International Review of Economics and Finance 29 (2014) 358–371

Contents lists available at ScienceDirect

International Review of Economics and Finance

journal homepage: www.elsevier.com/locate/iref

Capital structure and competitive position in product market

Hidetaka Mitani *

Faculty of Business Administration, Ritsumeikan University, 1-1-1 Nojihigashi, Kusatsu, Shiga 525-8577, Japan

ARTICLE INFO

Article history:
Received 27 January 2012
Received in revised form 25 June 2013
Accepted 25 June 2013
Available online 8 July 2013

JEL classification:
G32
L10
L60

Keywords:
Bertrand competition
Capital structure
Cournot competition
Market share

ABSTRACT

This paper examines the effect of capital structure on the competitive position of firms in the product market, as measured by the market share. Theoretical predictions suggest that this effect depends on whether Cournot or Bertrand competition determines firms' interactions. We present evidence that leverage affects market share positively under both types of competitions. This evidence supports the prevailing version of the limited liability effect of debt financing. Alternatively, we demonstrate that a firm's competitive position is important in determining its choice of capital structure.

1. Introduction

Capital structure theories customarily are developed in a single-firm framework and disregard competition intensity among firms in output markets. Theories implicitly assume that by choosing capital structure strategically, firms cannot enhance their competitive positions in output markets. In addition, output markets are assumed to offer an exogenous random return unaffected by firms' choices of capital structure. However, several studies such as Titman (1984), Brander and Lewis (1986), and Maksimovic (1988) examine the strategic choice of capital structure. These studies focus on the strategic role of debt, implying that debt financing shifts output strategies of a firm's rivals in a way that benefits the firm.[1] Using strategic debt characteristics, a firm can enhance its future competitive position in its industry. Alternatively, a debt equilibrium level is determined when benefits equal the agency costs associated with its increase.

Choice of capital structure can affect future competitive position in the manner that Brander and Lewis (1986) refer to as the limited liability effect of debt financing.[2] Because of this principle, managers (shareholders) need to only consider firms' returns during profitable periods, as creditors claim all assets in receivership. In other words, debt financing elevates managers' incentives to adopt riskier output strategies.[3] Hence, debt enhances competitive advantage by enabling firms to pre-commit to a more aggressive output strategy. This suggests that firms can influence their competitive position by strategically using debt. As a result, a firm's capital structure affects competitive interaction among firms in output markets.

* Tel.: +81 77 599 4170.
E-mail address: mitanih@fc.ritsumei.ac.jp.

[1] Fudenberg and Tirole (1984) define the strategic role of debt as the ratio change in a rival's profit to change in its own debt level as negative.

[2] The strategic bankruptcy effect also can drive strategies in output markets. Firms can choose products that enhance their chances of driving competitors toward insolvency, and the likelihood that a firm's financial distress depends on its capital structure.

[3] Brander and Lewis (1986) describe this point as follows: as debt levels change, the distribution of returns to shareholders over different states changes, in turn changing the output strategy that shareholders favor.

1059-0560/$ – see front matter
http://dx.doi.org/10.1016/j.iref.2013.06.009

Although the theoretical literature extensively analyzes the relationships among output strategy, competitive position, and capital structure, little empirical evidence confirms them. Among the empirical literature, Phillips (1995) and Kovenock and Philips (1997) investigate the relationship between intra-industry price variation and a firm's capital structure. Showalter (1995) theoretically demonstrates the conclusion in Brander and Lewis (1986) that firms' strategic incentive to increase debt depends both on the type of competitive interaction among firms in the output market and on the type of uncertainty the firm faces. Based on his earlier theoretical findings (Showalter, 1995), Showalter (1999) verifies the relationship between uncertainty in output markets and the strategic role of debt. MacKay and Phillips (2005) examine the relationship between a firm's capital structure and industry position, defined as the similarity of its capital–labor ratio to its industry's median capital–labor ratio.[4] Lyandres (2006) performs a broad cross-sectional analysis of the relationship between firms' capital structure and the extent of their competitive interaction (whether competition is Cournot or Bertrand).

These prior studies hypothesize that firms will choose a capital structure that enhances their advantage in the output market if debt financing presents a strategic advantage. Hence, these studies investigate relationship between capital structure and intra-industry price variation, uncertainty, industry concentration, and competitive interaction in output market. However, these analyses do not specifically reveal any strategic advantage offered by debt. This paper examines their unanswered question: How does the strategic advantage of debt manifest itself in output markets?

We examine market share as the variable that reflects the strategic advantage of debt because it is an important indicator of competitive position. A firm's objective in the output market is to improve its competitive position. If debt financing offers strategic value, it manifests itself in terms of the firm's improved competitive position. Few previous empirical studies define market share as the indicator of a firm's competitive position in its industry. For instance, Frésard (2010) empirically verifies whether cash holdings have a strategic advantage that improves the competitive position and defines a firm's market share as competitive position.

This paper assumes that a firm's capital structure influences its market share, and vice versa. This assumption originates in the Brander and Lewis (1986) that foresighted firms anticipate the consequences of their financial decisions on output markets; thus, output market conditions influence financial decisions. Our empirical strategy is to verify the relationship between capital structure and market share as an indicator of competitive position within the industry through simultaneous equations in which both variables are endogenous.

Theoretical literature predicts that the nature of competitive interaction among firms affects the relationship between capital structure and competitive position. "Nature of competitive interaction" refers to whether firms engage in Cournot (quantity) or Bertrand (price) competition. Cournot competition corresponds to strategic substitution: a firm complaisantly accommodates a competitor's strategic move. Bertrand competition corresponds to strategic complementarity: a firm escalates competition by matching a competitor's move. If a firm's output strategy is Cournot (substitutional), its reaction function slopes downward, while in the case of Bertrand (complementary), it slopes upward.

Based on this theoretical suggestion, we classify samples into Cournot or Bertrand competition and employ the Competitive Strategy Measure (*CSM*) to distinguish them. This verifies hypotheses regarding the relationship between capital structure and market share separately for Cournot and Bertrand firms. To this end, hypotheses to be verified are as follows.

