital (UNC Kenan-Flager Business School) Working Paper.

Prilmeier, Robert, and René M. Stulz, 2019, Securities Laws and the Choice Between Loans and Bonds for Highly Levered Firms, Fisher College of Business Working Paper 2019-03-01.

Rajan, Raghuram G., 1992, Insiders and Outsiders: The Choice Between Informed and Arm's-Length Debt, *Journal of Finance* 47, 1367–1400.

Rajan, Raghuram G., and Luigi Zingales, 1995, What Do We Know about Capital Structure? Some Evidence from International Data, *Journal of Finance* 50, 1421-1460.

Rauh, Joshua D., and Amir Sufi, 2010, Capital Structure and Debt Structure, *Review of Financial Studies* 23, 2010, 4242–4280.

Roberts, Michael R., and Amir Sufi, 2009, Renegotiation of Financial Contracts: Evidence from Private Credit Agreements, *Journal of Financial Economics* 93, 159–184.

Securities Industry and Financial Markets Association (Sifma), 2019, Capital Markets Fact Book, sifma.org/resources/research/fact-book/.

Sufi, Amir, 2009, Bank Lines of Credit in Corporate Finance: An Empirical Analysis, *Review of Financial Studies* 22, 1057-1088.

Voya Investment Management, 2020, Introduction to Investment Grade Private Credit, Voya Investment Management White Paper.

Table 1. Summary Statistics, 2004 to 2019

The sample consists of yearly observations of nonfinancial firms with publicly-traded equity and either loan debt, bond debt, or both. These statistics combine all observations for fiscal years 2004 through 2019. Market assets, defined as the sum of stock market capitalization and total liabilities, is in millions of 2019 US dollars (CPI adjusted). Loan+Bond Ratio is the sum of loan debt and bond debt divided by total debt. Total leverage is total debt divided by market assets. The bond leverage ratio for a firm is the ratio of the firm's bond debt to the sum of the firm's loan debt and bond debt.

Market	Number of firm-years	Statistic	Mean	Percentiles 10	25	50	75	90
China	27,444	Market Assets	3,720	291	566	1,150	2,579	6,221
		Total Leverage	0.16	0.01	0.04	0.12	0.25	0.39
		Loan+Bond Ratio	0.97	0.91	1.00	1.00	1.00	1.00
		Bond Lev Ratio	0.08	0.00	0.00	0.00	0.00	0.33
Hong Kong SAR	10,104	Market Assets	2,591	45	99	261	930	3,941
		Total Leverage	0.23	0.02	0.08	0.20	0.36	0.51
		Loan+Bond Ratio	0.93	0.76	0.95	1.00	1.00	1.00
		Bond Lev Ratio	0.16	0.00	0.00	0.00	0.16	0.76
India	30,907	Market Assets	818	4	13	49	227	1,032
		Total Leverage	0.34	0.03	0.14	0.31	0.51	0.67
		Loan+Bond Ratio	0.82	0.42	0.74	0.93	1.00	1.00
		Bond Lev Ratio	0.04	0.00	0.00	0.00	0.00	0.11
Indonesia	3,573	Market Assets	1,083	22	56	195	754	2,353
		Total Leverage	0.28	0.03	0.10	0.24	0.43	0.60
		Loan+Bond Ratio	0.94	0.82	0.96	1.00	1.00	1.00
		Bond Lev Ratio	0.13	0.00	0.00	0.00	0.06	0.58
Malaysia	10,447	Market Assets	684	19	37	95	288	1,039
		Total Leverage	0.27	0.03	0.10	0.24	0.40	0.54
		Loan+Bond Ratio	0.90	0.71	0.90	0.98	1.00	1.00
		Bond Lev Ratio	0.07	0.00	0.00	0.00	0.00	0.31

Continued next page

Table 1, continued

Market	Number of firm-years	Statistic	Mean	Percentiles 10	25	50	75	90
Philippines	1,891	Market Assets	1,755	23	60	197	1,062	5,103
		Total Leverage	0.22	0.02	0.07	0.19	0.33	0.49
		Loan+Bond Ratio	0.89	0.55	0.91	1.00	1.00	1.00
		Bond Lev Ratio	0.13	0.00	0.00	0.00	0.07	0.56
Singapore	5,616	Market Assets	1,131	25	52	128	449	2,008
		Total Leverage	0.25	0.03	0.09	0.21	0.37	0.52
		Loan+Bond Ratio	0.91	0.71	0.92	0.99	1.00	1.00
		Bond Lev Ratio	0.07	0.00	0.00	0.00	0.00	0.26
Korea	13,371	Market Assets	2,136	49	87	196	620	2,794
		Total Leverage	0.27	0.03	0.10	0.25	0.41	0.55
		Loan+Bond Ratio	0.92	0.71	0.95	1.00	1.00	1.00
		Bond Lev Ratio	0.19	0.00	0.00	0.00	0.31	0.68
Thailand	5,589	Market Assets	1,064	28	57	146	493	1,792
		Total Leverage	0.26	0.02	0.09	0.23	0.39	0.54
		Loan+Bond Ratio	0.92	0.71	0.95	1.00	1.00	1.00
		Bond Lev Ratio	0.17	0.00	0.00	0.00	0.28	0.68
United States	47,785	Market Assets	8,452	8	41	520	3,741	15,203
		Total Leverage	0.21	0.02	0.06	0.16	0.31	0.48
		Loan+Bond Ratio	0.93	0.77	0.94	1.00	1.00	1.00
		Bond Lev Ratio	0.52	0.00	0.00	0.58	1.00	1.00

Table 2. Rank Correlations, 2004 to 2019

The sample consists of yearly observations of nonfinancial firms with publicly-traded equity and either loan debt, bond debt, or both. The table displays Spearman rank correlations among various firm-level variables, where the observations are combined across all fiscal years from 2004 through 2019. The bond leverage ratio for a firm is the ratio of the firm's bond debt to the sum of the firm's loan-facility debt and bond debt. Total debt is in 2019 US dollars (CPI adjusted). The implied credit rating is described in Section 2.3. Higher values correspond to higher credit quality. Net working capital, revenue, net income, property plant and equipment, and market assets are denoted as NWC, Rev, NI, PPE, and MA, respectively.

