Does tradeoff theory explain high-frequency debt issuers?*

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Abstract

Over the past forty years, one-third of the publicly listed industrial firms in the U.S. raised two-thirds of all public and private debts (net of debt rollovers). We use these high-frequency debt issuers (HFIs)—large and highly leveraged, investment-intensive firms with low Tobin's Q—to test tradeoff theory of debt financing. Relative to low-frequency net-debt issuers (LFIs)—small, low-leveraged, R&D-intensive firms with high Q—HFIs appear to face low total and fixed issue costs. Under dynamic tradeoff theory, HFIs should therefore exhibit smaller issue sizes, lower leverage ratio volatility, and higher speed-of-adjustment to deviations from target leverage ratios than LFIs, which our evidence fails to support. However, consistent with dynamic financing and investment models, over-leveraged firms occasionally issue debt followed by equity issues and leverage ratio reductions. Finally, we show that CEO equity ownership and stock-based compensation are both higher for HFIs than for other sample firms.

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1 Introduction

It is well established that the distribution of leverage ratios among publicly traded nonfinancial U.S. firms has a persistent and sizable left tail consisting of firms with zero or near-zero debt (Strebulaev and Yang, 2013). These are firms that never or almost never issue debt during their lifetime as public companies. What is much less documented, however, is the *right* tail of the cumulative debt-issue frequency distribution: listed firms that persistently fund themselves by issuing new debt (beyond debt rollovers) and which, as it turns out, raise the bulk of all public and private debts. These firms evidently view debt-financing as uniquely beneficial, and they face sufficiently low debt issue costs to issue frequently. We argue that the dual combination of high debt benefits and low issue costs makes these firms ideally suited to test dynamic tradeoff theory: if high-frequency debt issuers do not dynamically rebalance capital structure towards a leverage target, who does?

The paper has three distinct objectives. The first is to document little-known differences in the firm characteristics of high- and low-frequency net-debt issuers, beginning with the year of public listing. Second, we provide evidence on the fundamental notion that low-frequency issuers have greater *fixed* debt-issue costs than high-frequency issuers. According to the dynamic tradeoff theory pioneered by Fischer, Heinkel, and Zechner (1989), which adds issue costs and optimal leverage conditions to the continuous-time asset pricing framework of Merton (1974), fixed issue costs contribute to long periods of issue inactivity. This theory also makes predictions about the relative issue behavior of high and low-frequency issuers when they *do* issue debt, and our third objective is to test these additional theoretical implications. In the process, we also address a key prediction of the more recent, discrete-time financing model with endogenous investment developed by DeAngelo, DeAngelo, and Whited (2011).

We sample debt issues and retirements (both private and public debts) using Compustat cash-flow statements for public industrial companies over the period from 1971 to 2012. As Lemmon, Roberts, and Zender (2008) and DeAngelo and Roll (2015), we sample at the annual frequency.[1] The annual debt issue frequency treats multiple debt issues within one year as being part of the same strategic time horizon, as may be the case for corporate investment decisions (that require external financing) as well. Importantly, to avoid pooling older firms with newly listed companies, we require firms to go public during the sample

[1] Our life cycle analysis (beginning with public listing) requires contiguous data, and there are more gaps for quarterly data. However, when requiring at least four contiguous quarters in the data, redoing our main tests based on quarterly observations yields similar inferences.

period and condition the analysis on firm age since going public.

Throughout the paper, high-frequency net-debt issuers (henceforth HFIs) are firms in the upper quartile of the annual cumulative net-debt issue frequency distribution (net of debt retirements) conditional on listing age. Moreover, low-frequency net-debt issuers (LFIs) are firms in the lower quartile of this conditional distribution. We focus on the net-debt issue frequency as we are primarily interested in the frequency of issue decisions that change the leverage ratio, rather than on debt-rollovers designed to extent the maturity of existing debt. Over the sample period, HFIs receive as much as 70% of all net-debt issue proceeds, while LFIs only receive 7%. Importantly, there is only minimal migration over time of firms between the HFI and LFI categories.

Our issue-frequency classification creates a substantial spread between HFIs and LFIs in terms of leverage stability, debt-issue dynamics and firm characteristics. Interestingly, high-frequency issuers stand out as relatively large investment-intensive firms with high leverage and low Tobin's Q. In contrast, low-frequency issuers are relatively small R&D-intensive firms with low leverage and high Q. Some of these differences are apparent already soon after public listing (thus the minimal migration between firms in the HFI and LFI classifications). Market leverage ratios quickly rise to an average of 35% for HFIs versus an average of 10% for LFIs. Moreover, while as much as 32% of the LFIs have zero leverage in a typical firm-year, only 1% of HFIs ever reduce leverage to zero during their lifetime as public companies. Overall, HFIs tend to finance a relatively capital-intensive investment (capex) program externally through debt issues, while LFIs tend to finance a relatively intensive R&D program internally.

In general, large fixed issue costs may slow issue frequency whether or not the firm manages capital structure towards a target. Thus, it is natural to assume at the outset that HFIs face smaller and less fixed issue costs than LFIs. As extant evidence on issue costs is sparse (Altinkilic and Hansen, 2000; Eckbo, Masulis, and Norli, 2007), and in order to corroborate this issue-cost assumption, we provide our own empirical issue-cost analysis, in two steps. First, we estimate dynamic issue hazard shapes using our full sample of public and private net-debt issues, and compare them to the simulated hazard shapes reported by Leary and Roberts (2005) for firms with fixed versus proportional issues costs, respectively. This simple comparison indeed suggests that LFIs have largely proportional and LFIs largely fixed issue costs.

Second, we directly identify a fixed-cost component in underwriter spreads using the Altinkilic and Hansen (2000) issue cost function for 3,773 public bond issues over the sample period. This estimation also suggests that low-frequency public debt issuers have significantly higher fixed issue costs than high-frequency issuers. Finally, other than these cost differences, extant quantitative indices (Kaplan and Zingales, 1997; Whited and Wu, 2006; Hadlock and Pierce, 2010) do not suggest that LFIs are fundamentally more financially constrained than HFIs. It appears that the spread between HFIs and LFIs may be a spread on direct issue costs but not on more fundamental sources of financial constraints that motivate such quantitative indices.

We then turn to predictions of dynamic tradeoff theory for differences in issue behavior of HFIs and LFIs. Under the assumption that LFIs have higher total and fixed issue costs than HFIs, we focus on three hitherto unexplored predictions: *relative to LFIs*, HFIs should exhibit (1) smaller issue sizes scaled by total assets, (2) lower leverage ratio volatility, and (3) higher speed-of-adjustment (SOA) to deviations from leverage targets.

Our evidence fails to support any of these predictions. First, net-debt issue sizes are roughly equal across HFIs and LFIs—and not greater for LFIs as predicted. Second, leverage ratio volatilities are substantially higher for HFIs than for LFIs (not lower as predicted). Medium to low-frequency net-debt issuers tend to have relatively stable leverage ratios. Thus, we also suspect that our HFIs drive much of the firm-level leverage instability by highly leveraged firms shown by DeAngelo and Roll (2015).

Third, notwithstanding the fact that the debt-issue frequency is typically ten times higher for HFIs than for LFIs, the two groups of firms receive statistically indistinguishable SOA coefficient estimates. In the SOA estimation, we use empirical leverage targets found elsewhere in the literature (Fama and French, 2002; Flannery and Rangan, 2006; Hovakimian and Li, 2012; Faulkender, Flannery, Hankins, and Smith, 2012). Apparently, net-debt changes (the denominator of the leverage ratio change) and total asset changes (the numerator) work in such a way as to produce similar SOA coefficient estimates for HFIs and LFIs. This finding, which fails to support tradeoff theory, also adds to the concern raised by Welch (2004) and others about the use of leverage ratio changes to identify the true speed with which firms manage leverage towards a target.

The data also indicate strongly that net-debt issues are driven by ongoing investments. In fact, we show that capex is the main determinant of the probability of becoming an HFI. Moreover, net-debt issue size and the size of capex are highly correlated for HFIs, which is also reflected in so-called financing-deficit regressions.[2] Since the ongoing debt funding of investments can mask true tradeoff behavior in the data,

[2]The financing deficit captures the shortfall in internally available funds for investment (Shyam-Sunder and Myers, 1999;

it may be an important reason why classical dynamic tradeoff theories that abstract from investment appear inadequate in terms of explaining actual debt issue behavior by HFIs.

In order to account for investment financing, we turn to the discrete-time, structural financing and investment model of DeAngelo, DeAngelo, and Whited (2011). In this model, firms dynamically maintain a long-term target leverage ratio while at the same time responding to persistent investment shocks. We are particularly interested in this model's prediction that *over-leveraged* firms may issue "transitory" debt to help finance new investments. In theory, as the investment shocks fade, these transitory debt issues will be followed by debt repurchases to restore leverage targets. Interestingly, when using the empirical leverage targets from the speed-of-adjustment analysis, we identify net-debt issues by firms that are both over-leveraged and invest in excess of the industry median capex. Moreover, these net-debt issues significantly increase the likelihood of subsequent leverage ratio reductions. On the other hand, this leverage ratio reduction is financed through a combination of retained earnings and additional (costly) equity issues rather than by debt repurchases—as ongoing funding needs dominate debt-retirement considerations.

We end the paper with a check on the stock ownership and stock-based compensation of Chief Executive Offer (CEO) of HFIs relative to all other firms in our sample. Eckbo, Thorburn, and Wang (2014) show that corporate bankruptcy imposes significant personal costs on the median CEO. Thus, some managers may choose to hedge against bankruptcy risk *ex ante* by reducing the firm's exposure to leverage. Interestingly, in their study of zero and near-zero leverage firms—a substantial fraction of which end up being classified as LFIs here—Strebulaev and Yang (2013) find that firms with large CEO equity ownership and more CEO-friendly boards are *more* likely to pursue low-leverage policies. In our data, HFIs have both greater equity ownership and a greater proportion of their total compensation paid in stock than is the case for other firms, suggesting that the impact of CEO ownership is more complex and perhaps nonlinear in firm leverage policy.

The rest of the paper is organized as follows. Section 2 identifies HFIs and LFIs and displays their firm characteristics, and documents the stability of the HFI classification over time. Section 3 shows the results of our dynamic hazard estimation and our estimates of the direct issue cost function using public bond issues. In Section 4, we explore predictions of the classical tradeoff model without corporate investment, followed by an examination of dynamic financing and investment theory in Section 5. We

Frank and Goyal, 2003). See also Leary and Roberts (2010) and Lemmon and Zender (2010) for empirical tests involving financing deficits, and DeAngelo, DeAngelo, and Stulz (2010) for evidence that firms issue equity after "running out of cash".

discuss CEO stock compensation in Section 6, while Section 7 concludes the paper.

2 Who are high-frequency debt issuers?

2.1 Sample selection

As summarized in Panel A of Table 1, our main sample consists of 12,131 nonfinancial, non-government, U.S. domiciled corporations and a (unbalanced) panel of 93,031 firm-years from the period 1971-2012. To arrive at this sample, we start with the merged CRSP/Compustat database and impose a largely standard set of sample requirements listed in Panel A. These restrictions include dropping financial firms and regulated utilities, foreign companies, and firms with missing entries of key balance sheet characteristics. The definition of the balance sheet and cash flow variables used in this paper are summarized in Appendix Tables 1 and 2 using Compustat mnemonics.

Our requirement that a sample firm went public during the sample period is unusual relative to the extant capital structure literature (Graham and Leary, 2011). This restriction excludes a total of 2,411 firms and 39,449 firm-years, primarily from the early sample years. Conditioning on the age of the firm is important for our lifecycle issue frequency analysis, and it allows us to properly document issue-frequency persistence. Moreover, the very notion of "issue frequency" is related to asset growth which likely differs with firm age. We define listing age as the difference between the reporting date of the financial statement and the date of the first month a company is reported in the CRSP/Compustat merged database. The average annual number of listed firms in the sample is 6,471 (median 6,848), and the average number of years a firm is listed is 8 (median 5). A total of 5,921 firms are listed for more than five years, 2,931 for more than ten years, and 782 firms for twenty years or more.

Panel B of Table 1 lists a sample of 3,773 public bond issues by 1,075 public companies drawn from the security issue section of SDC, 1980-2011. This sample is used in Section 3 below exclusively for the purpose of estimating a fixed-cost component in underwriter fees across high and low-frequency bond issuers. We return to a description of the selection criteria for this sample at that point.

2.2 Annual cumulative issue frequencies

2.2.1 Net-debt issues

Table 2 shows the annual cumulative frequencies of net-debt issues (Panel A), net-debt retirements (Panel B), and equity issues (Panel C). The frequency begins with the year of listing (event year 0), and it continues over the subsequent twenty years (the empirical analysis uses all years on record, also if longer than twenty). Since the issue frequency will depend on the issue size threshold used to define it, we report for illustrative purposes two frequencies in Table 2: the first based on a minimum issue size of 2.5% of total assets (Panel A), and the second based on the 5% threshold (Panel B) more commonly found in the extant literature on security issuances. To maximize sample size, the subsequent empirical analysis is based on the 2.5% issue-size threshold.

In each year following public listing, firms are classified as belonging to the group of high-frequency issuers (henceforth HFIs), low-frequency issuers (LFIs) or the group in between. HFIs are firms in the top quartile (above the 75^{th} percentile) of the annual cumulative net-debt issue distribution, while LFIs are firms in the bottom quartile (below the 25^{th} percentile). Of the total sample of 93,031 firm-year observations, 34% are represented by HFIs and 41% by LFIs. Moreover, the average annual number of HFIs (LFIs) is 2,474 (4,040). HFIs receive 70% of the total dollar value of all net-debt issues over the sample period, while LFIs receive only 7%. In sum, the HFIs not only issue frequently: they also receive a highly disproportional share of total issue proceeds.

Beginning with the year of public listing (year 0), Table 2 shows the annual distribution of the number of LFIs and HFIs, the annual average fraction of total net-debt issue proceeds received by each of the two categories, and the average cumulative number of net-debt issues. As shown, the cumulative net-debt issue frequency is skewed towards HFIs throughout the public firm lifecycle, both in terms of volume and number of issues.

For example, in Panel A.1, of the 5,921 firms that have been listed for five years, 2,739 or 46% fall in the LFI category and 1,823 or 31% are HFIs. Over these first five years of public listing, HFIs undertake on average 3.59 net-debt issues above the 2.5% size threshold, while LFIs undertake on average only 0.49 such issues. Moreover, in year five, HFIs raised 73% and LFIs 10% of aggregate issue proceeds. After ten years of listing, HFIs have on average made 5.98 issues, while LFIs have still made only 0.49 issues. Also, in year ten, HFIs raised 59% and LFIs only 4% of aggregate issue proceeds. Looking at the overall sample, the median cumulative number of net-debt issues is two after five years and three after ten years.

Raising the issue-size threshold to 5% in Panel A.2 of Table 2 shows that, after five years of public listing, HFIs have issued on average 2.73 net-debt issues and LFIs close to zero such issues. Moreover, in year five, HFIs raised 79% and LFIs 3% of aggregate proceeds. After ten years of listing, the cumulative number of issues averages 4.94 for HFIs (one issue every two years), and 0.51 by LFIs (one issue every twenty years). HFIs (LFIs) raised 56% (7%) of total issue proceeds, respectively, in year ten. The sample median cumulative number of net-debt issues at the 5% threshold is one after five years, two after ten years, and four after twenty years. Thus, the cumulative net-debt issue distribution is highly skewed towards HFIs also with the 5% threshold—both in terms of the number of issues and issue proceeds—with the median listed firm issuing net-debt at roughly half the pace of HFIs.

Quarterly sampling increases the issue frequency somewhat as net-debt issues occasionally cluster within the year. Also, it is interesting to compare the annual frequency in Panel A.2 of Table 2 to that reported by Leary and Roberts (2005). They find that firms on average issue net debt of 5% or more once every eight quarters (sample period 1984-2001). Assuming there are no years with multiple issues, this extrapolates into one debt issue every two years on average. In comparison, Panel A.2 of Table 2 shows that the actual annual net-debt issue frequency is less than half that: once every five years.

2.2.2 Net-debt retirements and equity issues

Our examination of dynamic financing and investment models also involves searching for debt retirements following what DeAngelo, DeAngelo, and Whited (2011) call "transitory" debt issues (positive net debt issues in a period where the firm is over-leveraged). While we return to an analysis of such retirements below (Section 5), Panel B of Table 2 shows the cumulative frequency and volume of net-debt retirements in the total sample. Interestingly, net debt retirements are much less skewed towards HFIs than is the case for net-debt issues.

For example, at the 2.5% size threshold in Panel B.1 and after five years of listing, HFIs and LFIs have almost identical average number of net-debt retirements: 1.22 and 1.30, respectively. Moreover, in year five, the percentage of total retirement volume is on average 37% for both categories of firms. The difference between HFIs and LFIs increases after ten years, with HFIs making 2.49 net-debt retirements on average and LFIs 1.54 such issues. The corresponding fractions of total retirement volume in year ten are 36% and 10%, respectively. In the overall sample, the median cumulative number of net-debt retirements is one after five years and two after ten years of public listing. A similar picture emerges when using the 5% size threshold in Panel B.2. The fact that HFIs issue net-debt more often and in much greater dollar volumes than LFIs, while at the same time retiring net-debt at a fairly similar rate to that of LFIs, suggest that HFIs on average develop a greater leverage ratio over time (confirmed below).

