Effects of Financial Constraints and Product Market Competition on Share Repurchases

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Abstract

This study explores the importance of financial constraints and product market competition on the share repurchase decision. We find that financially constrained firms are more likely to conduct debt-financed share repurchases. Financially unconstrained firms, however, tend to conduct debt-financed repurchases only when debt market conditions are favourable. We also find that the level of industry competition is a significant factor behind managers' decisions. High (low) industry competition forces financially unconstrained and undervalued firms to reduce (increase) the agency costs of free cash flows from overvalued debt financing. The implication is that firms in high-competition industries disburse excess cash through share repurchases. We find that this effect is strongest in periods outside financial crises.

Keywords: Cross-market arbitrage, share repurchases, financial constraints, product market competition

JEL classification: G03; G30; G31; G32.

1. Introduction

Share repurchases have become popular as a means of returning cash to shareholders. Between 2010 and 2019, the amount of cash distributions by US firms through share repurchases and dividends totalled $6 trillion and $4 trillion, respectively (Aramonte, 2020). In 2019 alone, the S&P 500 companies repurchased approximately $700 billion shares, a tenth consecutive year in which share repurchases have exceeded dividends.[1] Several studies have shown that firms repurchase undervalued shares (e.g., Ikenberry & Vermaelen, 1996; D'Mello & Shroff, 2000; Baker & Wurgler, 2002). Farre-Mensa, Michaely, and Schmalz (2018) find that some firms borrow to finance share repurchase programs, and Chen and Wang (2012) argue that some of the firms that borrow to fund share repurchases tend to be financially constrained. An interesting phenomenon is that a large number of firms that borrow to fund share repurchases are cash rich and financially unconstrained (e.g., Lei & Zhang, 2016). Thus, studies have attempted to explore the determinants behind managers' decisions regarding share repurchases. Ma's (2019) explanation is one of the most well-known, according to which financially unconstrained firms undertake debt-financed share repurchases by selling cheap debt in one market and using the proceeds to finance the repurchase of undervalued equity.

Product market competition could influence significantly debt-financed shares repurchases. Competition forces managers to reduce slack and disciplines them to pursue optimal decisions that serve the interests of their shareholders (Hart, 1983; Scharfstein, 1988; Hoberg, Phillips, & Prabhala, 2014). Firms operating in competitive industries are more likely to repurchase their shares to signal positive information about themselves and negative information about their rivals (Massa, Rehman, & Vermaelen, 2007). Financially unconstrained

[1] See Yardeni Research. 2021. Corporate Finance Briefing: S&P 500 Buybacks & Dividends, https://www.yardeni.com/pub/buybackdiv.pdf.

firms, unlike financially constrained firms, which issue overvalued debt, are thus more likely to have high agency costs of free cash flows (Jensen, 1986; Grullon & Michaely, 2014). The increased agency costs of free cash flows could force these firms to repurchase their shares when they face intense competition. Our paper studies this relation between product market competition and the repurchase decision that companies face.

We use US share repurchase announcements between 1990 and 2016 to undertake our empirical analysis. Using Hadlock and Pierce's (2010) measure of financial constraint, hereafter HP-index, we find evidence that financially constrained firms conduct debt-financed repurchases. Financially unconstrained 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. We find that the effects of financial constraints and debt market conditions on debt-financed share repurchases increase with product market competition. Financially unconstrained firms tend to conduct debt-financed share repurchases when debt market conditions are favourable and when facing intense competition. Moreover, firms repurchase undervalued shares by issuing overvalued debt when they face intense product market competition. These findings are consistent with the disciplinary roles of product market competition and external governance to reduce the agency costs of free cash flows (Grullon & Michaely, 2014; Grullon, Larkin, & Michaely, 2019).

Our study contributes to the share repurchases literature. Our findings contribute to the cross-market arbitrage argument by which firms issue debt to finance equity repurchases (Ma, 2019). We enhance the findings of cross-market arbitrage by focusing on the simultaneous effects of financial constraints and external governance mechanisms on share repurchases. We show that even though financially constrained firms are more likely to conduct debt-financed share repurchase, financially unconstrained firms time their debt-financed share repurchases when debt market conditions are favourable. This evidence supports the argument that

financially unconstrained firms take advantage of the flexibility inherent in share repurchases (Guay and Harford, 2000; Jagannathan, Stephens, and Weisbach, 2000; Wang, Yin, and Yu, 2021).

More importantly, we are the first to document the impact of product market competition on the cross-market arbitrage between debt issuance and equity repurchases. The empirical literature asserts that product market competition acts as an external governance mechanism that induces managers to pay out excess cash (Massa et al., 2007; He, 2012; Grullon & Michaely, 2014). Therefore, our study establishes a link between product market competition and debt-financed share repurchases, given the level of financial constraints, debt market conditions, and equity valuations. We emphasise that firms' payout policies tend to react to competitive threats, especially when cheap debt financing exacerbates the high agency costs of free cash flows. Finally, we argue that the effect of product market competition on debt-financed share repurchases is more pronounced when firms face periods of favourable financial conditions.

Overall, our findings shed light on the impact of product market competition on the funding of share repurchase programs. The agency costs of free cash flows are expected to be more acute during non-crisis periods relative to a financial crisis. With no external shock to liquidity and cheap debt financing available, firms can build a sufficient cash buffer and increase cash holdings. Firms that face intense competition can use share repurchases to signal information about their financial strength and boost their stock prices.

The remainder of the paper is organised as follows: Sections 2 formulates the hypotheses, Section 3 describes the data, Section 4 discusses the methodology, Sections 5 and 6 present the empirical findings, and Section 7 concludes the paper.

2. Hypothesis development

Several studies have explored the determinants of managers' decisions to repurchase their shares. The empirical evidence argues that cash-rich firms are more likely to undertake share

repurchases (e.g., Ikenberry & Vermaelen, 1996; Stephens & Weisbach, 1998; Dittmar, 2000; D'Mello & Shroff, 2000; Baker & Wurgler, 2002). It further finds that these share repurchases are conducted at significantly discounted prices relative to market prices (Ben-Rephael, Oded, & Wohl, 2014). However, share repurchases adversely impact a firm's liquidity as a result of decreases in cash balances and increases in leverage (Opler et al., 1999; Denis & Sibilkov, 2010; Chen & Wang, 2012). Studies such as Chen and Wang's (2012) argue that managerial hubris drives financially constrained firms to conduct share repurchases with significantly poor post-repurchase operating performance and an increase in financial distress risk. In addition to internally generated cash flows, firms can resort to external financing from both equity and debt to fund their share repurchases (Lei & Zhang, 2016; Ma, 2019).

Debt issuance decisions are sensitive to credit market conditions (Campello, Graham, & Harvey, 2010; Greenwood & Hanson, 2013; Becker & Ivashina, 2014; Harford, Martos-Vila, & Rhodes-Kropf, 2015), and borrowing to fund share repurchases thus depends on debt market conditions. Ma (2019) explains that these debt-financed share repurchases result from firms selling cheap debt in one market and using the proceeds to finance the repurchase of undervalued equity. This phenomenon of debt-financed share repurchases is expected to differ between financially constrained firms and their unconstrained counterparts. Financially constrained firms can face high costs of external financing compared to financially unconstrained firms. However, financially constrained firms are likely to borrow to build cash buffers to maintain liquidity. Financially unconstrained firms have the latitude to time such debt financing to take advantage of favourable debt market conditions.

This study introduces the significance of product market competition in shaping a firm's share repurchase policy. In competitive industries, firms compete to signal quality information about themselves at the expense of their rivals. The empirical evidence supports the view that the intensity of competition has important implications for firms' cash flows and stock returns

(Irvine & Pontiff, 2009; Hoberg & Phillips, 2010; Peress, 2010; Valta, 2012). The disciplinary forces of competition induce managers to pay out excess cash to reduce the agency costs of free cash flows (Jensen, 1986). Competition forces companies to maintain liquidity and decreases their propensity to make payouts via dividends or repurchases, especially for financially constrained firms (Hoberg et al., 2014). Increased competitive threats also pressure a firm to repurchase shares to send a positive signal about itself and a negative one about its competitors (Massa et al., 2007; Grullon & Michaely, 2014; Grullon et al., 2019).

Thus, firms prone to agency problems require an external mechanism to pressure insiders to increase payouts to outside investors. Product market competition can be an effective external mechanism that can force managers to disgorge cash to shareholders (He, 2012). Thus, firms that face intense product market competition are more likely to repurchase their shares to reduce agency costs associated with free cash flows. The effect of agency problems becomes more acute for financially unconstrained firms that obtain external debt financing. First, financially unconstrained firms, unlike financially constrained firms, bear low external financing costs and limited impacts of external financing shocks. Financially constrained firms can obtain external financing, but likely at a prohibitive cost. Second, financially unconstrained firms can time the market and obtain external financing when debt market conditions are favourable.

