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Structural Changes in Corporate Bond Underpricing

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Abstract

We show that in the aftermath of the financial crisis underwriters systematically place the most underpriced bonds to closely affiliated investors. We argue that in securing future intermediation in newly issued bonds, underwriters collude with affiliated investors who are rewarded through increased underpricing. We employ a novel identification strategy based on institutional investors' past holdings of bonds issued by underwriters to isolate the strength of underwriter-investor relations. Our channel fully explains the increase in average underpricing in the post-crisis relative to the pre-crisis period. Furthermore, we underpin the mechanism by examining the trading activity of newly issued bonds. Our results are informative about potential implications of post-crisis regulation.

JEL-Classification: G12, G32
Keywords: US corporate bond market, underpricing, underwriter-investor relations, post-crisis regulation, reaching for yield

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Investors aren't being treated equally.

Jeffery Elswick, Frost Investment Advisors, Bloomberg 2014-03-04

1 Introduction

The US corporate bond market has steadily grown over the past ten years from a total amount outstanding of \$4.6 trillion in 2005 up to \$8.2 trillion in 2015.[3] Therefore, this market represents an important platform for several market participants. The aftermath of the financial crisis is characterized by low interest rates and intermediaries being exposed to tighter regulation (see Duffie, 2012, for a discussion) and, as a consequence, the market structure is subject to changes. In particular, dealers reduce their liquidity provisioning in the secondary market by committing less capital to inventory management (e.g., Bessembinder, Jacobsen, Maxwell, and Venkataraman, 2016). Furthermore, many new firms approach the corporate bond market as a source of debt financing and investors increasingly engage in "reaching for yield" (e.g., Becker and Ivashina, 2015).

Underwriters play a central role in the corporate bond market. They provide placement services to firms and act as intermediaries between investors after bond issuance. Interestingly, the current discussion on the implications of the post-crisis regime focuses exclusively on the pricing and liquidity in the secondary market.[4] However, this is surprising because the issuance process is incredibly opaque and investors increasingly complain that they often get no access to bonds at the issuance stage.[5] Hence, this seems suggestive that underwriters exploit their market power in shaping the initial allocations of bonds.

In this paper we shed light on the initial allocations of bonds and their impact on under-

[3] http://www.sifma.org/research/statistics.aspx

[4] We refer to, among others, Trebbi and Xiao (2015), Randall (2015), Dick-Nielsen and Rossi (2016) or Bao, O'Hara, and Zhou (2016).

[5] For example, in 2014 the SEC conducted an investigation regarding the allocation of corporate bonds to the customers of Goldman Sachs and Citigroup. Moreover, FIDERES documents systematic underpricing of corporate bonds in 2010 to 2015, except for financials' own bonds.

pricing, as well as, on the trading activity of newly issued bonds. Specifically, we document that bonds are persistently more underpriced in the post-crisis compared to the pre-crisis period. We conjecture that the change in dealers' inventory management in the aftermath of the crisis affects the issuance process in a way that is detrimental to both, issuing firms and non-underwriter affiliated investors alike. Specifically, because dealers can only offer less inventory in the secondary market, they have an incentive to place bonds to closely affiliated investors in order to secure intermediation in newly issued bonds. In turn, underwriter-affiliated investors accept this deal because they are rewarded through increased underpricing.

We test this prediction and find strong support for it. We combine transactions data from the Trade Reporting and Compliance Engine (TRACE) with quarterly holdings data from Lipper-eMAXX and underwriter information from the Mergent Fixed Income Securities Database (Mergent FISD) over the period from 2003 to 2013.

Our analysis yields several distinct sets of findings. First, we document that average underpricing in the post-crisis period amounts to around 64 basis points (bps) compared to 23 bps in the pre-crisis period. Second, we examine the holdings distributions on the individual bond level in the first quarter after issuance and document that institutional investors hold a higher fraction of a bonds' amount issued in the post-crisis (around 38%) compared to the pre-crisis period (around 27%). The increase is mainly driven by mutual funds who hold around 16% of a bond in the post-crisis compared to 6% in the pre-crisis period. Third, we show that trading activity (trades, volume) of newly issued bonds is up to three times higher in the post-crisis period compared to before.

In our main empirical tests, we show that in the aftermath of the crisis underpricing increases because dealers systematically place bonds to closely related investors. In identifying this channel, we are confronted with two main empirical challenges. First, we do not observe the true initial allocation of bonds but observe holdings data at a quarterly frequency. Second, the holdings-data are equilibrium outcomes. Hence, even after conditioning on supply-side effects we cannot differentiate between "true demand" induced by investors in search of a particular bond and "colluded demand" attributable to underwriter-investor relations. Therefore, we employ a novel identification approach based on institutional investors' past holdings of bonds issued by underwriters to isolate the strength of underwriter-investor relations. In particular, in a given period we look back in time and identify the strength of relations for each underwriter based on its main past institutional bond investors. We use the past holdings of these relation-investors as an instrumental variable for the first observable allocation of newly issued bonds. In other words, the idea underlying our instrument is that it allows us to isolate the part of the initial allocation which is attributable to the strength of underwriter-investor relations. From an economic perspective, the instrument satisfies the exclusion restriction because it is unrelated to the fundamental values of the newly issued bonds and, therefore, influences underpricing only via the endogenous allocation of bonds. Furthermore, our instrument is valid and passes the weak instrument test.

In accordance with our proposed mechanism, we find that the instrumented allocations fully explain the difference in underpricing of 31 bps between the pre-crisis and post-crisis period, respectively. In addition, in order to close our line of argumentation - namely that underwriters collude with closely affiliated investors in order to secure intermediation in newly issued bonds - we examine the trading activity in terms of trades and volume of newly issued bonds. In this analysis, we show that the instrumented allocations help explaining the increase in trading activity of newly issued bonds in the post-crisis period. In other words, underwriter-investor relations explain the increase in underpricing and trading activity at the same time. We provide several additional tests to underpin the economic mechanism. Specifically, we show that the results are not driven by specific industries and do not capture time-invariant heterogeneity across underwriters. The results are also robust to the time-horizon on which the estimation of underpricing and trading activity are based on.

Furthermore, we exploit variation in the type of underwriter-investor relations, that is, we decompose the holdings of institutional investors into its two main components (mutual funds and insurance firms) to examine their relative importance. In this analysis, we find that the "relation channel" seems to be particularly strong among underwriters and mutual funds, potentially, due to the fact that mutual funds are subject to less stringent investment mandates compared to insurance firms.

In summary, we provide novel insights into the determinants of corporate bond underpricing by elaborating on the role of the investor base at issuance. Our results are of interest to, both, regulators and market participants alike. They help to understand how institutional changes in the secondary market affect the incentive structures of intermediaries with respect to the initial allocation of bonds among investors, and, their implications for underpricing and the trading activity of newly issued bonds.

Our paper is structured as follows. Section 2 provides information on the institutional background and discusses the hypotheses. Section 3 introduces the data, Section 4 discusses the empirical analysis and Section 5 concludes.

Literature. Our paper is related to three different strands of the literature. First, we contribute to understanding the drivers of underpricing in the context of corporate bonds. Interestingly, while there is substantial existing research related to equity markets, relatively little is known for rather opaque markets such as the one of corporate bonds.[6] For example, Datta, Iskandar-Datta, and Patel (1997) analyze IPO underpricing of US corporate bonds and find that it is most pronounced among speculative-grade bonds which are typically issued by less prestigious underwriters compared to those of investment-grade bonds. Datta, Iskandar-Datta, and Patel (1999) instead analyze whether the existence of a strong relationship between the underwriting bank and the issuing firm lowers the costs of issuing bonds. Cai, Helvege, and Warga (2007) examine the determinants of corporate bond underpricing and argue that information asymmetry is one of the main drivers of underpricing. Hence, they document

[6] For a theoretical analysis on equity underpricing we refer to, e.g., Welch (1989), Allen and Faulhaber (1989), Booth and Chua (1996) or Liu and Ritter (2011). Prominent empirical papers related to equity underpricing include among others, e.g. Beatty and Ritter (1986), Ruud (1993), Brennan and Franks (1997), Corwin (2003), Cliff and Denis (2004), Liu and Ritter (2004), Ellul and Pagano (2006), Chambers and Dimson (2009), Massa and Zhang (2012) or Fu and Lyandres (2016).

that underpricing is higher among riskier and unknown firms. Helvege and Wang (2016) investigate the pricing and liquidity of mega-bonds at issuance and show that they exhibit higher underpricing compared to smaller bonds.

Our paper is also related to a rather novel and growing literature that studies holdings of institutional investors in the corporate bond market. Massa, Yasuda, and Zhang (2013) examine the effect of bond capital supply uncertainty of institutional investors on the leverage of the firm, finding that the supply uncertainty of the firm's bond investor base has a negative effect on the leverage of the firm. Dass and Massa (2014) instead focus on how the variety of bond maturities offered by a firm affects the portfolio allocations of institutional investors. Their main result is that investors shift towards firms that offer a richer variety of maturities because of lower information-acquisition costs. Ivashina, Iverson, and Smith (2016) study the relation between a firm's debt ownership and bankruptcy outcomes. They show that higher ownership concentration favors the firm in the bankruptcy process. Moreover, Massa, Zhang, and Weina (2016) analyze the dynamics of the ownership structure of corporate bonds after issuance and document a decrease in ownership concentration over a bonds' lifetime.

Finally, our research is related to the notion of "reaching for yield", i.e. the preference of institutional investors to buy riskier assets to obtain higher yields. This phenomenon became particularly evident in the low-interest rate environment following the recent crisis. For example, Becker and Ivashina (2015), Choi and Kronlund (2016) and Acharya and Naqvi (2016) document reaching for yield by insurance companies, mutual funds and banks, respectively.

2 Institutional background and hypotheses

The issuance process in the US corporate bond market is very opaque and does not follow the standard book building process used in equity offerings (see e.g. Ritter and Welch, 2002). Underwriters provide placement services by guaranteeing issuing firms an offering price which is the price that investors pay in order to obtain the bond in the primary market.

There is a commission fee that underwriters charge implying that the net proceeds for firms per notional equal the offering price minus the commission fee. Underwriters then place the bonds to investors, whereby, underwriters are somewhat free in choosing the allocation. In principle, they could also keep the bonds on their own inventories and sell them later on in the secondary market.

This overall structure of the issuance process in the US corporate bond market indicates that underwriters have a somewhat special role because they provide primary market placement services while at the same time they act as dealers in the secondary market. In other words, this is suggestive of the idea that underwriters could exploit their central position in the market. For example, in shaping the initial allocation of bonds they can take into account their future role as dealers in the secondary market.