Because of the principle of limited liability, increasing debt raises a firm's incentive to adopt a more aggressive strategy. Hence, higher debt induces a Cournot firm to produce more and a Bertrand firm to reduce prices. How these actions affect a firm's market share depends on how rivals react. In the Cournot framework, a rival reduces its output, because Cournot firms compete as strategic substitutes. As a result, the leveraged Cournot firm's market share increases and the rival's market share decreases. In the Bertrand framework, the rival is likely to reduce prices, because Bertrand firms compete as strategic complements. In this case, the market share effects on leveraged Bertrand firms become ambiguous because this hypothesis assumes that competitors simultaneously reduce prices. However, the overall impact on market share becomes clear if firms do not set prices simultaneously, i.e., one is a Stackelberg price leader and the other the follower. The Stackelberg leader's share increases by reducing prices ahead of rivals, because demand for its product increases.

We present testable hypothesis about what the effect of market share on a firm's leverage ratio. Due to the limited liability effect of debt financing, a firm's equity holders have an incentive to prefer riskier output strategies. However, when providing additional funds, debt holders accommodate this effect by requiring a risk premium that increases proportionately to the amount of debt. Evidently a firm's market share increases through leverage; however, there is a simultaneous increase in the agency costs of debt. Hence, lower market share firms seeking to expand their market share generally increase leverage because the strategic benefits from debt outweigh the associated agency costs. However, agency costs exceed the debt benefits with an increase in market share. Hence, the greater the firm's market share, the lower its leverage ratio.[5]

This paper presents evidence for the following findings. Under Cournot competition (strategic substitutes), leverage affects market share positively, implying that leveraged Cournot firms can boost their market share. Similarly under Bertrand competition (strategic complements), leverage significantly and affirmatively affects market share, implying that Bertrand firms can increase market share via debt financing. They have incentives to reduce prices ahead of rivals. Thus, Bertrand competition fits the Stackelberg model.

---

[4] Their empirical strategy is based upon the idea of a natural hedge presented in Maksimovic and Zechner (1991).

[5] Our hypothesis is based on Bolton and Scharfstein's (1990) suggestion that external financing incurs costs and benefits. As for costs, they suggest that debt makes the firm vulnerable in its product markets. We thank the referee for this suggestion.

Table 1
Descriptive statistics of adjusted *CSM* based on industrial classification.

Industry	Number of firms	Mean	Median	Min	Max	Stdev
Electric machinery	153	−0.211	−0.174	−0.941	−0.001	0.174
Nonferrous metals	56	−0.020	−0.009	−0.452	0.466	0.254
Foods	73	−0.120	−0.072	−0.941	0.934	0.324
Textiles and apparel	41	−0.080	−0.052	−0.583	0.490	0.212
Automotive	42	−0.034	−0.006	−0.482	0.350	0.211
Chemicals	109	−0.031	−0.032	−0.725	0.656	0.275
Oil and coal products	8	−0.196	−0.213	−0.579	0.203	0.307
Pharmaceuticals	36	−0.105	−0.101	−0.746	0.565	0.243
Pulp and paper	13	0.134	0.131	−0.526	0.540	0.294
Rubber and products	11	−0.078	−0.084	−0.882	0.403	0.348
Glass and ceramics	24	−0.002	−0.029	−0.490	0.670	0.277
Precision instruments	26	−0.002	−0.028	−0.512	0.485	0.257
Steel products	33	−0.105	−0.085	−0.580	0.330	0.257
Machinery	116	0.015	0.031	−0.483	0.633	0.262
Shipbuilding	4	−0.074	−0.160	−0.390	0.413	0.363
Other transport equipment	9	0.068	0.032	−0.218	0.406	0.211
Other manufacturing	45	−0.027	−0.006	−0.838	0.431	0.240

Table 1 presents the descriptive statistics of adjusted *CSM* on the basis of industrial classifications. The first two columns in Table 1 list the industries in our sample and number of firms in each, respectively. Columns 3–7 present summary statistics for the adjusted *CSM*.
When the adjusted *CSM* is less than zero, firms are assumed to be engaged in Cournot competition; however, if greater than zero, firms are assumed to be engaged in Bertrand competition.

Market share affects leverage significantly and negatively regardless of whether firms compete as substitutes or complements, implying that market share leaders restrict debt financing and restrain leverage to preserve competitive advantage if agency costs outweigh the benefits of increased debt. Therefore, leverage is in equilibrium when the strategic benefits of debt equal the agency costs associated with its increase.

Table 2
Descriptive statistics.

	Cournot sample			Bertrand sample			Mean comparison	
	Observations = 6400			Observations = 6208			[Cournot–Bertrand]	
	Mean	Median	Stdev.	Mean	Median	Stdev.	Difference	*p*-value
Leverage								
TDA	0.531	0.531	0.193	0.540	0.549	0.221	−0.009	0.008
TDM	0.417	0.402	0.199	0.413	0.404	0.193	0.004	0.283
Market share	2.026	0.660	4.534	2.408	0.541	5.108	−0.382	0.000
Liquidity	0.201	0.201	0.185	0.193	0.190	0.209	0.008	0.021
Specificity	0.177	0.147	0.127	0.167	0.139	0.113	0.010	0.000
Discretionary	0.020	0.008	0.028	0.019	0.007	0.028	0.001	0.012
Growth opportunity	1.493	1.319	0.789	1.550	1.315	1.093	−0.057	0.001
HHI	750.044	578.360	490.844	731.818	559.847	484.986	18.226	0.215
Tangibility	0.273	0.258	0.115	0.268	0.252	0.123	0.013	0.016
Size	11.198	11.037	1.223	11.173	10.994	1.343	0.025	0.267
Bankruptcy risk	1.634	1.632	0.548	1.583	1.619	2.284	0.051	0.090
Profitability	0.087	0.083	0.045	0.084	0.081	0.058	0.003	0.002
Adjusted *CSM*	−0.211	−0.174	0.174	0.208	0.176	0.162	−0.003	0.000

