Strategic Competition, Capital Structure, and Market Share

Abe de Jong
Rotterdam School of Management, Erasmus University
ajong@rsm.nl

Thuy Thu Nguyen*
Rotterdam School of Management, Erasmus University
tnguyen@rsm.nl

Mathijs A. van Dijk
Rotterdam School of Management, Erasmus University
madijk@rsm.nl

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* Corresponding author: Department of Financial Management, Rotterdam School of Management, Erasmus University, Room T8-21, P.O. Box 1738, 3000 DR Rotterdam, The Netherlands. Tel: +31 10 4082792; Fax: +31 10 4089017. We thank Dan Kovenock, Marno Verbeek and seminar participants at Erasmus University for helpful comments.

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Abstract

This paper examines the interaction between a firm's capital structure and its market share. Theory predicts that this relation depends on the type of strategic competition (i.e., Cournot or Bertrand). We distinguish between Cournot and Bertrand industries in a sample of U.S. manufacturing firms based on an empirical measure of strategic substitutes and strategic complements. We study the joint determination of leverage and market share and test the theoretical predictions of Dasgupta and Titman (1998) and Faure-Grimaud (2000). We show that in Cournot (Bertrand) competition, leverage negatively (positively) affects market share. Conversely, market share has a negative impact on leverage for Cournot firms, but no impact for Bertrand firms. Our findings emphasize the role of strategic competition in the interaction between capital structure and market share.

Key words: Strategic debt, capital structure, market share, Cournot competition, Bertrand competition

JEL classification: G32, L10, L60

1. Introduction

Since Brander and Lewis (1986) and Maksimovic (1988), researchers have studied the strategic role of debt. Theory suggests that a firm's capital structure affects pricing and output choices. Empirical evidence on the link between debt and competition is still limited. Recent papers test the relation between a firm's capital structure and several aspects of product market competition, such as industry concentration (Kovenock and Phillips, 1997; MacKay and Phillips, 2005), the extent of competitive interaction (Lyandres, 2006), output market uncertainty (Showalter, 1999; de Jong, Nguyen, and van Dijk, 2007), and firms' production and pricing decisions (Phillips, 1995).

This paper zooms in on another key variable related to a firm's competitive position in the output market: its market share. We add to studies on industry concentration, competitive interaction, and output market uncertainty by studying the impact of capital structure choice on strategic competition at the level of the individual firm. We add to the detailed study of Phillips (1995) of four specific industries in which firms have sharply increased their leverage by providing a more general and more comprehensive analysis of the effect of leverage on market share in a large sample of U.S. manufacturing firms over the period 1985-2004. Furthermore, we recognize that not only is a firm's capital structure likely to affect its strategic behavior in the output market, the competitive environment of a firm could also have an impact on its capital structure choice. Thus, we test the interaction between leverage and market share in a simultaneous-equations system in which both variables are endogenous.

In contrast to almost all previous empirical studies, our paper takes into account that theoretical predictions about the relation between capital structure and competition depend on the type of strategic competition in an industry. We examine the interaction between leverage and market share separately for two samples of Cournot and Bertrand firms. We distinguish between Cournot and Bertrand firms based on an empirical measure of strategic substitutes and strategic complements and we show that this distinction matters for the estimated effect of leverage on market share.

Our focus on market share allows us to test the predictions of theoretical models that – to the best of our knowledge – have not been directly tested before. In the model of Dasgupta and Titman (1998), long-term debt induces firms to compete less aggressively in the output market, because it increases the rate at which future profits are discounted. In other words, higher debt induces a Bertrand firm to charge higher prices and a Cournot firm to produce less. The consequences of these actions for a firm's market share differ across Cournot and Bertrand firms, because their rivals react with different strategic moves. The rival of a levered Cournot firm is likely to increase its own production, as Cournot firms compete as strategic substitutes (Bulow, Geanakoplos, and Klemperer, 1985). As a result, the levered firm's market share decreases. The rival of a levered Bertrand firm reacts by also raising prices for its products, because Bertrand firms compete as strategic complements (Bulow et al., 1985). In the Bertrand case, the overall impact on market share is thus unclear as both firms raise their prices.

In a different theoretical setting, Faure-Grimaud (2000) also finds that debt causes firms to compete less aggressively. In his model of debt contracting under Cournot competition, levered firms behave less aggressively in the output market because they aim to limit the size of the default and increase the probability of getting a good credit record. The reduced aggressiveness of the levered Cournot firm leads to lower output and a lower market share in the next period.

We examine the joint determination of leverage and market share by estimating a simultaneous-equations system using two-stage least-squares. In line with theory, we investigate the interaction between leverage and market share separately for Cournot and Bertrand firms. In particular, we test the implication of the model of Dasgupta and Titman (1998) that under Cournot competition, leverage negatively affects market share, while under Bertrand competition, leverage has no effect on market share. We distinguish Cournot and Bertrand firms using the competitive strategy measure of Sundaram, John, and John (1996).

For Cournot firms, we find that leverage has a significantly negative impact on market share and that market share, in turn, has a significantly negative effect on leverage. The former finding is consistent with Dasgupta and Titman (1998) and Faure-Grimaud (2000). For Bertrand firms, on the other hand, we provide evidence that higher debt induces Bertrand firms to increase their market share. For these firms, we find no significant impact of market share on leverage. Our findings for Bertrand firms do not fit specific theoretical predictions. We discuss a potential explanation for these findings and offer several avenues for further research.

Our evidence indicates that competitive behavior has an influence on the interaction between capital structure and market share. Our results highlight the importance of incorporating the type of competitive behavior in studies of firms' capital structure in connection with output market considerations.

2. Literature and hypotheses

The model of Dasgupta and Titman (1998) is based on the argument of Klemperer (1987) that a firm can improve short-term profits at the expense of long-term profits by increasing its price today. Raising long-term debt increases a firm's discount rate for future profits, because outstanding debt raises the cost of new borrowing. The increase in borrowing costs due to existing debt can be traced back to the debt overhang problem of Myers (1977), who argues that debt removes the incentive to invest in positive net present value projects, because when debt repayments are large enough, the benefits from profitable investments go straight to creditors. The higher discount rate decreases the relative importance of long-term profits. Therefore, debt encourages Bertrand firms to raise prices to attempt to increase short-term profits. The argument carries over to Cournot firms, for which the model predicts a negative relation between output and debt.

