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Two Essays in Financial Economics

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Abstract

Chapter 1 of this study investigates the link between a firm's capital structure and their industry competitive behavior. Given the competitive behavior in certain markets, Cournot or Bertrand, we investigate if there are any inborn characteristics of these markets' competitive behavior that would create an incentive for Cournot firms to have a different strategic debt level than Bertrand firms. Related theories argue that any industry's competitive behavior, whether it is Bertrand or Cournot would typically consist of a certain type of debt and pursue a certain type of competitive strategy, based on its classification. In this study, we investigate the debt level of a sample of firms classified into either Cournot or Bertrand competition, i.e. explore competitive behavior as a characteristic of firms that tend to be associated with different debt ratios and determine if the competitive market type does in fact lead to a varying debt ratio target. We used two different measures to categorize competition type, the CSM and the SI measure. Our findings indicate that there is no significant difference between differentiated debt levels between Bertrand and Cournot firms.

Chapter 2 of the study examines various factors that may affect American Depository Receipts' trading volume distribution between their home and US markets. These include factors not previously considered in the extant literature. One such factor is the trading motive (hedging or speculative) of investors. Other factors examined include price impact, relative volatility, market to book ratio, as well as a cultural dimension factor: individualism. Controlling for time-specific effects, we find that the relative motive measure of cross-listed firms has a positive relationship on the trading volume distribution. In addition, when looking at a small sample of firms with different motive factors, we find that hedging motive in the home country leads to an increased proportion of trading in the host country relative to the home country, while speculative motive leads to a decrease in the volume share of the host country relative to the home country. A positive and significant relationship is also observed between volatility and the log of trading volume share. The relationship is negative for liquidity and visibility in relation to the trading volume distribution of cross-listed firm's stocks. Culture difference at home relative to host is found to positively impact trading volume distribution of cross-listed stocks.

Keywords: Capital Structure, Product market competition, Cournot, Bertrand;
Cross-listing, American depository receipts, ADR, Volume distribution, Trading Volume, Trading Motives, Hedging, Speculation

Chapter 1: DYNAMIC RELATION BETWEEN PRODUCT MARKET COMPETITION AND CAPITAL STRUCTURE

1. Introduction

Capital structure theories fall under three categories: the Static Trade-off Theory of Optimal Debt, the Pecking Order Theory, and the Signaling Theory[1]. The Trade-off Theory[2] argues that there is an optimal capital structure and the way to optimize this capital structure is by trading off the cost and benefits of debts. In other words, the optimal capital structure is the point at which the marginal benefit is exactly equal to the marginal cost of debt. Under this theory, many factors, such as taxes, bankruptcy, agency, free cash flow, and product market interaction factors have been identified to provide benefits or costs from using debt, and the trade-offs between these benefits and costs will lead to well-defined target debt ratios.

In this study, we will address a firm's capital structure in terms of their product market strategy, specifically capital structure of firms in oligopolistic market. An oligopoly market refers to an imperfectly competitive market with a small number of relatively large firms that sell differentiated or homogenous products and are aware of their interdependence. Oligopoly behavior is modeled as 1) Cournot with simultaneous choice of output quantity, and then price adjusts so that demand equals supply or 2) Bertrand with simultaneous choice of prices and then consumers choose from which firm to buy.

Traditionally, firms financing decisions and their behavior in the product market have been studied separately. Studies by Brander and Lewis (1986) and Showalter (1995 and 1999) were among the first to recognize that a firm's capital structure and product market behavior may be interrelated. The need to study capital structure in terms of product market strategy arises from the fact that market forms, such as oligopoly, stimulate the awareness and responsiveness of firms to the actions of its competitors. Such actions may pertain to a firm's chosen debt level since financing and output decisions are closely linked. It follows then that the capital structure of a firm will be changed by the existing competitive behavior in the industry. In other words, competitive behavior is a factor that may hamper a firm's ability to make required changes to

[1] For detail on the pecking order theory, the signaling theory and the theory of optimal capital structure, see Harris and Raviv (2012). Although product market research can be associated to both the Pecking and the signaling theory as well, this paper focuses on how it relates to the Static Trade off Theory.

[2] See Baxter, 1967; and Kraus and Litzenberger, 1973

bring about a target debt level since financial distress costs may arise if competitors take advantage and compete more aggressively when the firm in question is financially weakened[3].

This paper contributes to this research area by asking the following question: "Would one expect to see firms with a higher level of average debt in a Cournot or Bertrand market?" In other words, evaluating the average debt of two industries where one is predominantly price competitive while the other competes primarily on quantity. Are there any inborn characteristics of these markets' competitive behavior that would create an incentive for firms in one industry to gain a higher average level of debt than firms from the other industries[4]? We examine the interaction between leverage and product market competition 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 by Sundaram, John, and John (1996). We also implement a second measure of competitive environment, the strategic indicator measure "SI" proposed by Kedia, 2006. This alternative measure addresses some of the weaknesses perceived from Sundaram, John, and John (1996) CSM measure. To compare debt levels, we evaluate the interaction between leverage and firms' market structure through analysis of the two-direction effect between firm's leverage level and firm's competition measure[5] in each market type (Cournot and Bertrand competition), as well as over different industries.

[3] Opler and Titman (1994).

[4] If there exists no difference in debt ratio across the two groups, that need not imply that the product market strategy does not affect debt ratios; it may be that the conduit through which the market structure affects debt ratio for each group is different. If, however, a difference is found, the study could be further extended and seek to identify the underlying characteristics that justify this difference in debt level.

[5] Firms' competitive measure, the toughness or softness of the product market competition, is estimated by industry concentration (HHI) and (CONC), and the degree of competition measure as the Boone indicator (BOONE).

2. **Literature Review**

Brander and Lewis (1986) were among the first to survey the relationship between the product markets and financial markets. They point to the interaction between output and financial markets as a determinant of financial structure. They assessed the link between firm's choice of debt level and output decisions in a two-stage Cournot competition model. They suggested that firms in Cournot markets have an incentive to commit to a large output strategy, inducing favorable output reduction from competitors[6]. They do so via use of a highly leveraged capital structure since equity holders will ignore the possible reduction in returns in the bad (bankruptcy) states, and only consider the probability of increased returns in the good states. In bad states, debt holders suffer primarily since debt holders become the residual claimants to the firms' assets (limited liability effect of debt financing)[7]. Another suggested motive (predatory behavior or strategic bankruptcy effect) comes into effect when firms use leverage to vary output with the aim of driving rivals out of business[8].

Brander and Lewis' (1986 and 1988) study, in general, suggests that a firm's capital structure will impact the firm's business strategies or product market competition characteristics, such as pricing and/or output decisions. However, since firms will anticipate the capital structure impact on their competitive behavior, they will therefore adjust their debt level appropriately. In other words, the link between the firm's capital structure and its product market is not a unilateral relationship, i.e. each variable may influence the other. In addition, studies in this field provide support for this stance in asserting that firms in Bertrand or Cournot competition tend to have a certain level of debt[9]. However, this debt level may also lead to the type of competitive strategy.

Gertner, Gibbons and Scharfstein (1988) developed a two-audience signaling model and explored a firm's (informed party) choice of capital structure when the financing contract is observed by capital market and competing firm in the product market. They assume an endogenous profit structure for the informed firm since the competitor's action depends on the transaction it observes between the informed firm and the capital market. They conclude with results that indicate that capital-market equilibrium is determined by the structure of the product market. Their findings provide additional support for the need to analyze firm's financial structure and product structure concurrently.

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[6] Their model is similar to Jensen and Meckling (1976) in that an increase in debt encourages equity holders to follow riskier strategies.
[7] e.g. Brander and Lewis (1986), Showalter (1995).
[8] e.g. Fudenberg and Tirole (1986); and Chevalier and Scharfstein (1995)
[9] Chevalier and Scharfstein (1994); Dasgupta and Titman (1998)

Nevertheless, existing literature vis-à-vis the link between debt level and the nature of competition among firms focuses primarily on how capital structure influences firms competitive behavior with their rivals, and not how competition influences the strategic level of debt pursued by these firms. In other words, it is presumed that firms' first choose their debt level, then compete in the product market. In most of the studies reviewed, motivated by either the limited liability effect of debt financing or the strategic bankruptcy effect, researchers have investigated the manner in which debt level has impacted firms' business conduct or its competitive position.

Henceforth, based on prior literature, the following section 2.1 presents first, an overview of the research that deals with capital structure and strategic firm's behavior. Then, in section 2.2 we present an overview of the literature on market structure and its relationship with capital structure.

2.1 Capital Structure and Firm's Competitive Strategy

The literature in this subsection exploits the relationship between the firm's capital structure and its strategy in the product market. These models can be divided into three different theories; first, the limited liability effect; second, the predatory behavior (strategic bankruptcy); and third, the investment effect[10].

Limited Liability Effect:

Theoretical models investigating the relationship between capital structure and competition have been proposed by the various authors cited below. Among them, Chevalier and Scharfstein (1994), as well as Dasgupta and Titman (1998) studies suggest that high debt, in general, leads to less aggressive competition, i.e. higher prices for Bertrand firms and lower output for Cournot firms.

While Brander and Lewis' (1986) model predicts that Cournot firms subject to demand and/or cost uncertainty have an incentive to commit to a large output strategy using a high leverage structure. On the other hand, Showalter (1995) argues that firms in Bertrand competition will only increase debt level when market demand is uncertain[11], but not when costs are uncertain, since debt does not carry a strategic advantage in the latter case[12]. Thus, when firms compete in Bertrand competition, they find an incentive to use debt only when demand conditions are uncertain, since in this case, an increase in the firm's debt will cause both the firm's and its rival's price to increase. This in turn causes, both the debt and equity value of the

[10] This strand of literature, investment effect, not directly examined in this paper shows how high debt levels may induce firms to either decrease or increases their investment level.

[11] Increasing debt level, when demand is uncertain, would lead to an increase in industry prices as well as expected profit for the firm.

[12] In the latter case, when costs are uncertain, leverage would triggers industry prices and expected firm profit would then decline.

firm to rise and consequently, firms take on debt in order to raise industry prices and expected profits. Showalter's (1999) empirical study of a sample of U.S. manufacturing firms shows that higher cost uncertainties induce Bertrand competitive sample of firms to reduce leverage while demand uncertainties led to an increase in the level of debt. In other words, when rival firms compete primarily by setting prices: Bertrand strategy, the source of output market uncertainties will play a crucial role in determining firms' optimal debt level. Wanzenried's (2003) findings support those of Showalter, however, asserts that this is the case for either Cournot or Bertrand firms.

Contrary to the findings of Showalter (1995) and Wanzenried (2003), Schuhmacher (2002) argues that exposed to uncertain demand, increasing the debt level, for either Cournot or Bertrand firms, would cause industry prices, as well as, expected profits to decrease. When, on the other hand, firms are faced with uncertain costs, they do use high debt levels as leverage leads to an increase of expected firm's profits. The study contends that the Cournot model of quantity competition has to be interpreted as the reduced form of a more complex situation in which firms can commit to capacity levels before setting prices. As such, capacity-price competitors choose their optimal strategic debt depending on the type of uncertainty that exists in the oligopoly market. In addition, when demand is uncertain, firms do not take on debt, however, when cost is uncertain they assume high debt level strategies[13].

Glazer (1994) stresses that the leverage impact on output quantity presented by Brander and Lewis (1986) is changed when the debts issued are long-term rather than short-term. The study asserts that while short-term debts induce firms to behave aggressively, long-term debts do not have the same effect since the maturity date is so distant. Campos (2000) corroborate this theory and found that firms with high levels of short-term debt always behaved more aggressively in the product markets, as indicated from Brander and Lewis (1986). However, in firms with high levels of long-term debt, this effect was reduced.

Predatory Behavior Model - Strategic Bankruptcy Effect:

Theoretical studies by Brander and Lewis (1988), Poitevin (1989b), Bolton and Scharfstein (1990) as well as Telser (1966) analyze the prospect that high debt may be a factor that leads firms to be more susceptible to going out of business resulting from competition with rivals. In their model, unlevered, incumbent firms with access to capital have an incentive to increase quantity or reduce price in response to new entrant increase in leverage in order to force the leveraged firm out of the market.

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[13] They explained that the key difference that's driving the result is that in the capacity-price model increasing the demand parameter leads to a lower marginal profit to capacity. This is because the market demand increases with the demand parameter, so that raising the capacity in the first stage, leads to stronger competition and lower prices in the second stage, and thus becomes less profitable.

Maksimovic (1990) argues that firms gain strategic advantage when they can increase leverage using bank loan commitment at a fixed initial fee. This is because, with loan commitments, they can credibly threaten to produce greater quantities than it otherwise would in response to the rival's output decision. As a result, firms do pursue increased leverage through bank loan commitments. However, the increase in value created with loan commitment is eliminated when all firms gain access to bank loan commitments.

Subramanian (1998) also contend that debt financing empowers firms to credibly commit to a larger output in the product market. The message in their paper is that small levels of debt financing may be used to mimic an optimal contract and thus mitigate inefficiencies that arise in a monopolist's relationship between a firm and its suppliers. The effects of such an increase in leverage is Pareto optimal; a larger supplier base with non-negative earnings, increased firm value, and output quantity is increased resulting in lower prices, benefitting customers.

Poitevin (1990) contends that entrants, because they are at a financial disadvantage, wish to enter a market only when the incumbents have high costs. Therefore, low-cost incumbents have an incentive to signal their cost to potential entrants with the aim of deterring their entry. Another advantage to offering this signal is that it also reveals information to financial markets that support gaining advantageous financial prices. In equilibrium, they find that for incumbent firms with low cost structure, attaining high leverage create an effective entry deterrent in the product market.

Ashiya (2000) asserts that less leveraged incumbent firms will deliberately chose to use predatory strategies against certain entrant firms. In this strategy, the incumbent use these tactics against the strong entrant firms and not the weak firms with the explicit aim of keeping the market crowded; deflecting strong firms entry choices.

2.2 Market Structure and Capital Structure

In contrast to the literature on capital structure and strategic behavior, where small levels of debt tend to make firms aggressive in the product markets; the research on capital and market structure reviewed below generally indicate a negative relationship between firm's debt level and the degree of competition between firms in the market. Studies by Opler and Titman (1994), Phillips (1995) and Chevalier (1995) document this proving that at larger levels, the effect of debts appears not to make firms aggressive, in general. Krishnaswami and Subramaniam (2000) state that when firms are highly leveraged, they face difficulty in the financial market, as well as, in the product markets.

Opler and Titman (1994) studied the relationship between firm's capital structure and market structure in industry downturns. They maintain that during industry downturns, highly leveraged firms are the most vulnerable. They find that highly leveraged firms suffer a loss of market share relative to less leveraged firms during industry downturns. The firms in the top leverage deciles also experience a decline in the market value of their equities. One of the three potential explanations for this finding is related to the predatory theory, or strategic bankruptcy

effect[14]. They propose that unlevered firms may be exploiting industry downturns and engaging in predatory actions[15] with the intent of driving rivals out of the market, making them lose market share. As a result they argue that firms in concentrated market are less likely to carry significant debt. This is because firms in such market are more likely to be faced with aggressive competitive tactics by rival firms attempting to gain market share.

Chevalier's (1995) event study indicates that a leverage buyout announcement increases the market value of the leverage buyout chain's local rivals, and encourages supermarket chains to enter and expand in the local market. In other words, leverage was inversely related to product market competition; this is due to the leveraged firm financial vulnerability. In a subsequent study, Chevalier (1995) finds evidence suggesting that leverage buyouts create an incentive for firms to raise prices in local markets where rivals of leveraged buyout firms are also highly leveraged. Conversely, when rivals have low leverage and are more concentrated, the study finds that leverage buyouts lead to a decrease in prices.

Phillips (1995) examines how sudden increases in debt level impact the firm's strategic decisions in terms of pricing and/or production. The study concludes that, in general, debt level is positively related to product prices, but negatively related to output quantity. Firms that increased their debt level experienced a decrease in sales. However, in this same study, when the gypsum industry[16] is analyzed instead, support is consistent with theoretical study of Brander and Lewis (1986). They argue that highly leveraged firms have difficulty financing investment opportunities, because investors are unwilling to extend more funds due to their increased probability of default. As a result, they are also more likely to result in bankruptcy leading to a more concentrated market structure. They also show that following recapitalization, highly leveraged firms either lost market shares or failed to gain the shares of smaller rivals that exited the market.