Table 2 presents descriptive statistics of the measures of leverage, market share, and control variables across two samples of Cournot and Bertrand firms used in the empirical analysis.
TDA: The ratio of total debt (long-term plus short-term debt) to book value of assets. *TDM*: The ratio of total debt to market value of assets. *Market share*: Market share is defined as the annual sales divided by the industry's total sales.
Liquidity: Liquidity is defined as working capital (current assets minus current liabilities) divided by book value of assets. *Specificity*: Specificity is defined as selling, general, and administrative expenses divided by book value of assets. *Discretionary*: Discretionary is defined as R&D expenditure plus advertising expenses divided by book value of assets. *Growth opportunity*: Growth opportunity is defined as book value of assets minus book equity plus market value of equity divided by book value of assets. *HHI*: Herfindahl–Hirshman Index is calculated by expressing each firm's market share within the industry as a percentage, followed by squaring and summing these percentages. *Tangibility*: Tangibility is defined as net property, plant, and equipment divided by book value of assets. *Size*: Size is defined as the natural logarithm of sales. *Bankruptcy risk*: Firm's bankruptcy risk is defined as the unleveraged Z-score, which is based on the Altman's (1968) Z-score. The unleveraged Z-score is the Z-score without the component of leverage ratio. The unleveraged Z-score is used to avoid the possible endogeneity problem when estimating the leverage ratio. *Profitability*: Profitability is defined as earnings before interest, taxes, and depreciation divided by book value of assets. Adjusted *CSM* (Competitive Strategy Measure): adjusted *CSM* is the proxy for the degree of competitive interaction among firms. This measure was developed by Lyandres (2006). Lyandres's (2006) competitive strategy measure is the correlation between the ratio of the implied change in the firm's profit between two consecutive years and the implied change in its sales between two consecutive years, and the change in the firm's product market rivals' combined sales between two consecutive years.

Our evidence supports the prevailing notion of the limited liability effect of debt financing. In addition, we represent that a firm's competitive position significantly influences its choice of capital structure. The rest of this paper is organized as follows. Section 2 describes our data, variable definitions, sample characteristics, and empirical methodology. Section 3 presents the results of empirical tests. Section 4 concludes.

2. Data, variables, and empirical methods

We sample 799 manufacturing firms listed in the first section of the Tokyo Stock Exchange (TSE) from 1989 to 2004.[6] Firms' financial data are from Nikkei-NEEDS Financial Quest. Stock price data are electronically obtained and made available by Toyo Keizai Inc. We classify the sample into 17 industries on the basis of 36 Nikkei industrial classifications. Alternatively, we define the set of competitors as all firms in the industry as defined by the 36 Nikkei industrial classifications. The number of firm-years is 12,784 for the full sample.

To distinguish Cournot and Bertrand competition we use *CSM* as developed in Sundaram, John, and John (1996) and expanded in Lyandres (2006). *CSM* is the correlation between the ratio of change in a firm's profit and the change in its sales, and the change in rival firms' combined sales: $corr\left[\frac{\Delta\pi_f}{\Delta S_f}, \Delta S_c\right]$, where $\Delta\pi_f$ is the change in a firm's profit between two consecutive years, ΔS_f is its change in sales, and ΔS_c is the change in the combined sales of its rivals. Given this construction, negative *CSM* values correspond to Cournot competition, while positive values correspond to Bertrand competition.

In theory, whether firms conduct Cournot or Bertrand competition is determined by the sign of the cross-partial derivative of a firm's profit with respect to its output and the competitor's output. Specifically, when $\frac{\partial^2\pi_f}{\partial q_f \partial q_c}$, where π_f is the firm's profit, and q_f and q_c denote the outputs of a firm and its competitor is less than zero, it defines Cournot competition, and when it exceeds zero, it defines Bertrand competition (see Bulow, Geanakoplos, & Klemperer, 1985). Sundaram et al. (1996) first noticed that *CSM* is considered as a direct proxy of this second derivative.

Although we use the adjusted *CSM* elaborated by Lyandres (2006) based on the *CSM* by Sundaram et al. (1996), there is actually no difference in interpretation between these measures. Therefore, when adjusted *CSM* is less than zero, firms are assumed to be engaged in Cournot competition; however, if greater than zero, firms are assumed to be engaged in Bertrand competition. We classify samples into Cournot or Bertrand firms using this measure. Our sample includes 6400 Cournot and 6208 Bertrand firms.

Table 1 presents the descriptive statistics of adjusted *CSM* on the basis of industrial classifications. The first two columns in Table 1 list the industries in our sample and number of firms in each, respectively. Columns 3–7 present summary statistics for the adjusted *CSM*. Mean and median values are negative, except for Pulp and paper, Machinery, and Other transport equipment.

2.1. Measures of leverage and market share

We define leverage ratio and market share as dependent variables and apply four alternative measures of leverage as dependent variables. The first and broadest definition of leverage is the ratio of total debt (long-term plus short-term debt) to book value of assets, denoted *TDA*. Following previous empirical literature, we use market-valued leverage defined as the ratio of total debt to market value of assets, where market value of assets is defined as book value of assets minus book equity plus market value of equity, denoted as *TDM*. The market value of equity is defined as the closing stock price at fiscal year-end multiplied by outstanding shares. We define the firm's market share as the annual sales divided by the industry's total sales, denoted as *Market share*. Table 2 presents descriptive statistics of the variables and the summary statistics of the book and market leverage ratios.

2.2. Determinants of market share

We hypothesize that a firm's market share depends on six variables: *Liquidity*, *Specificity*, *Discretionary*, *Growth opportunity*, the *Herfindahl–Hirschman Index* (HHI), and *Leverage*.

2.2.1. Liquidity

Financial constraints affect a firm's output strategy versus competitors. Bolton and Scharfstein (1990) show that cash-rich firms have an incentive to adopt more aggressive output strategies, driving cash-poor competitors out of business by reducing their rivals' cash flow. In sum, a cash-rich firm may make greater investments in various projects and acquire a more competitive market position.[7] Thus, greater liquidity is expected to correspond to greater market share. Liquidity is defined as working capital (current assets minus current liabilities) divided by book value of assets.