Finally, Panel C of Table 2 shows that, when maintaining the definition of LFI and HFI based on net-debt issue activity, the average cumulative number of equity issues and percent of annual total issue volume is similar across LFIs and HFIs. This is true whether using a 2.5% or a 5% equity-issue size threshold. In the overall sample and using the 2.5% threshold, the average cumulative number of equity issues is 2.87 after ten years and 3.81 after twenty years, with a median of two and three for both years.[3]

In sum, our issue-frequency classification of firms into LFIs and HFIs identifies firms that differ significantly in terms of net-debt issue activity, but that are quite similar in terms of net-debt retirements and equity issue activity. We next show that the HFI and LFI classifications also result in a relatively stable set of firms within each category.

2.3 Firm-level stability of the issue-frequency classification

As Table 2 above demonstrates, the annual differences in cumulative issue frequencies between HFIs and LFIs persist across listing age and issue-size thresholds. Using the 2.5% issue size threshold, Table 3 further shows that individual companies, once classified as either HFI or LFI, tend to persist in that classification. Table 3 uses two measures of persistence, one backward-looking and one forward-looking. To illustrate, focus first on the backward-looking measures in columns (1) - (3) for the HFIs in Panel A. Column (1) says that 100% of the firms that are classified as HFI in year five were also classified as HFI one year earlier. Moreover, 88% were also classified as HFIs two years earlier, and 65% three years earlier. After ten years of listing, the corresponding backward-looking percentages are even higher: of the firms classified as HFIs in year ten, 100% were so classified also one year earlier, 92% two year earlier, and 82% three years earlier, respectively.

Turning to the forward looking measures of persistence, column (6) of Table 3 shows that only 1% of all firms classified as HFI after five years of listing change this classification to LFI in any future sample year. Thus, there is almost no migration from HFI to LFI. Moreover, 73% of the HFIs in year five retain

[3] While our breakdown of the listing age is new to the literature, the overall equity-issue frequencies in Panel C of Table 2 are in line with that reported elsewhere. See, e.g., Eckbo and Masulis (1995), Fama and French (2005), Eckbo, Masulis, and Norli (2007) and Leary and Roberts (2010).

the HFI classification for the future, with the balance of 26% migrating to the medium frequency issuers sometime in future sample years. After ten years of listing, these percentages are even more striking: 0% move from HFI to LFI while 82% remain HFI, respectively, with 18% migrating from HFI to become a "medium" frequency issuer (somewhere between the 25^{th} and 75^{th} percentiles).

Finally, Panel B of Table 3 further shows that there is almost no migration from LFI to HFI over the public lifecycle. In most of the years, 100% of the firms that are classified as LFI were also classified as LFI in each of the previous three years. The only major exception from the high level of persistence is due to rebalancing: in year five following public listing the threshold for being classified as a LFI increases from 0 to 1 (Table 2), which changes the portfolio composition of LFIs such that, in this year, only 59% of LFIs were also classified as low frequency in the previous year. However, looking forward, only 4% of these LFIs migrate to become HFIs in future sample years. After ten years of public listing, 100% of the LFIs were LFIs in each of the preceding three years, 89% remain LFI in future sample years, and 0% migrate to become HFIs. This, of course, is consistent with the evidence in Table 2 that a large majority of firms classified as LFI remain "dormant" in terms of net-debt issues for most of their lifecycle as public companies.

Having established the lack of firm migration between HFIs and LFIs, we next characterize the difference between HFIs and LFIs in terms of key firm characteristics.

2.4 Comparing average firm characteristics of HFIs and LFIs

The average annual firm characteristics listed in Table 4 show clear differences between HFIs and LFIs. First, LFIs are much less leveraged and have higher cash balances than HFIs. Using the overall average values at the bottom of each panel, the leverage ratio (both market and book leverage) is 35% for HFIs and 10% for LFIs. This difference in average leverage ratios is also reflected in column (3) which shows the fraction of the sample firms that are all-equity financed (AE): it is 32% for LFIs and only 1% for HFIs.

Moreover, the cash ratio C in column (4) is interesting. It is 31% for LFIs and 10% for HFIs. This means that much of the build-up of cash balances reported by Bates, Kahle, and Stulz (2009) is concentrated among our low-frequency net-debt issuers, causing these firms to have negative net leverage (debt minus cash) on average. High-frequency debt issuers have relatively high leverage ratios whether measured using gross debt or debt net of liquid assets such as cash balances.

Notice also the significant differences in asset structure and growth rates. Relative to LFIs, HFIs are large on average ($804 million versus $345 million for LFIs), have high degree of asset tangibility defined as PPE/Assets (0.36 versus 0.22 for LFIs), and exhibit low Q (1.80 versus 2.56 for LFIs). The relatively low Q for HFIs is reflected in low R&D spending (RD in column (11)), which is 3% for HFIs and 8% for LFIs. The dividend rate (relative to total assets) is also somewhat lower for HFIs than LFIs (on average 0.5% versus 0.9%, respectively). However, HFIs have greater capital expenditures ($Capex$ in column (12)): 10% of total assets versus 6% for LFIs. Perhaps a reflection of the greater investment intensity, HFIs have relatively high growth rates of both total assets (g_A) and total sales (g_S), as shown in the last two columns.[4]

In sum, Table 4 shows that HFIs tend to be large, highly leveraged, low-Q companies with a particularly active investment program that generates high asset and sales growth. We next show that investment and R&D expenditure rates are significant drives of issue frequencies.

2.5 Probability of becoming HFI in T years

Panel A of Table 5 presents estimates of the determinants of the probability of becoming a HFI after T years of listing. This probit estimation employs firm characteristics *in the year of public listing* (year 0) in the following model:

$$
\begin{aligned}
Y_{iT}^* &= \alpha + \beta X_{i0} + \epsilon_{iT} \qquad (1)\\
Y_{iT} &= 1 \;\text{ if }\; Y_{iT}^* \geq 75^{th} \text{ percentile and } 0 \text{ otherwise}
\end{aligned}
$$

where Y_{iT}^* is the latent variable for the probability of firm i being a HFI after T years of listing, and Y_{iT} is the dummy variable for Y_{iT}^*. The vector X_{i0} of firm characteristics includes most variables listed in Table 4 but now measured in year 0.[5] In addition, the estimation of Eq. (1) includes industry dummies

[4] To some degree, differences in firm characteristics relate to industry effects. Using the Fama-French 12-industry classification, we find the following distribution of HFIs and LFIs across different industries: consumer non-durables (HFIs: 8%; LFIs: 6%), consumer durables (HFIs: 3%, LFIs: 3%), manufacturing (HFIs: 13%, LFIs: 11%), energy (HFIs: 8%, LFIs: 4%), chemicals (HFIs: 2%, LFIs: 2%), business equipment (HFIs: 16%, LFIs: 31%), shops (HFIs: 18%, LFIs: 11%), healthcare (HFIs: 10%, LFIs: 16%) and other (HFIs: 21%, LFIs: 15%). The subsequent regression analysis will therefore account for industry (or firm-fixed) effects in addition to the individual firm characteristics.

[5] Asset and sale growth rates are not included as they are not available in the year of public listing. In addition, we include depreciation expenditures (the ratio of depreciation expenditures to assets) to account for non-debt related tax shields.

for eight of the 12 Fama-French (FF12) industries (excluding financial firms and regulated utilities). All covariates are winsorized at the 1(99) percent level.

Panel A shows parameter estimates for forecasting periods of 3, 6, 9, 12 and 15 years following public listing. These estimates strongly suggest that the issue frequency classification far out in time is predictable based on year-zero values of several of the characteristics. The initial investment (*Capex*) and leverage ratio (L) are the two characteristics most strongly associated with a greater probability of becoming a HFI. Moreover, initial $R\&D$ and cash balance C are associated with a significantly lower probability of becoming a HFI.[6]

We next turn to whether the differential net-debt issue activity for HFIs and LFIs may be attributed to HFIs facing lower total and fixed issue costs than LFIs.

3 Do fixed issue costs drive issue frequencies?

Dynamic capital structure theory predicts funding activity in part based on the level and form of security issuance costs (Fischer, Heinkel, and Zechner, 1989). Since high *fixed* issue costs slow the firm's optimal issue frequency, it is natural to view LFIs as high fixed-cost issuers relative to HFIs. In this section, we present new empirical evidence that, as it turns out, supports this view. This helps motivate our subsequent tests of dynamic capital structure theory exploiting the different issue behaviors of LFIs and HFIs.

Extant evidence on issue cost structure (fixed versus variable costs) is sparse (Eckbo, Masulis, and Norli, 2007). Below, we approach the possible presence of a fixed cost component in debt issue costs from two complementary angels. The first is an informal comparison of the shapes of estimated dynamic debt issue hazards (time between net-debt issues) with the simulated shapes in Leary and Roberts (2005). The second directly estimates fixed-cost components in underwriter fees paid by high- and low-frequency public bond issuers (a subset of our full Compustat sample of debt issues). We end the section with a brief check on whether LFIs are also more financially constrained than HFIs—perhaps beyond direct issue costs—as per quantitative indices suggested by the extant literature.

[6]The average marginal effects on the probability are as follows: a 10 percentage point increase in *Capex* (L) increases the probability of being classified as a HFI nine years following public listing by 7.9 points (2.1 points). A similar increase in $R\&D$ decreases the probability by 5.3 percentage points.

3.1 Dynamic issue-hazard estimation

Panels B and C of Table 5 show the results of estimating the determinants of the time between successive net-debt issues—the issue hazard or financing spell. In Panel B, the exponential hazard model is of the following form:

$$h_i = h_0 \exp(\beta_0 + \beta x_i)\alpha_i, \tag{2}$$

where h_0 is the baseline hazard (when all covariates are equal to zero and assumed constant in Panel B), and α_i captures unobserved heterogeneity analogous to a regression error term.[7] The firm characteristics x_i enter after subtracting the median value across all firms each year, which means that the baseline hazard is $\hat{h}_0 = exp(\hat{\beta}_0)$ for the median firm (Leary and Roberts, 2005). We perform the hazard rate estimation separately for LFIs and HFIs.

In Panel B, a hazard ratio which is statistically indistinguishable from unity means that the control variable does not change the likelihood of the financing event taking place the following year. The tabulated results are consistent with the probit estimation in Panel A in that *Capex* has a strong and significant impact on the net-debt issue decision. Specifically, a 10 percentage point increase in capital expenditures (relative to the median firm) raises the issue hazard by a factor of 1.5 for HFIs and a factor of 1.4 for LFIs. In other words, it appears that net-debt issues tend to be driven by the need to fund investment. Panel B also shows that the availability of internal funds—either C or $Prof$—reduces issue hazards with similar marginal effects for LFIs and HFIs.

In Panel C, we expand Eq. (2) using a cubic function of the number of years t between issues:

$$h_i(t) = h_0 \exp(\beta_0 + \beta x_i + \gamma f(t))\alpha_i \quad \text{where} \quad f(t) = t + t^2 + t^3. \tag{3}$$

As shown in Panel C, estimation of Eq. (3) exacerbates the difference in the impact of *Capex* in the issue hazards of LFIs and HFIs. This effect likely reflects a combination of the persistently lower investment activity for LFIs (shown earlier in Table 4) and the use of net-debt issues to fund new investment projects.

[7] If T is a random variable measuring the time between net-debt issues, the issue hazard function is defined as

$$h(t) = \lim_{m \to 0} \frac{\Pr(t \leq T < t + m | T \geq t)}{m}.$$

Here, $h(t)$ is the instantaneous rate at which a firm issues net debt conditional on not having done so for t periods. Intuitively, $h(t)m$ is the probability that a firm will issue over the next m periods, conditional on not having issued up to time t, For example, the hazard function for net-debt issuances at t=5 years tells us the probability that the firm will issue net debt over the next year (m=1).

Below, we exploit this cubic function estimation more specifically in the context of issue-cost differences between HFIs and LFIs.

3.2 Inferring fixed issue costs from dynamic issue hazard shapes

Panels A and B of Figure 1 plot the shapes of the dynamic net-debt issue hazards that follow from estimating Eq. (3) for LFIs and HFIs, respectively. The horizontal axis is years since last issue, which occur in year 0. For example, at year five, the dynamic hazard function gives the estimated probability of a debt issue in year six conditional on not having issued debt over the previous five years. The plots of the estimated hazard shapes have steps because time has been discretized to the annual frequency.

To explain the intuition behind these shapes, it is useful to refer to Figure V in Leary and Roberts (2005), which depicts dynamic hazard shapes using the above cubic function of time between issues on simulated data (thus without our firm characteristics x_i). For expositional simplicity, we copy their simulated hazard shapes directly into panels C and D of Figure 1. In these simulations, firms adjust the leverage ratio L towards a target L^*. As firm value drifts upwards, L falls to a lower boundary $\underline{L}$, which triggers a debt issue. The distance $L^* - \underline{L}$ depends on the magnitude and form of issue costs, with the distance being greatest for firms with high and largely fixed costs.[8]

The estimated shape for LFIs in Panel A is strikingly similar to the simulated shape in Panel C generated by Leary and Roberts under the assumption of fixed issue costs. Similarly, the estimated shape for HFIs in Panel B is similar to the simulated shape in Panel D assuming proportional issue costs only. To better understand the different intercepts and slopes of these dynamic issue hazard shapes, consider first the fixed-cost issuer in Panel A and C. Large fixed issue cost create a large wedge $L^* - \underline{L}$. Since, in year 0, the firm has just issued debt, the expected time to reach $\underline{L}$ again is relatively low, and so the intercept is low. Furthermore, the slope of the issue hazard is positive since the longer the time since the last issue, the closer (in expectation) L is to $\underline{L}$ and so the greater the probability that the firm will hit $\underline{L}$ again and issue in the next period.[9]

[8] As explained by Leary and Roberts (2005), the initial L^* is set equal to the midpoint between an upper and lower recapitalization boundary of 0.60 and 0.15, respectively, selected to match the maximum and minimum leverage ratios in a sample of industrial Compustat firms with at least four years of contiguous data, 1984-2001. Stock returns are assumed to follow a geometric Brownian motion with positive drift: mean 12% and standard deviation 46% (also selected to match the sample Compustat firms). The leverage process starts at the midpoint of the spread between the upper and lower boundaries (the assumed initial L^*) and are subsequently updated each period using the simulated equity returns.

[9] The hazard function in Panel A is hump-shaped, sloping downwards after ten years. This is driven by the fact that the number of observations available in the estimation diminishing rapidly with time t. Since t is reset to zero when the firm issues debt, firms with two or more issues do not influence the estimation beyond year 10. Leary and Roberts (2005) make

Turning to the relatively small proportional cost case in Panel B and D, note first that the equity value function (the Brownian motion) need not drift upwards much before the optimality condition for an issue is again met (where marginal issue cost equals marginal issue benefit). Thus, following an issue in year 0, the probability of another issue next year is high, and so the intercept is also high. However, this probability declines with t: the longer the time since the last debt issue, the more likely the stock return process has drifted downwards to create *over*-leverage, and the smaller the probability of hitting the lower recapitalization boundary over the next period.

As a caveat, the similarity of the empirical and simulated issue hazard shapes in Figure 1, while consistent with tradeoff behavior under fixed and proportional issue costs, may also be driven by other potential motivations for the observed issue activity of HFIs and LFIs. That is, while the shapes may be necessary, they are not sufficient to conclude in favor of tradeoff theory. For example, we know from Table 4 above that HFIs invest intensively, which may drive the bulk of their debt issues rather than rebalancing efforts. Also, we know from Table 5 that investment is a highly significant driver of the issue hazard estimates themselves, which the simulations do not address. We return to these issues in the empirical analysis of tradeoff theory predictions below. However, we first present direct evidence of a fixed-cost component in underwriter fees for public bond issues which, as it turns out, also depends on issuer frequency.

3.3 Estimating fixed issue costs in public debt offerings

The net-debt issues identified through our Compustat cash flow statements cover both public and private debt. While we do not have data on the issue cost of private debt issues, SDC's Global Issue database provide issue cost information for public bond issues by a subsample of our firms (1980–2012). In this section, we use this subsample to provide new and direct evidence on whether relatively high-frequency public debt issuers have lower fixed costs than low-frequency public debt issuers.

As summarized in Panel B of Table 1, we sample all available public bonds and medium term notes, and then restrict the issuer to be present in CRSP/Compustat. We follow Altinkilic and Hansen (2000) and impose several screens for data availability. Our final sample consists of 3,773 public debt issues made by 1,075 different firms. The sample average underwriter spread is 1.2% of offering proceeds, and firms raise on average \$334 million with an average total equity market value of \$11,523 million. Thus,

a similar observation when explaining the hump-shape in Panel C.

the average firm in the public bond issue sample used in this section is substantially larger than the average firm size of $804 million for our HFIs in the broader CRSP/Compustat sample (discussed earlier in Table 4 above).

Note that, in this section, we use the sample distribution of the public debt issues—not the Compustat sample classification—to classify high- and low-frequency public debt issuers, here labeled LFPIs and HFPIs, respectively. The reason for this is that, of the total of 9,283 LFIs in our sample, only 52 are recorded in SDCs Global Issue database as ever issuing public debt. The public debt issue frequency distribution based on this particular classification is also skewed: the mean and median are 3.5 and 2 public debt issues, 48% of the firms undertake a single public debt issue, and 66% undertake at most two such issues. In the right tail of the public debt issue frequency distribution, 27% of the firms undertake at least four issues and 6% do more than ten public debt issuances over the 23-year sample period. LFPIs are firms with at most two issues in the sample, while HFPIs are firms with at least four such debt issues.