Krishnaswami and Subramaniam (2000) reconcile the opposing views[17] by introducing an additional variable i.e. firm's supplier relations[18] in the strategic interaction between a firm and its rivals. They argue that increased leverage can be a strategic benefit in Cournot competition, when used to commit to a larger output since it is shown that an increase in a firm's

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[14] The other two potential suggestions were that 1) customers could simply be reducing business with highly leverage firms out of fear that leveraged firms will simply stop investing sufficient funds in product quality or reputation. Or 2) Leveraged firms are more inclined to efficiently downsize in response to a downturn.

[15] Such actions maybe increase advertisings or price dumping.

[16] The gypsum, the fibers glass insulation, the tractor-trailer and polyethylene industries were analyzed in this study. These industries were chosen on the basis of four criteria; 1) discrete increase of at least 25% in debt-to-market value by the firm with the largest sales, 2) limited number of producers in each industry with the top four firms comprising of at least 50% of the market, 3) product homogeneity within the industry and, 4) the leading firm producing at least 50% of its sales in the same 4 digit SIC code (Phillip, 1995).

[17] Theoretical model like Brander and Lewis (1986) predicts that under imperfect competition, higher debt levels create a strategic advantage for firms competing in the product markets. However, many empirical findings (Oplet and Titman (1994), Chevalier (1995) and Phillips (1995)) seem to indicate otherwise.

[18] Firm's supplier relation is a firm's contractual relation with its suppliers.

output leads to a decrease in the rival's output[19]. However, this benefit can be detrimental if the resulting increase in output results in a decrease in input cost for all firms in the industry due to suppliers' economies of scales. In such a case, the firms' leverage provides a benefit to the rival enabling them to increase output without the having to incur the cost of the debt. They explain that when both firms, in a duopoly, increase their output, the industry output moves away from the monopoly level, and as a result, the industry profits are lowered.

Lyandres' (2006) paper studied the link between firms' degree of competitive interaction and their capital structure. This study finds a positive relationship between firms' leverage level and the extent of competitive interaction in these industries. This is the case regardless of the competitive environment: Bertrand or Cournot.

In summary, the above literature review shows that the type of competitive behavior has continued to play a crucial role in studies of the relationship between competition and leverage. Therefore, we contribute to the literature by directly studying the debt level of Cournot firms against Bertrand firms in order to empirically test the intuitions if there are unique characteristics in these markets that create the incentive for differentiated debt levels. Thus, one of the goals of our study is to explore the characteristics of leverage levels in each of these markets relative to one another. Specifically, we do so by studying the relationship between the strength of competition in a given industry, the leverage of the firms in that industry along with the several other financial characteristics of these firms in a Cournot environment relative to a Bertrand environment. We speculate based on the various theories mentioned in the literature above that the relationship between competition and leverage may be different over different competitive environments. Namely, we zoom in onto the two environments: the Bertrand market and the Cournot market and test for differences in their capital and market structure. We also speculate that these relationships may also vary over industries and thus investigate these differences as well. We analyze the two-direction effect assumed between firm's capital structure and its market structure (softness or toughness of product market competition) for both Bertrand and Cournot competition, as well as over differentiated industries. We test for causality, i.e. we hypothesize that competition Granger causes leverage and leverage Granger causes competition. All our conjectures are tested using parametric and nonparametric tests.

The analysis is built on our ability to quantify competition for each industry and leverage for each firm. We test with 3 different metrics of competition and 4 different metrics of leverage. However, at each stage of the analysis, competition and leverage are defined unambiguously. So we will refer to them as variables Competition and Leverage.

[19] Supporting to Brander and Lewis (1986) theory.

3. Data, Variables, and Methodology

3.1 Data Selection

We collect all U.S. firm financial information over the period of January 1, 1960 – June 30, 2014 from Compustat. We obtain the data at both annual and quarterly frequencies depending on data charactristics. Firms' competitors are defined as all firms in Compustat database with the same 4-digit SIC code in each year. Observations without records of 4-digits historical SIC are to be removed from our sample. The data set is composed of 1,531,515 records, covering 33,631 firms in 448 industries. However, for many firms the financials area is available only for a few quarters and, therefore, we cannot use those firms for estimation of linear models with many predictors. This makes the effective sample size go down to anywhere between 400 and 4,000 firms depending on the exact model and statistical method.

3.2 Measures of the competitive environment

We identify industry competitive behavior following two alternative techniques from Sundaram et al. (1996) and Kedia, 2006 methodology. Sundaram et al., as well as Kedia's, 2006, approach constructs a proxy of competitive strategy measures to differentiate between firms that participate in Cournot vs. Bertrand competition.

Sundaram et al. (1996) assume that if two firms participate in a Cournot market, the effect of an exogenous shock on one firm will also impact the other firm's marginal profit in the same manner. However, if firms compete in Bertrand market, the effect of an exogenous shock that decreases marginal profit for one firm will increase the marginal profit of the other.

Therefore, they construct a proxy "competitive strategy measure (CSM)" for the nature of product market competition equal to the coefficient of correlation of the change in the firm's profit margin (Δ in net income ÷ Δ in net sales) with respect to the change in its competitors' output.

$$CSM = corr\left[\frac{\Delta S\Pi_1}{\Delta S_1}, \Delta S_2\right]$$

where Π_1 is the change in firm's profit between two consecutive years;
ΔS_1 is the change in the firm's sales between two consecutive years;
and ΔS_2 is the change in the firm's product rivals' combined sales between two years. The firm's product rivals' combined sale is defined as the combined annual sales of all other firms in the firm's four digit SIC industry.

If the marginal profit decreases with an increase in output, i.e. the correlation coefficient is negative, then the firms are presumed to be competing in a Cournot market; if on the other

hand, the correlation coefficient is positive, firms are presumed to be competing in Bertrand market.

On the other hand, Kedia's, 2006, methodology for the empirical assessment of the competitive environment "strategic interactions" between firms is derived from an estimation of the slope of firm's reaction functions to changes in rival's decisions. Using quarterly data on profits and sales, strategic interactions, proxy as the slope of the reaction function is obtained by taking the total differential of the firms' marginal profits.

The "strategic interaction measure" (SI) is documented as the t-statistic of $\beta_3 S_i + \beta_4$ in the following regression:

$$\Delta (\Delta \Pi_1 / \Delta S_1)_t = \beta_0 + \beta_1 * S_1 * \Delta S_1 + \beta_2 * \Delta S_1 + \beta_3 * S_1 * \Delta S_2 + \beta_4 * \Delta S_2 + \varepsilon.$$

Where, $\Delta \Pi_1$ is the change is firm's profit for firm i, and S_1 is sales for firm i, ΔS_1 is the change in sales for firm i, and ΔS_2 is the change in sales for the rest of the industry. Sales for the rest of the industry is defined as sales of all firms (except firm i), reported in the same four-digit SIC as firm i, in compustat.

In particular, if an estimate of $(\beta_3 S_i + \beta_4)$ is statistically significant and negative the firm is presumed to be in the Cournot environment. If SI is statistically significant and positive the firm is presumed to be in the Bertrand environment.

We estimate the competitive strategy measure (CSM & SI) for each firm for every year to account for possible changes in competitive behavior over time. Firms, with CSM value less than zero, are classified Cournot (strategic substitutes) and firms with CSM values greater than zero are classified as Bertrand (strategic complements). Firms with insignificant measure of competitive proxy are to be removed from the sample. Similarly, we identify Cournot and Bertrand firms using SI measure and create dummy variables to identify Cournot or Bertrand environment. We then obtain two samples of Bertrand and Cournot firms using CSM and SI measure.

3.3 Measures of Leverage

The balance between debt and equity is the firms' capital structure. If the firm uses more debt than equity, it is said to be highly leveraged and vice versa. We consider four alternative definitions of leverage, and compute the average leverage level for each firm as follows:

The book value of long-term debts defined as total long-term debt (Compustat item 9) divided by total assets (item 6);

$$\text{Book value of long-term debt} = \frac{\text{Average of total long term debt}}{\text{Average of total Assets}}$$

The market value of long-term debt ratio defined as the average of total long-term debt divided by the average market value of total assets. 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*item54) + item 10 – item 35);

$$\text{Market value of long-term debt} = \frac{\text{Average of total long term debt}}{\text{Average market value of total Assets}}$$

The book value of total debt ratio defined as total debt (which are long-term debt and debt in current liabilities: item 9 + item 34) divided by total assets (item 6).

$$\text{Book value of total debt} = \frac{\text{Average of total debt}}{\text{Average of total Assets}}$$

The market value of total debt ratio defined as total debt (which are long-term debt and debt in current liabilities: item 9 + item 34) over market value of total assets. 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*item54) + item 10 – item 35);

$$\text{Market value of total debt} = \frac{\text{Average of total debt}}{\text{Average market value of total Assets}}$$

3.4 Determinants of Leverage

Several factors have been documented as important in explaining a firm's leverage choices. Considering the static trade-off framework, firms are viewed as setting a target leverage ratio and moving towards it. This leverage ratio is determined by considering the trade-off between the costs, such as bankruptcy costs and benefits, such as tax-benefits of debt. We describe below some of these factors to be considered in this study which act as covariates in the simultaneous system of equations for Competition and Leverage.

Size: Warner (1977) indicates that the cost of bankruptcy constitutes a smaller proportion of larger firms. Therefore, firm size is a variable expected to be positively related to leverage. In addition, larger firms are likely to provide better information to the market and therefore may benefit from better access to credit. Firm size is calculated as the natural logarithm of average total assets.

Firm risk: Measured as the standard deviation of the ratio of operating income before depreciation (item 13) divided by the total asset (item 6); firm risk, which indicates a higher degree of volatility of earnings and thus greater likelihood of bankruptcy, is expected to be negatively related to the leverage ratio of the firm (Bradley at al. (1984)).

Asset Tangibility: Lower risk for lenders, and reduced bankruptcy costs are assumed with higher asset tangibility. Therefore, asset tangibility is expected to be positively related to

leverage. We measure asset tangibility as the ratio of average net fixed assets (item 8) to average total assets (item 6).

Collateral: Frank and Goyal (2003) found that the measure of collateral is highly correlated with tangibility measure. Lyandres (2006) explains that collateral reduces agency costs of debt and thus is expected to be positively correlated to the degree of leverage. We will substitute, in our equation, measures of collateral and asset tangibility for robustness. We measure collateral as the ratio of the sum of net fixed assets and inventories (item 8 + item 3) divided by total assets (item 6).

Liquidity: Measured as the ratio of average cash and short-term investment (item 1) to the average total assets (item 6) is also predicted to affect the level of leverage in firms. This is predicted by the pecking-order theory of Myers (1984).

Profitability: The pecking order theory suggests that firms prefer to raise capital from retained earnings, primarily. Secondarily, they will chose to raise capital by issuing debts; and as last resort, by issuing equity. If so, we would expect that the more profitable firms are, the less likely they are to resort to debt financing. Thus, we foresee a negative relation between profitability and leverage ratio. We measure profitability as the ratio of operating income (item 13) to total assets (item 6).

Mix of growth options and assets in place: Firms with high growth opportunities should be financing less debt than firms with few investment opportunities (Myers, 1977). This is because agency conflicts between equity holders and debt holders arise from asset-substitution and underinvestment. These conflicts can be partially mitigated by seeking more equity financing for projects instead of debt financing. Therefore, we expect a negative relationship between growth opportunities and leverage. We use market-to-book ratio, defined as the average market value of total assets (item 54*item 199 + item 9 + item 34) divided by the average book value of total assets (item 6), as a proxy for growth opportunities. An alternative measurement proxy for the mix of investment opportunities and asset in place is the ratio of research and development expenditure (item 46) to sales (item 12) (Barclay et al. (2006)).

Dividends and repurchases: The more internal funds a firm has, the less incentive it has to use leverage according to the pecking order theory. At the same time, firms with larger pools of internal funds are most likely to pay out dividends or repurchase stocks as an alternative way of distributing cash. Therefore, firms that pay out dividends or repurchased shares in a given year are predicted to seek lower leverage levels.

Tax advantages of debt: Variables such as tax credits and investment tax credits can be considered as a tax shield substitute for debt, and as argued by DeAngelo and Masulis (1980), since the associated tax advantage of debt decrease as such tax credit are increasing. Therefore, we expect a negative relation between leverage and non-debt tax shields such as investment tax credits (item 208) and the ratio of depreciation (item 125).

3.5 Measure of Industry Concentration

We look at three measures of industry concentration. All of them are defined on the industry-wide level. In each industry, we calculate the level of concentration (CONC) as the sum of market shares of the four firms with the largest market shares in the main market of the firm[20]. A second measure used in this study is the Herfindahl-Hirschman Index which infers competition from the degree of product market concentration (Campello, 2006); it is calculated as the summed, squared market shares of individual firms in the market in percentage form: HHI $=\sum_{i=1}^{n}(MS_i)^2$. Higher product market concentration is associated with lower competition and vice versa[21]. A third measure used is a non-structural approach that derives the degree of competition from market behavior. The Boone indicator by Boone, Griffith and Harrison (2005) measures the sensitivity of firms' profits (or market shares) to their inefficiency in product markets. It assumes that firm profits increase with efficiency and this increase is higher in more competitive industries. The Boone indicator is measured by estimating the following regression: $VROA_{it} = \alpha + \beta_t \ln Mc_{ij} + \varepsilon_{i,t}$ where VROA is calculated as sales revenue – cost of goods sold divided by its total assets. lnMc is the natural log of cost of goods sold divided by sales revenue. The absolute value of the time-varying parameter β_t measures the level of competition; thus BI = absolute value of β_t .

3.6 Determinants of Product Market Competition

Leverage level: As indicated in the literature review above, different streams of research dealing with the interaction between product market competition and the financial structure of companies (limited liability, predatory behavior, and investment effect) show an association between leverage level and product market competition.

Research and Development: Dasgupta and Stiglitz (1980) describe spending on research and development as an effective means of gaining a strategic advantage over competitors. If firms were able to utilize R&D to reduce their cost; the reduction in cost would create a strategic advantage for them to lower price or increase quantity and potentially drive rivals out of business. In this case, we would expect a positive relationship between R&D expense and product market completion measure (Campos, 2000). Sometimes, however, concerns about the high cost and risk of duplicating efforts associated with R&D expense, may lead to firms choosing to cooperate instead of competing, thus leading to less aggressive and softer product

[20] The four - firm concentration ratio has been used in Opler & Titman (1994), Chevalier (1995a,b), Kovenock & Phillips (1997) and Campello (2003).

[21] Demsetz (1973) note that high level of product market concentration can simply be the outcome of pronounced efficiency; as a result, higher concentration may not necessarily imply lower competition (Boone et al. (2005)). We address this concern by estimating and alternating using the Boone indicator measure.

market competition. R&D expenditure ratio is measured as R&D expenses divided by total sales.

Advertisement expense ratio: Spending on advertising is projected to have a positive correlation with the degree of competition in the product market. Advertisement expense ratio is equal to advertisement expenses divided by sales.

Market Share: Davies and Geroski (1997) argue that market share is positively related to degree of concentration. This is because if firms are not faced with significant level of competition, or if rivals have left the market causing the industry to become more concentrated, the remaining firms have more opportunities to gain market shares. Market share is calculated for each firm as the annual sales of the firm divided total industry sales.

3.7 Methodology

In this section we will state the model for the joint dynamics of competition and leverage, describe the statistical methods exploited for estimating the model and testing the variability of the parameters of the joint distribution of competition and leverage over different competitive environments and industries.

The model ties competition and leverage to one another as well as to several financial characteristics of the firms, which are described in the previous section. Competition and leverage are assumed to be endogenous. The other variables are assumed to be exogenous. The model states that, for each firm i and quarter t

$$\text{Competition}_{it} = \beta_{C0} + \beta_{C1} * \text{Leverage}_{it} + \beta_{C2} * \text{Market Share}_{it} + \varepsilon_{it},. \textbf{ (1)}$$

$$\text{Leverage}_{it} = \beta_{L0} + \beta_{L1} * \text{Competition}_{it} + \beta_{L2} * \text{Risk}_{it} + \beta_{L3} * \text{Asset Tangibility}_{it} + \beta_{L4} * \text{Collateral}_{it} + \beta_{L5} * \text{Liquidity}_{it} + \beta_{L6} * \text{Profitability}_{it} + \beta_{L7} * \text{Growth Options and Assets}_{it} + \beta_{L8} * \text{Dividend}_{it} + \beta_{L9} * \text{Tax Advantages of Debt}_{it} + \beta_{L10} * \text{Size}_{it} + \zeta_{it}. \textbf{ (2)}$$

In equation (1), residual ε_{it} is correlated with predictor Leverage_{it}. Likewise, in equation (2), residual ζ_{it} is correlated with predictor Competition_{it}. For that reason, the ordinary least squares method is inappropriate for parameter estimation. It delivers an inconsistent estimate of regression coefficients β_{C0} - β_{L10}. A well-established approach of correcting for the correlations is using instrumental variables, variables which are highly correlated with the predictors but uncorrelated with the residuals. We will use two-stage estimation for our analysis. The method is as follows:

Regress Leverage_{it} on Market Share_{it} and obtain the fitted value LevHat_{it}. Regress Competition_{it} on the other predictors in equation (2) and obtain the fitted value CompHat_{it}. To estimate coefficients in equation (1), regress Competition_{it} on LevHat_{it} and Market Share_{it}. To estimate coefficients in equation (2), regress Leverage_{it} on CompHat_{it} and the exogenous predictors in equation (2).