The increased debt-financing increases free cash flows and potential agency problems of financially unconstrained firms. Therefore, the market reacts more positively to share repurchase announcements among firms that are more likely to over-invest (Jensen, 1986; Grullon & Michealy, 2004). Firms facing competition can utilise share repurchases to signal quality to the market and distinguish themselves from their peers. Hence, financially unconstrained firms are more likely to conduct debt-financed share repurchases when facing intense product market competition. We thus posit the following hypothesis.

H1: Financially unconstrained firms are more likely to conduct debt-financed share repurchases when debt market conditions are favourable and when they face strong product market competition.

The effect of product market competition on debt-financed share repurchases will also be different during a financial crisis. On the one hand, firms can take advantage of a financial crisis to repurchase shares at lower valuations to adjust their capital structure. On the other hand, managers prefer to hold cash as a buffer rather than pay out when facing uncertain economic conditions, especially during a financial crisis (Jagannathan et al., 2000; Hoberg et al., 2014). Thus, firms tend to make less or no share repurchases during highly uncertain times (Pirgaip & Dinçergök, 2019). Prior evidence suggests that increases in repurchases pushed payouts to historical levels before the global financial crisis (Floyd, Li, & Skinner, 2015). Chen, Harper, and Iyer (2018) argue that even though firms may announce share repurchases during a financial crisis to shore up their stock prices, they tend to actually repurchase more shares prior to a financial crisis instead of during a financial crisis. In other words, Bliss et al. (2015) argue that payouts, including share repurchases, are more susceptible to the negative consequences of external financing shocks. Unlike dividends, which tend to be resilient during crisis periods, due to inherent commitment, share repurchases are more flexible to cuts during crises (Iyer & Rao, 2017).

Chen and Wang (2012) find that financially constrained firms utilise debt financing to fund their share repurchases. During a financial crisis, financially constrained firms are more likely to borrow to shore up their cash balances than to pay out through share repurchases (Opler et al., 1999; Almeida, Campello, & Weisbach, 2004; Denis & Sibilkov, 2010; Bliss et al., 2015). However, during non-crisis periods, firms can build significant cash buffers through a combination of internally generated cash flows and external debt financing. The cash buffer

becomes acute for already financially unconstrained firms, thereby exacerbating the agency costs of free cash flows (Jensen, 1986; Grullon & Michaely, 2014). Therefore, the disciplinary forces of competition should induce managers to pay out excess cash through share repurchases to outside investors. We, thus, expect that the effect of product market competition in mitigating agency problems becomes most pronounced during non-crisis periods, and we posit the following hypothesis.

H2: The effect of product market competition on debt-financed share repurchases is stronger for financially unconstrained firms during non-crisis periods.

3. Data and variable definitions

3.1. 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. Financial statement data are obtained from the Compustat database, and market and stock return data are from the Centre for Research in Security Prices (CRSP) database. Financial firms (with Standard Industrial Classification, or SIC, codes 6000–6999) and utilities (with SIC codes 4900–4999) are excluded, because of the stringent regulatory oversight under which they operate and their different capital structure (e.g., Denis & Sibilkov, 2010; Chen & Wang, 2012). Securities Data Company 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, a bridge loan, a debt issue, or other borrowings. Similarly, a cash-financed share repurchase is

financed exclusively by cash or corporate funds. Our initial sample comprises 240 debt-financed and 728 cash-financed share repurchases.[2]

3.2. Financial constraints

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

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

where size is the logarithm of inflation-adjusted (to 2004) book assets, and age is the number of years the firm has been listed by Compustat, with non-missing stock prices. Following Hadlock and Pierce, we replace size with log($4.5 billion) and age with 37 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 *HP-index.* Firms with the lowest *HP-index* values are placed in the bottom quintile, and those with the highest are placed in the top quintile. Following Baker, Stein, and Wurgler (2003) and Chen and Wang (2012), we classify repurchasing firms in the highest *HP-index* quintile as financially constrained, and repurchasing firms in the other quintiles as financially unconstrained.

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

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

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

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 SIC code industry sales growth; and *SG* is the firm's sales growth. A repurchasing firm in the highest *WW-index* quintile is considered financially constrained, and repurchasing firms in the other quintiles are classified as financially unconstrained.

3.3. Product market competition

We use the Herfindahl–Hirschman Index (HHI) as our primary measure of product market competition. The HHI is a widely used proxy for product market competition (e.g., Giroud & Mueller, 2011; Gu, 2016). A higher HHI implies weaker competition. The HHI is defined as the sum of squared market shares (based on sales):

$$HHI_{jt} = \sum_{i=1}^{N_j} S_{ijt}^2,$$

where S_{ijt} is the market share of firm i in industry j in year t, N_j is the number of firms in industry j in year t, and HHI_{jt} is the HHI of industry j in year t. The market share of an individual firm is computed as the ratio of individual firm sales to the total three-digit SIC code industry sales.

As robustness tests, we use product fluidity (Hoberg, Phillips, & Prabhala, 2014) and product similarity (Hoberg & Phillips, 2016) as additional measures of product market competition.[3] According to Hoberg et al. (2014), product fluidity is a firm-level measure based on each firm's unique product market vocabulary. It assesses the intensity of changes in the product market around a firm. Product similarity, on the other hand, is a firm-by-firm pairwise

[3] We obtain data for product fluidity and product similarity scores from Hoberg and Phillips' website at https://hobergphillips.tuck.dartmouth.edu/industryconcen.htm.

measure of product similarity based on the product descriptions from firms' 10-K annual reports (Hoberg & Phillips, 2016). Product fluidity and product similarity are both positively related to product market competition.

3.4. 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 spreads, and excess bond premiums represent debt valuations and reflect investor risk appetite and sentiment in the credit market.

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. The variable *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 Federal Reserve Economic Data (FRED) database. The variable *GZ credit spread* is the average unweighted credit spread of several outstanding bonds in a given year, and *Excess bond premium* is the residual component of *GZ credit spread* that captures investor attitudes towards credit risk.[4] This measure represents variation in the average price of bonds beyond compensation for expected defaults.

[4] The values of *GZ credit spread* and *Excess bond premium* are extracted from Gilchrist's website at http://people.bu.edu/sgilchri/Data/data.htm. Gilchrist and Zakrajšek (2012) argue that *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* value denotes the loosening of credit terms and a surge in the issuance of credit.

3.5. Equity misvaluation

The misvaluation proxy, *PV*, is the ratio of the market price *P* to the 'intrinsic value' *V*. Jensen (2005) states that equity overvaluation arises when the stock price is higher than the fundamental value of equity. We follow, for example, Lee, Myers, and Swaminathan (1999), Dong, Hirshleifer, and Teoh (2006), Dong, Hirshleifer, Richardson, and Teoh (2012), Badertscher (2011), and Ma (2019) and using *PV* as a measure of equity misvaluation.

We estimate a firm's intrinsic value *V* using the Edwards–Bell–Ohlson discounted residual income valuation model (Edwards & 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;[5] that is, we forecast earnings for the next three years and treat earnings in the third year 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 capital asset pricing model 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 B.

The empirical accounting and finance literature provide strong support for *PV* as a proxy for equity misvaluation. Lee et al. (1999) argue that *PV* is a stronger return predictor than the price to book (*PB*) or Tobin's Q. Since residual income *V* cannot perfectly capture growth, *PV*

[5] 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.

does not filter out all the growth effects. However, given that *PV* is 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*.

We retain negative *V* values when the returns on equity forecast are lower than the costs of equity. Negative *PV* values account for only 2% of the observations. Our definition of misvaluation, *PV,* rather than *VP,*[6] 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.

The control variables, which are defined in Appendix A, include *Cash ratio, Dividend, Firm size, Stock returns, Leverage, Z-score, Return on assets, Investments*, and *Intended repurchase ratio.*

3.6. 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 ($1,254.90 million) is larger than but not statistically significantly different from the average deal value of debt-financed share repurchases ($784.18 million).

[6] The variable *VP* is the ratio of the intrinsic value to the market price.

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* values of financial constraint are -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 financially unconstrained firms are more likely to fund their share repurchases with internally generated cash. We find a similar level of financial constraint between cash-financed and debt-financed repurchases using the *WW-index* measure of financial constraint. The mean difference for *WW-index* is also significantly negative, indicating that firms that undertake debt-financed share repurchases are 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 ratio* values of cash- and debt-financed repurchases is not statistically significant, implying no significant difference between the misvaluations of the two subsamples of repurchasing firms. The mean of *HHI* is lower (0.076) for cash-financed share repurchases than for debt-financed share repurchases (0.084), with a statistically significant difference at the 10% level. This result indicates that cash-financed share repurchases are associated with stronger competition than debt-financed share repurchases. The variable *Market credit spread* is significantly lower during periods of debt-financed repurchases compared to periods of cash-financed repurchases. Similarly, *GZ credit spread* for debt-financed share repurchases is significantly lower than for cash-financed share repurchases. These results provide 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 *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* value compared to debt-financed repurchasing firms. Other observations include 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 flows 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 & Lee, 2009; Denis & Sibilkov, 2010; Farre-Mensa et al., 2018). Harford et al. (2015) find that close to 75% of funds from debt issuance are used to finance capital expenditures. Thus, debt-financed share repurchases should not constrain investment expenditures.