From a different perspective, Faure-Grimaud (2000) argues that debt contracts are renegotiable at different stages (e.g., when the firm needs new financing, or the creditor rewards the well-performing firm after some time in operation). However, the debt contract is renegotiation-proof ex post, i.e., once profits are realized. Therefore, even though the debt contracts obtained are the best possible ones in an environment with asymmetric information on profits ex post, they are not first-best contracts. The adverse selection results in an increase in financing costs, which is higher as the default size (or output) increases. Under these circumstances, the firm's competitive position is weakened, and debt makes the Cournot firm less aggressive. By decreasing output, Cournot firms aim to limit the size of the default, and also to increase the probability of getting a good credit record for further financing. Faure-Grimaud shows that the negative effect due to financing costs offsets the positive limited liability effect of Brander and Lewis (1986) for Cournot firms.

In short, the models of Dasgupta and Titman (1998) and Faure-Grimaud (2000) predict that under both Cournot and Bertrand competition leverage induces a firm to engage in softer competition: a Cournot firm does so by reducing output, while a Bertrand firm raises the price. However, the implications of this strategic behavior for the market share of the firm are different for Cournot and Bertrand firms. Softer competition causes the rival of a Cournot firm to increase output because quantities are strategic substitutes, but the rival of a Bertrand firm increases its price because prices are strategic complements (Bulow et al., 1985). As a result, the levered Cournot firm experiences a reduction in market share, while the impact of debt on market share is undetermined for Bertrand firms. Accordingly, we aim to test the following hypotheses: (i) for Cournot firms, leverage has a negative effect on market share; and (ii) for Bertrand firms, leverage has no effect on market share.

The interaction between leverage and market share is not a one-way relation. Previous studies have identified a significant impact of the market position of a firm on its capital structure choice (e.g., Kovenock and Phillips, 1997; MacKay and Phillips, 2005). A firm's market share is an important indicator of its current market position and its market power within the industry. Therefore, we take into account both directional effects in our empirical analysis of the interaction between leverage and market share. Although theory does not provide us with clear predictions on the signs of the effect of market share on leverage in Cournot or Bertrand firms, we will empirically explore this relation and proceed to do the analysis separately for our samples of Cournot and Bertrand firms.

3. Data

We collect firm-level data on U.S. manufacturing firms over the period 1985 to 2004 from Compustat. We obtain data at both annual and quarterly frequencies. At the annual frequency, we take all manufacturing firms' relevant financial information (such as total assets, tangible assets, profits, debt levels, etc.). At the quarterly frequency, we collect data on sales and profits, which are needed to estimate the measure of strategic competition within industries.

We define competitors as all firms in the Compustat data base with the same 4-digit SIC code (ITEM#324) in each particular year. We drop firms that do not have records of 4-digit historical SIC. As we focus on U.S. manufacturing firms only, we omit observations with historical SICs below 2000 or above 3999. We also exclude firms in industries concerned with miscellaneous items. We require firms to have both total assets and sales greater than 1 million USD. We discard firms without quarterly data for sales, profits, and costs of goods sold. We follow MacKay and Phillips (2005) and drop observations with negative sales or assets for either annual or quarterly records.

The data screens yield a final sample of 126 industries, consisting of 14,007 firm-years and 2,660 distinct firms. We use the competitive strategy measure (*CSM*) – developed by Sundaram, John, and John (1996) and used by, among others, Lyandres (2006) – to distinguish firms competing in Cournot and Bertrand. We estimate *CSM* as the coefficient of correlation between the change in a firm's profit margin and the change in the competitors' output, based on 20 consecutive quarters of sales (ITEM#2, quarterly database) and profits (ITEM#8). We estimate *CSM* based on quarterly data during a relatively short period of time, because competitive behavior may change over time.

Sundaram et al. (1996) show that if *CSM* is smaller than zero, competition can be viewed to be in strategic substitutes (Cournot); if *CSM* is greater than zero, competition is in strategic complements (Bertrand). We use a narrow definition of industries based on their 4-digit SIC. Therefore, we argue that it is reasonable to assume that competitive behavior is consistent across firms in each industry-year. After obtaining the *CSM* measures for each firm-year, we calculate the mean and the standard deviation of the *CSM* for each industry in each year. If the industry-year mean *CSM* is significantly positive at the 10% level, we group the firm-year observations into the "Bertrand sample." If the industry-year mean *CSM* is significantly negative at the 10% level, we group the firm-year observations into the "Cournot sample." This procedure is consistent with Lyandres (2006), although he does not take into account the statistical significance.

After measuring strategic competition and obtaining other key variables, our sample of Bertrand firms includes 3,513 observations and our sample of Cournot firms includes 2,504 observations.

3.1 Dependent variables: Leverage and market share

We consider four alternative definitions of leverage: (i) the book value of the long-term debt ratio (*LDBV*) is defined as total long-term debt (Compustat data ITEM#9) divided by total assets (ITEM#6); (ii) the market value of the long-term debt ratio (*LDMV*) is defined as total long-term debt divided by the market value of total assets[1]; (iii) the book value of the total debt ratio (*TDBV*) is calculated as total debt (which are long-term debt plus debt in current liabilities (ITEM#34)) over total assets; (iv) the market value of the total debt ratio (*TDMV*) is calculated as total debt over market value of total assets.

We compute the market share (*MKTSH*) of each firm as the annual sales of the firm divided by total industry sales. For the total sales of the 4-digit SIC industry, we add up the sales of all firms with the relevant historical SIC in each industry-year.

3.2 Determinants of leverage

Empirical capital structure research uses variables related to static trade-off, agency, and information asymmetry considerations to explain leverage (see, e.g., Titman and Wessels, 1988; Frank and Goyal, 2003). In the static trade-off framework, the firm is viewed as setting a target debt-to-assets ratio and moving towards it. The firm's target capital structure is then determined by the trade-off between tax advantages and bankruptcy-related costs. With respect to bankruptcy costs, we use the following variables: asset tangibility (higher tangibility of assets indicates lower risk for the lender as well as lower direct costs of bankruptcy), firm risk (higher risk indicates higher volatility of earnings and a higher probability of bankruptcy), and firm size (an inverse proxy for the probability of bankruptcy; larger firms are less likely to face financial distress). We measure tangibility (*TANG*) as the ratio of net fixed assets (ITEM#8) to total assets; firm risk (*RISK*) as the standard deviation of the ratio of operating income before depreciation

[1] The market value of total assets is calculated as (Total debt + Market value of equity + Preferred stock – Deferred taxes and investment credits) = ITEM#9 + ITEM#34 + (ITEM#199*ITEM#54) + ITEM#10 – ITEM#35.