As Altinkilic and Hansen (2000), we estimate the following type of issue cost function:

$$s = \beta_0 + \beta_1 \frac{1}{x_1} + \beta_2 \frac{x_1}{x_2} + \gamma X + \epsilon, \tag{4}$$

where s is the bond underwriter spread,[10] x_1 is total offering proceeds, and x_2 is the issuer's market value of total equity on the day preceding the offering day. The vector X contains a set of control variables that includes five ratings dummies for debt issues (AAA, A, BBB, BB, and B-CCC), the lagged ratio of operating cash flow to total assets, the lagged book leverage ratio and a lagged market-to-book ratio. In addition, we construct an issue wave variable which compares the yearly aggregate net debt issue (equity issue) volume to the aggregate book value of assets.[11]

In Eq. (4), the parameter β_0 is the variable issue cost component of the spread, β_1 is the fixed issue cost component, while β_2 captures issue cost convexity. Table 6 shows the estimates of these three parameters. Panel A provides estimates based on the total sample of 3,773 as well as on the subsamples of 896 LFPIs and 2,622 HFPIs, respectively. The dollar value of the estimated fixed cost is obtained by multiplying the estimated parameter value by $10,000.

As shown in the total-sample column, the fixed-cost estimate β_1 is a highly significant $249,000 for

[10]The spread s is the ratio of the SDC variable "gross spread paid" to total issue proceeds. SDC defines "Gross Spread" as follows: "Total manager's fee. The fee is shared among lead managers, co-managers and syndicate group. Includes management fee, underwriting fee and selling concession."

[11]The issue wave variable is standardized relative to its mean and standard deviation.

the average public bond issue. Splitting the sample into low- and high-frequency issuers shows that the fixed-cost estimate β_1 is substantially lower both in magnitude and significance for HFPIs than for LFPIs. For LFPIs, the fixed-cost estimate β_1 range from \$448,000 to \$487,000, whereas the estimate drops to \$106,000 for firms issuing at least four times. Moreover, for the most active public debt issuers, the estimated fixed cost is a statistically insignificant \$43,000.

It is possible that younger firms have greater fixed bond issue costs, reflecting greater valuation uncertainty. However, the results in Panel B of Table 6 reject that the fixed-cost estimate for the LFPIs in Panel A are driven by firm age. The estimate of β_1 is large and highly significant across all the age categories shown, including firms that have been publicly traded for at least ten years. Across age groups, the fixed cost estimates ranges from \$356,000 to \$450,000.

The analysis so far suggests that low-frequency debt issuers may face greater fixed financing costs than high-frequency debt issuers. As a final check on issue costs, we next examine whether quantitative indices of financial constraints classify our sample LFIs as fundamentally more financially constrained than the HFIs. As these indices work with firm characteristics—and not issue frequency or direct cost estimates—the index scores may be viewed as a check on whether LFIs are constrained beyond what our dynamic issue hazard and direct issue cost analyses suggests.

3.4 Are LFIs fundamentally more financially constrained?

As discussed further below, the tradeoff theory concentrates on differences in debt-issue behavior driven by differences in issue cost structures alone, holding other firm-specific factors constant. Importantly, the evidence above suggests that sorting firms into groups of LFIs and HFIs also results in a spread between the type of high fixed and low proportional issue costs that the theory addresses. However, other firm-specific differences between LFIs and HFIs—not addressed by this theory—may also affect issue frequencies. For example, firms may differ in the nature of the benefits from debt financing, in asset composition and investment opportunities, and in agency costs (discussed further below). Moreover, as addressed in this section, LFIs may be fundamentally more financially constrained than HFIs—beyond the theoretical notion of relative fixed and variable issue costs.

It widely recognized that, absent debt collateral, the presence of moral hazard and informational asymmetries may significantly reduce a firm's ability to raise debt financing (Stiglitz and Weiss, 1981; Bernanke and Gertler, 1989; Innes, 1990). As these are fundamentally unobservable characteristics, the empirical capital structure literature suggests quantitative indices designed to indirectly identify the resulting financial constraints. In the construction of indices, researchers have used the sensitivity of investment to cash flow (Fazzari, Hubbard, and Petersen, 1988), univariate sorts based on individual firm characteristics (Almeida, Campello, and Weisbach, 2004), a classification based on firm size and age (Hadlock and Pierce, 2010), and various indices based on accounting and stock market information (Kaplan and Zingales, 1997; Lamont, Polk, and Saa-Requejo, 2001; Whited and Wu, 2006).

Debating the construction of these indices goes beyond our purpose (Farre-Mensa and Ljungqvist, 2014). Rather, we compute these simply as another descriptive check on whether LFIs on average appear to be more financially constrained than HFIs. Also, a lack of difference in index scores arguably increases the likelihood that the documented differences in net-debt issue activities between LFIs and HFIs is rooted in the type of direct issue cost differences discussed above and which lie at the core of our subsequent tests of tradeoff theory.

In Table 7, we classify, starting in the year of public listing, LFIs and HFIs using the three indices proposed by Kaplan and Zingales (1997) (KZ), Whited and Wu (2006) (WW) and Hadlock and Pierce (2010) (SA), respectively, as follows:

$$\begin{aligned} KZ &= -1.001909 \times Prof + 3.139193 \times L - 39.36780 \times Div - 1.314759 \times C + 0.2826389 \times Q \\ WW &= -0.091 \times Prof - 0.062 \times Divpos + 0.021 \times Tldt - 0.044 \times Size + 0.102 \times ISG - 0.035 \times g_S \\ SA &= -0.737 \times Size + 0.043 \times Size^2 - 0.04 \times Age. \end{aligned} \tag{5}$$

In KZ, Div is the ratio of dividends to assets. In WW, $Divpos$ is a dummy variable equal to one in case the firm paid dividends, $Tldt$ is the ratio of long-term debt to assets, ISG is industry sales growth (defined using 3-digit SIC codes) and g_S is sales growth.

The WW-index and the SA-index in Table 7 give similar scores to LFIs and HFIs, while the KZ-index scores HFIs as *more* financially constrained than LFIs. The anatomy of the index scores is as follows: First, the KZ-index attaches a relatively large weight to leverage, and HFIs are indeed highly leveraged (Table 4). Second, the WW-index also accounts for sales growth and firm size, and we have shown that HFIs grow substantially and are relatively large. In addition, it loads substantially less on leverage. As it turns out, the negative effect of firm size and sales growth on the financial constraint score dominates the positive effect of leverage, to the point where the difference between HFIs and LFIs becomes small under the WW index. Third, under the SA-index, the effect of firm size is non-linear and gives older (longer listed) firms a lower score. However, the variable Age dominates in the construction of the SA index as dollar differences in the book value of assets are mitigated by the logarithmic transformation of the size variable. The net effect of $Size$ and Age is such that the SA-index is similar for HFIs and LFIs. Based on these index scores, there is no evidence that LFIs are fundamentally more financially constrained than HFIs beyond, perhaps, the effect of firm characteristics on fixed issue costs.

In sum, we have shown in this section that HFIs exhibit an issue hazard shape consistent with low and largely proportional issues debt issue costs. Moreover, LFIs, who issue net-debt rarely over their lifetime, exhibit hazard shapes consistent with large and fixed debt issue costs. Also, direct fixed cost estimation indicates that underwriter fees in bond issues have a statistically significant fixed-cost components *only* in the subgroup of infrequent bond issuers. There is no evidence that LFIs and HFIs also on average differ in terms of quantitative financial constraints scores.

4 Does tradeoff theory explain HFIs?

4.1 Predictions for HFIs relative to LFIs

Abstracting from corporate investments, classical dynamic tradeoff theory combines assumptions about issue-cost structure with the corporate objective of managing leverage ratios toward an optimal target (Fischer, Heinkel, and Zechner, 1989; Goldstein, Ju, and Leland, 2001; Strebulaev, 2007).[12] Whether or not firms have leverage targets, the presence of large fixed issuance costs can cause long financing spells (periods of issue inactivity). Thus, as discussed above, our issue cost evidence for HFIs and LFIs is necessary but not sufficient to conclude in favor of the tradeoff theory. In this section, we examine three additional, testable implications of this class of capital structure theories for the differences in issue behavior of HFIs and LFIs.

The three additional implications address the *relative* values across LFIs and HFIs of issue size (standardized by the market value of assets), leverage ratio volatility, and speed-of-adjustment to deviations from a target leverage ratio:

Proposition 1 (dynamic tradeoff without investment):

[12] Brennan and Schwartz (1984) and Kane, Marcus, and McDonald (1984, 1985) provide dynamic capital structure models without issue costs. Early examinations of the impact of adjustment costs on optimal financing behavior include the cash management model of Miller and Orr (1966) and the portfolio selection theory of Constantinides (1979).

Suppose HFIs face lower fixed and total debt issuance costs than LFIs. Abstracting from corporate investments, classical dynamic tradeoff theory then implies the following:

(1) Net-debt issues by HFIs are smaller than those of LFIs.

(2) Leverage ratios of HFIs are less volatile than those of LFIs.

(3) HFIs exhibit greater speed-of-adjustment to target leverage ratio deviations than do LFIs.

The basic intuition behind these three predictions follows readily from the model simulations in Table V of Fischer, Heinkel, and Zechner (1989) and from the discussion of the dynamic hazard shapes in Section 3.2 above. Again, because the theory abstracts from the need to finance new investment, debt issues are a response to exogenous increases in equity value causing the leverage ratio to fall below the target ratio L^*. The (presumed) fixed issue costs of LFIs drive a greater wedge between L^* and the recapitalization boundary $\underline{L}$ than do the (presumed) proportional issue costs of HFIs. This implies both a period of inactivity (to reach the boundary) and, when the firm *does* issue, a debt issue size that is sufficiently large to increase the leverage ratio all the way back up the associated (concave) firm value function to its maximum at L^*. With proportional issue costs, the distance $L^* - \underline{L}$ is smaller, and so both the length of the financing spell and the resulting issue size are also smaller.[13] Moreover, since greater fixed issuance costs imply a wider spread $L^* - \underline{L}$, they lead to more volatile leverage ratios for LFIs and slower speed of adjustment back to L^* than for HFIs.

4.2 Relative issue size

Since the tradeoff theory models the behavior of a single firm, cross-sectional tests of Proposition 1 must control for cross-sectional differences between HFIs and LFIs that are not modelled. Specifically, the issue size prediction of Proposition 1 requires a firm size standardization (later, we also control for other firm characteristics entering the empirical model for L^*). We use two different methods of standardization. The first method scales the net-debt issue size with the lagged value of total assets (using market value for total equity), as is common in the literature. With this scaling, annual net-debt issue sizes average 16% for HFIs and 17% for LFIs, with medians of 10% and 9%, respectively, which fails to support prediction (1) of Proposition 1.

[13]Issue size is smaller for proportional costs because the first order condition for an optimal issue size (where marginal issue cost equals marginal issue benefit) is more restrictive relative to the case with fixed issue costs, where the marginal cost is zero.

The second method follows Eckbo and Kisser (2015) and scales issue size by the firm's total funding sources. The tradeoff theory does not distinguish between internal and external sources of equity funding, and it abstracts from financing costs other than for debt issues. However, if these other financing costs are empirically important, they may affect the overall funding mix and therefore debt issue size relative to total funding sources. We therefore scale the net-debt issues by the total funding sources obtained from the cash flow statement, as summarized in Appendix Tables 1 and 2.

Define a funding ratio for the (non-negative) funding source S_j as $R_j \equiv S_j / \sum_i^7 S_i$, where the denominator sums over the seven mutually exclusive sources that make up the total funding reported in the firm's cash flow statement:

$$\sum_i^7 S_i \equiv CF^+ + EI + NDI^+ + \Delta C^- + I^- + \Delta W^- + O^+, \tag{6}$$

where CF^+ is the positive portion of operating cash flow, EI is proceeds from equity issues, NDI^+ is positive net debt issues (debt issues exceeding debt retirements), ΔC^- is draw-down of cash balances, I^- is sale of investments, sale of property, plant and equipment (PPE) and cash flows from other investment activities, ΔW^- is reduction in net working capital, and O^+ is a small residual that maintains the cash flow identity.[14]

Table 8 and Figure 2 show the annual values of each of the funding ratios and their components. To simplify the exposition, Figure 2 aggregates the contribution of liquid and illiquid asset sales into a single *Asset Sales* ratio: $R_{AS} \equiv (\Delta C^- + \Delta W^- + O^+ + I^-) / \sum_i^7 S_i$. The other three ratios shown in the figure are, respectively, the *Net-Debt Issue* ratio $R_{NDI^+} \equiv NDI^+ / \sum_i^7 S_i$, the *Equity Issue* ratio $R_{EI} \equiv EI / \sum_i^7 S_i$, and the positive *Operating Cash Flow* ratio $R_{CF^+} \equiv CF^+ / \sum_i^7 S_i$. By construction, these four ratios sum vertically to one in Figure 2.

Interestingly, HFIs exhibit substantially greater net-debt funding ratios than LFIs: the annual value of R_{NDI^+} averages 26% for HFIs and only 2% for LFIs, respectively. Thus, net-debt issues by HFIs are

[14]In 1988, Statement of Financial Accounting Standards (SFAS) instituted a new and uniform reporting system for working capital, including its component assets and liabilities. We work with net working capital over the entire sample period. Separate analysis on the post-1988 period shows that splitting net working capital into assets and liabilities does not affect our main conclusions below. Also, debt and equity issues extracted from cash flow statements may differ from balance sheet induced changes of debt and equity when a transaction impacting the balance sheet does not also involve a cash flow. Examples include stock swaps, balance sheet consolidation following acquisitions, convertible debt conversions, and stock issued under employee stock option plans. Computing the difference between net debt issues and balance-sheet implied positive changes in debt, shows that this effect is small in our data: the mean (median) difference (scaled by assets) is 0% (0%). For equity issues, the distribution is slightly more skewed with a mean (median) of 2% (-1%).

substantially larger than those of LFIs in terms of their importance for the annual funding mix. In sum, HFIs raise at least as much net-debt as LFIs per issue, issue net-debt more often, and rely to a much greater extent than LFIs on net-debt as an overall funding source, all of which reject prediction (1) of Proposition 1.

4.3 Relative leverage instability and volatility

Prediction (2) of Proposition 1 holds that the leverage ratio volatility of LFIs should exceed that of HFIs. To test this, Table 9 provides evidence on annual leverage ratio "instability" and volatility for HFIs and LFIs following public listing. In the table, L_0 is the leverage ratio in the listing year (year 0). The first four columns report the fraction of the sample firms in year $t > 0$ with an absolute change in the leverage ratio of at least 20 percentage points (pp.): $|L_t - L_0| > 0.2$.[15] The last four columns show average annual leverage volatility, computed as the average of the standard deviation of the individual annual leverage ratios, beginning with five annual observations in year five.

Panel A of Table 9 shows that HFIs exhibit substantially higher leverage ratio volatilities than LFIs. This is true in virtually every year since public listing, and it holds whether we use the fraction of leverage instability or average leverage volatility. For example, after five years of listing, 50% of the individual HFIs have experienced a leverage ratio change exceeding +/-20 pp., while only 16% of the leverage ratios among the LFIs were similarly unstable. Moreover, after five years, the average leverage ratio volatility is 17% for HFIs—double that of the 8% for LFIs. The failure to support prediction (2) of Proposition 1 also holds if we use net rather than gross leverage ratios. Subtracting cash balances, the net-leverage volatility is 19% for both HFIs and LFIs. Moreover, net-leverage ratios of HFIs are relatively unstable as 43% of all HFIs experience significant changes in net-leverage ratios relative to the year of public listing, whereas only 26% of the LFIs do so.

Panel B of Table 9 repeats the analysis using the estimated *target* leverage ratio: $L^*_{i,t}(\beta X_{i,t-1})$, where the determinants $X_{i,t-1}$ are the lagged values of size, profitability, Q, cash ratio, tangibility, depreciation, R&D expenses, capital expenditures and the median industry leverage ratio (all winsorized at the 1(99) percent level). Here, instability is the exception as only 6% of all HFIs experience a target leverage ratio change in excess of 20 percentage points. More to the point, the target leverage ratio volatility is similar across LFIs and HFIs, indicating that the greater leverage ratio instability and volatility shown in Panel

[15] DeAngelo and Roll (2015) refer to a leverage ratio change exceeding this threshold as "unstable".

A of Table 9 for HFIs is not reflecting changes in the target L^*.

Since our HFIs are highly leveraged both absolutely and relative to LFIs (Table 4 above), the evidence in Table 9 corroborates the conclusion of DeAngelo and Roll (2015) that leverage ratio volatility of relatively high-leveraged companies is substantial relative to low-leveraged firms. In addition, given the relatively stable leverage ratios of LFIs evidenced in Table 9, our results suggest that much of the leverage ratio instability reported by DeAngelo and Roll (2015) is also driven by high-frequency net-debt issuers.

