Why Do Financially Unconstrained Firms Borrow to Repurchase Shares?

Daniel Gyimah
University of Aberdeen

Antonios Siganos
University of Glasgow

Chris Veld*
Monash University

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Abstract

We study the impact of financial constraints on cross-market arbitrage. We find that financially constrained firms are more likely to conduct debt-financed share repurchases. Such repurchases tend to reduce investments and increase financial distress risks, especially when financially constrained firms are over-leveraged. Less financially constrained firms instead tend to conduct debt-financed repurchases only when debt market conditions are favourable. Moreover, less financially constrained firms tend to issue overvalued debt to fund the repurchase of undervalued equity. These results are in line with the cross-market arbitrage hypothesis according to which firms fund repurchases during good debt market conditions even though internal funding is available.

Keywords: Debt-financed share repurchases, financial constraints, debt market conditions, equity undervaluation, investment expenditures

JEL classification: G03, G30, G31, G32.

* Corresponding author: Monash Business School, Monash University, 900 Dandenong Road, 3145 Caulfield East, Melbourne, Australia, tel: +61399034142, email: chris.veld@monash.edu The authors are grateful to Seth Armitage, Vidhan Goyal, Yulia Merkoulova, Patrick Verwijmeren, and Betty Wu for helpful comments and suggestions. Special thanks go to two anonymous referees and to Alan Lowe and Nathan Joseph, the editors, for their very helpful comments.

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1. Introduction

During the last few decades, share repurchases have become popular as a means to return cash to shareholders. In 2007 alone, share repurchases peaked at more than $700 billion near the market top.[1] Data from J.P. Morgan and Bloomberg showed that in 2016 S&P500 firms issued new debt to fund 39% of over $536.4 billion of share repurchases. A case in point is Home Depot, which has been buying back a large amount of stocks for several years. In February 2019 they announced a $15 billion stock buyback, which led CNBC reporter Bob Pisani to call the company part of the group of "buyback monsters".[2]

A large body of empirical evidence posits that firms repurchase undervalued shares (Ikenberry and Vermaelen, 1996; Stephens and Weisbach, 1998; D'Mello and Shroff, 2000; Dittmar, 2000; Baker and Wurgler, 2002). The evidence further shows that these firms are cash-rich and financially less constrained. However, another strand of the literature such as Chen and Wang (2012) and Farre-Mensa, Michaely, and Schmalz (2018) find evidence consistent with financially constrained firms borrowing to finance repurchase programs. We are interested in the position of less financially constrained firms. These firms are expected to be in a good position to time the market. This is because, unlike financially constrained firms, they do not face a significant difference between internal and external financing costs.

This paper explores whether cross-market timing drives less financially constrained firms to issue cheap debt to finance the repurchase of undervalued equity. The evidence that firms repurchase undervalued shares is not new to the finance literature. For example, Ben-

[1] See Michael Milken: "Why capital structure matters", *The Wall Street Journal*, April 21, 2009.
[2] See Bob Pisani: "Companies keep buying their own stock in force, led by 'buyback monsters' like Home Depot", CNBC, February 27, 2019. See: https://www.cnbc.com/2019/02/27/companies-keep-buying-their-own-stock-in-force-led-by-buyback-monsters-like-home-depot.html (retrieved on November 18, 2019).

Rephael, Oded, and Wohl (2014) report that firms repurchase their shares at significantly discounted prices relative to market prices. Similarly, Campello, Graham, and Harvey (2010), Greenwood and Hanson (2013); Becker and Ivashina (2014); Harford, Martos-Vila, and Rhodes-Kropf (2015) find evidence that firms' debt issuance decisions are sensitive to credit market conditions. Chen and Wang (2012) argue that financially constrained firms conduct share repurchases, whereas Lei and Zhang (2016) find evidence of significant debt-financed share repurchases. Ma (2019) explains that firms act as cross-market arbitrageurs in their securities by selling cheap debt in one market and using the proceeds to finance the repurchase of undervalued equity. A relatively unexplored aspect of the literature is how the level of financial constraints affects the decision to issue overvalued debt to repurchase undervalued equity. Our paper aims to fill this gap in the literature.

We test two main hypotheses in this paper. Firstly, we examine the phenomenon that less financially constrained firms undertake debt-financed share repurchases when debt market conditions are favourable. Further, we explore whether debt-financed share repurchases are consistent with the simultaneous issuance of overvalued debt and the repurchase of undervalued equity. This cross-market timing is associated with the use of cheap debt when interest rates are low. Barry, Mann, Mihov, and Rodriguez (2008), for example, find some evidence that debt market timing behaviour is associated with less financially constrained firms. Harford et al. (2015) argue that firms take advantage of inaccurate and optimistic credit ratings to issue more debt (see also Ma, 2019). Cheap debt implies favourable debt market conditions in terms of lower interest rates or narrow credit spread. Less financially constrained firms have more debt capacity that allows them to borrow and invest in assets that can serve as collateral for further borrowings (Hahn and Lee, 2009). Since less financially constrained firms have both borrowing capacity and access to

attractive interest rates, these firms take advantage of favourable interest rates to borrow without depleting their existing cash holdings.

The second hypothesis is that, when the firm is less financially constrained, the issuance of overvalued debt and simultaneous repurchase of undervalued equity should preserve liquidity to undertake investment expenditures. Acharya, Almeida, and Campello (2007), for example, argue that cash is not the same as negative debt. In other words, firms do not think of cash as playing the role of debt capacity. Thus, firms whose investment opportunities are counter-cyclical would borrow when debt is cheap and transfer liquidity across states by holding cash. Grullon and Michaely (2004) and Denis and Sibilkov (2009) show that firms may reduce their investments after share repurchase activities due to limited available cash flows. Chen and Wang (2012) report lower stock performance following share repurchases by financially constrained firms, and Lei and Zhang (2016) find that debt-financed share repurchases are associated with positive short-run and long-run stock performance. Thus, we test the hypothesis that the simultaneous issuance of overvalued debt and repurchase of undervalued equity affect post-repurchase changes in investment expenditures. We then examine the post-repurchases stock performance for debt-financed share repurchases, given the level of financial constraints.

We test our hypotheses for US share repurchases announcements between 1990 and 2016. Using the Hadlock and Pierce (2010) measure of financial constraints, hereafter *HP-index*, we find, as expected, evidence that financially constrained firms conduct debt-financed repurchases. Interestingly, we find that less financially constrained firms tend to borrow to finance share repurchases only when debt market conditions are favourable. They then obtain cheap (overvalued) debt financing to fund the repurchase of cheap (undervalued) equity. These results are supported using firm- and market-level measures of the cost of debt financing, and are robust to the use of an alternative measure of financial constraints in the form of the Whited and Wu

(2006) index, hereafter *WW-index*. This study then supports the cross-market arbitrageurs' hypothesis to explain the reasoning for unconstrained firms borrowing to repurchase their shares.

We also explore the significance of debt-financed share repurchases in relation to post-repurchases firm investment and performance. We find that debt-financed share repurchases increase investments when the firm is less financially constrained. The additional debt financing curtails any liquidity shocks that might have led to decreases in investments for debt-financed repurchasing firms. Moreover, debt-financed share repurchases are associated with increases in financial distress risk when firms are financially constrained and over-leveraged. Interestingly, we also find that debt-financed share repurchases are associated with positive short-run and long-run abnormal returns when the firm is less financially constrained and undervalued, highlighting that investors react positively to firms' cross-market arbitrage activities.

Studies that are related to our paper include Chen and Wang (2012) who find evidence consistent with poor post-repurchase abnormal returns associated with financially constrained firms that repurchase shares. However, they do not formally test whether repurchases are financed with debt issuance or cash. Lei and Zhang (2016) also test debt-financed repurchases, but focus on the post-repurchase stock price performance. Unlike Lei and Zhang (2016), we test the effects of financial constraints and equity undervaluation on the post-debt-financed repurchase stock performance. Ma (2019) also argues that firms act as cross-market arbitrageurs using debt/equity issuances and equity repurchases. Our study instead examines the interactions between both market- and firm-level debt conditions and equity valuation on share repurchase financing. We focus on financially unconstrained firms that offer an interesting context on the impact of financial constraints on the relation between the simultaneous debt and equity valuations and debt-financed share repurchases. Thus, our findings shed light on the effects of debt market dynamics on share repurchase financing, given the level of financial constraints.

Our study contributes to the literature in two ways. Firstly, we test the impact of debt market conditions on the financing of share repurchase programs in the context of company financial constraints. Our findings highlight the simultaneous issuance of overvalued debt and the repurchase of undervalued equity. We posit that this phenomenon is more pronounced for less financially constrained firms. Secondly, the effects of debt-financed share repurchases on investment and financial distress risks depend on the level of financial constraints. Debt-financed share repurchases reduce investments and increase financial distress risks when repurchasing firms are financially constrained.

The rest of the paper is organised as follows: Sections 2 and 3 describe the data that we used, and the methodology followed, respectively. Section 4 presents the empirical findings. Section 5 provides robustness tests, and Section 6 concludes.

2. Data and Variable Definitions

2.1. Data

We collect data on open market share repurchases of US firms between January 1, 1990, and December 31, 2016, from the Securities Data Company (SDC) database. The source of the financial statement data is the Compustat database; market and stock return data are from the Centre for Research in Security Prices (CRSP) database. Financial firms (SIC codes between 6000 and 6999) and utilities (SIC codes between 4900 and 4999) are excluded due to the stringent regulatory oversight under which they operate and because of their different capital structure (see, for example, Denis and Sibilkov (2009) and Chen and Wang (2012)). SDC reports the "source of funds used to finance the share repurchase deal". We define a share repurchase as debt-financed if it is partially or fully financed by debt. Specifically, we classify repurchases as debt-financed if at least part of the funding is from a line of credit, bridge loans, debt issues, and

other borrowings. Similarly, a cash-financed share repurchase is exclusively financed by cash or corporate funds. Our initial sample is made up of 240 debt-financed and 728 cash-financed share repurchases.[3]

2.2. Financial Constraints

Our primary measure of financial constraints is the Hadlock and Pierce (2010) index, hereafter *HP-index.* This measure of financial constraints uses the size and age of the firm. A firm with a high *HP-index* is considered more financially constrained. We follow Hadlock and Pierce (2010) and construct the index for each firm-year as follows:

$$HP-index=\left(-0.737*Size\right)+\left(0.043*Size^{2}\right)-\left(0.040*Age\right)$$

Where size is the log of inflation-adjusted (to 2004) book assets, and age is the number of years the firm has been on Compustat with a non-missing stock price. Following Hadlock and Pierce (2010), we replace size with log ($4.5 billion) and age with thirty-seven years if the actual values exceed these thresholds. The role of firm age and size in financial constraints diminishes as young and small firms grow.

Our repurchase sample is sorted into quintiles each year according to the values of the *HP-index.* Firms with the lowest *HP-index* values are placed in quintile one, and those with the highest values are placed in quintile five. Following Baker, Stein, and Wurgler (2003) and Chen and Wang (2012), we classify repurchasing firms in the highest *HP-index* quintile to be financially constrained and repurchasing firms in the other quintiles to be less financially constrained.

[3] Note that we lose some observations in the regressions due to missing data on some of the variables.

For robustness purposes, and consistent with the argument that there is no ideal measure of financial constraints (Farre-Mensa and Ljungqvist, 2016), we use an alternative measure of financial constraints. We follow Chen and Wang (2012) and use the Whited and Wu (2006), hereafter *WW-index,* as an alternative measure of financial constraints. This index is constructed as follows:

$$WW-index = -0.091\left(CF/TA\right) - 0.062\left(DIVDUM\right) + 0.021\left(LTD/TA\right) - 0.044\log TA + 0.102\,INDSG - 0.035\,SG$$

Where *DIVDUM* equals one if the firm pays cash dividends and zero otherwise; *LTD* is long-term debt; *INDSG* is the firm's three-digit industry sales growth; *SG* is the firm's sales growth. A repurchasing firm in the highest quintile *WW-index* is considered more financially constrained, and repurchasing firms in the other quintiles are classified as less financially constrained.

2.3. Debt Valuations

Since debt-financed repurchases utilise both a combination of credit lines, bridge loans, borrowings, and debt issues, the measures of debt market valuations include bank lending factors and factors that affect debt issuance. Debt market conditions such as nonperforming loans, market credit spread, and excess bond premium represent debt valuations and reflect investor risk appetite and sentiment in the credit market.