(ITEM#13) to total assets during a 5-year period which consists of the current year plus four prior years; and firm size (*SIZE*) as the natural logarithm of total assets.

DeAngelo and Masulis (1980) argue that the tax advantage of debt diminishes as other tax reductions, such as tax and investment tax credits, increase. Because these variables act as a tax shield substitute for debt, a negative relation between leverage and these non-debt tax shields is expected. The proxy for non-debt tax shields we use (*NDTS*) is defined as the ratio of depreciation (ITEM#125) and investment tax credit (ITEM#208) to total assets.

Agency conflicts between equity holders and debt holders arise from asset-substitution and underinvestment. To minimize these conflicts, firms with high growth opportunities have a preference for a low leverage, thus seeking equity financing for their new projects instead of debt financing. Agency theory predicts that growth opportunities are negatively associated with leverage. We use the market-to-book ratio (*MTB*), defined as the market value of total assets over the book value of total assets, as a proxy for growth opportunities. If debt is not collateralized, equity holders have incentives to expropriate wealth from debt holders. Creditors may also demand a higher interest rate, forcing firms to choose equity instead. Our measure of tangibility can be used as a proxy for collateralization, which is expected to be positively related to leverage.

The pecking-order theory suggests that firms follow a specific hierarchy in financing: they prefer internal over external financing. If external financing is required, a firm issues the safest security first. That is, it first issues debt, then hybrid securities such as convertible bonds, and equity only as the last resort. We use profitability to test the pecking-order theory: more profitable firms are likely to have less leverage as they make use of the internally generated fund first. We measure profitability (*PROFIT*) as operating income before depreciation (ITEM#13) divided by the total assets. Similarly, we expect liquidity to have a negative relation with leverage as accumulated cash and other liquid assets serve as internal sources of funding, which will be used first instead of debt. We measure liquidity (*LIQUID*) as the ratio of cash and short-term investments (ITEM#1) to total assets. Bigger firms are likely to exhibit less asymmetric information and are expected to have better access to credit. Hence, firm size is expected to be positively correlated with debt levels.

3.3 Determinants of market share

We expect firm size to be positively associated with market share as larger firms have more financing power in the competition for market share. We use our measure of firm size (*SIZE*) as discussed in section 3.2. R&D expenses, advertising and selling expenses are made in an attempt to gain a better position in the market, improving the firm's market share in the near future. Therefore, we include these as explanatory variables of market shares in our analysis: (i) the research and development expenditure ratio (*R&D*) is R&D expenses (ITEM#46) scaled by total sales (ITEM#12); (ii) the advertisement expense ratio (*ADVERT*) is advertisement expenses (ITEM#45) scaled by sales; and (iii) the selling, general and administration expense ratio (*SGA*) is selling, general and administration expenses (ITEM#189) scaled by sales. We follow Frank and Goyal (2003) in recoding missing values of R&D expenditure, advertisement expenses, selling, general and administration expenses as zero. In addition to the sales-related variables, growth opportunity is another variable to take into account. Firms with high growth opportunities, proxied by market-to-book ratio, can gradually increase their positions and market shares in the product market.

As argued by Davies and Geroski (1997), concentration tends to have a positive relation with market share. If firms are faced with less competition, or some rivals leave the market (the industry becomes more concentrated), they are more likely to have opportunities to gain higher market shares. To measure the industry concentration, we use the Herfindahl-Hirschman Index, taking into account both the number of firms and the inequality of market shares. $HHI = S_1^2 + S_2^2 + S_3^2 + ... + S_K^2 = \sum_{i=1}^{K} S_i^2$, in which K is the number of firms in the industry and S_i denotes the market share of firm i. *HHI* is measured by industry (4-digit SIC) and by year. Similar to our market share measure, we calculate *HHI* by using all firms available in Compustat in the particular industry-year.

Firms often have to make a trade-off between their markup and market share. Other things equal, if firms want to have higher margins they tend to increase their prices and lose a portion of their market share to rivals. We expect a negative relation between markup and market share. We measure the annual markup of firms (*MARKUP*) using the approach of Phillips (1995), who computes markups as (Sales – costs of good sold + change in inventories) / (Sales + change in inventories) = (ITEM#12 – ITEM#41 + ΔITEM#3) / (ITEM#12 + ΔITEM#3).

4. Methodology

We conduct a panel data analysis by using firm fixed effect models with time dummies. We estimate the following system of simultaneous equations using two-stage least squares (2SLS):

$$MKTSH_{i,t} = \sum_{j=1}^{N} \gamma_{0j} d_{ij} + \gamma_1 SIZE_{i,t-1} + \lambda_2 R\&D_{i,t-1} + \gamma_3 SGA_{i,t-1} + \gamma_4 ADV_{i,t-1} + \gamma_5 MTB_{i,t-1} +$$

$$+ \gamma_6 HHI_{i,t-1} + \gamma_7 MARKUP_{i,t-1} + \gamma_8 LEV_{i,t-1} + \sum_{k=9}^{21} \gamma_k YEARDUM + u_{i,t} \qquad (1)$$

$$LEV_{i,t} = \sum_{j=1}^{N} \beta_{0j} d_{ij} + \beta_1 NDTS_{i,t-1} + \beta_2 TANG_{i,t-1} + \beta_3 SIZE_{i,t-1} + \beta_4 RISK_{i,t-1} + \beta_5 MTB_{i,t-1} +$$

$$+ \beta_6 PROFIT_{i,t-1} + \beta_7 LIQUID_{i,t-1} + \beta_8 MKTSH_{i,t-1} + \sum_{k=9}^{21} \beta_k YEARDUM + \varepsilon_{i,t} \qquad (2)$$

where i denotes the i^{th} firm in the sample and i = 1, 2, …, N; d_{ij} is a firm dummy which equals 1 if $i = j$ and 0 elsewhere; *MKTSH* is a firm's market share; and *SIZE* (firm size), *R&D* (R&D expenditure ratio), *SGA* (selling, general and administration expense ratio), *ADV* (advertisement expense ratio), *MTB* (market-to-book ratio), *HHI* (Herfindahl-Hirschman Index), and *MARKUP* (price-cost markup) are determinants of market shares; *LEV* is the leverage measure, which can be one of our four proxies: *LDBV* (book value of the long-term debt ratio), *LDMV* (market value of the long-term debt ratio), *TDBV* (book value of the total debt ratio), or *TDMV* (market value of the total debt ratio); *NDTS* (non-debt tax shields), *TANG* (tangibility), *RISK* (business risk), *SIZE* (firm size), *MTB* (market-to-book ratio), *PROFIT* (profitability), and *LIQUID* (liquidity) are the conventional determinants of leverage. We add year dummies in every equation to account for year fixed effects.