In this respect, the nature of acting as a dealer in the secondary market changed after the crisis. In particular, several papers document that dealer inventories and dealers' willingness to provide immediacy to investors in the secondary market for corporate bonds decreased in the aftermath of the financial crisis.[7] Furthermore, Bessembinder, Jacobsen, Maxwell, and Venkataraman (2016) show that dealers commit less capital to market making activities and that dealers take more the role of a "match-maker", that is, they focus on matching buyers and sellers without taking on additional inventory risk. In this vein, Friewald and Nagler (2015) show that inventory risk became increasingly more important in pricing bonds in the period following the crisis. While the reasons might be manifold, it seems that dealers exposures to tighter regulations (Duffie, 2012) are the main determinants of these developments. Additionally, the low interest rate environment also increases investors desire to engage in "reaching-for-yield" as discussed by Becker and Ivashina (2015), thereby, focusing more attention on finding potentially undervalued bonds.

We conjecture that these changes in the secondary market structure in the post-crisis period affect the incentives of underwriters in shaping the initial allocation of bonds across

[7] We refer to, for example, Choi and Shachar (2013); Randall (2015); Bao, O'Hara, and Zhou (2016); Dick-Nielsen and Rossi (2016); Bao, O'Hara, and Zhou (2016).

investors and, thereby, underpricing and the trading activity of newly issued bonds. Specifically, in the post-crisis period dealers are exposed to gain less from intermediation because they can offer less to investors in the secondary market after issuance of a bond. As a consequence, dealers are incentivized to place bonds to closely related investors because in doing so they secure access to the bonds and can intermediate transactions in newly issued bonds until they end up at "final" investors. In other words, using this device, dealers can secure the intermediation spread. In turn, affiliated investors accept to provide immediacy to underwriters at the issuance stage if they are compensated through increased underpricing. Hence, if this described mechanism is at work in the post-crisis period then we expect:

H1: *Underpricing as well as the trading activity of newly issued bonds are higher in the post-crisis compared to the pre-crisis period.*

H2: *The increase in underpricing as well as in the trading activity of newly issued bonds is driven by underwriters systematically placing bonds to closely related investors.*

In what follows, we test these two hypotheses by examining the drivers of underpricing as well as trading activity of newly issued bonds. We then use an instrumental variable IV in a two-stage-least-squares (2SLS) procedure to provide causal evidence on this relation channel.

3 Empirical measures and data

In this section we discuss the definiton of underpricing, how we measure the trading activity of newly issued bonds and discuss the construction of the dataset used in our analysis.

3.1 Underpricing

Following Cai, Helvege, and Warga (2007), we define underpricing UP as the average return relative to the bonds' offering price in excess of the market return over a given period.

Specifically, UP of bond i, issued on day t, over n days after issuance is given by

$$UP_{it}^{n} = \frac{1}{n}\sum_{k=0}^{n}\left[\frac{P_{t+k} - OP_{it}}{OP_{it}} - \frac{MK_{t+k} - MK_{t}}{MK_{t}}\right]. \tag{1}$$

OP_{it} is the offering price of bond i, P_{t+k} is the volume-weighted transactions price on day $t+k$, and MK_{t+k} is the value of the Bloomberg FINRA Corporate bond index on day $t+k$. We calculate underpricing for $n \in [10, 30]$ days. In our baseline results we use $n = 10$ days.

3.2 Measuring trading activity

We use two measures of trading activity of newly issued bonds in our analysis. First, we employ a measure of trading frequency TF. We estimate this measure as the average number of trades per trade day within $n \in [10, 30]$ days after issuance of a bond. The second measure captures the trading volume VOL. We define this measure as the average trading volume per trade day, again, within $n \in [10, 30]$ days after issuance of a bond.

3.3 Data

We make use of several databases to establish our findings. First, we use the Enhanced Trade Reporting and Compliance Engine (TRACE) database to obtain transactions data including prices and volumes of the underlying bonds. We apply standard filters as described by Bessembinder, Jacobsen, Maxwell, and Venkataraman (2016) or Friewald and Nagler (2015) to clean the data. We obtain bond characteristics and underwriters' information from the Fixed Income Securities Database (Mergent FISD). We retrieve information on investor's quarterly holdings of corporate bonds from Lippers eMAXX fixed-income database (see Dass and Massa, 2014; Becker and Ivashina, 2015, for a detailed description). Moreover, we download the FINRA Corporate bond index from Bloomberg.

We match bond characteristics from Mergent with bond trades from TRACE by using the CUSIP code. For each bond, we are able to identify every agent that participates in the issue, and its respective role (lead underwriter, underwriter, financial agent, etc.). In our analysis, we will focus on the leading underwriter of the issue, and, whenever bonds have multiple lead underwriters we take the average of the variables that are lead underwriter-specific. We furthermore match bond trades and characteristics with quarterly bond holdings from eMAXX by using again the CUSIP identifier. At the end of each quarter, we know, for each bond, the identity of the institutional investors' funds that hold the bond and how much of the offering amount is in their portfolio. We aggregate all institutional holdings as given by eMAXX at the bond level and construct the measure $INST$, which is the fraction of a bonds' offering amount held by institutional investors. Throughout our analysis, we are interested in the holdings at the end of the issuance quarter of a bond. Additionally, we know the type of each fund reported in the dataset, which allows us to extend the analysis in the cross-section of the institutional investors.[8] Here, we decompose $INST$ into its two main components, namely, mutual funds MUT and insurance firms INS.

Our empirical strategy requires us to identify the bonds issued by underwriters themselves. Since Mergent does not provide a unique identifier that links underwriters to their own bonds, we manually match each underwriter in our sample with its bonds, using the underwriter and issuer name available in the data. Such a procedure also allows us to identify those bonds where issuer and lead underwriter are the same entity. Moreover, thanks to the holding data, we are able to observe the entire ownership structure of each underwriter's own bonds. To the best of our knowledge, we are the first to explicitly link corporate bond transactions, bond holdings, and underwriter information in a unique database.

We construct a dataset for our empirical tests which covers bond issuances from the beginning of 2003 to the end of 2013. At the lower end of the sample period we are restricted by the availability of transactions data while at the upper end we are restricted by the availability of the holdings data. The dataset contains $10,177$ bond issuances which are

[8] Our holdings data are both at the fund and firm level, meaning that if an investor (e.g. Blackrock) has multiple corporate bond funds, we know all the single holdings of each of them. In our analysis we work at the fund level, but results do not change if we aggregate the data at the firm level.

attributable to $2,385$ firms. Moreover, in the calculation of the holdings variables ($INST$, MUT, INS) used in the dataset enter $11,646$ unique funds which are related to $1,969$ firms.

We provide descriptive statistics of the key variables used in our tests in Table 2. The average value of UP is 41 bps with a standard deviation of 105 bps. TF is around 9 while VOL is around \$14 million, on average. Standard deviations are 17 for TF and \$33 million for VOL, respectively. On average, the fraction of a bonds' offering amount held by institutional investors $INST$ at the end of the issuance quarter is 33% out of which the fraction of insurance firms INS is higher with a value of 22% compared to the 10% of MUT. Relative bond size is on average 34 bps and the standard deviation is 39 bps. The average rating at issuance is 7.6 with a standard deviation of 3.8, while the average maturity at issuance is around 11 years. The average number of agents involved in the underwriting syndicate is 4.

4 Empirical analysis

4.1 Underpricing, trading activity and allocation of newly issued bonds

We begin our discussion by studying the time-series dynamics of underpricing computed over $n = 10$ days after issuance. Figure 1 presents the bond size-weighted average of underpricing at a quarterly frequency. Underpricing is low at a level of around 23 bps in the pre-crisis period and substantially increases up to a level of 72 bps during the crisis period. In the post-crisis period underpricing decreases slightly to 64 bps, however, it remains persistently higher compared to the pre-crisis period.

Figure 2 presents the trading activity of newly issued bonds over the first 12 weeks after issuance. Again, we compute bond size-weighted averages. Panel A shows the trading frequency TF for the pre-crisis and post-crisis period, respectively. In the pre-crisis period we see that TF is very stable at a value of around 6 in the weeks after bond issuance. The dynamics are very different in the post-crisis period in which TF is especially high with a value of 14 in the first week after issuance while, following the first week, TF remains stable at around 11. Panel B presents VOL over the first 12 weeks after bond issuance. In the pre-crisis period there is little variation in VOL which is stable at around $13 million over the 12 weeks after issuance. The picture is quite different in the post-crisis period in which VOL is especially elevated at $20 million in the first week after issuance and then drops back to a level of around $11 million. Therefore, we see that TF and VOL of newly issued bonds are higher in the post-crisis compared to the pre-crisis period.

Furthermore, Figure 3 provides the holdings of institutional investors as a percentage of offering amount $INST$ at the end of the issuance quarter of a bond. We present bond size-weighted averages. In the pre-crisis period $INST$ is on average 26% compared to 38% in the post-crisis period, hence, $INST$ increases by 12% on average over this interval. Moreover, also in Figure 3, we decompose $INST$ into its two main components, namely, mutual funds MUT and insurance firms INS. The holdings of insurance firms remain very stable over the sample period with an average value of around 20%. On the contrary, the holdings of mutual funds increase sharply from 5% in the pre-crisis period up to 16% in the post-crisis period, respectively.

Overall, this discussion provides descriptive support for the first hypothesis. We find that underpricing as well as the trading activity of newly issued bonds is higher in the post-crisis compared to the pre-crisis period. In what follows, we provide comprehensive and causal support for the relation channel between underwriters and investors in driving these increases.

4.2 Baseline model: explaining underpricing

In this section we discuss our baseline model that we augment in the subsequent sections in order to identify the drivers of corporate bond underpricing over time. Therefore, in a first step, we run the following regression

$$UP_{it}^{n=10} = \alpha + crisis_t + post\_crisis_t + \beta \cdot INST_{it} + \gamma \cdot X_{it} + e_{it}. \tag{2}$$

Hence, we regress underpricing estimated over $n = 10$ days after issuance against the crisis and post-crisis dummies, respectively. In order to obtain an intuition on the role of institutional investors for UP we include $INST$ in the model. Moreover, we include a set of control variables which are defined in Table 1. We compute clustered standard errors at the firm level and present the results in Model (1) in Table 3. First, in the crisis period UP increases by around 52 bps. Second, in accordance with the discussion in Section 2, UP in the post-crisis period is significantly higher compared to the pre-crisis period by 31 bps. The variable $INST$ exhibits a significant positive coefficient, e.g. a ten percentage points increase in $INST$ increases UP by around 7 bps. Among the set of control variables we find that larger bonds have higher UP as in Helvege and Wang (2016). Lower rated bonds have higher UP (around 5 bps per notch) and, additionally, speculative-grade bonds are more underpriced by 32 bps. This effect is likely the result of market segmentation arising from investor mandates as discussed by Ellul, Jotikasthira, and Lundblad (2011). Furthermore, among these qualitative results, there are three additional things worth mentioning. First, IPOs are more underpriced by 30 bps. Second, the same insight is true for non-financial bonds which exhibit higher UP by 18 bps, indicating that financials might exploit their market power. Third, own underwritten bonds exhibit lower UP by 22 bps.