Following Milcheva (2013) and Becker and Ivashina (2014), our measure of bank lending factors is the ratio of nonperforming loans to total loans (*NPLoans*). The data for this factor is available from the website of the Federal Reserve Bank of St. Louis (FRED). A higher value for *NPLoans* indicates a contraction in bank credit. The second measure of debt market conditions is related to factors that affect debt issuance. Consistent with Barry et al. (2008; 2009), Gilchrist and Zakrajšek (2012), Harford et al. (2015), and Ma (2019), we use *Market credit spread*, *GZ credit spread,* and *Excess bond premium* as proxies for debt market conditions and

debt valuations. *Market credit spread* is defined as the difference between the Baa corporate yield and the 10-year constant maturity Treasury yield. The 10-year constant maturity Treasury yield and the Baa corporate yield are extracted from the FRED database. *GZ credit spread* is the average unweighted credit spread of several outstanding bonds in a given year. The *Excess bond premium* is the residual component of *GZ credit spread* that captures investor attitudes toward credit risk.[4] This measure represents variation in the average price of bonds beyond the compensation for expected defaults.

Further, we obtain data from the Thomson Reuters DealScan database about the loan facility arranged by each of the repurchasing firms. Specifically, we identify and match the costs of the loan facility using the Initial AllInDrawn, which is the amount the borrower pays in basis points over LIBOR. This amount is the *Loan spread* and represents the firm-level loan valuation. We also follow Ma (2019) and obtain *Bond credit spread* data from both the Mergent Fixed Income Securities Database (FISD) and Trade Reporting and Compliance Engine (TRACE). We have limited matched data from these sources for the firm-level measures of debt valuation.[5]

2.4. Equity Misvaluation

The misvaluation proxy, *PV*, is the ratio of market price *P* to the 'intrinsic value' *V*. Jensen (2005) states that equity overvaluation occurs when the stock price is higher than the fundamental value of equity. We follow studies, such as Lee, Myers, and Swaminathan (1999), Dong, Hirshleifer, and

[4] The values of *GZ credit spread* and *Excess bond premium* are extracted from Gilchrist's website. Gilchrist and Zakrajšek (2012) argue that the *Excess bond premium* captures the variation in the average price of corporate bonds above and beyond the compensation for default risk. A low *Excess bond premium* denotes loosening of credit terms and a surge in the issuance of credit.

[5] Similar to Lei and Zhang (2016), we use share repurchases announcements reported in Thomson One since this indicates the source of financing. However, most of the firms whose share repurchases are announced in Thomson One do not have the corresponding bond data reported in TRACE and Mergent FISD. This limitation substantially reduces the number of observations (170) for the regression analysis on the firm-level debt conditions.

Teoh (2006), Dong, Hirshleifer, Richardson, and Teoh (2012), Badertscher (2011), and Ma (2019) in using *PV* as a measure of equity misvaluation.

We estimate a firm's intrinsic value *V,* using the Edwards-Bell-Ohlson (EBO) discounted residual income valuation model (Edwards and Bell, 1961; Ohlson, 1995). Following Lee et al. (1999), D'Mello and Shroff (2000), Dong et al. (2012), and Badertscher (2011), we estimate a three-year finite period residual income discounted to determine the intrinsic value.[6] That is, we forecast earnings for the next three years and treat earnings in Year 3 as a perpetuity. The three-year residual income equation is stated as follows:

$$V_t = B_t + \frac{\left(fROE_{t+1} - r_e\right)}{\left(1+r_e\right)} B_t + \frac{\left(fROE_{t+2} - r_e\right)}{\left(1+r_e\right)^2} B_{t+1} + \frac{\left(fROE_{t+3} - r_e\right)}{\left(1+r_e\right)^2 r_e} B_{t+2},$$

where B is the book value of equity, $fROE_{t+i}$ is the forecast return on equity for period $t+i$ derived from Institutional Brokers Estimate System (I/B/E/S) consensus earnings-per-share (EPS) estimates, r_e is the annual CAPM cost of equity, and the last term discounts the period $t+3$ residual income as a perpetuity. Further details about the estimation of *PV* are provided in Appendix A2.

The empirical accounting and finance literature provides strong support for *PV* as a proxy for equity misvaluation. Lee et al. (1999) argue that *PV* is a stronger return predictor than price-to-book (*PB*) or Tobin's Q. Since residual income *V* cannot perfectly capture growth, *PV* does not filter out all the growth effects. However, given that *PV* is a forward-looking earnings forecast, a large portion of the growth effects contained in *PB* should be filtered out of *PV* (Dong et al. 2012). Therefore, *PV* is arguably a better measure of misvaluation than *PB*.

[6] Lee et al. (1999) report that the choice of forecast horizon beyond three years does not affect the estimate of the intrinsic value. Dong et al. (2012) explain that their results remain robust to different forecast horizons.

We retain negative *V* values when forecast *ROEs* are lower than the cost of equity. Negative *PV* values account for only 2% of the observations. Our definition of misvaluation, *PV,* rather than *VP,*[7] provides for a straightforward interpretation of our results. That is, negative and low values of *PV* indicate undervaluation and large values of *PV* indicate overvaluation.

2.5. Target Leverage and Excess Leverage

Baker and Wurgler (2002) argue that share repurchases have implications for capital structure. Lei and Zhang (2016) find evidence of significant increases in financial leverage following leveraged buybacks. To capture this effect, we determine whether repurchasing firms were over- or under-leveraged before the repurchasing decision and the impact on the leverage following the repurchasing decision. We first estimate the target leverage ratio for each firm per year consistent with Faulkender, Flannery, Hankins, and Smith (2012), and Lei and Zhang (2016) using the model below.

$$MDR_{i,t+1} = \beta X_{i,t} + \varepsilon_{it}$$

Where $MDR_{i,t+1}$ is firm *i's* market debt ratio, i.e. the book value of debt divided by the sum of the book value of debt and the market value of equity, at year *t+1*; $X_{i,t}$ is a vector of firm characteristics related to costs and benefits of adjusting the leverage ratio. The firm characteristics include *EBIT/TA* defined as earnings before interest and taxes divided by total assets; the market-to-book ratio of assets (*MB*); the ratio of depreciation to total assets (*DEP/TA*); size defined as the log of total assets (*LnTA*); the ratio of fixed to total assets (*FA/TA*); Research and Development expenses as a proportion of total assets (*R&D/TA*). *R&DDUM* is a dummy variable that equals one if a firm did not report *R&D* expenses. *Ind_median* is the median

[7] *VP* is the ratio of the intrinsic value to the market price.

industry market debt ratio calculated for each year based on the industry groupings in Fama and French (2002). A firm is defined as over-levered (under-levered) if its actual market debt ratio is higher (lower) than the target debt ratio (the predicted value of $MDR_{i,t+1}$) before the repurchase announcement.

2.6. Abnormal Investment and Operating Performance

First, we compute *Investment* as the ratio of capital expenditure to total assets. We then follow Lei and Zhang (2016) to estimate *Abnormal Investment*, which is defined as the difference between the *Investment* of the repurchasing firm and its matched control non-repurchasing firm. The control sample of non-repurchasing firms matches investment, industry, and book assets. For each repurchasing firm, the matched control firm is of the same two-digit SIC code, and with both pre-repurchase investment and the book value of assets in the year -1 within ±20% of those of the repurchasing firm. If more than one firm satisfies these criteria, we select the firm with the least deviations from the repurchasing firm. We are able to identify a control firm for each repurchasing firm using the above criteria.

Similarly, we compute return on assets (*ROA*) as the ratio of the operating income before depreciation to book assets. The *Abnormal ROA* is calculated as the difference between the *ROA* of the repurchasing firm and the *ROA* of the matched non-repurchasing firm. The control firm is constructed using *ROA,* industry (two-digit SIC code), and book assets (which is between ±20% of that of the repurchasing firm). If more than one firm satisfies these criteria, we select the firm with the least deviations from the repurchasing firm. For each repurchasing firm, a matched non-repurchasing firm is identified using the above criteria.

2.7. Abnormal Stock Returns

We measure short-run stock price reactions to announcements of share repurchases by the three-day cumulative abnormal returns (*CAR*) over the period from day −1 through day +1, where day 0 is the announcement date of a share repurchase. We use the market model to measure expected returns and the CRSP value-weighted market index as the benchmark. The estimation period ends 46 days before the repurchase announcement, the minimum estimation window is 15 days, and the maximum estimation length is 255 days.

Long-run abnormal stock returns are the 12, 24, and 36 months buy-and-hold abnormal returns (*BHAR*) following repurchase announcements, based on Barber and Lyon's (1997) methodology. Studies that use this approach include Lakonishok, Shleifer, and Vishny (1994), Chan, Lakonishok, and Sougiannis (2001) and Chen and Wang (2012). Buy-and-hold abnormal returns are estimated as the difference between buy-and-hold returns for the repurchasing firm and buy-and-hold returns for the control firm. The control firm must be within the same industry (two-digit SIC code) and with a book value of assets between ±20% of that of the repurchasing firm. If more than one firm satisfies these criteria, we select the firm with the least deviations from the repurchasing firm. For each repurchasing firm, a matched non-repurchasing firm is identified using the above criteria.

2.8. Financial Distress (Z-score)

The measure of financial distress risk is the Altman (1968) *Z-score,* in line with Chen and Wang (2012) who argue that financially constrained firms making significant buybacks are associated with high financial distress risk. The *Z-score* is computed using the model below.

$$Z-score=\left[1.2*\left(ACT-LCT\right)+1.4*RE+3.3*EBIT+0.999*SALES\right]\Big/TA+0.6*\left(MV/LT\right)$$

Where *ACT* is total current assets and *LCT* is total current liabilities; *RE* is retained earnings; *EBIT* is earnings before interest and taxes; *SALES* is sales revenue; *TA* is total assets; *MV* is the market value of equity; *LT* is total liabilities.

We also compute the *Abnormal Z-score* as the difference between the *Z-score* of the repurchasing firm and the *Z-score* of the matched non-repurchasing firm, where the match is constructed using the *Z-score,* industry, and book assets. The matched firm is in the same two-digit SIC code and within ±20% of the book assets of the repurchasing firm. Again, if more than one firm satisfies these criteria, we select the firm with the least deviations from the repurchasing firm. For each repurchasing firm, a matched non-repurchasing firm is identified using the above criteria. All other control variables are defined in Appendix A1.

2.9. Summary Statistics

Table 1 presents the number of share repurchases for both cash-financed and debt-financed share repurchases during the sample period.

[Please Insert Table 1 here]

This table also provides the mean and median dollar amounts of the repurchase deal value financed using cash and debt. The final sample is made up of 728 cash-financed and 240 debt-financed share repurchases. We can observe an increase in the number of debt-financed repurchases after the financial crisis of 2007 and 2008. The average deal value of cash-financed ($1254.90M) is larger than but not statistically significantly different from the average deal value of debt-financed share repurchases ($784.18M). This result is consistent with Lei and Zhang (2016).

Next, we compare the firm characteristics and debt market conditions between cash-financed and debt-financed share repurchases. Table 2 provides the summary statistics of firm characteristics and debt market conditions for both cash and debt-financed share repurchases.

[Please Insert Table 2 here]

We find that the mean *HP-index* of financial constraints is -3.561 and -3.433 for cash-financed and debt-financed repurchases, respectively. The difference is significant at the 1%-level. This preliminary evidence suggests that less financially constrained firms are more likely to fund their share repurchases with internally generated cash. We find a similar level of financial constraints between cash-financed and debt-financed repurchases using the *WW-index* measure of financial constraints. The mean differences for the *WW-index* are also significantly negative, indicating that firms that undertake debt-financed share repurchases are relatively more financially constrained than cash-financed repurchasing firms. This result means that financially constrained firms are more likely to seek external debt financing when undertaking share repurchase programs.

The mean difference between the *PV ratios* of cash- and debt-financed repurchases is not statistically significant, implying that there is no significant difference between the misvaluation of the two subsamples of repurchasing firms. There are no statistical differences for non-performing loans (*NPLoans*) between cash and debt-financed repurchases. *Market credit spread* is significantly lower during periods of debt-financed repurchases compared to periods of cash-financed repurchases. Similarly, the *GZ credit spread* for debt-financed share repurchases is significantly lower than for cash-financed share repurchases. This result provides preliminary evidence that firms tend to use debt financing for their share repurchases when debt market conditions are favourable. Low debt valuations shed some light on investor attitudes towards risks leading to loosening credit terms and a surge in the supply of credit to investors.