We use lagged explanatory variables as well as instrumental-variable (IV) estimation to overcome the possibility of endogeneity of our dependent variables. The instrumental variables for $LEV_{i,t-1}$ in Equation (1) are: $NDTS_{i,t-2}$, $TANG_{i,t-2}$, $RISK_{i,t-2}$, $PROFIT_{i,t-2}$, $LIQUID_{i,t-2}$. The instrumental variables for $MKTSH_{i,t-1}$ in Equation (2) are: $R\&D_{i,t-2}$, $SGA_{i,t-2}$, $ADV_{i,t-2}$, $HHI_{i,t-2}$, and $MARKUP_{i,t-2}$. To examine the validity of our instruments we measure the between-R^2 in the first-stage regressions. For the market share and leverage regressions we find R^2-values of 12% and 30%, respectively. In the first-stage regression for leverage, all instruments have significant coefficients (at the 1% level), while in the market share model only the coefficient on *HHI* is significant at the 1% level. We perform a robustness check with *HHI* as the only instrument for market share in Equation (2), and find qualitatively similar results (available from the authors upon request).

Our initial analysis concentrates on the estimation results of the simultaneous-equations system for the Cournot and Bertrand sample separately. As a further step in the analysis, we combine the Cournot and Bertrand firms into one sample and re-estimate the model with interactions of two dummy variables (the strategic substitutes, or *SS*, dummy to indicate a Cournot firm, and the strategic complements, or *SC*, dummy to indicate a Bertrand firm) with all explanatory variables in both equations. We use a χ^2-test to investigate whether the right-hand-side variables (notably, leverage and market share) have identical coefficients in the samples of Cournot and Bertrand firms.

5. Empirical results

We start our discussion with the summary statistics of all the variables in our analysis, presented in Table 1. The mean value of our leverage proxies ranges from 0.136 to 0.224, similar to previous studies on U.S. firms (see e.g., Frank and Goyal, 2003; MacKay and Phillips, 2005; Lyandres, 2006). Cournot firms have a higher leverage in market value terms, but a lower leverage in book value terms. This is consistent with the fact that Cournot firms have considerably lower market-to-book ratios compared to Bertrand firms. The distribution of market shares is remarkably similar for Cournot and Bertrand firms. Generally, Cournot firms are smaller, less prone to business risk, and more profitable than Bertrand firms. Cournot firms also have higher markups, but smaller fixed assets, fewer growth opportunities, and fewer liquid assets. The Cournot firms in our sample tend to spend more on selling and administration activities, while the Bertrand firms spend more on R&D and advertisement.

5.1 Results - Cournot sample

Table 2 presents the 2SLS estimation results of the system of Equations (1) and (2) for the Cournot sample. We find clear evidence in favor of the hypothesis that leverage has a negative impact on market share for Cournot firms. All four measures of leverage have negative coefficients, three of which are statistically significant. The effect of leverage on market share is also economically significant. A one standard deviation increase in previous year *LDBV*, *TDBV*, or *TDMV* leads to a 5.31%, 8.38%, or 8.31% decrease, respectively, in the firms' average market share in the following year. We note that because we estimate the model with firm fixed effects, the dependent variables are essentially measured as the deviation from their long-term average, which implies that we can indeed interpret the coefficients as measuring the impact of the explanatory variables in terms of changes in a firm's market share. Our estimation results of the market share model support the prediction of Dasgupta and Titman (1998) and Faure-Grimaud (2000) that leverage induces Cournot firms to behave less aggressively in the output market.

The signs of the coefficients on the other determinants of market share are generally in line with expectations. In particular, we find evidence that firm size, selling expenses, and industry concentration have a significantly positive effect on the market share. Other explanatory variables do not have a coefficient that is statistically significant at conventional significance levels.

Estimation results of Equation (2) show a negative impact of lagged market shares on leverage choice. This relation is statistically significant for both book value measures of leverage. The effects are non-trivial from an economic point of view. A one standard deviation increase in the one-year lagged market share is associated with a 9.62% (7.04%) decrease in the average *LDBV* (*TDBV*) of Cournot firms. Apparently, Cournot firms with a high market share tend to restrict the use of debt. A potential explanation is that these firms have lower leverage to maintain their strong position in the output market.

Several of the conventional determinants of leverage also have significant coefficients. The sign of these coefficients is in line with capital structure theories. Tangibility, firm size, and liquidity consistently show significant coefficients with signs as predicted in the capital structure literature. The coefficients on the market-to-book ratio and on profitability have the correct sign, but are only significant in two of the specifications. The coefficients on non-debt tax shields and business risk are not significant, although they do have the expected signs in most cases. For the business risk variable, we find one (out of four) significantly positive coefficient, which is inconsistent with the argument that higher risk should induce firms to restrict their debt usage.[2]

We also note that both equations for Cournot firms yield reasonably high values for the overall-R^2, ranging from 36% to 37% in the market share models, and from 15% to 23% in the leverage models. This indicates that the model specifications we use capture a good part of the variations in market share and leverage of Cournot firms.

5.2 Results - Bertrand sample

Table 3 shows the estimated coefficients in the simultaneous-equations system of leverage and market share for the Bertrand sample. Interestingly, the estimation results of the market share equation show positive coefficients for all four measures of leverage, all of which are significant at the 1% level. Theory does not offer a clear prediction about the impact of the debt level of a Bertrand firms on its market share, but our empirical analysis indicates that more highly levered Bertrand firms enjoy higher market shares in the output market. These effects are substantial, even larger than the magnitude found for Cournot firms. A one standard deviation increase in lagged *LDBV*, *TDBV*, *LDMV*, or *TDMV* is associated with a 12.26%, 8.79%, 18.70%, or 14.57% decrease, respectively, in the average market share of Bertrand firms. This result is robust to excluding or including different control variables.