In addition to estimating regression coefficients for Competition_{it} and Leverage_{it}, we calculate their pairwise correlations with respective predictors in equations (1) and (2).

Next, we are interested in seeing whether the regression coefficients and correlations vary between the competitive environments. To compare the competitive environments, we will use the independent-sample t-tests, since the estimates of the regression coefficients and correlations are a result of averaging many observations. Therefore, they are approximately normal due to the effect of the Central Limit Theorem. We use the t-test method allowing for unequal variances in the competitive environments.

To compare coefficients and correlations over different industries, we will run non-parametric Kruskal-Wallis tests since the Kruskal-Wallis test is less sensitive to the assumption of equal variance in all industry groups than the parametric ANOVA test.

The Kruskal-Wallis test is rank-based. The observations in all industry groups are combined and turned into ranks. Then the ranks of different groups are compared to one another to see if the discrepancy can be due to pure randomness. As the result, the test is completely insensitive to outliers and to any distortions in the tails for some or all of the groups. The Kruskal-Wallis test compares the *medians* of the studied random variable over the industry groups.

As stated before, studies in this area has tended to suggest that the firm's capital structure will impact the firms' business strategies or product market competition characteristics and not how competition influences the strategic level of debt pursued by these firms. In other words, it is presumed that firms first choose their debt level, and then compete in the product market.

However, since firms will anticipate the capital structure impact on their competitive behavior, they will therefore adjust their debt level appropriately. Stated differently, the link between the firm's capital structure and its product market competition is not a unilateral relationship, i.e. each variable may influence the other.

Therefore, we will run Granger tests to explore potential causality between competition and leverage. For every firm i, we say that leverage Granger causes competition with lags m, p and q if coefficients β_{Cp} - β_{Cq} are jointly statistically significant according to an F-test in the following regression:

$$\text{Competition}_{it} = \mu_{C0} + \alpha_{C1} * \text{Competition}_{i(t-1)} + \ldots + \alpha_{Cm} * \text{Competition}_{i(t-m)} + \beta_{Cp} * \text{Leverage}_{i(t-p)} + \ldots + \beta_{Cq} * \text{Leverage}_{i(t-q)} + \gamma_{C1} * \text{Market Share}_{it} + \varepsilon_{it}. \quad (3)$$

Likewise, we say that competition Granger causes leverage with lags m, p and q if coefficients $\beta_{Lp} - \beta_{Lq}$ are jointly statistically significant according to an F-test in the following regression:

$$\text{Leverage}_{it} = \mu_{L0} + \alpha_{L1} * \text{Leverage}_{i(t-1)} + \ldots + \alpha_{Lm} * \text{Leverage}_{i(t-m)} + \beta_{Lp} * \text{Competition}_{i(t-p)} + \ldots + \beta_{Lq} * \text{Competition}_{i(t-q)} + \gamma_{L1} * \text{Risk}_{it} + \gamma_{L2} * \text{Asset Tangibility}_{it} + \gamma_{L3} * \text{Collateral}_{it} + \gamma_{L4} * \text{Liquidity}_{it} + \gamma_{L5} * \text{Profitability}_{it} + \gamma_{L6} * \text{Growth Options and Assets}_{it} + \gamma_{L7} * \text{Dividend}_{it} + \gamma_{L8} * \text{Tax}_{it} \text{ Advantages of Debt}_{it} + \gamma_{L9} * \text{Size}_{it} + \zeta_{it}. \quad (4)$$

We use the following settings: m = 2, p = 1, q = 2 and the significance level equal to 10%. We end up with a p-value for each firm and aggregate the p-values to make one conclusion. Under the null hypothesis, the lags of Leverage have zero influence on Competition.

This means that each p-value is a random variable distributed uniformly on [0, 1]. If, however, the lags of leverage have non-zero influence on competition the p-values will concentrate close to 0. Their distribution will be tilted from 1 to 0.

Therefore we will test whether the sample distribution of the p-values is uniform on [0, 1] using Kolmogorov-Smirnov goodness-of-fit test and report its p-value as the aggregate p-value of Granger causality test. We will do the same as well in checking the causality in the opposite direction: from competition to leverage.

4. **Results**

In what follows, we will address our results one by one. In general, most of our conclusions are the same uniformly over different definitions of competition and leverage which adds extra robustness and validity to the analysis. We present the results for the regression coefficients and correlations separately.

4.1. Differences of the joint dynamics of competition and leverage

We, first estimate equations (1) and (2), and then estimate the pairwise correlations between the dependent variable and predictors in each equation. These correlations present a separate set of metrics characterizing the joint distribution of all the financial factors involved. We will review the variation of these metrics (regression coefficients) between the two competitive environments, as well as the variation of the correlation coefficients.

4.1.1. Tests for regression coefficients

Tables 1 and 2 are compiled of p-values characterizing the difference of the regression coefficients between the Bertrand and Cournot environments when those are defined according to the CSM scheme. Table 1 refers to equation (1) and table 2 refers to equation (2). The p-values correspond to independent sample t-tests allowing for unequal variances. We will comment on each table separately in the following.

Insert Table 1 and Table 2 here

Tables 1 and 2 show the results with the various definitions of Competition and Leverage. In Table 1, competition, when defined as the level of concentration (CONC), shows significant sensitivity to leverage ratio in the form of market value of long-term debt (MVLD). In addition the degree of competition, when defined by the Herfindahl-Hirschman index (HHI), also exhibits significant sensitivity to the leverage ratio measured as the book value of long-term debt (MVLD). However, the results from equation 1, illustrate that in most cases the p-values of the t-tests are higher than the significance level of 5% to 10%. In regards to equation 2, it is shown that the degree of leverage is sensitive to the competitive environment only when leverage is measured using the book value of long term debt (BVLD) method and competition is measured using the Boone indicator. Leverage also shows sensitivity to other control variables as shown in Table 2. Despite this apparent connection in the cases mentioned above, the lack of sensitivity on the majority of combinations implies that there is not enough evidence to claim that the sensitivities of competition to leverage and market share, or the sensitivities of leverage

to competition and other covariates, in the joint model are different between the two competitive environments when this environment is defined by the CSM measure.

Next, we proceed to looking at the difference of the regression coefficients between the two environments when those are defined according to the SI scheme. Table 3 refers to equation (1) and table 4 refers to equation (2).

Insert Table 3 and Table 4 here

Studying the resulting p-values of t-tests comparing the regression coefficients in the "Leverage" and the "Competition" equation between the Bertrand and Cournot environments as defined by the SI measure show that similarly to the CSM definition, over different definitions of Competition and Leverage, the p-values of the t-tests continue to be much higher than the significance level of 10%. This is the case in all but one scenario in equation 1, which is when leverage is measured using BVLD, and competition is measured using the CONC method. This implies that there is not enough evidence to claim that the sensitivities of competition to leverage and market share, and the sensitivities of leverage to competition and other covariates in the joint model are different between the two competitive environments when those are defined according to the SI scheme either. The occasional p-values below 10% could easily be a consequence of type I errors as this may happen every 20^{th} time even if the null hypothesis is true and there is absolutely no difference between the Bertrand and Cournot environments.

4.1.2. Test for Correlations

Correlation tests under both CSM and SI framework deliver very similar results to those for regression coefficients. For each correlation test, the number of firms in the Bertrand and Cournot groups is the same as the number of Bertrand and Cournot firms for the test on the corresponding regression coefficient.

Starting with the CSM framework, tables 5 and 6 below are compiled of p-values characterizing the difference of the pairwise correlations between the Bertrand and Cournot environments. Table 5 refers to equation (1) and table 6 refers to equation (2). The p-values correspond to independent sample t-tests allowing for unequal variances.

Insert Table 5 and Table 6 here

Resulting p-values of t-tests comparing the correlations of competition and its candidate predictors between the Bertrand and Cournot environments as defined by the CSM imply that there is not enough evidence to claim that the marginal sensitivities of competition to leverage and market share are different between the two competitive environments. In addition, table 6 also shows that over different definitions of competition and leverage, the p-values of the t-tests are higher than the significance level of 10%. This implies that there is not enough evidence to

claim that the marginal sensitivities of leverage to competition and other covariates are different between the two competitive environments. The results are remarkably similar for different covariates.

Next we look into the SI framework. Table 7 refers to equation (1) and table 8 refers to equation (2). Contrary to our CSM-based conclusions, our SI-based results characterizing the differences of pairwise correlation between Bertrand and Cournot, show consistent sensitivity for the CONC and HHI competition measures to the BVLD and BVTD leverage measures. Over these four combinations of Competition and Leverage (CONC&BVLD, CONC&BVTD, HHI&BVLD, HHI&BVTD), the p-values of the t-tests are significant at levels of 10% or lower, implying that the marginal sensitivities of competition to leverage and market share are different between the two competitive environments.

Insert Table 7 and Table 8 here

4.2. Differences of the joint dynamics of competition and leverage over industries.

As explained in the methodology section, we choose to study the industry effects via Kruskal-Wallis tests. But this is not the biggest difference with the previous section. Most importantly here is we no longer classify firms into Bertrand and Cournot categories. In the reported tables below, statistical significance estimates are obvious. The industry effects are significant.

4.2.1. Test for regression coefficients

Tables 9 and 10 below are compiled of p-values characterizing the difference of the regression coefficients between the industries. Table 9 refers to equation (1) and table 10 refers to equation (2). The p-values correspond to Kruskal-Wallis tests.

Insert Table 9 and Table 10 here

Inferences from the p-values of Kruskal-Wallis tests comparing the regression coefficients in the "Competition" or "Leverage" equation between the industries confirm that over different definitions of competition and leverage, the sensitivity of competition to market share in the joint model is different in different industries. For half of combinations of definitions of competition and leverage, the sensitivity of competition to leverage in the joint model is different in different industries. For the other half, the sensitivity is the same over different industries. Choosing the metrics for competition and leverage seems to matter. Different definitions of competition and leverage do not agree perfectly, however, in general there is

enough evidence to claim that the sensitivity of leverage to risk, liquidity, profitability, growth options and assets and size in the joint model is different in different industries.

While, there is not enough evidence to claim that the sensitivity of leverage to competition, asset tangibility, collateral, dividend and tax advantages of debt in the joint model is different in different industries.

4.2.2. Test for correlations

Tables 11 and 12 below are compiled of p-values characterizing the difference of the correlations between the industries. Table 11 refers to equation (1) and table 12 refers to equation (2). The p-values correspond to Kruskal-Wallis tests comparing the correlations of Competition and its candidate predictors, and sequentially comparing the correlations of Leverage and its candidate predictors between the industries.

Insert Table 11 and Table 12 here

Our results attest that over different definitions of competition and leverage, the marginal sensitivities of competition to leverage and market shares, as well as the marginal sensitivities of leverage to competition and other covariates are different in different industries.

4.3. Granger Causality Tests

Finally, we get to test the causality in both directions between competition and leverage. As explained in the methodology section, we do that separately for each firm and then aggregate the results using the Kolmogorov-Smirnov procedure. This way we have only one p-value for each definition of competition and leverage. See Table 13 below.

Insert Table 13 here

Table 13 shows p-values of aggregate Granger causality tests. For each firm the maximum lag is 2. The p-values have been aggregated over firms using the Kolmogorov-Smirnov test. Consistently, we find that over different definitions of Competition and Leverage, the aggregate p-values of the Granger tests are much lower than the significance level of 10%. This is the case for both directions: the influence of leverage on competition and the influence of competition on leverage. The results definitively state that leverage causes competition and competition causes leverage.

5. Conclusion

This study first strived to confirm the assumption of differentiated debt levels between firms operating in Cournot versus Bertrand markets. Our results, however, indicate that there is no difference in the relative debt levels between the two competitive environments when using the CSM measure. Some differences are observed in the correlation of competition and leverage between Bertrand and Cournot firms when the samples are partitioned using the SI measure. However, these relationships are not maintained throughout the study with neither the CSM measure, nor independent sample t-test of the correlation using either CSM or SI measure.

The study then proceeds with conducting Kruskal-Wallis tests, to characterize differences in the coefficients, as well as the correlation, of competition and leverage over different industries. Results from the study confirm that the joint distribution of competition and leverage is different in different industries. The partial sensitivities of competition and leverage to half of financial factors in the study are different in different industries. The marginal sensitivities of competition and leverage to all factors in the study are different in different industries.

Over all industries and firms in our sample, we find that leverage Granger causes competition and competition Granger causes leverage.

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Tables

Table 1: DIFFERENCES IN THE COEFFICIENTS OF COMPETITION AND LEVERAGE BETWEEN THE TWO ENVIRONMENTS (CSM)

The table below reports results from estimating equation (**1**) $\text{Competition}_{it} = \beta_{C0} + \beta_{C1} * \text{Leverage}_{it} + \beta_{C2} * \text{Market Share}_{it} + \varepsilon_{it}$, with two-stage estimation, and testing the research hypothesis that the average debt level of firms relative to their industry concentration is different in Cournot versus Bertrand market. Competition and leverage measures are varied in each regression run and charted below for the various combinations as indicated. p-values presented correspond to independent sample t-tests allowing for unequal variances comparing the regression coefficients of leverage proxies in the "Competition" equation for a sample of Bertrand and Cournot firms, with the environment defined by the **CSM** measure. N represents the split between Bertrand and Cournot firms which is determined by the CSM measure.

Competitive strategy measure (CSM) for the nature of product market competition equal to the coefficient of correlation of the change in the firm's profit margin (Δ in net income ÷ Δ in net sales) with respect to the change in its competitors' output. $CSM = corr\left[\frac{\Delta S\Pi_1}{\Delta S_1}, \Delta S_2\right]$ where Π_1 is the change in firm's profit between two consecutive years, $\Delta S_1$is the change in the firm's, and $\Delta S_2$is the change in the firm's product rivals' combined sales between two years. If the marginal profit decreases with an increase in output, i.e. the correlation coefficient is negative, then the firms are presumed to be competing in a Cournot market; if on the other hand, the correlation coefficient is positive, firms are presumed to be competing in Bertrand market.

CONC, HHI, and BOONE are measures of competition defined on the industry-wide level (see section 3.5)
BVLD, MVLD, BVTD, MVTD are measures of leverage defined on the firm-specific level (see section 3.4)
Market Share is a control variable in the "Competition" equation (see section 3.5)

	CONC				HHI				BOONE			
	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD	MVTD
Leverage	0.103	0.018*	0.348	0.303	0.016*	0.134	0.134	0.220	0.125	0.412	0.337	0.332
Market Share	0.117	0.180	0.237	0.220	0.135	0.126	0.234	0.187	0.967	0.584	0.735	0.693
Constant	0.289	0.379	0.384	0.298	0.971	0.868	0.966	0.888	0.879	0.325	0.489	0.206
N (Bertrand/Cournot)	158/198	160/201	156/191	152/186	158/198	160/201	155/191	152/186	136/162	138/163	133/152	130/149

* denotes statistical significance level 10% or lower

Table 2:DIFFERENCES IN THE COEFFICIENTS OF COMPETITION AND LEVERAGE BETWEEN THE TWO ENVIRONMENTS(CSM)
The table below reports results from estimating equation (**2**) Leverage it = βL0 + βL1 * Competition it + βL2 * Risk it + βL3 * Asset Tangibility it + βL4 * Collateral it + βL5 * Liquidity it + βL6 * Profitability it + βL7 * Growth Options and Assets it + βL8 * Dividend it + βL9 * Tax Advantages of Debt it + βL10 * Size it + ζ it., with two-stage estimation, and testing the research hypothesis that the industry concentration level relative to the firms leverage level is different in Cournot versus Bertrand market. Competition and leverage measures are varied in each regression run and charted below for the various combinations as indicated. p-values presented correspond to independent sample t-tests allowing for unequal variances comparing the regression coefficients of competition proxies in the "Leverage" equation for a sample of Bertrand and Cournot firms, with the environment defined by the **CSM** measure. N represents the split between Bertrand and Cournot firms which is determined by the CSM measure.

