Dynamic capital structure under changing market conditions with heterogeneous indebtedness: An empirical investigation

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1. Introduction
2. Theoretical Approach
3. Methodological Approach
4. Data
5. Results
   - First Regression
   - Second Regression
   - Third Regression
6. Conclusions

Motivation

Capital structure has many implications for a firm's operation:

- It can influence how aggressively a firm prices its products or how it interacts with labor unions.
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What we know?

- Firms' characteristics, such as size and asset tangibility, line up with observed capital structures in practice.
- Firm's life events may cause it to be over- or underleveraged relative to a certain target.
- These events are related to 'market timing' opportunities, cyclicality of the firm's profitability, or significant changes in the expected future earnings of the firm that are reflected in its current market prices.

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Theoretical Approach

Fama and French (2012) proposed a new regression framework that nests the most popular capital structure theories in the literature: the trade-off, pecking order, and market conditions models.

They proposed three pairs of cross-section regressions that focus on separated aspects of the capital structure decisions:

- The division of total new outside financing between shares issued and debt.
- The division of new debt funding between short-term and long-term.
- The division of total new equity financing between retained dividends and shares issued.

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- The division of new debt funding between short-term and long-term.
- The division of total new equity financing between retained dividends and shares issued.

We use the Fama and French (2012) framework. Additionally, we show that the current level of the same funding variables decided by the firms:

- The growth rate of indebtedness, during the year,
- The volume of shares issued,
- The growth rate of short-term and long-term debt,
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Methodological Approach

The regressions proposed by Fama and French (2012) are linear and they are generally estimated by Ordinary Least Squares (OLS) regressions.

In this case, the slope coefficients measure a "mean to mean" effect.

Current managerial practices and financial structure decisions will likely assert a significant influence on the capital structure decisions made by a firm.

Therefore, firms' heterogeneity regarding the dependent variables in Fama and French regressions must be considered, in order to evaluate their funding decisions.

To this end, we carried out by means of conditional quantile regression (Koenker y Bassett, 1978; Koenker, 2005).

Data

Our database consists of annual cross-sectional observations for the years running from 2007 to 2016.

The companies included are listed on the NYSE and are classified by NASDAQ into four oil-related sectors: integrated oil, oil and gas production, refining and marketing, and oilfield services and equipment companies.

Raw data were retrieved for DataStream. The sample period spans January 2007 - December 2016.

Results

We identify three periods within the sample associated to different macroeconomic conditions, dynamics of fundamentals, and credit conditions, which affect the financing decisions made by firms.

- **Global financial crisis (2007-2009)**: weakened oil demand, volatility in oil prices, tight credit conditions for oil companies.
- **Market recovery and strong fundamentals (2011-2013)**: stable oil prices, growing demand, and low-interest rates.
- **Structural industry change (2014-2016)**: shale oil revolution, dramatic drop in oil prices, weakening of oil demand.

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Shares issued *vs.* debt

The cash flow constraint:

$$dS_t + dL_t = dA_t + D_t - Y_t$$

Regressions pair:

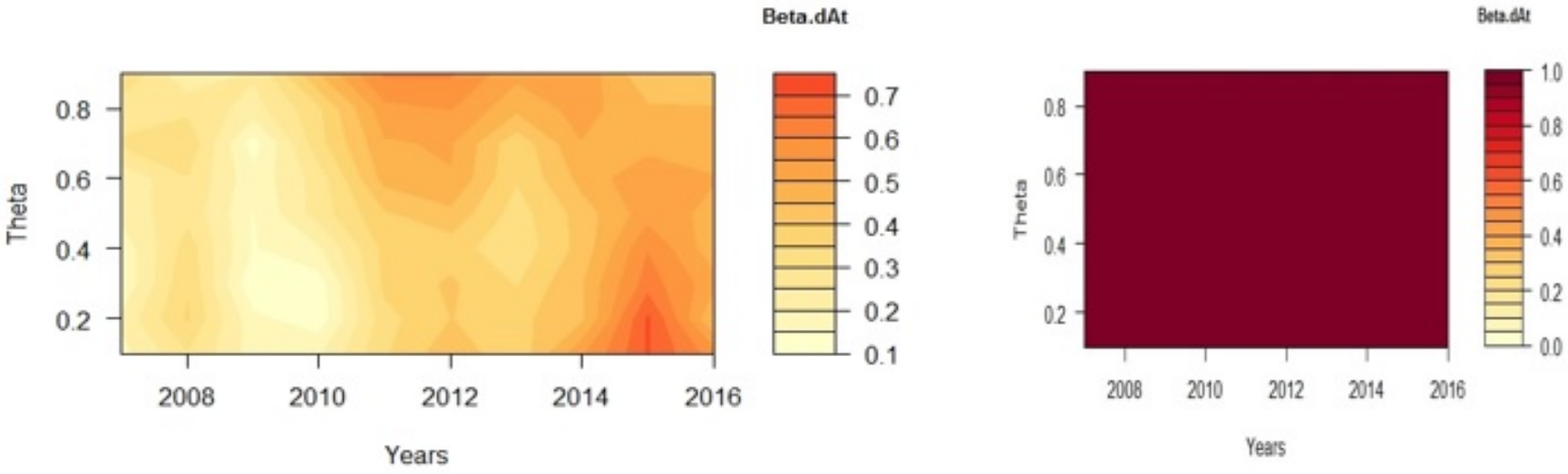
$$dS_t = a_t + b_1 dA_t + b_2 D_t + b_3 Y_t + b_4 P/B_{t-1} + b_5 LS_{t-1} + \varepsilon_t$$