4.4 Relative speed-of-adjustment to deviations from L^*

Prediction (3) of Proposition 1 holds that HFIs, through their high-frequency debt issue activity, will exhibit greater speed-of-adjustment (SOA) than LFIs to deviations from the putative leverage target L^*. To examine this prediction, we follow the capital structure literature and estimate the SOA parameter ϕ using the following dynamic regression with the change in the market leverage ratio $L_{i,t} - L_{i,t-1}$ as dependent variable:

$$L_{i,t} - L_{i,t-1} \quad = \quad \alpha + \eta_i + \phi\left(L^*_{i,t}(\beta X_{i,t-1}) - L_{i,t-1}\right) + \epsilon_{i,t}. \qquad (7)$$

here, the determinants $X_{i,t-1}$ of the target leverage ratio $L^*_{i,t}$ are the same as in the previous section. The estimation of Eq. (7) also accounts for firm fixed effects (η_i), that the regressor $L^*_{i,t}$ is itself estimated, and that the lagged dependent variable $L_{i,t-1}$ also features as a regressor.[16] As recommended by the literature, we use system GMM estimation.[17]

The first column of Table 10 shows the estimated value of ϕ for the total sample of 10,783 firms (80,900 firm-years) that are listed for at least two years. This estimate is statistically significant with a value of 0.259 (p-value of 0.01), which is close to GMM estimates of 0.25 reported by Lemmon, Roberts, and Zender (2008). It suggests that it takes the average firm about three years to recover half of the target leverage deviation (the half-life implied by ϕ is $ln(0.5)/ln(1+\phi)$). More surprising, as shown in columns

[16] To see this, note that Eq. (7) is equivalent to: $L_{i,t} = \alpha + \eta_i + \phi L^*_{i,t}(\beta X_{i,t-1}) + (1-\phi)L_{i,t-1} + \epsilon_{i,t}$.

[17] See, e.g., Blundell and Bond (1998), Lemmon, Roberts, and Zender (2008), and Flannery and Hankins (2013). Alternatives to the dynamic panel estimation used here are long difference estimation (Hahn, Hausman, and Kuersteiner, 2007; Huang and Ritter, 2009) and bias correction methods (Kiviet, 1995; Bruno, 2005). The application of these methods is often complicated by the fact that corporate finance panels are unbalanced and suffer from non-contiguous data due to missing observations. Flannery and Hankins (2013) simulate data with similar properties and compare the performance of these estimates. Their simulations suggest that bias correction methods and system GMM estimates emerge as the most accurate methodologies. We implement system GMM in Stata using the command xtabond2 and treat lagged leverage and the vector $X_{i,t-1}$ as predetermined and use a maximum of 3 (lagged leverage) and 5 ($X_{it,-1}$) lags when constructing instruments. Changing the specification and modelling $X_{i,t}$ as endogenous does not change our results.

two and three, the SOA coefficient estimate is large and highly significant for *both* HFIs ($\phi = 0.316$, p-value of 0.01) and LFIs ($\phi = 0.272$, p-value of 0.02). As shown in column four, the difference between the SOA coefficient estimates for HFIs and LFIs is 0.044, which is different from zero only at the 10% level of significance. Thus, prediction (3) of Proposition 1 is rejected at conventional levels of statistical significance.

Note also that the high SOA coefficient estimate for the LFIs is interesting in of itself as the *a priori* expected size of this coefficient is low. Recall from Panel A of Table 2 that LFIs on average undertake only one-half net-debt issue (with the 2.5% threshold) during the first ten years of listing, and only 1.6 issues over the first twenty years. With this in mind, the SOA coefficient estimate for LFIs in Table 10 simply *cannot* be driven by net-debt issues. Rather, for LFIs, the dynamic behavior of the market leverage ratio must be driven by changes in the denominator of the leverage ratio. However, this raises concerns about the very informativeness of the SOA estimation for LFIs: it appears to be confounded by the dynamics of the asset side of the balance sheet (Welch, 2004, 2010).

The empirical analysis in this section fails to support the three predictions of dynamic tradeoff theory summarized in Proposition 1. While there may be multiple reasons for this rejection, we are particularly interested in the role of the firm's ongoing need to finance investment, measured here by capital expenditures ($Capex$). The need to finance investment shocks may mask true tradeoff behavior in the data as it gives rise to transitory or temporary debt issues. We address this issue next.

5 Tradeoff with investment financing and transitory debt

Dynamic financing and investment models allow firms to issue debt to finance investment projects in addition to responding to deviations from a target leverage ratio (Hennessy and Whited, 2005, 2007; DeAngelo, DeAngelo, and Whited, 2011). We focus in this section on the implication that firms may optimally issue debt to finance new investments even if current leverage exceeds a long-run target. In the vernacular of DeAngelo, DeAngelo, and Whited (2011), such debt issues are "transitory" in the sense that the excess debt will optimally be retired as the investment shocks recede. Proposition 2 summarizes this prediction:

Proposition 2 (dynamic tradeoff with investment):

Suppose firms jointly determine financing and investment in a dynamic tradeoff setting. Dy-

namic tradeoff theory with investment implies that an over-leveraged firm may issue debt to finance investments. Such debt issues are transitory as they are subsequently repurchased to restore the leverage target.

Below, we examines Proposition 2 empirically. We focus on the HFIs as, of the total sample of transitory net debt issues (defined below), 74% are undertaken by HFIs.[18] We begin by identifying a close association between net-debt issue activity and investments for the HFIs, followed by a search for transitory debt issuances and retirements in the data.

5.1 Net-debt issue size and investment

Recall from Table 5 that *Capex* is perhaps the strongest predictor of the net-debt issue frequency and hazard. In this section we further show that net-debt issue size and *Capex* are also positively correlated for HFIs. This positive correlation is apparent both from Figure 3 and from the regression results in Table 11. The horizontal axis in Figure 3 sorts all net-debt issues (relative to book assets) into ten deciles, while the vertical axis plots the associated average *Capex*. For HFIs, *Capex* averages 10% with a median of 6%, and its 95^{th} percentile is 32% of book assets. As shown, average *Capex* increases monotonically with the net-debt issue decile from low to high.

Table 11 shows a similar effect in a multivariate regression framework using the following modified "financing deficit" regression (Shyam-Sunder and Myers, 1999; Frank and Goyal, 2003; Lemmon and Zender, 2010):

$$\frac{NDI_{i,t}}{A_{i,t}} = \alpha + \beta_1 Capex_{i,t} + \beta_2 NetDeficit_{i,t} + \beta_3 Capex^2_{i,t} + \beta_4 NetDeficit^2_{i,t} + \epsilon_{i,t}. \tag{8}$$

NDI/A is net-debt issues (retirements when negative) scaled by total assets, and $NetDeficit$ is the financing deficit net of $Capex$.[19] The inclusion of squared terms addresses the possibility that, in a dynamic financing pecking order setting, firms financing larger projects may optimally choose to issue both debt and equity (and not just debt) in order to preserve future debt capacity.

Column (1) of Table 11 shows a positive and significant (univariate) correlation between invest-

[18] LFIs only account for 5% of all transitory net debt issues, implying that medium frequency issuers undertake the remaining 21%.

[19] Using the Compustat mnemonics in Appendix Table 2: $NetDefecit \equiv dv + aqc + ivch - siv - ivstch - sppe - ivaco - oancf + chech$. All variables are scaled by total assets.

ment ($Capex$) and issue size. This slope coefficient on $Capex$ increases, from 0.34 to 0.52, after adding $NetDeficit$ in column (2), and it increases further to 0.57 in the full model in column (4). Moreover, $Capex^2$ also receives a positive and significant coefficient, suggesting that larger capital expenditures are financed with a greater fraction of net debt issues. In sum, net-debt issues are strongly related to $Capex$, and the more so the greater the capital expenditure program in relation to total assets.

5.2 Cumulative debt and equity issues by over-leveraged firms

Within the issue-cost structure assumed by DeAngelo, DeAngelo, and Whited (2011), transitory debt issues are followed by net-debt repurchases as the investment shocks recede. Below, we provide a simple visual impression of the existence of net debt issues by over-leveraged firms, followed in the next section by estimates of the probability that such debt issues trigger the predicted debt repurchases and leverage ratio reductions.

Let $Dev_t = L_{t-1} - L_t^*(\beta X_{t-1})$ denote the leverage ratio deviation from the target going into period t, where $L_t^*(\beta X_{t-1})$ is estimated as in Table 10 above. Moreover, let $Ecapex$ denote the firm's capital expenditure in excess of the industry median. The dummy variable $TNDI_{i,t-1}$ indicates whether the firm made a transitory net-debt issue in year $t-1$. Specifically, $TNDI_{t-1}$ equals one if, in period $t-1$, the following three conditions are met: the firm (1) was over-leveraged going into the period ($Dev_{t-1} > 0$), (2) issued net-debt in excess of 2.5% of total assets ($NDI_{t-1} > 0$), and (3) invested in excess of the industry median ($Ecapex_{t-1} > 0$). For the HFIs, $TNDI$ equals one in 15% of the sample firm-years where $NDI > 0$. Moreover, when $TNDI = 1$, firms are on average over-leveraged by 8 percentage points.

Figure 4 shows in event time what happens on average after a transitory versus a non-transitory net-debt issue in year zero ($NDI_0 > 0$). The figure plots, over the next three years, the annual average leverage ratio L ("Debt"), cumulative net-debt issue ("Cumulative NDI"), cumulative net equity issue ("Cumulative NEI", net of stock repurchases and dividends), and capital expenditure ("Capex"). Panel A conditions on $TNDI = 0$ (a non-transitory net debt issue), while Panel B investigates the case when $TNDI = 1$ (a transitory net-debt issue).

The leverage ratio L is increasing somewhat in Panel A (where NDI_0 occurs when $TNDI = 0$), while it is decreasing in Panel B. This supports the notion that the net-debt issues in Panel B are transitory. On the other hand, Cumulative NDI and Cumulative NEI are increasing in both panels, while $Capex$ is largely flat following the event year 0. It appears that the leverage decrease in Panel B is driven by net equity issues rather than by net debt retirements. Thus, notwithstanding that HFIs are relatively active in terms of undertaking net-debt retirements (Table 2 above), this retirement activity does not appear in Figure 4 to coincide with the predicted repurchases following transitory debt issues.

While Figure 4 plots the average cumulative net-debt and net-equity issuances following a transitory net-debt issue, Proposition 2 may also be addressed by estimating the marginal effect of $TNDI$ on the propensity for a net-debt repurchase in the next period. We turn to this estimation next.

5.3 Probability of debt retirements following transitory debt issues

Table 12 presents coefficient estimates of the determinants of the probability that a transitory net debt issue in period $t-1$, as indicated by the dummy variable $TNDI_{i,t-1}$, is followed in year t by, alternatively, a decrease in leverage (Panel A), a net-debt retirement exceeding 2.5% of total assets (Panel B), or a net equity issue exceeding 2.5% (Panel C). The model is:

$$Y_{i,t} = \alpha + \beta TNDI_{i,t-1} + \gamma Ecapex_{i,t} + \delta Dev_{i,t} + \epsilon_{i,t}, \tag{9}$$

where $Y_{i,t} = 1$ is the binary dependent variable for firm i in year t. The estimation also includes industry dummies for eight of the 12 Fama-French (FF12) industries (excluding financial firms and regulated utilities).

Consistent with the evidence on cumulative issuances in Figure 4 above, the results in Panel A of Table 12 suggest that a transitory debt issue significantly increases the probability that a firm decreases leverage in the subsequent period. Also, current $Ecapex$ is significantly negatively correlated with reductions in leverage. This is also consistent with our earlier findings that HFIs tend to finance investments with debt, and so do not lever down in periods when $Ecapex$ is relatively high.

Panel B estimates the probability of a net-debt retirement directly. The results here are mixed. In the first of the two regression specifications, the coefficient estimates on $TNDI_{t-1}$ and $Ecapex$ are highly significant and of the sign expected under Proposition 2: having issued transitory net debt last year increases the probability of a net-debt retirement this year, while greater $Ecapex$ reduces this probability. However, the coefficient on $TNDI_{t-1}$ becomes small and statistically insignificant when we add Dev_t to the regression. That is, in the full regression specification, the probability of a net-debt retirement is increasing with the deviation from current-period optimal leverage ratio, while it is independent of whether or not the firm undertook a "transitory" net-debt issue $TNDI$ in the last period.

Finally, consistent with Figure 4, Panel C of Table 12 shows that net-debt issues $TNDI_{t-1}$ and capital expenditures $Ecapex_t$ combine to trigger subsequent equity issues in period t. The estimated coefficients on both $TNDI_{t-1}$ and $Ecapex_t$ are positive and highly significant. Overall, these results suggest that some of the leverage increase resulting from a debt issue of type $TDNI$ is reduced over the following year through a combination of retained earnings and (relatively costly) equity issues to finance continued investments. While the reduction in leverage following $TNDI > 0$ supports Proposition 2, the lack of follow-on net-debt repurchases does not. Rather, the leverage ratio reduction reflects a combination of retained earnings and new (costly) equity issues rather than by debt repurchases—as if ongoing funding needs dominate debt-retirement considerations.

6 Issue frequency and CEO compensation

The analysis so far has considered tradeoff behavior in terms of optimal managerial adjustments to investment shocks and issue costs. Leverage policies (and therefore, indirectly, net-debt issue frequencies) may be driven by considerations other than shareholder value maximization, such as agency cost created by the personal bankruptcy costs of the Chief Executive Officer (CEO) (Ross, 1977; Eckbo, Thorburn, and Wang, 2014). Also, cash-strapped young firms with few pledgable assets have low leverage and routinely compensate their executives in restricted stock. These additional considerations suggest that CEO stock ownership and stock-based compensation may differ in complex ways across HFIs and LFIs, which we examine briefly below.

Table 13 shows interesting differences between HFIs and LFIs in terms of both CEO stock ownership and stock-based compensation. CEO ownership and compensation information is from ExecuComp over the period 1992-2012. Since ExecuComp samples relatively large companies, and we require firms to go public during our sample period, ExecuComp data is available for only about ten percent of our total sample: 1,659 firms and 13,907 firm-year observations. Moreover, since HFIs are significantly larger than LFIs on average (Table 4), the sample in Table 13 is skewed towards HFIs relative to LFIs (it also includes, of course, firms that are classified as neither).

While HFIs and LFIs on average hold similar percentage of shares outstanding (approximately 5%), the first row of Table 13 indicates that, after controlling for firm-fixed effects and firm characteristics, CEOs of HFIs hold a significantly greater percentage equity than all other firms (LFIs and those in between LFIs and HFIs). Moreover, CEOs of LFIs hold significantly less stock than all other firms in the regression. Furthermore, the second regression shows that HFIs are associated with significantly greater stock-based compensation than all other firms.[20]

We emphasize that the evidence of a significant association between CEO stock ownership/stock-based compensation and HFI does not mean that a similar association exists with firm leverage ratios. Indeed, Strebulaev and Yang (2013) sample all firms on ExecuComp over the period 1992 and 2009 (6,476 firm-years) and find that CEO stock ownership is associated with greater probability of having near-zero (less than 5%) leverage. We have verified that a similar effect is present in our data, suggesting that the impact of stock ownership and compensation on both net-debt issue frequency and leverage ratios is likely non-linear in nature, an interesting topic for future research.

7 Conclusion

Over the past forty years, a group of highly leveraged, high-frequency debt issuers (our HFIs) raised the bulk of all public and private debts issued by public non-financial U.S. firms. While much attention has been given to zero or near-zero-leverage firms, little is known about the HFIs. Since these firms evidently view debt-financing as uniquely beneficial, and face sufficiently low debt issue costs to issue frequently, they are ideally suited to test tradeoff theory. In this paper, we contrast the firm characteristics of HFIs versus low-frequency debt issuers (our LFIs), and we exploit the differences in debt issue behavior across HFIs and LFIs in new tests of capital structure theory.

HFIs stand out already at the time of public listing as relatively large, investment-intensive firms with high leverage and low Tobin's Q. On the other hand, LFIs are relatively small R&D-intensive firms with low leverage and high Q. There is only minimal migration between firms in the HFI and LFI categories. Market leverage ratios quickly rise to an average of 35% for HFIs versus an average of 10% for LFIs. Moreover, while as much as 32% of the LFIs have zero leverage in a typical firm-year, only 1% of HFIs ever reduce leverage to zero during their lifetime as public companies. Overall, HFIs tend to finance a relatively capital-intensive investment (capex) program externally through debt issues, while LFIs tend

[20]Separate estimation (not shown in Table 13) also shows that CEO stock ownership in year $t-1$ is associated with greater probability of being classified as HFI in year t.

to finance a relatively intensive R&D program internally.

Large fixed issue costs slow issue frequency whether or not a firm manages capital structure towards a target. It is therefore natural to assume that HFIs face smaller and less fixed issue costs than LFIs. In preparation for testing dynamic tradeoff theory, we corroborate this issue-cost assumption with new evidence. The evidence is both indirect (using estimated dynamic issue hazard shapes) and direct (using underwriter fees of public bond issues). This estimation suggests that LFIs in general, and low-frequency public bond issuers in particular, face significant fixed issue costs. There is no other obvious difference in external finance costs as LFIs and HFIs have similar scores on quantitative indices of financial constraints.

Dynamic tradeoff theory, which abstracts from investment financing, predicts that, relative to LFIs, debt issues by HFIs are smaller, leverage ratio volatility is lower, and the speed-of-adjustment to deviations from leverage targets is higher. Our evidence fails to support these three predictions: issue size is no smaller for HFIs than for LFIs, leverage ratio volatilities are substantially higher, and LFIs and HFIs receive statistically indistinguishable speed-of-adjustment coefficient estimates. Given the extremely low issue frequency of LFIs (on average one tenth of that of HFIs), the latter finding raises concern about the use of leverage ratio changes to identify the true speed with which firms manage leverage towards a target.