Market	Bond Leverage Ratio	Total Debt	Implied Rating	Debt/ MA	5-year Mean of NI/MA	5-year Mean of Rev/MA	5-year SD of NWC/MA
Panel A. United States							
Total Debt	0.14	1					
Implied Rating	0.08	0.39	1				
Debt/MA	0.06	0.44	−0.33	1			
5-yr Mean of NI/MA	−0.04	0.43	0.64	−0.09	1		
5-yr Mean of Rev/MA	−0.20	−0.11	−0.10	0.01	0.17	1	
5-yr SD of NWC/MA	−0.13	−0.53	−0.62	−0.03	−0.33	0.36	1
PPE/MA	−0.03	0.38	0.12	0.33	0.21	0.17	−0.17
Panel B. Hong Kong SAR and Korea							
Total Debt	0.34	1					
Implied Rating	−0.16	−0.06	1				
Debt/MA	0.26	0.63	−0.50	1			
5-yr Mean of NI/MA	−0.20	0.14	0.46	−0.12	1		
5-yr Mean of Rev/MA	−0.13	−0.10	−0.04	0.05	0.15	1	
|NWC|/MA	−0.07	−0.23	−0.50	0.04	−0.14	0.15	1
PPE/MA	−0.04	0.22	−0.03	0.32	0.16	0.23	−0.15
Panel C. Other Asian Markets							
Total Debt	0.46	1					
Implied Rating	0.00	0.03	1				
Debt/MA	0.19	0.35	−0.65	1			
5-yr Mean of NI/MA	0.04	0.00	0.24	−0.15	1		
5-yr Mean of Rev/MA	−0.20	−0.30	−0.30	0.19	0.21	1	
|NWC|/MA	−0.14	−0.27	−0.53	0.17	−0.06	0.27	1
PPE/MA	−0.01	0.00	−0.28	0.41	0.05	0.31	−0.03

Table 3. Determinants of Debt Specialization Choices, 2004 to 2019

The sample consists of yearly observations of nonfinancial firms with publicly-traded equity and either bond and loan debt. Logistic regressions specify the probability that the firm is Type 1 relative to Type 2, where the types are specified in the table. The table reports parameter estimates with standard errors in parentheses. The text discusses calculation of the standard errors. All variables are winsorized at their 1st and 99th percentiles, then normalized to mean zero and variance one. Positive coefficients imply that higher values of the explanatory variable correspond to a higher probability that the firm is in Type 1 rather than Type 2. Large borrowers are those in the top two deciles of total debt, medium borrowers are in deciles four through eight, and small borrowers are those in one through three. PPE stands for Property, Plant, and Equipment. Dummy variables for deciles of total debt are included in each logistic regression. The sample period is 2004 through 2019. Asterisks denote statistical significance at two-sided 10, 5, and 1 percent levels.

Panel A. US Firms

Borrower Type	Type 1 [Obs]	Type 2 [Obs]	Implied Credit Rating	Leverage	Average Revenue/ Assets	Average Profit/ Assets	PPE/ Assets
Large	Only Loans [211]	Bonds and Loans [5701]	0.351 (0.699)	0.118 (0.458)	−0.309 (0.468)	−0.212 (1.406)	−0.687 (0.413)*
Medium	Only Loans [6492]	Bonds and Loans [8062]	0.285 (0.146)*	−0.275 (0.108)**	−0.017 (0.072)	0.006 (0.147)	−0.144 (0.081)*
Small	Only Loans [2620]	Bonds and Loans [1554]	0.540 (0.182)***	−0.761 (0.240)***	0.171 (0.129)	−0.063 (0.152)	0.068 (0.172)
Large	Only Bonds [2417]	Bonds and Loans [5701]	−0.004 (0.251)	−1.081 (0.203)***	−0.240 (0.159)	−0.717 (0.522)	0.125 (0.114)
Medium	Only Bonds [3535]	Bonds and Loans [8062]	0.005 (0.158)	−0.450 (0.127)***	−0.409 (0.110)***	−0.405 (0.162)**	−0.138 (0.100)
Small	Only Bonds [1893]	Bonds and Loans [1554]	0.196 (0.142)	−0.538 (0.219)**	−0.159 (0.145)	−0.190 (0.137)	−0.107 (0.186)
Medium	Only Loans [6492]	Only Non-Convert Bonds [2149]	−0.021 (0.234)	0.286 (0.175)	0.100 (0.117)	0.205 (0.224)	−0.267 (0.115)**
Small	Only Loans [2620]	Only Non-Convert Bonds [1326]	0.146 (0.175)	0.038 (0.269)	0.184 (0.132)	0.035 (0.146)	−0.008 (0.175)
Medium	Only Loans [6492]	Only Bonds, Some Convertible [1386]	0.749 (0.271)***	0.167 (0.198)	0.976 (0.233)***	0.547 (0.234)**	0.535 (0.205)***
Small	Only Loans [2620]	Only Bonds, Some Convertible [567]	0.422 (0.201)**	−0.547 (0.332)*	0.678 (0.297)**	0.366 (0.181)**	0.542 (0.420)

Panel B. Hong Kong/Korea Firms

Borrower Type	Type 1 [Obs]	Type 2 [Obs]	Implied Credit Rating	Leverage	Average Revenue/ Assets	Average Profit/ Assets	PPE/ Assets
Large	Only Loans [1087]	Bonds and Loans [2859]	−0.084 (0.222)	−0.102 (0.226)	−0.412 (0.198)**	0.578 (0.304)*	−0.216 (0.155)
Medium	Only Loans [4918]	Bonds and Loans [2767]	0.155 (0.149)	−0.158 (0.146)	0.115 (0.107)	0.541 (0.160)***	0.151 (0.105)
Small	Only Loans [3373]	Bonds and Loans [458]	0.324 (0.274)	−0.570 (0.416)	0.290 (0.246)	0.203 (0.218)	0.586 (0.340)*

Panel C. Other Asian Firms

Borrower Type	Type 1 [Obs]	Type 2 [Obs]	Implied Credit Rating	Leverage	Average Revenue/ Assets	Average Profit/ Assets	PPE/ Assets
Large	Only Loans [5428]	Bonds and Loans [8074]	−0.157 (0.117)	−0.340 (0.129)***	0.239 (0.108)**	−0.409 (0.136)***	0.083 (0.089)
Medium	Only Loans [24297]	Bonds and Loans [4235]	0.242 (0.105)**	−0.188 (0.108)*	0.342 (0.096)***	−0.078 (0.080)	0.082 (0.078)
Small	Only Loans [14990]	Bonds and Loans [414]	0.324 (0.275)	0.418 (0.312)	0.215 (0.216)	0.072 (0.170)	−0.138 (0.184)

Table 4. Determinants of Bond/Loan Choices of Firms with Diversified Financing, 2004 to 2019

The sample consists of yearly observations of nonfinancial firms with publicly-traded equity and both bond and loan debt. The ratio of bond debt to the sum of bond and loan debt is regressed on firm-level variables. The table reports parameter estimates with standard errors in parentheses. The text discusses calculation of the standard errors. All variables are winsorized at their 1st and 99th percentiles, then normalized to mean zero and variance one. Large borrowers are those in the top two deciles of total debt, medium borrowers are in deciles four through eight, and small borrowers are those in one through three. Net Working Capital is denoted NWC and Property, Plant and Equipment is denoted PPE. Dummy variables for deciles of total debt are included in each logistic regression. The sample period is 2004 through 2019. Asterisks denote statistical significance at two-sided 10, 5, and 1 percent levels.