2.2.2. Specificity

Firms that conduct extensive sales promotions are expected to expand market share in the near future. Specificity is defined as selling, general, and administrative expenses divided by book value of assets.

[6] Following the procedure in the literature on capital structure, we exclude non-manufacturers, financial firms, and regulated utilities from the sample.

[7] Kuan, Li, and Liu (2012) use a sample of Taiwanese publicly listed companies from 1997 to 2009. They also suggest that firms accumulate cash to meet their unanticipated contingencies and to finance their investments if the costs of other funding sources are prohibitively high.

Table 3
A simultaneous-equations model for market share and leverage – Cournot sample.

Panel A: Estimation results for the market share equation

Dependent variable: *Market share*

	Predicted sign		Coefficient	*p*-value		Coefficient	*p*-value
Intercept			−0.144	0.000		−0.041	0.000
Liquidity	+		0.124	0.000		0.026	0.000
Specificity	+		−0.053	0.000		−0.046	0.000
Discretionary	+		0.241	0.000		0.221	0.000
Growth opportunity	+		0.006	0.000		0.013	0.000
HHI	+		−0.000	0.285		−0.000	0.181
Leverage	+	*TDA*	0.202	0.000	*TDM*	0.092	0.000
Observations			5522			5522	

Tests of endogeneity of: *Leverage*

TDA			
Wu–Hausman F Test:	500.413	F (1, 5484)	*p*-value = 0.000
Durbin-Wu–Hausman chi^2 test:	461.746	chi-sq (1)	*p*-value = 0.000
TDM			
Wu–Hausman F test:	96.438	F (1, 5484)	*p*-value = 0.0000
Durbin-Wu–Hausman chi^2 test:	96.428	chi-sq (1)	*p*-value = 0.0000

Weak identification test:

Minimum eigenvalue statistic:	292.985	229.223
Critical value for 2SLS relative bias:	16.85 (*p*-value = 0.05)	16.85 (*p*-value = 0.05)
2SLS size of nominal 5% Wald test:	24.58 (*p*-value = 0.10)	24.58 (*p*-value = 0.10)
LIML size of nominal 5% Wald test:	5.44 (*p*-value = 0.10)	5.44 (*p*-value = 0.10)

Panel A presents the two-stage least squares for estimation results for the market share equation in Cournot sample. The latter portion of Panel A in Table 3 tests whether *Leverage* should be treated exogenously using the Durbin and Wu–Hausman tests. We verify the test of weak instruments using the Cragg and Donald (1993) minimum eigenvalue statistic.
Both critical value of "2SLS size of nominal 5% Wald test" and "LIML size of nominal 5% Wald test" show that the hypothesis tests of parameters estimated by instrumental-variable estimators may suffer from severe size distortions. This hypothesis test of parameters presents a set of instruments to be weak if a Wald test at the 5% level can have an actual rejection rate of no more than 10%. For example, in the case of using *Leverage* as *TDA*, the 2SLS estimator shows that the null hypothesis of weak instruments can be rejected because 292.985 > 24.58. Furthermore, LIML estimator also presents that the null hypothesis can be rejected because 292.985 > 5.44.

Panel B: Estimation results for the *leverage* equation

Dependent variable: *Leverage*		*TDA*		*TDM*	
	Predicted sign	Coefficient	*p*-value	Coefficient	*p*-value
Intercept		−0.353	0.001	0.149	0.086
Tangibility	+	−0.053	0.051	0.091	0.000
Size	+	0.122	0.000	0.057	0.000
Bankruptcy risk	−	−0.225	0.000	−0.160	0.000
Growth opportunity	−	0.007	0.100	−0.070	0.000
Profitability	±	−0.078	0.396	−0.774	0.000
Market share	±	−0.041	0.000	−0.019	0.000
Observations		5521		5521	

Tests of endogeneity of: *Market share*

Dependent variable: *TDA*			
Wu–Hausman F test:	15.534	F (1, 5484)	*p*-value = 0.0001
Durbin-Wu–Hausman chi^2 test:	15.595	chi-sq (1)	*p*-value = 0.0001
Dependent variable: *TDM*			
Wu–Hausman F test:	85.619	F (1, 5484)	*p*-value = 0.0000
Durbin-Wu–Hausman chi^2 test:	84.879	chi-sq (1)	*p*-value = 0.0000

Weak identification test:

Minimum eigenvalue statistic:	40.4626	40.4626
Critical value for 2SLS relative bias:	16.85 (*p*-value = 0.05)	16.85 (*p*-value = 0.05)
2SLS size of nominal 5% Wald test:	24.58 (*p*-value = 0.10)	24.58 (*p*-value = 0.10)
LIML size of nominal 5% Wald test:	5.44 (*p*-value = 0.10)	5.44 (*p*-value = 0.10)

Panel B presents the two-stage least squares for estimation results for the leverage equation in Cournot sample. The latter portion of Panel B in Table 3 tests whether *Market share* should be treated exogenously using the Durbin and Wu–Hausman tests. We verify the test of weak instruments using the Cragg and Donald (1993) minimum eigenvalue statistic.

Both critical value of "2SLS size of nominal 5% Wald test" and "LIML size of nominal 5% Wald test" show that the hypothesis tests of parameters estimated by instrumental-variable estimators may suffer from severe size distortions. For example, in the case of using dependent variable as *TDA*, the 2SLS estimator shows that the null hypothesis of weak instruments can be rejected because 40.4626 > 24.58. Furthermore, LIML estimator also presents that the null hypothesis can be rejected because 40.4626 > 5.44.

Table 4
A simultaneous-equations model for *market share* and *leverage* – Bertrand sample.

