Industry Concentration and Investment Funding:

The Importance of Understanding the Market Structure

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Abstract

Prior studies document that firms use less debt financing relative to equity financing, and preserve more cash holding when they face competitive pressure. However, those studies are silent on the potential difference in market structure between price and non-price competition. Focusing on the industry concentration as an inverse measure of competition pressure, we find that the influences of industry concentration on external financing and cash holding are stronger for non-price competition industries than for price competition industries. Further analysis shows that the difference between price and non-price competition is more pronounced when industry is growing, firm has growth opportunity, or firm is younger. This implies that high industry concentration is more likely to indicate low competition pressure for non-price competition industries than for price competition industries.

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1. Introduction

This study investigates an influence of industry-level competition type on the relation between industry concentration and investment funding choice. Many studies document that firms under intense industry competition fund investment using less debt, more equity financing, and less cash holding because competition pressure reduces profitability and increases default risk (Ovtchinnikov, 2010; Xu, 2012; Hoberg et al., 2014; Morellec et al., 2014). However, the potential difference between price and non-price competition is unexplored in this literature. Based on the product market research that highlights the difference in market structure between price and non-price competition, we provide new evidence that the relation between industry concentration and financing activities.

Several studies show that a firm's behavior as a response to product market competition can be different between price and non-price competition (Stigler, 1968; Sutton, 1991). While the firm under price competition competes by setting low prices, non-price competition requires firm to obtain market share by building up brand value, improving the quality of products and services, and providing reliable guarantee services. Therefore, firms in non-price competition industries have a higher reliance on intangible investments such as advertisement or research and development (R&D) expenditures than those in price competition industries (Sutton, 1991; Symeonidis, 2000; Karuna, 2007).

Particularly, Sutton (1991) highlights the difference of market structure between price and non-price competition by focusing on industry concentration in the presence of endogenous sunk costs such as advertising, and R&D investments. He defines endogenous

sunk costs as investments that increase in market size and hinder other firms (i.e., competitors or potential entrants). He suggests that an increase of market size in the industry without endogenous sunk costs intensifies competition in the long run, yielding very low industry concentration, even if the initial level of concentration is high in the short run. In contrast, he argues that an increase of market size in the industry with endogenous sunk costs would result in a substantial level of industry concentration because endogenous sunk costs create the entry barrier for potential entrants. As a result, as market size increases, price competition industry becomes fragmented and non-price competition industry becomes concentrated. These arguments imply that high industry concentration in short run can be a weaker indicator of low industry competition in the long run under price competition than under non-price competition.[1] Exploring this different implication of industry concentration under price and non-price competition, we examine whether the positive relation between industry concentration and the use of debt financing relative to equity financing is different between price and non-price competition.

To compare financing choice of firms under price and non-price competition, we use U.S. firms from 1990 to 2012. We use the Herfindahl-Hirschman Index (HHI) of total assets and the HHI of sales, which are based on Compustat database. We also use the HHI based on the Census of Manufactures publications provided by the U.S. Census Bureau, which covers all public and private companies, because HHIs based on Compustat database do not consider private firms (e.g., Karuna, 2007; Ali et al., 2014). We capture industry-level endogenous sunk costs, which have the most important role in the difference between price and non-price competitions, by calculating industry-level expenses-to-sales ratio. Empirical identification of endogenous sunk costs should be the entry barrier against new competitors, which is

[1] Given that price competition is more similar to the industry with complements rather than to the industry with substitutes, this is consistent with Bulow et al.'s (1985) suggestion that firms choose more aggressive strategy in industry with complements.

constructed by incumbent firms and is not replicated by short-term catch-up by other firms. Prior studies define non-price competition industries as industries with a higher reliance on advertising activities because investment on advertisements builds up the entry barrier through enhanced customer loyalty and wider exposure to customers' sights (Stigler, 1968; Sutton, 1991; Symeonidis, 2000). Following this convention, we classify the industries with advertising expenses-to-sales ratios higher (lower) than the industry-level median as non-price (price) competition industries.[2]

We start an empirical analysis by showing that a positive relation between industry concentration and the firm's profitability is more pronounced for non-price competition industries than for price competition industries. This indicates that the potential economic gain from limiting the number of firms within industry is larger for non-price competition compared to price competition. We then link this finding to investment funding decision because the decreased profitability due to competition pressure is a primary reason on the negative relation between competition pressure and firm's leverage decision in prior studies (Ovtchinnikov, 2010; Xu, 2012; Hoberg et al., 2014; Morellec et al., 2014).