Competitive strategy measure (CSM) for the nature of product market competition equal to the coefficient of correlation of the change in the firm's profit margin (Δ in net income ÷ Δ in net sales) with respect to the change in its competitors' output. $CSM = corr\left[\frac{\Delta S\Pi_1}{\Delta S_1}, \Delta S_2\right]$ where Π_1 is the change in firm's profit between two consecutive years, $\Delta S_1$is the change in the firm's, and $\Delta S_2$is the change in the firm's product rivals' combined sales between two years. If the marginal profit decreases with an increase in output, i.e. the correlation coefficient is negative, then the firms are presumed to be competing in a Cournot market; if on the other hand, the correlation coefficient is positive, firms are presumed to be competing in Bertrand market.

CONC, HHI, and BOONE are measures of competition defined on the industry-wide level (see section 3.5)
BVLD, MVLD, BVTD, MVTD are measures of leverage defined on the firm-specific level (see section 3.4)
Risk, Asset Tangibility, Collateral, Liquidity, Profitability, Growth Options and Assets, Dividend, Tax Adv of Debt, Size are all control variables of the leverage equation (see section 3.4)

	CONC			HHI					BOONE			
	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD	MVTD
Competition	0.160	0.573	0.382	0.747	0.604	0.235	0.361	0.287	0.042*	0.776	0.750	0.572
Risk	0.601	0.252	0.462	0.091*	0.545	0.160	0.638	0.325	0.844	0.255	0.218	0.057*
Asset Tangibility	0.499	0.957	0.381	0.168	0.335	0.121	0.401	0.250	0.231	0.355	0.090*	0.120
Collateral	0.271	0.707	0.296	0.776	0.516	0.322	0.083*	0.188	0.616	0.621	0.918	0.567
Liquidity	0.164	0.130	0.563	0.199	0.197	0.180	0.184	0.191	0.146	0.321	0.581	0.576
Profitability	0.487	0.228	0.448	0.623	0.595	0.361	0.840	0.149	0.115	0.677	0.047*	0.165
Growth Options	0.421	0.603	0.430	0.656	0.215	0.363	0.218	0.675	0.640	0.545	0.685	0.528
Dividend	0.241	0.270	0.321	0.948	0.515	0.568	0.245	0.066*	0.499	0.753	0.457	0.504
Tax Adv of Debt	0.341	0.902	0.281	0.503	0.240	0.728	0.867	0.373	0.769	0.199	0.189	0.587
Size	0.532	0.665	0.604	0.429	0.053*	0.335	0.378	0.563	0.150	0.436	0.067*	0.368
Intercept	0.117	0.557	0.281	0.685	0.561	0.508	0.824	0.893	0.094	0.390	0.089	0.304
N (Bertrand/Cournot)	155/190	156/191	150/182	147/177	161/199	162/201	156/191	153/186	139/162	140/163	134/152	131/149

* denotes statistical significance level 10% or lower

Table 3: DIFFERENCES IN THE COEFFICIENTS OF COMPETITION AND LEVERAGE BETWEEN THE TWO ENVIRONMENTS (SI)
The table below reports results from estimating equation (**1**) $\text{Competition}_{it} = \beta_{C0} + \beta_{C1} * \text{Leverage}_{it} + \beta_{C2} * \text{Market Share}_{it} + \varepsilon_{it}$, with two-stage estimation, and testing the research hypothesis that the average debt level of firms relative to their industry concentration is different in Cournot versus Bertrand market. Competition and leverage measures are varied in each regression run and charted below for the various combinations as indicated. p-values presented correspond to independent sample t-tests allowing for unequal variances comparing the regression coefficients of leverage proxies in the "Competition" equation for a sample of Bertrand and Cournot firms, with the environment defined by the **SI** measure. N represents the split between Bertrand and Cournot firms which is determined by the SI measure.

Strategic interaction measure (SI) is documented as the t-stat of $\beta_3 S_i + \beta_4$ in the regression: $\Delta(\Delta\Pi_1 / \Delta S_1)_t = \beta_0 + \beta_1 * S_1 * \Delta S_1 + \beta_2 * \Delta S_1 + \beta_3 * S_1 * \Delta S_2 + \beta_4 * \Delta S_2 + \varepsilon$. Where, $\Delta\Pi_1$ is the change is firm's profit for firm i, and S_1 is sales for firm i, ΔS_1 is the change in sales for firm i, and ΔS_2 is the change in sales for the rest of the industry. In particular, if an estimate of $(\beta_3 S_i + \beta_4)$ is statistically significant and negative the firm is presumed to be in the Cournot environment. If SI is statistically significant and positive the firm is presumed to be in the Bertrand environment.

CONC, HHI, and BOONE are measures of competition defined on the industry-wide level (see section 3.5)
BVLD, MVLD, BVTD, MVTD are measures of leverage defined on the firm-specific level (see section 3.4)
Market Share is a control variable in the "Competition" equation (see section 3.5)

	CONC				HHI				BOONE			
	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD	MVTD
Leverage	0.096*	0.132	0.282	0.488	0.266	0.486	0.727	0.275	0.948	0.952	0.663	0.846
Market Share	0.813	0.793	0.975	0.798	0.909	0.962	0.844	0.969	0.929	0.899	0.834	0.951
Constant	0.448	0.087	0.151	0.045	0.347	0.146	0.142	0.051	0.165	0.624	0.103	0.381
N (Bertrand/Cournot)	111/86	112/86	106/81	104/80	111/86	112/86	106/81	104/80	94/72	94/72	90/66	88/66

* denotes statistical significance level 10% or lower

Table 4: DIFFERENCES IN THE COEFFICIENTS OF COMPETITION AND LEVERAGE BETWEEN THE TWO ENVIRONMENTS (SI)

The table below reports results from estimating equation (**2**) Leverage it = βL0 + βL1 * Competition it + βL2 * Risk it + βL3 * Asset Tangibility it + βL4 * Collateral it + βL5 * Liquidity it + βL6 * Profitability it + βL7 * Growth Options and Assets it + βL8 * Dividend it + βL9 * Tax Advantages of Debt it + βL10 * Size it + ζ it., with two-stage estimation, and testing the research hypothesis that the industry concentration level relative to the firms leverage level is different in Cournot versus Bertrand market. Competition and leverage measures are varied in each regression run and charted below for the various combinations as indicated. p-values presented correspond to independent sample t-tests allowing for unequal variances comparing the regression coefficients of competition proxies in the "Leverage" equation for a sample of Bertrand and Cournot firms, with the environment defined by the **SI** measure. N represents the split between Bertrand and Cournot firms which is determined by the SI measure.

Strategic interaction measure (SI) is documented as the t-stat of $\beta_3 S_i + \beta_4$ in the regression: $\Delta (\Delta\Pi_1 / \Delta S_1)_t = \beta_0 + \beta_1 * S_1 * \Delta S_1 + \beta_2 * \Delta S_1 + \beta_3 * S_1 * \Delta S_2 + \beta_4 * \Delta S_2 + \varepsilon$. Where, $\Delta\Pi_1$ is the change is firm's profit for firm i, and S_1 is sales for firm i, ΔS_1 is the change in sales for firm i, and ΔS_2 is the change in sales for the rest of the industry. In particular, if an estimate of $(\beta_3 S_i + \beta_4)$ is statistically significant and negative the firm is presumed to be in the Cournot environment. If SI is statistically significant and positive the firm is presumed to be in the Bertrand environment.

CONC, HHI, and BOONE are measures of competition defined on the industry-wide level (see section 3.5)
BVLD, MVLD, BVTD, MVTD are measures of leverage defined on the firm-specific level (see section 3.4)
Risk, Asset Tangibility, Collateral, Liquidity, Profitability, Growth Options and Assets, Dividend, Tax Adv of Debt, Size are all control variables of the leverage equation (see section 3.4)

	CONC				HHI				BOONE			
	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD	MVTD
Competition	0.197	0.138	0.335	0.124	0.293	0.211	0.278	0.269	0.379	0.221	0.881	0.994
Risk	0.12	0.363	0.286	0.71	0.284	0.151	0.034*	0.222	0.35	0.897	0.214	0.233
Asset Tangibility	0.237	0.162	0.372	0.105	0.352	0.471	0.684	0.586	0.311	0.804	0.154	0.346
Collateral	0.291	0.046*	0.466	0.096*	0.276	0.171	0.486	0.387	0.476	0.362	0.356	0.875
Liquidity	0.552	0.612	0.137	0.097*	0.548	0.32	0.036*	0.028*	0.875	0.596	0.789	0.561
Profitability	0.073*	0.355	0.05*	0.362	0.154	0.667	0.196	0.734	0.161	0.462	0.316	0.769
Growth Options and Assets	0.076*	0.788	0.072*	0.099*	0.208	0.469	0.548	0.482	0.072*	0.346	0.17	0.209
Dividend	0.299	0.02*	0.219	0.535	0.273	0.752	0.231	0.537	0.325	0.047*	0.236	0.076*
Tax Adv of Debt	0.282	0.553	0.282	0.957	0.95	0.751	0.588	0.097*	0.197	0.202	0.448	0.36
Size	0.486	0.358	0.216	0.159	0.8	0.444	0.323	0.313	0.77	0.334	0.514	0.447
Intercept	0.134	0.135	0.209	0.131	0.271	0.352	0.334	0.404	0.411	0.581	0.757	0.506
N (Bertrand/Cournot)	108/83	108/83	102/78	100/77	112/87	113/87	106/82	104/81	95/73	95/73	90/67	88/67

* denotes statistical significance level 10% or lower

Table 5: DIFFERENCES IN THE CORRELATION OF COMPETITION AND LEVERAGE BETWEEN THE TWO ENVIRONMENTS (CSM)

The table below reports results from estimating equation (1) Competition it = βC0 + βC1 * Leverage it + βC2 * Market Share it + ε it, with two-stage estimation, and testing the research hypothesis that the correlation of debt level of firms relative to their industry concentration is different in Cournot versus Bertrand market. Competition and leverage measures are varied in each regression run and charted below for the various combinations as indicated. p-values presented correspond to independent sample t-tests allowing for unequal variances characterizing the difference of the pairwise correlations of leverage and competition for a sample of Bertrand and Cournot firms, with the environment defined by the **CSM** measure. N represents the split between Bertrand and Cournot firms which is determined by the CSM measure.

Competitive strategy measure (CSM) for the nature of product market competition equal to the coefficient of correlation of the change in the firm's profit margin (Δ in net income ÷ Δ in net sales) with respect to the change in its competitors' output. $CSM = corr\left[\frac{\Delta S\Pi_1}{\Delta S_1}, \Delta S_2\right]$ where Π_1 is the change in firm's profit between two consecutive years, $\Delta S_1$is the change in the firm's, and $\Delta S_2$is the change in the firm's product rivals' combined sales between two years. If the marginal profit decreases with an increase in output, i.e. the correlation coefficient is negative, then the firms are presumed to be competing in a Cournot market; if on the other hand, the correlation coefficient is positive, firms are presumed to be competing in Bertrand market.

CONC, HHI, and BOONE are measures of competition defined on the industry-wide level (see section 3.5)
BVLD, MVLD, BVTD, MVTD are measures of leverage defined on the firm-specific level (see section 3.4)
Market Share is a control variable in the "Competition" equation (see section 3.5)

	CONC				HHI				BOONE			
	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD	MVTD
Leverage	0.815	0.715	0.913	0.969	0.279	0.247	0.324	0.230	0.855	0.741	0.488	0.462
Market Share	0.585	0.640	0.730	0.756	0.335	0.440	0.395	0.362	0.199	0.187	0.298	0.243
N (Bertrand/Cournot)	159/199	160/201	156/191	152/186	159/199	160/201	156/191	152/186	137/162	138/163	134/152	131/149

* denotes statistical significance level 10% or lower

Table 6: DIFFERENCES IN THE CORRELATION OF COMPETITION AND LEVERAGE BETWEEN THE TWO ENVIRONMENTS (CSM)
The table below reports results from estimating equation (2) Leverage it = βL0 + βL1 * Competition it + βL2 * Risk it + βL3 * Asset Tangibility it + βL4 * Collateral it + βL5 * Liquidity it + βL6 * Profitability it + βL7 * Growth Options and Assets it + βL8 * Dividend it + βL9 * Tax Advantages of Debt it + βL10 * Size it + ζ it., with two-stage estimation, and testing the research hypothesis that the correlation between the industry concentration level relative to the firms leverage level is different in Cournot versus Bertrand market. Competition and leverage measures are varied in each regression run and charted below for the various combinations as indicated. p-values presented correspond to independent sample t-tests allowing for unequal variances characterizing the difference in the pairwise correlations of competition and leverage for a sample of Bertrand and Cournot firms, with the environment defined by the **CSM** measure. N represents the split between Bertrand and Cournot firms which is determined by the CSM measure.

Competitive strategy measure (CSM) for the nature of product market competition equal to the coefficient of correlation of the change in the firm's profit margin (Δ in net income ÷ Δ in net sales) with respect to the change in its competitors' output. $CSM = corr\left[\frac{\Delta S\Pi_1}{\Delta S_1}, \Delta S_2\right]$ where Π_1 is the change in firm's profit between two consecutive years, $\Delta S_1$is the change in the firm's, and $\Delta S_2$is the change in the firm's product rivals' combined sales between two years. If the marginal profit decreases with an increase in output, i.e. the correlation coefficient is negative, then the firms are presumed to be competing in a Cournot market; if on the other hand, the correlation coefficient is positive, firms are presumed to be competing in Bertrand market.

CONC, HHI, and BOONE are measures of competition defined on the industry-wide level (see section 3.5)
BVLD, MVLD, BVTD, MVTD are measures of leverage defined on the firm-specific level (see section 3.4)
Risk, Asset Tangibility, Collateral, Liquidity, Profitability, Growth Options and Assets, Dividend, Tax Adv of Debt, Size are all control variables of the leverage equation (see section 3.4)

	CONC				HHI				BOONE		
	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD
Competition	0.815	0.715	0.913	0.969	0.279	0.247	0.324	0.230	0.855	0.741	0.488
Risk	0.479	0.692	0.288	0.315	0.479	0.692	0.288	0.315	0.735	0.980	0.698
Asset Tangibility	0.118	0.167	0.092*	0.155	0.118	0.167	0.092*	0.155	0.161	0.375	0.064*
Collateral	0.053*	0.079*	0.108	0.067*	0.053*	0.079*	0.108	0.067*	0.126	0.263	0.131
Liquidity	0.151	0.187	0.669	0.233	0.151	0.187	0.669	0.233	0.195	0.325	0.700
Profitability	0.304	0.189	0.252	0.409	0.304	0.189	0.252	0.409	0.644	0.349	0.254
Growth Options and Assets	0.400	0.448	0.334	0.184	0.400	0.448	0.334	0.184	0.159	0.475	0.138
Dividend	0.903	0.951	0.976	0.413	0.903	0.951	0.976	0.413	0.676	0.822	0.799
Tax Adv of Debt	0.555	0.372	0.371	0.147	0.555	0.372	0.371	0.147	0.589	0.575	0.772
Size	0.238	0.065*	0.139	0.031*	0.238	0.065*	0.139	0.031*	0.503	0.344	0.547
N (Bertrand/Cournot)	160/201	156/191	152/186	159/199	160/201	156/191	152/186	137/162	138/163	134/152	131/149

* denotes statistical significance level 10% or lower

Table 7: DIFFERENCES IN THE CORRELATION OF COMPETITION AND LEVERAGE BETWEEN THE TWO ENVIRONMENTS (SI)
The table below reports results from estimating equation (1) Competition it = βC0 + βC1 * Leverage it + βC2 * Market Share it + ε it, with two-stage estimation, and testing the research hypothesis that the correlation of debt level of firms relative to their industry concentration is different in Cournot versus Bertrand market. Competition and leverage measures are varied in each regression run and charted below for the various combinations as indicated. p-values presented correspond to independent sample t-tests allowing for unequal variances characterizing the difference of the pairwise correlations of leverage and competition for a sample of Bertrand and Cournot firms, with the environment defined by the **SI** measure. N represents the split between Bertrand and Cournot firms which is determined by the SI measure.

Strategic interaction measure (SI) is documented as the t-stat of $\beta_3 S_i + \beta_4$ in regression: $\Delta (\Delta \Pi_1 / \Delta S_1)_t = \beta_0 + \beta_1 * S_1 * \Delta S_1 + \beta_2 * \Delta S_1 + \beta_3 * S_1 * \Delta S_2 + \beta_4 * \Delta S_2 + \varepsilon$. Where, $\Delta \Pi_1$ is the change is firm's profit for firm i, and S_1 is sales for firm i, ΔS_1 is the change in sales for firm i, and ΔS_2 is the change in sales for the rest of the industry. In particular, if an estimate of $(\beta_3 S_i + \beta_4)$ is statistically significant and negative the firm is presumed to be in the Cournot environment. If SI is statistically significant and positive the firm is presumed to be in the Bertrand environment.