[2] Considering that the risk variable might have a measurement error, we run all the regressions again without *RISK* as a robustness check. The regressions yield similar results.

Why is the effect of leverage on market share for Bertrand firms opposite to what we find for Cournot firms? A specific aspect of the paper of Dasgupta and Titman (1998) can potentially explain this finding. Their main prediction that debt induces firms to compete less aggressively in the output market is based on a theoretical result derived within the context of a Nash model. However, Dasgupta and Titman argue that when firms do not determine their output market strategies simultaneously, but one firm (the Stackelberg follower) selects its strategy after observing the actions of the other firm (the Stackelberg leader), this result does not necessarily hold. In other words, in the Stackelberg case debt can induce firms to compete more aggressively. Dasgupta and Titman (1998) do not investigate exactly under which conditions this result obtains.

This argument could potentially explain our empirical results if competition in our Bertrand sample is more accurately characterized by a Stackelberg model, while Cournot competition resembles a Nash model. We are not aware of studies that support this view, but intuitively it makes sense, since prices are easier to observe than output. In any case, our results highlight the need for a theory that describes in more detail the interaction of Bertrand firms' capital structure with various aspects of industry competition.

The coefficients on the other variables in the market share equation exhibit a similar pattern for Bertrand firms as for Cournot firms. Consistent with expectations, we again find that firm size, selling expenses, and industry concentration have a significantly positive effect on the market share.

The estimation results for the leverage equations show no discernible effect of a firm's market share on its future choice of leverage. This finding suggests that the impact of a firm's market position within the industry on capital structure decisions is different under Cournot and Bertrand competition. Consistent with de Jong, Nguyen, and van Dijk (2007), we find that output market considerations are less important for Bertrand firms than for Cournot firms in determining their capital structure choice. We invite future theoretical and empirical work to shed more light on the rationale for these findings.

Similarly to what we observe for Cournot firms, the traditional capital structure variables perform well in Equation (2) for Bertrand firms. Tangibility, firm size, market-to-book ratio, profitability, and liquidity have significant explanatory power for the leverage choice of Bertrand firms. However, in general the overall-R^2 values for Bertrand firms are lower than those for Cournot firms. Specifically, the overall-R^2 in the market share models for Bertrand firms falls between 18.8% and 19.6%, and the overall-R^2 in the leverage models ranges from 8% to 12.4%.

It is remarkable that the estimated effects of leverage on market share and market share on leverage exhibit considerable differences across our Cournot and Bertrand samples, while the coefficients on the other variables are very similar. In section 5.3, we present formal tests for the equality of the leverage and market share coefficients across the Cournot and Bertrand samples.

5.3 Results – Tests for equality of coefficients across Cournot and Bertrand firms

In this section, we estimate the simultaneous-equations model of leverage and market share for the combined sample of Cournot and Bertrand samples and test whether the coefficients of the leverage and market share variables are the same for the two types of competitive behavior. We do so by interacting all explanatory variables with two dummy variables (*SS* and *SC*) to indicate a Cournot and a Bertrand firm. We compute a χ^2-

statistic to test the hypothesis that the leverage effect on market share and the market share effect on leverage are equal across the samples of Cournot and Bertrand firms.

Table 4 presents the results of these tests. The test results confirm our conclusions from Tables 2 and 3 with respect to the impact of leverage on market share. For three out of the four measures of leverage, we detect a statistically significant difference between the estimated coefficients for the Cournot and Bertrand samples. Again, the impact of leverage on market share is negative for Cournot firms and positive for Bertrand firms. For $LDBV_{t-1}$, the estimated coefficients on leverage interacted with *SS* and *SC* are similar, but the difference is not statistically significant with a *p*-value of 0.163. With respect to the leverage equation, the results in Table 4 are in line with the estimation results for the two separate samples, but the difference in the estimated coefficients across the Cournot and Bertrand samples is not statistically significant at conventional significance levels.

Table 5 summarizes our findings. The table gives an overview of the hypotheses – derived from theoretical models – and our empirical results. Overall, we find empirical support for our main hypothesis that leverage has a negative effect on market share for Cournot firms, while leverage has no effect on market share for Bertrand firms. Our results are particularly strong for our measure of long-term debt, which accords well with the debt overhang channel that plays a central role in the model of Dasgupta and Titman (1998). The results for Cournot firms are also consistent with Faure-Grimaud's (2000) prediction that debt causes firms to compete less aggressively. Our analysis indicates that models of the strategic role of debt in firms' output market decisions provide us with important insights into their competitive behavior. Conversely, we support previous empirical research that suggests that product market competition affects a firm's capital structure. We still lack a full theoretical understanding of how these mechanisms work, and why and how they work differently under Cournot and Bertrand competition.

5.4 Robustness checks

We conduct various robustness checks. First, we introduce 2-digit SIC industry dummies into our regression models to explain leverage. The purpose is to capture the unobservable effects of industry characteristics on the capital structure choice of firms with common product lines. We obtain similar results. Second, our risk variable might suffer from measurement error, so we re-estimate all models without the *RISK* variable. Estimation results are virtually identical. Third, we drop *MARKUP* from the market share model because of its fairly high correlation with *HHI*, and we still arrive at similar conclusions. Fourth, as mentioned in section 4, we use *HHI* as the only instrument for *MKTSH* in Equation (2) that explains leverage, and we obtain almost the same results.

6. Conclusions

This study contributes to the limited empirical literature on the interaction between a firm's financing decisions and its competitive behavior and position in the output market. In contrast to most of the previous papers, we analyze the impact of capital structure on the position of individual firms in the output market, as measured by their market share. We test the implications of the models of Dasgupta and Titman's (1998) and Faure-Grimaud (2000) on the interaction between leverage and market share. Because these implications depend on the type of strategic competition, we empirically distinguish between Cournot and Bertrand firms using the competitive strategy measure of Sundaram, John, and John (1996).

Our paper focuses on testing hypotheses regarding the influence of leverage on market share, but we take into account possible feedback effects of a firm's competitive position on its capital structure choice by estimating a system of simultaneous equations in which capital structure and market share are jointly determined. We present evidence that under Cournot competition, levered firms tend to have a lower future market share. This finding is consistent with Dasgupta and Titman's (1998) argument that due to a higher discount rate for future profits debt causes firms to produce less, and with Faure-Grimaud's (2000) proposition that non-optimal debt contracting leads to restricted production. Conversely, we find that a higher market share induces Cournot firms to restrict their use of debt.