$$dL_t = -a_t + (1-b_1)A_t + (1-b_2)D_t - (1+b_3)Y_t - b_4 P/B_{t-1} - b_5 LS_{t-1} - \varepsilon_t$$

Pecking order model prediction: outside financing issued to cover changes in firms' cash flow is primarily debt.

Hence, one should expect the slopes associated with the investment, dividends, and earnings to be further from zero in the new debt regression than in the new shares regression.

Figure: Investment's estimated slopes in dS_t regression



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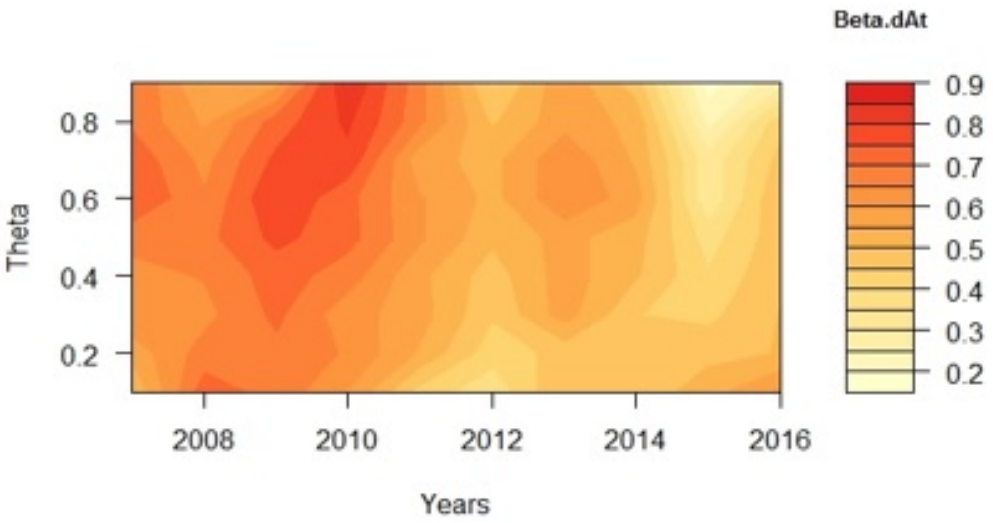

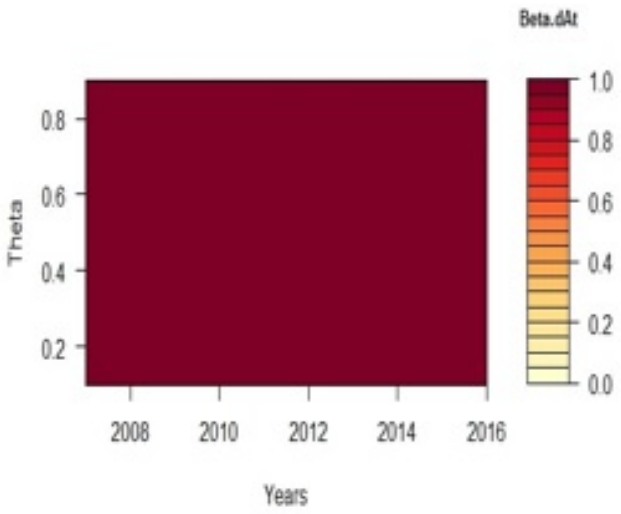

Global financial crisis:

- Changes in investment induce higher variations on the issuing of new debt. This trend is largely observed in firms with the highest changes in new debt issued.
- In 2007 firms located on the 60th and 70th quantiles of the distribution of new debt issued are 13% and 10%, respectively, more affected than firms located at the median.
- From 2008-2010, firms with the highest and lowest levels of new shares issued appear more sensitive to variations in dividend payments.
- Specifically, firms located at the 10th and 20th quantiles are affected 20% and 13% more than firms at the median.