Panel A: Estimation results for the market share equation

Dependent variable: *Market share*

	Predicted sign		Coefficient	*p*-value		Coefficient	*p*-value
Intercept			−0.111	0.000		−0.071	0.000
Liquidity	+		0.127	0.000		0.058	0.000
Specificity	+		−0.023	0.002		−0.014	0.056
Discretionary	+		0.203	0.000		0.286	0.000
Growth opportunity	+		−0.001	0.340		0.011	0.000
HHI	+		0.000	0.843		0.000	0.445
Leverage	+	*TDA*	0.154	0.000	*TDM*	0.142	0.000
Observations			5265			5265	

Tests of endogeneity of: *Leverage*

TDA			
Wu–Hausman F test:	198.856	F (1, 5227)	*p*-value = 0.0000
Durbin-Wu–Hausman chi^2 test:	192.856	chi-sq (1)	*p*-value = 0.0000
TDM			
Wu–Hausman F test:	198.568	F (1, 5227)	*p*-value = 0.0000
Durbin-Wu–Hausman chi^2 test:	192.691	chi-sq (1)	*p*-value = 0.0000

Weak identification test:

Minimum eigenvalue statistic:	183.878	194.324
Critical value for 2SLS relative bias:	16.85 (*p*-value = 0.05)	16.85 (*p*-value = 0.05)
2SLS size of nominal 5% Wald test:	24.58 (*p*-value = 0.10)	24.58 (*p*-value = 0.10)
LIML size of nominal 5% Wald test:	5.44 (*p*-value = 0.10)	5.44 (*p*-value = 0.10)

Panel A presents the two-stage least squares for estimation results for the *market share* equation in Bertrand sample. The latter portion of Panel A in Table 4 tests whether *Leverage* should be treated exogenously using the Durbin and Wu–Hausman tests. We verify the test of weak instruments using the Cragg and Donald (1993) minimum eigenvalue statistic.
Both critical value of “2SLS size of nominal 5% Wald test”and “LIML size of nominal 5% Wald test” show that the hypothesis tests of parameters estimated by instrumental-variable estimators may suffer from severe size distortions. For example, in the case of using *Leverage* as *TDA*, the 2SLS estimator shows that the null hypothesis of weak instruments can be rejected because 183.878 > 24.58. Furthermore, LIML estimator also presents that the null hypothesis can be rejected because 183.878 > 5.44.

Panel B: Estimation results for the leverage equation

Dependent variable: *Leverage*		*TDA*		*TDM*	
	Predicted sign	Coefficient	p-value	Coefficient	p-value
Intercept		−5.250	0.000	−2.279	0.000
Tangibility	+	1.133	0.000	0.687	0.000
Size	+	0.520	0.000	0.245	0.000
Bankruptcy risk	−	−0.003	0.617	−0.004	0.205
Growth opportunity	−	0.083	0.000	−0.327	0.000
Profitability	±	−1.618	0.000	−1.367	0.000
Market share	±	−0.233	0.000	−0.106	0.000
Observations		5265		5265	

Tests of endogeneity of: *Market share*

Dependent variable: *TDA*			
Wu–Hausman F test:	466.026	F (1, 5228)	p-value = 0.0000
Durbin-Wu–Hausman chi^2 test:	430.913	chi-sq (1)	p-value = 0.0000
Dependent variable: *TDM*			
Wu–Hausman F test:	165.759	F (1, 5228)	p-value = 0.0000
Durbin-Wu–Hausman chi^2 test:	161.802	chi-sq (1)	p-value = 0.0000

Weak identification test:

Minimum eigenvalue statistic:	9.72852	9.72852
Critical value for 2SLS relative bias:	6.71 (p-value = 0.20)	6.71 (p-value = 0.20)
2SLS size of nominal 5% Wald test:	8.31 (p-value = 0.25)	8.31 (p-value = 0.25)
LIML size of nominal 5% Wald test:	5.44 (p-value = 0.10)	5.44 (p-value = 0.10)

Panel B presents the two-stage least squares for estimation results for the leverage equation in Bertrand sample. The latter portion of Panel B in Table 4 tests whether *Market share* should be treated exogenously using the Durbin and Wu–Hausman tests. We verify the test of weak instruments using the Cragg and Donald (1993) minimum eigenvalue statistic.
Both critical value of size of "2SLS size of nominal 5% Wald test" and "LIML size of nominal 5% Wald test" show that the hypothesis tests of parameters estimated by instrumental-variable estimators may suffer from severe size distortions. In this analysis, it is not until the rejection rate exceeds 20% that the test statistic of 9.72852 exceeds the critical value. Thus, we cannot reject the null hypothesis of weak instruments. However, we use the LIML estimator, we can reject the null hypothesis because 9.72852 > 5.44.

Table 5
3SLS estimates of market share and leverage – Cournot sample.

Panel A: Estimation results for the market share equation

Dependent variable: *Market share*

	Predicted sign		Coefficient	*p*-value		Coefficient	*p*-value
Intercept			−0.156	0.000		−0.033	0.000
Liquidity	+		0.137	0.000		0.022	0.000
Specificity	+		−0.054	0.000		−0.047	0.000
Discretionary	+		0.255	0.000		0.218	0.000
Growth opportunity	+		0.006	0.000		0.010	0.000
HHI	+		−0.000	0.272		−0.000	0.170
Leverage	+	*TDA*	0.219	0.000	*TDM*	0.085	0.000
Observations			5522			5522	

Panel B: Estimation results for the leverage equation

Dependent variable: *Leverage*		*TDA*		*TDM*	
	Predicted sign	Coefficient	*p*-value	Coefficient	*p*-value
Intercept		−0.200	0.011	0.164	0.011
Tangibility	+	−0.050	0.041	0.128	0.000
Size	+	0.108	0.000	0.051	0.000
Bankruptcy risk	−	−0.220	0.000	−0.149	0.000
Growth opportunity	−	0.005	0.170	−0.060	0.000
Profitability	±	−0.072	0.380	−0.843	0.000
Market share	±	−0.035	0.000	−0.016	0.000
Observations		5522		5522	

Panel A presents the estimation results for the market share equation. Panel B presents the estimation results for the leverage equation. We use three-stage least squares (3SLS) for estimation of market share and leverage.