Panel A. US Firms

Borrower Type (Obs)	Implied Credit Rating	Leverage	Log SD of NWC /Assets	Average Revenue/ Assets	Average Profit/ Assets	PPE/ Assets
Large (5733)	0.098 (0.018)***					
Large (6653)		−0.084 (0.013)***				
Large (5701)	0.055 (0.034)	−0.751 (0.021)***	0.012 (0.020)	−0.012 (0.016)	−0.068 (0.064)	0.031 (0.012)**
Medium (8096)	−0.021 (0.018)					
Medium (10494)		0.005 (0.013)				
Medium (8062)	−0.014 (0.032)	−0.027 (0.020)	−0.012 (0.022)	−0.028 (0.014)**	−0.073 (0.032)**	0.021 (0.015)
Small (1608)	−0.047 (0.024)**					
Small (4003)		0.033 (0.023)				
Small (1554)	−0.024 (0.032)	0.025 (0.038)	0.013 (0.043)	−0.050 (0.030)*	−0.008 (0.030)	−0.010 (0.035)

Panel B. Hong Kong/Korea Firms

Borrower Type (Obs)	Implied Credit Rating	Leverage	Log SD of NWC /Assets	Average Revenue/ Assets	Average Profit/ Assets	PPE/ Assets
Large (2859)	0.046 (0.023)*					
Large (3376)		−0.049 (0.020)**				
Large (2859)	0.014 (0.038)	−0.043 (0.031)	−0.032 (0.026)	0.006 (0.021)	−0.051 (0.042)	0.025 (0.020)
Medium (2772)	−0.015 (0.025)					
Medium (4346)		−0.040 (0.021)*				
Medium (2767)	−0.013 (0.037)	−0.054 (0.030)*	−0.007 (0.029)	−0.032 (0.024)	−0.044 (0.033)	−0.037 (0.026)
Small (459)	−0.041 (0.049)					
Small (899)		−0.005 (0.058)				
Small (458)	−0.039 (0.075)	0.009 (0.095)	0.006 (0.069)	−0.039 (0.061)	0.005 (0.054)	−0.045 (0.087)

Panel C. Other Asian Firms

Borrower Type (Obs)	Implied Credit Rating	Leverage	Log SD of NWC /Assets	Average Revenue/ Assets	Average Profit/ Assets	PPE/ Assets
Large (8074)	0.045 (0.012)***					
Large (9980)		−0.055 (0.011)***				
Large (8074)	−0.021 (0.020)	−0.044 (0.019)**	−0.033 (0.014)**	−0.035 (0.016)**	0.050 (0.021)**	−0.025 (0.013)**
Medium (4235)	0.060 (0.017)***					
Medium (6404)		−0.066 (0.013)***				
Medium (4235)	0.007 (0.031)	−0.042 (0.026)	−0.014 (0.023)	−0.020 (0.022)	0.014 (0.019)	−0.028 (0.019)
Small (414)	−0.025 (0.066)					
Small (636)		−0.038 (0.054)				
Small (414)	−0.055 (0.098)	−0.020 (0.116)	−0.039 (0.082)	0.020 (0.062)	0.011 (0.051)	−0.017 (0.053)

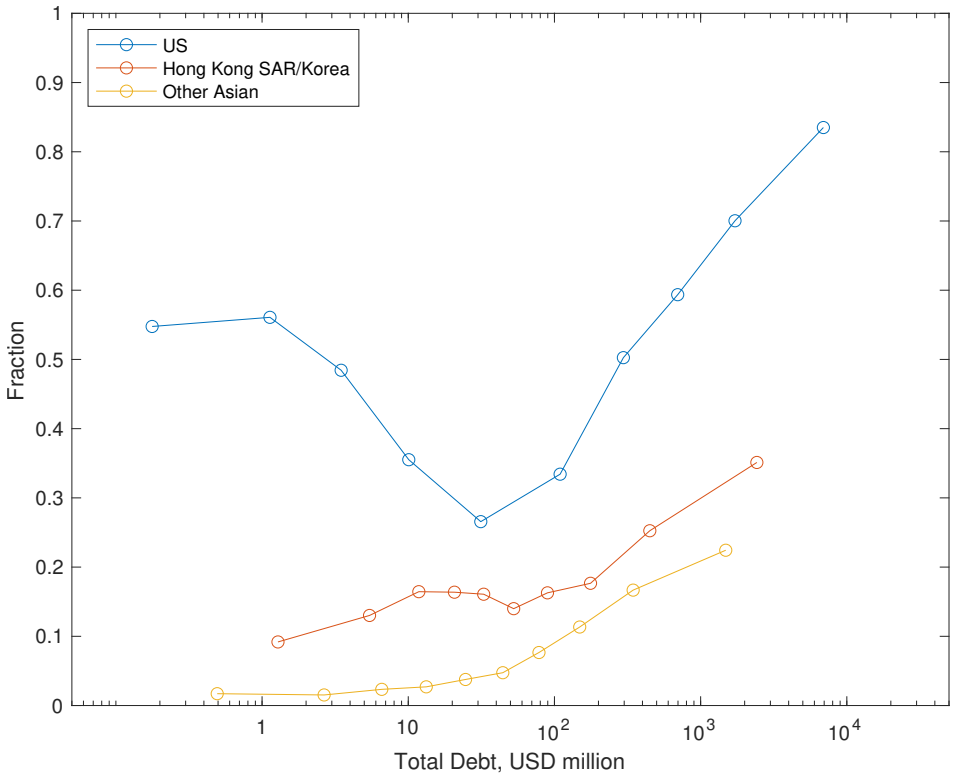


Figure 1. Bond financing relative to loan financing, 2004 through 2019. For a given region, firms with publicly-traded equity and either loan debt, bond debt, or both are sorted into ten groups based on their total debt. The bond category includes both publicly traded and privately placed bonds. The figure displays means, across firms in each group, of bond debt relative to the sum of loan and bond debt. Values on the horizontal axis are median levels of debt for each decile, expressed in 2019 dollars.