CONC, HHI, and BOONE are measures of competition defined on the industry-wide level (see section 3.5)
BVLD, MVLD, BVTD, MVTD are measures of leverage defined on the firm-specific level (see section 3.4)
Market Share is a control variable in the "Competition" equation (see section 3.5)

	CONC				HHI				BOONE			
	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD	MVTD
Leverage	0.073*	0.532	0.049*	0.267	0.043	0.935	0.061*	0.302	0.661	0.861	0.581	0.726
Market Share	0.108	0.104	0.08*	0.077*	0.034*	0.03*	0.025*	0.035*	0.283	0.283	0.155	0.227
N (Bertrand/Cournot)	111/86	112/86	106/82	104/80	111/86	112/86	106/82	104/80	94/72	94/72	90/67	88/66

* denotes statistical significance level 10% or lower

Table 8: DIFFERENCES IN THE CORRELATION OF COMPETITION AND LEVERAGE BETWEEN THE TWO ENVIRONMENTS (SI)
The table below reports results from estimating equation (2) Leverage it = βL0 + βL1 * Competition it + βL2 * Risk it + βL3 * Asset Tangibility it + βL4 * Collateral it + βL5 * Liquidity it + βL6 * Profitability it + βL7 * Growth Options and Assets it + βL8 * Dividend it + βL9 * Tax Advantages of Debt it + βL10 * Size it + ζ it., with two-stage estimation, and testing the research hypothesis that the correlation between the industry concentration level relative to the firms leverage level is different in Cournot versus Bertrand market. Competition and leverage measures are varied in each regression run and charted below for the various combinations as indicated. p-values presented correspond to independent sample t-tests allowing for unequal variances characterizing the difference in the pairwise correlations of competition and leverage for a sample of Bertrand and Cournot firms, with the environment defined by the **SI** measure. N represents the split between Bertrand and Cournot firms which is determined by the SI measure.

Strategic interaction measure (SI) is documented as the t-stat of $\beta_3 S_i + \beta_4$ in regression: $\Delta (\Delta\Pi_1 / \Delta S_1)_t = \beta_0 + \beta_1 * S_1 * \Delta S_1 + \beta_2 * \Delta S_1 + \beta_3 * S_1 * \Delta S_2 + \beta_4 * \Delta S_2 + \varepsilon$. Where, $\Delta\Pi_1$ is the change is firm's profit for firm i, and S_1 is sales for firm i, ΔS_1 is the change in sales for firm i, and ΔS_2 is the change in sales for the rest of the industry. In particular, if an estimate of $(\beta_3 S_i + \beta_4)$ is statistically significant and negative the firm is presumed to be in the Cournot environment. If SI is statistically significant and positive the firm is presumed to be in the Bertrand environment.

CONC, HHI, and BOONE are measures of competition defined on the industry-wide level (see section 3.5)
BVLD, MVLD, BVTD, MVTD are measures of leverage defined on the firm-specific level (see section 3.4)
Risk, Asset Tangibility, Collateral, Liquidity, Profitability, Growth Options and Assets, Dividend, Tax Adv of Debt, Size are all control variables of the leverage equation (see section 3.4)

	CONC				HHI				BOONE			
	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD	MVTD
Competition	0.073*	0.532	0.049*	0.267	0.043*	0.935	0.061*	0.302	0.661	0.861	0.581	0.726
Risk	0.159	0.325	0.148	0.195	0.159	0.325	0.148	0.195	0.37	0.487	0.186	0.303
Asset Tangibility	0.718	0.953	0.983	0.954	0.718	0.953	0.983	0.954	0.301	0.47	0.491	0.519
Collateral	0.954	0.986	0.773	0.841	0.954	0.986	0.773	0.841	0.823	0.723	0.987	0.762
Liquidity	0.864	0.693	0.901	0.9	0.864	0.693	0.901	0.9	0.892	0.72	0.519	0.66
Profitability	0.697	0.643	0.718	0.715	0.697	0.643	0.718	0.715	0.813	0.601	0.688	0.882
Growth Options and Assets	0.19	0.602	0.049*	0.363	0.19	0.602	0.049*	0.363	0.26	0.319	0.054*	0.109
Dividend	0.255	0.779	0.54	0.745	0.255	0.779	0.54	0.745	0.493	0.77	0.929	0.932
Tax Adv of Debt	0.788	0.558	0.796	0.193	0.788	0.558	0.796	0.193	0.865	0.562	0.749	0.22
Size	0.798	0.916	0.861	0.532	0.798	0.916	0.861	0.532	0.879	0.766	0.816	0.56
N (Bertrand/Cournot)	111/86	112/86	106/82	104/80	111/86	112/86	106/82	104/80	94/72	94/72	90/67	88/66

* denotes statistical significance level 10% or lower, <0.01 denotes statistical significance level 1% or lower

Table 9: DIFFERENCES IN THE COEFFICIENTS OF COMPETITION AND LEVERAGE OVER INDUSTRIES

The table below reports results from estimating equation (1) Competition it = βC0 + βC1 * Leverage it + βC2 * Market Share it + ε it, with two-stage estimation, and testing for the differences in the correlation of debt level of firms relative to their industry concentration over different industries.
Competition and leverage measures are varied in each regression run and charted below for the various combinations as indicated. P-values presented correspond to Kruskal-Wallis test and characterize the difference in leverage coefficient relative to the industry competition level over the different industries. N represents the split between firms and industries sample used in test.

CONC, HHI, and BOONE are measures of competition defined on the industry-wide level (see section 3.5)
BVLD, MVLD, BVTD, MVTD are measures of leverage defined on the firm-specific level (see section 3.4)
Market Share is a control variable in the "Competition" equation (see section 3.5)

	CONC				HHI				BOONE			
	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD	MVTD
Leverage	0.994	0.995	0.917	0.507	0.064*	0.178	0.023*	<0.01	0.035*	0.028*	0.001*	0.093*
Market Share	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.037*	0.010*	0.024*	0.027*
Constant	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
N (firms/Industries)	4170/372	4206/373	4052/368	4000/368	4170/372	4206/373	4052/368	4000/368	4170/372	4206/373	4052/368	4000/368

* denotes statistical significance level 10% or lower, <0.01 denotes statistical significance level 1% or lower

Table 10: DIFFERENCES IN THE COEFFICIENTS OF COMPETITION AND LEVERAGE OVER INDUSTRIES

The table below reports results from estimating equation (2) Leverage it = βL0 + βL1 * Competition it + βL2 * Risk it + βL3 * Asset Tangibility it + βL4 * Collateral it + βL5 * Liquidity it + βL6 * Profitability it + βL7 * Growth Options and Assets it + βL8 * Dividend it + βL9 * Tax Advantages of Debt it + βL10 * Size it + ζ it., with two-stage estimation, and testing for the differences in the correlation of debt level of firms relative to their industry concentration over different industries. Competition and leverage measures are varied in each regression run and charted below for the various combinations as indicated. P-values presented correspond to Kruskal-Wallis test and characterize the difference in the competition coefficient relative to the firm's leverage level over the different industries.

CONC, HHI, and BOONE are measures of competition defined on the industry-wide level (see section 3.5)
BVLD, MVLD, BVTD, MVTD are measures of leverage defined on the firm-specific level (see section 3.4)
Risk, Asset Tangibility, Collateral, Liquidity, Profitability, Growth Options and Assets, Dividend, Tax Adv of Debt, Size are all control variables of the leverage equation (see section 3.4)

	CONC				HHI				BOONE			
	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD	MVTD
Competition	0.035*	<0.01	0.111	<0.01	0.995	0.994	0.998	0.768	0.726	0.649	0.278	0.844
Risk	0.006*	0.004*	0.004*	0.002*	0.137	0.024*	0.015*	0.06*	0.01*	<0.01	0.004*	<0.01
Asset Tangibility	0.179	0.07*	0.492	0.027*	0.018*	<0.01	0.074*	0.117	0.178	0.02*	0.443	0.21
Collateral	0.017*	0.073*	0.016*	0.034*	0.08*	0.875	0.299	0.025*	0.24	0.105	0.25	0.076*
Liquidity	0.199	0.043*	0.044*	0.031*	0.002*	0.006*	0.001*	0.001*	0.417	0.006*	0.547	0.021*
Profitability	0.001*	0.117	0.015*	<0.01	0.162	0.062*	0.017*	<0.01	0.042*	0.325	0.201	<0.01
Growth Options and Assets	0.03*	<0.01	0.001*	<0.01	0.005*	<0.01	<0.01	<0.01	0.014*	<0.01	0.001*	<0.01
Dividend	0.264	0.057*	0.241	0.139	0.04*	0.065*	0.791	0.047*	0.913	0.18	0.88	0.327
Tax Adv of Debt	0.734	0.504	0.459	0.008*	0.263	0.366	0.418	0.035*	0.834	0.769	0.56	0.037*
Size	0.043*	0.011*	0.059*	0.027*	0.057*	0.088*	0.066*	0.005*	0.127	0.076*	0.044*	0.032*
Intercept	0.023*	<0.01	0.097*	0.004*	0.256	<0.01	0.207	<0.01	0.588	0.001*	0.022*	<0.01
N (firms/Industries)	4046/372	4068/373	3902/368	3855/368	4222/372	4245/373	4071/368	4019/368	3688/313	3712/314	3538/306	3496/306

* denotes statistical significance level 10% or lower, <0.01 denotes statistical significance level 1% or lower

Table 11: DIFFERENCES CORRELATION OF COMPETITION AND LEVERAGE OVER INDUSTRIES

The table below reports results from estimating equation (1) Competition it = βC0 + βC1 * Leverage it + βC2 * Market Share it + ε it, with two-stage estimation, and testing for the differences in the correlation of debt level of firms and the industry concentration level over different industries. Competition and leverage measures are varied in each regression run and charted below for the various combinations as indicated. P-values presented correspond to Kruskal-Wallis test comparing the correlations of the competition proxies and candidate predictors between the different industries.

CONC, HHI, and BOONE are measures of competition defined on the industry-wide level (see section 3.5)
BVLD, MVLD, BVTD, MVTD are measures of leverage defined on the firm-specific level (see section 3.4)
Market Share is a control variable in the "Competition" equation (see section 3.5)

	CONC				HHI				BOONE			
	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD	MVTD
Leverage	0.262	<0.01	0.071*	<0.01	0.049*	<0.01	0.042*	<0.01	<0.01	<0.01	<0.01	<0.01
Market Share	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
N (firms/Industries)	4189/372	4211/373	4063/368	4000/368	4190/372	4211/373	4064/368	4001/368	3658/313	3680/314	3532/306	3480/306

* denotes statistical significance level 10% or lower, <0.01 denotes statistical significance level 1% or lower

Table 12: DIFFERENCES CORRELATION OF COMPETITION AND LEVERAGE OVER INDUSTRIES

The table below reports results from estimating equation (2) Leverage it = βL0 + βL1 * Competition it + βL2 * Risk it + βL3 * Asset Tangibility it + βL4 * Collateral it + βL5 * Liquidity it + βL6 * Profitability it + βL7 * Growth Options and Assets it + βL8 * Dividend it + βL9 * Tax Advantages of Debt it + βL10 * Size it + ζ it., with two-stage estimation, and testing for the differences in the correlation of debt level of firms and the candidate predictors over different industries. Competition and leverage measures are varied in each regression run and charted below for the various combinations as indicated. P-values presented correspond to Kruskal-Wallis test comparing the correlations of the competition proxies and candidate predictors between the different industries.

CONC, HHI, and BOONE are measures of competition defined on the industry-wide level (see section 3.5)
BVLD, MVLD, BVTD, MVTD are measures of leverage defined on the firm-specific level (see section 3.4)
Risk, Asset Tangibility, Collateral, Liquidity, Profitability, Growth Options and Assets, Dividend, Tax Adv of Debt, Size are all control variables of the leverage equation (see section 3.4)

	CONC				HHI				BOONE			
	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD	MVTD
Competition	0.262	<0.01	0.071	<0.01	0.049*	<0.01	0.042*	<0.01	<0.01	<0.01	<0.01	<0.01
Risk	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Asset Tangibility	<0.01	<0.01	0.001	<0.01	<0.01	<0.01	0.001*	<0.01	<0.01	<0.01	0.007*	0.001
Collateral	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Liquidity	0.145	<0.01	0.027	<0.01	0.145	<0.01	0.027*	<0.01	0.179	<0.01	0.011*	<0.01
Profitability	0.003	<0.01	0.027	<0.01	0.003*	<0.01	0.027*	<0.01	0.001*	<0.01	0.008*	<0.01
Growth Options and Assets	0.002	<0.01	<0.01	<0.01	0.002*	<0.01	<0.01	<0.01	0.001*	<0.01	<0.01	<0.01
Dividend	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Tax Adv of Debt	<0.01	<0.01	<0.01	0.008	<0.01	<0.01	<0.01	0.008*	<0.01	<0.01	<0.01	0.006*
Size	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
N (firms/Industries)	4189/372	4211/373	4063/368	4000/368	4190/372	4211/373	4064/368	4001/368	3658/313	3680/314	3532/306	3480/306

* denotes statistical significance level 10% or lower, <0.01 denotes statistical significance level 1% or lower

Table 13: GRANGER CAUSALITY TESTS

The Granger Causality test is done separately for each firm and then aggregate the results using the Kolmogorov-Smirnov procedure. As a result, we have only one p-value for each definition of Competition and Leverage. The results are based on the choice of parameter m, which is set to 2

Leverage is said Granger causes Competition with lags m, p and q if coefficients βCp - βCq are jointly statistically significant according to an F-test in the following regression: $\text{Competition}_{it} = \mu_{C0} + \alpha_{C1} * \text{Competition}_{i(t-1)} + \ldots + \alpha_{Cm} * \text{Competition}_{i(t-m)} + \beta_{Cp} * \text{Leverage}_{i(t-p)} + \ldots + \beta_{Cq} * \text{Leverage}_{i(t-q)} + \gamma_{C1} * \text{Market Share}_{it} + \varepsilon_{it}$.

Likewise, Competition is said to Granger causes Leverage with lags m, p and q if coefficients $\beta_{Lp} - \beta_{Lq}$ are jointly statistically significant according to an F-test in the following regression: $\text{Leverage}_{it} = \mu_{L0} + \alpha_{L1} * \text{Leverage}_{i(t-1)} + \ldots + \alpha_{Lm} * \text{Leverage}_{i(t-m)} + \beta_{Lp} * \text{Competition}_{i(t-p)} + \ldots + \beta_{Lq} * \text{Competition}_{i(t-q)} + \gamma_{L1} * \text{Risk}_{it} + \gamma_{L2} * \text{Asset Tangibility}_{it} + \gamma_{L3} * \text{Collateral}_{it} + \gamma_{L4} * \text{Liquidity}_{it} + \gamma_{L5} * \text{Profitability}_{it} + \gamma_{L6} * \text{Growth Options and Assets}_{it} + \gamma_{L7} * \text{Dividend}_{it} + \gamma_{L8} * \text{Tax}_{it}\ \text{Advantages of Debt}_{it} + \gamma_{L9} * \text{Size}_{it} + \zeta_{it}$.

	CONC				HHI				BOONE			
	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD	MVTD	BVLD	MVLD	BVTD	MVTD
Leverage ---> Competition	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Competition ---> Leverage	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02*	<0.01	<0.01	<0.01

<0.01 denotes statistical significance level 1% or lower, and * denotes statistical significance level 10% or lower

CHAPTER 2: DYNAMICS OF MULTI-MARKET TRADING

1. Introduction

Early academic literature strived primarily to understand the motives and net benefits to the firms that list their shares outside of their home market[22]. Many studies document the economic benefits of international cross-listings[23]. However, there is disagreement on the sources of the value created through cross-listing (Siegel, 2009; Karolyi, 2012). Beginning in the 2000's, academic focus changed from seeking to understand the motives of cross-listing toward understanding the economic consequences and dynamics of multi-market trading[24]. This was driven by growing dissatisfaction with the market segmentation hypothesis[25] as the reasoning of firms that chose to cross-list[26]. Baruch (2007) and Halling (2008) show that while some stocks displayed very active trading in the foreign exchange after the cross-listing event, other firms demonstrate only limited trading. The variability in the liquidity of cross-listed firms between home and host markets highlight the need to better understand the various factors influencing the distribution of the trading volume of a given multi-listed firm.