4. Methodology

Our baseline model for estimating the decision to undertake debt-financed share repurchases is the logit regression model 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 one if a repurchase is debt financed, and zero otherwise. The variable *FC* is the measure of financial constraint, using the *HP-index* dummy, which equals one for financially constrained repurchasing firms and zero for financially

unconstrained repurchasing firms.[7] Since financially unconstrained firms are more likely to conduct share repurchases, we expect a positive sign for *HP-index,* indicating that financially constrained firms are expected to obtain external financing to fund their share repurchases.

The term *DebtMkt* is the vector of proxies for debt market conditions at both the macro and firm levels. The debt market variables include *Market credit spread, GZ credit spread,* and *Excess bond premium.* 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 a loosening of credit terms and a surge in the issuance of credit to risky investors. The term *FC* ×*DebtMkt* is the interaction term between the financial constraint 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 (*Market credit spread* × *HP-index, GZ credit spread* × *HP-index, Excess bond premium* × *HP-index, Firm loan spread* × *HP-index*, and *Firm bond credit spread* × *HP-index*). The term *CONTROLS* represents the control variables used in the regression model and includes variables such as *Cash ratio, Dividend, Firm size, Leverage, Stock returns, Z-score, Return on assets, Investments,* and *Intended repurchase ratio.*

To test our hypotheses, we run a subsample analysis of the model based on the level of product market competition using the HHI. Here, the sample is split based on the median HHI to define low competition (high HHI) and high competition (low HHI). We then rerun these subsample analyses for non-crisis and crisis periods. We expect firms operating in more competitive markets to conduct debt-financed share repurchases when debt market conditions are favourable, especially when they are financially unconstrained.

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

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 the proxy for equity valuation, *PV ratio.* Thus, the interaction terms to capture the effects of debt market valuation and equity valuation are *Market credit spread × PV ratio, GZ credit spread × PV ratio,* and *Excess bond premium × PV ratio*.

5. Empirical results

In this section, we present our main empirical results. In particular, we discuss the determinants of firms' usage of debt financing for their share repurchases. Our discussion focuses on the extent to which financial constraints and product market competition are related to firms' decisions. We also test the importance of these factors in crisis and non-crisis periods.

5.1. Debt-financed share repurchases and financial constraints

We undertake logit estimations exploring the effects of financial constraints on debt-financed share repurchases. The dependent variable is equal to one for debt-financed share repurchases and zero for cash-financed share repurchases. The independent variables measure financial constraint (*HP-index*), debt market conditions (*Market credit spread, GZ credit spread,* and *Excess bond premium*), and their interactions (*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. According to H1, we expect a positive coefficient for the interaction terms to indicate that financially unconstrained firms are more likely to conduct debt-financed share repurchases when debt market conditions are favourable.

Panel A of Table 3 reports the results for the full sample of firms. In all of the regressions, we find that the coefficient of *HP-index* has a significantly positive effect on the propensity to conduct debt-financed share repurchases.

[Please Insert Table 3 here]

This result shows that financially constrained firms are more likely to borrow to finance share repurchases. The coefficients of *Market credit spread* are negatively significant at the 5% and 1% levels in Columns (1) and (4) of Table 3, respectively. We also find a significant negative coefficient at the 5% level for *Excess bond premium* in Column (6). These results indicate that firms are more likely to conduct debt-financed share repurchases when debt market conditions are favourable. More importantly, for our study, we examine the simultaneous impact of financial constraints and debt market conditions on debt-financed repurchases. The interaction terms *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. We find that the coefficients of the interaction terms are all significantly positive.

These positive coefficients can be interpreted in two ways: (i) financially constrained firms are more likely to conduct debt-financed share repurchases if debt market conditions are worse or (ii) financially unconstrained firms are more likely to conduct debt-financed share repurchases if debt market conditions are favourable. The first interpretation is akin to that of Chen and Wang (2012), who find that financially constrained firms use external debt to fund share repurchases. However, borrowing when debt market conditions are worse is a suboptimal financial decision, especially when share repurchases offer flexibility to cut (Iyer & Rao, 2017). The second interpretation seems a more logical and optimal financial decision, since it indicates that financially unconstrained firms time their debt-financed repurchases to coincide with periods of favourable debt market conditions. Thus, while financially unconstrained 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.

In Panel B of Table 3, we split the sample into financially unconstrained firms, in Columns (1), (3), and (5), and financially constrained firms, in Columns (2), (4), and (6). We compare the coefficients of *Market credit spread* for financially unconstrained (Column (1)), and financially constrained (Column (2)) firms. Similarly, we compare the coefficients of *GZ credit spread* and *Excess bond premium* for financially unconstrained firms (Columns (3) and (5), respectively) versus financially constrained firms (Columns (4) and (6), respectively). We find that the coefficients of *Market credit spread* and *GZ credit spread* are significantly negative in Columns (1) and (3) for financially unconstrained firms, respectively, but nonsignificant in Columns (2) and (4) for financially constrained firms. Note that the coefficients of *Excess bond premium* are not significant. The tests of the differences in the coefficients of *Market credit spread* and *GZ credit spread* between financially unconstrained and financially constrained firms are statistically significant. Thus, we find evidence showing that financially unconstrained firms are more likely to issue overvalued debt to fund share repurchase programs.

Regarding the control variables, the negative coefficients of *Cash ratio* in Panel A of Table 3 show that firms with a sufficient cash ratio are more likely to conduct cash-financed share repurchases. The negative coefficients for the Z-score suggest that firms with low financial distress risk are more likely to conduct debt-financed repurchases. This evidence is consistent with the results of Lei and Zhang (2016), who find that leveraged repurchasing firms have more debt capacity. Finally, *Investments* is significantly and positively related to the decision to conduct debt-financed share repurchases in Panels A and B for only financially unconstrained firms. 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 & Lee, 2009; Denis & Sibilkov, 2010; Farre-Mensa et al., 2018). Overall, we show that favourable debt market conditions motivate financially unconstrained firms to fund their share repurchases using debt financing.

5.2. Product market competition and debt-financed share repurchases

Importantly for this study, we now examine the impact of product market competition on debt-financed share repurchases, given the level of financial constraints, debt market conditions, and equity valuation. Studies such as those of Massa et al. (2007) and Grullon and Michaely (2014) argue that firms in more competitive markets have significantly higher payout ratios than firms in less competitive markets because competition pressures managers to reduce agency problems associated with free cash flows. We examine here whether industry competition drives the debt-financed share repurchase phenomenon in which firms are financially unconstrained, issue overvalued debt, and repurchase undervalued shares. These results are reported in Table 4.

[Please Insert Table 4 here]

We first split the sample into firms experiencing low and high levels of competition, using the median HHI. Since HHI is a measure of concentration, a high (low) HHI represents low (high) competition. Consistent with our hypothesis, we expect that firms operating in more competitive markets should be more likely to borrow to fund their share repurchases, especially when they are financially unconstrained and debt market conditions are favourable. As shown in Panel A of Table 4, the coefficients of *HP-index* are significantly positive for low competition using the HHI, as shown in Columns (1) and (3), at the 5% level, and Column (5) at the 1% level. The coefficient of *HP-index* for high competition is significantly positive at the 10% level in Column (2) but nonsignificant in Columns (4) and (6). However, these coefficients for *HP-index* between low and high levels of competition are not statistically different, except between Columns (5) and (6). We thus find that the effects of financial constraints on debt-financed shares are not influenced by product market competition.

We then focus on the coefficients of the interaction terms. We find that the coefficients on *Market credit spread* × *HP-index* and *Excess bond premium* × *HP-index* are significantly

positive for high competition in Columns (2) and (6) in Table 4. For the comparable low-competition cohort, the coefficients of *Excess bond premium* × *HP-index* are significantly negative at the 10% level in Column (5). The coefficients of *Market credit spread* × *HP-index* between low and high levels of competition (Column (1) versus Column (2)) are statistically different. We find a similar statistically different coefficient for *Excess bond premium* × *HP-index* between low and high competition levels (Column (5) versus Column (6)).[8] Therefore, we find some evidence indicating that firms in more competitive industries issue overvalued debt to conduct debt-financed share repurchases, especially when they are financially unconstrained.