4.3 The dynamics of underpricing and $INST$

In this Section we examine whether the increase in $INST$ explains the increase in UP in the post-crisis period. We test this conjecture and augment the baseline model by an interaction term $post\_crisis \times INST$, hence, we run the following regression

$$\begin{aligned} UP_{it}^{n=10} = \alpha + crisis_t + post\_crisis_t + \beta_1 \cdot INST_{it} \\ + \beta_2 \cdot post\_crisis_t \times INST_{it} + \gamma \cdot X_{it} + e_{it}, \end{aligned} \tag{3}$$

and present the result in Model (2) in Table 3. Interestingly, we find that the interaction term exhibits a negative coefficient and is not statistically different from zero. Moreover, the post-crisis dummy remains highly statistically significant with a value of 33 bps (t-stat: 5.7). Hence, at the first sight, it appears that variation in $INST$ in the post-crisis period cannot explain the increase in underpricing.

Of course, in this specification the variable $INST$ is highly endogenous. Specifically, in interpreting the role of $INST$ for UP we are confronted with two main empirical challenges. First, we observe holdings data at a quarterly frequency which implies that our best-estimate of the true initial allocation of bonds are the holdings at the end of the issuance quarter. Second, the holdings-data are equilibrium outcomes, which implies that even after conditioning on supply-side effects we cannot differentiate between "true demand" induced by investors in search of a particular bond and "colluded demand" attributable to underwriter-investor relations, as outlined in Section 2. In other words, we need an instrumental variable IV for $INST$ that is exogenous to the fundamental values of the newly issued bonds while at the same time it is correlated with the bonds' initial allocation due to underwriter-investor relations.

We propose a novel instrument based on institutional investors' past holdings of bonds issued by underwriters in order to isolate underwriter-investor relations. Specifically, in a given period $t \in$ [pre-crisis, crisis, post-crisis] we look back in time and identify the strength of relations for each underwriter based on its main past institutional bond investors. Specifically, we define our IV for underwriter u in period $t \in$ [pre-crisis, crisis, post-crisis] as

$$IV_t^u = \frac{1}{k-s} \sum_{\tau=s}^{k} \frac{h_\tau^u}{w_\tau^u} \tag{4}$$

where h_τ^u is the amount of u's bonds held by its top three investors in quarter τ and w_τ^u is the total bond amount outstanding of u in quarter τ. For [t = pre-crisis] we use the period before our underpricing-sample to define IV, hence, we set [$s = Q1$ 2000] and [$k = Q4$ 2002]. For

[$t =$ crisis] and [$t =$ post-crisis] we use the period before the crisis to define the IV, that is, we set [$s = Q1$ 2000] and [$k = Q2$ 2007]. Figure 4 shows the time-series of our instrument with the average value being around 2%. The idea underlying our IV is that it identifies across underwriters the strength of relations with respect to their own bond investors, thereby, it allows us identifying which underwriters are potentially eligible to engage in "collusion".

At this point, it is especially important to note that for the post-crisis period our IV is solely based on information from the pre-crisis period. Hence, in doing so, the interpretation of the role of underwriter-investor relations in the post-crisis period is not subject to the critique of any strategic alliances due to anticipation of the post-crisis regime. Furthermore, from an economic viewpoint, there is no rationale that could justify why our IV should influence the fundamental values of newly issued bonds directly and, therefore, it satisfies the exclusion restriction (see Roberts and Whited, 2012, for detailed discussions). We also provide statistical evidence for the exclusion restriction by regressing $UP_{it}^{n=10}$ against IV as well as time-dummies and the controls. We find that the coefficient of IV is insignificant (t-stat of 1.2).

We employ a two-stage least square estimation (2SLS) procedure. Therefore, in the first stage we run the following regression

$$INST_{it} = \alpha + crisis_t + post\_crisis_t + \zeta \cdot IV_t^u + \gamma \cdot X_{it} + u_{it} \tag{5}$$

and present the result in Model (3) in Table 3. We find that our IV satisfies the relevance condition because the coefficient ζ is different from zero with a t-stat of 5 and a Partial F-Statistic of 25. We then run a second-stage regression in which we replace in the baseline model given by Equation (2) the endogenous variable $INST$ with the fitted values $\widehat{INST}$ from the first-stage regression, hence,

$$UP_{it}^{n=10} = \alpha + crisis_t + post\_crisis_t + \beta \cdot \widehat{INST}_{it} + \gamma \cdot X_{it} + e_{it} \tag{6}$$

and present the findings in Model (4). In all second-stage regressions we use bootstrapping (1000 replications) to adjust the standard errors, which we again cluster at the firm level (see Roberts and Whited, 2012, for discussions). There are two main take-aways from the results in Model (4). First, the coefficient of $\widehat{INST}$ exhibits a significant positive coefficient which is almost twice as large compared to the estimate in the baseline model of Equation (2). In addition, the post-crisis dummy is still different from zero with an estimate of 27 bps (t-stat of 7). Thus, from an economic perspective we see that relation-investors get on average access to more underpriced bonds and that the replacement of $INST$ with $\widehat{INST}$ slightly reduces the estimate of the post-crisis dummy from 31 bps in the baseline model to 27 bps, which is indicative that these two variables share common variation. Therefore, we test whether variation in $\widehat{INST}$ over time can explain the increase in UP in the post-crisis period. We re-run the model of Equation (3) with the instrumented interaction term $post\_crisis \times \widehat{INST}$

$$
\begin{aligned}
UP_{it}^{n=10} = \alpha + crisis_t + post\_crisis_t + \beta_1 \cdot \widehat{INST}_{it} \\
+ \beta_2 \cdot post\_crisis_t \times \widehat{INST}_{it} + \gamma \cdot X_{it} + e_{it}
\end{aligned}
\tag{7}
$$

and present the results in Model (5). We find that the inclusion of the interaction-term fully captures the increase in UP in the post-crisis period implying that the post-crisis dummy turns insignificant. Moreover, in accordance with our line of argumentation that in the post-crisis period relation-investors get access to the most underpriced bonds we find that the interaction term exhibits a positive significant coefficient (t-stat: 2.3). In other words, compared to the endogenous model of Equation (3), the interaction term flips its sign and gets significant.

In summary, the 2SLS estimation procedure provides strong support for the notion that the increase in underpricing in the aftermath of the crisis is driven by underwriters systematically placing the most underpriced bonds to affiliated investors. In what follows, we show that employing the same mechanism and econometric setup helps to explain the increase in trading activity of newly issued bonds in the post-crisis period as well.

4.4 The dynamics of trading activity and $INST$

As outlined in Section 2, if the "collusion mechanism" holds true in the data, then we should expect that the increase in trading activity in the post-crisis period of newly issued bonds is attributable to underwriter-investors relations as well. Hence, in what follows, we show that employing the same mechanism and econometric setup we find support for this notion. Put differently, underwriter-investor relations explain the post-crisis increase in underpricing and trading activity of newly issued bonds at the same time.

In establishing the results, we employ exactly the same step-wise procedure as in the case of underpricing, that is, we first discuss the baseline model, then augment the model by an interaction-term and then address the endogeneity with our IV in a 2SLS estimation procedure. The endogeneity comes from the fact that we do not observe the parties involved in a trade. This implies that we need our IV to isolate those transactions that are attributable to underwriter-investor relations. We first discuss the results for the trading frequency TF and then for trading volume VOL, both of which we estimate over $n = 10$ days after issuance.

Trading frequency. We present the results for trading frequency TF in Table 4. In Model (1) we estimate the baseline model of Equation (2) with TF as dependent variable. We find that the post-crisis dummy is positive and significant, i.e. TF is higher by a value of 8.6 in the aftermath of crisis (t-stat: 18.6). Furthermore, TF increases with $INST$ as well as relative bond size, credit rating and for IPOs. In Model (2) we include following Equation (3) the interaction term $post\_crisis \times INST$ which exhibits a positive significant coefficient of 4.7 (t-stat of 2.3). Interestingly, the coefficient of $INST$ turns insignificant suggesting that the variation in $INST$ that explains TF comes from the post-crisis period. The coefficient of the post-crisis dummy decreases slightly to 7.2 but remains significant (t-stat: 8.6).

We now turn to the 2SLS estimation in which we use the same first-stage model as in Equation (5) and instrument $INST$ with our IV. We then re-run the baseline model in a second stage regression as in Equation (6) and present the results in Column (4). Here, we find a highly significant (t-stat of 12.3) post-crisis dummy of around 8.1, while at the same time the coefficient of $\widehat{INST}$ is insignificant. In the same spirit as above, we show that most of the increase in TF of newly issued bonds in the post-crisis period can be explained by underwriters placing bonds to relation-investors. In Model (5) we present the result in which we re-run Equation (7). In line with our argumentation, the interaction term $post\_crisis \times \widehat{INST}$ is highly significant and positive, i.e. the estimate of the coefficient is 12.1 (t-stat of 3.3) compared to 4.2 (t-stat of 2.3) of the non-instrumented baseline specification. Furthermore, although still positive significant, the coefficient of the post-crisis dummy strongly decreases to a value of around 4 (t-stat of 2.7) compared to the baseline-coefficient of 7.2 (t-stat of 8.6). In other words, the post-crisis increase in TF of newly issued bonds is mainly attributable to the relations-channel.

Trading volume. In what follows we show in Table 5 that the increase in the daily trading volume VOL of newly issued bonds is also attributable to the relations-channel. In Model (1) we run the baseline specification and show that VOL is higher by around \$10 million (t-stat: 13.2) in the post-crisis compared to pre-crisis period. Furthermore, in Model (2) we then augment the specification by the interaction term $post\_crisis \times INST$, which exhibits a significant coefficient of around 2 (t-stat: 6.6) while at the same time the post-crisis dummy decreases to around \$4 million (t-stat: 3.4). This is already indicative that variation in $INST$ picks up variation in VOL over time.

We use the same 2SLS estimation as before and show in Model (4) that the replacement of $INST$ with $\widehat{INST}$ decreases the post-crisis dummy to \$8.6 million (t-stat: 8.02) and that the coefficient of $\widehat{INST}$ is positive and significant. Finally, in Model (5) we include the interaction term $post\_crisis \times \widehat{INST}$ which is highly significant with a coefficient of 4.6 (t-stat: 7.22). Furthermore, the post-crisis dummy turns negative to a value of around \$-7 million (t-stat: 2.8). Therefore, the results also show here that variation in underwriter-investor relations helps to explain the increase in VOL from the pre-crisis compared to post-crisis period.

In summary, the discussed results provide strong support for the hypotheses outlined in Section 2. We document that in the aftermath of the crisis the increase in underpricing UP, trading frequency TF and volume VOL of newly issued bonds is driven by underwriters placing bonds to closely affiliated investors. In other words, the underwriter-investor channel explains the increase in UP, TF and VOL in the post-crisis period at the same time.

4.5 Further results and robustness

In this section we show that our results are robust to various model specifications, i.e. industry fixed effects or underwriter fixed effects. In addition, we show that the economic nature of our results does not change if we calculate underpricing and the trading activity variables over a $n = 30$ days horizon after issuance. We employ the same step-wise procedure as discussed above, hence, we estimate the baseline models and then proceed with the 2SLS procedure to account for the endogeneity of the initial allocation of bonds.