This paper investigates the determinants of foreign versus domestic trading volume, and contributes to the literature by examining factors not yet considered in the extant literature that may impact trading volume distribution of stocks listed in two or more countries. We frame our empirical investigation in the framework proposed by Llorente, Michaely, Saar, and Wang (2002) in which investors' trade to speculate on their private information or to rebalance their portfolios. Their model predicts that returns generated by speculative trades (driven by informed investors) tend to continue themselves following high volume days, as the information embodied in the original trade is gradually impounded in the price by market participants. On the other hand, returns generated by risk-sharing trades tend to reverse themselves following high volume

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[22] Karolyi (1998) provides a comprehensive survey of earliest contributions on international cross-listings which primarily focused on the valuation and liquidity effects of cross-listing, as well as the impact to the company's global risk exposure and cost of capital.

[23] Studies from Alexander, Eun, and Janakiramanan (1988), Foerster and Karolyi (1999), Miller (1999), Lang, Lins, and Miller (2003), Bailey, Karolyi, and Salva (2005), Coffee (1999), Reese and Weisbach (2002), Doidge, Karolyi, and Stulz (2004) all examine the sources of economic benefit from international cross-listings for issuers.

[24] The change in focus was set off from the findings of Foerster and Karolyi (1999) and Miller (1999). They uncovered statistically-significant share price reactions of 1.15% on the day of the cross-listing announcement; further economically-large pre-listing share-price run-ups of 10% and post-listing declines of 9%; and the most dramatic share-price reactions for large numbers of emerging-market firms listing on major U.S. exchanges, Level I OTC listings and private placements (Gagnon and Karolyi, 2010).

[25] "Market segmentation hypothesis" is the positive revaluation that arises from the elimination of a "super risk premium" representing additional compensation demanded by local investors for their inability to diversify their risks globally (Errunza and Losq, 1985).

[26] Karolyi, 2006 survey features a number of research initiatives, at the time, motivated with the growing dissatisfaction with the "conventional wisdom" of the market-segmentation hypothesis as a rationale for the choice of firms to cross-list.

days. We believe that hedging trades are more likely to impact volume distribution in cross-listed stocks, since a hedging trader's intent is primarily to allocate risk. This hypothesis is driven by the belief that a wider variety of stocks would become attractive to hedging traders attempting to diversify[27]. However, study from Baruch et al. (2007) does predict a higher share of trading volume for stocks with greater correlation with other assets in the foreign market, i.e. less diversification benefits. In other words, there are arguments for either side.

Several studies have suggested that culture plays an important role in the firm decision to cross-list[28]. Chui et al (2010) find that cross-country cultural differences are positively associated with trading volume. Hence, we argue that cross-country cultural differences measured with an individualism index developed by Hofstede (2001) may be an important determinant of trading volume distribution of multi-listed firms' stocks. The goal is to understand the extent to which the distribution of trading volume of stocks listed in two or more exchanges is influenced by the individualism measure. The individualism factor does not directly measure the behavioral biases of over optimism and overconfidence. However, literature studies in psychology suggest a link between individualism and overconfidence. The individualism theory suggests that traders/ investors in countries with more individualistic cultures tend to be more confident in their abilities, and perhaps, overconfident[29]. This confidence theoretically should impact trading volume in these countries; therefore we will seek to analyze this impact through testing.

Pagano (1989) suggests that when a stock is traded on more than one exchange with different level of execution costs, the trading from other exchanges should migrate to the exchange with the lowest trading cost. Therefore, another factor that we consider for their effect on the distribution of trading volume is a measure of price impact employed in Amihud's (2002) survey. This measure is intended to represent the daily price response associated with each dollar of trading volume. The larger the price impact measure, the greater is the impact of trading on prices, indicating a more illiquid market. In other words, it is measure of market liquidity i.e. an asset's ability to be sold without causing a significant movement in the price and with minimum loss of value. We expect that the trading volume distribution of cross-listed stocks would be affected by the liquidity level of the market in which it is listed.

Chordia et al.'s (2007) study of the impact of liquidity trading measure on the trading activities of a sample of NYSE/AMEX and NASDAQ stocks is at the base of the succeeding measure used in determining its impact on trading volume distribution. Chordia et al. study suggests that the extent of liquidity trading depends on stock visibility. Book to market, amongst others, is proposed as a proxy for firm visibility. Hence, we explore the relationship between book to market ratio and trading volume distribution of multi-listed firms.

Another potential determinant of trading volume distribution is the relative volatility of stock itself. This measure of a stock's risk is a key factor in many investment decisions. The literature on the whole is not conclusive on this measure as it relates to volume distribution of

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[27] Dodd et al. (2012) findings suggest that the ratio of foreign to domestic trading volume is larger when the return correlation between host and home market returns is low, that is, when the stock offers diversification benefits to foreign investors.

[28] Sarkissian and Schill (2004) finds that firms prefer to cross-list in markets that are more similar to their home market from an economic, industrial, geographic and cultural perspective. Licht (2004) argue that cultural distance between the foreign and home market significantly impact the degree of legal bonding attained from cross-listing.

[29] Individualism has been linked to overconfidence (Chui, Titman, and Wei, 2010).

cross-listed stocks. Therefore, we will evaluate the impact of relative volatility on volume distribution of cross-listed shares within our dataset.

In summary, this paper contributes to the development of this research area in that we explicitly associate the influence of trading motives of investors, a culture dimension factor: individualism, the daily stock price response associated with each dollar of trading volume, market to book ratio, as well as the relative volatility of stocks on the volume distribution of stocks from globally cross-listed firms.

The remainder of this paper is organized as follows. Section II outlines the necessary background information. Section III reviews the prior literature relevant to developing the hypotheses. Section IV provides more details on the factors. The sample and research design are discussed in Section V. Concluding remarks are presented in Section VI.

2. Background

The globalization trend led investors to seek diversification benefits by investing in the foreign equity market. Subsequently, firms also gained interest in raising capital globally by offering their shares on other exchanges outside of their home country (see Saugadaran (1988), Karolyi (1998, 2006), Doidge, Karolyi and Stulz (2004) and Sarkissian and Schill (2004)). They did so through cross-listing or depository receipts programs. Cross-listing refers to the listing of a company's common share on a different exchange than its primary and original stock exchange. Depositary Receipts (DRs) are transferable securities issued by depositary banks, which represent ownership of a given number of a foreign company's shares. These can be listed and traded independently from the underlying shares.

In 2012, a total of 133.4 billion DRs were traded in terms of volume and US $2.53 trillion in terms of dollar value traded. At the end of 2012, there were more than 2,300 Sponsored DR programs available for more than 1,750 companies from 85 countries. The DR market continues to grow with 89 new sponsored American Depository Receipt (ADR) programs and 208 unsponsored ADR programs added in 2012. Over the past 5 years, 605 new sponsored DR programs have been setup by 533 companies from 56 countries, demonstrating the continued growth of the market throughout the financial crisis (Deutsche Bank Depositary Receipts, Overview of 2012). The firms' ultimate goal in offering their shares outside of their home market ranges from gaining access to larger pools of capital, increasing trading volumes, to positioning firm for better governance rule for the benefit of investors (Karolyi, 2006, 2010; King & Mittoo, 2007).

3. Literature Review

Significant research exists on the area of trading volume in general, i.e. not specific to cross-listed firms. This study focuses on understanding the relative importance of determinants that may affect the distribution of trading volume of cross-listed firms. Therefore, this section reviews the background literature on this topic beginning with a discussion of general volume studies, following very broadly with early work documenting and evaluating the growing trend

of stock cross-listing; and subsequently, evolving to studies that sought to understand why there is variation in the success among various firms that cross-list their shares, i.e. volume distribution.

3.1 Volume and Cross-listing literature

Madhavan's (2000) survey on market microstructure highlights several volume related research studies. Amihud and Mendelson's (1980) research on asset pricing shows that expected returns are a decreasing function of liquidity. French and Roll's (1986) research shows the importance of information trading in price determination through an empirical study of the variability of stock returns over trading and non-trading days. They find the trading process itself causes about 12% of the daily return variance.

Looking at the general behavior of stock, research shows that price patterns are expected to vary in response to trades with different information content. Studies investigating the relationship between trading volume and aggregate stock return predictability at short horizons originate from the following authors. Campbell, Grossman, and Wang (1993) find that for both stock indexes and individual large stocks, the first-order daily return autocorrelation tends to decline with volume. Gallant, Rossi, and Tauchen (1992) investigate the joint dynamics of price changes and volume on the stock market. They find that daily trading volume is positively and nonlinearly related to the magnitude of the daily price change. Large price movements are associated with higher subsequent volume.

Hasbrouck's (1995) study of price discovery linked information shares (magnitude and persistence of arbitrage gaps) to the proportion of actual trading activity that take place across competing markets. Amihud et al. (1991, 1997) follows up with other studies supporting this original theory, documenting large changes in asset values for stocks moving to more liquid exchanges. It follows then that findings from this line of research could be applied to cross-listed stocks to evaluate the impact on trading volume since a commonly noted benefit of cross-listing is to gain access to more liquid markets.

Both Siegel (2009) and Karolyi (2012) have evaluated the sources of the benefits associated with cross-listing stocks, but overall evidence remains mixed. Bancel and Mittoo (2001) both note that corporate managers often cite an increase in stock liquidity as primary benefits. This view is supported by Foester and Karolyi's (1998) work which show that trading volume and value increase significantly when compared to before cross-listing. While this is true when viewed very broadly, it was shown that for some stocks the impact on trading volume is limited in many cases (Halling, et al., 2008; Baruch, et al., 2007).

Baruch et al. (2007) developed a new model of multimarket trading to explain the differences in the foreign share of trading volume of internationally cross-listed stocks. They investigate the variation in the US share of global trading volume across a sample of non-US stocks cross-listed on US exchanges. Their model predicts that under general conditions, the distribution of trading volume across home and host exchanges are related to the correlation of the cross-listed asset returns with the returns of other assets traded in the respective markets. They use a measure of incremental information based on the difference in R^2 of two regressions to explain the company's stock return. The first regression uses only the home market index return as explanatory variable, and the second regression utilizes both the foreign and the domestic market's index return. The information factor, in other words, quantifies the incremental contribution of foreign market movements in explaining a company's stock price in addition to the information contained in its domestic market returns. After controlling for a host

of factors, they find that in their sample, the US fraction of global trading is strongly, positively related to the US calculated measure of information factor.

Halling et al. (2008) investigates cross-listed firms and finds evidence of a decrease in foreign trading volume following a listing event. However, they also find that this occurrence was not consistent for firms from less developed markets, markets with worse insider-trading laws, small, high growth and technology-oriented companies, as well as firms from a different time-zone.

Seizing on the questions raised by Halling et al. (2008) relative to the potential impact of other variables on the distribution of trading volume, Wang and Zhou (2012), undertake a study to examine the cross-country distribution of trading volume of globally cross-listed firms. In addition, for firms that cross-list on multiple foreign host markets, they also review trading volume distribution, as well as the influence of the market and firms' characteristics among competing host markets. They document evidence of a higher share of trading volume for host markets that provide more information about the price of cross-listed firms. The information factor is the extent of information provided about the price of the cross-listed firm. It is a measure of the incremental information provided by a new market, in addition to those provided by the existing markets. It is estimated based on a generalized Baruch, Karolyi and Lemmon (2007) (BKL) model to allow for a prediction on the dependence of a stock's dynamic volume-return relationship on the extent of information asymmetry. To estimate the information regarding the price of stock *i* provided by a new market, they regress weekly returns of stock *i* in the domestic home market, on the weekly index returns in the existing market. The information factor, in other words, is estimated as the correlation of a stock with other assets in the host market. They document evidence of a higher share of trading volume for host markets that provide more information about prices of cross-listed firms, are closer to home markets, have lower trading costs, better information protection, and share a common language or legal origin with the home markets.

3.2 Factors Affecting Trading Volume Distribution by Extant Research

Halling et al. (2008) in their analysis of the location of stock trading with a US cross-listing, state that if after a cross-listing, competing markets continue to coexist, in principle, the variables that could affect the distribution of trading volume between two markets belong to three groups: (i) those relevant for non-information-based trading; (ii) those relevant for information-based trading, and (iii) those measuring trading frictions. Whereas, prior studies broadly categorized these variables into more broad "motives": fundamental and informational (Pagano, 1989; Chowdry and Nanda, 1991; Huddart, et al., 1999). Regardless of the categorization, many of the variables generally overlap in these studies, e.g. diversification (market correlation), legal environment, market proximity, and stock risk, among others. The related literature specific to the variables we will be evaluating in the paper will be reviewed below.

4. Additional Factors Considered by This Study and Their Measurements

This section discusses the additional factors that we will explore as determinants of trading volume distribution: Trading Motives, Culture Factor, Price Impact, Market to Book, and Relative Volatility.

Trading Motives: Hedging or Speculative

A factor not previously examined in the literature of trading volume distribution for cross-listed firms is the impact of trading motives: speculative or hedging. Focusing on the relationship between trading volume and short-horizon individual stock return autocorrelation, Llorente, Michaely, Saar, and Wang's (2002) study presents a model that documents additional evidence on the nature of the dynamic volume-return relation. They argue that stock returns autocorrelations under trading volume can reveal the main motive for trading. They depict two important motives for trading: allocation of risk (hedging trade) and speculation on future returns (speculative trade) based on coefficient generated from their model. They find that stocks associated with a high degree of informed trading, i.e. speculative trades, exhibit more return continuation on high volume days. Stocks that are associated with a low degree of informed trading, i.e. hedging trades, show more return reversal on high volume days. The authors explain that information-motivated trades, because they reveal new information, shift stock prices permanently. On the other hand, liquidity-driven trades only induce temporary price pressure effects. The stock prices change in order to attract risk-averse investors, and then these deviations are reversed. We suspect that hedging trades are more likely to drive increase volume distribution in cross-listed stocks, since the goal there is to diversify risk and cross-listed stocks may be well positioned to assist. However, some studies such as Baruch et al. (2007) provide valid arguments that would suggest the opposite. Therefore, our methodology will include this variable in which the correlation will imply the trading motivation. A significant positive correlation would indicate informed trading, a negative one would indicate portfolio balancing, and an insignificant correlation would indicate that neither motivation dominates, i.e. likely random liquidity trading. Specifically, for each stock in each exchange, we estimate the following.

(Equation 1) $R_{i,t+1}=C0_1+C1_i.R_{i,t}+C_{2i}.V_{i,t}R_{i,t}+e_{i,t+1}$

where $R_{i,t}$ is the daily return of the stock on day t and $V_{i,t}$ is the daily trading volume measured as daily turnover. Daily turnover is the total number of shares traded during the day (t) divided by the total shares outstanding for each stock. We should expect statistically significant positive values of C_2 coefficients for stocks that are associated with high degree of speculative trades and significantly negative values of C_2 for stocks with primarily hedging trades. Returns are generated by three sources: public information about future payoffs ($C_1=0$), investors' hedging trades resulting in negative serially correlated returns ($C_2 < 0$) and speculative trades with statistically positive returns ($C_2 > 0$).

Culture: Individualism

Hofstede (2001) defines culture as "the collective programming of the mind that distinguishes the members of one group or category of people from another". Sarkissian and Schill (2004), Licht (2004), Daugherty and Georgieva (2011) and Dodd, Frinjns, and Gilbert (2012) are several studies that suggest the impact of culture on cross-listing. Work by Sarkissian and Schill (2004) shows that firms prefer to cross-list on markets that are closer in proximity to the home market. This proximity, however, may be measured in terms of physical distance (geographic), cultural, or economically. In 2004, Licht takes this a step further arguing that the legal bonding resulting from cross-listing is also impacted by the cultural distance. On the same topic, it was shown that cultural similarity also impacts a firm's decision to de-list from the US markets (Daugherty and Georgieva, 2011). Dodd, Frinjns, and Gilbert (2012) examined the role of cultural similarity in a firm's choice of which host market to cross-list, and found that there was a greater propensity for a firm to cross list in a country with similar values as the home market. Studies in psychology have suggested that there is a link between individualism and overconfidence[30]. Ahern, Danielle, and Fracassi (2012) investigate the effect of cultural values on mergers around the world. They find significant and economically meaningful effect of culture on the volume of mergers. Chui, Titman and Wei (2010) examine the impact of culture on the returns of momentum strategies. They find that people in individualistic culture tend to be more optimistic about their abilities. They point to the findings of Odean (1998) as evidence. This study shows a correlation between the individualism measure and trading volume and volatility of stocks. Glaser and Weber (2009), as well as Statman, Thorley, and Vorkink's (2006) research also suggest that overconfidence generates excess trading activity.[31] The individualism index is based on survey conducted by Geert Hofstede and is available on the web.