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Market recovery period:

- Changes in investment exhibit a higher effect on new debt variations.
- Debt, as a financing source, is especially relevant for firms with above average growth levels of new debt issued.
- The issuance of new shares is mainly influenced by changes in dividend payments.

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Structural industry change:

- Debt loses relevance as the primary funding source of investment.
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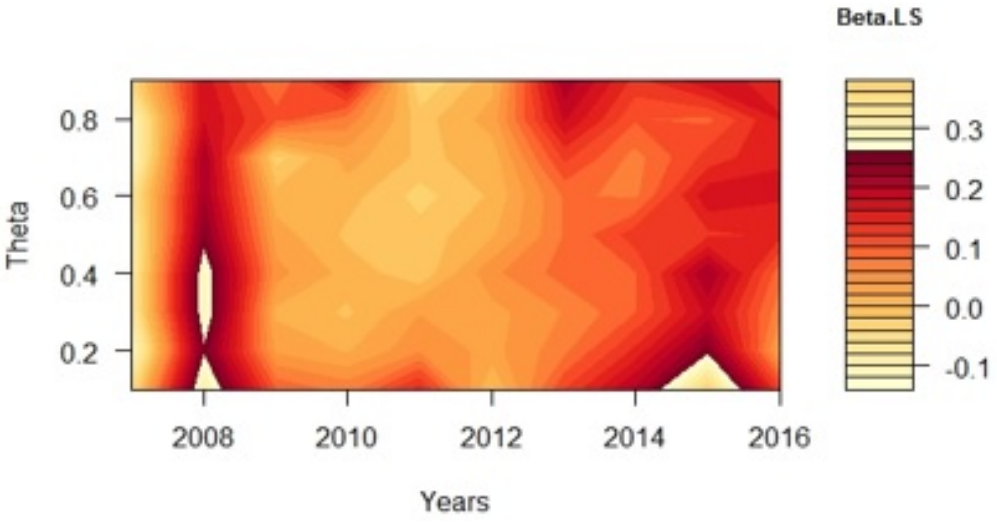
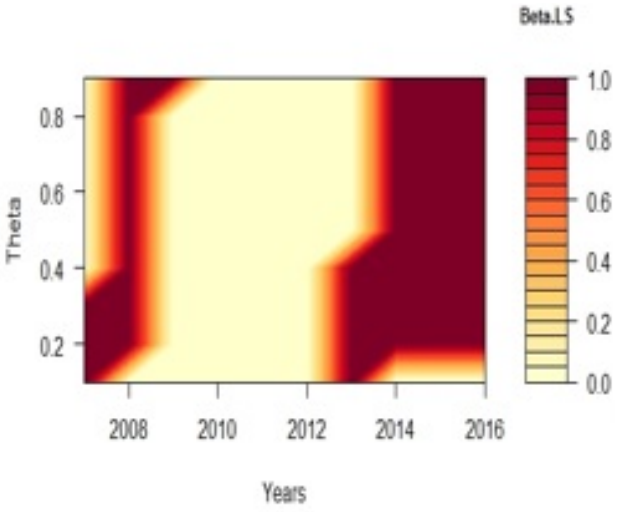
Trade-off model prediction: higher leverage deviations from the target induce firms to issue more stock and less debt in order to finance their operations.

Therefore, the slopes for LS_{t-1} should be positive in the regression explaining new shares issued and negative in the regression explaining debt issues.