The firm-level loan (*Firm loan spread*) and debt conditions (*Firm bond credit spread*) are not statistically different between cash- and debt-financed repurchases, indicating that the costs of loans and debt issues are similar. The *Stock returns* variable is not statistically different between cash-financed and debt-financed repurchasing firms. Not surprisingly, cash-financed repurchasing firms tend to have a higher *Cash ratio* compared to debt-financed repurchasing firms. Other observations include that there is no difference in dividend payments and that cash-financed repurchasing firms are larger than debt-financed firms. However, debt-financed firms have more leverage, are more profitable, and invest more in capital projects than cash-financed repurchasing firms.

As discussed earlier, share repurchases deplete free cash flow that could otherwise be used to finance investment expenditures. Firms can mitigate the underinvestment concerns occasioned by repurchases by obtaining external financing. Debt issues prevent limited liquidity after share repurchases that could support investment expenditures (Hahn and Lee, 2009; Denis and Sibilkov, 2009; Farre-Mensa et al., 2018). Harford et al. (2015) find that close to 75% of funds from debt issuance is used to finance capital expenditures. Thus, debt-financed share repurchases should not constrain investment expenditures.

Table 3 provides the results of the pre- and post-repurchase changes in *Cash ratio, Leverage, Return on assets, Investment* and *Z-score* for both cash-financed and debt-financed share repurchases.

[Please Insert Table 3 here]

Both cash-financed and debt-financed share repurchasing firms report post-share repurchases decreases in cash and increases in leverage. Also, debt-financed repurchasing firms report significant decreases in operating performance following share repurchases. Both cash-

and debt-financed repurchasing firms report reductions in investment 3-years post-repurchases and significant declines in financial distress risk.

Table 4 presents the results for additional univariate analysis where we compute the abnormal *ROA, Investment*, and *Z-score.*

[Please Insert Table 4 here]

Abnormal *ROA, Investment*, and *Z-score* are respectively the sample firm's *ROA, Investment*, and *Z-score* minus the *ROA, Investment* and *Z-score* of matched control firms. As shown in Panel A of Table 4, we do not find significant differences between *ROA, Investment*, and *Z-score* of cash-financed and debt-financed repurchasing firms. In Panel B, we analyse the changes in the abnormal *ROA, Investment*, and *Z-score* for both under-levered and over-levered debt-financed repurchasing firms. We find no significant differences in the changes in abnormal *ROA, Investment*, and *Z-score* between under-levered and over-levered debt-financed repurchasing firms, after adjusting for the abnormal *ROA, Investment*, and *Z-score* of the matched sample of non-repurchasing firms. Overall, these results are consistent with Lei and Zhang (2016), who also find no significant differences in operating performance and financial distress risk after share repurchases. A possible explanation is that firms use debt-financed share repurchases to optimise their capital structure.

The univariate analysis in Table 5 tests the stock market reactions following the share repurchases for both cash-financed and debt-financed repurchasing firms.

[Please Insert Table 5 here]

The pre-announcement stock returns (Day -30 to Day -2) are -4.6% and -4.2% for cash-financed and debt-financed repurchases, respectively. The negative returns indicate that share repurchases follow periods of stock undervaluation regardless of the source of financing. However, the insignificant mean difference suggests that this undervaluation is not different

between cash-financed and debt-financed share repurchases. The short-run and long-run stock performance are positive for both cash-financed and debt-financed repurchases, but the mean returns are not statistically different between the two subsamples.

3. Methodology

Our baseline model for estimating the decision to undertake debt-financed share repurchases is the logit regression model that is specified as:

$$Pr(DFRep=1) = \log it = \alpha_{it} + \beta_1 FC_{it} + \beta_2 DebtMkt_t + \beta_3\left(FC_{it} \times DebtMkt_t\right) + \beta_i CONTROLS_{it} + \mu_{it}$$

where *DFRep* is the dependent variable that takes a value of 1 if a repurchase is debt-financed and 0 otherwise. The variable *FC* is the measure of financial constraints using the *HP-index* dummy that equals 1 for financially constrained repurchasing firms and 0 for less financially constrained repurchasing firms.[8] Since less financially constrained firms are more likely to conduct share repurchases, we expect a positive sign for the *HP-index,* indicating that financially constrained firms are expected to obtain external financing to fund their share repurchases.

DebtMkt is the vector of proxies for debt market conditions at both the macro and firm levels. The debt market variables include *NPLoans, Market credit spread, GZ credit spread,* and *Excess bond premium. Firm loan spread* and *Firm bond credit spread* are the measures of debt valuations at the firm-level. We expect negative coefficients for the measures of debt market conditions to indicate that firms tend to borrow more when debt market conditions are favourable. Investors tend to be complacent about default risks when debt market conditions are optimistic, leading to loosening credit terms and a surge in the issuance of credit to risky

[8] In robustness tests, the *FC* variable is defined using the *WW-index.*

investors. *FC ×DebtMkt* is the interaction term between the financial constraints dummy and the measures of debt market conditions.

We expect positive coefficients for the interactions between financial constraints and the measures of debt market conditions (*NPLoans* × *HP-index, Market credit spread* × *HP-index, GZ credit spread* × *HP-index,* and *Excess bond premium* × *HP-index, Firm loan spread* × *HP-index*, and *Firm bond credit spread* × *HP-index*). *CONTROLS* are the control variables used in the regression model and include variables such as *Cash ratio, Dividend dummy, Firm size, Leverage, Stock returns, Z-score, Return on assets, Investment,* and *Intended repurchase ratio.*

In subsequent analysis, we test the simultaneous effects of debt and equity valuation on the decision to conduct debt-financed share repurchases. We modify the model and replace the interaction terms with the interactions between debt market conditions and proxy for equity valuation, *PV ratio.* Thus, the interaction terms to capture the effects of debt market valuation and equity valuation are *NPLoans* × *PV ratio, Market credit spread* × *PV ratio, GZ credit spread* × *PV ratio,* and *Excess bond premium* × *PV ratio, Firm loan spread* × *PV ratio*, and *Firm bond credit spread* × *PV ratio*. Finally, we conduct a subsample analysis to examine whether the simultaneous effects of financial constraints and debt market conditions on the decision to conduct debt-financed share repurchases depend on the level of equity valuation (undervalued and overvalued equity).

4. Empirical Results

In this section, we explore the factors that explain why firms use debt financing for their share repurchases. The analyses capture the extent to which debt market timing explain this phenomenon and the effects on post-repurchase changes in investment expenditures, operating performance, and financial distress risk.

4.1. Debt-Financed Share Repurchases and Financial Constraints

Table 6 presents the logit regression results of the effects of financial constraints on debt-financed share repurchases.

[Please Insert Table 6 here]

The results also examine how the interactions between financial constraints and debt market conditions affect the decision to conduct debt-financed share repurchases. The dependent variable is equal to 1 for debt-financed and 0 for cash-financed share repurchases. The independent variables measure financial constraints (*HP-index*), debt market conditions (*NPLoans, Market credit spread, GZ credit spread,* and *Excess bond premium*), and their interactions (*NPLoans* × *HP-index, Market credit spread* × *HP-index, GZ credit spread* × *HP-index,* and *Excess bond premium* × *HP-index*). We also control for industry fixed effects using the industry dummies.

In all of the regressions, *HP-index* is significantly and positively related to the decision to conduct debt-financed share repurchases. This result implies that financially constrained firms are more likely to borrow to finance share repurchases. Our finding is in line with Chen and Wang (2012), who report that financially constrained firms undertake share repurchases. Their study further finds poor post-repurchase stock returns and operating performance when the firm is financially constrained. The first four columns generally show non-significant coefficients for the debt market conditions except for *Market credit spread*, which is significantly negative in Column (2).

We next examine the simultaneous impact of financial constraints and debt market conditions on debt-financed repurchases. The interaction terms *NPLoans* × *HP-index, Market credit spread* × *HP-index, GZ credit spread* × *HP-index,* and *Excess bond premium* × *HP-index* capture the simultaneous effects of financial constraints and debt market conditions on debt-

financed repurchases. The interaction terms are all significantly and positively related to debt-financed share repurchases, indicating that less financially constrained firms are more likely to finance their share repurchases with debt issuance when debt market conditions are favourable. This evidence strongly suggests that less financially constrained firms time their debt-financed repurchases to coincide with periods of favourable debt market conditions. Thus, while less financially constrained firms are likely to have cash buffers to finance share repurchases, they take advantage of the availability of low-cost debt financing by issuing debt to fund their share repurchases. The evidence points to the importance of debt market conditions for the funding of share repurchases.

Regarding the control variables, the negative coefficients of *Cash ratio* show that firms with sufficient cash ratio are more likely to conduct cash-financed share repurchases. The negative coefficients of *Z-score* suggest that firms with low financial distress risk are more likely to conduct debt-financed repurchases. This evidence is consistent with Lei and Zhang (2016) who find that leveraged repurchasing firms have more debt capacity. Finally, *Investment* is significantly and positively related to the decision to conduct debt-financed share repurchases. The debt issues provide additional cash flow to build cash buffers allowing the repurchasing firm to invest. Debt issues prevent limited liquidity after a share repurchase that could support investment expenditures (Hahn and Lee, 2009; Denis and Sibilkov, 2009; Farre-Mensa et al., 2018). Overall, we find evidence that favourable debt market conditions motivate less financially constrained firms to fund their share repurchases using debt financing.

4.2. Equity Valuation, Debt Market Conditions, and Debt-Financed Share Repurchases

Next, we examine the hypothesis that firms issue overvalued debt to finance undervalued equity. In other words, we test the findings by Baker and Wurgler (2002) that firms consistently time

their repurchases to coincide with periods of low market values relative to their book values. A study by Harford et al. (2015) posits that debt issues coincide with optimistic credit market conditions, where firms can borrow cheaply. They report that firms obtain debt finance to finance capital expenditures and acquisitions when credit ratings are inaccurate. Other studies assert that firms utilise proceeds from the issuance of overvalued debt to finance the repurchase of undervalued equity. For example, Ma (2019) argues that firms use debt issues (low returns) to replace or repurchase equity (high returns) by acting as cross-market arbitrageurs. We test this phenomenon that firms obtain cheap debt financing to fund the repurchase of undervalued equity.

Table 7 reports the results of the analysis of the effects of overvalued debt and undervalued equity on debt-financed repurchases. For brevity, we do not report the results for the control variables for the remaining of the study.

[Please Insert Table 7 here]

Similar to previous results, we find evidence that financially constrained firms conduct debt-financed share repurchases. The coefficient of *PV ratio* is negative and significant in Columns 2-4 of the table, indicating evidence of debt-financed repurchase of undervalued equity. We find statistically significant negative coefficients for *Market credit spread* in Columns 2, and for *GZ credit spread* and *Excess bond premium* in Columns 3 and 4, respectively. These results indicate that debt valuations and credit market conditions influence the use of debt financing to fund share repurchases. The interaction terms *Market credit spread* × *PV ratio, GZ credit spread* × *PV ratio*, and *Excess bond premium* × *PV ratio* are positive and significant. These results suggest that debt-financed share repurchases coincide with the simultaneous issue of overvalued debt and repurchase of undervalued equity. Our results provide evidence of the cross-market arbitrage argument (Ma, 2019) that firms borrow cheaply to finance the repurchase of undervalued equity.

Thus, not only do firms time the repurchases of undervalued equity, it seems that debt valuations and credit market conditions drive this market timing phenomenon. More to the point, debt market conditions significantly influence the source of financing for the repurchase of undervalued equity. Generally, firms utilise internal funds to finance share repurchase programs. However, favourable debt market conditions that drive down the costs of debts motivate firms to obtain cheap external financing to pay for the repurchase of undervalued equity. Overall, we find evidence for the tendency for firms to borrow cheaply to repurchase their undervalued equity.

In Table 8, we explore whether less financially constrained repurchase undervalued equity by issuing overvalued debt.

[Please Insert Table 8 here]

We extend the argument that firms use debt issues to replace or repurchase equity by acting as cross-market arbitrageurs. Ma (2019) establishes that financing flows in either debt or equity markets respond to valuations in each market, but does not test the impact of the level of financial constraints on this relationship. To the extent that less financially constraints use debt financing to fund share repurchases, we contend that the level of financial constraints significantly determines the extent of the funding flows between debt and equity markets.