Liquidity and Visibility: Price Impact, Market to Book ratio

More active markets tend to be more liquid. Liquidity is referred to as the ability to buy or sell significant quantities of a security quickly, anonymously, and with minimal or no price impact. There is substantial literature documenting that cross-listing improves a stock's liquidity[32]. Kyle (1985) suggests that prices are set in the market at an increasing function of order flow because market makers are unable to distinguish between order flows generated by informed traders as opposed to liquidity traders. Hence, Amihud's proxy 'price impact' is based on the idea that illiquidity is the relationship between the price change and the associated order flow or trading volume. Halling, Moulton, and Panayides (2011) examined the dynamics of trading volume in a multimarket setting in order to capture the degree to which traders actively exploit multimarket environments[33] and treat competing markets as one market. They show that

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[30] Hofstede (2001) classifies cultures into five dimensions and identifies individualism as the most closely related to overconfidence and self-attribution bias.

[31] Another potential determinant of trading volume distribution is related relative risk aversion of investors. Bakshi and Chen (1994) investigate the extent to which stock price movements are influence by variations in population age structure. They argue that investor's relative risk aversion increase with age. In Bakshi and Chen (1994), the weighted average age of the country population of persons 20 and older is used as measurement of age distribution.

[32] See Gagnon and Karolyi (2010b) for comprehensive survey.

[33] Multimarket environments refer to an environment where trading of shares of the same firm occurs in multiple markets. The focus of their study is to understand the extent to which investors are able and willing to trade in both markets; and the factors that may influence their behavior.

there is a strong association between liquidity improvements using Amihud's proxy for liquidity and "multimarket trading" measured as the correlation of trading volume shocks in domestic and cross-listed shares[34].

Chordia et al. (2007) test whether trading activity of stocks depends upon the degree of liquidity trading. They hypothesize that liquidity trading depends both on a stock's visibility, proxied by book to market ratio, and on portfolio rebalancing needs triggered by past price performance. They find that the impact of book to market on unsigned trading activity is not as robust as the coefficients of book to market changes in different sub periods and when controlling for the effect of earnings. Models by Pagano (1989) and Chowdry and Nanda (1991) show that cross-listing may not always enhance liquidity due to potential offsetting impact of market fragmentation.

Amihud's Price Impact measure (proxy of illiquidity) ($A_{i,t}$=Illiq or Illiquidity ratio) is obtained from daily data and is defined as the absolute (percentage) price change per dollar of annual trading volume.

(Equation 2) $$A_{i,t} = \sum_{j=1}^{d_t} \frac{|r_{i,j}|}{dvol_{i,j}}$$

$r_{i,j}$ = daily return
$dvol_{i,t}$ = dollar volume

Market to Book measure (Stock visibility) is defined by
(Equation 3) Market to Book ratio = Market value of assets/Book value of assets

Relative Volatility

Risky stocks drive more active trading among investors because riskier companies have higher level of prediction error, which require more frequent rebalancing of foreign investors' portfolios (Chordia, 2007). Riskier stocks are also more likely to cross-list in more developed markets as shown by Abdallah and Goergen (2008). This seems to indicate that high-risk stocks are more attractive to foreign investors. Halling, et al. (2008) found differing effects for volatility impact on the share of U.S. trading volume depending on whether the company is based in a developed or emerging market. We will examine the variable, relative volatility with respect to the US (host) market to investigate the measure's impact on volume distribution. Relative Volatility is the standard deviation of weekly stock returns in the host market relative to the standard deviation of weekly stock returns in the home market.

[34] They explain that positive volume shock correlations could arise from multimarket trading of discretionary traders or correlated trading needs of captive investors who respond to public firm-specific news or common economic shocks across markets. However, they explain that if correlated trading volume shocks were driven purely by correlated trading needs in the two markets, there should be no relation between the trading volume shock correlations and multimarket trading barriers and benefits such as liquidity.

5. Data and Methodology

5.1 Data and Sample

Our study examines a large sample of international firms from several countries whose shares are traded in their home market and in the U.S. concurrently through an American Depositary Receipt (ADR) facility. The initial sample consists of all companies whose shares were cross-listed in the U.S. major stock markets (NYSE, NASDAQ, and AMEX) at any point in time between 1993 and 2013.[35] Cross-listed firm names, stock ticker and CUSIP, ratio of ADR to ordinary share, listed exchange and level, region, industry, originality, underlying stock exchange, depositary bank, and effective date are obtained from the ADR universe on www.adr.com. Following the sample selection method of Wang and Zhou (2012), we will exclude financial firms, investment funds and trusts, firms from tax haven regions, as well as firms lacking data during the sample period selected. The size of the sample is further constrained by data availability. We retain ADRs classified as exchange-listed Level II and Level III (capital-raising) programs and exclude over-the-counter issues (Level I ADRs), as well as Securities and Exchange Commission (SEC) Regulation S shares and private placements issues falling under SEC Rule 144a. We also exclude preferred shares, Real Estate Investment Trust units. Cross-listed stocks with no home-market counterpart available are also discarded. We collect daily data on prices, return, number of shares traded, shares outstanding, market capitalization, and bid-ask spread from DataStream for the sample of ADR in their home and host exchanges.

5.2 Analyzing the Relative Importance of Factors

This section presents the methodology to be used in the empirical investigation of the determinants of the distribution of trading volume of the cross-listed stocks between foreign and domestic markets in a multivariate framework.

Similar to Halling et al. (2008), we measure the dependent variable, volume share, as the ratio of domestic to foreign trading volume for each cross-listed share. More precisely, volume share is defined as the trading volume on a host market divided by the trading volume on the home (foreign) market.

(Equation 5) $(Vol_{HT,i}/Vol_{HM})$

We examine the relation between the explanatory variables and trading volume shares in the following regression analysis.

(Equation 6) $Ln(Vol_{HT,i}/Vol_{HM})_{it} = \beta_0 + \beta_1(\text{Trading Motive}_{HT}/\text{Trading Motive}_{HM})_{it} + \beta_2 (Ind_{HT}\text{-}Ind_{HM})_i + \beta_3 (\text{Price Impact}_{HT}/\text{ Price Impact}_{HM})_{it} + \beta_4 (MTB_{HT}/\ MTB_{HM})_{it} + \beta_5 (\text{Volatility}_{HT}/\ \text{Volatility}_{HM})_{it} + \mu_{it}$

The dependent variable (volume shares) and explanatory variables trading motive, price impact, market to book (MTB), and relative volatility (RVol) vary over time. We estimate each

[35] Sample includes companies that were listed prior to 1993, as well as companies delisted prior to the end of the sample.

of these explanatory variables for each cross-listed stock in each calendar year by calculating their time-series annual average. In addition, we calculate the cross-sectional average of these factors for all cross-listings on the home and host market.[36] The explanatory variable, individualism (Ind), is constant and varies only by exchange. The individualism factor was evaluated as the difference between the U.S. and home markets, rather than as a ratio.

We will run two sets of regression analyses. The first will be a purely cross-sectional analysis including all variables (time-varying and fixed) in which the time-varying variables will be defined by their average across the applicable time period, and the second analysis will exclude the fixed variable, individualism, in a panel regression.

6. Results

Table 1 below shows the average values, for trading volume distribution (Volume Share), trading motive (Motive Ratio), culture differences (Culture Diff), illiquidity (Illiquidity Ratio), visibility (Visibility Ratio), as well as volatility (Volatility Ratio) of cross-listed firms on the host market relative to values in their home market exchange. Volume share factor is the ratio of host trading volume to the home trading volume. It shows that the relative share of trading volume for cross listed firms is approximately 5.28 times more than the share volume experience in the firms' home country[37].

[36] Average price impact is calculated as the time series average for every firm in its domestic market, as well as in the host market. The difference between the averages for every company (price impact at home – price impact on host) defines the price impact differences between the home and host markets.

[37] We limit our sample, and do not include firms from Canada, which in other studies accounts for close to half of the sample data, which could justify differences in the average volume share seen in other studies.

Table 1: Summary Statistics of foreign cross-listings

The table reports summary statistics of all cross-listings.
Volume Share is calculated as the ratio of companies trading volume in the host market to the trading volume in the firm's home market.
Motive Ratio is determined by the sign of the correlation coefficient of the regression of returns on Ri,t+1=C01+C1i.Ri,t+C2i .Vi,t Ri,t +ei,t+1 where Ri,t is the daily return of the stock on day t and Vi,t is the daily trading volume measured as daily turnover. Daily turnover is the total number of shares traded during the day (t) divided by the total shares outstanding for each stock. Motive ratio is the ratio of the average C2 factors on the host market by the C2 factors on the home market.
Culture Diff is calculated as the difference in the individualism index of the Host country to that of the Home country. This index is based on survey conducted by Geert Hofstede and is available on the web.
Illiquidity Ratio is defined as the absolute (percentage) price change per dollar of annual trading volume in the Host exchange relative to the Home exchange.
Visibility Ratio is defined as the Host to Home market to book ratio.
Volatility Ratio is the standard deviation of weekly stock returns in the host market relative to the standard deviation of weekly stock returns in the home market.

Variable	N	Mean	Std Dev	Minimum	Maximum
Id	2207			653	54660
Date	2207			Mar, 1994	Dec, 2013
VOLUME SHARE	2210	5.2872	2.446946	-1.876801	14.60938
MOTIVE RATIO	1267	-0.0229475	1.563204	-6.657308	7.268738
CULTURE DIFF	2231	37.43523	24.79724	1	78
ILLIQUIDITY RATIO	2210	-5.651614	2.166451	-15.07078	1.634969
VISIBILITY RATIO	2206	-2.36672	1.726983	-13.83571	3.619863
VOLATILITY RATIO	2231	0.0412624	0.2623259	-1.384045	3.017281

Table 2 covers the average correlation coefficients between our variables in the model examined. The absolute values of correlation coefficients between the each of the independent variables are are mostly less than 0.3.

Table 2: Correlation coefficients

Pearson Correlation Coefficients, N = 1257

Prob > |r| under H0: Rho=0

	VOLUME SHARE	MOTIVE RATIO	CULTURE DIFF	ILLIQUIDITY RATIO	VISIBILITY RATIO
MOTIVERATIO	**0.106**				
CULTUREDIFF	**0.2194**	**0.0063**			
LIQUIDITYRATIO	**-0.8715**	**-0.134**	**-0.2136**		
VISIBILITYRATIO	**0.4197**	**0.0884**	**0.1225**	**-0.5841**	
VOLATILITYRATIO	**0.0316**	**0.039**	**0.0303**	**0.0517**	**-0.12**

Distribution of Trading Volumes between Home and Host Markets

The table below shows the distribution of countries (home) with firms cross-listed on stock exchanges in the United States (host), excluding Canada. We evaluated a total of 172 firms listed on US exchanges. These 172 firms represent listings from a total of 33 home markets. Of these markets, the United Kingdom has the largest number of firms listed on US markets, with several other countries tied for the lowest number of cross listings, at 1.

Table 3 present the distribution of the 172 cross-listed firms from 33 different home markets listed in the U.S. major stock exchanges (NYSE, NASDAQ, and AMEX) between the time period 1993 and 2013. Values shown are the country average of the values examined for firms in their home and host exchange market.

Excluded are firms from Canada, financial firms, investment funds and trust firms, as well as firms from tax haven regions.
We retain ADRs classified as exchange-listed Level II and Level III (capital-raising) programs and exclude over-the-counter issues (Level I ADRs), as well as Securities and Exchange Commission (SEC) Regulation S shares and private placements issues falling under SEC Rule 144a.
We also exclude preferred shares, Real Estate Investment Trust units. Cross-listed stocks with no home-market counterpart available are also discarded.

country	COMPANIES LISTED	Volume Home	Volume Host	Motive Home	Motive Host	Culture Home	Culture Host	Illiquidity Home	Illiquidity Host	Visibility Home	Visibility Host	Volatility Home	Volatility Host
Argentina	8	219.9937	1039606	-0.2036	-0.2022	46	91	2.2E-06	2.4E-09	11900000	2532849	0.530	0.600
Australia	8	5925.439	1233372	-0.1967	-0.1642	90	91	3.1E-06	3.8E-09	14000000	959921.4	0.840	0.819
Belgium	2	839.3569	298388.1	-0.0548	-0.1358	75	91	2.5E-09	2.9E-11	32600000	28600000	0.390	0.392
Brazil	11	2185.725	1.19E+08	-0.0082	-0.8121	38	91	5.9E-07	1.6E-09	11900000	4307444	0.536	0.570
Chile	4	8014.977	6339419	-0.0111	-0.1372	23	91	1.6E-07	1.5E-10	4514526	528909.4	0.440	0.422
China	14	23134.94	5778190	-0.1778	-0.2946	20	91	1.8E-08	2.4E-10	19500000	470735.2	0.599	0.638
Colombia	1	9204.598	6139343	-0.0221	-0.1545	13	91	4.3E-09	5.7E-11	81000000	2661006	0.395	0.444
Denmark	2	4053.837	77190.94	-0.0985	-0.0583	74	91	1.9E-07	2.5E-09	2657483	1049538	0.509	0.814
Finland	1	24816.09	15200000	-0.1134	-0.2877	63	91	6.6E-10	5.6E-13	57700000	18200000	0.595	0.591
France	7	4494.694	560929	-0.1706	-0.1065	71	91	5.7E-08	2.1E-10	44700000	2928090	0.485	0.502
Germany	5	62.7276	527421.6	-0.2357	-0.1039	67	91	2.6E-07	1.2E-09	29100000	1912379	0.507	0.539
Greece	1	308.844	24478.69	-0.0154	-0.2258	35	91	1.2E-08	4.4E-10	9288621	188468.6	0.487	0.468
Hong Kong	7	24181	6724937	-0.1229	-0.217	25	91	6.2E-07	4.5E-09	43800000	1104051	0.729	0.726
India	9	2955.531	952161.2	0.1258	-0.1967	48	91	2.0E-07	6.1E-10	5211172	806782.7	0.689	0.722
Indonesia	1	7296.802	74461.41	-0.1118	-0.198	14	91	5.0E-08	1.4E-10	1770185	369156	0.589	0.512
Ireland	5	1968.824	907075.4	-0.3506	-0.0416	70	91	2.0E-06	1.0E-09	5901226	1222540	0.498	0.494
Israel	6	264.31	2715549	-0.1608	-0.1044	54	91	3.2E-07	9.9E-10	5086152	4066462	0.475	0.510

Table 3 cont. present the distribution of the 172 cross-listed firms from 33 different home markets listed in the U.S. major stock exchanges (NYSE, NASDAQ, and AMEX) between the time period 1993 and 2013.
Values shown are the country average of the values examined for firms in their home and host exchange market.