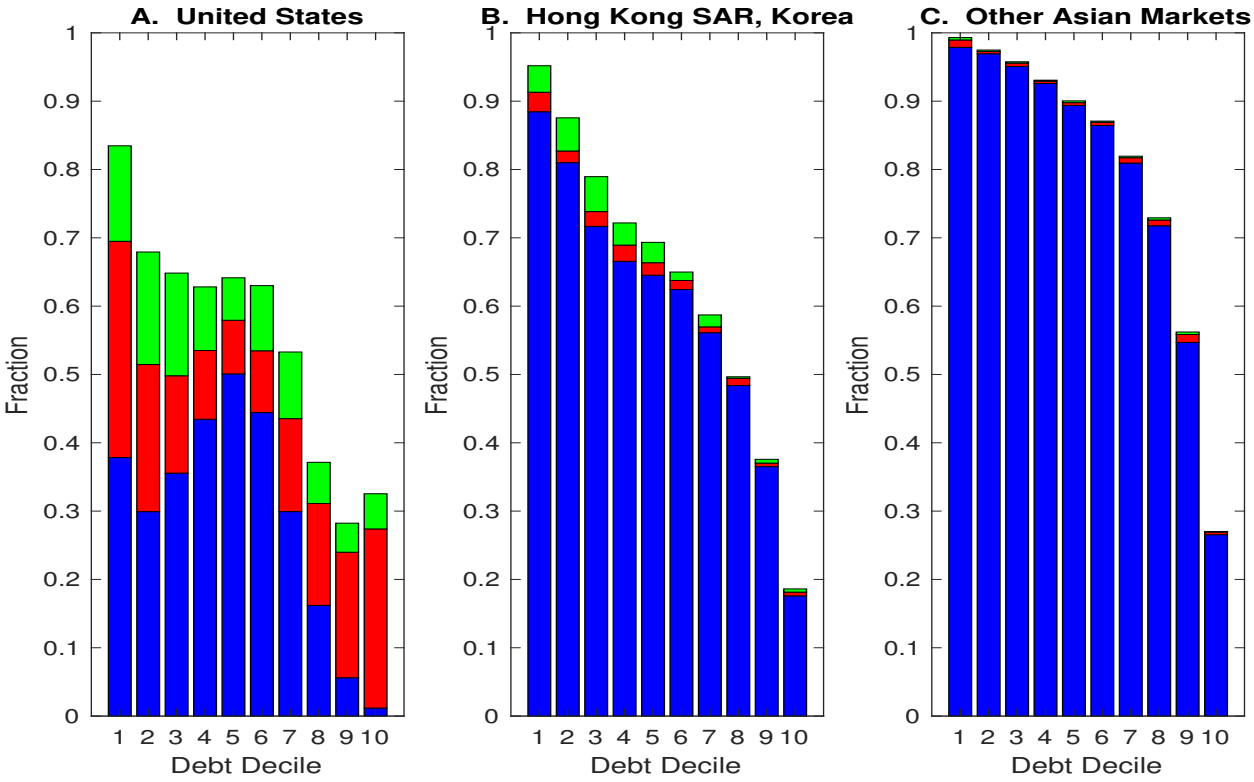


Figure 2. Fractions of firms that use a single type of debt financing, 2004 through 2019. For a given region, firms with publicly-traded equity and either loan debt, bond debt, or both, are sorted into ten groups based on their total debt (1 = smallest). Blue columns are the fractions of firms that use only loan debt, red columns are the fractions that use only nonconvertible bond debt, and green columns are the fractions that use only bond debt, of which some is convertible.

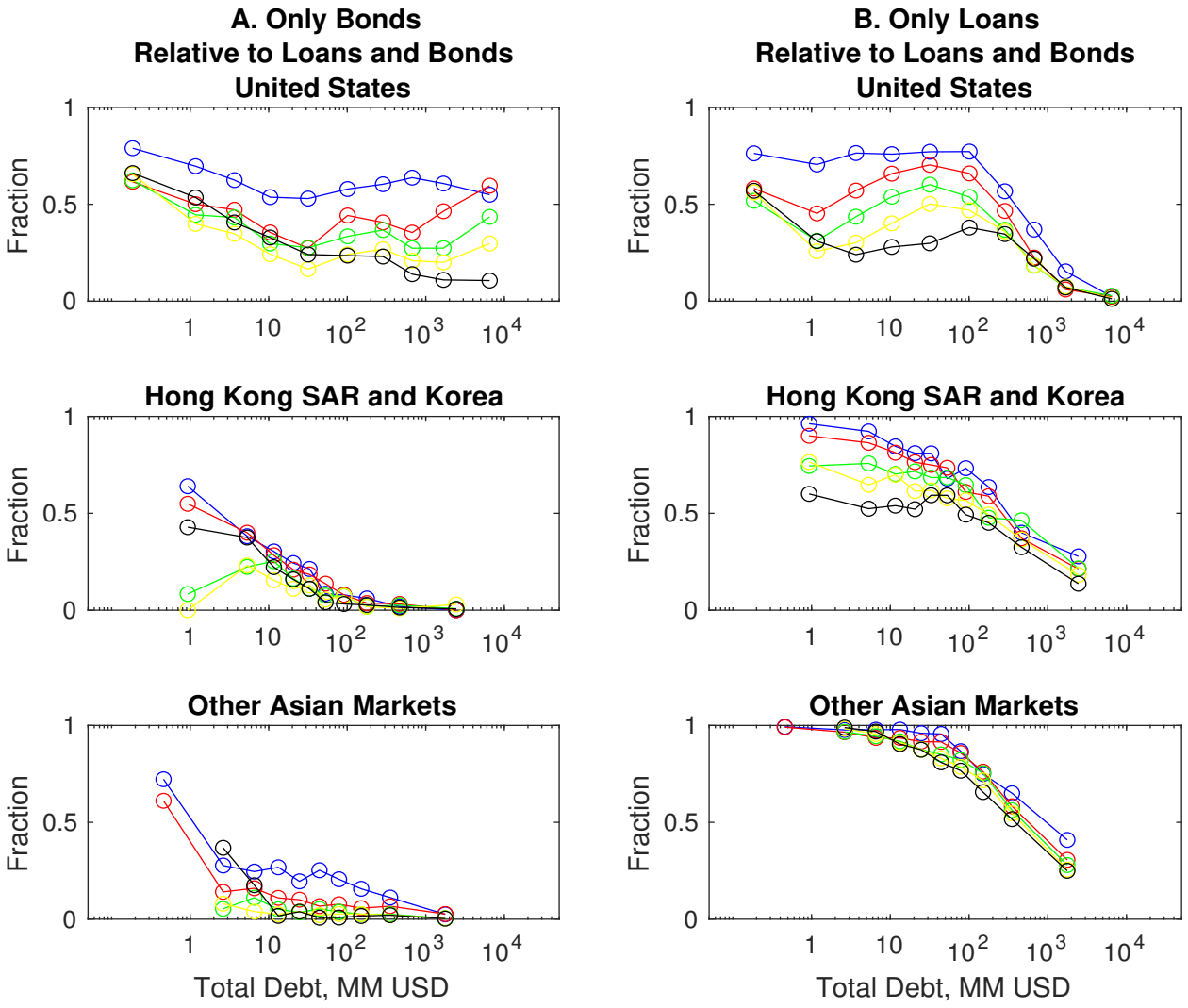


Figure 3. Fractions of firms that use a single type of debt financing, by total debt and leverage, 2004 through 2019. For a given region, firms with publicly-traded equity and either some bond debt or some loan debt are sorted into total debt deciles and leverage quintiles. Column A reports the number of firms in a debt/leverage bucket that have only bond debt relative to those with both bond and loan debt. Column B reports the corresponding fractions for firms with loan debt. The leverage quintiles are displayed from lowest to highest as blue, red, green, yellow, and black lines. Values on the horizontal axis are median levels of debt for each decile, expressed in 2019 dollars.