Figure: Leverage surplus' estimated slopes in dS_t regression





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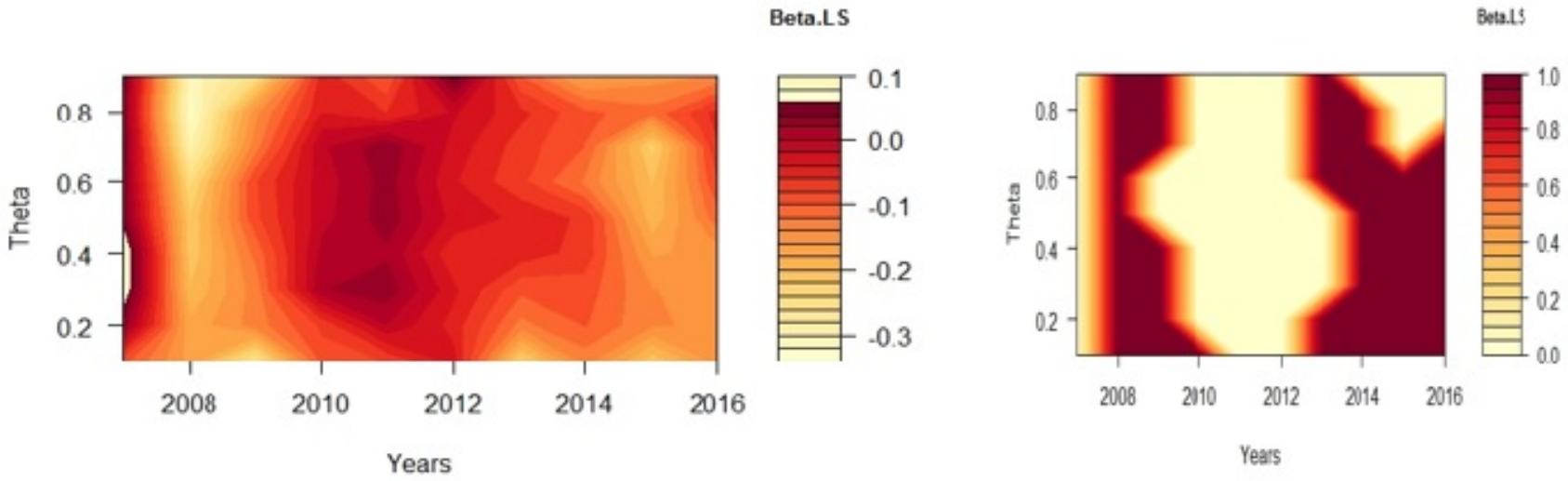

Global financial crisis:

- The leverage surplus is statistically non-significant most of the times in the regression explaining new share issues.
- In the case of the debt regression, the slopes for LS_{t-1} were negative, suggesting that from the firm perspective, being away from the industry debt benchmark constitutes a reason to restricting new debt issuing.

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Market recovery period:

- LS_{t-1} does not render statistically significant estimates in the regressions of new shares issues and new debt issues.

Structural industry change:

- Leverage surplus is statistically significant for most of the quantiles in both regressions.
- Its negative effects on the issuing of new debt are more pronounced for companies at the highest quantiles of new indebtedness.
- In 2014, firms at the 80th and 90th quantile of new debt issued, reduced their new debt issues by 46% and 156% more than firms at the median, as consequence of being above industry leverage targets.

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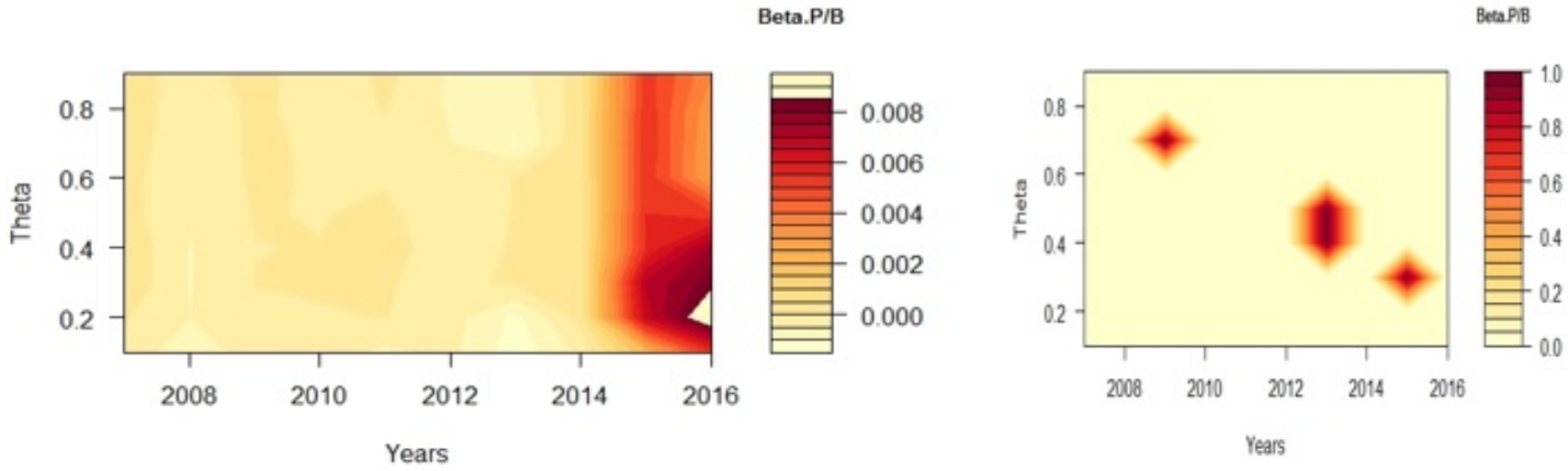
Market conditions model prediction: It is expected that higher P/B_{t-1} firms will prefer share issues rather than use other outside financing alternatives.