We split the sample into *Undervalued equity (Low PV ratio)* and *Overvalued equity (High PV ratio) based* on the median *PV ratio.* Columns 1-4 give the results of the *Undervalued equity* subsample*,* whereas Columns 5-8 of the *Overvalued equity* subsample. The coefficients of *HP-index* in Columns 1-4 are significantly and positively related to the decision to conduct debt-financed share repurchases. These effects are much weaker for overvalued equity. We find a significantly positive coefficient in Column (5), but only weakly significant coefficients in Columns (7) and (8). There is no significant effect in Column (6). Also, there is some evidence

of favourable debt market conditions driving debt-financed share repurchases for the *Undervalued equity* subsample given the significantly negative coefficients for *Market credit spread* and *Excess bond premium.*

The coefficients of the interaction terms *NPLoans* × *HP-index, Market credit spread* × *HP-index, GZ credit spread* × *HP-index,* and *Excess bond premium* × *HP-index* are significantly positive in Columns 1-4 for the *Undervalued equity* subsample. We interpret this result as evidence that less financially constrained firms obtain overvalued debt financing to repurchase undervalued equity. In extending the financing flow argument by Ma (2019), we establish that financial constraints have a more significant influence on the relationship between the debt market and equity market dynamics. The coefficients of the interaction terms are only significant in the *Undervalued equity* subsample. Thus, less financially constrained firms tend to obtain cheap debt financing to fund the repurchase of cheap equity.

4.3. Firm-Level Debt Conditions and Debt-Financed Share Repurchase

Table 9 reports firm-level results of the issuance of overvalued debt and the repurchase of undervalued equity.

[Please Insert Table 9 here]

The estimation model is similar to the earlier logit regression model using the macro-level measures of debt market conditions, but at this stage at the firm level. The dependent variable is equal to 1 for debt-financed and equal to 0 for cash-financed share repurchases. The independent variables measure financial constraints, firm-level debt market conditions, equity valuation, and their interactions. The proxies for firm-level debt market conditions are *Firm loan spread* and *Firm bond credit spread*. We measure financial constraints using the *HP-index*, which takes a value of 1 for financially constrained repurchasing firms and 0 for less financially constrained

repurchasing firms. Control variables include *Cash ratio, Dividend dummy, Firm size, Stock returns, Leverage, Z-score, Return on assets, Investment*, and *Intended repurchase ratio.* We also control for both year and industry fixed effects using the year and industry dummies.

We find that the coefficients of both *Firm loan spread,* and *Firm bond credit spread* are negative and significant at the 5%-level in Columns 1 and 2, respectively. Thus, similar to the debt market conditions, there is some evidence of firm-level debt conditions affecting the decision to conduct debt-financed share repurchases. The positive coefficient of *Firm bond credit spread* × *HP-index* indicates that firms tend to conduct debt-financed repurchases when they are less financially constrained and the bond credit spread is low. We find a similar effect for the *Firm loan spread*, but the interaction term (*Firm loan spread* × *HP-index*) is only significant at the 10%-level. The coefficients for *Firm loan spread* × *PV ratio,* and *Firm bond credit spread* × *PV ratio* in Columns 3 and 4 are positive and significant. These results suggest that firms repurchase undervalued equity using debt issuance when firm-level debt financing cost is low. Overall, it seems general debt market conditions and firm-level borrowing conditions influence the decision to conduct debt-financed share repurchases.

4.4. Post-Repurchase Changes in Operating Performance, Investment, Financial Distress Risk, and Stock Performance

Firms that conduct share repurchases are more likely to experience reduced corporate liquidity stemming from reduced cash balance and increased financial leverage. The decrease in corporate liquidity limits the amounts of cash to undertake investments, resulting in poorer operating performance (Hahn and Lee, 2009; Denis and Sibilkov, 2009). They are also likely to suffer increases in financial distress risks due to the effect of share repurchases on financial leverage (Chen and Wang, 2012). Debt-financed share repurchases will exacerbate the adverse impact of share repurchases on investments, operating performance, and financial distress risks if the firm

is financially constrained. Table 10 provides the results for the post-repurchase changes in operating performance, investment and financial distress risk.

[Please Insert Table 10 here]

The coefficients of *DFRep* and *HP-index* either show none or little impact on the decision to conduct share repurchases and the level of financial constraints on post-repurchase abnormal operating performance (*Abnormal ROA*) and financial distress risk (*Abnormal Zscore*). These findings are consistent with Lei and Zhang (2016), who argue that debt-financed and cash-financed repurchasing firms report identical changes in post-repurchase operating performance. Debt-financed share repurchase (*DFRep)* is negatively related to post-repurchase investment (*Abnormal CAPEX*). This result indicates that debt-financed share repurchase decision in itself does not result in increases in investments.

The coefficients of *DFRep* × *HP-index* and *DFRep* × *OverLEV* in Columns 4 and 6, respectively of Table 10 are significantly negative. This result indicates a decrease in post-repurchase investments when the firm is financially constrained or over-levered. Thus, debt-financing provides a cash buffer to curtail liquidity shocks and underinvestment that stem from share repurchase programs. The evidence so far is consistent with firms borrowing to finance repurchases of undervalued equity.

We further analyse the post-repurchase impact on financial distress risk using the Altman's *Z-score.* A repurchase not only reduces cash flow or liquidity, but it also results in a high leverage ratio due to the reduction in equity capital. For example, Chen and Wang (2012) report that constrained firms, which make substantial buybacks, are associated with higher financial distress risk following the repurchase. For firms issuing debt during repurchases, the leverage ratio is likely to be higher. Excessive leverage levels are associated with high financial

distress risks. Therefore, we examine here whether post-repurchase financial distress risk levels change.

Columns 7 to 9 show the results of the post-repurchase changes in the *Z-score*. We find that debt-financed repurchases do not necessarily increase financial distress risk. Our results also show that financial constraints and undervalued equity do not increase financial distress risk following share repurchases. The coefficients of *DFRep* × *HP-index* and *DFRep* × *OverLEV* are both positive and statistically significant at the 5%-level. This result means that less financially constrained debt-financed repurchasing firms are associated with significant decreases in financial distress risk. In other words, debt-financed share repurchases will only increase financial distress risk if the repurchasing firm is financially constrained. This evidence is consistent with Chen and Wang (2012), who report significant increases in financial distress risk following share repurchases by financially constrained firms. We also find evidence that debt-financed share repurchases increase post-repurchase financial distress risk for over-leveraged firms.

We analyse the stock market reactions following the share repurchases announcements. Prior research argues that share repurchases generate positive signals that benefit investors, explaining the positive abnormal returns associated with share repurchases (Ikenberry, Lakonishok, and Vermaelen, 1995; Grullon and Michaely, 2004; Peyer and Vermaelen, 2009). However, the abnormal returns following share repurchases are likely to differ based on whether the repurchase is cash- or debt-financed. The level of financial constraints and equity undervaluation would also determine the market reactions following share repurchases. Hence, we expect debt-financed share repurchases to generate more positive abnormal returns when the firm is less financially constrained and undervalued. Table 11 presents the results of both the short-run response and the long-run stock performance.

[Please Insert Table 11 here]

The measure of short-run performance is the three-day cumulative abnormal returns *CAR* (-1, +1). We estimate the 24-month buy-and-hold abnormal returns *BHAR* (0, +24) for the long-run stock performance. Columns 1-5 give the results for the short-run returns (-1,1 days) and Columns 6-10 report the long-run stock returns (0, 24 months) following the share repurchases announcements. We find that the coefficients of *DFRep* are not statistically significant in most of the models for both short-run and long-run stock performance. This result indicates that debt-financed share repurchases do not explain the market reaction following share repurchases. *HP-index* is negative and significant in Columns 6 and 9 for the long-run stock performance, indicating some evidence of lower long-run abnormal returns associated with share repurchases by financially constrained firms (Chen and Wang, 2012).

Our variables of interest are the interaction terms *DFRep* × *HP-index, DFRep* × *PV ratio, DFRep* × *OverLEV, HP-index* × *PV ratio,* and *HP-index* × *OverLEV.* In Column 2 for short-run stock performance, the coefficient of *DFRep* × *PV ratio* is negative and significant. This suggests that debt-financed share repurchases of overvalued equity are associated with lower abnormal returns. The coefficients of *DFRep* × *HP-index, DFRep* × *OverLEV, HP-index* × *PV ratio,* and *HP-index* × *OverLEV* are either not or only marginally significant, showing little impact on short-run market reactions. The coefficients of *DFRep* × *HP-index, DFRep* × *PV ratio,* and *HP-index* × *OverLEV* are negatively related to long-run stock performance. We interpret these results to mean that debt-financed share repurchases generate positive abnormal returns when repurchasing firms are less financially constrained and equity is undervalued. Over-leveraged firms that are financially constrained are associated with lower long-run abnormal returns.

5. Robustness Tests

5.1. Debt-Financed Share Repurchases and Completion Rates

Studies such as Chan, Ikenberry, Lee, and Wang (2010) and Bonaime (2012) argue that managers conduct share repurchases for their self-interest. For example, Chen and Wang (2012) emphasise that managerial hubris drives financially constrained firms to undertake share repurchases. This evidence suggests that debt-financed share repurchases are less likely to be completed and translated into actual share repurchases following their announcements (Lei and Zhang, 2016). However, for less financially constrained firms, additional debt financing allows them to profit from arbitrage opportunities, especially when equity is significantly undervalued (Ma, 2019). We, therefore, test the effects of financial constraints and equity undervaluation on the completion rates of debt-financed share repurchases. This analysis sheds light on how firms translate repurchases announcements into actual share repurchases.

Our measure of actual share repurchases or completion rates is the purchase of common and preferred stock (PRSTKC) minus any decrease in redeemable preferred stock (PSTKRV) from Compustat, divided by the market value of equity (Grullon and Michaely, 2002; Kulchania, 2013; Jiang, Kim, Lie, and Yang 2013; Lei and Zhang, 2016). We run both OLS and Tobit regressions, where the dependent variable is the *Actual repurchase ratio*. The independent variables are the *DFRep, HP-index, PV ratio,* and their interactions. All the control variables are similar to those used in earlier regressions. We also control for both year and industry fixed effects using the year and industry dummies. Table 12 provides the results.

[Please Insert Table 12 here]

Columns 1-3 give the OLS regression results, while Columns 4-6 report the Tobit regression results. We find a positive relation between debt-financed share repurchases (*DFRep*) and the actual repurchase ratio. These results indicate that the additional cash flow from debt issuance allows firms to complete the repurchase transactions. While we find no evidence for the effects of financial constraints on actual share repurchases, undervaluation seems to increase

the repurchase completion rates. However, the statistically significant negative coefficient of *DFRep* × *PV ratio* suggests that debt-financed share repurchases are associated with increases in actual share repurchases if the equity is undervalued. This result highlights the impact of the undervaluation hypothesis on actual repurchases (Stephens and Weisbach, 1998; Baker and Wurgler, 2002; Grullon and Michaely, 2002). Thus, completion rates of share repurchases increase with debt-financed share repurchases when equity is undervalued.

5.2. Alternative Definitions and Measures of Financial Constraints

We estimate whether our results are robust to an alternative measure of financial constraints. We use the *WW-index* of Whited and Wu (2006) measure as a proxy for financial constraints to examine whether financial constraints influence the decision to conduct debt-financed share repurchases. The reason is that there is no ideal measure of financial constraints (Chen and Wang, 2012; Farre-Mensa and Ljungqvist, 2016). In Table 13, we use identical specifications as in Table 5, but now with the *WW-index* instead of the *HP-index* to measure financial constraints.

[Please Insert Table 13 here]

Consistent with our earlier results, we find that financially constrained firms are more likely to conduct debt-financed share repurchases than less financially constrained firms. We find statistically significant positive coefficients for *Market credit spread* × *WW-index*, *GZ credit spread* × *WW-index,* and *Excess bond premium* × *WW-index*, but not for *NPLoans* × *WW-index*. Firms are thus more likely to conduct debt-financed repurchases when they are less financially constrained, and debt market conditions are favourable.

6. Conclusions

We explore why less financially constrained firms issue debt when they conduct share repurchases. The empirical evidence supports debt market timing to coincide with favourable and optimistic debt market conditions. Thus, firms are more likely to take advantage of low-interest rates and credit spreads to time debt issuance decisions. Also, there is a large body of evidence that firms repurchase undervalued equity. A relatively unexplored phenomenon is the effect of financial constraints on a firm's decision to issue overvalued debt to repurchase undervalued equity.