We now analyse the effects of product market competition on debt-financed shares, given debt market conditions and equity valuation. We interact the measures of debt market conditions and the equity valuation, *Market credit spread* × *PV ratio, GZ credit spread* × *PV ratio*, and *Excess bond premium* × *PV ratio*. Again, undervalued firms should be more inclined to borrow to fund their share repurchases when debt market conditions are favourable and when facing intense product market competition. As shown in Panel B of Table 4, these coefficients are significantly positive at either the 1% or 5% level in Columns (2) and (4) for high levels of competition. The coefficients of the interaction terms for low competition are nonsignificant, except in Column (1), where the coefficient of *Market credit spread* × *PV ratio* is significantly positive at the 10% level. More importantly, the coefficients of the interaction terms *Market credit spread* × *PV ratio* and *GZ credit spread* × *PV ratio* are statistically different between low and high competition levels (Column (1) versus Column (2), and Column (3) versus Column (4)). These results provide some evidence that firms are more likely to issue overvalued debt to repurchase undervalued equity when they face intense product market competition.

[8] The coefficients of *GZ credit spread* × *HP-index* are nonsignificant for both low and high competition.

Overall, in this section we offer support for H1, which states that financially unconstrained firms are more likely to conduct debt-financed share repurchases when debt market conditions are favourable and when facing high product market competition. By obtaining external financing, financially unconstrained firms increase free cash flows and exacerbate the agency costs of free cash flows. Our findings are consistent with the disciplinary roles of product market competition and external governance (Grullon et al., 2019). As firms obtain additional cash flows from overvalued debt financing, high industry competition forces these firms to reduce the agency costs of free cash flows by disbursing excess cash to shareholders through share repurchases.

5.3. Effects of financial crises on debt-financed share repurchases

We now study the significance of the financial crisis in our previously reported results. As an exogenous credit supply shock, we contend that this setup resembles a quasi-natural experiment to test whether firms are more likely to conduct debt-financed share repurchases. Our definition of non-crisis and crisis periods is similar to that of Bliss et al. (2015). We include the fiscal year 2001 as a crisis period, because the National Bureau of Economic Research defines the US economy as having experienced a recession in 2001 during the dot-com bubble. We use the years 2001, 2007, 2008, and 2009 as crisis periods.

[Please Insert Table 5 here]

Table 5 shows the estimated results of the effects of debt market conditions and financial constraints on debt-financed share repurchases around non-crisis and crisis periods. This table is the equivalent of Table 3, but we compare the results for crisis versus non-crisis periods for each independent variable. We find that the effects of financial constraints and debt market conditions on debt-financed share repurchases are statistically different between non-crisis and crisis periods. Thus, firms undertake debt-financed share repurchases when debt market conditions are favourable, regardless of whether there is a financial crisis or not. The coefficients of the

interaction terms *Market credit spread* × *HP-index*, *GZ credit spread* × *HP-index,* and *Excess bond premium* × *HP-index* are significantly positive in Columns (1), (3), and (5), respectively, for non-crisis periods, and negative and significant in Columns (2), (4), and (6), respectively, for crisis periods. The coefficients of the interaction terms are also significantly different between non-crisis and crisis periods. These results indicate that financially unconstrained firms conduct debt-financed share repurchases when debt market conditions are favourable during non-crisis periods. Financially constrained firms, instead, utilise cheap debt financing to fund share repurchases programs during periods of crisis.

In Table 6, we examine the effects of product market competition on debt-financed share repurchases in relation to the crisis and non-crisis periods.

[Please Insert Table 6 here]

Table 6 is the equivalent of Table 4, but in relation to the crisis and non-crisis periods. Panel A provides the logit regression output for non-crisis periods, whereas Panel B gives the results for the crisis periods. We find that the interaction terms *Market credit spread* × *HP-index*, *GZ credit spread* × *HP-index,* and *Excess bond premium* × *HP-index* are significantly positive, as shown in Columns (2), (4), and (6), for high competition. The counterpart coefficients are, instead, nonsignificant for the low-competition subsamples, except in Column (1), where the coefficient of *Market credit spread* × *HP-index* is negative and significant at the 10% level. The results for the crisis periods in Panel B show that the coefficients of the interaction terms are not statistically significant. These results provide evidence that the effects of product market competition on debt-financed share repurchases are more pronounced during non-crisis periods. We thus support H2.

6. Robustness tests

6.1. Alternative measurement of financial constraint

We first estimate whether our results are robust to an alternative measure of financial constraint. We use the *WW-index* measure of Whited and Wu (2006) as a proxy for financial constraints to examine whether financial constraints influence the decision to conduct debt-financed share repurchases. The reason we do so is that there is no ideal measure of financial constraint (Chen & Wang, 2012; Farre-Mensa & Ljungqvist, 2016). In Table 7, we use identical specifications as in Table 4, but now with *WW-index* instead of *HP-index* to measure financial constraint.

[Please Insert Table 7 here]

Consistent with our earlier results, we find that financially constrained firms are more likely to conduct debt-financed share repurchases than financially unconstrained firms. We find statistically significant positive coefficients for *Market credit spread* × *WW-index*, *GZ credit spread* × *WW-index,* and *Excess bond premium* × *WW-index*. Firms are thus more likely to conduct debt-financed repurchases when they are financially unconstrained and debt market conditions are favourable.

Our results in Table 8 also confirm the earlier findings of the effects of product market competition and financial constraints on debt-financed share repurchases.

[Please Insert Table 8 here]

Similar to earlier results, the coefficients of *Market credit spread* × *WW-index*, *GZ credit spread* × *WW-index,* and *Excess bond premium* × *WW-index* are positive and significant for the high-competition cohorts in Columns (2), (4), and (6) of Table 8. These coefficients are not significant in the low-competition subsamples in Columns (1), (3), and (5). Hence, we conclude

that these results indicate evidence that financially unconstrained firms that face high product market competition are more likely to conduct debt-financed share repurchases when debt market conditions are favourable. Again, we emphasise that the external influence of competitive threats to reduce associated agency costs force financially unconstrained firms that obtain debt financing to return some cash to shareholders through share repurchases.

6.2. Alternative measurement of equity valuation

As a robustness check, we augment our analyses by estimating equity valuation using the Abnormal Earnings Growth (AEG) valuation model (Ohlson and Juettner-Nauroth, 2005). The AEG model is based on earnings and dividends and uses future earnings and earnings growth to estimate the current price. Further details on estimating a firm's intrinsic value using the Abnormal Earnings Growth (AEG) valuation model are provided in Appendix B. The results are reported in Table 9.

[Please Insert Table 9 here]

We find positive and significant coefficients for the interaction terms *Market credit spread* × *PV ratio,* and *Excess bond premium* × *PV ratio* when firms face high product market competition. Again, the coefficients of the interaction terms for low competition are nonsignificant. This evidence supports our earlier findings that undervalued firms are more likely to borrow when debt market conditions are favourable. Since debt-financing increases free cash flows, these firms are more inclined to distribute cash to their shareholders, especially when facing external monitoring through intense product market competition. We confirm our earlier results when using an alternative measure of equity valuation. Overall, these results provide some evidence that firms are more likely to issue overvalued debt to repurchase undervalued equity when they face intense product market competition.

6.3. Alternative measurements of product market competition

Finally, Table 10 replicates the analysis previously reported in Table 4 by using two additional measures of product market competition. The first proxy is the product market fluidity of Hoberg et al. (2014), *HPP fluidity,* which measures the extent to which the product market around a firm changes each year. Increases in product fluidity thus pose competitive threats, leading to product market competition. The second measure is Hoberg and Phillips' (2016) product similarity, which is a measure of how firms differ from their competitors according to a time-varying textual analysis of the firm's 10-K product descriptions. High product similarity is related to high product market competition.

[Please Insert Table 10 here]

The results in Table 10 show that the coefficients of *Market credit spread* × *HP-index* (Column (2)), *GZ credit spread* × *HP-index* (Column (4)), and *Excess bond premium* × *HP-index* (Column (6)) are positive and statistically significant for the high-competition cohort when product fluidity is used to measure competition. We also find significant positive coefficients at the 10% level for *GZ credit spread* × *HP-index* (Column (10)), and *Excess bond premium* × *HP-index* (Column (12)) for high competition when using product similarity to measure competition. However, the coefficients of the interaction terms are negative and nonsignificant for the low-competition subsamples, except in Columns (5) and (11), where they are significant at the 10% and 5% levels, respectively. Thus, similar to earlier analyses, we find that product market competition – that is, product fluidity and similarity – influences debt-financed shares repurchases. Financially unconstrained firms that obtain cheap debt financing when debt market conditions are favourable are more likely to conduct debt-financed share repurchases, especially when facing high product market competition. Product market competition, serving as a

disciplinary mechanism to prevent managerial excesses, forces managers to use external debt financing to fund share repurchases.

7. Conclusions

We explore the effects of product market competition and financial constraints on debt-financed 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. Additionally, there is a large body of evidence indicating that firms repurchase undervalued equity. A relatively unexplored phenomenon is the effects of financial constraints and competitive threats on a firm's decision to issue overvalued debt for repurchasing undervalued equity.