For Bertrand firms, we find a markedly different pattern of interactions. Market share has no significant impact on leverage, while a higher debt level induces substantially greater market shares for Bertrand firms in the next period. Theory provides us with little guidance about the expected interaction between leverage and market share under Bertrand competition. We hope that our empirical findings will encourage future theoretical work in this area.

Our paper highlights the importance of strategic aspects of capital structure choice. The use of debt influences the future competitive position of a firm. We emphasize that competitive behavior has an important impact on the interaction between a firm's market share and its leverage. Cournot and Bertrand firms are different in the way their financial structure affects their output market position and vice versa.

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Table 1: Summary statistics

This table presents summary statistics of the measures of leverage, market share, and their determinants across two samples of Cournot and Bertrand firms, period 1985-2004. *TDBV*: Total debt ratio in book value, defined as total debt (long-term debt plus debt in current liabilities) over total assets. *TDMV*: Total debt ratio in market value, defined as total debt over market value of total assets (which is total debt plus market value of equity plus preferred stock minus deferred taxes and investment credits). *LDBV*: Long-term debt ratio in book value, defined as long-term debt over total assets. *LDMV*: Long-term debt ratio in market value, defined as long-term debt over market value of total assets. *MKTSH*: Market share, defined as the firm's sales over industry sales. *NDTS*: Non-debt tax shield defined as the ratio of depreciation and investment tax credit to total assets. *TANG*: Tangibility, defined as the ratio of net fixed assets to total assets. *SIZE*: Firm size, defined as the natural logarithm of total assets. *RISK*: Business risk, defined as the standard deviation of the ratio of operating income before depreciation to total assets during the current year and 4 prior years. *MTB*: Market-to-book ratio, defined as market value of total assets over book value of total assets. *PROFIT*: Profitability, defined as the ratio of operating income before depreciation to total assets. *LIQUID*: Liquidity, defined as the ratio of cash and short-term investments to total assets. *R&D*: R&D expenditure scaled by sales. *SGA*: Selling, general and administration expenses scaled by sales. *ADVERT*: Advertisement expenses scaled by sales. *HHI*: Herfindahl-Hirschman Index, computed as the sum of the squared sales of all firms within the 4-digit SIC industry. *MARKUP*: Markup defined as the value of sales minus costs of good sold plus change in inventories over the value of sales plus change in inventories. *t* denotes the current year, and *t-1* denotes a one year lag.

	Cournot sample # obs. = 2504				Bertrand sample # obs. = 3513				Mean comparison (Cournot – Bertrand)	
	Mean	**Stdev**	**Min**	**Max**	**Mean**	**Stdev**	**Min**	**Max**	**difference**	***p*-value**
$LDBV_t$	0.136	0.157	0.000	0.968	0.153	0.176	0.000	0.963	-0.017	0.000
$LDBV_{t-1}$	0.138	0.156	0.000	0.899	0.148	0.170	0.000	0.939	-0.010	0.025
$TDBV_t$	0.191	0.185	0.000	0.994	0.200	0.196	0.000	0.993	-0.009	0.069
$TDBV_{t-1}$	0.190	0.179	0.000	0.969	0.193	0.189	0.000	1.000	-0.003	0.565
$LDMV_t$	0.161	0.210	0.000	0.957	0.143	0.187	0.000	0.986	0.018	0.001
$LDMV_{t-1}$	0.161	0.208	0.000	0.957	0.141	0.187	0.000	0.979	0.020	0.000
$TDMV_t$	0.224	0.252	0.000	0.996	0.187	0.218	0.000	0.993	0.037	0.000
$TDMV_{t-1}$	0.220	0.244	0.000	0.984	0.184	0.216	0.000	0.984	0.036	0.000
$MKTSH_t$	0.047	0.120	0.000	0.931	0.043	0.111	0.000	0.973	0.004	0.194
$MKTSH_{t-1}$	0.046	0.120	0.000	0.956	0.042	0.109	0.000	0.973	0.004	0.106
$NDTS_t$	0.054	0.046	0.004	1.270	0.051	0.036	0.000	0.453	0.003	0.052
$NDTS_{t-1}$	0.052	0.034	0.000	0.581	0.051	0.036	0.000	0.783	0.001	0.846
$TANG_t$	0.229	0.169	0.004	0.814	0.265	0.199	0.000	0.898	-0.036	0.000
$TANG_{t-1}$	0.233	0.168	0.004	0.809	0.270	0.199	0.000	0.917	-0.037	0.000
$SIZE_t$	4.895	2.202	0.276	10.654	5.374	2.295	0.027	12.087	-0.479	0.000
$SIZE_{t-1}$	4.861	2.176	0.368	10.654	5.283	2.278	-0.326	11.977	-0.422	0.000

Table 1, continued

	Cournot sample # obs. = 2504				Bertrand sample # obs. = 3513				Mean comparison (Cournot - Bertrand)	
	Mean	**Stdev**	**Min**	**Max**	**Mean**	**Stdev**	**Min**	**Max**	**difference**	***p*-value**
$RISK_t$	0.092	0.142	0.002	4.864	0.106	0.163	0.003	2.741	-0.014	0.000
$RISK_{t-1}$	0.094	0.161	0.004	5.592	0.114	0.200	0.003	4.264	-0.020	0.000
MTB_t	1.595	1.755	0.000	22.224	2.200	2.708	0.055	46.494	-0.605	0.000
MTB_{t-1}	1.603	1.744	0.009	26.736	2.306	3.067	0.058	46.191	-0.703	0.000
$PROFIT_t$	0.039	0.247	-4.369	0.569	0.022	0.275	-3.303	0.778	0.017	0.013
$PROFIT_{t-1}$	0.045	0.222	-1.872	0.569	0.025	0.268	-2.594	0.743	0.020	0.002
$LIQUID_t$	0.157	0.178	0.000	0.871	0.245	0.263	0.000	0.997	-0.088	0.000
$LIQUID_{t-1}$	0.160	0.184	0.000	0.871	0.242	0.263	0.000	0.993	-0.082	0.000
$R\&D_t$	0.090	0.233	0.000	5.533	0.577	2.306	0.000	45.213	-0.487	0.000
$R\&D_{t-1}$	0.164	2.179	0.000	84.453	0.710	3.396	0.000	76.900	-0.546	0.000
SGA_t	0.355	0.327	-0.038	4.487	0.284	0.300	0.000	2.784	0.071	0.000
SGA_{t-1}	0.344	0.290	-0.038	2.140	0.284	0.300	0.000	2.570	0.060	0.000
$ADVERT_t$	0.009	0.033	0.000	0.515	0.011	0.036	0.000	0.633	-0.002	0.051
$ADVERT_{t-1}$	0.009	0.034	0.000	0.531	0.011	0.037	0.000	0.582	-0.002	0.016
HHI_t	0.258	0.178	0.049	0.897	0.194	0.168	0.057	0.948	0.064	0.000
HHI_{t-1}	0.253	0.181	0.056	0.916	0.190	0.164	0.054	0.948	0.063	0.000
$MARKUP_t$	0.389	1.435	-4.947	68.197	-0.230	4.072	-80.715	31.623	0.619	0.000
$MARKUP_{t-1}$	0.366	0.718	-6.773	28.375	-0.091	2.771	-66.947	9.400	0.457	0.000