Industry FE. In Tables A1 to A3 in the Internet Appendix we present the results using industry fixed effects. That is, instead of using the non-financials dummy we use dummies based on the two-digit SIC code in each of the specifications. In this analysis, we find in Table A1 that UP is higher by around 29 bps in the post-crisis period and that the interaction term $post\_crisis \times INST$ is insignificant. The first-stage regression of the 2SLS procedure shows that the IV is valid with a Partial-F Statistic of 22. The second stage regressions then confirm that the interaction term $post\_crisis \times \widehat{INST}$ fully captures the increase in UP from the pre-crisis relative to the post-crisis period.

In Table A2 we present the results for trading frequency TF where we also find that in the post-crisis period TF of newly issued bonds is higher by 8.5 (t-stat: 18.1). We find that the non-instrumented interaction term $post\_crisis \times INST$ is insignificant and captures little variation of the increase in TF in the post-crisis period. In the second stage regressions we then find that the term $post\_crisis \times \widehat{INST}$ is highly significant (t-stat: 2.4) and captures a large fraction of the post-crisis increase in TF (i.e. the t-stat is strongly diminished to 3.1).

Finally, Table A3 shows the results for the daily trading volume VOL of newly issued bonds. VOL is higher by around \$10 million in the post-crisis period, and, the inclusion of the term $post\_crisis \times INST$ captures variation in VOL in the post-crisis period. In the second stage regressions we then find that the instrumented interaction term $post\_crisis \times \widehat{INST}$ fully explains the increase in VOL in the post-crisis period, implying that the post-crisis dummy is insignificant while the interaction term is highly significant (t-stat: 5.6).

Underwriter FE. In Tables A4 to A6 we use underwriter FE to account for time-invariant and unobserved heterogeneity across underwriters. Table A4 shows the results for UP where we again find the same pattern that explains the increase in UP of around 33 bps in the post-crisis period. That is, in the baseline regressions the term $post\_crisis \times INST$ does not capture any time-variation in UP, while the instrumented term $post\_crisis \times \widehat{INST}$ fully explains the increase in UP in the post-crisis period. As far as the first-stage regression is concerned, the IV remains significant and valid with a Partial-F Statistic of around 24. Thus, our IV does not capture unobserved heterogeneity across underwriters.

In Tables A5 and A6 we show the results for TF and VOL, respectively. In both cases, the results are robust to using underwriter FE. That is, the economic nature of the obtained findings remains basically identical compared to before.

Underpricing over 30 days horizon. We provide additional robustness by estimating UP as defined in Equation (1) over $n = 30$ days horizon after issuance. Moreover, we also estimate TF as well as VOL over a 30 days horizon. The results are presented in Tables A7 to A9 in the Internet Appendix. We find in Table A7 that in this case UP is higher by 49 bps in the post-crisis period (t-stat: 10.6), hence, this estimate is a bit higher compared to the benchmark case of 31 bps over $n = 10$ days after issuance. Furthermore, the non-instrumented interaction term is insignificant while we find in the second stage regressions that the interaction term (t-stat: 2) fully captures the increase in UP in the post-crisis period.

Tables A8 and A9 show the results for TF and VOL, respectively. The economic nature of the results is basically identical compared to the benchmark case, hence, underwriter-investor relations explain a large part of the increase in TF and VOL in the post-crisis period.

4.6 The role of MUT and INS

In this section, we examine variation in underwriter-investor relations with respect to the type of institutional investors in understanding the dynamics of underpricing and trading activity of newly issued bonds. In order to do so, we decompose $INST$ into its two main components, namely, mutual funds MUT and insurance firms INS.

Underpricing. Therefore, we proceed in a similar manner as before and start by discussing the drivers of UP. We adjust the baseline-specification of Equation (2) accordingly, hence,

$$UP_{it}^{n=10} = \alpha + crisis_t + post\_crisis_t + \beta_1 \cdot MUT_{it} + \beta_2 \cdot INS_{it} + \gamma \cdot X_{it} + e_{it} \tag{8}$$

and we present the results in Model (1) in Table 6. Again, we find a significant post-crisis dummy of 26 bps and the coefficients of MUT and INS are positively significant. We then introduce the interaction-terms to see whether changes in the cross-sectional variation in MUT and INS over time help to explain the post-crisis dummy, thus,

$$\begin{aligned} UP_{it}^{n=10} = {} & \alpha + crisis_t + post\_crisis_t + \beta_1 \cdot MUT_{it} + \beta_2 \cdot INS_{it} \\ & + \beta_3 \cdot post\_crisis_t \times MUT_{it} + \beta_4 \cdot post\_crisis_t \times INS_{it} + \gamma \cdot X_{it} + e_{it}. \end{aligned} \tag{9}$$

The results are given in Model (2) where we find that the post-crisis dummy remains highly significant with a value of 33 bps while the two interaction terms are negative and insignificant. We then follow the 2SLS procedure and adjust our instrument IV of Equation (4) accordingly by constructing two new instruments $IV_t^u(j)$ with $j \in [MUT, INS]$. That is, we define

$$IV_t^u(j) = \frac{1}{k-s} \sum_{\tau=s}^{k} \frac{h_\tau^u(j)}{w_\tau^u} \tag{10}$$

where $h_\tau^u(j)$ is the amount of bonds issued by underwriter u which is held by investor type j among its top three investors. Thus, we keep the original definition of the IV fixed but instead of being agnostic about the investor types, we base the calculation only on investor type j. This allows us to examine which investor type is likely to drive the variation in IV and, therefore, the type of underwriter-investor relation that explains the increase in UP in the post-crisis period. In the first step, we run two first-stage regressions and instrument MUT and INS, respectively,

$$MUT_{it} = \alpha + crisis_t + post\_crisis_t + \zeta_1 \cdot IV_t^u(MUT) + \zeta_2 \cdot IV_t^u(INS) + \gamma \cdot X_{it} + u_{it} \tag{11}$$

and

$$INS_{it} = \alpha + crisis_t + post\_crisis_t + \zeta_1 \cdot IV_t^u(INS) + \zeta_2 \cdot IV_t^u(MUT) + \gamma \cdot X_{it} + u_{it}. \tag{12}$$

Following that, we rerun the baseline specifications in a second stage regression,

$$UP_{it}^{n=10} = \alpha + crisis_t + post\_crisis_t + \beta \cdot \widehat{MUT}_{it} + \beta \cdot \widehat{INS}_{it} + \gamma \cdot X_{it} + e_{it} \tag{13}$$

where the result in Model (5) reveals that already in this specification the post-crisis dummy turns insignificant while, at the same time, the coefficients of MUT and INS are insignificant as well. Hence, this indicates that the underwriter-investor channel associated with MUT and INS behaves differently in the pre-crisis compared to the post-crisis period. Therefore, we run the second-stage regression augmented by two interaction terms to examine to which extent the two investor types absorb the post-crisis dummy, hence,

$$UP_{it}^{n=10} = \alpha + crisis_t + post\_crisis_t + \beta_1 \cdot \widehat{MUT}_{it} + \beta_2 \cdot \widehat{INS}_{it} + \beta_3 \cdot post\_crisis_t \times \widehat{MUT}_{it} + \beta_4 \cdot post\_crisis_t \times \widehat{INS}_{it} + \gamma \cdot X_{it} + e_{it}. \tag{14}$$

We find that compared to the non-instrumented specification in (9) both interaction terms flip their signs and become positively significant. However, $post\_crisis_t \times \widehat{INS}$ is only marginally significant (t-stat of 1.7), while $post\_crisis_t \times \widehat{MUT}$ is clearly significant (t-stat of 2.1). In other words, the underwriter-investor channel seems to be strongly pronounced among mutual funds, potentially, due to the fact that they are subject to less stringent investment mandates compared to insurance firms.

Trading frequency. In Table 7 we employ exactly the same methodology to elaborate on TF. In the baseline model we find that in the post-crisis TF is higher by around 6.1 (t-stat: 14.3) compared to the pre-crisis period. In the second baseline model that includes the interaction terms, we find that the post-crisis dummy is diminished to a value of around 4.2 (t-stat: 4.9). Among the interaction terms, $post\_crisis \times MUT$ is significantly positive (t-stat: 11.5) while $post\_crisis \times INS$ is significantly negative (t-stat: 6.1). Hence, this suggests that relative changes in the cross-sectional variation in MUT and INS over time explain the increase in TF in the post-crisis period.

Once again, to pin down the relation channel between underwriters and investor types, we implement the 2SLS procedure. Model (5) presents the second-stage regression without interaction terms where the estimate of the post-crisis dummy is marginally significant with a value of 12 (t-stat: 1.7). Among the investor types, both, $\widehat{MUT}$ and $\widehat{INS}$ are insignificant. We then run the second-stage regression that includes the interaction-terms and show the result in Model (6). In this specification, the post-crisis dummy becomes insignificant, hence, is fully absorbed by the underwriter-investor-relation channel. In this respect, the coefficients of the interaction terms reveal interesting insights. That are, $post\_crisis \times \widehat{MUT}$ gets more significant (t-stat of 15.3) compared to the non-instrumented baseline model, while the opposite is true for $post\_crisis \times \widehat{INS}$ which gets less significant (t-stat of 5.4) compared to before. In other words, the post-crisis increase in TF seems to be dominated by the underwriter-investor channel associated with mutual funds.

Trading volume. Finally, we discuss the implications of underwriter-investor-type relations for VOL and present the results in Table 8. In the baseline specification in Model (1) we see that VOL is higher by around \$6.3 million in the post-crisis period compared to before. In Model (2), which includes the interaction-terms, we find that the post-crisis dummy is insignificant while, again, $post\_crisis \times MUT$ is significantly positive (t-stat: 14.2) and $post\_crisis \times INS$ is significantly negative (t-stat: 1.9).

We then turn to the 2SLS models where we find results similar compared to before. Hence, in the second stage model that includes the interaction terms, we find that most of the post-crisis increase in VOL is attributable to relations between underwriters and mutual funds. This is the case since $post\_crisis \times \widehat{MUT}$ is significantly positive with an increased t-stat of 15.7 while $post\_crisis \times INS$ is significantly negative with a t-stat of 2.1.

In summary, the increases in UP, TF and VOL in the post-crisis period seem to be explained simultaneously by the underwriter-investor channel associated with mutual funds.

5 Conclusion

We document that bonds are persistently more underpriced by around 31 bps in the post-crisis compared to the pre-crisis period. We conjecture that - regulatory induced - changes in dealers' inventory management in the aftermath of the crisis affect the issuance process. In particular, since dealers can only offer less to asset managers in the secondary market, they have an incentive to place bonds at issuance to affiliated investors in order to secure intermediation in these newly bonds. In turn, underwriter-affiliated investors accept this deal because they are rewarded through increased underpricing.