Our study finds that financially constrained firms are more likely to conduct debt-financed share repurchases. Conversely, financially unconstrained firms undertake debt-financed share repurchases when debt market conditions are favourable. We highlight in this study the significance of product market competition by showing that financially unconstrained firms conduct debt-financed share repurchases when they face high competition. The external pressure from competition forces financially unconstrained firms to disburse excess cash to shareholders, especially when debt market conditions are favourable. The effect of product market competition on debt-financed share repurchases for financially unconstrained firms is more pronounced during non-crisis periods.

These findings highlight the disciplinary role of product market competition in reducing the agency costs of free cash flows associated with financially unconstrained firms. As firms accumulate excess cash flows through debt financing when debt market conditions are favourable, the agency problems of free cash flows become acute. Hence, product market competition provides an external mechanism to mitigate these agency problems by forcing

managers to disgorge more cash to external shareholders. We also highlight that firms are more inclined to distribute cash flows to shareholders via share repurchases when economic conditions are favourable.

There are significant implications of share repurchases for the firm, shareholders, and policymaking. First, financially unconstrained firms suffer fewer liquidity problems after share repurchases compared to financially constrained firms. Second, share repurchases that occur during favourable economic conditions may undermine a company's resilience during crises periods. In other words, firms that report an upsurge in share repurchases to opportunistically boost stock prices dissipate liquidity for long-term investments. This effect is likely more acute for financially constrained firms that utilise internally generated funds to finance their share repurchase programs. Third, share repurchases increase leverage, leading to financial distress and bankruptcy risks. This is a financial stability concern for the economy. Financing share repurchases through debt issuances worsen the financial stability concern, especially for financially constrained firms. Policymakers should be concerned about the effect of share repurchases on leverage.

Appendix A: Variable Definitions

Variable	Definition	Source of Data
Deal value	Dollar value of share repurchase.	Thomson One
Intended repurchase ratio	Deal value divided by the market value of equity (MV_{equity}), where MV_{equity} is the number of shares outstanding (*CSHO*) times the 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 logarithm of inflation-adjusted (to 2004) book assets, and age is the number of years the firm has been on Compustat, with non-missing stock prices. Size is replaced with log($4.5 billion) and age with 37 years if the actual values exceed these thresholds.	Compustat
WW-index	$WW-index=-0.091\left(CF/TA\right)-0.062\left(DIVDUM\right)+0.021\left(LTD/TA\right)-0.044\log TA$ $+0.102\,INDSG-0.035SG$ follows Whited and Wu's (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, and *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 the stock market price *P* to the intrinsic value *V*, where *P* is the closing share price (*PRCC_F*) and *V* is the intrinsic value of equity, estimated using the Edwards–Bell–Ohlson residual income approach, as explained in Appendix B.	Compustat & I/B/E/S
HHI	The HHI is the sum of the squares of the individual market shares (by sales) for the total number of firms in the four-digit SIC industry.	Compustat
HPP Fluidity	Product market fluidity variable of Hoberg et al. (2014).	Hoberg and Phillips' website
HP Similarity	Text-based product similarity variable of Hoberg and Phillips (2016).	Hoberg and Phillips' website
Market credit spread	Difference between the Baa corporate yield and the 10-year constant maturity Treasury yield.	FRED database
GZ credit spread	The average unweighted credit spread of several outstanding bonds in a given year (Gilchrist & Zakrajšek, 2012).	Gilchrist's website

Excess bond premium	The residual component of *GZ credit spread* that captures investor attitudes towards credit risk. This measure represents variation in the average price of bonds beyond compensation for expected defaults (Gilchrist & Zakrajšek, 2012).	Gilchrist's website
Cash ratio	Cash and cash equivalents (*CHE*) divided by total assets (*TA*).	Compustat
Dividend	Ratio of cash dividends to the market value of equity.	Compustat
Firm size	Logarithm of total assets (*TA*).	Compustat
Leverage	Long-term debt (*DLTT*) divided by total book assets (*TA*).	Compustat
Stock returns	Cumulative abnormal returns from 30 days to 2 days prior to each share repurchase announcement.	CRSP
Z-score	$Zscore = \left[1.2*\left(ACT - LCT\right) + 1.4*RE + 3.3*EBIT + 0.999*SALES\right] \Big/ TA$ $+0.6*\left(MV/LT\right)$ 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, and *LT* is total liabilities.	Compustat
Return on assets (ROA)	Gross operating income (*OIBDP*) divided by total assets (*TA*).	Compustat
Investments	Capital expenditure (*CAPX*) divided by total assets (*TA*).	Compustat

Appendix B: Equity Valuation Models

i. Residual income price-to-value ratio *(PV)*

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

Ohlson (1995) shows that, under the assumption of clean surplus accounting, the change in the 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 incomes:

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

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

where B_t is the book value of equity at time t (negative book values are deleted), E_t is the expectations operator, NI_{t+i} is net income for period $t + i$, r_e is the annualised cost of equity capital, and ROE_{t+i} is 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;[1] 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 $fROE_{t+i}$ is the forecast return on equity for period $t + i$, r_e is the annual capital asset pricing model (CAPM) cost of equity, and the last term discounts the period $t + 3$ residual income as a perpetuity.

The return on equity forecast 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,

[1] 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 that their results remain robust to different forecast horizons.

if the 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, we substitute the missing forecast EPS with the first preceding available forecast EPS. We delete *fROE* values greater than one 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

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

where the payout ratio k is given as

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

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

The cost of equity, r_e, is the annualised CAPM firm-specific rate, where beta is computed using the trailing five-year monthly return data. If the monthly return data are not sufficient, 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 be within the range 5–20%.

ii. Abnormal Earnings Growth (AEG) valuation model.

We estimate equity value using the Abnormal Earnings Growth (AEG) valuation model (Ohlson and Juettner-Nauroth, 2005). The AEG model is based on earnings and dividends and uses future earnings and earnings growth to estimate the current price. We, thus, estimate the value of equity using the AEG model defined as follows:

$$P_0 = \frac{eps_1}{r} + \sum_{t=1}^{\infty} (1+r)^{-t} z_t, \text{where } z_t = \frac{1}{r}\left(eps_{t+1} + rdps_t - (1+r)\,eps_t\right)$$

where the share price at the date of valuation is P_0, eps_t is the expected bottom-line earnings per share at the end of year t and dps_t is the expected dividend at the same date. z_t is the capitalized increase in abnormal earnings per share between year t and year t+1.

We forecast earnings and dividends for the next three years and treat earnings in the third year as a perpetuity when estimating the value of z. Our definition of misvaluation, PV, is the ratio of stock price to the intrinsic value calculated from the AEG model, indicating that negative and low values of PV indicate undervaluation, and large values of PV indicate overvaluation.

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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 1990–2016. Repurchases are defined as debt financed if firms specify 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. * and ** indicate significance at the 10% and 5% levels, 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 firm characteristics and debt market conditions

This table presents the summary statistics of the firm characteristics and debt market conditions. It 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. The variable *HP-index* is Hadlock and Pierce's (2010) index for financial constraint, where firms in the highest quintile of *HP-index* are defined as financially constrained and the remaining firms are defined as financially unconstrained. The variable *WW-index* is Whited and Wu's (2010) index for financial constraint, where firms in the highest quintile of *WW-index* are defined as financially constrained, and the remaining firms are defined as financially unconstrained. The variable *PV ratio* is the stock market price (*P*) divided by the intrinsic value (*V*). The measures of product market competition are the HHI (*HHI*), Hoberg–Phillips–Prabhala product fluidity (*HPP Fluidity*), and Hoberg–Phillips product similarity (*HP Similarity*). The variable *Market credit spread* is the Baa corporate 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 & Zakrajšek, 2012); *Excess bond premium* is the residual component of *GZ credit spread* that captures investor attitudes towards credit risk (Gilchrist & Zakrajšek, 2012); *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 total debt divided by total assets; *Stock returns* are the 30-day preannouncement date cumulative abnormal returns; *Z-score* is Altman's (1968) measure of bankruptcy prediction; *Return on assets* is the ratio of operating profit before depreciation to total assets; *Investment* is total capital expenditures divided by total assets; and *Intended repurchase ratio* is the deal value divided by the market value of equity. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, 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)
HHI	589	0.076	0.063	207	0.084	0.068	-0.008*	(-1.96)
HPP fluidity	481	5.823	5.220	139	5.461	5.180	0.362	(1.38)
HP similarity	491	2.984	1.839	147	2.779	1.707	0.205	(0.64)
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)
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)
Investments	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: 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 repurchases. The dependent variable is equal to one for a debt-financed repurchase, and zero otherwise. Panel A provides the results for the full sample, and Panel B gives the results for the subsample of financially unconstrained (FU) and financially constrained (FC) firms. The *HP-index* variable measures financial constraint according to Hadlock and Pierce (2010) and equals one for firms in the highest quintile, and zero otherwise. The measures of debt market conditions are *Market credit spread,* the Baa corporate bond yield minus the 10-year constant maturity Treasury yield; *GZ credit spread,* the average unweighted credit spread of several outstanding bonds in a given year (Gilchrist & Zakrajšek, 2012); and *Excess bond premium,* the residual component of *GZ credit spread* that captures investor attitudes towards credit risk (Gilchrist & Zakrajšek, 2012). The terms *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. See Appendix A for the definitions and measurements of the other variables in the model. Standard errors are Newey–West (1987) with four lags, and *t*-statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Full Sample