Our study finds that financially constrained firms are more likely to conduct debt-financed share repurchases, and are associated with decreases in post-repurchases investments and increases in financial distress risks, especially when they are over-leveraged. Conversely, less financially constrained firms undertake debt-financed share repurchases when debt market conditions are favourable. In other words, less financially constrained firms exploit the availability of cheap debt financing and utilise it to fund their repurchase transactions. Moreover, less financially constrained firms obtain cheap (overvalued) debt financing to fund the repurchase of cheap (undervalued) equity.

We examine the implications of debt-financed share repurchases on post-repurchases investment, operating performance, financial distress risks, and stock performance. Our findings suggest that the impact of repurchases on investments and performance depends on the level of financial constraints, leverage, debt and equity valuations. Overall, debt-financed share repurchases are associated with increases in investment and positive stock performance when firms are less financially constrained and undervalued.

Appendix A1: Variable Definitions

Variable	Definition	Source of Data
Deal value	Dollar value of share repurchase	Thomson One
Intended repurchase ratio	Deal value divided by market value of equity (MV_{equity}), where MV_{equity} is the number of shares outstanding (*CSHO*) times closing share price (*PRCC_F*)	Thomson One and Compustat
HP-index	$HP-index=\left(-0.737*Size\right)+\left(0.043*Size^2\right)-\left(0.040*Age\right)$ follows Hadlock and Pierce (2010) where size is the log of inflation-adjusted (to 2004) book assets, and age is the number of years the firm has been on Compustat with a non-missing stock price. Size is replaced with log ($4.5 billion) and age with thirty-seven years if the actual values exceed these thresholds.	Compustat
WW-index	$WW-index=-0.091\left(CF/TA\right)-0.062\left(DIVDUM\right)+0.021\left(LTD/TA\right)-0.044\log TA$ $+0.102INDSG-0.035SG$ follows Whited and Wu (2006) index where *DIVDUM* equals one if the firm pays cash dividends and zero otherwise; *LTD* is long-term debt; *INDSG* is the firm's three-digit industry sales growth; *SG* is the firm's sales growth. A firm with a high *WW-index* is considered more financially constrained.	Compustat
PV ratio	The ratio of stock market price *P* to intrinsic value *V*, where *P* is the closing share price (*PRCC_F*); and *V* is the intrinsic value of equity estimated using the EBO residual income approach as explained in Appendix A2.	Compustat & I/B/E/S
NPLoans	Total Nonperforming Loans to Total Loans	FRED database
Market credit spread	Baa corporate Yield – 10-year constant maturity Treasury yield	FRED database
GZ credit spread	*GZ credit spread* is the average unweighted credit spread of several outstanding bonds in a given year (Gilchrist and Zakrajšek, 2012).	Gilchrist's website
Excess bond premium	*Excess bond premium* is the residual component of *GZ credit spread* that captures investor attitudes toward credit risk. This measure represents variation in the average price of bonds beyond the compensation for expected defaults (Gilchrist and Zakrajšek, 2012).	Gilchrist's website

Firm loan spread	The Initial Allin Drawn Spread	Thomson One
Firm bond credit spread	Bond credit spread associated with each bond issuance	Thomson One
Z-score	$Zscore = \left[1.2 * \left(ACT - LCT\right) + 1.4 * RE + 3.3 * EBIT + 0.999 * SALES\right] / TA + 0.6 * \left(MV / LT\right)$ follows Altman (1968) where *ACT* is total current assets and *LCT* is total current liabilities; *RE* is retained earnings; *EBIT* is earnings before interest and taxes; *SALES* is sales revenue; *TA* is total assets; *MV* is the market value of equity; *LT* is total liabilities.	Compustat
Investments	Capital expenditure (*CAPX*) divided by total assets (*TA*)	Compustat
MB ratio	$MV_{equity} / BV_{equity}$, where MV_{equity} is the number of shares outstanding (*CSHO*) times closing share price (*PRCC F*); and BV_{equity} is total assets (*TA*) minus total liabilities (*LT*)	Compustat
Cash ratio	Cash and cash equivalents (*CHE*) divided by total assets (*TA*)	Compustat
Stock returns	CAR from 30 days to 2 days prior to share repurchase announcements	CRSP
Short run CAR	3-day cumulative abnormal return following share repurchase announcements	CRSP
Long run BHAR	12-, 24- and 36- month buy-and-hold abnormal returns following share repurchase announcements	CRSP
Firm size	Logarithm of total assets (*TA*)	Compustat
Return on assets (ROA)	Gross operating income (*OIBDP*) to total assets (*TA*)	Compustat
Leverage	Long-term debt (*DLTT*) divided by total book assets (*TA*)	Compustat
Dividend	*Dividend* is the ratio of cash dividends to the market value of equity	Compustat
Actual repurchase ratio	Dollar amounts spent on repurchases are calculated using Purchase of Common and Preferred stock (*PRSTKC*) after adjusting for the decrease in Preferred Stock Redemption (*PSTKRV*) from previous year divided by market equity.	Compustat

Appendix A2: Residual Income Price-to-Value ratio *(PV)*

We use the Edwards-Bell-Ohlson (EBO) discounted residual income valuation model to compute a proxy for the intrinsic value of a firm (Edwards and Bell, 1961; Ohlson, 1995). This estimation approach is used in studies, such as Lee, Myers, and Swaminathan (1999), D'Mello and Shroff (2000), Dong, Hirshleifer, and Teoh (2012). For each period, we estimate the intrinsic value, *V* and compute the ratio of stock price to intrinsic value, *PV* as our measure of misvaluation.

Ohlson (1995) shows that under the assumption of "clean surplus" accounting, the change in book value from period to period is equal to earnings minus dividends. Therefore, the intrinsic value is the sum of the reported book value and an infinite sum of discounted residual income.

$$V_t = B_t + \sum_{t=1}^{\infty} \frac{E_t\left[NI_{t+i} - \left(r_e * B_{t+i-1}\right)\right]}{\left(1+r_e\right)^i},$$

$$V_t = B_t + \sum_{t=1}^{\infty} \frac{E_t\left[\left(ROE_{t+i} - r_e\right) * B_{t+i-1}\right]}{\left(1+r_e\right)^i},$$

where B_t = book value of equity at time *t* (negative book values are deleted). E_t is the expectations operator, NI_{t+i} = Net income for period *t+i,* r_e = annualised cost of equity capital, and ROE_{t+i} = the after-tax return on equity for period *t+i.*

Following Lee et al. (1999) and Dong et al. (2012), we use a three-year finite period to estimate the discounted residual income intrinsic value.[9] That is, we forecast earnings for the next three years and treat earnings in year three as perpetuity.

The three-year residual income equation is stated as follows:

$$V_t = B_t + \frac{\left(fROE_{t+1} - r_e\right)}{\left(1+r_e\right)} B_t + \frac{\left(fROE_{t+2} - r_e\right)}{\left(1+r_e\right)^2} B_{t+1} + \frac{\left(fROE_{t+3} - r_e\right)}{\left(1+r_e\right)^2 r_e} B_{t+2},$$

where $fROE_{t+i}$ is the forecast return on equity for period *t+i,* r_e is the annual CAPM cost of equity, and the last term discounts the period *t*+3 residual income as perpetuity.

Forecast *ROE* is computed as:

$$fROE_{t+i} = \frac{fEPS_{t+i}}{\bar{B}_{t+i-1}},$$

where $\bar{B}_{t+i-1}$ is defined as the mean of *B*(*t*+*i*-1) and *B*(*t*+*i*-2), and $fEPS_{t+i}$ is the forecasted *EPS* for period *t+i.* We follow Dong et al. (2012) and make the following adjustments to the forecast *EPS.* First, if the

[9] Lee et al. (1999) report that the choice of forecast horizon beyond three years does not affect the estimate of the intrinsic value and Dong et al. (2012) explain their results remain robust to different forecast horizons.

EPS forecast is missing for any period, we substitute it with the compounded previous period forecast *EPS* at the I/B/E/S long-term growth rate. Second, if the long-term growth rate is not available, then we substitute the missing forecast *EPS* with the first preceding available forecast *EPS.* We delete *fROE* that is greater than 1 and less than -1.

Future book values of equity are computed as follows:

$$B_{t+i} = B_{t+i-1} + fEPS_{t+i} - fDPS_{t+i},$$

where $fDPS_{t+i}$ is the forecasted dividend per share for year $t+i$, estimated using the current dividend payout ratio, k, and computed as follows:

$$fDPS_{t+i} = fEPS_{t+i} * k$$

where payout ratio, k, is given as

$$k = \frac{DPS_t}{EPS_t},$$

where DPS_t and EPS_t are the dividend per share and earnings per share for year, t. Following Lee et al. (1999) and Dong et al. (2012), we divide *DPS* by (0.06 × total assets) to derive an estimate of the payout ratio if $k<0$ (owing to negative *EPS*). Finally, we delete all observations for which k is greater than 1.

Cost of equity, r_e, is the annualised CAPM firm-specific rate, where beta is computed using the trailing five years monthly return data. If monthly return data is not enough, then we use at least two years of monthly data to determine the beta. The market risk premium is the average annual premium over the risk-free rate for the CRSP value-weighted index over the preceding 30 years. Following Dong et al. (2012), we set the cost of equity to within the range of 5%-20%.

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Table 1: Share Repurchase Announcements and Deal Value

This table presents the number of annual share repurchase announcements by US companies during the sample period of 1990-2016. Repurchases are defined as Debt-financed if firms specified the source of funding is from debt including loans and other borrowings, and Cash-financed if only corporate funds are utilised to finance the share repurchases. *, ** indicate significance at the 10% and 5%-level, respectively.

	Cash-Financed Repurchases			Debt-Financed Repurchases			Mean Difference	
Year	*N*	Mean Deal Value ($M)	Median Deal Value ($M)	*N*	Mean Deal Value ($M)	Median Deal Value ($M)	Difference	*t*-stat
1990	14	99.45	9.50	9	113.44	4.70	-13.99	(-0.11)
1991	8	408.38	79.44	4	59.12	16.75	349.25	(0.96)
1992	6	17176.81	13.90	9	85.85	25.00	17090.96	(1.24)
1993	5	13.03	6.25	5	26.67	15.94	-13.64	(-1.08)
1994	14	316.53	7.14	8	88.73	18.38	227.80	(0.56)
1995	6	12.88	12.79	12	69.87	14.81	-56.99	(-1.25)
1996	8	60.53	7.34	8	4475.01	17.44	-4414.47	(-0.99)
1997	7	791.57	4.00	8	106.59	31.50	684.98	(1.17)
1998	12	318.68	4.00	13	489.44	29.69	-170.76	(-0.49)
1999	7	2118.12	1750.00	7	85.81	65.31	2032.30*	(1.96)
2000	5	126.93	18.38	2	155.50	155.50	-28.57	(-0.19)
2001	11	641.32	11.49	5	372.12	230.00	269.20	(0.36)
2002	9	2230.13	9.60	5	224.43	158.03	2005.70	(0.67)
2003	5	708.38	98.80	2	76.53	76.53	631.85	(0.80)
2004	21	1141.18	122.75	3	1773.33	1730.00	-632.16	(-0.47)
2005	23	3641.94	417.32	3	222.23	291.68	3419.71	(0.41)
2006	14	350.72	46.00	4	212.40	251.06	138.32	(0.47)
2007	48	733.91	91.70	18	1412.87	425.00	-678.96	(-1.14)
2008	61	673.58	27.44	17	2367.25	46.30	-1693.66	(-1.38)
2009	16	592.60	23.85	5	136.32	86.00	456.28	(0.77)
2010	18	1087.91	200.00	4	528.80	180.40	559.11	(0.63)
2011	42	544.98	152.50	15	229.28	50.00	315.70	(0.99)
2012	28	7821.77	212.50	10	327.02	150.00	7494.75	(0.59)
2013	57	1222.97	200.00	8	848.86	99.50	374.12	(0.38)
2014	122	454.05	150.00	15	990.70	205.16	-536.65**	(-2.27)
2015	100	1060.01	172.25	30	1104.31	375.00	-44.29	(-0.08)
2016	61	889.72	120.00	11	57.40	40.00	832.32	(1.25)
Total	**728**	**1254.90**	**100.00**	**240**	**784.18**	**70.25**	**470.72**	**(0.78)**