We find that firms under non-price competition fund investments using more debt financing, less equity financing, and more cash holding when industry concentration is higher, while such relations are weaker or insignificant for firms under price competition. Further analysis shows that the difference of the relation between industry concentration and investment funding decision between price and non-price competition is more prevalent for industries with higher growth rate, growth firms, and young firms. These findings are consistent with Sutton's (1991) argument that the difference in the implication of industry concentration between price and non-price competition industries becomes more prevalent as

[2] Overall results remain qualitatively similar when we use the ratio of the sum of advertising expenses and R&D expenses on sales in order to classify the sample into price and non-price competition.

the market size increases. In other words, industry concentration better explains industry competition for firms under non-price competition than for firms under price competition.

In addition, we address the possibility that different firms within the same industry face different types of product market competition by constructing a firm-level indicator of non-price competition. A firm is assumed to face non-price competition rather than price competition when it has high advertising expenses-to-sales ratio, high R&D expenses-to-sales ratio, high market-to-book ratio, low capital expenditures, and short history. The empirical results show that our previous inference remains unchanged.[3]

A weaker relation between industry competition and financing decision for price competition than for under non-price competition may be attributable to firms being insensitive to the threat from price competition rather than to the lack of precision of industry concentration measure to explain price competition. We check this possibility by using the import penetration as a proxy of competition threat (Xu, 2012), and find that firms under price competition employ more conservative leverage and cash holding policies as import penetration increases. This implies that firms adjust their financing decision as a response to product market competition, but industry concentration does not capture such competition threat. We also test whether the collateral effect of investment drives different relations between industry concentration and financing decision between price and non-price competition because tangible investments (capital expenditure) have higher collateral value relative to intangible investments (advertising or R&D expenditure) (Frank and Goyal, 2009; Loumioti, 2015). We find that firms under intense non-price competition rely on equity financing rather than on debt financing or cash holding even to fund capital expenditure. This discards an alternative explanation that a high reliance on equity financing of firms under

[3] Karuna (2007) use the price-cost margin, the amount of industry sales, and industry-level fixed assets to define the price competition intensity. However, his paper focuses on the construction of price competition intensity measure rather than on the comparison between price and non-price competition.

intense non-price competition is due to large intangible investments. These results indicate that firms respond to intense competition pressure by adjusting financing decisions regardless of being under price or non-price competition, and that industry concentration measure does not capture price competition pressure.

This study contributes to the product market literature by shedding light on the importance of competition type and the role of endogenous sunk costs when the researcher investigates the relation between product market competition and firm's behavior. Many studies use industry concentration measure to capture competition pressure and assume that the relation between industry concentration and firm behavior is homogenous across industries and regardless of investment choice (e.g., Gaspar and Massa, 2006; Cheng et al., 2013; Ali et al., 2014).[4] However, since our finding implies that industry concentration does not capture price competition pressure, the research on industry competition should be handled with caution with a knowledge on the market structure.

Our study also highlights a proper choice on product market competition proxy. Although industry concentration is widely used as a proxy of product market competition, it lacks the power to detect competition intensity which can change the firm's operating and financial policies (Ali et al., 2009; Dedman and Lennox, 2009; Bens et al., 2011). Our finding provides additional evidence on a failure of industry concentration to capture competition pressure which damages the firm's performance.[5]

Another contribution of this study lies on the literature examining the relation between competition intensity and financing decisions. Although there are several related studies that use more sophisticated, and less problematic, proxies of competition intensity, they do not test industry concentration measure in this context (Ovtchinnikov, 2010; Xu,

[4] One notable exception is Chen et al. (2015) who document that the use of customer satisfaction measures in executive compensation contract is different between price and non-price competition industries.
[5] To address this concern, recent studies on product market competition develop new competition intensity measures (Ovtchinnikov, 2010; Xu, 2012; Li et al., 2013; Hoberg et al., 2014).