True tradeoff behavior by HFIs may be masked by the ongoing funding of their intensive investment program. We show that not only are capital expenditures a main determinant of the probability of becoming an HFI but issue size of HFIs is also highly correlated with capital expenditures. Recent investment and financing models predict that temporarily over-leveraged firms may issue debt in response to persistent investment shocks. As the investment shocks fade, these "transitory" debt issues are followed by debt repurchases to restore leverage targets. Using the empirical leverage targets from the speed-of-adjustment analysis, there is evidence of the existence of net-debt issues by over-leveraged firms. This extra debt is transitory in the sense that it is followed by a reduction in leverage—however, the reduction is achieved using mostly equity issues (not debt repurchases), which suggests that ongoing and immediate funding needs tend to dominate debt-retirement considerations also for temporarily over-leveraged firms.

Finally, we show briefly that, as perhaps expected, CEOs of HFIs have high stock ownership and receive a greater portion of total pay in terms of stocks and options relative to all other sample firms (with available compensation data). In other words, CEOs of HFIs appear to have relatively strong incentives to maximize shareholder value. However, we leave it to future research to identify a possible causal effects of CEO stock ownership and incentive-based pay on firms' net-debt issue frequency and leverage policy.

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Figure 1: **Estimated and simulated hazards curves**

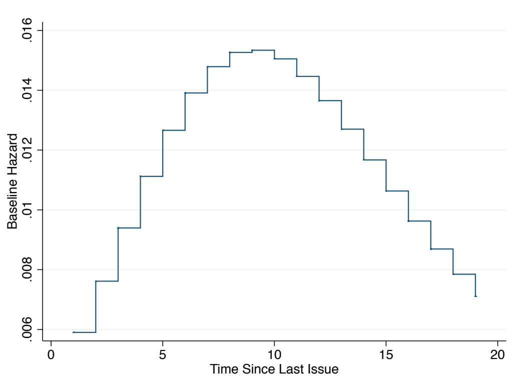
The estimated hazard curves in Panel A and B use our sample of 12,131 firms and 93,031 firm-years and the following exponential shared frailty hazard model:

$$h_i(t) = h_0 \exp(\beta_0 + \beta x_i + \gamma f(t))\alpha_i \quad \text{and} \quad f(t) = t + t^2 + t^3,$$

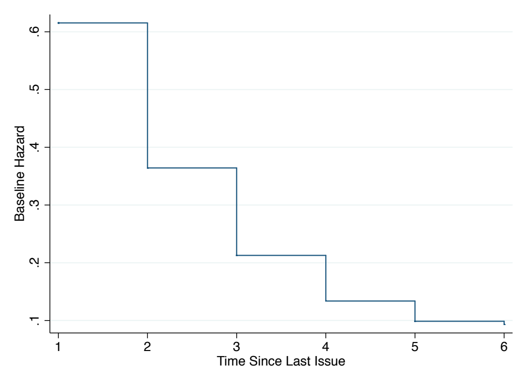
where t is time (years) since last issue, h_0 is the baseline hazard (when all covariates are equal to zero), and α_i captures unobserved heterogeneity analogous to a regression error term. The covariates are investment ($Capex$), R&D expenditures ($R\&D$), market leverage ratio (L), cash ratio (C), logarithm of assets ($Size$), operating cash flow ($Prof$), tangibility (Tan), Tobin's Q (Q) and depreciation expenditures ($Depr$). All covariates are winsorized at the 1(99) percent level or must lie between zero and one (cash ratio and leverage). They enter after subtracting their median values. The high and low-frequency classification (HFI and LFI) is performed annually and based on a 2.5% issue size threshold. Variable definitions are in Appendix Tables 1 and 2.

The simulated hazard curves in Panel C and D are from Figure 5 in Leary and Roberts (2005), which are generated using the cubic polynomial $f(t)$) but not the covariates x_i. The simulations assume stock returns follow a geometric Brownian motion, with a mean (12%) and standard deviation (46%) of equity returns matching a sample of industrial Compustat firms with at least four years of contiguous data, 1984-2001. Firms are assumed to recapitalize when they hit an upper or a lower leverage boundary, matched to the sample median maximum (0.60) and minimum (0.15), respectively. The leverage process starts at the midpoint of the spread between the upper and lower boundaries and are updated each period using the simulated equity returns. Firms in Panel C face fixed issues costs and rebalance all the way back to the midpoint. Firms in Panel D face proportional issue costs and optimally rebalances to the nearest boundary only.

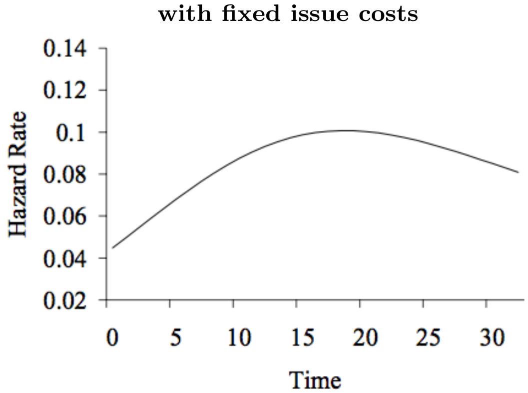
A: Eckbo-Kisser estimated hazard for LFIs



B: Eckbo-Kisser estimated hazard for HFIs



C: Leary-Roberts simulated hazard with fixed issue costs



D: Leary-Roberts simulated hazard with proportional issue costs

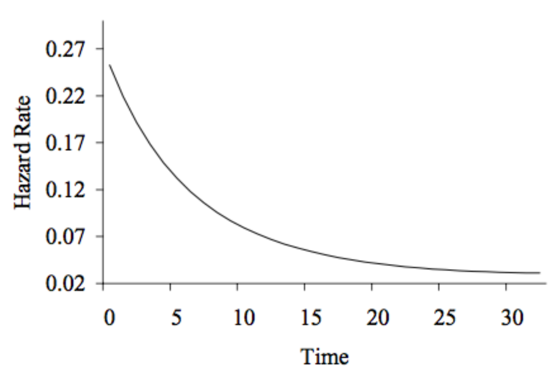
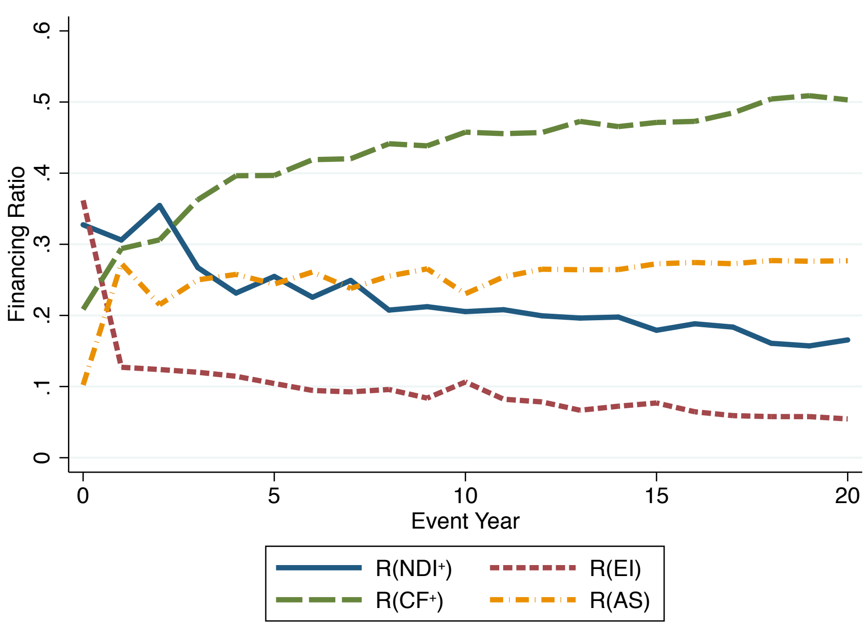


Figure 2: **Lifecycle financing ratios for high- and low-frequency net-debt issuers**

The figure plots four financing ratios $R_j \equiv S_j^+ / \sum_i^7 S_i^+$, where $\sum_i^7 S_i^+$ is the firm's total cash contribution from each of its seven (non-negative) sources of funds: $\sum_i^7 S_i^+ = EI + NDI^+ + CF^+ + \Delta C^- + I^- + \Delta W^- + O^+$. EI is proceeds from equity issues, NDI^+ is positive net debt issues (net of debt retirements), CF^+ is positive operating cash flow, ΔC^- is cash drawdowns, I^- is sale of illiquid assets (sale of investments, PPE and other investments), ΔW^- is reduction in net working capital, and O^+ is "other" sources of funds (a small residual closing the cash flow identity). By construction, the four ratios sum vertically to one: $R_{EI} = EI / \sum_i^7 S_i^+$, $R_{NDI^+} = NDI^+ / \sum_i^7 S_i^+$, $R_{CF^+} = CF^+ / \sum_i^7 S_i^+$, and $R_{AS} = (\Delta C^- + I^- + \Delta W^- + O^+) / \sum_i^7 S_i^+$. Year 0 is the year of public listing. Variable definitions are in Appendix Tables 1 and 2. Sample of 12,131 U.S. public industrial firms and 93,101 firm-years, 1971-2012.

Panel A: Average funding ratios for HFI



Panel B: Average funding ratios for LFI

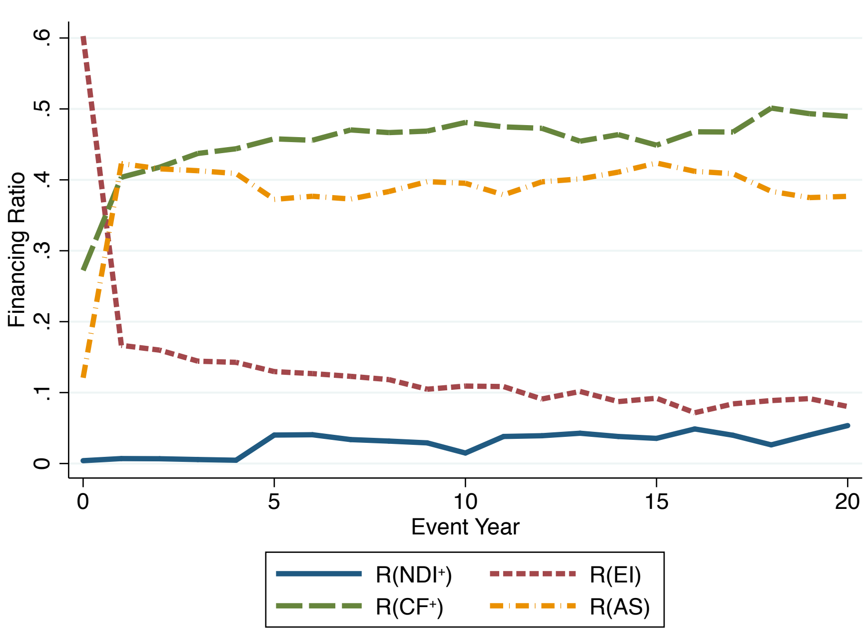


Figure 3: **Capital expenditures and size of net debt issues for HFIs**

The figure plots average capital expenditures ($Capex$) for ten different portfolios of HFIs. The decile sort is based on the size of net debt issues (NDI), expressed relative to the book value of assets. Decile 1 corresponds to the smallest net debt issues, decile 10 denotes the largest net debt issues. Variable definitions are in Appendix Tables 1 and 2. Total sample of 6,684 U.S. public firms and 31,449 firm-years, 1971-2012.

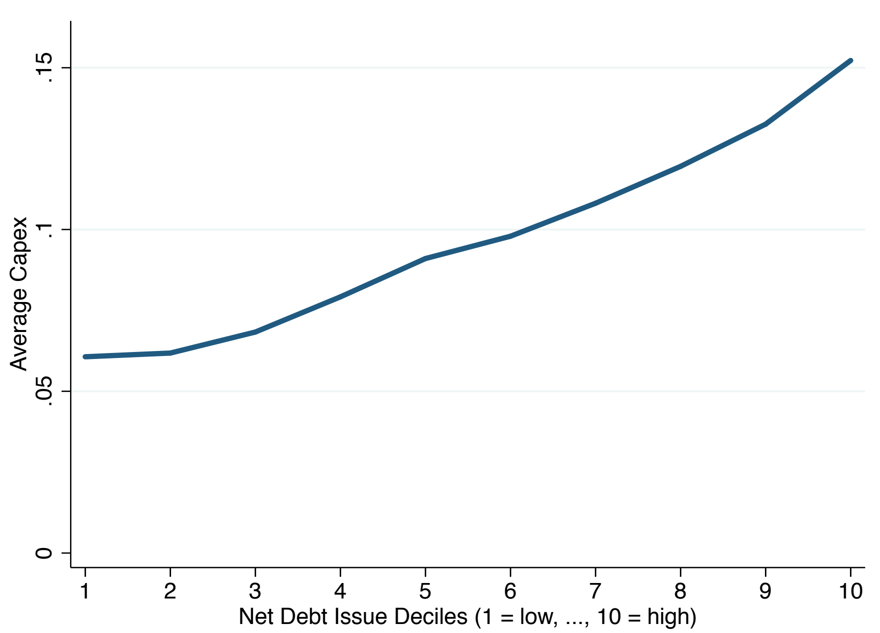


Figure 4: **Financing and investment following non-transitory and transitory debt issues by HFIs**

The figure plots the evolution of leverage, cumulative net debt issues, cumulative net equity issues and average investment over three years following a non-transitory ($TNDI = 0$) and transitory net-debt issue ($TNDI = 1$), respectively, in year 0. A net-debt issue is defined as transitory if the following three conditions are met: (1) NDI exceeds 2.5% of total assets, (2) the firm had excess leverage in the year prior to the issue ($Dev > 0$), and (3) capital expenditures exceed the industry median capital expenditures (in percent of assets). $Dev_t = L_{t-1} - L^*_t(\beta X_{t-1})$ and the leverage target (L^*) is estimated as in Table 10. Variable definitions are in Appendix Tables 1 and 2. Total sample of 6,684 U.S. public firms and 31,449 firm-years, 1971-2012.

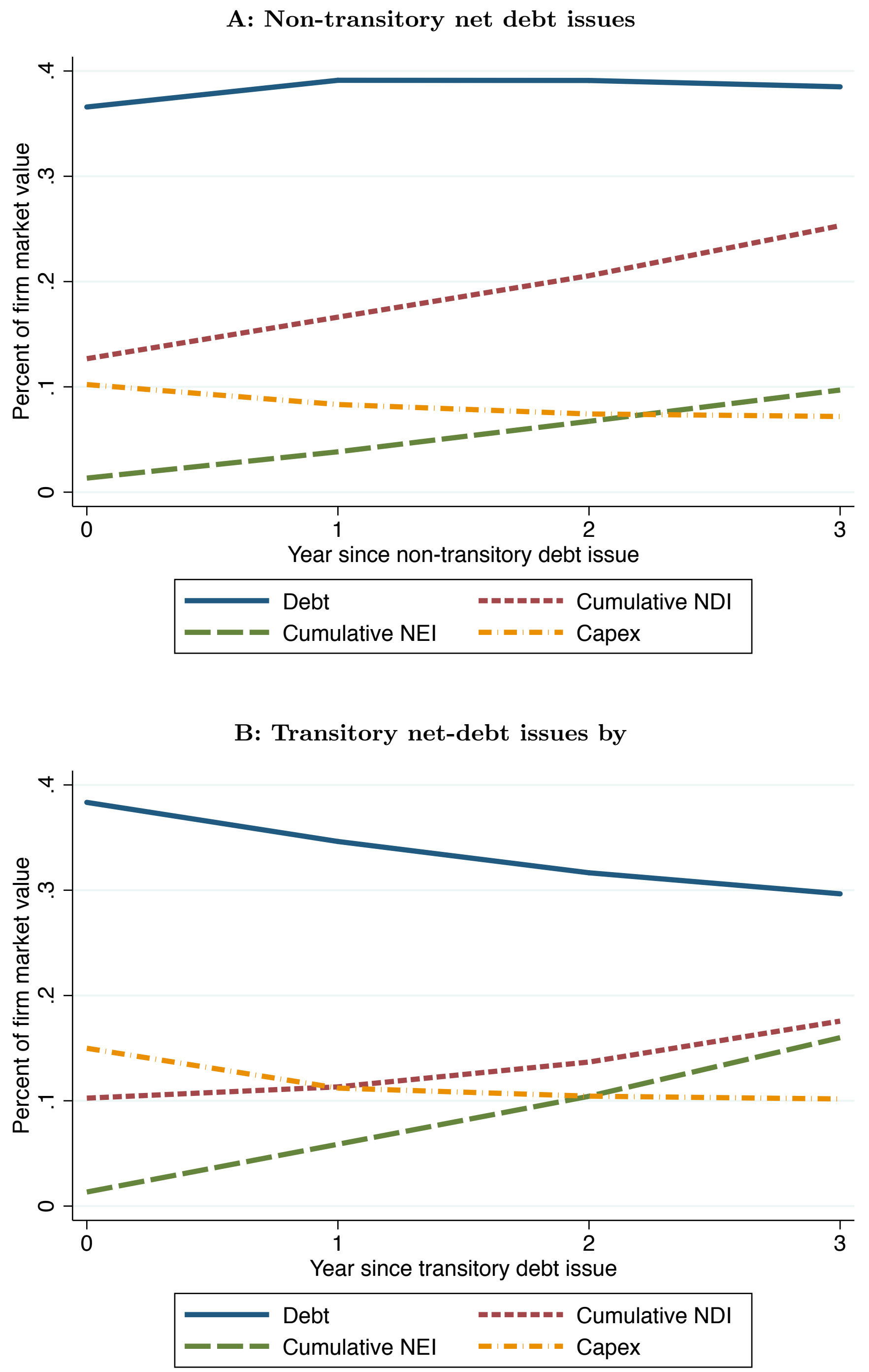


Table 1: **Selection of CRSP/Compustat firm-years and SDC public debt offerings**

Sample restriction	Firm-years	Firms
A: CRSP/Compustat sample, 1971-2012		
Sample after merging CRSP and Compustat	250,053	23,081
U.S. domiciled firms only	-20,473	-2,158
Nongovernmental, industrial firms only[a]	-65,011	-5,593
No multiple annual observations	-1,817	0
No missing information on book value of assets	-449	-16
Firm age positive[b]	-5,463	-382
Consistent cash-flow statement data[c]	-4,888	-333
Consistent balance sheet data[d]	-2,528	-57
Went public during sample period	-39,449	-2,411
Contiguous annual observations[e]	-16,944	0
Final CRSP/Compustat sample	93,031	12,131
B: SDC public bond issue sample, 1980-2012		
Sample after merging SDC with CRSP and Compustat[f]	12,481	1,845
Total asset data available	-230	-2
No deals within 30 days	-115	-28
Underwriter fee data available	-5,683	-125
Merge SDC with CRSP	-2,213	-458
Firm on CRSP for 260 trading days before issue	-165	-101
Data on last fiscal year available	-72	-16
Issue size at least $10mn (in 1990 dollars)	-33	-11
Issue size at most $10bn (in 1990 dollars)	-35	-2
Underwriter fee at least 5 bp	-80	-5
Final SDC/CRSP/Compustat public bond issue sample	3,773	1,075

[a] Eliminates utilities (SIC codes 4899-5000), financial firms (SIC codes 5999-7000), and government entities (SIC codes greater than 8999).