	(1)	(2)	(3)	(4)	(5)	(6)
HP-index	0.813*	0.968**	1.012**	4.065***	1.599***	0.955**
	(1.71)	(2.08)	(2.19)	(3.37)	(3.09)	(2.03)
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)
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	-0.073	-0.208	-0.225	-0.207	-0.172	-0.340
	(-0.21)	(-0.63)	(-0.68)	(-0.59)	(-0.51)	(-0.98)
Cash ratio	-7.987**	-7.786**	-7.705**	-9.269**	-6.903*	-8.703**
	(-2.22)	(-2.21)	(-2.19)	(-2.45)	(-1.90)	(-2.46)
Dividend	-0.013	0.039	0.064	-0.094	-0.046	-0.017
	(-0.03)	(0.10)	(0.17)	(-0.24)	(-0.12)	(-0.04)
Firm size	0.136	0.148	0.156	0.159	0.154	0.136
	(0.91)	(1.00)	(1.07)	(1.06)	(1.04)	(0.92)
Leverage	-1.590	-1.599	-1.427	-1.871	-1.543	-1.319
	(-1.21)	(-1.22)	(-1.10)	(-1.38)	(-1.15)	(-1.00)
Stock returns	-1.517	-0.491	0.464	-1.537	-0.274	0.438
	(-1.17)	(-0.39)	(0.37)	(-1.16)	(-0.22)	(0.34)
Z-score	-0.195**	-0.189**	-0.180**	-0.223***	-0.201**	-0.203**
	(-2.48)	(-2.39)	(-2.30)	(-2.68)	(-2.44)	(-2.52)
Return on assets	-2.312	-2.181	-2.116	-3.150	-2.042	-2.628
	(-0.86)	(-0.84)	(-0.82)	(-1.12)	(-0.79)	(-0.99)
Investments	8.615**	9.184**	8.772**	9.202**	7.223*	8.824**
	(2.13)	(2.28)	(2.16)	(2.16)	(1.71)	(2.12)
Intended repurchase ratio	0.303	0.388	0.300	0.316	0.400	0.359
	(0.45)	(0.58)	(0.45)	(0.47)	(0.58)	(0.53)
Constant	3.268*	2.270	1.798	14.586***	4.247**	1.823
	(1.78)	(1.27)	(1.03)	(3.36)	(2.18)	(1.04)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	844	844	844	844	844	844
Pseudo-R^2	0.252	0.241	0.241	0.270	0.262	0.256
Chi-squared	121.567	116.232	116.445	130.502	126.495	123.735
F-Test	-180.571	-183.238	-183.132	-176.104	-178.107	-179.487

Panel B: Financially Unconstrained (FU) versus Financially Constrained (FC) Firms						
	FU	*FC*	*FU*	*FC*	*FU*	*FC*
	(1)	(2)	(3)	(4)	(5)	(6)
Market credit spread	-0.819***	-0.008				
	(-2.75)	(-0.02)				
GZ credit spread			-0.120**	-0.061		
			(-2.52)	(-0.16)		
Excess bond premium					0.444	0.270
					(1.10)	(0.42)
Constant	3.823*	-1.956	2.004	-1.820	1.446	-2.108*
	(1.95)	(-1.20)	(1.06)	(-1.19)	(0.80)	(-1.69)
Difference (FU vs. FC)						
Market credit spread		13.18***				
GZ credit spread				4.02**		
Excess bond premium						0.06
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	674	170	674	170	674	170
Pseudo-R^2	0.264	0.193	0.244	0.193	0.247	0.195
Chi-squared	107.723	20.371	99.605	20.397	100.528	20.542
F-Test	-149.870	-42.579	-153.929	-42.566	-153.467	-42.493

Table 4: Effects of product market competition on debt-financed share repurchases

This table shows the results of a logit estimation of the effects of debt market conditions and financial constraints (Panel A) and debt market conditions and equity valuation (Panel B) on debt-financed share repurchases, given the level of product market competition. The measure of product market competition is the HHI *(HHI).* The dependent variable is equal to one for a debt-financed repurchase, and zero otherwise. The *HP-index* variable measures financial constraint according to Hadlock and Pierce (2010) and equals one for firms in the highest quintile, and zero otherwise. The measures of debt market conditions are *Market credit spread,* the Baa corporate bond yield minus the 10-year constant maturity Treasury yield; *GZ credit spread,* the average unweighted credit spread of several outstanding bonds in a given year (Gilchrist & Zakrajšek, 2012); and *Excess bond premium,* the residual component of *GZ credit spread* that captures investor attitudes towards credit risk (Gilchrist & Zakrajšek, 2012). The terms *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, and the terms *Market credit spread* × *PV ratio*, *GZ credit spread* × *PV ratio*, and *Excess bond premium* × *PV ratio* are the interactions between debt valuations and equity valuation. See Appendix A for the definitions and measurements of the other variables in the model. Standard errors are Newey–West (1987) with four lags, and *t*-statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Debt Market Conditions and Financial Constraints

	HHI (*HHI*)					
	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)
HP-index	2.829**	3.357*	5.678**	0.503	3.252***	-1.121
	(1.99)	(1.65)	(2.43)	(0.31)	(3.16)	(-1.26)
Market credit spread	0.029	-9.184***				
	(0.01)	(-3.17)				
GZ credit spread			-4.363	-3.696*		
			(-1.13)	(-1.67)		
Excess bond premium					-12.841*	-4.627
					(-1.83)	(-1.24)
Market credit spread × HP-index	0.201	2.192***				
	(0.17)	(2.87)				
GZ credit spread × HP-index			-1.216	0.940		
			(-1.13)	(1.47)		
Excess bond premium × HP-index					-3.668*	1.364**
					(-1.90)	(1.27)
Constant	4.937	25.131***	13.743*	10.499**	5.728*	2.759
	(0.49)	(3.26)	(1.69)	(1.99)	(1.72)	(1.21)
Difference (High vs. Low)						
HP-index		2.08		0.01		3.35*
Market credit spread		5.94**				
GZ credit spread				0.59		
Excess bond premium						0.05
Market credit spread × HP-index		6.10**				
GZ credit spread × HP-index				1.00		
Excess bond premium × HP-index						4.22**
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	398	398	398	398	398	398
Pseudo-R^2	0.391	0.346	0.390	0.285	0.403	0.273
Chi-squared	82.436	68.694	82.321	56.606	85.004	54.145
F-Test	-64.276	-64.791	-64.334	-70.835	-62.992	-72.065

Panel B: Debt Market Conditions and Equity Valuation

	HHI (*HHI*)					
	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)
HP-index	3.320***	-2.905***	3.255***	-1.939**	3.392***	-1.187
	(3.07)	(-2.58)	(3.05)	(-2.01)	(3.22)	(-1.33)
PV ratio	-3.295*	-10.782***	-1.909	-4.051**	0.148	-0.426
	(-1.65)	(-3.27)	(-1.13)	(-2.30)	(0.22)	(-0.74)
Market credit spread	-1.630*	-2.576***				
	(-1.94)	(-3.63)				
GZ credit spread			-0.630	-1.145**		
			(-0.94)	(-2.38)		
Excess bond premium					-0.524	0.059
					(-0.47)	(0.07)
Market credit spread × PV ratio	1.358*	3.548***				
	(1.82)	(3.26)				
GZ credit spread × PV ratio			0.863	1.334**		
			(1.24)	(2.18)		
Excess bond premium × PV ratio					1.394	0.010
					(1.11)	(0.01)
Constant	8.774**	6.830**	6.694*	4.531*	5.914*	2.467
	(2.28)	(2.29)	(1.89)	(1.84)	(1.74)	(1.10)
Difference (High vs. Low)						
HP-index		4.02**		3.41**		2.87**
PV ratio		6.11***		5.21***		0.16
Market credit spread		0.79				
GZ credit spread				0.98		
Excess bond premium						2.82*
Market credit Spread × PV ratio		10.87***				
GZ Credit spread × PV ratio				12.04***		
Excess bond premium × PV ratio						0.22
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	429	415	429	415	429	415
Pseudo-R^2	0.407	0.371	0.392	0.301	0.391	0.265
Chi-squared	85.847	73.524	82.608	59.703	82.559	52.491
F-Test	-62.571	-62.376	-64.190	-69.286	-64.215	-72.893