2012; Hoberg et al., 2014; Morellec et al., 2014). We fill the void by using Herfindahl-Hirschman Index as industry concentration measure and show that concentration measure should be carefully examined due to its differential implication between price and non-price industry.

The remainder of this paper proceeds as follows. Section 2 reviews prior literature and Section 3 explains the research design and sample. Section 4 tests the differential effects of competition intensity on future performance between price and non-price competition industries. The tests on the relation between competition and financing choices are presented in Section 5. Section 6 provides additional tests, and Section 7 concludes the paper.

2. Literature Review

2.1. Product Market Competition and Firm's Behavior

Many prior studies investigate the relation between product market competition and firm's behavior. One widely accepted finding is that intense competition deteriorates profitability and increases the uncertainty of future performance (Gaspar and Massa, 2007; Irvine and Pontiff, 2009; Xu, 2012). The negative impact of intense competition on future performance motivates the firm to reduce leverage in order to decrease default risks. In addition, a decrease in future free cash flows due to intense competition alleviates the concern that managers will appropriate the firm's resource for private benefits, further reducing the incentives to maintain debt in the capital structure (Jensen, 1986; Ovtchinnikov, 2010; Xu, 2012).[6] Then, given that firms actively adjust their leverage to the implicit or explicit target leverage (Byoun, 2008; Faulkender et al., 2012), firms will reduce their leverage as product market competition intensifies. The risk of predation from competitor or

[6] Several studies argue that product market competition exerts external pressure to improve operating efficiency (Giroud and Mueller, 2010; Kim and Yu, 2011).

potential entrant also motives firms to employ conservative financial policies such as low leverage and large cash holding because firms under financial constraints are easier targets for predation (Bolton and Scharfstein, 1990; Berdard, 2016).

Furthermore, firms accumulate more cash holding when they face intense product market competition because competition pressure increases the likelihood of failing to meet cash payment requirement to lenders and suppliers (Alimov, 2014). Consistent with this argument, Morellec et al. (2014) find that firms increase their cash reserves as product market competition intensifies. Hoberg et al. (2014) also find that intense product market competition decreases the payout to equity holders. Fresard (2010) extends this literature by showing that a large cash holding leads to the future gain of market share, particularly when competitors face tighter financial constraints.

2.2. Price vs. Non-Price Competition

In price competition industries, firms provide homogenous products and services. Thus, they should cut the price of their products and services to attract customers from competitors. In contrast, non-price competition refers to the extent that companies distinguish themselves from competitors by offering products and service of high quality, establishing higher brand quality, and providing better guarantee services.

Among many prior studies that document the difference between price and non-price competition (e.g., Stigler, 1968; Joskow, 1983; Symeonidis, 2000), Sutton (1991) develops economic models on the difference between two types of product market competition by focusing on industry concentration measure. The first type of product market competition in his study is the industry with exogenous sunk costs, which are fixed costs incurred upon market entry. In this industry, firms compete on price and quantity, thus incurring lower costs is the most critical competitive edge. His economic model predicts that an increase in the

market size would allow more firms to profitably enter into this industry in the long run since a potential entrant will obtain sufficient short-time profit to cover the sunk costs for entry. As a result, as the market size increases, the number of firms grow without the limit, making the concentration ratio converge to zero.