[b] Firm age is the difference between the reporting date of the financial statement and the date of the first month a company is reported in the CCM monthly stock price database, rounded to the next smaller integer.

[c] For cash-flow data consistency, we first drop observations with negative values for the following Compustat variable names (see Appendix Table 1 and 2 for variable definitions): dltis, dltr, sstk, prstkc, dv, capx, aqc, ivch, sppe and siv (eliminates 3,493 obs.). Moreover, we set missing entries for items in the cash flow statement to zero and drop observations in case total sources or uses of funds equal zero (eliminates 1,165 obs.) or deviate by more than 1% from each other (eliminates 230 obs.).

[d] For balance sheet data consistency, we set missing entries for deferred taxes and investment tax credit (txditc) and preferred stock liquidation value (pstkl) equal to zero and subsequently require non-missing data for the market value of the firm's equity (prcc_f × csho), Tobin's Q (lt + pstkl - txditc + prcc_f × csho)/at), total debt (dltt + dlc), cash holdings (che), property plant and equipment (ppent) and further drop observations in case the book leverage ratio is outside the unit interval or cash holdings are negative.

[e] We eliminate observations once the underlying annual data become non-contiguous. For example, suppose a firm has a total 11 annual observations on Compustat but only the first 8 years are contiguously available. In this case, only the first 8 annual observations are included in the final sample.

[f] The SDC sample is merged with CRSP/Compustat after having accounted for rows (1) to (8) in Panel A.

Table 2: **Annual cumulative net-debt issues, retirements and equity issues following public listing** In Panel A, a net-debt issue (NDI^+) is the positive portion of total debt issue minus debt retirement as given by annual Compustat cash flow statements. Event year 0 is the year of public listing. In each event year, firms in the bottom quartile of the cumulative net-debt issue distribution are classified as low-frequency issuers (LFIs), while high-frequency issuers (HFIs) are in the top quartile. This LFI and HFI classification is based on net-debt issues and is maintained also in Panel B and C that report on net-debt retirements (NDI^-) and equity issues (EI), respectively. Each panel first shows the issue frequency assuming a 2.5% issue size threshold (relative to total assets) and, second, assuming a 5% size threshold. In the columns reporting the cumulative number of issues, the reported number is the mean for the LFI and the HFI columns, while the Mean and Median columns are for the total sample of 12,131 U.S. public firms, 1971-2012. Variable definitions are in Appendix Tables 1 and 2.

	Number of Firms			Fraction of aggregate issue proceeds		Cumulative number of issues			
Year	All	LFI	HFI	LFI	HFI	LFI	Mean	Median	HFI
A.1 Net-debt issues with a 2.5% threshold									
0	12131	9028	3103	0.02	0.98	0.00	0.26	0	1.00
1	10783	5500	5283	0.02	0.98	0.00	0.61	0	1.25
2	9264	3652	2495	0.02	0.73	0.00	0.94	1	2.22
3	7918	2509	3029	0.01	0.74	0.00	1.24	1	2.45
4	6848	1850	3236	0.01	0.83	0.00	1.52	1	2.68
5	5921	2739	1823	0.10	0.73	0.49	1.79	2	3.59
6	5046	2058	1900	0.28	0.59	0.50	2.07	2	3.80
7	4344	1574	1107	0.15	0.56	0.51	2.33	2	4.72
8	3815	1219	1161	0.08	0.65	0.51	2.60	2	4.92
9	3345	954	1206	0.04	0.67	0.50	2.87	3	5.10
10	2931	754	763	0.04	0.59	0.49	3.11	3	5.98
15	1549	419	552	0.11	0.63	1.14	4.50	4	7.53
20	782	215	243	0.04	0.45	1.64	5.78	6	9.77
A.2 Net-debt issues with a 5% threshold									
0	12131	n.A.	n.A.	n.A.	n.A.	n.A.	0.21	0	n.A.
1	10783	6275	4508	0.04	0.96	0.00	0.51	0	1.21
2	9264	4378	4886	0.03	0.97	0.00	0.76	1	1.45
3	7918	3137	2284	0.04	0.65	0.00	1.00	1	2.38
4	6848	2351	2482	0.05	0.75	0.00	1.22	1	2.56
5	5921	1788	2492	0.03	0.79	0.00	1.43	1	2.73
6	5046	1325	1297	0.06	0.49	0.00	1.64	1	3.65
7	4344	2065	1309	0.21	0.63	0.51	1.83	2	3.79
8	3815	1654	1322	0.16	0.66	0.52	2.03	2	3.94
9	3345	1310	1301	0.14	0.63	0.52	2.23	2	4.07
10	2931	1047	767	0.07	0.56	0.51	2.41	2	4.94
15	1549	592	482	0.20	0.54	1.10	3.43	3	6.22
20	782	223	237	0.04	0.43	1.07	4.26	4	7.58

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Table 2 – continued from previous page

Year	Number of Firms All	LFI	HFI	Fraction of aggregate issue proceeds LFI	HFI	Cumulative number of issues LFI	Mean	Median	HFI
B.1 Net-debt retirements with a 2.5% threshold									
0	12131	9028	3103	1.00	0.00	0.46	0.34	0	0.00
1	10783	5500	5283	0.64	0.36	0.62	0.51	0	0.40
2	9264	3652	2495	0.38	0.20	0.74	0.70	1	0.44
3	7918	2509	3029	0.30	0.39	0.82	0.92	1	0.80
4	6848	1850	3236	0.16	0.60	0.91	1.15	1	1.12
5	5921	2739	1823	0.37	0.37	1.30	1.37	1	1.22
6	5046	2058	1900	0.26	0.57	1.39	1.59	1	1.55
7	4344	1574	1107	0.18	0.33	1.47	1.81	2	1.62
8	3815	1219	1161	0.20	0.42	1.52	2.05	2	2.01
9	3345	954	1206	0.12	0.56	1.52	2.28	2	2.37
10	2931	754	763	0.10	0.36	1.54	2.50	2	2.49
15	1549	419	552	0.07	0.49	2.28	3.68	4	4.02
20	782	215	243	0.06	0.33	2.74	4.61	4	5.12
B.2 Net-debt retirements with a 5% threshold									
0	12131	n.A.	n.A.	n.A.	n.A.	n.A.	0.27	0	n.A.
1	10783	6275	4508	0.68	0.32	0.41	0.37	0	0.31
2	9264	4378	4886	0.43	0.57	0.49	0.49	0	0.50
3	7918	3137	2284	0.35	0.28	0.54	0.63	0	0.59
4	6848	2351	2482	0.21	0.47	0.60	0.78	1	0.81
5	5921	1788	2492	0.15	0.50	0.62	0.92	1	1.02
6	5046	1325	1297	0.10	0.45	0.62	1.05	1	1.11
7	4344	2065	1309	0.30	0.50	0.96	1.19	1	1.32
8	3815	1654	1322	0.31	0.47	1.01	1.34	1	1.56
9	3345	1310	1301	0.19	0.59	1.04	1.49	1	1.74
10	2931	1047	767	0.17	0.37	1.04	1.63	1	1.91
15	1549	592	482	0.16	0.51	1.52	2.33	2	2.85
20	782	223	237	0.36	0.30	1.42	2.84	3	3.68

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Table 2 – continued from previous page

Year	Number of Firms			Fraction of aggregate issue proceeds		Cumulative number of issues			
	All	LFI	HFI	LFI	HFI	LFI	Mean	Median	HFI
C.1 Equity issues with a 2.5% threshold									
0	12131	9028	3103	0.76	0.24	0.79	0.75	1	0.66
1	10783	5500	5283	0.43	0.57	1.07	1.04	1	1.01
2	9264	3652	2495	0.31	0.44	1.34	1.30	1	1.30
3	7918	2509	3029	0.26	0.47	1.61	1.54	1	1.52
4	6848	1850	3236	0.20	0.57	1.86	1.76	1	1.73
5	5921	2739	1823	0.37	0.42	2.04	1.99	2	1.99
6	5046	2058	1900	0.37	0.47	2.33	2.19	2	2.13
7	4344	1574	1107	0.29	0.42	2.61	2.38	2	2.31
8	3815	1219	1161	0.33	0.39	2.86	2.56	2	2.46
9	3345	954	1206	0.23	0.51	3.07	2.70	2	2.55
10	2931	754	763	0.23	0.43	3.30	2.87	2	2.81
15	1549	419	552	0.15	0.53	3.97	3.56	3	3.36
20	782	215	243	0.11	0.38	4.08	3.81	3	3.79
C.2 Equity issues with a 5% threshold									
0	12131	n.A.	n.A.	n.A.	n.A.	n.A.	0.73	1	n.A.
1	10783	6275	4508	0.48	0.52	0.99	0.97	1	0.95
2	9264	4378	4886	0.36	0.64	1.19	1.18	1	1.18
3	7918	3137	2284	0.32	0.39	1.35	1.37	1	1.43
4	6848	2351	2482	0.28	0.48	1.50	1.53	1	1.62
5	5921	1788	2492	0.26	0.50	1.68	1.70	1	1.79
6	5046	1325	1297	0.24	0.40	1.85	1.83	1	1.99
7	4344	2065	1309	0.38	0.48	1.91	1.95	2	2.08
8	3815	1654	1322	0.41	0.44	2.04	2.06	2	2.20
9	3345	1310	1301	0.31	0.54	2.12	2.16	2	2.25
10	2931	1047	767	0.29	0.39	2.25	2.27	2	2.54
15	1549	592	482	0.24	0.48	2.68	2.71	2	2.93
20	782	223	237	0.24	0.43	2.58	2.70	2	3.23

Table 3: Persistence of the net-debt issue-frequency classification

In each event year, firms in the bottom quartile of the cumulative net-debt issue frequency distribution shown in Table 2 are classified as low-frequency issuers or LFIs, while high-frequency issuers (HFIs) are in the top quartile. The issue frequency classification uses the 2.5% issue-size threshold. Year 0 is the year of public listing. Columns (1) through (3) are backward looking and show the fraction of firms classified as HFI and LFI in a given year that are also classified as HFI and LFI in the previous year (n=1), in the previous two years (n=2), and in the previous three years (n=3), respectively. Columns (4) through (6) are forward looking and show the fraction of HFIs and LFIs in a given year that are also classified as LFI, medium frequency issuer, or HFI in any of the firm's remaining sample years. Sample of 12,131 U.S. public firms, 1971-2012.

Years	Percent of sample firms with no classification change over past n sample years			Percent of sample firms with no classification change over all future sample years		
since listing	n=1 (1)	n=2 (2)	n=3 (3)	LFI (4)	Median (5)	HFI (6)
A: High frequency issuers (HFIs)						
0	n.A.	n.A.	n.A.	0.06	0.27	0.67
1	0.51	n.A.	n.A.	0.08	0.36	0.56
2	1.00	0.59	n.A.	0.02	0.24	0.74
3	0.69	0.69	0.41	0.02	0.31	0.66
4	0.80	0.55	0.55	0.03	0.39	0.58
5	1.00	0.88	0.65	0.01	0.26	0.73
6	0.81	0.81	0.71	0.01	0.33	0.66
7	1.00	0.88	0.88	0.00	0.19	0.81
8	0.84	0.84	0.75	0.00	0.23	0.77
9	0.84	0.70	0.70	0.00	0.30	0.70
10	1.00	0.92	0.82	0.00	0.18	0.82
15	0.88	0.76	0.76	0.00	0.30	0.70
20	0.92	0.92	0.88	0.00	0.25	0.73
Mean	0.81	0.76	0.69	0.01	0.21	0.78
B: Low frequency issuers (LFIs)						
0	n.A.	n.A.	n.A.	0.46	0.29	0.25
1	1.00	n.A.	n.A.	0.58	0.30	0.12
2	1.00	1.00	n.A.	0.68	0.26	0.07
3	1.00	1.00	1.00	0.76	0.20	0.03
4	1.00	1.00	1.00	0.82	0.17	0.02
5	0.59	0.59	0.59	0.67	0.29	0.04
6	1.00	0.65	0.65	0.72	0.26	0.03
7	1.00	1.00	0.69	0.77	0.22	0.02
8	1.00	1.00	1.00	0.82	0.17	0.01
9	1.00	1.00	1.00	0.87	0.13	0.01
10	1.00	1.00	1.00	0.89	0.10	0.00
15	1.00	1.00	1.00	0.91	0.09	0.00
20	1.00	1.00	1.00	0.94	0.18	0.03
Mean	0.94	0.89	0.83	0.88	0.11	0.02

Table 4: **Average annual firm characteristics following public listing**

In each event year, firms in the bottom quartile of the cumulative net-debt issue frequency distribution shown in Table 2 are classified as low-frequency issuers or LFIs, while high-frequency issuers (HFIs) are in the top quartile. The issue frequency classification uses the 2.5% issue-size threshold. Year 0 is the year of public listing. The table lists the average annual values, scaled by total book value of assets (when relevant), of the market leverage ratio (L), the book leverage ratio (BL), the fraction of firms that are all-equity financed firms (AE, defined as zero-leverage firms), the cash ratio (C), the book asset value ($Assets$) itself, the operating profitability ($Prof$), asset tangibility (Tan), Tobin's Q (Q), $R\&D$ expenditures, dividend payouts (Div), capital expenditures ($Capex$), asset growth rate (g_A) and sales growth rate (g_S). Variable definitions are in Appendix Tables 1 and 2. Sample of 12,131 U.S. public firms, 1971-2012.