Table 6
3SLS estimates of market share and leverage – Bertrand sample.

Panel A: Estimation results for the *market share* equation

Dependent variable: *Market share*

	Predicted sign		Coefficient	p-value		Coefficient	p-value
Intercept			−0.102	0.000		−0.110	0.000
Liquidity	+		0.135	0.000		0.097	0.000
Specificity	+		−0.017	0.005		−0.014	0.000
Discretionary	+		0.158	0.000		0.353	0.000
Growth opportunity	+		−0.000	0.649		0.016	0.000
HHI	+		−0.000	0.449		0.000	0.700
Leverage	+	*TDA*	0.142	0.000	*TDM*	0.212	0.000
Observations			5265			5265	

Panel B: Estimation results for the leverage equation

Dependent variable: *Leverage*		*TDA*		*TDM*	
	Predicted sign	Coefficient	*p*-value	Coefficient	*p*-value
Intercept		−3.389	0.000	−0.966	0.000
Tangibility	+	0.521	0.000	0.506	0.000
Size	+	0.373	0.000	0.130	0.000
Bankruptcy risk	−	0.004	0.350	−0.001	0.625
Growth opportunity	−	0.058	0.000	−0.047	0.000
Pro.tability	±	−2.177	0.000	−1.467	0.000
Market share	±	−0.226	0.000	−0.060	0.000
Observations	5265	5265			

Panel A presents the estimation results for the market share equation. Panel B presents the estimation results for the leverage equation. We use three-stage least squares (3SLS) for estimation of market share and leverage.

2.2.3. Discretionary

Firms that invest more in R&D and advertising are expected to out-perform rivals and compete more aggressively. Discretionary is defined as R&D expenditure plus advertising expenses divided by book value of assets.

2.2.4. Growth opportunity

Firms with higher growth opportunities are expected to improve their competitive position and increase their market shares in the near future. We expect that the higher the growth opportunity, the higher will be the market share. Growth opportunity is defined as book value of assets minus book equity plus market value of equity divided by book value of assets.

2.2.5. HHI

Davies and Geroski (1997) present a positive relationship between industry concentration and a firm's market share. Firms in concentrated industries face less competition because they are likely to have more opportunities to expand their market shares. To measure industry concentration, we use HHI, the predominant measure of industry structure that is calculated by expressing each firm's market share within the industry as a percentage, followed by squaring and summing these percentages. HHI is measured by year and industry (36 Nikkei industrial classifications).

2.2.6. Leverage

Because of a limited liability effect, increasing debt raises a firm's incentive to adopt a more aggressive strategy. Hence, higher debt induces a Cournot firm to produce more and a Bertrand firm to reduce prices ahead of rivals. Consequently, market share of leveraged Cournot and Bertrand firms increases while their rival's market share decreases.

2.3. Determinants of leverage ratio

This subsection provides the set of explanatory variables that, according to existing literature, are considered to affect a firm's leverage ratio. Based on Titman and Wessels (1988), Harris and Raviv (1991), Rajan and Zingales (1995), and Hovakimian, Opler, and Titman (2001), we select six variables: *Tangibility*, *Size*, *Bankruptcy risk*, *Growth opportunity*, *Profitability*, and *Market share*.

2.3.1. Tangibility

Firms with proportionally higher collateral values generally have higher leverage ratios. The leverage ratio is expected to increase with an increase in the value of tangibility. Tangibility is defined as net property, plant, and equipment divided by book value of assets.

2.3.2. Size

Larger firms are expected to have higher leverage ratios because they are more diversified and face lower bankruptcy risk. In addition, fixed direct bankruptcy costs constitute a smaller portion of firm value for larger firms, leading to relatively lower leverage costs. Leverage ratio is expected to increase directly with Size measured as the natural logarithm of sales.

2.3.3. Bankruptcy risk

Firms with lower bankruptcy risk generally maintain lower leverage ratios to maintain financial flexibility. Financial flexibility represents the firm's ability to access and restructure its finances with low transaction costs. Firms with low bankruptcy risk do not need to borrow since they are financially sound. A positive relationship is expected between Bankruptcy risk and the leverage ratio. We define *Bankruptcy risk* as the unleveraged Z-score. Based on Altman's (1968) Z-score, unleveraged Z-score is the Z-score without the component of leverage ratio. A higher unleveraged Z-score indicates lower bankruptcy risk. An inverse relationship is expected between the unleveraged Z-score and the leverage ratio.

2.3.4. Growth opportunity

Firms with higher growth opportunities generally have lower leverage ratios. It is argued that these firms choose lower leverage ratios to retain investment flexibility. An inverse relationship is expected between the value of Growth opportunity and the leverage ratio.

2.3.5. Profitability

According to the pecking order hypothesis, there should be a negative relationship between profitability and the leverage ratio; however, according to the trade-off theory, there should be a positive relationship. Therefore, profitability is expected to have both positive and negative effects on leverage ratio. Profitability is defined as earnings before interest, taxes, and depreciation divided by book value of assets.

2.3.6. Market share

The limited liability effect of debt financing increases equity holders' incentive to choose a riskier output strategy. As a result, firms can increase their share in product markets. When providing additional funds, however, if debt holders consider this effect, they claim a higher risk premium that increases in proportion to the amount of debt. Agency costs associated with increased debt in higher market share firms should outweigh the strategic benefits of debt. Therefore, an inverse relationship is expected between Market share and leverage ratio.