Table 2: Summary statistics of the firm characteristics and debt market conditions

This table presents the summary statistics of the firm characteristics and debt market conditions. The table also shows the mean difference tests of the variables between cash-financed and debt-financed repurchases. Repurchases are defined as cash-financed if corporate funds are used to finance the share repurchases, and debt-financed if firms issue loans and debt capital to finance the share repurchases. *HP-index* is the Hadlock and Pierce (2010) index for financial constraints where firms in the highest quintile of *HP-index* are defined as financially constrained, and the remaining firms are defined as less financially constrained. *WW-index* is the Whited and Wu (2010) index for financial constraints where firms in the highest quintile of respectively the *WW-index* are defined as financially constrained, and the remaining firms are defined as less financially constrained. *PV ratio* is the stock market price (*P*) divided by the intrinsic value (*V*); *NPLoans* is the ratio of total nonperforming loans to total loans, *Market credit spread* is the Baa corporate yield minus 10-year constant maturity treasury yield, *GZ credit spread* is the average unweighted credit spread of several outstanding bonds in a given year (Gilchrist and Zakrajšek, 2012) and *Excess bond premium* is the residual component of *GZ credit spread* that captures investor attitudes toward credit risk (Gilchrist and Zakrajšek, 2012). *Firm Loan spread* is the AllinDrawn spread over Libor and *Firm Bond credit spread* is the credit spread on bonds issued. *Cash ratio* is the ratio of cash and cash equivalents to total assets; *Dividend* is the ratio of cash dividends to the market value of equity. *Firm size* is the natural logarithm of total assets; *Leverage* is the total debt divided by total assets; *Stock returns* are the 30-days pre-announcement date cumulative abnormal returns, *Z-score* is the Altman (1968) measure of bankruptcy prediction. *Return on assets* is the ratio of operating profit before depreciation to total assets; *Investment* is the total of capital expenditure divided by total assets; the *Intended repurchase ratio* is the deal value divided by the market value of equity. *, **, *** indicate significance at the 10%, 5% and 1%-level, respectively.

	Cash-Financed Repurchases			Debt-Financed Repurchases			Mean Differences	
	N	Mean	Median	*N*	Mean	Median	Difference	*t-stat*
HP-index	667	-3.561	-3.616	227	-3.433	-3.439	-0.128***	(-2.91)
WW-index	667	-0.313	-0.311	227	-0.289	-0.290	-0.024***	(-2.74)
PV ratio	667	3.190	1.745	227	2.938	1.436	0.253	(0.51)
NPLoans	735	2.187	1.830	247	2.111	1.600	0.059	(0.68)
Market credit spread	735	2.657	2.590	247	2.459	2.400	0.210***	(3.62)
GZ Credit spread	738	2.295	2.019	252	2.151	1.986	0.144**	(2.24)
Excess bond premium	738	0.016	-0.188	252	0.032	-0.102	-0.016	(-0.45)
Firm loan spread	145	1.414	1.250	84	1.379	1.250	0.035	(0.27)
Firm bond credit spread	80	1.866	1.521	37	1.930	1.300	-0.064	(-0.24)
Cash ratio	667	0.228	0.175	227	0.087	0.041	0.140***	(10.07)
Dividend	667	0.013	0.000	227	0.016	0.000	-0.003	(-1.15)
Firm size	667	6.857	6.977	227	6.572	6.545	0.285*	(1.90)
Leverage	667	0.093	0.075	227	0.141	0.138	-0.048***	(-6.56)
Stock returns	716	-0.046	-0.019	244	-0.042	-0.026	-0.004	(-0.35)
Z-score	664	4.451	3.462	222	3.638	3.180	0.813***	(2.62)
Return on assets	667	0.143	0.142	227	0.171	0.162	-0.027***	(-4.02)
Investment	667	0.047	0.033	227	0.072	0.047	-0.025***	(-5.98)
Intended repurchase ratio	659	0.158	0.074	217	0.177	0.096	-0.020	(-0.84)

Table 3: Univariate Results of Changes in Cash, Leverage, ROA, Investment, and Z-score Around Share Repurchases

This table presents the univariate results of the pre- and post-repurchase changes in *CASH*, Leverage (*LEV*), Return on Assets (*ROA*), *Investment*, and *Z-score* for cash-financed (Panel A) and debt-financed (Panel B) repurchases. Period refers to changes in years i.e. (-2,-1) indicates changes between 2 years and 1 year to the repurchase announcement. *CASH* is the ratio of cash and cash equivalents to total assets, *LEV* is the total debt divided by total assets, *ROA* is the ratio of operating profit before depreciation to total assets, *Investment* is capital expenditure divided by total assets, and the Altman's (1968) *Z-score* measures financial distress risk. *, **, *** indicate significance at the 10%, 5%, and 1%-level, respectively.

Panel A: Cash-Financed

Period (in years)	Changes in *CASH*	Changes in *LEV*	Changes in *ROA*	Changes in *Investment*	Changes in *Z-score*
(-2,-1)	0.005	-0.003	0.000	-0.001	-0.010
	1.46	-1.93**	0.17	-1.15	-2.45**
(-1,0)	-0.006	0.005	0.006	0.001	0.170
	-1.81*	3.39***	2.64***	0.50	-1.79*
(-1,+1)	-0.012	0.012	-0.003	0.001	-0.459
	-2.75***	5.86***	-0.94	0.83	-2.41**
(-1,+2)	-0.026	0.012	-0.005	-0.000	-0.655
	-4.78***	4.40***	-1.19	-0.21	-3.30***
(-1,+3)	-0.033	0.012	-0.005	-0.006	-0.909
	-5.30***	3.24***	-0.95	-2.63***	-3.29***

Panel B: Debt-Financed

Period (in years)	Changes in *CASH*	Changes in *LEV*	Changes in *ROA*	Changes in *Investment*	Changes in *Z-score*
(-2,-1)	-0.011	-0.002	0.005	0.004	0.045
	-2.66***	-0.47	1.26	1.68*	0.36
(-1,0)	-0.017	0.025	0.001	0.004	-0.403
	-3.35***	6.29**	0.19	0.94	-1.97**
(-1,+1)	-0.014	0.032	-0.009	-0.006	-0.535
	-2.12**	6.40***	-1.82	-1.55	-2.35**
(-1,+2)	-0.019	0.026	-0.021	-0.011	-0.668
	-2.67***	4.32***	-3.66***	-2.21**	-2.55**
(-1,+3)	-0.018	0.024	-0.029	-0.010	-0.84
	-2.18**	3.22***	-3.89***	-2.45**	-2.73***

Table 4: Univariate Results of Post-Repurchases Changes in Abnormal *ROA,* Investment, and Z-score

This table presents the univariate results of the post-repurchase changes in abnormal *ROA*, *Investment*, and *Z-score* and tests of the mean difference between cash-financed and debt-financed repurchases as reported in Panel A and between under-levered and over-levered debt-financed repurchasing firms in Panel B. A repurchase is classified as cash-financed if the firm indicates that the source of finance is cash and it is debt-financed if the repurchase is financed using loans and debt financing. A firm is classified as under-levered if the actual leverage for the year is less than the target leverage and it is over-levered if the actual leverage is higher than the target leverage. *ROA* is the ratio of operating profit before depreciation to total assets, *Investment* is capital expenditure divided by total assets, and the Altman's *Z-score* measures financial distress risk. Abnormal *ROA,* Abnormal *Investment*, and Abnormal *Z-score* are the differences between the Abnormal *ROA,* Abnormal *Investment*, and Abnormal *Z-score* of the sample firms minus the Abnormal *ROA,* Abnormal *Investment*, and Abnormal *Z-score* of a matched control sample. * indicates significance at the 10%-level.

Panel A: Cash-Financed and Debt-Financed

	Cash-Financed Repurchases			Debt-Financed Repurchases			Mean Differences	
Variables (in years)	*N*	Mean	Median	*N*	Mean	Median	Difference	*t*-stat
Changes in Abnormal *ROA* (-1,+1)	255	0.001	0.003	114	0.010	0.016	-0.010	(-0.99)
Changes in Abnormal *ROA* (-1,+2)	192	-0.003	0.000	93	0.001	0.000	-0.003	(-0.25)
Changes in Abnormal *ROA* (-1,+3)	137	0.018	0.010	80	0.003	-0.001	0.015	(0.97)
Changes in Abnormal *Investment* (-1,+1)	282	0.003	0.000	113	0.004	0.001	-0.001	(-0.13)
Changes in Abnormal *Investment* (-1,+2)	216	0.003	-0.001	102	0.005	0.001	-0.002	(-0.24)
Changes in Abnormal *Investment* (-1,+3)	163	0.005	0.000	83	0.005	0.002	-0.000	(-0.03)
Changes in Abnormal *Z-score* (-1,+1)	276	0.126	-0.079	111	-0.519	-0.235	0.645	(1.45)
Changes in Abnormal *Z-score* (-1,+2)	211	-0.069	-0.011	100	-0.455	-0.175	0.386	(0.69)
Changes in Abnormal *Z-score* (-1,+3)	159	-0.344	-0.167	82	-0.605	-0.221	0.261	(0.36)

Panel B: Under-levered and Over-levered Debt-Financed Firms

	Under-levered Debt-Financed			Over-levered Debt-Financed			Mean Differences	
Variables (in years)	*N*	Mean	Median	*N*	Mean	Median	Difference	*t*-stat
Changes in Abnormal *ROA* (-1,+1)	88	0.005	0.008	26	0.027	0.049	-0.022	(-0.92)
Changes in Abnormal *ROA* (-1,+2)	72	0.001	0.003	21	0.002	-0.016	-0.001	(-0.03)
Changes in Abnormal *ROA* (-1,+3)	61	-0.006	-0.009	19	0.034	0.029	-0.040	(-1.17)
Changes in Abnormal *Investment* (-1,+1)	87	0.001	-0.000	26	0.016	0.010	-0.016	(-0.94)
Changes in Abnormal *Investment* (-1,+2)	77	0.003	0.002	25	0.008	0.000	-0.005	(-0.24)
Changes in Abnormal *Investment* (-1,+3)	62	0.004	0.002	21	0.007	-0.001	-0.003	(-0.18)
Changes in Abnormal *Z-score* (-1,+1)	85	-0.111	-0.262	26	-1.853	-0.022	1.741*	(1.76)
Changes in Abnormal *Z-score* (-1,+2)	75	-0.063	-0.320	25	-1.631	-0.067	1.567	(1.22)
Changes in Abnormal *Z-score* (-1,+3)	61	-0.125	-0.299	21	-2.001	0.145	1.876	(1.06)

Table 5: Univariate Results of Post-Repurchases Stock Performance

This table presents the univariate results of the post-repurchases short-run and long-run stock performance for cash-financed and debt-financed repurchases. A repurchase is classified as cash-financed if the firm indicates that the source of finance is cash, and it is debt-financed if the repurchase is financed using loans and debt financing. Panel A shows the cumulative abnormal return (*CAR*) based on different event windows. We use the market model and select the value-weighted (VW) market index as the benchmark. Panel B reports the monthly buy-and-hold abnormal returns (*BHAR*) 12-, 24-, and 36-month following the repurchase announcement date. ***, **and * represent the 1%, 5% and 10% significance level, respectively.