In our main empirical tests, we show that the post-crisis increase in underpricing is attributable to dealers systematically placing bonds to closely related investors. In order to establish this channel, we employ a novel identification approach based on institutional investors' past holdings of underwriters' own bonds to isolate underwriter-investor relations. We use these past holdings of relation-investors as an instrumental variable for the first observable allocation of bonds. The relation-channel of the initial allocation of bonds fully captures the increase in underpricing in the post-crisis period. We provide several robustness tests to underpin the economic nature of our results, e.g., the results are not driven by specific industries and do not capture time-invariant heterogeneity across underwriters. The results are also robust to the time-horizon of the estimation of underpricing. In addition, we provide evidence that the channel is particularly present between underwriters and mutual funds.

Furthermore, in order to close our line of argumentation that relations between underwriters and investors matter in the post-crisis period because underwriters want to secure intermediation in newly issued bonds, we examine the trading activity of newly issued bonds. Here, we show that the post-crisis increase in trading activity in terms of trading frequency and volume can be explained by underwriter-investor relations as well. Put differently, underwriter-investor relations explain the increase in underpricing and trading activity in the post-crisis period at the same time.

Overall, we provide novel insights into the drivers of corporate bond underpricing and the underlying issuance process, which is currently under scrutiny by the SEC. Furthermore, our analysis is informative about potential implications of post-crisis regulation.

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A Figures and tables

Figure 1: US corporate bond underpricing. We plot the value-weighted average of corporate bond underpricing in basis points on a quarterly basis. Underpricing is defined as the average return of an issued bond over 10 days relative to the bonds' offering price in excess of the market return. The sample is based on US corporate bond issuances from Mergent FISD and transaction data of corporate bonds from TRACE for the period from January 2003 to December 2013 and comprises 10, 177 issuances.

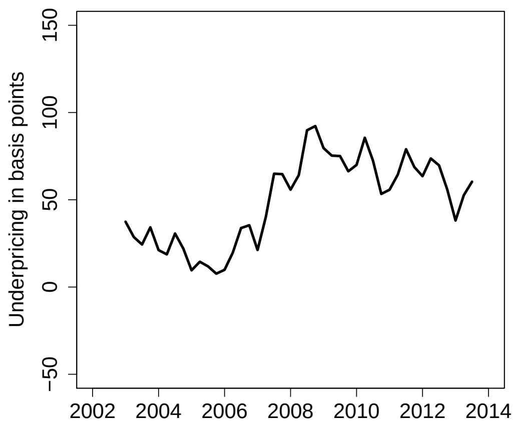

Figure 2: Trading activity of newly issued bonds. We plot over the first 12 weeks the trading activity given by the trading frequency and trading volume, respectively, of newly issued bonds. Panel A gives the number of trades per trade day as a weekly average for the pre-crisis and post-crisis period. Panel B gives trading volume per trade day as a weekly average for the pre-crisis and post-crisis period. The sample is based on US corporate bond issuances from Mergent FISD and transaction data of corporate bonds from TRACE for the period from January 2003 to December 2013 and comprises 10, 177 issuances.

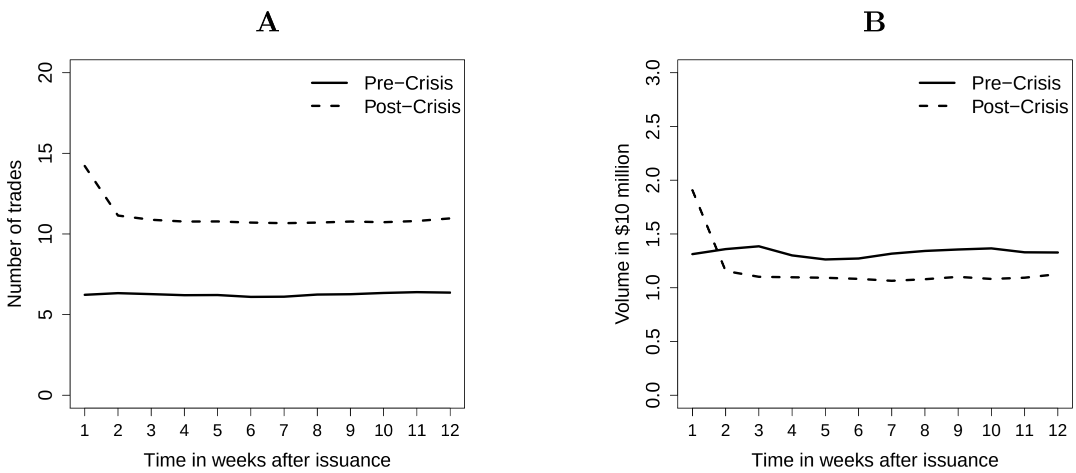

Figure 3: Holdings of newly issued bonds. We plot the corporate bond holdings relative to a bonds' offering amount of institutional investors of newly issued bonds at the end of the issuance quarter. Among the types of institutional investors, we plot separately the holdings of insurance firms and mutual funds, respectively. We retrieve information on investor's holdings of corporate bonds from Lippers eMAXX. The sample is based on US corporate bond issuances from Mergent FISD and transaction data of corporate bonds from TRACE for the period from January 2003 to December 2013 and comprises $10,177$ issuances.

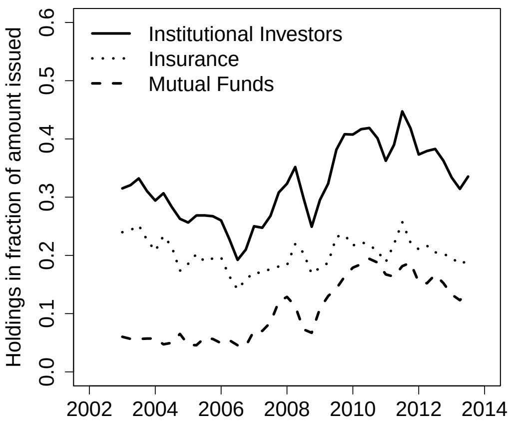

Figure 4: Instrumental variable. We plot our instrumental variable used for the initial allocation of bonds across institutional investors. The instrument is constructed based on past institutional holdings of bonds issued by underwriters. We retrieve information on investor's holdings of corporate bonds from Lippers eMAXX. The sample is based on US corporate bond issuances from Mergent FISD and transaction data of corporate bonds from TRACE for the period from January 2003 to December 2013 and comprises $10,177$ issuances.

Table 1: Definition of explanatory variables. We describe the construction of the variables used in our analysis and their corresponding data sources. The sample is based on US corporate bond issuances from Mergent FISD and transaction data of corporate bonds from TRACE for the period from January 2003 to December 2013. We retrieve information on investor's holdings of corporate bonds from Lippers eMAXX.

Variable	Definition	Source
$INST$	Percentage of a bonds' offering amount held by institutional investors at the end of the issuance quarter	eMAXX
MUT	Percentage of a bonds' offering amount held by mutual funds at the end of the issuance quarter	eMAXX
INS	Percentage of a bonds' offering amount held by insurance companies at the end of the issuance quarter	eMAXX
IV	This variable indicates, for each underwriter, the quarterly percentages of the offering amount of the bonds issued by an underwriter that are held by its top three investors, averaged over a given period	MERGENT, eMAXX
Relative bond size	Offering amount of a bond divided by the total offering amount of all the bonds issued in the same month	MERGENT
Rating	Average bond rating (mapped to natural numbers, i.e. $AAA = 1$, $AA+ = 2, \ldots, D = 21$) of the outstanding bonds of the issuer across the three major rating agencies (*Fitch*, *Moody's*, *Standard and Poor's*) in the issuance quarter	MERGENT
IPO	Dummy equal to one if the bond issue is an initial public offering (IPO)	MERGENT
Maturity	Bond maturity at issuance in years	MERGENT
Own underwriter	Dummy equal to one if the bond is underwritten by the issuer itself	MERGENT
Speculative-grade	Dummy equal to one if rating is below investment-grade	MERGENT
Number of agents	Number of all agents (lead underwriter, underwriter, tax-consultant etc.) involved in the underwriting syndicate of the bond issue	MERGENT
Non-financial	Dummy equal to one if the bond is issued by a non-financial firm	MERGENT

Table 2: Summary statistics. We summarize descriptive statistics for underpricing UP, trading frequency TF, trading volume VOL, the fraction of a bonds' offering amount held by institutional investors at the end of the issuance quarter $INST$, the fraction of a bonds' offering amount held by mutual funds at the end of the issuance quarter MUT, the fraction of a bonds' offering amount held by insurance firms at the end of the issuance quarter INS, the instrumental variable IV, offering amount, rating, maturity and the number of agents. UP is defined as the average return of a newly issued bond over 10 days relative to the bonds' offering price in excess of the market return over the corresponding period. TF is defined as the average number of trades per trade day within 10 days after issuance. VOL is defined as the average trading volume per trade day within 10 days after issuance. We assign integer numbers to the credit ratings (i.e., AAA=1, AA+=2, ..., D=22) and calculate averages at the firm level in the issuance quarter. We report across all bonds the means, standard deviations, and the 25%, 50%, and 75% quantiles. The sample is based on US corporate bond issuances from Mergent FISD and transaction data of corporate bonds from TRACE for the period from January 2003 to December 2013 and comprises 10,177 issuances. We retrieve information on investor's holdings of corporate bonds from Lippers eMAXX.

Variable	**Unit**	**Mean**	**SD**	**0.25**	**Median**	**0.75**
UP	[bps]	40.821	105.348	−15.173	25.080	84.986
TF	[number]	9.254	17.359	2.000	3.500	7.636
VOL	[$10 million]	1.399	3.274	0.126	0.422	1.075
$INST$	[fraction]	0.333	0.217	0.156	0.339	0.487
MUT	[fraction]	0.103	0.119	0.011	0.067	0.150
INS	[fraction]	0.219	0.196	0.062	0.166	0.335
IV	[fraction]	0.019	0.014	0.009	0.017	0.025
Relative bond size	[bps]	33.820	38.952	11.340	22.420	42.560
Rating	[number]	7.695	3.725	5.333	7.000	9.500
Maturity	[years]	10.628	8.854	5.022	9.997	10.093
Number of agents	[number]	4.228	2.033	3.000	5.000	5.000