2.4. Empirical methodology

We assume that a firm's capital structure influences its market share and that competition intensity among firms influences its capital structure. We verify the relationship between capital structure and market share through simultaneous equations in which both variables are endogenous. The tested regressions are as follows:

$$\begin{aligned} Market\ share_{i,t} = \beta_0 + \beta_1 Liquidity_{i,t-1} + \beta_2 Specificity_{i,t-1} \\ + \beta_3 Discretionary_{i,t-1} + \beta_4 Growth\ opportunity_{i,t-1} \\ + \beta_5 HHI_{i,t-1} + \beta_6 Leverage_{i,t-1} + \mu_{i,t}, \end{aligned} \quad (1)$$

$$\begin{aligned} Leverage_{i,t} = \gamma_0 + \gamma_1 Tangibility_{i,t-1} + \gamma_2 Size_{i,t-1} \\ + \gamma_3 Bankruptcy\ risk_{i,t-1} + \gamma_4 Growth\ opportunity_{i,t-1} \\ + \gamma_5 Profitability_{i,t-1} + \gamma_6 Market\ share_{i,t-1} + \epsilon_i, t, \end{aligned} \quad (2)$$

where i and t are firm and time subscripts, respectively, and *Leverage* is the measure of leverage, which can be one of our two proxies: *TDA*, *TDM*. We estimate Eqs. (1) and (2) using two-stage least squares. We add industry and year dummies to assess industry-specific and time-specific effects.

Instrumental variables for $Leverage_{i,t-1}$ in Eq. (1) are $Tangibility_{i,t-2}$, $Size_{i,t-2}$, $Bankruptcy\ risk_{i,t-2}$, and $Profitability_{i,t-2}$. Instrumental variables for $Market\ share_{i,t-1}$ in Eq. (2) are $Liquidity_{i,t-2}$, $Specificity_{i,t-2}$, $Discretionary_{i,t-2}$, and $HHI_{i,t-2}$.

In the first-stage regression for $Leverage_{i,t-1}$, coefficients for all instruments in the Cournot sample are significant at 1% level. In the Bertrand sample, however, coefficients of $Tangibility_{i,t-2}$ and $Bankruptcy\ risk_{i,t-2}$ are not statistically significant when *TDM* defines leverage, but otherwise coefficients of all instruments are significant at 1% level. Alternatively, in the first-stage regression for $Market\ share_{i,t-1}$, coefficients of all instruments in the Cournot sample are significant at 5% level. In the Bertrand sample, coefficients of $Specificity_{i,t-2}$ and $Discretionary_{i,t-2}$ are not statistically significant, but otherwise coefficients of all instruments are significant at 1% level.[8]

3. Empirical results

Table 3 presents the results of the regression analysis of Eqs. (1) and (2) for the Cournot sample. Panel A in Table 3 presents the results of the market share model in Eq. (1). Under Cournot competition, leverage affects market share significantly and positively. This result shows that leveraged Cournot firms can boost their market shares. Consequently, we confirm that debt financing strategically benefits Cournot firms. Most other control variables support the underlying theories. Coefficients of *Liquidity*, *Discretionary*, and *Growth opportunity* show significantly positive influence on Market share. However, HHI shows no significant impact or a tiny negative impact on *Market share*. Alternatively, *Specificity* has a significantly negative effect on *Market share*. These results are inconsistent with each hypothesis.

The latter portion of Panel A in Table 3 tests whether *Leverage* should be treated exogenously using the Durbin and Wu–Hausman tests. The null hypothesis of the Durbin and Wu–Hausman tests is that the examined variable is exogenous. Both test statistics are highly significant; therefore, we reject the null hypothesis and treat *Leverage* as endogenous. We verify the test of weak instruments using the Cragg and Donald (1993) minimum eigenvalue statistic and find that it exceeds Stock and Yogo's (2005) critical values. Therefore, we conclude that our instrumental variables are not weak.[9]

Panel B in Table 3 presents the estimation results of Eq. (2). *Market share* of Cournot firms significantly and negatively affects the leverage ratio. This result implies that Cournot firms enjoying a high market share limit debt financing, perhaps to prevent forfeiting their market share if agency costs outweigh the strategic benefits of increased debt. Several other determinants of leverage show significant coefficients. Signs of most variables coincide with the capital structure hypotheses. *Tangibility* affects the leverage ratio significantly and positively except when *TDA* defines leverage. *Size* and *Bankruptcy risk* consistently present significant coefficients with the signs predicted by the capital structure hypotheses. *Growth opportunity* affects the leverage ratio significantly and negatively except when *TDA* defines leverage. *Profitability* correlates negatively with *Leverage*. This result is consistent with the theoretical prediction of the pecking order theory. The latter portion of Panel B in Table 3 tests whether *Market share* is exogenous, thereby rejecting the null of exogeneity. We verify the test of weak instruments and conclude that our instrumental variables are not weak.

Table 4 shows results from the Bertrand sample. Panel A presents results of the market share model in Eq. (1). Under Bertrand competition, *Leverage* influences *Market share* significantly and positively. This result supports the hypothesis that Bertrand firms can expand market share using the strategic characteristics of debt and have incentives to reduce prices ahead of rivals. These findings alternatively imply that Bertrand competition fits the Stackelberg model. Most other determinants of market share support the underlying theories. Coefficients of *Liquidity*, *Discretionary*, and *Growth opportunity* affect *Market share* significantly

[8] First-stage regression results are omitted in tables. They are available upon request.

[9] For example, when *Leverage* is defined as *TDA*, the minimum eigenvalue statistic is 292.985, exceeding Stock and Yogo's critical value of 16.85 at the rejection rate of a nominal 5%. Therefore, we reject the null hypothesis of weak instruments at the 5% level.

and positively. HHI has no significant effect on *Market share*; however, *Specificity* affects it significantly and negatively. The latter portion of Panel A in Table 4 indicates that *Leverage* must be treated as endogenous. We verify the test of weak instruments and conclude that our instrumental variables are not weak.

Panel B in Table 4 presents the estimation results of Eq. (2). *Market share* of Bertrand firms affects leverage ratio significantly and negatively. These results imply that Bertrand firms enjoying a high market share restrain debt financing, perhaps to preserve share in the output market if agency costs outweigh the strategic benefits of increased debt. Several other determinants of leverage have significant coefficients. The signs of most variables are in line with the capital structure hypotheses. *Tangibility* and *Size* consistently present significant coefficients with signs predicted by the capital structure hypotheses. *Profitability* correlates negatively with *Leverage*. This result is consistent with theoretical predictions of the pecking order theory.