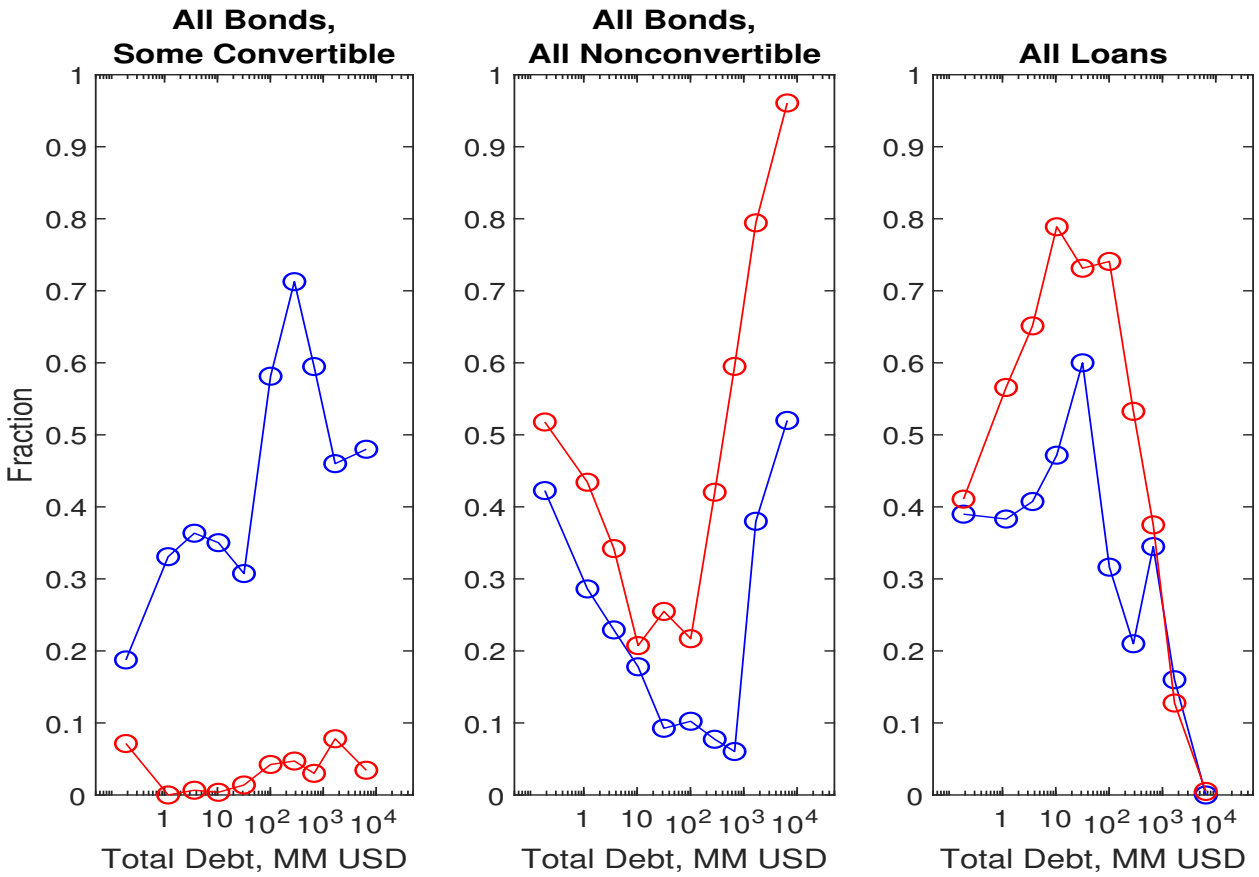


Figure 4. Fractions of US firms that use a single type of debt financing, 2004 through 2019. "Low quality" US firms have below-median values for implied credit ratings, average revenue/assets, average profits/assets, and property, plant and equipment/assets. "High quality" US firms have above-median values for each of these four categories. Low quality and high quality firms are further sorted by deciles of total debt. The figures display ratios of firms that choose the given financing method to the total number of firms that choose any of the three methods. Blue lines are ratios for low quality firms and red lines are ratios for high quality firms. Firms that use both bonds and loans are excluded from these calculations. Values on the horizontal axis are median levels of debt for each decile, expressed in 2019 dollars.