Table 3: Corporate bond underpricing over 10 days horizon. We present results of explaining the drivers of underpricing UP which is defined as the average return of a newly issued bond over 10 days relative to the bonds' offering price in excess of the market return over the corresponding period. UP is the dependent variable in Models (1), (2), (4) and (5). Model (3) shows the first-stage regression of the 2SLS estimation procedure with the dependent variable given by the holdings of institutional investors $INST$ at the end of the issuance quarter. The IV is based on past institutional holdings of bonds issued by underwriters. Models (4) and (5) show the second-stage regressions where we use the fitted values $\widehat{INST}$ as an explanatory variable. The sample is based on US corporate bond issuances from Mergent FISD and transaction data of corporate bonds from TRACE for the period from January 2003 to December 2013. We retrieve information on investor's holdings of corporate bonds from Lippers eMAXX. All standard errors (given in parentheses) are clustered at the firm level. For the second-stage regressions we use bootstrapping (1000 replications) to adjust the standard errors.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
	UP	UP	$INST$	UP	UP
$crisis$	52.220***	52.232***	−0.001	52.640***	52.996***
	(4.949)	(4.937)	(0.009)	(4.851)	(5.159)
$post\_crisis$	30.909***	33.573***	0.055***	27.286***	4.824
	(2.925)	(5.902)	(0.010)	(3.892)	(11.441)
$INST$	67.929***	71.714***			
	(7.095)	(8.857)			
$post\_crisis \times INST$		−7.913			
		(12.515)			
IV			1.533***		
			(0.308)		
$\widehat{INST}$				131.559**	106.416*
				(51.774)	(61.023)
$post\_crisis \times \widehat{INST}$					66.144**
					(29.207)
Relative bond size	0.352***	0.353***	0.0001	0.345***	0.336***
	(0.038)	(0.039)	(0.0001)	(0.035)	(0.044)
Rating	4.977***	4.979***	0.017***	3.899***	3.899***
	(0.684)	(0.683)	(0.003)	(1.047)	(1.229)
IPO	30.375***	30.332***	−0.002	30.570***	30.661***
	(4.207)	(4.208)	(0.008)	(4.226)	(4.178)
Maturity	0.321**	0.318**	0.002***	0.227	0.223
	(0.138)	(0.138)	(0.0004)	(0.157)	(0.168)
Own underwriter	−22.409***	−22.730***	−0.092***	−16.229**	−14.397
	(6.270)	(6.241)	(0.019)	(7.138)	(8.788)
Speculative-grade	31.770***	31.930***	−0.122***	39.910***	40.344***
	(5.915)	(5.897)	(0.022)	(8.446)	(9.670)
Number of agents	2.819***	2.833***	0.013***	1.942**	1.962*
	(0.653)	(0.647)	(0.003)	(0.886)	(1.057)
Non-financial	17.815***	17.669***	0.101***	11.086***	10.061
	(3.334)	(3.303)	(0.013)	(6.263)	(6.928)
Observations	10,177	10,177	10,177	10,177	10,177
Adjusted R^2	0.245	0.245	0.275	0.231	0.232
Clustered SE	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes
Partial-F Statistic	-	-	24.853	-	-

Table 4: Trading frequency of newly issued bonds over 10 days horizon. We present results of explaining the drivers of trading frequency TF of newly issued bonds. TF is defined as the average number of trades per trade day within 10 days after issuance. TF is the dependent variable in Models (1), (2), (4) and (5). Model (3) shows the first-stage regression of the 2SLS estimation procedure with the dependent variable given by the holdings of institutional investors $INST$ at the end of the issuance quarter. The IV is based on past institutional holdings of bonds issued by underwriters. Models (4) and (5) show the second-stage regressions where we use the fitted values $\widehat{INST}$ as an explanatory variable. The sample is based on US corporate bond issuances from Mergent FISD and transaction data of corporate bonds from TRACE for the period from January 2003 to December 2013. We retrieve information on investor's holdings of corporate bonds from Lippers eMAXX. All standard errors (given in parentheses) are clustered at the firm level. For the second-stage regressions we use bootstrapping (1000 replications) to adjust the standard errors.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
	TF	TF	$INST$	TF	TF
$crisis$	5.538***	5.532***	−0.001	5.603***	5.668***
	(0.478)	(0.480)	(0.009)	(0.504)	(0.503)
$post\_crisis$	8.618***	7.213***	0.055***	8.061***	3.973***
	(0.464)	(0.863)	(0.010)	(0.656)	(1.498)
$INST$	3.142***	1.147			
	(1.063)	(1.321)			
$post\_crisis \times INST$		4.171**			
		(1.836)			
IV			1.533***		
			(0.308)		
$\widehat{INST}$				12.925	8.349
				(9.071)	(8.805)
$post\_crisis \times \widehat{INST}$					12.038***
					(3.655)
Relative bond size	0.092***	0.092***	0.0001	0.091***	0.090***
	(0.009)	(0.009)	(0.0001)	(0.009)	(0.008)
Rating	0.579***	0.577***	0.017***	0.413**	0.413**
	(0.159)	(0.156)	(0.003)	(0.199)	(0.188)
IPO	4.415***	4.437***	−0.002	4.445***	4.461***
	(0.984)	(0.982)	(0.008)	(0.989)	(0.965)
Maturity	−0.008	−0.006	0.002***	−0.022	−0.023
	(0.013)	(0.013)	(0.0004)	(0.020)	(0.019)
Own underwriter	0.784	0.954	−0.092***	1.734	2.068*
	(0.899)	(0.895)	(0.019)	(1.306)	(1.237)
Speculative-grade	10.121***	10.036***	−0.122***	11.372***	11.451***
	(1.359)	(1.338)	(0.022)	(1.665)	(1.601)
Number of agents	−0.476***	−0.483***	0.013***	−0.611***	−0.607***
	(0.138)	(0.133)	(0.003)	(0.213)	(0.182)
Non-financial	−1.776***	−1.699***	0.101***	−2.810**	−2.997***
	(0.577)	(0.573)	(0.013)	(1.127)	(1.096)
Observations	10,177	10,177	10,177	10,177	10,177
Adjusted R^2	0.200	0.201	0.275	0.199	0.201
Clustered SE	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes
Partial-F Statistic	-	-	24.853	-	-

Table 5: Trading volume of newly issued bonds over 10 days horizon. We present results of explaining the drivers of trading volume VOL of newly issued bonds. VOL is defined as the average trading volume per trade day in \$10 million within 10 days after issuance. VOL is the dependent variable in Models (1), (2), (4) and (5). Model (3) shows the first-stage regression of the 2SLS estimation procedure with the dependent variable given by the holdings of institutional investors $INST$ at the end of the issuance quarter. The IV is based on past institutional holdings of bonds issued by underwriters. Models (4) and (5) show the second-stage regressions where we use the fitted values $\widehat{INST}$as an explanatory variable. The sample is based on US corporate bond issuances from Mergent FISD and transaction data of corporate bonds from TRACE for the period from January 2003 to December 2013. We retrieve information on investor's holdings of corporate bonds from Lippers eMAXX. All standard errors (given in parentheses) are clustered at the firm level. For the second-stage regressions we use bootstrapping (1000 replications) to adjust the standard errors.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
	VOL	VOL	$INST$	VOL	VOL
crisis	0.504***	0.501***	−0.001	0.523***	0.547***
	(0.082)	(0.081)	(0.009)	(0.091)	(0.086)
post_crisis	1.031***	0.368***	0.055***	0.867***	−0.688***
	(0.078)	(0.121)	(0.010)	(0.108)	(0.248)
$INST$	0.917***	−0.025			
	(0.185)	(0.174)			
post_crisis $\times INST$		1.969***			
		(0.299)			
IV			1.533***		
			(0.308)		
$\widehat{INST}$				3.788**	2.048
				(1.670)	(1.436)
post_crisis $\times \widehat{INST}$					4.579***
					(0.634)
Relative bond size	0.019***	0.019***	0.0001	0.019***	0.018***
	(0.001)	(0.001)	(0.0001)	(0.001)	(0.001)
Rating	0.117***	0.116***	0.017***	0.068**	0.068**
	(0.023)	(0.022)	(0.003)	(0.034)	(0.029)
IPO	1.231***	1.241***	−0.002	1.240***	1.246***
	(0.201)	(0.200)	(0.008)	(0.202)	(0.201)
Maturity	0.0004	0.001	0.002***	−0.004	−0.004
	(0.002)	(0.002)	(0.0004)	(0.003)	(0.003)
Own underwriter	0.040	0.120	−0.092***	0.319	0.446**
	(0.113)	(0.102)	(0.019)	(0.207)	(0.179)
Speculative-grade	1.828***	1.788***	−0.122***	2.195***	2.225***
	(0.225)	(0.218)	(0.022)	(0.303)	(0.261)
Number of agents	−0.118***	−0.121***	0.013***	−0.157***	−0.156***
	(0.026)	(0.025)	(0.003)	(0.041)	(0.033)
Non-financial	−0.269***	−0.233**	0.101***	−0.573***	−0.644***
	(0.098)	(0.097)	(0.013)	(0.202)	(0.189)
Observations	10,177	10,177	10,177	10,177	10,177
Adjusted R^2	0.196	0.200	0.275	0.194	0.199
Clustered SE	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes
Partial-F Statistic	-	-	24.853	-	-

Table 6: Corporate bond underpricing over 10 days horizon: The role of MUT and INS. We present results of explaining the drivers of underpricing UP which is defined as the average return of a newly issued bond over 10 days relative to the bonds' offering price in excess of the market return over the corresponding period. UP is the dependent variable in Models (1), (2), (5) and (6). Models (3) and (4) show the first-stage regressions of the 2SLS estimation procedure with the dependent variables given by the holdings of mutual funds MUT and insurance firms INS, respectively, at the end of the issuance quarter. The two instruments, IV_{MUT} and IV_{INS}, are based on past holdings of MUT and INS of bonds issued by underwriters. Models (5) and (6) show the second-stage regressions where we use the fitted values $\widehat{MUT}$ and $\widehat{INS}$ as explanatory variables. The sample is based on US corporate bond issuances from Mergent FISD and transaction data of corporate bonds from TRACE for the period from January 2003 to December 2013. We retrieve information on investor's holdings of corporate bonds from Lippers eMAXX. All standard errors (given in parentheses) are clustered at the firm level. For the second-stage regressions we use bootstrapping (1000 replications) to adjust the standard errors.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	UP	UP	MUT	INS	UP	UP
$crisis$	49.251***	48.586***	0.047***	−0.047***	20.895	19.612
	(4.982)	(4.964)	(0.004)	(0.008)	(27.979)	(27.912)
$post\_crisis$	26.415***	32.555***	0.084***	−0.023***	−16.002	−40.344
	(3.137)	(5.997)	(0.003)	(0.009)	(38.168)	(37.209)
MUT	112.701***	144.581***				
	(15.800)	(25.874)				
INS	57.435***	62.908***				
	(7.207)	(8.989)				
$post\_crisis \times MUT$		−43.947				
		(29.546)				
$post\_crisis \times INS$		−11.934				
		(12.313)				
IV_{MUT}			1.039**	−0.046		
			(0.420)	(1.111)		
IV_{INS}			0.345***	0.867***		
			(0.107)	(0.258)		
$\widehat{MUT}$					584.211	562.534
					(421.345)	(421.561)
$\widehat{INS}$					−86.943	−129.175
					(205.162)	(199.838)
$post\_crisis \times \widehat{MUT}$						101.352**
						(47.574)
$post\_crisis \times \widehat{INS}$						52.442*
						(30.425)
Observations	10,177	10,177	10,177	10,177	10,177	10,177
Adjusted R^2	0.246	0.246	0.499	0.264	0.231	0.232
Clustered SE	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Partial-F Statistic	-	-	6.134	11.310	-	-

Table 7: Trading frequency of newly issued bonds over 10 days horizon: The role of MUT and INS. We present results of explaining the drivers of trading frequency TF of newly issued bonds. TF is defined as the average number of trades per trade day within 10 days after issuance. TF is the dependent variable in Models (1), (2), (5) and (6). Models (3) and (4) show the first-stage regressions of the 2SLS estimation procedure with the dependent variables given by the holdings of mutual funds MUT and insurance firms INS, respectively, at the end of the issuance quarter. The two instruments, IV_{MUT} and IV_{INS}, are based on past holdings of MUT and INS of bonds issued by underwriters. Models (5) and (6) show the second-stage regressions where we use the fitted values $\widehat{MUT}$ and $\widehat{INS}$ as explanatory variables. The sample is based on US corporate bond issuances from Mergent FISD and transaction data of corporate bonds from TRACE for the period from January 2003 to December 2013. We retrieve information on investor's holdings of corporate bonds from Lippers eMAXX. All standard errors (given in parentheses) are clustered at the firm level. For the second-stage regressions we use bootstrapping (1000 replications) to adjust the standard errors.