In contrast, Sutton's second type of product market competition needs an additional consideration of endogenous sunk costs which increase the fixed entry costs as well as yield higher profit margin as the market size increases. A typical example of the endogenous sunk costs include advertising and R&D expenses. When firms choose the size of investment related to endogenous sunk costs, this investment increases the price-cost margin without increasing the marginal cost of production. Therefore, Sutton predicts that, despite of an increase of market size, the number of firms in the industry decreases and there is a lower bound to the industry concentration in the long run.[7]

Sutton's analysis implies that the influence of industry concentration on corporate behavior can be very different between price and non-price competition industries. In price competition industry, the initially high concentration does not hinder a potential entrant with financial strength enough to bear a short-run fixed costs. Thus, under price competition, high industry concentration, which is often viewed as an evidence of low competition, can be lowered by new entries in the long run. However, in the case of non-price competition, the entry barrier constructed by endogenous sunk costs (advertising and R&D investments) strongly discourage the new entries, thus enhancing the incumbent's market position. As a result, high industry concentration of non-price competition industry is less likely to be challenged by new entrants than that of price competition industry. As prior studies view the detrimental effect of competition on future earnings as a critical determinant of financing

[7] Sutton's (1991) two types of market structure are well summarized by Bresnahan (1992) and Schmalensee (1992).

choice (Ovtchinnikov, 2010; Xu, 2012; Hoberg et al., 2014; Morellec et al., 2014), the industry concentration ratio is more likely to be an indicative factor of external financing and cash holding decisions for firms under non-price competition than for firms under price competition.

3. Research Design and Sample

3.1 Measurement of Industry Concentration

Herfindahl-Hirschman Index (HHI) is the most frequently used measure of industry concentration. We use the Compustat Fundamentals Annual database to construct the HHI using the total assets of firms within the 2-digit SIC industry (*HHI_Asset*). We also calculate HHI using the sales of firms in the same database (*HHI_Sale*). Lower values of the HHIs imply more intense product market competition.

However, Karuna (2007) and Ali et al. (2009) report that the concentration ratio based on Compustat overestimates competition intensity because private firms are not included in the Compustat database. To address this limitation, we also use HHI based on the Census of Manufactures publications provided by the U.S. Census Bureau, which covers all public and private companies (*HHI_Census*). Since the Census of Manufactures is published in every 5 years, we assume that the HHI values of 1997, 2002, and 2007 are valid for 5 years period centered on 1997, 2002, and 2007 (Ali et al., 2009). For example, we use HHI in the 1997 Census of Manufactures for observations from 1995 to 1999. We match the HHI from Census of Manufactures to Compustat data using 3-digit NAICS (North American Industry Classification System) rather than 6-digit NAICS. While using 6-digit NAICS can maximize the cross-sectional variation of product market competition in our sample, it can increase the measurement error in the industry-level advertising expense-to-sales ratio, which is critical in the price and non-price competition partition, due to small number of firms within each

industry. In contrast, the use of 3-digit NAICS can reduce the effect of outliers in the industry-level advertising expense-to-sales ratio and increase the accuracy in the price and non-price competition partition.[8]

3.2 Measurement of Competition Type

Prior studies on the market structure document that one of the most important indicator of non-price competition relative to price competition is a high reliance on advertising activities (Stigler, 1968; Sutton, 1991; Symeonidis, 2000). Following them, we classify the industries with an advertising expense–to-sales ratio that are higher (lower) than the industry-level median as non-price (price) competition industries. Since this classification criteria of competition type is at the industry-level, we implicitly assume that whether the firm is subject to price or non-price competition is exogenous to the firm's investment and financing decision. We use 2-digit SIC classification when we use *HHI_Asset* or *HHI_Sale*, and use 3-digit NAICS classification when the competition intensity measure is *HHI_Census*.[9]

3.3 The System of Equations Approach to Capture Investment Funding Decision

A conventional research design implemented to investigate the relation between competition pressure and funding decision is the *unconditional* regression of external financing on competition intensity measure (Ovtchinnikov, 2010; Xu, 2012; Hoberg et al., 2014; Morellec et al., 2014). However, this research design can yield biased empirical results due to the omitted variable problem because the cash shortfalls from investment and operating activities are the main driver of external financing (Myers and Majluf, 1984; Kim

[8] We divide *HHI_Census* by 100 to ease the interpretation of coefficients in the regression results.