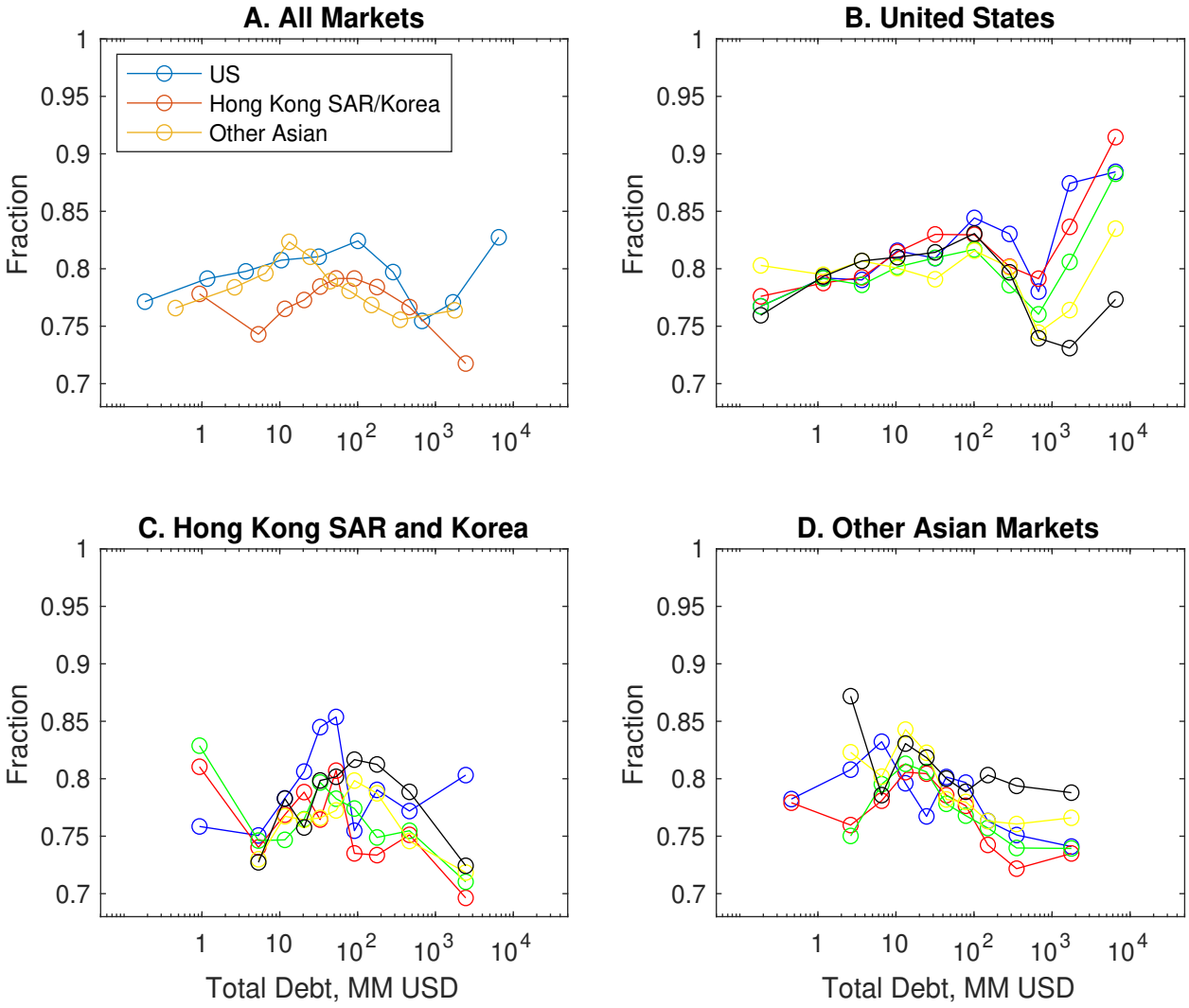


Figure 5. Concentration of Borrowing for Firms with Both Loans and Bonds, 2004 through 2019 For a given region, firms with publicly-traded equity and both bond debt and loan debt are sorted into total debt deciles, and (for Panels B through D) into leverage quintiles. The figure reports the mean, across firms in a given group, of max(bond debt, loan debt)/(bond + loan debt). The leverage quintiles are displayed from lowest to highest as blue, red, green, yellow, and black lines. Values on the horizontal axis are median levels of debt for each decile, expressed in 2019 dollars.

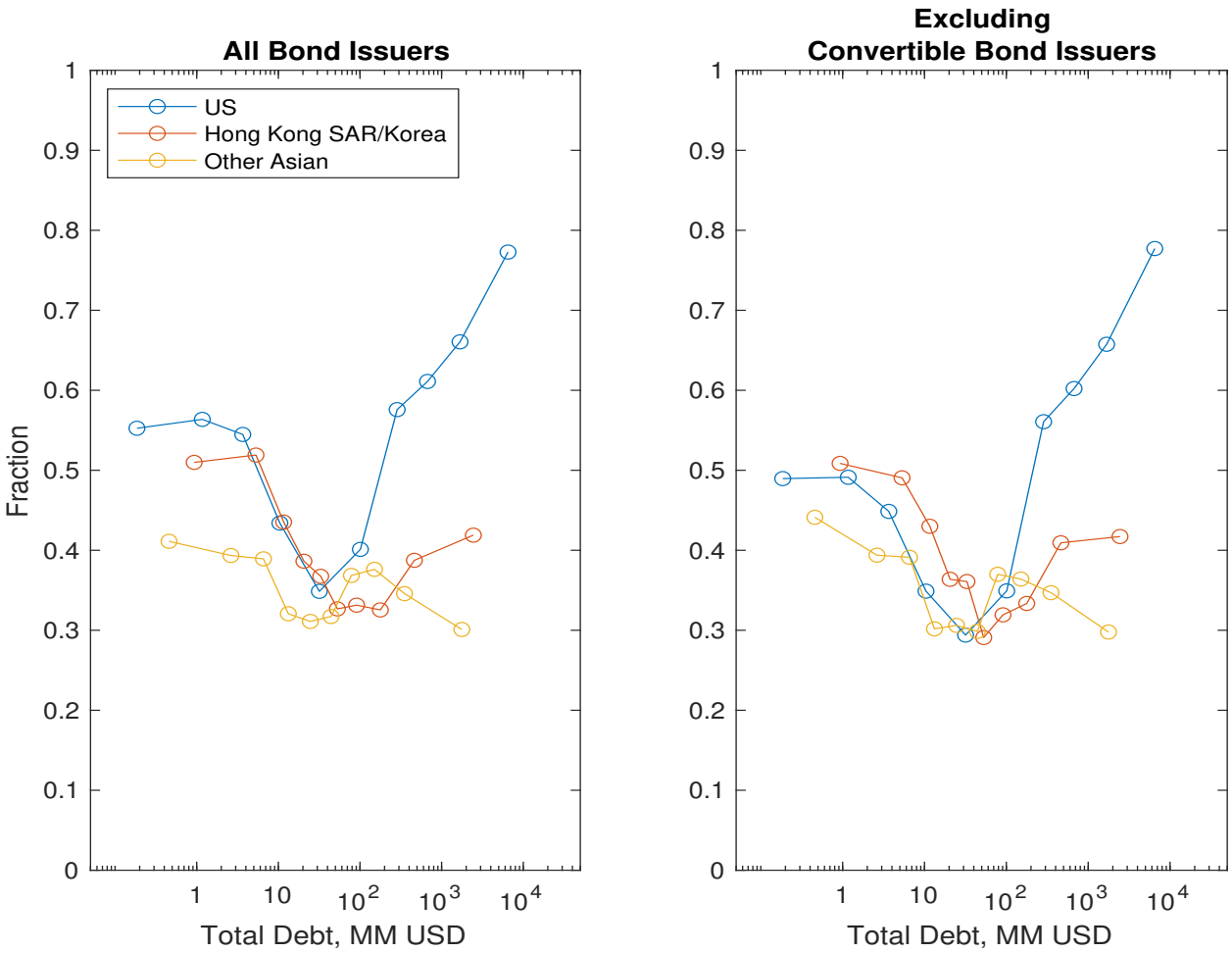


Figure 6. Bond financing relative to loan financing for firms that use both, 2004 through 2019. For a given region, firms with publicly-traded equity are are sorted into ten groups based on their total debt. The figure displays means, across firms in the given size group, of bond debt relative to the sum of loan and bond debt. The left panel includes firms that have both bond debt and loan debt. The right panel excludes firms that have any convertible bond debt.