Table 5: Effects of financial crisis on debt-financed share repurchases

This table shows the results of a logit estimation of the effects of financial crisis on debt-financed share repurchases. Panel A shows the results for how financial crisis determines the effects of debt market conditions and financial constraints on debt-financed share repurchases, and Panel B shows the effects of debt market conditions and equity valuation on debt-financed share repurchases. The dependent variable is equal to one for a debt-financed repurchase, and zero otherwise. The *HP-index* variable measures financial constraint according to Hadlock and Pierce (2010) and equals one for firms in the highest quintile, and zero otherwise. The measures of debt market conditions are *Market credit spread,* the Baa corporate bond yield minus the 10-year constant maturity Treasury yield; *GZ credit spread,* the average unweighted credit spread of several outstanding bonds in a given year (Gilchrist & Zakrajšek, 2012); and *Excess bond premium,* the residual component of *GZ credit spread* that captures investor attitudes towards credit risk (Gilchrist & Zakrajšek, 2012). The terms *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. See Appendix A for the definitions and measurements of the other variables in the model. Standard errors are Newey–West (1987) with four lags, and *t*-statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Non-Crisis	Crisis	Non-Crisis	Crisis	Non-Crisis	Crisis
	(1)	(2)	(3)	(4)	(5)	(6)
HP-index	2.147***	1.029***	1.195**	7.288**	0.292	-0.906
	(2.62)	(3.19)	(2.48)	(2.49)	(0.11)	(-1.01)
Market credit spread	-3.987**	-2.130***				
	(-2.39)	(-3.29)				
GZ credit spread			-1.762**	-1.421***		
			(-2.18)	(-2.74)		
Excess bond premium					-9.459**	-2.724***
					(-2.15)	(-3.40)
Market credit spread × HP-index	1.643**	-6.223***				
	(2.39)	(-3.36)				
GZ credit spread × HP-index			5.115**	-3.560***		
			(2.30)	(-2.83)		
Excess bond premium × HP-index					2.374**	-8.220***
					(2.20)	(-3.48)
Constant	62.522**	67.744***	26.071**	30.573***	-21.766*	1.998
	(2.41)	(3.29)	(2.15)	(2.70)	(-1.82)	(0.55)
Difference (Non-Crisis vs. Crisis)						
HP-index		0.86		0.81		0.01
Market credit spread		10.22***				
GZ credit spread				11.08***		
Excess bond premium						20.32***
Market credit spread × HP-index		12.33***				
GZ credit spread × HP-index				10.93***		
Excess bond premium × HP-index						10.62***
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	548	296	548	296	548	296
Pseudo-R^2	0.480	0.373	0.423	0.356	0.602	0.389
Chi-squared	54.329	81.823	47.930	78.153	68.133	85.358
F-Test	-29.454	-68.896	-32.654	-70.731	-22.552	-67.129

Table 6: Effects of product market competition and financial crisis on debt-financed share repurchases

This table shows the results of a logit estimation of the effects of financial crisis on debt-financed share repurchases. Panel A shows the results for how financial crisis determines the effects of debt market conditions and financial constraints on debt-financed share repurchases, and Panel B shows the effects of debt market conditions and equity valuation on debt-financed share repurchases. The measure of product market competition is the HHI (*HHI*). The dependent variable is equal to one for a debt-financed repurchase, and zero otherwise. The *HP-index* variable measures financial constraint according to Hadlock and Pierce (2010) and equals one for firms in the highest quintile, and zero otherwise. The measures of debt market conditions are *Market credit spread,* the Baa corporate bond yield minus the 10-year constant maturity Treasury yield; *GZ credit spread,* the average unweighted credit spread of several outstanding bonds in a given year (Gilchrist & Zakrajšek, 2012); and *Excess bond premium,* the residual component of *GZ credit spread* that captures investor attitudes towards credit risk (Gilchrist & Zakrajšek, 2012). The terms *Market credit spread* × *HP-index*, *GZ credit spread* × *HP-index*, and *Excess bond premium* × *HP-index* are the interactions between debt valuations and the price-to-value ratio. See Appendix A for the definitions and measurements of the other variables in the model. Standard errors are Newey–West (1987) with four lags, and *t*-statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Non-Crisis Periods

	HHI (*HHI*)					
	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)
HP-index	0.816	0.722	-1.487	-0.100	-2.422**	1.180
	(0.35)	(0.33)	(-0.71)	(-0.05)	(-2.05)	(1.26)
Market credit spread	-6.583*	0.840				
	(-1.75)	(0.25)				
GZ credit spread			-2.879	1.336		
			(-0.85)	(0.37)		
Excess bond premium					0.211	-2.512
					(0.05)	(-0.49)
Market credit spread × HP-index	-1.861*	0.256***				
	(-1.70)	(3.25)				
GZ credit spread × HP-index			-0.750	0.608**		
			(-0.76)	(2.55)		
Excess bond premium × HP-index					-0.171	0.698**
					(-0.15)	(2.46)
Constant	8.817	0.296	1.200	-0.995	-3.120	1.779
	(1.27)	(0.04)	(0.21)	(-0.16)	(-1.51)	(0.80)
Difference (High vs. Low)						
Market credit spread × HP-index		12.42***				
GZ credit spread × HP-index				10.92***		
Excess bond premium × HP-index						6.08***
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	105	126	105	126	105	126
Pseudo-R^2	0.249	0.182	0.230	0.193	0.230	0.184
Chi-squared	36.216	29.216	33.439	31.028	33.424	29.442
F-Test	-54.630	-65.593	-56.018	-64.687	-56.025	-65.480

Panel B: Financial Crisis Periods

	HHI (*HHI*)					
	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)
HP-index	3.422	-1.171	-1.125	0.446	-0.560	0.563
	(1.32)	(-0.61)	(-0.86)	(0.32)	(-0.97)	(0.91)
Market credit spread	-5.000	2.024				
	(-1.45)	(0.94)				
GZ credit spread			1.134	-0.039		
			(0.65)	(-0.02)		
Excess bond premium					1.767	-0.946
					(0.56)	(-0.27)
Market credit spread × HP-index	-1.339	0.571				
	(-1.52)	(0.91)				
GZ credit spread × HP-index			0.225	0.042		
			(0.48)	(0.08)		
Excess bond premium × HP-index					0.364	-0.168
					(0.43)	(-0.17)
Constant	14.085	-7.051	-4.386	-0.576	-1.521	-0.573
	(1.37)	(-1.04)	(-0.86)	(-0.11)	(-0.76)	(-0.30)
Difference (High vs. Low)						
Market credit spread × HP-index		3.84**				
GZ credit spread × HP-index				0.07		
Excess bond premium × HP-index						0.18
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	235	203	235	203	235	203
Pseudo-R^2	0.129	0.054	0.123	0.052	0.121	0.053
Chi-squared	29.873	10.414	28.638	10.088	28.028	10.189
F-Test	-101.258	-91.180	-101.876	-91.343	-102.181	-91.292

Table 7: *WW-index* measure of financial constraint 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 repurchases. The dependent variable is equal to one for a debt-financed repurchase, and zero otherwise. The variable *WW-index* measures financial constraints according to the Whited–Wu (2006) index and is equal to one for firms in the highest quintile, and zero otherwise. The measures of debt market conditions are *Market credit spread,* the Baa corporate bond yield minus the 10-year constant maturity Treasury yield; *GZ credit spread,* the average unweighted credit spread of several outstanding bonds in a given year (Gilchrist & Zakrajšek, 2012); and *Excess bond premium,* the residual component of *GZ credit spread* that captures investor attitudes towards credit risk (Gilchrist & Zakrajšek, 2012). The terms *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. See Appendix A for the definitions and measurements of the other variables in the model. Standard errors are Newey–West (1987) with four lags, and *t*-statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
WW-index	4.497**	2.639*	0.259	9.538***	6.737**	0.774
	(2.00)	(1.81)	(1.52)	(2.84)	(2.23)	(1.61)
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)
Market credit Spread × *WW-index*				5.756**		
				(2.15)		
GZ credit spread × *WW-index*					6.287***	
					(2.72)	
Excess bond premium × *WW-index*						9.540**
						(2.50)
Constant	2.402	1.038	0.214	6.540**	2.327	0.433
	(1.38)	(0.62)	(0.13)	(2.46)	(1.31)	(0.27)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	844	844	844	844	844	844
Pseudo-R^2	0.260	0.244	0.240	0.269	0.261	0.254
Chi-squared	125.324	117.636	116.016	129.788	125.964	122.398
F-Test	-178.693	-182.536	-183.346	-176.460	-178.373	-180.156

Table 8: Alternative measurement of financial constraints (*WW-index*) and debt-financed share repurchases