[9] Innovation literature uses patent data to capture R&D activities. However, we do not use it for price and non-price competition partition because there is an ongoing debate on whether patent data is a reliable proxy of R&D activities (see Griliches, 1998; Watanabe et al., 2001).

and Weisbach, 2008). Thus, employing the pecking order regression in the capital structure literature (Shyam-Sunder and Myers, 1999; Frank and Goyal, 2003), we examine the relation between competition intensity and investment funding decision *conditional* on internal cash flows and cash holdings.

Additionally, we use the system of equations to address the interdependence of financing activities by imposing the restriction that cash inflows (i.e., changes in cash holdings, debt and equity financing) are equal to cash outflows (financing needs). This is because a failure to address the interdependence of financing activities can yield biased estimates on the relation between investment and external financing or cash holding change (Gatchev et al., 2009). Based on Gatchev et al. (2009), the construction of a system of equations starts from the restriction that cash inflows are equal to cash outflows as follows:

$$\Delta Debt + \Delta Equity - \Delta Cash = Def \quad (1)$$

where $\Delta Debt$ is net debt issue, $\Delta Equity$ is net equity issue, and $\Delta Cash$ is the change in cash holdings. Def is the financing deficit, which captures the firm's financing needs. It is calculated as the sum of capital expenditure, the increase in working capital, acquisitions, and dividend payments, minus cash flows from operations and sales of property, plant, and equipment, all scaled by lagged total assets (Frank and Goyal, 2003). The detailed definitions of variables are in Appendix A.

Using this restriction, we construct the system of equations with the interaction term between industry concentration and financing deficit as the independent variable:

$$y_{i,t+1} = B_1 HHI_{i,t} + B_2 Def_{i,t+1} + B_3 HHI_{i,t}*Def_{i,t+1} + C z_{i,t} + e_{i,t+1} \quad (2)$$

where y is a 3 x 1 vector of financing choices (i.e., $\Delta Debt$, $\Delta Equity$, $\Delta Cash$). B and C are the 3 x 1, and 3 x k vectors of coefficients on the independent variables, respectively. z is a k x 1

vector of determinants of financing choices, and *HHI* is the measure of industry concentration. To maintain the accounting identity in Equation (1), we impose the following cross-equation restrictions on the coefficients: $i'B_1 = 0_{1 \times 1}$, $i'B_2 = 1_{1 \times 1}$, $i'B_3 = 0_{1 \times 1}$, $i'C = 0_{1 \times k}$, and $i'e = 0_{1 \times 1}$ where i is the matrix of [1, 1, -1]. This implies that competition intensity is related with the association between financing deficit and financing choices, but does not change the restriction in Equation (1). We use one-year-lagged values of *HHI* to reduce the bias from simultaneity problems because capital structure choices can influence the firm's survival rate and competition intensity. The system of equations is estimated using the maximum likelihood method with standard errors clustered at the firm-level (Gould et al., 2006).[10]

We further mitigate correlated omitted variable problem by controlling for firm characteristics that can influence financing choices as well as competition intensity. We control for firm size (*Size*) as larger firms have more stable cash flows and thus are more capable of attracting debt financing.[11] We include the book-to-market of equity (*BM*), an inverse measure of growth opportunity, because growth options decrease the underinvestment costs and free cash flows problem, reducing the benefits of using debt financing over equity financing (Barclay et al., 2006). *SalesVola* and *CFVola* are the volatility of sales and operating cash flows scaled by total asset over at least three of the last five years, respectively. Higher volatility is associated with a lower level of investment, reducing the demand for external financing (Minton and Schrand, 1999). We also control for the volatility of past performances using the percentage of years that the firm reports losses in net income in at least three of the last five years (*Loss%*), because high default risk reduces the optimal level of leverage. Tangibility (*Tangible)* and depreciation and amortization costs (*Dep*) are controlled for because fixed assets can be used as collateral for debt financing (Frank and

[10] We find that our findings remain largely unchanged when we use the single regression models.
[11] Controlling for firm size is important in the analysis of product market competition because larger firms are more likely to survive and less likely to be predated by other firms (Berdard, 2016).