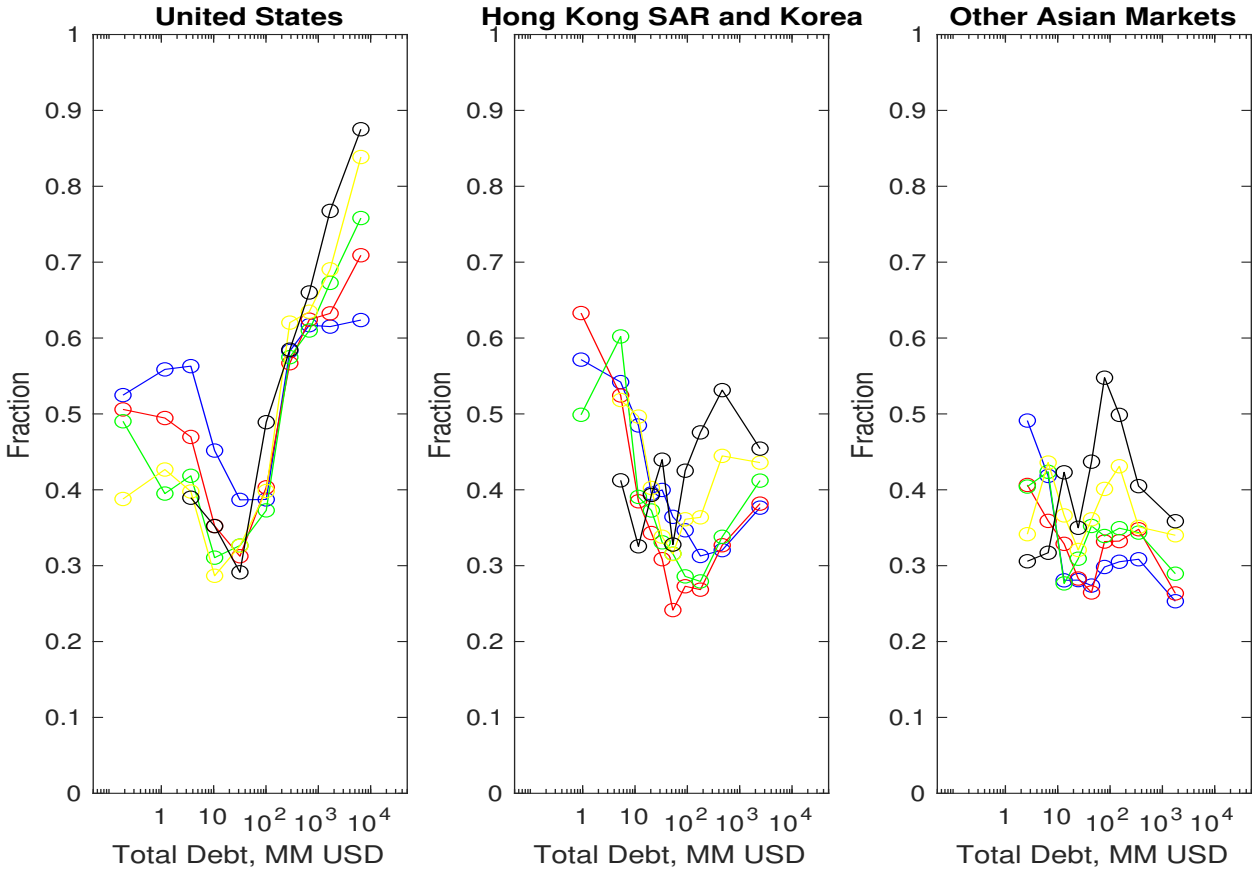


Figure 7. Mean bond leverage ratios of firms with both bond and loan debt, 2004 through 2019. For a given region, firms with publicly-traded equity and both bond debt and loan debt are sorted into total debt deciles and credit quality quintiles. The panels show cross-firm means of the ratio of bond debt to the sum of loan and bond debt. The credit quality quintiles are displayed from lowest to highest as blue, red, green, yellow, and black lines. Means for cells with fewer than ten observations are not displayed.

Appendix A

This appendix describes how we construct the data sample. We use financial statement information from Capital IQ. In Capital IQ, each company ID has associated with it a single country ID, a single currency ID, and a single two-digit industry ID. These IDs are based on the most recent financial statement of the company. Capital IQ does not report histories of these IDs for different fiscal years. We retain only those company IDs for which the country ID corresponds to any of China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Singapore, Thailand, and the United States. We also require that the currency ID is the local currency of the geographic location. We use the industry code to exclude financial firms. Using Capital IQ's categories, financial firms are those with industry codes between 46 and 52, as well as 68, which is the code for mortgage REITs.

We include only firms with publicly traded equity in our analysis. Capital IQ includes a flag for such firms, but as with the country, currency and industry IDs, this flag is based on the most recent financial statement of a firm and not on its history. We use Capital IQ's market data package, which provides daily data on the market capitalization of publicly traded firms. If a positive market cap exists as of the fiscal year-end date for a firm, we include that firm-year observation in our sample.

We refer to the above filters as "preliminary" filters.

The fiscal year information for each firm has a field for "total bank debt," which is more accurately described as "total loan debt." It is comprised of revolving credit (which, apart from revolving credit facilities, includes overdraft facilities and bills payable facilities), term loans (which includes term bank loans, bridge loans and mortgage loans), and Federal Home Loan Bank borrowings. There are also fields for "senior bonds and notes" and "subordinated bonds and notes." There are three reasons why any of these three fields might be empty. First, the firm may not have any debt of the specified type; the correct value is zero. Second, the firm's financial statements are insufficiently detailed to report that level of information; the correct value is missing. Third, Capital IQ did not retrieve the information; the correct value is missing.

We use two rules to distinguish the first reason from the latter two reasons. First, we treat blank fields as missing for fiscal years prior to 2003. Capital IQ's coverage is limited prior to this year. Second, for fiscal years 2003 and later, we assume that if a financial

statement is sufficiently detailed to contain information about one type of debt, then it is sufficiently detailed to contain information about the other types of debt. Thus if one field is not empty and the other two are empty, we interpret the empty fields as zero. For example, if the database has a nonzero value in a given year for a firm's loan debt, and no information in that year about either senior or subordinated notes/bonds, we infer that the firm has no bond debt in that year.

We include a firm's fiscal year t in our sample if it passes both our preliminary and our "secondary" filters,

1. The fiscal year t record has either positive loan debt or positive bond debt (either senior or subordinated debt is positive), has positive total debt, and positive total liabilities;

2. The firm has a record in Capital IQ for fiscal year $t-1$ that is in the same fiscal year chain as the record for t (roughly, the firm's definition of fiscal year does not change from $t-1$ to t) and this $t-1$ record passes the preliminary filters.

We impose the first secondary filter because we study the choice between loan and bond debt. A fiscal year record with neither is not informative about this choice. If the record says that the firm has either loan or bond debt, yet either total debt or total liabilities equals zero, the observation is suspicious and thus we exclude it. We impose the second secondary filter because we use year $t-1$ variables to interpret a firm's year t capital structure.