Panel A: Short-run *CAR*

	Cash-financed repurchases			Debt-financed repurchases			Mean Difference	
Variables (in days)	*N*	Mean	Median	*N*	Mean	Median	Difference	*t*-stat
CAR (-30,-2)	716	-0.046	-0.019	244	-0.042	-0.026	-0.004	(-0.35)
CAR (-1,0)	716	0.009	0.006	244	0.009	0.007	-0.001	(-0.16)
CAR (0,1)	716	0.018	0.014	244	0.021	0.018	-0.004	(-0.65)
CAR (-1,1)	716	0.017	0.013	244	0.019	0.017	-0.002	(-0.37)
CAR (-2,2)	716	0.014	0.012	244	0.017	0.020	-0.003	(-0.46)
CAR (1,30)	716	0.023	0.014	244	0.028	0.019	-0.005	(-0.48)

Panel B: Long-run *BHAR*

	Cash-financed repurchases			Debt-financed repurchases			Mean Difference	
Variables (in months)	*N*	Mean	Median	*N*	Mean	Median	Difference	*t*-stat
BHAR (0,+12)	674	0.038	0.010	227	0.062	0.001	-0.024	(-0.73)
BHAR (0,+24)	674	0.068	-0.008	227	0.043	-0.004	0.024	(0.47)
BHAR (0,+36)	674	0.103	-0.045	227	-0.030	-0.081	0.133*	(1.80)

Table 6: Financial Constraints, Debt Market Conditions, and Debt-Financed Share Repurchases

This table shows the results of a logit estimation of the effect of financial constraints and debt market conditions on debt-financed share repurchase. The dependent variable is equal to 1 for a debt-financed repurchase and 0 otherwise. *HP-index* measures financial constraints according to Hadlock and Pierce (2010) and is equal to 1 for firms in the highest quintile and 0 otherwise. The measures of debt market conditions are *NPLoans,* the percentage of Nonperforming loans to total loans*, Market credit spread,* the Baa corporate bond yield minus the 10-year constant maturity Treasury yield. *GZ credit spread* is the average unweighted credit spread of several outstanding bonds in a given year (Gilchrist and Zakrajšek, 2012) and *Excess bond premium* is the residual component of *GZ credit spread* that captures investor attitudes toward credit risk (Gilchrist and Zakrajšek, 2012). *NPLoans* × *HP-index*, *Market credit spread* × *HP-index*, *GZ credit spread* × *HP-index*, and *Excess bond premium* × *HP-index* are the interactions between debt valuations and financial constraints. Refer to Appendix A for definitions and measurements of all other variables in the model. Standard errors are Newey-West (1987) with 4 lags. *t*-statistics are shown in parentheses. *, **, and *** show significance at the 10%, 5%, and 1%-level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
HP-index	0.955**	0.813*	0.968**	1.012**	3.870***	4.065***	1.599***	0.955**
	(2.05)	(1.71)	(2.08)	(2.19)	(3.49)	(3.37)	(3.09)	(2.03)
NPLoans	-0.188				-0.377***			
	(-1.43)				(-2.61)			
Market credit Spread		-0.639**				-5.271***		
		(-2.35)				(-3.26)		
GZ credit spread			-0.158				-0.007	
			(-0.76)				(-0.04)	
Excess bond premium				0.321				-6.519**
				(0.89)				(-2.48)
NPLoans × HP-index					1.163***			
					(2.95)			
Market Credit Spread × HP-index						1.332***		
						(2.94)		
GZ credit spread × HP-index							0.736***	
							(2.98)	
Excess bond premium × HP-index								1.987***
								(2.62)
PV ratio	-0.195	-0.073	-0.208	-0.225	-0.310	-0.207	-0.172	-0.340
	(-0.58)	(-0.21)	(-0.63)	(-0.68)	(-0.93)	(-0.59)	(-0.51)	(-0.98)
Cash ratio	-7.854**	-7.987**	-7.786**	-7.705**	-4.872	-9.269**	-6.903*	-8.703**
	(-2.23)	(-2.22)	(-2.21)	(-2.19)	(-1.38)	(-2.45)	(-1.90)	(-2.46)
Dividend dummy	0.031	-0.013	0.039	0.064	-0.020	-0.094	-0.046	-0.017
	(0.08)	(-0.03)	(0.10)	(0.17)	(-0.05)	(-0.24)	(-0.12)	(-0.04)
Ln(Assets)	0.142	0.136	0.148	0.156	-0.229**	0.159	0.154	0.136
	(0.96)	(0.91)	(1.00)	(1.07)	(-2.00)	(1.06)	(1.04)	(0.92)
Leverage	-1.368	-1.590	-1.599	-1.427	-1.295	-1.871	-1.543	-1.319
	(-1.05)	(-1.21)	(-1.22)	(-1.10)	(-0.97)	(-1.38)	(-1.15)	(-1.00)
Stock returns	0.025	-1.517	-0.491	0.464	0.154	-1.537	-0.274	0.438
	(0.02)	(-1.17)	(-0.39)	(0.37)	(0.13)	(-1.16)	(-0.22)	(0.34)
Z-score	-0.183**	-0.195**	-0.189**	-0.180**	-0.202**	-0.223***	-0.201**	-0.203**
	(-2.31)	(-2.48)	(-2.39)	(-2.30)	(-2.39)	(-2.68)	(-2.44)	(-2.52)
Return on assets	-2.172	-2.312	-2.181	-2.116	-0.177	-3.150	-2.042	-2.628
	(-0.82)	(-0.86)	(-0.84)	(-0.82)	(-0.07)	(-1.12)	(-0.79)	(-0.99)
Investment	8.695**	8.615**	9.184**	8.772**	7.423*	9.202**	7.223*	8.824**
	(2.15)	(2.13)	(2.28)	(2.16)	(1.83)	(2.16)	(1.71)	(2.12)
Intended repurchase ratio	0.337	0.303	0.388	0.300	0.297	0.316	0.400	0.359
	(0.51)	(0.45)	(0.58)	(0.45)	(0.43)	(0.47)	(0.58)	(0.53)
Constant	2.141	3.268*	2.270	1.798	2.418	14.586***	4.247**	1.823
	(1.23)	(1.78)	(1.27)	(1.03)	(1.42)	(3.36)	(2.18)	(1.04)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	844	844	844	844	844	844	844	844
pseudo-R^2	0.244	0.252	0.241	0.241	0.266	0.270	0.262	0.256
Chi-squared	117.744	121.567	116.232	116.445	128.320	130.502	126.495	123.735
F-test	-182.482	-180.571	-183.238	-183.132	-177.195	-176.104	-178.107	-179.487

Table 7: Equity Undervaluation, Debt Market Conditions, and Debt-Financed Share Repurchases

This table shows the results of a logit estimation of equity valuation and debt market conditions on debt-financed share repurchase. The dependent variable is equal to 1 for a debt-financed repurchase and 0 otherwise. *HP-index* measures financial constraints according to Hadlock and Pierce (2010) and is equal to 1 for firms in the highest quintile and 0 otherwise. The measure of equity undervaluation is the price-to-value ratio, *PV ratio.* The measures of debt market conditions are *NPLoans,* the percentage of Nonperforming loans to total loans*, Market credit spread,* the Baa corporate bond yield minus the 10-year constant maturity Treasury yield. *GZ credit spread* is the average unweighted credit spread of several outstanding bonds in a given year (Gilchrist and Zakrajšek, 2012) and *Excess bond premium* is the residual component of *GZ credit spread* that captures investor attitudes toward credit risk (Gilchrist and Zakrajšek, 2012). *NPLoans* × *PV ratio*, *Market credit spread* × *PV ratio*, *GZ credit spread* × *PV ratio*, and *Excess bond premium* × *PV ratio* are the interactions between debt valuations and market-to-book ratio. Refer to Appendix A for definitions and measurements of all other variables in the model. Standard errors are Newey-West (1987) with 4 lags. *t*-statistics are shown in parentheses. *, **, and *** show significance at the 10%, 5%, and 1%-level, respectively.

	(1)	(2)	(3)	(4)
HP-index	0.983**	0.684	0.822*	1.036**
	(2.15)	(1.45)	(1.77)	(2.29)
PV ratio	-0.504	-3.541***	-2.675***	-0.281*
	(-0.71)	(-3.26)	(-2.84)	(-1.82)
NPLoans	-0.263			
	(-1.57)			
Market credit Spread		-1.205***		
		(-3.66)		
GZ credit spread			-0.603**	
			(-2.20)	
Excess bond premium				-0.012**
				(-2.03)
NPLoans × PV ratio	0.125			
	(0.51)			
Market credit spread × PV ratio		1.217***		
		(3.41)		
GZ credit spread × PV ratio			0.972***	
			(2.80)	
Excess bond premium × PV ratio				0.764**
				(2.27)
Constant	2.632	4.462**	3.317*	2.217
	(1.51)	(2.39)	(1.84)	(1.28)
Control variables	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	844	844	844	844
pseudo-R^2	0.235	0.265	0.246	0.235
Chi-squared	113.209	127.954	118.842	113.247
F-test	-184.750	-177.378	-181.933	-184.731

Table 8: Debt-Financed Share Repurchases for Samples of Undervalued and Overvalued Equity

This table shows the results of a logit estimation of debt-financed share repurchase of undervalued and overvalued equity based on median price-to-value ratio, *PV ratio.* The dependent variable is equal to 1 for a debt-financed repurchase and 0 otherwise. *HP-index* measures financial constraints according to Hadlock and Pierce (2010) and is equal to 1 for firms in the highest quintile and 0 otherwise. The measures of debt market conditions are *NPLoans,* the percentage of Nonperforming loans to total loans*, Market credit spread,* the Baa corporate bond yield minus the 10-year constant maturity Treasury yield. *GZ credit spread* is the average unweighted credit spread of several outstanding bonds in a given year (Gilchrist and Zakrajšek, 2012) and *Excess bond premium* is the residual component of *GZ credit spread* that captures investor attitudes toward credit risk (Gilchrist and Zakrajšek, 2012). *NPLoans* × *HP-index*, *Market credit spread* × *HP-index*, *GZ credit spread* × *HP-index*, and *Excess bond premium* × *HP-index* are the interactions between debt valuations and price-to-value ratio. Refer to Appendix A for definitions and measurements of all other variables in the model. Standard errors are Newey-West (1987) with 4 lags. *t*-statistics are shown in parentheses. *, **, and *** show significance at the 10%, 5%, and 1%-level, respectively.

	Undervalued Equity (Low PV ratio)				*Overvalued Equity (High PV ratio)*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
HP-index	6.485**	11.219***	2.549**	2.296**	5.407**	-0.324	1.378*	1.503*
	(2.43)	(2.93)	(2.39)	(2.22)	(2.45)	(-0.18)	(1.68)	(1.93)
NPLoans	-0.098				-1.042***			
	(-0.30)				(-3.08)			
Market credit Spread		-4.900***				2.650		
		(-2.91)				(1.00)		
GZ credit spread			-0.208				0.383	
			(-0.48)				(1.05)	
Excess bond premium				-9.270*				0.411
				(-1.67)				(0.09)
NPLoans × *HP-index*	1.321*				2.992***			
	(1.73)				(3.26)			
Market credit spread × *HP-index*		4.122***				0.786		
		(2.69)				(1.10)		
GZ credit spread × *HP-index*			1.371**				0.431	
			(2.52)				(0.76)	
Excess bond premium × *HP-index*				3.004*				-0.027
				(1.78)				(-0.02)
Constant	1.289	33.438***	6.011**	2.239	-0.307	-3.936	0.709	2.334
	(0.63)	(2.95)	(2.02)	(0.84)	(-0.13)	(-0.57)	(0.24)	(0.93)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	430	430	430	430	414	414	414	414
pseudo-R^2	0.312	0.365	0.336	0.292	0.341	0.274	0.274	0.270
Chi-squared	50.358	58.822	54.236	47.105	70.492	56.622	56.674	55.822
F-test	-55.428	-51.196	-53.489	-57.055	-68.206	-75.141	-75.115	-75.541

Table 9: Firm-Level Debt Conditions and Debt-Financed Share Repurchases

This table shows the results of a logit estimation of the effects of financial constraints and firm-level debt conditions on debt-financed share repurchase. The dependent variable is equal to 1 for a debt-financed repurchase and 0 otherwise. The measures of firm-level debt conditions are *Firm loan spread* and *Firm bond credit spread. HP-index* measures financial constraints according to Hadlock and Pierce (2010) index and is equal to 1 for firms in the highest quintile and 0 otherwise. The measure of equity undervaluation is the price-to-value ratio, *PV ratio.* The *Firm loan spread* × *HP-index* and *Firm bond credit spread* × *HP-index* are the interactions between debt valuations and financial constraints; *Firm loan spread* × *PV ratio* and *Firm bond credit spread* × *PV ratio* are the interactions between debt valuations and price-to-value ratio. Refer to Appendix A for definitions and measurements of all other variables in the model. Year and industry dummies are included. *t*-statistics are shown in parentheses. *, **, and *** show significance at the 10%, 5%, and 1%-level, respectively.