Year	L (1)	BL (2)	AE (3)	C (4)	$Assets$ (5)	$Prof$ (6)	Tan (7)	Q (8)	$R\&D$ (9)	Div (10)	$Capex$ (11)	g_A (12)	g_S (13)
A: High frequency issuers (HFIs)													
0	0.26	0.34	0.01	0.19	294	-0.01	0.33	2.56	0.04	0.01	0.14	n.A.	n.A.
1	0.30	0.33	0.01	0.13	276	-0.02	0.34	2.16	0.05	0.00	0.12	0.44	1.92
2	0.39	0.40	0.00	0.09	391	0.02	0.37	1.79	0.03	0.00	0.11	0.38	0.68
3	0.38	0.37	0.01	0.09	392	0.03	0.36	1.72	0.03	0.00	0.09	0.30	1.62
4	0.37	0.35	0.02	0.10	404	0.04	0.35	1.69	0.03	0.00	0.08	0.23	0.36
5	0.41	0.39	0.01	0.08	500	0.05	0.37	1.55	0.03	0.00	0.09	0.22	0.32
6	0.39	0.37	0.02	0.08	512	0.05	0.37	1.57	0.03	0.01	0.08	0.18	0.18
7	0.41	0.40	0.02	0.07	581	0.06	0.38	1.56	0.02	0.01	0.09	0.79	0.20
8	0.39	0.37	0.02	0.08	581	0.06	0.38	1.63	0.02	0.01	0.09	0.15	0.35
9	0.39	0.36	0.02	0.08	877	0.06	0.37	1.52	0.02	0.01	0.08	0.17	0.20
10	0.38	0.37	0.01	0.08	960	0.06	0.38	1.60	0.02	0.01	0.08	0.15	0.14
15	0.35	0.32	0.01	0.08	1,540	0.08	0.35	1.47	0.02	0.01	0.07	0.13	0.12
20	0.31	0.31	0.02	0.06	2,469	0.09	0.36	1.50	0.02	0.01	0.07	0.08	0.07
Mean	0.35	0.35	0.01	0.10	804	0.03	0.36	1.80	0.03	0.01	0.10	0.27	0.72
B: Low frequency issuers (LFIs)													
0	0.11	0.14	0.21	0.33	181	0.01	0.23	3.17	0.06	0.01	0.08	n.A.	n.A.
1	0.11	0.11	0.28	0.31	206	-0.02	0.22	2.70	0.08	0.00	0.08	0.25	0.94
2	0.10	0.09	0.33	0.31	236	-0.02	0.22	2.55	0.09	0.01	0.06	0.20	1.02
3	0.09	0.08	0.39	0.33	256	0.00	0.21	2.54	0.10	0.01	0.05	0.18	0.60
4	0.07	0.06	0.45	0.34	281	0.01	0.20	2.51	0.10	0.01	0.05	0.16	0.33
5	0.12	0.11	0.30	0.28	311	0.02	0.22	2.27	0.08	0.01	0.06	0.18	0.28
6	0.11	0.10	0.34	0.28	368	0.03	0.22	2.28	0.08	0.01	0.06	0.17	0.35
7	0.10	0.09	0.37	0.29	428	0.04	0.21	2.26	0.09	0.01	0.05	0.17	0.39
8	0.08	0.08	0.39	0.31	468	0.04	0.21	2.23	0.09	0.01	0.05	0.19	0.20
9	0.08	0.07	0.42	0.31	387	0.04	0.20	2.19	0.09	0.01	0.05	0.09	0.13
10	0.06	0.06	0.44	0.32	406	0.05	0.20	2.27	0.08	0.01	0.05	0.10	0.99
15	0.06	0.06	0.44	0.29	451	0.06	0.22	2.14	0.08	0.01	0.05	0.09	0.11
20	0.06	0.07	0.42	0.28	459	0.08	0.23	2.17	0.07	0.02	0.05	0.09	0.08
Mean	0.10	0.10	0.32	0.31	345	0.02	0.22	2.56	0.08	0.01	0.06	0.17	0.53

Table 5: Net-debt issue hazards and the probability of becoming a high-frequency issuer

Panel A presents coefficient-estimates determining the probability of becoming a HFI T years following public listing (year 0) conditional on the year-0 covariates:

$$Y_{iT} = \alpha + \beta X_{i,0} + \epsilon_{iT},$$

where $Y_{iT} = 1$ if firm i is classified as a HFI in T years, $T = 3, 6, 9, 12, 15$. Panel B presents coefficient estimates determining the number of years between successive net-debt issues (financing spells) for LFIs and HFIs, respectively, using the following exponential shared frailty hazard model:

$$h_i = h_0 \exp(\beta_0 + \beta x_{i,t-1})\alpha_i,$$

where h_0 denotes a constant baseline hazard, and α_i is a frailty term capturing unobserved observation-specific effects. Panel C allows a time-varying baseline hazard by extending the hazard model

$$h_i = h_0 \exp(\beta_0 + \beta x_{i,t-1} + \gamma f(t))\alpha_i$$

where $f(t) = t + t^2 + t^3$. The covariates are investment (*Capex*), R&D expenditures (*R&D*), market leverage ratio (L), cash ratio (C), logarithm of assets (*Size*), operating cash flow (*Prof*), tangibility (*Tan*), Tobin's Q (Q) and depreciation expenditures (*Depr*). In Panel A, the estimation includes industry dummies, based on the Fama-French 12 Industry Classification. In Panel B and C, the covariates $x_{i,t-1}$ enter subtracting their median values. All covariates are winsorized at the 1(99) percent level or must lie between zero and one (cash ratio and leverage). The high and low-frequency classification (HFI and LFI) is performed annually and based on a 2.5% issue size threshold. Variable definitions are in Appendix Tables 1 and 2. *, ** indicate significance at the 5% and 1% level, respectively. Sample of 12,131 U.S. public firms, 1971-2012.

		Firm-specific explanatory variables (X)								
	N	*Capex*	*R&D*	*L*	C	*Size*	*Prof*	*Tan*	*Q*	*Depr*
A: Probability of becoming HFI T years from public listing (X measured in year 0): $Y_{iT} = \alpha + \beta X_{i,0} + \epsilon_{iT}$										
$T = 3$ years	7,918	2.658**	-1.180**	0.321**	-1.245**	-0.013	-0.813**	-0.056	-0.022**	-2.345**
$T = 6$ years	5,046	2.509**	-1.359**	0.489**	-1.248**	-0.038**	-0.854**	-0.176	-0.031**	-1.157
$T = 9$ years	3,345	2.426**	-1.632**	0.653**	-1.375**	-0.036*	-0.961**	-0.245	-0.027*	-0.475
$T = 12$ years	2,307	2.215**	-2.324**	0.842**	-1.280**	-0.050**	-1.133**	-0.176	-0.029	-1.946
$T = 15$ years	1,549	2.103**	-2.310**	1.037**	-1.352**	-0.048	-0.653*	-0.375	-0.009	-1.768
B: Time between net-debt issues,with constant baseline hazard: $h_i = h_0\mathbf{exp}(\beta_0 + \beta x_{i,t-1})\alpha_i$										
LFI only	29,421	13.652**	1.412	0.338**	0.055**	1.039*	0.375**	0.702	1.02	0.183
HFI only	28,346	14.765**	1.113	0.567**	0.446**	1.007	0.705**	0.767**	0.997	0.033**
C: Time between net-debt issues, with time-varying baseline hazard: $h_i = h_0\mathbf{exp}(\beta_0 + \beta x_{i,t-1} + \gamma f(t))\alpha_i$										
LFI only	29,421	15.159**	1.243	0.486**	0.056**	1.034	0.363**	0.72	1.027	0.160*
HFI only	28,162	3.081**	0.914	0.410**	0.619**	0.999	0.887*	0.962	0.984**	0.159**

Table 6: Fixed-cost estimation using underwriter fees in public debt issues

The table displays parameter estimates for the direct issue cost function

$$s = \beta_0 + \beta_1 \frac{1}{x_1} + \beta_2 \frac{x_1}{x_2} + \gamma X + \epsilon,$$

where s is underwriter spread, x_1 is offering proceeds, x_2 is issuer's total equity value. The coefficient β_1 represents the fixed issue-cost component, β_0 is the variable cost component, while β_2 represents a quadratic cost component. The vector X of firm-specific control variables contains five ratings dummies for debt issues (AAA, A, BBB, BB, and B-CCC), the lagged ratio of operating cash flow to total assets, the lagged book leverage ratio, a lagged market-to-book ratio and an issue wave variable. Issue wave is constructed the difference between the annual aggregate net debt issue volume and the aggregate book value of assets, standardized by its total sample mean and standard deviation. Firms with at most two public debt issues in the sample are labeled low-frequency public debt issuers (LFPI), while firms with at least four sample debt issues are labeled high-frequency (HFPI). Standard errors in parentheses. Variable definitions are in Appendix Tables 1 and 2. *, ** indicate significance at the 5% and 1% level, respectively. Sample of 3,773 public debt issues, 1980-2012.

A: Issue cost components by absolute public debt issue frequency (LFPIs and HFPIs)

	Total	LFPI		HFPI	
Issue cost parameter	sample	$\sum DI = 1$	$\sum DI \leq 2$	$\sum DI \geq 4$	$\sum DI \geq 11$
Fixed-cost component (β_1)	24.915**	48.722**	44.827**	10.644**	4.256
	(3.42)	(7.03)	(5.95)	(3.48)	(3.72)
Variable cost component (β_0)	2.157**	2.290**	2.449**	1.704**	1.633**
	(0.10)	(0.26)	(0.20)	(0.10)	(0.12)
Quadratic-cost component (β_2)	0.210**	0.103*	0.124*	0.734**	0.708*
	(0.08)	(0.05)	(0.05)	(0.11)	(0.33)
Firm controls	yes	yes	yes	yes	yes
R2	0.672	0.774	0.767	0.457	0.241
Number of debt issues	3774	513	897	2622	1331
Number of issuing firms	1075	513	705	285	66

B: Issue cost components by age of low-frequency public debt issuers (LFPIs)

	$\sum DI = 1$			$\sum DI \leq 2$		
Issue cost parameter	Age > 3	Age > 6	Age > 9	Age > 3	Age > 6	Age > 9
Fixed-cost component (β_1)	45.043**	42.873**	37.535**	41.224**	39.899**	35.637**
	(7.30)	(8.66)	(9.12)	(6.15)	(6.93)	(7.28)
Variable cost component (β_0)	2.220**	2.368**	2.397**	2.310**	2.341**	2.396**
	(0.30)	(0.33)	(0.34)	(0.24)	(0.26)	(0.26)
Quadratic-cost component (β_2)	0.081	0.059	0.265*	0.105*	0.093	0.275**
	(0.05)	(0.07)	(0.11)	(0.05)	(0.08)	(0.09)
Firm controls	yes	yes	yes	yes	yes	yes
R2	0.798	0.804	0.834	0.784	0.784	0.808
N	406	330	275	738	620	527

Table 7: Financial constraint scores for high- and low-frequency debt issuers

In each event year, firms in the bottom quartile of the cumulative net-debt issue frequency distribution shown in Table 2 are classified as low-frequency issuers or LFIs, while high-frequency issuers (HFIs) are in the top quartile. The issue frequency classification uses the 2.5% issue-size threshold. Year 0 is the year of public listing. The financial constraint scores are the *KZ-index* (Kaplan and Zingales, 1997), the *WW-index* (Whited and Wu, 2006), and the *SA-index* (Hadlock and Pierce, 2010). Variable definitions are in Appendix Tables 1 and 2. Sample of 12,131 U.S. public firms, 1971-2012.

	KZ-index		WW-index		SA-index	
Year	LFI	HFI	LFI	HFI	LFI	HFI
0	0.54	1.24	n.a.	n.a.	-1.92	-1.95
1	0.56	1.33	-0.19	-0.23	-2.02	-2.07
2	0.42	1.47	-0.21	-0.21	-2.11	-2.26
3	0.30	1.33	-0.20	-0.25	-2.21	-2.33
4	0.18	1.22	-0.20	-0.21	-2.29	-2.41
5	0.32	1.32	-0.20	-0.23	-2.37	-2.53
6	0.24	1.24	-0.22	-0.23	-2.45	-2.60
7	0.13	1.30	-0.22	-0.25	-2.53	-2.75
8	0.02	1.25	-0.22	-0.25	-2.60	-2.79
9	-0.05	1.19	-0.22	-0.25	-2.66	-2.84
10	-0.13	1.25	-0.25	-0.25	-2.73	-2.94
15	-0.21	1.02	-0.25	-0.29	-3.00	-3.27
20	-0.42	0.96	-0.27	-0.30	-3.32	-3.56
Avg.	0.28	1.24	-0.22	-0.25	-2.34	-2.56

Table 8: Average annual corporate funding mix following public listing

In each event year, firms in the bottom quartile of the cumulative net-debt issue frequency distribution shown in Table 2 are classified as low-frequency issuers or LFIs, while high-frequency issuers (HFIs) are in the top quartile. The issue frequency classification uses the 2.5% issue-size threshold. Year 0 is the year of public listing. The annual (non-negative) cash contribution of the i'th funding source is the ratio $R_j \equiv S_j / \sum_i^7 S_i$, where the denominator is the sum of the seven individual funding sources in the firm's total cash flow statement:

$$\sum_i^7 S_i = NDI^+ + EI + CF^+ + \Delta C^- + \Delta W^- + I^- + O^+$$

The four columns are: R_{NDI^+} is the net debt issue ratio (NDI^+ in the numerator), R_{EI} is the equity issue ratio, R_{CF^+} is the operating cash flow contribution, $R_{\Delta C^-}$ is the contribution from cash draw-downs, $R_{\Delta W^-}$ is contribution of reductions in net working capital and R_{I^-} is the fraction of funds provided by illiquid asset sales. Variable definitions are in Appendix Tables 1 and 2. Sample of 12,131 U.S. public firms, 1971-2012.

	R_{NDI^+}		R_{EI}		R_{CF^+}		$R_{\Delta C^-}$		$R_{\Delta W^-}$		R_{I^-}		R_{O^+}	
Year	HFI	LFI	HFI	LFI	HFI	LFI	HFI	LFI	HFI	LFI	HFI	LFI	HFI	LFI
0	0.33	0.00	0.36	0.60	0.21	0.27	0.02	0.03	0.04	0.04	0.03	0.04	0.01	0.01
1	0.31	0.01	0.13	0.17	0.29	0.40	0.12	0.20	0.07	0.10	0.07	0.12	0.01	0.01
2	0.35	0.01	0.12	0.16	0.31	0.42	0.06	0.14	0.08	0.11	0.07	0.15	0.01	0.01
3	0.27	0.01	0.12	0.14	0.36	0.44	0.06	0.14	0.09	0.10	0.09	0.16	0.01	0.01
4	0.23	0.00	0.11	0.14	0.40	0.44	0.06	0.14	0.10	0.09	0.09	0.17	0.01	0.01
5	0.25	0.04	0.10	0.13	0.40	0.46	0.05	0.12	0.09	0.10	0.09	0.14	0.01	0.01
6	0.23	0.04	0.09	0.13	0.42	0.46	0.06	0.12	0.09	0.09	0.10	0.15	0.01	0.01
7	0.25	0.03	0.09	0.12	0.42	0.47	0.04	0.11	0.08	0.09	0.10	0.15	0.01	0.01
8	0.21	0.03	0.10	0.12	0.44	0.47	0.05	0.11	0.10	0.08	0.10	0.17	0.01	0.01
9	0.21	0.03	0.08	0.10	0.44	0.47	0.05	0.11	0.11	0.10	0.09	0.18	0.01	0.01
10	0.21	0.01	0.11	0.11	0.46	0.48	0.04	0.14	0.08	0.08	0.10	0.17	0.01	0.01
15	0.18	0.04	0.08	0.09	0.47	0.45	0.05	0.13	0.11	0.08	0.10	0.20	0.01	0.01
20	0.17	0.05	0.05	0.08	0.50	0.49	0.06	0.11	0.11	0.09	0.11	0.17	0.01	0.01
Mean	0.26	0.02	0.13	0.24	0.38	0.41	0.06	0.11	0.08	0.08	0.09	0.13	0.01	0.01
Median	0.19	0.00	0.01	0.04	0.36	0.35	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Funding source standardization by lagged total assets														
Mean	0.11	0.01	0.11	0.22	0.11	0.12	0.02	0.04	0.03	0.03	0.03	0.07	0.00	0.01
Median	0.03	0.00	0.00	0.01	0.09	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 9: Leverage ratio instability and volatility following public listing

In each event year, firms in the bottom quartile of the cumulative net-debt issue frequency distribution shown in Table 2 are classified as low-frequency issuers or LFIs, while high-frequency issuers (HFIs) are in the top quartile. The issue frequency classification uses the 2.5% issue-size threshold. Year 0 is the year of public listing. *Leverage instability* is fraction of firms for which the leverage ratio change from year 0 to year t exceeds +/− 20 percentage points ($|L_t - L_0| > 0.2$) and leverage volatility is the average standard deviation of the firm-level leverage ratio up to year t using a minimum of five yearly observations. Net leverage is gross leverage net of cash balances. Panel A works with actual leverage ratios, while Panel B works with estimated target leverage ratios: $L^*_{i,t}(\beta X_{i,t-1})$, where the determinants $X_{i,t-1}$ are the lagged values of size, profitability, Q, cash ratio, tangibility, depreciation, R&D expenses, capital expenditures and the median industry leverage ratio (all winsorized at the 1(99) percent level). Variable definitions are in Appendix Tables 1 and 2. Sample of 12,131 U.S. public firms, 1971-2012.