Table 2: A simultaneous-equations model for market share and leverage – Cournot sample

This table presents the estimation results of the following system of equations for the 2504 observations in our sample of Cournot firms:

$$MKTSH_{i,t} = \gamma_0 + \gamma_1 SIZE_{i,t-1} + \lambda_2 R\&D_{i,t-1} + \gamma_3 SGA_{i,t-1} + \gamma_4 ADV_{i,t-1} + \gamma_5 MTB_{i,t-1} + \gamma_6 HHI_{i,t-1} + \gamma_7 MARKUP_{i,t-1} + \gamma_8 LEV_{i,t-1} + \sum_{k=9}^{21} \gamma_k YEARDUM + u_{i,t}$$

$$LEV_{i,t} = \beta_0 + \beta_1 NDTS_{i,t-1} + \beta_2 TANG_{i,t-1} + \beta_3 SIZE_{i,t-1} + \beta_4 RISK_{i,t-1} + \beta_5 MTB_{i,t-1} + \beta_6 PROFIT_{i,t-1} + \beta_7 LIQUID_{i,t-1} + \beta_8 MKTSH_{i,t-1} + \sum_{k=9}^{21} \beta_k YEARDUM + \varepsilon_{i,t}$$

We estimate the system using two-stage least squares (2SLS). Variable definitions are included in table 1. We do not report intercept and year dummy coefficients to conserve space. We estimate each of the equations of each of the four leverage measures. The superscripts ^{a}, ^{b}, and ^{c} indicate statistical significance at the 1%, 5% and 10% level, respectively.

Panel A: Estimation results for the market share equation

Dependent variable: $MKTSH_t$	Coefficient	p-value		Coefficient	p-value		Coefficient	p-value		Coefficient	p-value
$SIZE_{t-1}$	**0.011**^{a}	0.000		**0.011**^{a}	0.000		**0.011**^{a}	0.000		**0.011**^{a}	0.000
$R\&D_{t-1}$	0.000	0.950		0.000	0.936		0.000	0.959		0.000	0.960
SGA_{t-1}	**0.012**^{c}	0.094		**0.012**^{c}	0.077		**0.012**^{c}	0.094		**0.012**^{c}	0.079
ADV_{t-1}	0.013	0.827		0.014	0.808		0.017	0.778		0.017	0.768
MTB_{t-1}	0.000	0.805		0.000	0.743		0.000	0.763		0.000	0.632
HHI_{t-1}	**0.044**^{a}	0.000		**0.045**^{a}	0.000		**0.044**^{a}	0.000		**0.045**^{a}	0.000
$MARKUP_{t-1}$	0.000	0.808		0.000	0.833		0.000	0.838		0.000	0.898
$LDBV_{t-1}$	**-0.016**^{c}	0.093	$TDBV_{t-1}$	**-0.022**^{a}	0.005	$LDMV_{t-1}$	-0.010	0.157	$TDMV_{t-1}$	**-0.016**^{b}	0.014
Within R^2	0.028			0.030			0.027			0.029	
Between R^2	0.393			0.379			0.397			0.394	
Overall R^2	0.368			0.360			0.372			0.371	

Panel B: Estimation results for the leverage equation

Dependent variable	$LDBV_t$		$TDBV_t$		$LDMV_t$		$TDMV_t$	
$NDTS_{t-1}$	0.029	0.767	0.191	0.791	-0.092	0.477	0.079	0.577
$TANG_{t-1}$	**0.076**^{b}	0.032	**0.125**^{a}	0.002	**0.079**^{c}	0.091	**0.164**^{a}	0.001
$SIZE_{t-1}$	**0.033**^{a}	0.000	**0.050**^{a}	0.000	**0.048**^{a}	0.000	**0.060**^{a}	0.000
$RISK_{t-1}$	0.027	0.470	**0.085**^{b}	0.045	-0.026	0.594	0.015	0.782
MTB_{t-1}	-0.002	0.196	-0.002	0.202	**-0.006**^{a}	0.004	**-0.008**^{a}	0.001
$PROFIT_{t-1}$	-0.014	0.422	**-0.042**^{b}	0.031	-0.028	0.210	**-0.051**^{b}	0.041
$LIQUID_{t-1}$	**-0.078**^{a}	0.000	**-0.164**^{a}	0.000	**-0.086**^{a}	0.002	**-0.175**^{a}	0.000
$MKTSH_{t-1}$	**-0.109**^{c}	0.052	**-0.112**^{c}	0.084	-0.074	0.319	-0.074	0.361
Within R^2	0.045		0.094		0.075		0.149	
Between R^2	0.255		0.155		0.260		0.190	
Overall R^2	0.233		0.153		0.227		0.180	

Table 3: A simultaneous-equations model for market share and leverage – Bertrand sample

This table presents the estimation results of the following system of equations for the 3513 observations in our sample of Bertrand firms:

$$MKTSH_{i,t} = \gamma_0 + \gamma_1 SIZE_{i,t-1} + \lambda_2 R\&D_{i,t-1} + \gamma_3 SGA_{i,t-1} + \gamma_4 ADV_{i,t-1} + \gamma_5 MTB_{i,t-1} + \gamma_6 HHI_{i,t-1} + \gamma_7 MARKUP_{i,t-1} + \gamma_8 LEV_{i,t-1} + \sum_{k=9}^{21} \gamma_k YEARDUM + u_{i,t}$$

$$LEV_{i,t} = \beta_0 + \beta_1 NDTS_{i,t-1} + \beta_2 TANG_{i,t-1} + \beta_3 SIZE_{i,t-1} + \beta_4 RISK_{i,t-1} + \beta_5 MTB_{i,t-1} + \beta_6 PROFIT_{i,t-1} + \beta_7 LIQUID_{i,t-1} + \beta_8 MKTSH_{i,t-1} + \sum_{k=9}^{21} \beta_k YEARDUM + \varepsilon_{i,t}$$

We estimate the system using two-stage least squares (2SLS). Variable definitions are included in table 1. We do not report intercept and year dummy coefficients to conserve space. We estimate each of the equations of each of the four leverage measures. The superscripts [a], [b], and [c] indicate statistical significance at the 1%, 5% and 10% level, respectively.