	(1)	(2)	(3)	(4)
HP-index	3.056**	6.507***	0.714	1.873*
	(2.24)	(2.70)	(1.22)	(1.75)
PV ratio	-0.122	-0.060	-0.442*	-0.824**
	(-0.43)	(-0.12)	(-1.87)	(-1.98)
Firm loan spread	-6.019**		-0.690*	
	(-2.03)		(-1.87)	
Firm bond credit spread		-0.091**		-0.008
		(-2.30)		(-1.64)
Firm loan spread × HP-index	1.451*			
	(1.88)			
Firm bond credit spread × HP-index		0.021**		
		(2.18)		
Firm loan spread × PV ratio			0.214***	
			(2.75)	
Firm bond credit spread × PV ratio				0.002***
				(2.67)
Constant	13.072**	31.117***	4.430**	13.383**
	(2.50)	(3.02)	(2.06)	(2.44)
Control variables	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Observations	170	90	170	90
pseudo-R^2	0.124	0.265	0.109	0.224
Chi-squared	27.621	29.119	24.445	24.606
F-test	-97.853	-40.484	-99.442	-42.740

Table 10: Post-Repurchases and Changes in Abnormal ROA, Investment, and Z-score

This table shows the results of an OLS regression of post-repurchase changes in abnormal *ROA* (Columns 1-3), *Investment* (Columns 4-6), and *Zscore* (Columns 7-9). The dependent variable is the abnormal *ROA* (Columns 1-3), *Investment* (Columns 4-6), and *Zscore* (Columns 7-9) 2-years following the share repurchases. The independent variables include dummy *DFRep* which takes a value of 1 for debt-financed and 0 for cash-financed share repurchases; *HP-index* measures financial constraints according to the Hadlock and Pierce (2010) index and is equal to 1 for firms in the highest quintile and 0 otherwise. The measure of equity undervaluation is the price-to-value ratio, *PV ratio. OverLEV* is the difference between actual leverage and target leverage, the interaction between debt-financed repurchase dummy and financial constraints *DFRep × HP-index Dummy,* the interaction between debt-financed repurchases and equity valuation *DFRep × PV ratio*, and the interaction between debt-financed repurchases and over-leverage *DFRep × Over-leverage*. Refer to Appendix A for definitions and measurements of all other variables in the model. Year and industry dummies are included. *t*-statistics are shown in parentheses. *, **, and *** show significance at the 10%, 5%, and 1%-level, respectively.

	Abnormal ROA			*Abnormal CAPEX*			*Abnormal ZScore*		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DFRep	-0.023	-0.044*	-0.014	-0.031**	-0.028*	-0.036**	-0.168	-1.788	0.129
	(-1.16)	(-1.90)	(-0.64)	(-1.99)	(-1.70)	(-2.28)	(-0.12)	(-1.24)	(0.09)
HP-index		-0.066*	-0.075**		-0.034*	-0.034*		-1.188	-1.815
		(-1.96)	(-2.25)		(-1.76)	(-1.80)		(-0.71)	(-1.11)
PV ratio	0.000			0.001			0.044		
	(0.20)			(0.57)			(0.37)		
OverLEV	0.015	0.018	0.038	0.001	0.002	-0.019	-2.014	-1.874	-0.215
	(0.66)	(0.81)	(1.46)	(0.07)	(0.16)	(-1.09)	(-1.55)	(-1.43)	(-0.14)
DFRep × HP-index	-0.139**			-0.067**			5.117**		
	(-2.14)			(-2.28)			(2.00)		
DFRep × PV ratio		0.005			0.003			0.579	
		(1.15)			(0.76)			(1.53)	
DFRep × OverLEV			-0.070			-0.059**			5.469**
			(-1.50)			(-2.00)			(2.11)
Constant	0.027	0.029	0.043	-0.026	-0.029	-0.048	1.435	2.212	3.278
	-0.023	-0.044*	-0.014	(-0.34)	(-0.37)	(-0.61)	(0.21)	(0.33)	(0.49)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	271	271	271	300	300	300	293	293	293
Adjusted R^2	0.239	0.239	0.250	0.078	0.094	0.061	0.529	0.542	0.507

Table 11: Post-Repurchases Stock Performance

This table shows the results of an OLS regression of post-repurchase stock performance. The dependent variable in Columns 1-5 is the three-day cumulative abnormal returns *CAR* (-1, +1) for short-run stock performance, and in Columns 6-10 is the 24-months buy-and-hold abnormal returns *BHAR* (0, +24) for long-run stock performance following share repurchases. The independent variables include dummy *DFRep* which takes a value of 1 for debt-financed and 0 for cash-financed share repurchases; *HP-index* measures financial constraints according to the Hadlock and Pierce (2010) index and is equal to 1 for firms in the highest quintile and 0 otherwise. The measure of equity undervaluation is the price-to-value ratio, *PV ratio. Stock returns* is the 30-days pre-announcement date cumulative abnormal returns*, OverLEV* is the difference between actual leverage and target leverage, the interaction between debt-financed repurchase dummy and financial constraints *DFRep × HP-index,* the interaction between debt-financed repurchases and equity valuation *DFRep × PV ratio*, the interaction between debt-financed repurchases and over-leverage *DFRep × OverLEV,* the interaction between financial constraints and equity valuation *HP-index × PV ratio,* and the interaction between financial constraints and over-leverage *HP-index × OverLEV*. Refer to Appendix A for definitions and measurements of all other variables in the model. Year and industry dummies are included. *t*-statistics are shown in parentheses. *, **, and *** show significance at the 10%, 5%, and 1%-level, respectively.

	Short run stock performance (CAR)					***Long run stock performance (BHAR)***				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
DFRep	0.004	0.024**	0.001	0.003	0.008	0.033	0.231**	0.026	0.043	0.016
	(0.43)	(2.08)	(0.10)	(0.36)	(0.63)	(0.50)	(2.10)	(0.32)	(0.48)	(0.20)
HP-index	0.021	0.011	0.019	0.015	0.009	-0.187**	-0.185	-0.114	-0.276**	-0.073
	(1.62)	(0.92)	(1.35)	(1.15)	(0.64)	(-2.00)	(-1.58)	(-1.13)	(-2.00)	(-0.71)
PV ratio	-0.002	-0.009	0.005	-0.004	0.001	0.024	0.150*	0.078	0.038	0.089
	(-0.31)	(-1.00)	(0.52)	(-0.64)	(0.12)	(0.46)	(1.80)	(1.22)	(0.46)	(1.40)
Stock returns	-0.059**	-0.054**	-0.060**	-0.068***	-0.052*	-0.292	-1.534	-0.210	-2.637	-0.179
	(-2.45)	(-2.25)	(-2.12)	(-2.94)	(-1.84)	(-1.50)	(-0.73)	(-0.85)	(-1.23)	(-0.73)
OverLEV			0.024		-0.142			0.199		0.596
			(0.21)		(-1.32)			(0.29)		(0.89)
DFRep × HP-index	-0.051*					-0.127***				
	(-1.93)					(-2.70)				
DFRep × PV ratio		-0.030**					-0.411***			
		(-2.01)					(-2.83)			
DFRep × OverLEV			-0.310*					-0.083		
			(-1.94)					(-0.08)		
HP-index × PV ratio				-0.020					0.264	
				(-0.87)					(1.16)	
HP-index × OverLEV					-0.308*					-2.345**
					(-1.85)					(-2.08)
Constant	0.050	0.047	-0.005	0.045	0.004	0.294**	1.212	0.307*	1.539	0.307*
	(0.64)	(0.60)	(-0.06)	(0.60)	(0.05)	(2.09)	(1.24)	(1.84)	(1.55)	(1.87)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes	No
Year dummies	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	No
Observations	664	664	664	664	664	650	650	650	650	650
Adjusted R^2	0.228	0.228	0.156	0.193	0.155	0.007	0.030	0.007	0.013	0.016

Table 12: Debt-Financed Share Repurchases and Completion Rates

This table shows the results of an OLS regression (Columns 1 and 2) and Tobit regression (Columns 3 and 4) of actual repurchase completion rates. The dependent variable is the actual repurchase ratio computed as the Dollar amounts spent on repurchases are calculated using Purchase of Common and Preferred stock (PRSTKC) after adjusting for the decrease in Preferred Stock Redemption (PSTKRV) from the previous year divided by market equity. The independent variables include dummy *DFRep* which takes a value of 1 for debt-financed and 0 for cash-financed share repurchases; *HP-index* measures financial constraints according to the Hadlock and Pierce (2010) index and is equal to 1 for firms in the highest quintile and 0 otherwise. The measure of equity undervaluation is the price-to-value ratio, *PV ratio*. The interaction between debt-financed repurchase dummy and financial constraints *DFRep × HP-index,* and the interaction between debt-financed repurchases and equity valuation *DFRep × PV ratio*. Refer to Appendix A for definitions and measurements of all other variables in the model. Standard errors are Newey-West (1987) with 4 lags. *t*-statistics are shown in parentheses. *, **, and *** show significance at the 10%, 5%, and 1%-level, respectively.

	OLS			*Tobit*		
	(1)	(2)	(3)	(4)	(5)	(6)
DFRep	0.027***	0.037	0.045***	0.027***	0.037	0.045***
	(3.19)	(0.65)	(2.78)	(3.70)	(0.77)	(3.06)
HP-index	0.001		0.001	0.001		0.001
	(0.13)		(0.09)	(0.13)		(0.08)
PV ratio	-0.008***	-0.008***		-0.008**	-0.008**	
	(-2.80)	(-2.77)		(-2.19)	(-2.15)	
DFRep × HP-index		0.003			0.003	
		(0.20)			(0.24)	
DFRep × PV ratio			-0.015***			-0.015**
			(-2.66)			(-2.36)
Constant	0.050**	0.048**	0.045**	0.050**	0.048*	0.045*
	(2.20)	(2.17)	(2.00)	(2.17)	(1.82)	(1.92)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	733	733	733	733	733	733
R^2	0.081	0.081	0.084			
pseudo-R^2				-0.041	-0.041	-0.042
Chi-squared				62.088	62.130	64.022
F-test	787.772	787.793	788.739	787.772	787.793	788.739

Table 13: WW-index measure of Financial Constraints and Debt-Financed Share Repurchases

This table shows the results of a logit estimation of the effect of financial constraints and debt market conditions on debt-financed share repurchase. The dependent variable is equal to 1 for a debt-financed repurchase and 0 otherwise. *WW-index* measures financial constraints according to the Whited and Wu (2006) index and is equal to 1 for firms in the highest quintile and 0 otherwise. The measures of debt market conditions are *NPLoans,* the percentage of Nonperforming loans to total loans, *Market credit spread,* the Baa corporate bond yield minus the 10-year constant maturity Treasury yield. *GZ credit spread* is the average unweighted credit spread of several outstanding bonds in a given year (Gilchrist and Zakrajšek, 2012) and *Excess bond premium* is the residual component of *GZ credit spread* that captures investor attitudes toward credit risk (Gilchrist and Zakrajšek, 2012). The *NPLoans* × *WW-index*, *Market credit spread* × *WW-index*, *GZ credit spread* × *WW-index*, and *Excess bond premium* × *WW-index* are the interactions between debt valuations and financial constraints. Refer to Appendix A for definitions and measurements of all other variables in the model. Standard errors are Newey-West (1987) with 4 lags. *t*-statistics are shown in parentheses. *, **, and *** show significance at the 10%, 5%, and 1%-level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
WW-index	3.049*	4.497**	2.639*	0.259	3.863**	9.538***	6.737**	0.774
	(1.92)	(2.00)	(1.81)	(1.52)	(1.99)	(2.84)	(2.23)	(1.61)
NPLoans	-0.264**				-0.250*			
	(-2.00)				(-1.89)			
Market credit Spread		-0.814***				-2.479***		
		(-2.94)				(-2.95)		
GZ credit spread			-0.290				-0.207	
			(-1.36)				(-0.96)	
Excess bond premium				0.200				-2.515**
				(0.54)				(-2.16)
NPLoans × *WW-index*					0.171			
					(0.78)			
Market Credit Spread × *WW-index*						5.756**		
						(2.15)		
GZ credit spread × *WW-index*							0.626***	
							(2.72)	
Excess bond premium × *WW-index*								9.540**
								(2.50)
Constant	0.698	2.402	1.038	0.214	1.008	6.540**	2.327	0.433
	(0.44)	(1.38)	(0.62)	(0.13)	(0.61)	(2.46)	(1.31)	(0.27)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	844	844	844	844	844	844	844	844
pseudo-R^2	0.248	0.260	0.244	0.240	0.250	0.269	0.261	0.254
Chi-squared	119.875	125.324	117.636	116.016	120.498	129.788	125.964	122.398
F-test	-181.417	-178.693	-182.536	-183.346	-181.105	-176.460	-178.373	-180.156