This table shows the results of a logit estimation of the effects of debt market conditions and financial constraints on debt-financed share repurchases, given the level of product market competition. The measure of product market competition is the HHI (*HHI*). The dependent variable is equal to one for a debt-financed repurchase, and zero otherwise. The variable *WW-index* measures financial constraints according to Whited and Wu's (2006) index and is equal to one for firms in the highest quintile, and zero otherwise. The measures of debt market conditions are *Market credit spread,* the Baa corporate bond yield minus the 10-year constant maturity Treasury yield; *GZ credit spread,* the average unweighted credit spread of several outstanding bonds in a given year (Gilchrist & Zakrajšek, 2012); and *Excess bond premium,* the residual component of *GZ credit spread* that captures investor attitudes towards credit risk (Gilchrist & Zakrajšek, 2012). The terms *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. See Appendix A for the definitions and measurements of the other variables in the model. Standard errors are Newey–West (1987) with four lags, and *t*-statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	HHI (*HHI*)					
	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)
WW-index	8.434	2.396***	4.190	8.279***	3.374	7.598**
	(0.80)	(2.94)	(1.19)	(2.66)	(0.64)	(2.31)
Market credit spread	-1.368	-4.266**				
	(-1.13)	(-2.32)				
GZ credit spread			-1.636	-2.155		
			(-1.16)	(-1.46)		
Excess bond premium					-1.420	-3.472
					(-0.61)	(-1.41)
Market credit spread × WW-index	-1.731	10.760*				
	(-0.52)	(1.86)				
GZ credit spread × WW-index			-4.269	6.080***		
			(-1.01)	(5.12)		
Excess bond premium × WW-index					-5.162	12.784**
					(-0.73)	(2.40)
Constant	0.632	15.378***	1.100	8.942**	-2.314	4.005**
	(0.16)	(2.88)	(0.29)	(2.27)	(-0.97)	(2.00)
Difference (High vs. Low)						
Market credit spread × WW-index		3.52**				
GZ credit spread × WW-index				10.96***		
Excess bond premium × WW-index						5.90***
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	168	154	168	154	168	154
Pseudo-R^2	0.342	0.342	0.336	0.315	0.332	0.309
Chi-squared	72.254	67.796	70.958	62.482	69.964	61.172
F-Test	-69.367	-65.240	-70.015	-67.897	-70.512	-68.552

Table 9: Alternative measurement of equity valuation

This table shows the results of a logit estimation of the effects of debt market conditions and equity valuation on debt-financed share repurchases, given the level of product market competition. The measure of product market competition is the HHI *(HHI)*. The dependent variable is equal to one for a debt-financed repurchase, and zero otherwise. The *HP-index* variable measures financial constraint according to Hadlock and Pierce (2010) and equals one for firms in the highest quintile, and zero otherwise. *PV ratio* is the measure of equity valuation using the Abnormal Earnings Growth model (Ohlson and Juettner-Nauroth, 2005). The measures of debt market conditions are *Market credit spread,* the Baa corporate bond yield minus the 10-year constant maturity Treasury yield; *GZ credit spread,* the average unweighted credit spread of several outstanding bonds in a given year (Gilchrist & Zakrajšek, 2012); and *Excess bond premium,* the residual component of *GZ credit spread* that captures investor attitudes towards credit risk (Gilchrist & Zakrajšek, 2012). The terms *Market credit spread* × *PV ratio*, *GZ credit spread* × *PV ratio*, and *Excess bond premium* × *PV ratio* are the interactions between debt valuations and the price-to-value ratio. See Appendix A for the definitions and measurements of the other variables in the model. Standard errors are Newey–West (1987) with four lags, and *t*-statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	HHI (*HHI*)					
	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)
HP-index	-4.491**	2.477*	-3.511*	2.485	-3.866**	2.593*
	(-2.13)	(1.65)	(-1.90)	(1.64)	(-2.14)	(1.70)
PV ratio	1.560	0.078	0.256	0.120	0.875**	0.167
	(1.53)	(0.24)	(0.40)	(0.34)	(2.29)	(1.48)
Market credit spread	0.634	-0.573				
	(0.65)	(-0.66)				
GZ credit spread			-0.231	-0.107		
			(-0.31)	(-0.16)		
Excess bond premium					-2.103	-0.559
					(-1.47)	(-0.41)
Market credit spread × PV ratio	-0.469	0.024**				
	(-1.29)	(2.16)				
GZ credit spread × PV ratio			0.013	0.004		
			(0.04)	(0.02)		
Excess bond premium × PV ratio					1.563	0.195***
					(0.98)	(2.50)
Constant	7.959	1.877	10.761*	0.550	11.652**	0.324
	(1.25)	(0.31)	(1.85)	(0.10)	(2.07)	(0.06)
Difference (High vs. Low)						
HP-index		1.43		0.54		3.47***
PV ratio		0.83		0.88		0.97
Market credit spread		0.94				
GZ credit spread				0.62		
Excess bond premium						0.64
Market credit Spread × PV ratio		11.83*				
GZ Credit spread × PV ratio				0.88		
Excess bond premium × PV ratio						0.67
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	407	412	407	412	407	412
Pseudo-R^2	0.493	0.498	0.479	0.495	0.517	0.497
Chi-squared	67.365	69.304	65.497	68.863	70.651	69.155
F-Test	-34.653	-34.910	-35.587	-35.130	-33.010	-34.984

Table 10: Alternative measurements of product market competition

This table shows the results of a logit estimation of the effects of debt market conditions and financial constraints on debt-financed share repurchases, given the level of product market competition. The dependent variable is equal to one for a debt-financed repurchase, and zero otherwise. The measures of product market competition are Hoberg–Phillips–Prabhala product fluidity (*HPP Fluidity*) in Columns (1) to (6) and Hoberg–Phillips product similarity (*HP Similarity*) in Columns (7) to (12). The *HP-index* variable measures financial constraints according to Hadlock and Pierce (2010) and is equal to one for firms in the highest quintile, and zero otherwise. The measures of debt market conditions are *Market credit spread,* the Baa corporate bond yield minus the 10-year constant maturity Treasury yield; *GZ credit spread,* the average unweighted credit spread of several outstanding bonds in a given year (Gilchrist & Zakrajšek, 2012); and *Excess bond premium,* the residual component of *GZ credit spread* that captures investor attitudes towards credit risk (Gilchrist & Zakrajšek, 2012). The terms *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. See Appendix A for the definitions and measurements of the other variables in the model. Standard errors are Newey–West (1987) with four lags, and *t*-statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	HPP Fluidity						*HP Similarity*					
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
HP-index	1.804	20.176***	1.418	14.189***	0.285	2.027	3.830	8.273**	3.320	9.311***	0.028	4.328***
	(0.75)	(3.09)	(0.63)	(3.05)	(0.28)	(1.46)	(1.45)	(2.22)	(1.45)	(2.68)	(0.03)	(2.77)
Market credit spread	-1.809	-29.396***					-5.302	-6.218				
	(-0.61)	(-3.01)					(-1.53)	(-1.22)				
GZ credit spread			-1.838	-20.929***					-5.049	-6.905		
			(-0.56)	(-2.75)					(-1.48)	(-1.56)		
Excess bond premium					-11.035	-34.816**					-12.241**	-11.719
					(-1.64)	(-2.56)					(-2.05)	(-1.52)
Market credit spread × HP-index	-0.506	7.321***					-1.378	-1.580				
	(-0.60)	(2.96)					(-1.41)	(-1.21)				
GZ credit spread × HP-index			-0.464	5.359***					-1.371	2.094*		
			(-0.49)	(2.70)					(-1.37)	(1.72)		
Excess bond premium × HP-index					-3.386*	9.077**					-3.594**	3.631*
					(-1.70)	(2.53)					(-2.06)	(1.72)
Constant	3.026	101.237***	2.374	76.589***	-2.796	26.951***	10.261	38.377**	7.986	38.694***	-4.980	22.633***
	(0.36)	(3.39)	(0.30)	(3.22)	(-0.75)	(3.40)	(1.07)	(2.48)	(0.97)	(2.80)	(-1.39)	(3.38)
Difference (High vs. Low)												
Market credit spread × HP-index		3.96***						0.07				
GZ credit spread × HP-index				8.58***						2.22**		
Excess bond premium × HP-index						10.05***						6.50***
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	283	252	283	252	283	252	282	266	282	266	282	266
Pseudo-R^2	0.313	0.508	0.314	0.496	0.339	0.483	0.383	0.341	0.385	0.370	0.394	0.379
Chi-squared	39.682	74.473	39.794	72.783	43.006	70.913	66.177	47.169	66.423	51.124	67.987	52.493
F-Test	-43.577	-36.117	-43.521	-36.961	-41.915	-37.896	-53.265	-45.584	-53.142	-43.607	-52.360	-42.923