The latter portion of Panel B in Table 4 tests whether *Market share* should be treated as exogenous. Results indicate that it should be treated as endogenous. Next we verify that the null hypothesis of weak instruments cannot be rejected because the minimum eigenvalue statistic (9.72852) exceeds the critical value of 6.71 at the rejection rate of a nominal 20%. However, if we use the limited information maximum likelihood (LIML) estimator instead, the null hypothesis can be rejected at 10% level.

To test the robustness of our results, we analyze Eqs. (1) and (2) using three-stage least squares (3SLS),[10] the results of which are shown in Panels A and B in Table 5 and Table 6 and generally coincide with the results in Tables 3 and 4. That is, under both Cournot and Bertrand competition, firms can increase their market shares using debt. Moreover, *Market share* affects *Leverage* significantly and negatively regardless of the competitive mode. Therefore, leverage is in equilibrium when the strategic benefits of debt equal the agency costs associated with its increase.

4. Conclusion

This paper examined the effect of capital structure on the competitive position of firms in the product market as measured by market share. Alternatively, we assumed that a firm's capital structure influences its market share, and vice versa. We verified the relationship between capital structure and market share through simultaneous equations in which both variables are endogenous.

Theoretical predictions suggested that the interaction between capital structure and market share depended on whether Cournot or Bertrand competition presided in the output market. Therefore, we classified our sample into Cournot or Bertrand competition on the basis of empirical measures of strategic substitutes and strategic complements.

We presented evidence that leverage affects market share positively under both Cournot (strategic substitutes) and Bertrand competition (strategic complements). This evidence supports the prevailing notion of the limited-liability effect of debt financing. Alternatively, market share affects leverage significantly and negatively regardless of whether firms compete as substitutes or complements. This result implies that firms enjoying a high market share restrict debt financing, perhaps to maintain their competitive advantage in case agency costs outweigh the strategic benefits associated with the increase in debt. Our evidence suggested that a firm's capital structure influences its market share, and vice versa. We determined that leverage is in equilibrium when the strategic benefits of debt equal the agency costs associated with its increase.

Acknowledgment

The author would like to thank the anonymous referee and the editor of this journal, Hamid Beladi, for their valuable comments. This research was partially supported by the Ministry of Education, Science and Culture, Grant-in-aid for Research Activity Start-up, 22830115, 2011.

References

Altman, E. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *Journal of Finance*, *23*, 589–609.
Bolton, P., & Scharfstein, D. (1990). A theory of predation based on agency problems in financial contracting. *American Economic Review*, *80*, 93–106.
Brander, J., & Lewis, T. (1986). Oligopoly and financial structure: Theory limited liability effect. *American Economic Review*, *76*, 956–970.
Bulow, J., Geanakoplos, J., & Klemperer, P. (1985). Multimarket oligopoly: Strategic substitutes and complements. *Journal of Political Economy*, *93*, 488–511.
Cragg, J., & Donald, S. (1993). Testing identifiably and specification in instrumental variable models. *Econometric Theory*, *9*, 222–240.
Davies, S., & Geroski, P. (1997). Changes in concentration, turbulence, and the dynamics of market shares. *The Review of Economics and Statistics*, *79*, 383–391.
Frésard, L. (2010). Financial strength and product market behavior: The real effects of corporate cash holdings. *Journal of Finance*, *65*, 1097–1122.
Fudenberg, D., & Tirole, J. (1984). The fat-cat effect, the puppy dog ploy, and the lean and hungry look. *American Economic Review Papers and Proceedings*, *74*, 361–366.
Harris, M., & Raviv, R. (1991). The theory of capital structure. *Journal of Finance*, *46*, 297–355.
Hovakimian, A., Opler, T., & Titman, S. (2001). The debt–equity choice. *Journal of Financial and Quantitative Analysis*, *36*, 1–24.
Kovenock, D., & Philips, G. (1997). Capital structure and product market behavior: An examination of plant exit and investment decisions. *Review of Financial Studies*, *3*, 767–803.
Kuan, T. -H., Li, C. -S., & Liu, C. -C. (2012). Corporate governance and cash holdings: A quantile regression approach. *International Review of Economics and Finance*, *24*, 303–314.
Lyandres, E. (2006). Capital structure and interaction among firms in output markets: Theory and evidence. *Journal of Business*, *79*, 2381–2421.
MacKay, P., & Phillips, G. (2005). How does industry affect a firm's financial structure? *Review of Financial Studies*, *18*, 1432–1466.
Maksimovic, V. (1988). Capital structure in repeated oligopolies. *The RAND Journal of Economics*, *19*, 389–407.
Maksimovic, V., & Zechner, J. (1991). Debt, agency costs, and industry equilibrium. *Journal of Finance*, *46*, 1619–1643.

[10] We thank the referee who suggested conducting this robustness check using 3SLS.

Phillips, G. (1995). Increased debt and industry product markets: An empirical analysis. *Journal of Financial Economics*, *37*, 189–238.
Rajan, R., & Zingales, L. (1995). What do we know about capital structure? Some evidence from international data. *Journal of Finance*, *50*, 1421–1460.
Showalter, D. (1995). Oligopoly and financial structure, comment. *American Economic Review*, *85*, 647–653.
Showalter, D. (1999). Strategic debt: Evidence in manufacturing. *International Journal of Industrial Organization*, *17*(3), 319–333.
Stock, J., & Yogo, M. (2005). Testing for weak instruments in linear IV regression. In D. W. K. Andrews, & J. H. Stock (Eds.), *Identification and inference for econometric models: Essays in honor of Thomas Rothenberg* (pp. 80–108). New York: Cambridge University Press.
Sundaram, A., John, T., & John, K. (1996). An empirical analysis of strategic competition and firm values: The case of R&D competition. *Journal of Financial Economics*, *40*, 459–486.
Titman, S. (1984). The effect of capital structure on a firm's liquidation decision. *Journal of Financial Economics*, *13*, 137–151.
Titman, S., & Wessels, R. (1988). The determinants of capital structure. *Journal of Finance*, *43*, 1–19.