Therefore, one should also expect a positive slope of P/B_{t-1}in the regression explaining new shares issues and a negative effect on the issuing of new debt.

Figure: Price to book ratio estimated slopes in dS_tregression



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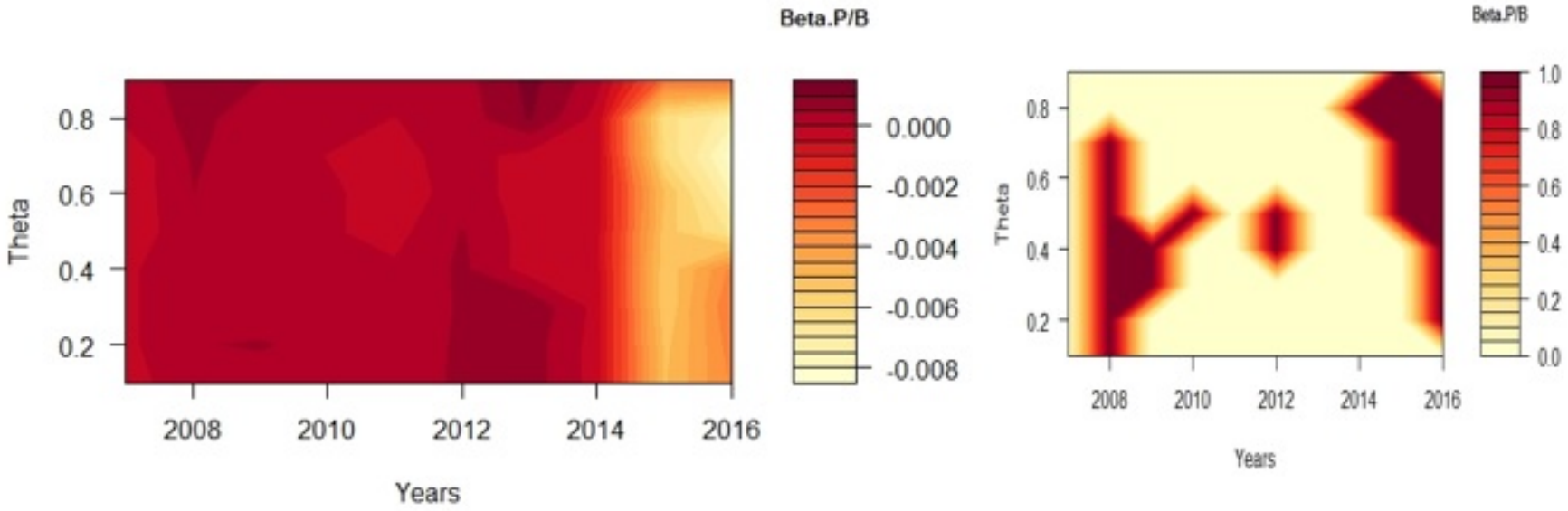

- The lagged price to book ratio is statistically non-significant for most of the sample period in the new shares regression.
- In the new debt regression the effect of P/B_{t-1} is null for most of the sample period.