Excluded are firms from Canada, financial firms, investment funds and trust firms, as well as firms from tax haven regions.
We retain ADRs classified as exchange-listed Level II and Level III (capital-raising) programs and exclude over-the-counter issues (Level I ADRs), as well as Securities and Exchange Commission (SEC) Regulation S shares and private placements issues falling under SEC Rule 144a.
We also exclude preferred shares, Real Estate Investment Trust units. Cross-listed stocks with no home-market counterpart available are also discarded.

country	COMPANIES LISTED	Volume Home	Volume Host	Motive Home	Motive Host	Culture Home	Culture Host	Illiquidity Home	Illiquidity Host	Visibility Home	Visibility Host	Volatility Home	Volatility Host
Italy	2	11797.43	447226.2	-0.1012	-0.1381	76	91	3.4E-09	1.2E-11	57700000	1404847	0.365	0.359
Japan	12	3053.854	222853.5	0.0657	-0.0826	46	91	1.1E-08	1.8E-09	24600000	1031844	0.421	0.416
Mexico	8	5121.361	19800000	-0.1127	-0.1272	30	91	2.2E-07	9.1E-10	5070119	4433115	0.536	0.548
Netherland	1	8721.495	1031265	-0.1715	-0.3518	80	91	4.2E-10	2.8E-12	29400000	3480250	0.458	0.456
Norway	1	8304.163	995252	-0.2799	-0.3856	69	91	8.2E-10	2.8E-11	56500000	1252805	0.427	0.416
Philippines	1	162.8915	171534.6	-0.2551	-0.241	32	91	1.9E-08	1.8E-11	5941659	1476006	0.420	0.412
Portugal	1	4674.439	181323.8	-0.1358	-0.1988	27	91	2.7E-09	3.8E-11	7054510	515595.9	0.361	0.383
Russia	2	846.3413	3516274	-0.1709	-0.5169	39	91	1.2E-07	2.9E-12	12400000	4990457	0.607	0.705
South Africa	5	1059.101	6315453	-0.0541	-0.0892	65	91	1.5E-07	2.1E-10	6010875	1309674	0.574	0.564
South Korea	5	939.0795	253106.9	-0.0961	-0.1743	18	91	3.6E-09	9.8E-12	14800000	2449020	0.505	0.495
Spain	3	22583.08	951722.3	-0.0643	-0.0614	51	91	1.1E-08	9.6E-11	47100000	2913794	0.451	0.495
Sweden	1	18441.24	5873954	-0.1603	-0.2648	71	91	5.5E-10	1.5E-12	102000000	6710815	0.583	0.904
Switzerland	5	4434.108	873414.4	-0.1197	-0.0882	68	91	1.8E-09	7.9E-11	42800000	3902431	0.407	0.409
Taiwan	7	42264.41	9713260	-0.1439	-0.1765	17	91	3.9E-09	3.8E-10	7781094	863201.1	0.521	0.592
Turkey	1	5866.902	1168879	-0.2096	-0.1283	37	91	5.7E-09	5.2E-11	8941930	793053.1	0.597	1.062
U.K.	25	19566.78	4537348	-0.0722	-0.1747	89	91	2.5E-07	7.6E-10	36900000	5620705	0.405	0.489
ALL COUNTRIES	172	9843.553	7735480	-0.1018	-0.1811	54	91	4.4E-07	1.0E-09	22500000	2925949	0.512	0.549

Table 4 shows the mean values of ratios of company and market characteristics evaluated at the country level. All of the characteristics evaluated in the paper are company characteristics with the exception of culture, which is a market characteristic. We first calculate the ratio of volume share (Volratio) defined as the volume of the host markets divided by the volume of the home market. Note that this measure only examines the US volume versus the home market, and not trading on other host markets on which a firm may be listed. We found that, on average, the US market attracts 5.25 times the trading volume of the corresponding home market. The country with the largest difference in trading volume is Russia, with the US attracting approximately 9 times more volume, followed by the German markets. The country with the least difference is Indonesia, with the US markets attracting approximately 2 times the trading volume as their markets.

Next, we look at trading motive (equation 1), as a factor that may influence the trading volume distribution of cross-listed firms in the host country relative to the home country. We calculate the yearly trading motive for each cross listed firm, as well as the time series average of the trading motive for each firm. Also each the average for all firms in a given country is taken with the results shown in Table 4. The average trading motive among the firms was -1.39. 23 of the 33 countries primarily have a different trading motive than the U.S., as indicated by the negative values. The remaining 10 have the same trading motives. Trades in the U.S. in general have hedging motive as strategy.

Next, we examined the culture factor of the home versus host markets. This was measured by subtracting the Hofstede index for each country from that of the United States. Therefore, the larger the difference between the indices, the more significant the difference is in culture between the two countries. The average difference in the Hofstede index was 36.89. The country most similar in culture to the US was Australia with a difference of 1, followed by the U.K. with a difference of 2. The countries with the greatest difference in culture from the US were Columbia, Indonesia, Taiwan, and South Korea with differences of 78, 77, 74, and 73, respectively.

Next, the difference in the liquidity of the firms' shares in the home versus host markets was examined. Amihud's price impact measure (equation 2) is used as the measure for stock illiquidity and the ratio of US versus the home country is shown in Table 4. The average relative price impact is shown to be 0.032. The countries with the most difference in liquidity relative to US are Argentina and Russia with at 0.00071 and 0.0034 respectively. The country most similar in liquidity is Japan at 0.129.

The next characteristic examined is stock visibility, measured by market to book ratio (equation 3). The average difference in stock visibility is 0.446. The country with the highest difference in stock visibility compared to the US was South Africa with 1.69. The country with the lowest difference was Norway at 0.019.

Lastly, volatility measure was examined between US and host market. The average difference in volatility was measured at 1.09. The country with the highest and lowest difference was Turkey at 1.34 and Indonesia at 0.892, respectively.

Table 4 summarizes mean values for characteristics studied by country of origin. Mean values are calculated by averaging the variables ratios within each home country.

COUNTRY	COMPANIES LISTED	VOLUME SHARE	MOTIVE RATIO	CULTURE DIFF	ILLIQUIDITY RATIO	VISIBILITY RATIO	VOLATILITY RATIO
Argentina	8	8.601625	-15.58009	45	0.0007123	1.255763	1.16219
Australia	8	4.601905	-0.2083123	1	0.0341119	0.2184671	1.030291
Belgium	2	3.759392	-0.2429382	16	0.0195543	0.3445948	1.005185
Brazil	11	7.443811	4.561736	53	0.0035773	0.7008642	1.132456
Chile	4	5.189591	-2.734097	68	0.0011759	0.1358708	1.021824
China	14	5.197524	3.366598	71	0.0142176	0.0746278	1.182699
Colombia	1	6.1639	1.173	78	0.00593	0.0643	1.15229
Denmark	2	2.693829	-1.81635	17	0.022587	1.164865	1.344934
Finland	1	6.0118	-56.538	28	0.00315	1.1076	1.05736
France	7	4.404571	-0.8523896	20	0.0446151	0.1210546	1.04152
Germany	5	8.049944	0.9787331	24	0.0017041	0.1140158	1.099936
Greece	1	3.8743	0.304	56	0.0722	0.0235	0.96584
Hong Kong	7	5.386426	-0.9456071	66	0.0045749	0.0933856	1.034661
India	9	5.93027	-4.113581	43	0.0084695	0.2643176	1.122818
Indonesia	1	2.0094	2.253	77	0.00241	0.4714	0.89273
Ireland	5	6.824564	-1.301455	21	0.0232201	0.5321603	1.041024
Israel	6	6.807738	-0.8167684	37	0.0086026	0.7474823	1.14359
Italy	2	3.911183	0.7419321	15	0.0363962	0.0597596	1.006128
Japan	12	3.218972	0.5381683	45	0.1294757	0.8417371	1.007173
Mexico	8	7.04191	-2.338519	61	0.0035649	0.8639063	1.058686
Netherland	1	4.8027	-0.155	11	0.01527	0.1187	1.01541
Norway	1	4.3187	0.243	22	0.0373	0.019	0.97334
Philippines	1	6.9067	0.751	59	0.00248	0.2942	1.02434
Portugal	1	3.3836	-2.753	64	0.04318	0.1585	1.11359
Russia	2	8.969223	28.90332	52	0.0003498	0.3646692	1.315647
South Africa	5	6.840566	1.343195	26	0.0188356	1.692409	1.018566
South Korea	5	5.740272	-0.9256411	73	0.0099276	0.2373975	1.03905
Spain	3	3.374214	1.734219	40	0.0371568	0.268906	1.114703
Sweden	1	5.6025	-11.232	20	0.00553	0.3769	1.22908
Switzerland	5	4.589351	-5.804907	23	0.0494495	0.0822878	1.038991
Taiwan	7	4.630335	-2.328618	74	0.0413296	0.0959894	1.175212
Turkey	1	4.9539	-0.214	54	0.00798	0.1375	1.34916
U.K.	25	3.740425	0.2960048	2	0.0427025	0.1248714	1.143015
ALL COUNTRIES	172	5.251377	-1.394631	36.89278	0.03164	0.4467254	1.09375

Regression Analysis

We will examine the distribution of trading volume between the home (foreign) and host (US) markets. We will discuss the results of univariate analysis on the distribution of trading volume and a multivariate analysis to examine the determinants of this distribution, similar to the method used by Wang and Zhou, 2012.

Univariate Analysis

Our first regression analysis consisted of running the regression on each variable independently to evaluate the impact on the distribution of trading volume. The dependent variable is the logged volume share ratio of the host versus home markets $\log(Vol_{host}/Vol_{home})$. All of the independent variables except culture are also logged to gain a more symmetric distribution of the residuals. The factors: motive, culture, liquidity, and visibility are statistically significant at 1% or lower. The volatility factor was not found to be significant.

On the first factor, trading motive estimates are positively correlated to the trading volume distribution of cross-listed firms on the host market relative the volume on the home market. For a more precise evaluation of trading motive, we ran the regression of the log of volume share on the log of the trading motive factor on two samples of the data, both of which consisting of markets with differing trading motives. One sample contains companies in the host market with hedging as the trading motive, and the other sample is of companies in host market with primarily speculative motive. From these two samples, we find that when the host market motive is hedging and the home market is speculative, there is not an incentive for increased volume in the host market, the coefficient is negative; however, when the home market motive is hedging, the coefficient of motive factor is positive, indicating an increase in the distribution of volume in the host (US) market. In other words, a hedging motive in the home country leads to an increased proportion of trading in the host country relative to the home country, while speculative motive leads to a decrease in the volume share of the host country relative to the home country.

On the second factor, culture difference, it is shown that an increase in the cultural difference results in an increase in the volume share for the US market. For illiquidity ratio, the estimate shows that the more liquid the firms' shares are on the host market compared the home market; there is an increase in volume share for the host market. It is also shown for that the more visible a firm is in the host market relative to the home market, the more volume distribution in the host market. As stated earlier, relative volatility, was not found to be significant in the univariate analysis.

Table 5: Determinants of the Distribution of Trading Volume- Univariate

Results are from "univariate" regressions involving only one independent variable per regression.
The dependent variable is the log of trading volume share.

Univariate Regression Dependent Variable: LOGVOLUMESHARE					
	MOTIVE RATIO	CULTURE DIFF	ILLIQUIDITY RATIO	VISIBILITY RATIO	VOLATILITY RATIO
Estimates	0.16062	0.01652	-0.98802	0.63018	0.04702
t-statistics	3.71	7.99	-84.83	23.09	0.22
Pr > |t|	<.0001	<.0001	<.0001	<.0001	0.828
Obs-Co Yrs	1264	2210	2210	2187	2210
Adj. R-square (%)	1.00	2.76	76.52	19.6	-0.04

Multivariate Analysis

We next ran regressions using combinations of multiple variables, as well as, regressing all of the variables in one model. These were the same independent variables that were run in the univariate analysis with the dependent variable being the volume share ratio of host versus home markets. These combinations are shown in Table 6 as models 1 through 12. Model 1 was a multivariate regression ran with all the variables. All are significant with the exception of trading motive, with an R-squared of 77.62%. Deviating from the univariate analysis, motive and volatility reversed places in terms of significance in the multivariate analysis. Model2 was ran disregarding the motive factor and in this case all of the factors are significant and the adjusted R-squared is at 77.8%. Model2 dropped the culture factor, in addition to the motive factor and the remaining variables are still significant and the model's adjusted R-squared is at 77.3%. Model10 regress the volume share against motive culture and illiquidity. In this case, motive is again insignificant, with culture still positively correlated and illiquidity being negatively correlated with an R-squared of 76.4%. Model7 consisted of motive, culture, illiquidity, and visibility. Motive again remains insignificant in this combination. Illiquidity remains significant and negatively correlated, and visibility is negatively correlated. The R-squared for this combination is 77.22%. Model5 are all the variables except for motive and visibility. All variables included remains significant. All signs are the same for the repeated variables, with the new variable, volatility, showing a positive correlation with an R-squared of 77.37%. In summary, for Model2, as can be seen in Table 6, the fit (adjusted R-squared) of the model is the best fit for the run with all variables, except for motive, with an r-squared of 77.8%.

Table 6: Determinants of the Distribution of Trading Volume- Multivariate

Dependent Variable: LOGVOLUMESHARE

		Model1	**Model2**	**Model3**	**Model4**	**Model5**	**Model6**	**Model7**	**Model8**	**Model9**	**Model10**	**Model11**	**Model12**
MOTIVE RATIO	Coef.	-0.01859			-0.0198			-0.01364			-0.01287	-0.01377	
	Std. Err.	0.020961			0.02099			0.021119			0.0213	0.021346	
	t-stat	-0.89			-0.94			-0.65			-0.6	-0.65	
	P>|t|	0.375			0.346			0.518			0.546	0.519	
CULTURE DIFF	Coef.	0.002986	0.002716			0.002872		0.003258		0.00302	0.003481		0.002873
	Std. Err.	0.0013	0.000993			0.00101		0.00131		0.001027	0.001341		0.00101
	t-stat	2.3	2.73			2.84		2.49		2.94	2.6		2.84
	P>|t|	0.022	0.006			0.005		0.013		0.003	0.01		0.004
LIQUIDITY RATIO	Coef.	-1.08853	-1.05557	-1.06115	-1.09641	-0.9925	-0.99773	-1.08944	-1.05835	-0.98257	-0.997	-1.00601	-1.05246
	Std. Err.	0.019379	0.014234	0.014107	0.019105	0.011633	0.011504	0.019548	0.014347	0.011774	0.016236	0.015896	0.014473
	t-stat	-56.17	-74.16	-75.22	-57.39	-85.32	-86.73	-55.73	-73.77	-83.45	-61.41	-63.29	-72.72
	P>|t|	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
VISIBILITY RATIO	Coef.	-0.17854	-0.14222	-0.14335	-0.17841			-0.19102	-0.15642				-0.15515
	Std. Err.	0.023336	0.017822	0.017844	0.023376			0.023394	0.018088				0.018064
	t-stat	-7.65	-7.98	-8.03	-7.63			-8.17	-8.65				-8.59
	P>|t|	<.0001	<.0001	<.0001	<.0001			<.0001	<.0001				<.0001
VOLATILITY RATIO	Coef.	0.71466	0.913381	0.918581	0.729537	0.905723	0.910663						
	Std. Err.	0.148818	0.104523	0.104661	0.148931	0.103482	0.103634						
	t-stat	4.8	8.74	8.78	4.9	8.75	8.79						
	P>|t|	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001						
	Adj. R^2	77.62	77.8	77.73	77.54	77.37	77.29	77.22	76.96	76.59	76.38	76.28	77.03

Panel Data Analysis

We proceed and perform a panel data analysis in order to control for other variables that may be influencing volume distribution, but are not easily measured. This also reduces the risk of bias in the OLS regression due to omitted variables.

To undertand if there are significant grounds for changes within each of the companies volume shares as seen in the graph above. We first run the fixed-effects model, which control for all time-invariant differences between the companies. Results from fixed effects model show that approximately 96% of the of the variance in the log of volume share can be explained by the variables in the study. The coefficient for motive is positive, and signifant. The coefficient indicates that the trading volume share of the host relative to the home exchange increase 2.7% with every percent change in the trading motive factor. The coefficient of liquidity, visibility, as well as volatility are also all significant, and have the assumed sign sign for their relatioship with trading volume share. The intraclass correlation shows that 88.9% of the variance is due to differences across the sample companies panels. We test to see if time fixed effect is needed when running the Fixed Effect model, and finds that the time fixed-effects are needed in analysing this relationship.

Table 7: Determinants of the Distribution of Trading Volume- FIXED EFFECT MODEL

	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
MOTIVE RATIO	0.027839	0.008497	3.28	0.001	0.011167	0.044511
ILLIQUIDITY RATIO	-1.06699	0.014961	-71.32	<.0001	-1.09635	-1.03764
VISIBILITY RATIO	-0.15361	0.015958	-9.63	<.0001	-0.18492	-0.1223
VOLATILITY RATIO	0.702332	0.06863	10.23	<.0001	0.567669	0.836996
_cons	-1.1266	0.106508	-10.58	<.0001	-1.33559	-0.91762

7. Conclusion

This paper looked at various factors that may affect the trading volume distribution of American Depository Receipts. We contribute to the development of this research area in that we explicitly associate the influence of trading motives of investors, a culture dimension factor: individualism, the daily stock price response associated with each dollar of trading volume, market to book ratio, as well as the relative volatility of stocks on the volume distribution of stocks from globally cross-listed firms. In the multivariate regression, there is not a significant relationship with motive. Controlling for time-specific effects, in a fixed effect model, we find that the relative motive measure of cross-listed firms on the host market to the home market has a positive relationship on the trading volume distribution. Specifically, when looking at a small sample of firms with different motive factors, we find that hedging motive in the home country leads to an increased proportion of trading in the host country relative to the home country, while speculative motive leads to a decrease in the volume share of the host country relative to the home country. In addition, in our fixed effect model, we also find a positive and significant association of the volatility factor with the trading volume share.

Culture difference is found to positively impact trading on the host market relative to the home market. The relative liquidity of a firm's stock in the host market compared to its home market is found to positively drive more volume proportion in the host market. The more visible the firm stock in the host market relative to the home market, the higher the proportion of trade in the host market.

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