	(1)	(2)	(3)	(4)	(5)	(6)
	TF	TF	MUT	INS	TF	TF
$crisis$	3.936***	4.896***	0.047***	−0.047***	9.404*	6.264**
	(0.460)	(0.451)	(0.004)	(0.008)	(5.294)	(3.025)
$post\_crisis$	6.092***	4.200***	0.084***	−0.023***	12.428*	1.766
	(0.460)	(0.857)	(0.003)	(0.009)	(7.441)	(4.396)
MUT	31.517***	−9.100***				
	(3.243)	(3.217)				
INS	−2.879***	1.383				
	(0.965)	(1.110)				
$post\_crisis \times MUT$		53.147***				
		(4.635)				
$post\_crisis \times INS$		−9.215***				
		(1.541)				
IV_{MUT}			1.039**	−0.046		
			(0.420)	(1.111)		
IV_{INS}			0.345***	0.867***		
			(0.107)	(0.258)		
$\widehat{MUT}$					−30.977	−26.773
					(84.566)	(45.346)
$\widehat{INS}$					53.183	32.129
					(38.517)	(23.849)
$post\_crisis \times \widehat{MUT}$						105.905***
						(6.927)
$post\_crisis \times \widehat{INS}$						−22.130***
						(4.106)
Observations	10,177	10,177	10,177	10,177	10,177	10,177
Adjusted R^2	0.224	0.249	0.499	0.264	0.200	0.254
Clustered SE	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Partial-F Statistic	-	-	6.134	11.310	-	-

Table 8: Trading volume of newly issued bonds over 10 days horizon: The role of MUT and INS. We present results of explaining the drivers of trading volume VOL of newly issued bonds. VOL is defined as the average trading volume per trade day in \$10 million within 10 days after issuance. VOL is the dependent variable in Models (1), (2), (5) and (6). Models (3) and (4) show the first-stage regressions of the 2SLS estimation procedure with the dependent variables given by the holdings of mutual funds MUT and insurance firms INS, respectively, at the end of the issuance quarter. The two instruments, IV_{MUT} and IV_{INS}, are based on past holdings of MUT and INS of bonds issued by underwriters. Models (5) and (6) show the second-stage regressions where we use the fitted values $\widehat{MUT}$ and $\widehat{INS}$ as explanatory variables. The sample is based on US corporate bond issuances from Mergent FISD and transaction data of corporate bonds from TRACE for the period from January 2003 to December 2013. We retrieve information on investor's holdings of corporate bonds from Lippers eMAXX. All standard errors (given in parentheses) are clustered at the firm level. For the second-stage regressions we use bootstrapping (1000 replications) to adjust the standard errors.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	VOL	VOL	MUT	INS	VOL	VOL
$crisis$	0.253***	0.456***	0.047***	−0.047***	0.148	−0.427
	(0.082)	(0.082)	(0.004)	(0.008)	(0.843)	(0.633)
$post\_crisis$	0.634***	−0.144	0.084***	−0.023***	0.117	−2.643***
	(0.078)	(0.116)	(0.003)	(0.009)	(1.186)	(0.937)
MUT	5.350***	−3.530***				
	(0.584)	(0.507)				
INS	0.035	0.276*				
	(0.169)	(0.157)				
$post\_crisis \times MUT$		11.794***				
		(0.829)				
$post\_crisis \times INS$		−0.513*				
		(0.273)				
IV_{MUT}			1.039**	−0.046		
			(0.420)	(1.111)		
IV_{INS}			0.345***	0.867***		
			(0.107)	(0.258)		
$\widehat{MUT}$					12.634	12.459
					(13.105)	(9.523)
$\widehat{INS}$					4.981	−0.234
					(5.823)	(4.832)
$post\_crisis \times \widehat{MUT}$						21.744***
						(1.385)
$post\_crisis \times \widehat{INS}$						−1.570**
						(0.721)
Observations	10,177	10,177	10,177	10,177	10,177	10,177
Adjusted R^2	0.212	0.242	0.499	0.264	0.194	0.249
Clustered SE	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Partial-F Statistic	-	-	6.134	11.310	-	-

B Internet Appendix

Internet Appendix to

Structural Changes in Corporate Bond Underpricing

Table A1: Corporate bond underpricing over 10 days horizon: Industry FE. We present results of explaining the drivers of underpricing UP which is defined as the average return of a newly issued bond over 10 days relative to the bonds' offering price in excess of the market return over the corresponding period. UP is the dependent variable in Models (1), (2), (4) and (5). Model (3) shows the first-stage regression of the 2SLS estimation procedure with the dependent variable given by the holdings of institutional investors $INST$ at the end of the issuance quarter. The IV is based on past institutional holdings of bonds issued by underwriters. Models (4) and (5) show the second-stage regressions where we use the fitted values $\widehat{INST}$ as an explanatory variable. The sample is based on US corporate bond issuances from Mergent FISD and transaction data of corporate bonds from TRACE for the period from January 2003 to December 2013. We retrieve information on investor's holdings of corporate bonds from Lippers eMAXX. All standard errors (given in parentheses) are clustered at the firm level. For the second-stage regressions we use bootstrapping (1000 replications) to adjust the standard errors.

	(1)	(2)	(3)	(4)	(5)
	UP	UP	$INST$	UP	UP
$crisis$	50.764***	50.776***	−0.008	51.786***	52.034***
	(4.944)	(4.936)	(0.008)	(4.910)	(4.971)
$post\_crisis$	29.381***	31.545***	0.054***	24.720***	6.554
	(2.899)	(5.750)	(0.008)	(4.285)	(10.081)
$INST$	62.005***	65.154***			
	(7.505)	(9.379)			
$post\_crisis \times INST$		−6.422			
		(12.349)			
IV			1.219***		
			(0.261)		
$\widehat{INST}$				146.816**	125.983*
				(63.585)	(71.102)
$post\_crisis \times \widehat{INST}$					53.383**
					(24.265)
Observations	10,177	10,177	10,177	10,177	10,177
Adjusted R^2	0.249	0.249	0.339	0.239	0.240
Clustered SE	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Partial-F Statistic	-	-	22.036	-	-

Table A2: Trading frequency of newly issued bonds over 10 days horizon: Industry FE. We present results of explaining the drivers of trading frequency TF of newly issued bonds. TF is defined as the average number of trades per trade day within 10 days after issuance. TF is the dependent variable in Models (1), (2), (4) and (5). Model (3) shows the first-stage regression of the 2SLS estimation procedure with the dependent variable given by the holdings of institutional investors $INST$ at the end of the issuance quarter. The IV is based on past institutional holdings of bonds issued by underwriters. Models (4) and (5) show the second-stage regressions where we use the fitted values $\widehat{INST}$ as an explanatory variable. The sample is based on US corporate bond issuances from Mergent FISD and transaction data of corporate bonds from TRACE for the period from January 2003 to December 2013. We retrieve information on investor's holdings of corporate bonds from Lippers eMAXX. All standard errors (given in parentheses) are clustered at the firm level. For the second-stage regressions we use bootstrapping (1000 replications) to adjust the standard errors.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
	TF	TF	$INST$	TF	TF
$crisis$	5.687***	5.683***	−0.008	5.950***	5.988***
	(0.470)	(0.473)	(0.008)	(0.524)	(0.512)
$post\_crisis$	8.476***	7.618***	0.054***	7.276***	4.555***
	(0.469)	(0.844)	(0.008)	(0.757)	(1.490)
$INST$	5.165***	3.917***			
	(1.053)	(1.256)			
$post\_crisis \times INST$		2.545			
		(1.747)			
IV			1.219***		
			(0.261)		
$\widehat{INST}$				26.994**	23.874**
				(12.251)	(10.604)
$post\_crisis \times \widehat{INST}$					7.996**
					(3.367)
Observations	10,177	10,177	10,177	10,177	10,177
Adjusted R^2	0.223	0.223	0.339	0.221	0.221
Clustered SE	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Partial-F Statistic	-	-	22.036	-	-

Table A3: Trading volume of newly issued bonds over 10 days horizon: Industry FE. We present results of explaining the drivers of trading volume VOL of newly issued bonds. VOL is defined as the average trading volume per trade day in \$10 million within 10 days after issuance. VOL is the dependent variable in Models (1), (2), (4) and (5). Model (3) shows the first-stage regression of the 2SLS estimation procedure with the dependent variable given by the holdings of institutional investors $INST$ at the end of the issuance quarter. The IV is based on past institutional holdings of bonds issued by underwriters. Models (4) and (5) show the second-stage regressions where we use the fitted values $\widehat{INST}$ as an explanatory variable. The sample is based on US corporate bond issuances from Mergent FISD and transaction data of corporate bonds from TRACE for the period from January 2003 to December 2013. We retrieve information on investor's holdings of corporate bonds from Lippers eMAXX. All standard errors (given in parentheses) are clustered at the firm level. For the second-stage regressions we use bootstrapping (1000 replications) to adjust the standard errors.