After inspection of these data, we chose to restrict our attention to capital structures in fiscal years 2004 and later. Table A1 reports that this sample contains roughly 170,000 firm-year observations. The earliest financial statements we use are from 1999, to construct lagged five-year means and standard deviations for a few variables.

Appendix B

This appendix describes how we estimate the multinomial logit equation for observed credit ratings. The eight explanatory variables fit into five categories. The categories are

1. Total leverage

   We measure total leverage using the firm's total debt divided by market assets.

2. Profitability

   We measure both average profits and the volatility of profits using the most recent five years of net income divided by market assets. Our measures are the sample mean and the log of the sample standard deviation of these five yearly observations. We require that none of these five observations is missing.

3. Asset composition

   We use total intangible assets divided by market assets. Intangible assets is defined as book equity less tangible book equity.

4. Operational activity relative to assets

   Is a firm operating on a thin layer of firm value? We measure this in two ways. One is the average over the past five years of total revenue divided by market assets. The other is the log of the standard deviation of net working capital divided by market assets. The standard deviation is calculated using ratios for years $t-5$ through $t-1$.

5. Past and expected future growth

   We measure past growth by the log five-year change in book assets. We measure expected future growth by the ratio of market assets to book assets.

Although firm size is correlated with credit quality, we do not include it among the explanatory variables. A glance at Table A2 reveals why. Credit ratings are available only for the largest firms. There are 13,553 observations of US firms with credit ratings from 2004 through 2019 that have non-missing observations of the eight explanatory variables. Only 110 are in the smallest four deciles of firms, as measured by market assets. The empirical relation between size and credit quality can be estimated reliably only for large firms.

Estimation results are in Table A3. We produce conservative standard errors by calculating standard errors as if all of the observations are independent, then multiplying these standard errors by four. In other words, we assume the information in the sample is only 1/16 of the information based on the assumption of iid observations. Our methodology would be exact if the data were for a sample of 847 firms that are observed repeatedly over each of 16 years from 2004 through 2019, where each firm's data is independent of another firm's data, and within-firm observations over time are perfectly correlated.

Table A1. Measures of Debt Composition, 2004 to 2019

The sample consists of yearly observations of nonfinancial firms with publicly-traded equity and either loan debt, bond debt, or both. The table displays statistics for (loan debt plus bond debt)/(total debt), where loan and bond debt levels are determined from notes to financial statements and total debt is reported on the balance sheet. The observations are combined across all fiscal years 2004 through 2019.

	Number of	Loan + Bond Debt/Total Debt				
Restriction	Observations	Median	Mean	Ratio > 1	Ratio > 1.01	Ratio > 1.02
None	169,225	1.000	2.612	0.148	0.088	0.074
Ratio <= 1.02	156,727	0.998	0.910	0.080	0.015	0.000

Table A2. Sample of Credit Ratings, 2004 to 2019

The sample consists of yearly observations of US nonfinancial firms with publicly-traded equity and either loan debt, bond debt, or both. The table displays the number of credit ratings in each category, aggregated over the 2004 through 2019 period. A firm-year observation is included only if there are nonmissing observations of the eight firm-level variables used to explain credit ratings. The rating labels follow Moody's notation, although the rating for firm i in year t, if the higher of the firm's rating from S&P and Moody's. Size is measured by total market assets.

Size Decile	Aaa and Aa	A	Baa	Ba	B	Caa through C
1 (smallest)	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	1	3	14	2
4	0	0	0	17	62	11
5	0	14	6	64	317	53
6	2	54	47	318	604	140
7	5	62	201	743	703	136
8	21	161	591	967	668	153
9	51	528	1,250	980	445	79
10 (largest)	524	1,285	1,478	529	201	64
Total	603	2,104	3,574	3,621	3,014	638

Table A3. Multinomial Logit Model for Credit Ratings, 2004 to 2019

The table presents parameter estimates of equation (4). The explanatory variables and the construction of standard errors is described in Appendix B. Market assets and book assets are denoted MA and BA respectively.

Explanatory Variable	Estimate	Standard Error	T-stat
Category 1 Constant	−5.618	0.460	−12.21
Category 2 Constant	−3.774	0.429	−8.80
Category 3 Constant	−2.238	0.415	−5.39
Category 4 Constant	−0.766	0.410	−1.87
Category 5 Constant	1.628	0.435	3.74
Debt/MA	−3.706	0.468	−7.92
Mean of NI/MA	2.721	1.186	2.29
Log Std Dev of NI/MA	−0.526	0.065	−8.05
Intangibles/MA	−0.935	0.404	−2.31
Mean of Revenue/MA	−0.261	0.118	−2.22
Log Std Dev of NWC/MA	−0.374	0.081	−4.60
5 yr Log Change, BA	−0.475	0.123	−3.85
MA/BA	−0.186	0.079	−2.34

Previous volumes in this series

927 February 2021	Do macroprudential policies affect non-bank financial intermediation?	Stijn Claessens, Giulio Cornelli, Leonardo Gambacorta, Francesco Manaresi and Yasushi Shiina
926 February 2021	Answering the Queen: Machine learning and financial crises	Jérémy Fouliard, Michael Howell and Hélène Rey
925 January 2021	What 31 provinces reveal about growth in China?	Eeva Kerola, and Benoît Mojon
924 January 2021	Permissioned distributed ledgers and the governance of money	Raphael Auer, Cyril Monnet and Hyun Song Shin
923 January 2021	Optimal bank leverage and recapitalization in crowded markets	Christoph Bertsch and Mike Mariathasan
922 January 2021	Does regulation only bite the less profitable? Evidence from the too-big-to-fail reforms	Tirupam Goel, Ulf Lewrick and Aakriti Mathur
921 January 2021	Firm-specific risk-neutral distributions with options and CDS	Sirio Aramonte, Mohammad R Jahan-Parvar, Samuel Rosen and John W Schindler
920 January 2021	Investing like conglomerates: is diversification a blessing or curse for China's local governments?	Jianchao Fan, Jing Liu and Yinggang Zhou
919 January 2021	Understanding bank and nonbank credit cycles: A structural exploration	C Bora Durdu and Molin Zhong
918 January 2021	Sovereign credit and exchange rate risks: Evidence from Asia-Pacific local currency bonds	Mikhail Chernov, Drew Creal and Peter Hördahl
917 January 2021	Trade sentiment and the stock market: new evidence based on big data textual analysis of Chinese media	Marlene Amstad, Leonardo Gambacorta, Chao He and Dora Xia
916 January 2021	Firm-level R&D after periods of intense technological innovation: The role of investor sentiment	Sirio Aramonte and Matthew Carl
915 December 2020	The globalisation of inflation in the European emerging countries	Horatiu Lovin
914 December 2020	Demographic shifts, macroprudential policies, and house prices	Jieun Lee and Hosung Jung

All volumes are available on our website www.bis.org.