Panel A: Estimation results for the market share equation

Dependent variable: $MKTSH_t$	Coefficient	p-value		Coefficient	p-value		Coefficient	p-value		Coefficient	p-value
$SIZE_{t-1}$	**0.007**[a]	0.000		**0.007**[a]	0.000		**0.007**[a]	0.000		**0.008**[a]	0.000
$R\&D_{t-1}$	0.000	0.695		0.000	0.680		0.000	0.665		0.000	0.663
SGA_{t-1}	**0.010**[c]	0.067		**0.010**[c]	0.070		**0.010**[c]	0.067		**0.010**[c]	0.061
ADV_{t-1}	0.048	0.267		0.049	0.257		0.051	0.236		0.052	0.228
MTB_{t-1}	0.000	0.655		0.000	0.758		0.000	0.519		0.000	0.541
HHI_{t-1}	**0.030**[b]	0.011		**0.031**[a]	0.008		**0.028**[b]	0.015		**0.030**[a]	0.010
$MARKUP_{t-1}$	0.000	0.814		0.000	0.843		0.000	0.956		0.000	0.940
$LDBV_{t-1}$	**0.031**[a]	0.000	$TDBV_{t-1}$	**0.020**[a]	0.003	$LDMV_{t-1}$	**0.043**[a]	0.000	$TDMV_{t-1}$	**0.029**[a]	0.000
Within R^2	0.033			0.029			0.039			0.034	
Between R^2	0.210			0.211			0.217			0.225	
Overall R^2	0.189			0.189			0.188			0.196	

Panel B: Estimation results for the leverage equation

Dependent variable	$LDBV_t$		$TDBV_t$		$LDMV_t$		$TDMV_t$	
$NDTS_{t-1}$	0.022	0.833	0.028	0.804	-0.030	0.770	-0.137	0.247
$TANG_{t-1}$	**0.073**[b]	0.041	**0.116**[a]	0.002	0.039	0.258	**0.112**[a]	0.004
$SIZE_{t-1}$	**0.033**[a]	0.000	**0.037**[a]	0.000	**0.041**[a]	0.000	**0.045**[a]	0.000
$RISK_{t-1}$	**0.051**[b]	0.020	**0.043**[c]	0.067	0.025	0.245	0.019	0.428
MTB_{t-1}	**-0.002**[b]	0.017	**-0.004**[a]	0.001	**-0.002**[c]	0.082	**-0.003**[a]	0.002
$PROFIT_{t-1}$	0.022	0.137	-0.014	0.382	**-0.065**[a]	0.000	**-0.114**[a]	0.000
$LIQUID_{t-1}$	**-0.112**[a]	0.000	**-0.158**[a]	0.000	**-0.132**[a]	0.000	**-0.180**[a]	0.000
$MKTSH_{t-1}$	-0.019	0.684	-0.046	0.370	0.057	0.219	0.062	0.243
Within R^2	0.056		0.071		0.094		0.123	
Between R^2	0.108		0.093		0.159		0.160	
Overall R^2	0.080		0.084		0.118		0.124	

Table 4: Tests for equality of coefficients in the models for market share and leverage across Cournot and Bertrand firms

This table presents the results of tests of equality of the coefficients of key variables in our simultaneous-equations model of market share and leverage across the samples of Cournot and Bertrand firms. We carry out these tests by estimating the system of equations using the full sample of firms and including the interactions of dummy variables for *SS* (strategic substitutes, indicating Cournot competition) and *SC* (strategic complements, indicating Bertrand competition) with all the explanatory variables.

Panel A: Estimation results for the market share equation – Tests for the equality of coefficients across Cournot and Bertrand firms

Leverage measure:	$LDBV_{t-1}$		$TDBV_{t-1}$		$LDMV_{t-1}$		$TDMV_{t-1}$	
	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value
Cournot	-0.016	0.093	-0.022	0.005	-0.010	0.157	-0.016	0.014
Bertrand	0.031	0.000	0.020	0.003	0.043	0.000	0.029	0.000
Cournot – Bertrand	-0.047	0.163	-0.042	0.000	-0.053	0.000	-0.045	0.000
Test result	No rejection		Rejection		Rejection		Rejection	

Panel B: Estimation results for the leverage equation – Tests for the equality of coefficients across Cournot and Bertrand firms

Dependent variable:	$LDBV_{t-1}$		$TDBV_{t-1}$		$LDMV_{t-1}$		$TDMV_{t-1}$	
	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value
Cournot	-0.109	0.052	-0.112	0.084	-0.074	0.319	-0.074	0.361
Bertrand	-0.019	0.684	-0.046	0.370	0.057	0.219	0.062	0.243
Cournot – Bertrand	-0.090	0.239	-0.066	0.334	-0.131	0.121	-0.136	0.115
Test result	No rejection		No rejection		No rejection		No rejection	

Table 5: Summary of hypotheses and empirical evidence

This table summarizes the testable hypotheses for firms competing in Cournot and Bertrand, and the relevant empirical results with different proxies for leverage (long-term debt and total debt ratio's measured on the basis of book values and market values, see the definitions in Table 1).

	Cournot firms		Bertrand firms	
Impact of	Hypothesis	Empirical result	Hypothesis	Empirical result
Leverage on market share	–		0	
Leverage = LDBV		–		+
Leverage = LDMV		–		+
Leverage = TDBV		0		+
Leverage = TDMV		–		+
Market share on leverage	?		?	
Leverage = LDBV		–		0
Leverage = LDMV		–		0
Leverage = TDBV		0		0
Leverage = TDMV		0		0