	(1)	(2)	(3)	(4)	(5)
	VOL	VOL	$INST$	VOL	VOL
$crisis$	0.518***	0.515***	−0.008	0.570***	0.585***
	(0.083)	(0.083)	(0.008)	(0.098)	(0.092)
$post\_crisis$	1.005***	0.395***	0.054***	0.772***	−0.347
	(0.080)	(0.123)	(0.008)	(0.128)	(0.254)
$INST$	1.072***	0.184			
	(0.197)	(0.185)			
$post\_crisis \times INST$		1.809***			
		(0.296)			
IV			1.219***		
			(0.261)		
$\widehat{INST}$				5.320**	4.038**
				(2.194)	(1.976)
$post\_crisis \times \widehat{INST}$					3.287***
					(0.587)
Observations	10,177	10,177	10,177	10,177	10,177
Adjusted R^2	0.211	0.214	0.339	0.208	0.212
Clustered SE	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Partial-F Statistic	-	-	22.036	-	-

Table A4: Corporate bond underpricing over 10 days horizon: Underwriter FE. We present results of explaining the drivers of underpricing UP which is defined as the average return of a newly issued bond over 10 days relative to the bonds' offering price in excess of the market return over the corresponding period. UP is the dependent variable in Models (1), (2), (4) and (5). Model (3) shows the first-stage regression of the 2SLS estimation procedure with the dependent variable given by the holdings of institutional investors $INST$ at the end of the issuance quarter. The IV is based on past institutional holdings of bonds issued by underwriters. Models (4) and (5) show the second-stage regressions where we use the fitted values $\widehat{INST}$ as an explanatory variable. The sample is based on US corporate bond issuances from Mergent FISD and transaction data of corporate bonds from TRACE for the period from January 2003 to December 2013. We retrieve information on investor's holdings of corporate bonds from Lippers eMAXX. All standard errors (given in parentheses) are clustered at the firm level. For the second-stage regressions we use bootstrapping (1000 replications) to adjust the standard errors.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
	UP	UP	$INST$	UP	UP
crisis	56.790***	56.781***	0.026**	53.725***	53.714***
	(4.943)	(4.935)	(0.010)	(4.936)	(5.144)
post_crisis	32.548***	35.619***	0.059***	22.886***	−17.065
	(3.858)	(6.721)	(0.013)	(4.247)	(11.527)
$INST$	69.573***	74.129***			
	(7.111)	(9.436)			
post_crisis × $INST$		−9.387			
		(12.937)			
IV			2.295***		
			(0.468)		
$\widehat{INST}$				234.893***	190.785***
				(53.763)	(63.741)
post_crisis × $\widehat{INST}$					120.323***
					(31.262)
Observations	10,177	10,177	10,177	10,177	10,177
Adjusted R^2	0.249	0.249	0.293	0.236	0.239
Clustered SE	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Underwriter FE	Yes	Yes	Yes	Yes	Yes
Partial-F Statistic	-	-	24.472	-	-

Table A5: Trading frequency over 10 days horizon: Underwriter FE. We present results of explaining the drivers of trading frequency TF of newly issued bonds. TF is defined as the average number of trades per trade day within 10 days after issuance. TF is the dependent variable in Models (1), (2), (4) and (5). Model (3) shows the first-stage regression of the 2SLS estimation procedure with the dependent variable given by the holdings of institutional investors $INST$ at the end of the issuance quarter. The IV is based on past institutional holdings of bonds issued by underwriters. Models (4) and (5) show the second-stage regressions where we use the fitted values $\widehat{INST}$ as an explanatory variable. The sample is based on US corporate bond issuances from Mergent FISD and transaction data of corporate bonds from TRACE for the period from January 2003 to December 2013. We retrieve information on investor's holdings of corporate bonds from Lippers eMAXX. All standard errors (given in parentheses) are clustered at the firm level. For the second-stage regressions we use bootstrapping (1000 replications) to adjust the standard errors.

	(1)	(2)	(3)	(4)	(5)
	TF	TF	$INST$	TF	TF
$crisis$	4.971***	4.974***	0.026**	5.014***	5.014***
	(0.502)	(0.501)	(0.010)	(0.499)	(0.513)
$post\_crisis$	8.891***	7.722***	0.059***	9.029***	6.315***
	(0.526)	(0.893)	(0.013)	(0.658)	(1.608)
$INST$	4.183***	2.449**			
	(0.984)	(1.144)			
$post\_crisis \times INST$		3.573*			
		(1.868)			
IV			2.295***		
			(0.468)		
$\widehat{INST}$				1.822	−1.174
				(8.399)	(8.962)
$post\_crisis \times \widehat{INST}$					8.174**
					(4.162)
Observations	10,177	10,177	10,177	10,177	10,177
Adjusted R^2	0.215	0.215	0.293	0.213	0.213
Clustered SE	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Underwriter FE	Yes	Yes	Yes	Yes	Yes
Partial-F Statistic	-	-	24.472	-	-

Table A6: Trading volume over 10 days horizon: Underwriter FE. We present results of explaining the drivers of trading volume VOL of newly issued bonds. VOL is defined as the average trading volume per trade day in \$10 million within 10 days after issuance. VOL is the dependent variable in Models (1), (2), (4) and (5). Model (3) shows the first-stage regression of the 2SLS estimation procedure with the dependent variable given by the holdings of institutional investors $INST$ at the end of the issuance quarter. The IV is based on past institutional holdings of bonds issued by underwriters. Models (4) and (5) show the second-stage regressions where we use the fitted values $\widehat{INST}$ as an explanatory variable. The sample is based on US corporate bond issuances from Mergent FISD and transaction data of corporate bonds from TRACE for the period from January 2003 to December 2013. We retrieve information on investor's holdings of corporate bonds from Lippers eMAXX. All standard errors (given in parentheses) are clustered at the firm level. For the second-stage regressions we use bootstrapping (1000 replications) to adjust the standard errors.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
	VOL	VOL	$INST$	VOL	VOL
$crisis$	0.405***	0.407***	0.026**	0.397***	0.396***
	(0.088)	(0.085)	(0.010)	(0.091)	(0.089)
$post\_crisis$	1.056***	0.411***	0.059***	1.030***	−0.170
	(0.096)	(0.132)	(0.013)	(0.128)	(0.271)
$INST$	0.984***	0.026			
	(0.192)	(0.176)			
$post\_crisis \times INST$		1.973***			
		(0.311)			
IV			2.295***		
			(0.468)		
$\widehat{INST}$				1.437	0.113
				(1.613)	(1.686)
$post\_crisis \times \widehat{INST}$					3.613***
					(0.720)
Observations	10,177	10,177	10,177	10,177	10,177
Adjusted R^2	0.214	0.218	0.293	0.211	0.214
Clustered SE	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Underwriter FE	Yes	Yes	Yes	Yes	Yes
Partial-F Statistic	-	-	24.472	-	-

Table A7: Corporate bond underpricing over 30 days horizon. We present results of explaining the drivers of underpricing UP which is defined as the average return of a newly issued bond over 30 days relative to the bonds' offering price in excess of the market return over the corresponding period. UP is the dependent variable in Models (1), (2), (4) and (5). Model (3) shows the first-stage regression of the 2SLS estimation procedure with the dependent variable given by the holdings of institutional investors $INST$ at the end of the issuance quarter. The IV is based on past institutional holdings of bonds issued by underwriters. Models (4) and (5) show the second-stage regressions where we use the fitted values $\widehat{INST}$ as an explanatory variable. The sample is based on US corporate bond issuances from Mergent FISD and transaction data of corporate bonds from TRACE for the period from January 2003 to December 2013. We retrieve information on investor's holdings of corporate bonds from Lippers eMAXX. All standard errors (given in parentheses) are clustered at the firm level. For the second-stage regressions we use bootstrapping (1000 replications) to adjust the standard errors.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
	UP	UP	$INST$	UP	UP
$crisis$	64.896***	64.927***	−0.005	65.534***	65.772***
	(6.399)	(6.384)	(0.009)	(6.320)	(6.700)
$post\_crisis$	49.270***	52.052***	0.052***	46.100***	21.735
	(3.690)	(7.021)	(0.009)	(4.815)	(13.918)
$INST$	96.163***	100.075***			
	(8.780)	(11.430)			
$post\_crisis \times INST$		−8.302			
		(14.898)			
IV			1.552***		
			(0.302)		
$\widehat{INST}$				155.513**	129.266
				(65.533)	(79.780)
$post\_crisis \times \widehat{INST}$					72.019**
					(36.083)
Observations	10,339	10,339	10,339	10,339	10,339
Adjusted R^2	0.218	0.218	0.280	0.200	0.201
Clustered SE	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Partial-F Statistic	-	-	24.853	-	-

Table A8: Trading frequency of newly issued bonds over 30 days horizon. We present results of explaining the drivers of trading frequency TF of newly issued bonds. TF is defined as the average number of trades per trade day within 30 days after issuance. TF is the dependent variable in Models (1), (2), (4) and (5). Model (3) shows the first-stage regression of the 2SLS estimation procedure with the dependent variable given by the holdings of institutional investors $INST$ at the end of the issuance quarter. The IV is based on past institutional holdings of bonds issued by underwriters. Models (4) and (5) show the second-stage regressions where we use the fitted values $\widehat{INST}$ as an explanatory variable. The sample is based on US corporate bond issuances from Mergent FISD and transaction data of corporate bonds from TRACE for the period from January 2003 to December 2013. We retrieve information on investor's holdings of corporate bonds from Lippers eMAXX. All standard errors (given in parentheses) are clustered at the firm level. For the second-stage regressions we use bootstrapping (1000 replications) to adjust the standard errors.

	(1)	(2)	(3)	(4)	(5)
	TF	TF	$INST$	TF	TF
$crisis$	5.358***	5.341***	−0.005	5.452***	5.490***
	(0.489)	(0.493)	(0.009)	(0.518)	(0.512)
$post\_crisis$	8.558***	7.091***	0.052***	8.090***	4.217***
	(0.458)	(0.820)	(0.009)	(0.608)	(1.528)
$INST$	3.188***	1.125			
	(1.021)	(1.245)			
$post\_crisis \times INST$		4.378**			
		(1.739)			
IV			1.552***		
			(0.302)		
$\widehat{INST}$				11.957	7.786
				(8.465)	(8.101)
$post\_crisis \times \widehat{INST}$					11.446***
					(3.697)
Observations	10,339	10,339	10,339	10,339	10,339
Adjusted R^2	0.208	0.209	0.280	0.207	0.208
Clustered SE	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Partial-F Statistic	-	-	26.522	-	-

Table A9: Trading volume of newly issued bonds over 30 days horizon. We present results of explaining the drivers of trading volume VOL of newly issued bonds. VOL is defined as the average trading volume per trade day in \$10 million within 30 days after issuance. VOL is the dependent variable in Models (1), (2), (4) and (5). Model (3) shows the first-stage regression of the 2SLS estimation procedure with the dependent variable given by the holdings of institutional investors $INST$ at the end of the issuance quarter. The IV is based on past institutional holdings of bonds issued by underwriters. Models (4) and (5) show the second-stage regressions where we use the fitted values $\widehat{INST}$ as an explanatory variable. The sample is based on US corporate bond issuances from Mergent FISD and transaction data of corporate bonds from TRACE for the period from January 2003 to December 2013. We retrieve information on investor's holdings of corporate bonds from Lippers eMAXX. All standard errors (given in parentheses) are clustered at the firm level. For the second-stage regressions we use bootstrapping (1000 replications) to adjust the standard errors.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
	VOL	VOL	$INST$	VOL	VOL
crisis	0.414***	0.407***	−0.005	0.440***	0.456***
	(0.081)	(0.079)	(0.009)	(0.090)	(0.083)
post_crisis	0.973***	0.289**	0.052***	0.844***	−0.740***
	(0.076)	(0.113)	(0.009)	(0.099)	(0.215)
$INST$	0.937***	−0.025			
	(0.173)	(0.155)			
post_crisis $\times$ $INST$		2.040***			
		(0.284)			
IV			1.552***		
			(0.302)		
$\widehat{INST}$				3.347**	1.641
				(1.518)	(1.382)
post_crisis $\times$ $\widehat{INST}$					4.681***
					(0.570)
Observations	10,339	10,339	10,339	10,339	10,339
Adjusted R^2	0.199	0.204	0.280	0.197	0.203
Clustered SE	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Partial-F Statistic	-	-	26.522	-	-