	Fraction of leverage instability $\lvert(L_t - L_0)\rvert > 0.2$				Average leverage volatility $\frac{1}{T}\sum_\tau (L_\tau - \bar{L})^2$			
	Gross leverage		Net leverage		Gross leverage		Net leverage	
Year	LFI	HFI	LFI	HFI	LFI	HFI	LFI	HFI
A: Actual leverage ratios								
0	n.A.	n.A.	n.A.	n.A.	n.A.	n.A.	n.A.	n.A.
1	0.06	0.24	0.20	0.31	n.A.	n.A.	n.A.	n.A.
2	0.09	0.45	0.30	0.49	n.A.	n.A.	n.A.	n.A.
3	0.09	0.45	0.35	0.51	n.A.	n.A.	n.A.	n.A.
4	0.09	0.46	0.35	0.52	n.A.	n.A.	n.A.	n.A.
5	0.16	0.50	0.38	0.55	0.08	0.17	0.20	0.20
6	0.16	0.49	0.39	0.56	0.07	0.17	0.20	0.20
7	0.15	0.50	0.39	0.57	0.07	0.17	0.19	0.19
8	0.14	0.48	0.41	0.55	0.07	0.17	0.20	0.19
9	0.13	0.47	0.41	0.53	0.06	0.16	0.20	0.19
10	0.12	0.44	0.36	0.52	0.06	0.16	0.19	0.19
15	0.16	0.46	0.43	0.52	0.07	0.16	0.19	0.18
20	0.20	0.44	0.37	0.47	0.08	0.17	0.18	0.19
Avg.	0.10	0.38	0.26	0.43	0.08	0.16	0.19	0.19
B: Target leverage ratios								
0	n.A.	n.A.	n.A.	n.A.	n.A.	n.A.	n.A.	n.A.
1	0.00	0.00	0.00	0.00	n.A.	n.A.	n.A.	n.A.
2	0.01	0.01	0.00	0.01	n.A.	n.A.	n.A.	n.A.
3	0.02	0.04	0.01	0.03	n.A.	n.A.	n.A.	n.A.
4	0.03	0.06	0.02	0.05	n.A.	n.A.	n.A.	n.A.
5	0.04	0.09	0.03	0.09	0.06	0.06	0.05	0.06
6	0.05	0.10	0.03	0.09	0.06	0.06	0.05	0.06
7	0.05	0.12	0.04	0.11	0.06	0.06	0.05	0.06
8	0.05	0.10	0.03	0.12	0.05	0.06	0.05	0.06
9	0.05	0.12	0.04	0.10	0.05	0.06	0.05	0.06
10	0.05	0.10	0.04	0.10	0.05	0.06	0.05	0.06
15	0.06	0.11	0.07	0.11	0.06	0.06	0.05	0.06
20	0.06	0.11	0.07	0.14	0.05	0.06	0.06	0.07
Avg.	0.03	0.06	0.02	0.06	0.06	0.06	0.05	0.06

Table 10: Speed of leverage ratio adjustments to target leverage deviations

The table reports estimates of the speed-of-adjustment coefficient ϕ in the regression:

$$L_{i,t} - L_{i,t-1} = \alpha + \eta_i + \phi\left(L^*_{i,t}(\beta X_{i,t-1}) - L_{i,t-1}\right) + \epsilon_{i,t}.$$

where the dependent variable is firm i's change in market leverage ratio L from time $t-1$ to t, $\epsilon_{i,t}$ is the regression error term, α is the constant, η_i is firm fixed effect, $L^*_{i,t}(\beta X_{i,t-1})$ is the (estimated) target leverage ratio where the determinants $X_{i,t-1}$ are the lagged values of size, profitability, Q, cash ratio, tangibility, depreciation, R&D expenses, capital expenditures and the median industry leverage ratio (all winsorized at the 1(99) percent level). Coefficients are estimated using system GMM, implemented using the stata command xtabond2, assuming that all regressors are predetermined. We use a maximum number of lags of 3 (5) for market leverage (target leverage ratio regressors). Variable definitions are in Appendix Tables 1 and 2. *, ** indicate significance at the 5% and 1% level, respectively. Total sample of 10,783 U.S. public firms and 80,900 firm-years, 1971-2012.

	GMM estimates of ϕ			
Dependent variable	All	HFI	LFI	HFI - LFI
Market leverage change	0.259**	0.316**	0.272**	0.044
	(0.009)	(0.014)	(0.020)	(z-score: 1.793)

Table 11: Association between net-debt issue size, capex, and financing deficit for HFIs

The table reports coefficient estimates using the following regression:

$$\frac{NDI_{i,t}}{A_{i,t}} = \alpha + \beta_1 Capex_{i,t} + \beta_2 NetDeficit_{i,t} + \beta_3 Capex^2_{i,t} + \beta_4 NetDeficit^2_{i,t} + \epsilon_{i,t}.$$

where NDI/A is net-debt issues (or retirements) scaled by total assets, and $Capex$ and $NetDeficit$ are capital expenditures and the financing deficit net of $Capex$, respectively, also scaled by total assets. $NetDeficit \equiv dv + aqc + ivch - siv - ivstch - sppe - ivaco - oancf + chech$, where all Compustat mnemonics are scaled by total assets. Variable definitions are in Appendix Tables 1 and 2. Standard errors in parentheses, *, ** indicate significance at the 5% and 1% level, respectively. Total sample of 6,684 U.S. public firms and 31,449 firm-years, 1971-2012.

	(1)	(2)	(3)	(4)
$Capex$	0.334**	0.518**	0.589**	0.567**
	(0.01)	(0.01)	(0.02)	(0.02)
$NetDeficit$		0.354**	0.599**	0.598**
		(0.01)	(0.01)	(0.01)
$Capex^2$			0.149**	0.164**
			(0.04)	(0.04)
$NetDeficit^2$			-0.485**	-0.474**
			(0.01)	(0.01)
α	0.032**	0.004**	0.014**	0.022*
	(0.00)	(0.00)	(0.00)	(0.01)
Industry	no	no	no	yes
Age	no	no	no	yes
N	31449	31449	31449	31449
R^2	0.06	0.40	0.53	0.54

Table 12: Transitory debt issues as a determinant of leverage reductions for HFIs

Panel A presents coefficient-estimates determining the probability that a transitory net debt issue in period $t-1$, $TNDI_{i,t-1}$, is followed in year t by, alternatively, a decrease in leverage (Panel A), a net-debt retirement exceeding 2.5% of total assets (Panel B), or a net equity issue exceeding 2.5% (Panel C). The logit model is:

$$Y_{i,t} = \alpha + \beta TNDI_{i,t-1} + \gamma Ecapex_{i,t} + \delta Dev_{i,t} + \epsilon_{i,t},$$

where $Y_{i,t} = 1$ is the binary dependent variable for firm i in year t. Moreover, $Dev_{i,t} = L_{i,t-1} - L^*_{i,t}(\beta X_{i,t-1})$ is the deviation of the optimal leverage ratio at the beginning of year t from last period's actual leverage ratio, where $L^*_{i,t}(\beta X_{i,t-1})$ is estimated as in Table 10 above. The variable $Ecapex_{i,t-1}$ is the capital expenditure in period $t-1$ in excess of firm i's industry median capex. Finally, $TNDI_{i,t-1}$ is a dummy variable for transitory debt issues: it is equal to one if, in period $t-1$, the following three conditions are fulfilled: the firm (1) issued net-debt in excess of 2.5% of total assets ($NDI_{i,t-1} > 0$), (2) invested heavily ($Ecapex_{i,t-1} > 0$), and (3) was over-leveraged ($Dev_{i,t-1} > 0$). The estimation also includes industry dummies, based on the Fama-French 12 Industry Classification. The HFI classification is performed annually and based on a 2.5% issue size threshold. Variable definitions are in Appendix Tables 1 and 2. Standard errors in parentheses, *, ** indicate significance at the 5% and 1% level, respectively. Total sample of 6,684 U.S. public firms and 31,449 firm-years, 1971-2012.

Sample	Explanatory variables		
with Y=1	$TNDI_{t-1}$	$Ecapex_t$	Dev_t
A: Y=1 if leverage reduction			
10,843	0.738**	-2.910**	
	(0.05)	(0.21)	
10,843	0.211**	-1.214**	6.113**
	(0.05)	(0.23)	(0.13)
B: Y=1 if net-debt retirement			
6,291	0.438***	-6.063***	
	(0.05)	(0.29)	
6,291	-0.013	-4.610***	5.024***
	(0.06)	(0.29)	(0.13)
C: Y=1 if net equity issue			
7,633	0.346**	1.634**	
	(0.06)	(0.24)	
7,633	0.423**	1.413**	-0.766**
	(0.06)	(0.24)	(0.14)

Table 13: **CEO stock ownership and stock-based pay at HFIs and LFIs**

The table estimates the impact of issue frequency on compensation policy

$$Y_{i,t} = \alpha + \beta_1 HFI_{i,t} + \beta_2 LFI_{i,t} + \gamma X_{i,t-1} + \gamma_i + \epsilon_{i,t},$$

where γ_i is firm-fixed effect, and the control variables X (lagged by one period) include investment *Capex*, R&D expenditures (*R&D*), the cash ratio (C), the logarithm of assets ($Size$), operating cash flow ($Prof$), tangibility (Tan), Tobin's Q (Q), and depreciation expenditures (*Depr*). In the first row, the dependent variable Y is the percentage of firm's outstanding share owned by the executive. In the second row, the dependent variable is the proportion of total CEO compensation that is paid in (restricted) stocks and option. Compensation data are from ExecutComp, 1992-2012. Variable definitions are in Appendix Tables 1 and 2. Standard errors in parentheses, *, ** indicate significance at the 5% and 1% level, respectively. Total sample of 1,659 U.S. public firms and 13,907 firm-years, 1971-2012.

Dependent var. (Y)	HFI	LFI	$Capex$	$R\&D$	C	$Size$	$Prof$	Tan	Q	$Depr$	R^2	Firm-years
Shares owned	0.009*	-0.012**	0.035	-0.029	-0.008	-0.017**	0.009	0.005	0.001	-0.11	0.073	9484
	(0.00)	(0.00)	(0.02)	(0.02)	(0.01)	(0.00)	(0.01)	(0.02)	(0.00)			
Fraction stock	0.034**	-0.009	0.170*	-0.056	-0.068	0.029**	0.081	-0.078	0.018**	-0.025	0.012	13626
	(0.01)	(0.01)	(0.08)	(0.11)	(0.04)	(0.01)	(0.05)	(0.06)	(0.00)			

Appendix Table 1: Variable construction using Compustat mnemonics

Variable	Description (Compustat mnemonics)	Mean	Median	St.Dev.
I: Selected firm characteristics (All Financial Statements)				
ML	*Market leverage*: (dlcc + dlt)/(prcc_f*csho + dlcc + dlt)	0.22	0.13	0.24
BL	*Book leverage*: (dlcc + dlt)/at	0.22	0.17	0.21
C	*Cash ratio*: che/at	0.20	0.10	0.23
Size	log(at)	4.24	4.15	1.89
Prof	*Profitability*: (oancf + nwc_inv)/at	0.03	0.09	0.23
Tan	*Tangibility*: ppent/at	0.28	0.22	0.23
Q	*Tobin's Q*: (lt + pstkl - txditc + prcc_f*csho)/at	2.13	1.45	1.99
R&D	xrd/at	0.05	0.00	0.11
Div	dv/at	0.01	0.00	0.02
Capex	capx/at	0.07	0.05	0.08
Depr	dp/at	0.05	0.04	0.04
Tldt	dltt/at	0.16	0.09	0.18
KZ	-1.001909 × Prof + 3.139193 × L - 39.36780 × Div - 1.314759 × C + 0.2826389 × Q	0.71	0.71	1.20
WW[a]	-0.091 × Prof - 0.062 × Divpos + 0.021 × Tldt - 0.044 × Size + 0.102 × ISG - 0.035 × g_S	-0.23	-0.22	0.59
SA	-0.737 × Size + 0.043 × Size^2 - 0.04 × Age	-2.50	-2.58	0.83
II: Sources of funds (Cash Flow Statement)				
EI	*Equity Issues*: sstk	14.6	0.4	95.5
DI	*Debt Issues*: dltis + max[dlcch,0]	68.9	0.4	590.6
CF^+	*Positive operating Cash Flow*: max[oancf + nwc_inv,0]	69.3	4.4	600.5
ΔC^-	*Draw-down of Cash balance*: max[chech*(-1),0]	7.1	0.0	78.4
I^-	*Asset sales*: siv + min[ivstch,0] + min[ivaco,0] + sppe	29.6	0.1	577.8
ΔW^-	*Decrease in net Working capital*: max[nwc_inv*(-1),0]	5.5	0.0	52.5
O^+	*Other sources*: max[fincf_oth,0]	2.1	0.0	31.3
III: Uses of funds (Cash Flow Statement)				
ER	*Distributions to equity-holders*: dv + prstkc	22.1	0.0	246.7
DR	*Debt Retirements*: dltr + min[dlcch,0]*(-1)	56.7	0.9	533.8
CF^-	*Negative operating Cash Flow*: max[(oancf + nwc_inv)*(-1),0]	2.8	0.0	31.9
ΔC^+	*Build-up of Cash balance*: max[chech,0]	12.9	0.0	113.3
I^+	*Investments*: ivch + aqc + min[ivstch*(-1),0] + min[ivaco*(-1),0] + capx	88.6	6.1	919.7
ΔW^+	*Increase in net Working capital*: max[nwc_inv,0]	10.8	0.5	103.4
O^-	*Other uses*: max[fincf_oth*(-1),0]	3.2	0.0	85.6
IV: Composite Variables (Cash Flow Statement)				
NDI	*Debt issue minus debt retirement*: DI - DR	12.2	0.0	229.1
NDI^+	*Positive portion of debt issue minus debt retirement*: max[DI - DR,0]	22.1	0.0	200.0
NDI^-	*Negative portion of debt issue minus debt retirement*: max[DR - DI,0]	10.0	0.0	109.6
$NetDeficit$	(dv + aqc + ivch - siv - ivstch - sppe - ivaco - oancf + chech)/at	0.04	-0.03	0.41
V: Compensation Variables (ExecuComp)				
SO	*CEO stock ownership*: max[shrown_tot_pct,shrown_excl_opts_pct]	0.05	0.02	0.08
CEO_cash	Salary + bonus + ltip + othcomp	1166.7	786.9	2027.7
CEO_stock	rstkgrnt	218.4	0.0	5645.7
CEO_opt	option_awards_blk_value	1710.4	390.9	8163.3
FS	*Fraction stock*: (CEO_stock + CEO_opt)/(CEO_cash + CEO_stock + CEO_opt)	0.36	0.37	0.31

[a] Divpos is a dummy variable equal to one in case the firm paid dividends, ISG is industry sales growth (defined using 3-digit SIC codes) and g_S is sales growth.

Appendix Table 2: Compustat mnemonics used for variable construction

Variable	Description (Compustat mnemonics)	Mean	Median	St.Dev.
I: Compustat balance sheet items				
che	Cash and cash equivalents	63.6	5.7	511.9
ppent	Property, plant and equipment (net of depreciation)	209.8	12.1	1805.8
at	Total assets	593.0	63.7	4281.7
dlc	Debt in current liabilities	19.6	0.8	195.5
dltt	Long-term debt	142.1	3.0	1010.7
lt	Tota liabilities	334.4	23.7	2494.0
pstkl	Preferred stock liquidation value	3.4	0.0	62.1
txditc	Deferred taxes and investment tax credit	30.5	0.0	465.6
prcc_f	Stock price	13.7	8.5	19.7
csho	Common shares outstanding	30.4	9.1	153.8
II: Compustat income statement items				
sale	Revenues	601.6	66.6	5166.3
xrd	Research and development expenditures	11.0	0.0	112.5
dp	Depreciation expenses (Income statement)	28.9	2.4	249.1
III: Compustat cash flow statement statement items				
ibc	Income Before Extraordinary Items	22.9	1.2	376.9
dpc	Depreciation and Amortization	31.3	2.5	275.5
ocf_oth[a]	Other Operating Cash Flow (= xidoc + txdc +esubc + sppiv + fopo + fsrco + exre)	12.2	0.4	225.3
nwc_inv[b]	Investment into Net Working Capital [= (recch + invch + apalch + txach + aoloch)*(-1)]	5.3	0.5	116.5
oancf	ibc + dpc + ocf_oth + nwc_inv	61.2	2.6	577.5
capx	Capital Expenditures	40.9	3.0	327.1
aqc	Acquisitions	16.0	0.0	173.5
ivch	Increase in Investments	23.1	0.0	728.7
siv	Sale of Investments	20.4	0.0	567.5
sppe	Sale of Property, Plant and Equipment	2.2	0.0	40.8
ivstch	Short-term Investments - Change	-1.5	0.0	76.8
ivaco[c]	Investing Activities - Other	-0.1	0.0	132.5
inv_total	capx + aqc + ivch - siv - sppe - ivstch - ivaco	58.9	4.1	482.5
sstk	Sale of Common and Preferred Stock	14.6	0.4	95.5
prstkc	Purchase of Common and Preferred Stock	13.6	0.0	175.4
dv	Cash Dividends	8.5	0.0	110.0
dltis	Long-Term Debt - Issuance	66.2	0.0	580.9
dltr	Long-Term Debt - Reduction	54.2	0.7	524.1
dlcch	Changes in Current Debt	0.2	0.0	81.0
fincf_oth[d]	Other Financing Cash Flow [= (txbcof + fiao)]	-1.1	0.0	90.5
fin_total	sstk + prstkc + dv + dltis + dltr + dlcch + fincf_oth	3.5	0.4	295.1
chech	Change in cash and cash equivalents	5.8	0.0	138.5
IV: ExecuComp items				
shrown_excl_opts_pct	Percentage shares owned excluding options	4.7	1.3	8.3
shrown_tot_pct	Percentages shares owned (total)	4.5	1.7	8.6
salary	Salary	577.1	511.5	326.7
bonus	Bonus	359.4	90.0	993.2
ltip	Long-term incentive plan	44.4	0.0	481.2
othcomp	Other compensation	185.8	26.6	1342.2
rstkgrnt	Restricted stock grants	336.7	0.0	7007.1
option_awards_blk_value[e]	Options granted (Black Scholes)	2059.3	473.9	9826.6

[a] ocf_{oth} is the sum of extraordinary items and discontinued operations (xidoc), deferred taxes (txdc), equity in net loss (esubc), loss from sale of PPE and investments (sppiv), funds from operations–other (fopo), other sources of funds (fsrco) and exchange rate effects (exre). The item fsrco is 0 if the company reports according to format code 7 (scf=7), exre is zero in case of format codes scf=1, 2 or 3.

[b] nwc_{inv} is constructed as follows: For format code 7, it is the sum of (multiplied by minus 1) accounts receivable-decrease (recch), inventory-decrease (invch), accounts payable and accrued liabilities-increase (apalch), income taxes-accrued-increase (txach), assets and liabilities-other (aoloch). For format code 1, it is the variable wcapc. In case of format codes 2 and 3, it is $wcapc * (-1)$.

[c] ivaco is replaced by fuseo*(-1) in case of format codes 1, 2 or 3.

[d] $fincf_{oth}$ is the sum of excess tax benefits of stock options (txbcof) and other financing activities (fiao).

[e] option_awards_blk_value is replaced with option_awards_rpt_value and then with option_awards_fv in case the information is missing.