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Short-term debt *vs.* long-term debt

The cash flow constraint:

$$dSTD_t + dLTDt = dA_t + D_t - Y_t - dS_t$$

Regressions pair:

$$dSTD_t = a_t + b_1 dA_t + b_2 D_t + b_3 Y_t + b_4 dS_t + b_5 P/B_{t-1} + b_6 STS_{t-1} + \varepsilon_t$$

$$dLTD_t = -a_t + (1 - b_1) dA_t + (1 - b_2) D_t - (1 + b_3) Y_t - (1 + b_4) dS_t$$

$$- b_5 P/B_{t-1} - b_6 STS_{t-1} - \varepsilon_t$$

Pecking order model prediction: The debt issued in response to cash flows is primarily short-term.

Global financial crisis:

- Investment induces high levels of variation in the short-term and long-term indebtedness growth rates.
- Investment tends to have a higher effect on the issuing of long-term debt.
- In 2009 firms at the 10th and 20th quantile of the long-term debt issues, are 29% and 12% more affected by changes in investment than firms at the median of the distribution.

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Markets recovery:

- A preference for long-term debt to finance cash flow changes is recorded.
- This preference is especially relevant for firms with high-level variations of long-term debt issuance .

Structural industry change:

- Almost all the variations in investment and dividend payments were funded with the issuing of long-term debt.
- Share issues and earnings appear again as alternative sources of financing just in the long-term regression.
- Share issues and earnings are non-statistically significant in the explanation of short-term debt.

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Trade-off model prediction: firms have short-term debt targets and its indebtedness levels tend to return to such targets.

- From 2012 to 2016, short-term debt surplus is statistically significant and has a negative effect on the issuing of new short-term debt at the lowest quantiles of the dependent variable distribution.
- The effect of short-term surplus on the long-term debt levels is positive and statistically significant for all the quantiles in 2008 and 2015.

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Market conditions model prediction: companies with higher P/B_{t-1} will prefer long-term debt over short-term debt.

- The effects of the lagged price to book ratio over oil companies' short-term levels render statistically significance in 2014 and 2015.
- A higher lagged price to book ratio induces a negative effect on the short-term issues of companies with average and low short-term debt growth rates.
- In the long-term debt regression, P/B_{t-1} is statistically significant for the companies with high levels of long-term issues from 2014 to 2016.

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Shares issued *vs.* retained earnings

The cash flow constraint:

$$dS_t - D_t = dA_t - Y_t - dL_t$$

Regression Pair:

$$dS_t = a_t + b_1 dA_t + b_2 Y_t + b_3 dL_t + b_4 P/B_{t-1} + \varepsilon_t$$

$$D_t = a_t + (b_1 - 1)dA_t + (b_2 + 1)Y_t + (b_3 + 1)dL_t + b_4 P/B_{t-1} + \varepsilon_t$$

Pecking order model prediction: Shares issuance is the most expensive source of financing. Hence, firms should finance changes in investment by reducing firms' dividend payments.

- Our results indicate that the highest variation in the issuance of new shares is induced by changes in investment.
- This effect was especially relevant during the global financial crisis period, principally at the median and lowest quantiles of new shares issues.
- Changes in investment are not statistically significant when explaining variations in dividend payments

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Market conditions model prediction: A higher lagged price to book ratio lead some firms to increase dividend payouts in order to be able to make large share issues.

- The P/B_{t-1} is statistically and economically non-significant for all of the sample period and quantiles in the two regressions.

Conclusions

- We test the main hypotheses in the literature regarding the way in which firms fund their operation.
- Our results allow us to study asymmetries previously unidentified by the literature that affect capital structure decisions.
- We explore the asymmetries related to decisions made about outside indebtedness, and short versus long-term debt, alongside regarding the payment of dividends.

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- We explore the asymmetries related to decisions made about outside indebtedness, and short versus long-term debt, alongside regarding the payment of dividends.

- Our results indicate that oil firms with the highest levels of new debt issuing preferred to continue financing changes in their investment by the issuing of new debt.
- In terms of the tradeoff model, our results point out a reversion to the leverage target in the oil industry.
- Firms exhibit a preference for issuing long-term over short-term debt. This preference appears for all the sample period.
- From 2007 to 2010 firms change their levels of shares issued to cover changes in their cash flow rather than reduce their dividend payments.

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- In terms of the tradeoff model, our results point out a reversion to the leverage target in the oil industry.
- Firms exhibit a preference for issuing long-term over short-term debt. This preference appears for all the sample period.
- From 2007 to 2010 firms change their levels of shares issued to cover changes in their cash flow rather than reduce their dividend payments.

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