Goyal, 2009). We also include R&D expenses (*R&D*) and *R&D_D*, which is an indicator variable that equals one for firms reporting R&D expenses, and zero otherwise. *RetVola* is the standard deviation of daily stock returns over the fiscal year. *Ret* is annual stock returns, included to control for market timing activities of equity financing (Baker and Wurgler, 2002).

Prior studies conventionally assume that financing activities have a linear relationship with financing deficit regardless of the sign of the financing deficit (e.g., Shyam-Sunder and Myers, 1999). However, firms with financing surplus (i.e., negative financing deficit) do not need to obtain the proceeds from external financing. Rather, they have the incentives to distribute the cash to outside investors. Furthermore, Jensen (1986) suggests that firms with sufficient internal cash flows (positive free cash flows) are subject to agency costs, as managers invest free cash flows in low-return projects. To ease the interpretation of empirical results, we omit the firms with negative financing deficit when we estimate the system of equations in Equation (2).

3.4. Sample Description

The sample includes U.S. firms with data available from the intersection of Compustat and CRSP over the period of 1990 to 2012. Following prior studies, financial firms (SIC codes 6000-6999) and utilities (4900-4999) are excluded from the sample. We winsorize all continuous variables at the top and bottom 1% to eliminate the effect of outliers.

Panel A of Table 1 shows the annual distribution of firm-year observations with data on financing activities and competition intensity. Competition intensity measures show increasing trends over the sample period, indicating that the product market competition has become more intensive over time (Irvine and Pontiff, 2009). Panel B of Table 1 displays five 2-digit SIC industries with the highest and lowest ratios of advertising expenses to sales. Industries with the lowest advertising expenses-to-sales ratios include coal mining (2-digit

SIC: 12), nonmetallic minerals except fuels (14), trucking and warehousing (42), special trade contractors (17), and heavy construction except building (16). Industries with the highest advertising expenses-to-sales ratios include educational services (82), miscellaneous retail (59), metal mining (10), personal services (72), and transportation services (47). The last two columns in Panel B of Table 1 show the industry-level mean (*ROA*) and the industry-level standard deviation of return-on-assets (*Std*(*ROA*)). They show that non-price competition industries have a lower profitability and a larger standard deviation of profitability than price competition industries.

[Insert Table 1 around here]

4. Industry Concentration, Competition Type, and Future Performance

Before examining the relation between industry concentration and investment funding decision, we examine the effect of industry concentration on future performance because the effect of competition pressure on future profitability is a primary reason that firms adjust capital structure and cash holding as a response to industry competition. The test results are presented in Table 2. For each measure of industry concentration, we partition the sample into price and non-price competition industries. While the coefficients on *HHI* are insignificant for the subsample of price competition industries, they are significantly positive in non-price competition industries. Untabulated statistics indicate that the differences between the coefficients on *HHI* are significant at the 5% level except when the measure of industry concentration is *HHI_Census*. These results imply that the positive impact of high industry concentration on future performance is more pronounced for non-price competition industries than for price competition industries. This is consistent with Sutton's (1991) argument that high industry concentration under price competition does not guarantee high future profitability due to new entrants. Since lower profitability is the main channels through

which more intense competition is associated with lower leverage and more conservative cash holding policies (Ovtchinnikov, 2010; Xu, 2012; Hoberg et al. 2014; Morellec et al. 2014), the results in Table 2 imply that the relations between competition intensity and financial policies would be stronger for non-price competition industries than for price competition industries.

One potential explanation for a weaker relation between industry concentration and future profitability for price competition industries compared with non-price competition industries might be a lower variance of HHI measures for price competition industries than for non-price industries. However, in untabulated tests, we find that the difference in the variance of HHI measures between price and non-price competition industries is statistically insignificant at 10% level. Thus, it is unlikely that HHI measures in price competition do not have a sufficient variation to capture the industry-level difference in industry concentration.

[Insert Table 2 around here]

5. Industry Concentration, Competition Type, and Investment Funding Decision

5.1. Univariate test of investment funding decision

Before estimating the system of equations in Equation (2), we check the univariate results on debt financing, equity financing, and the change in cash holding conditional on industry concentration and financing deficit.

Table 3 shows debt financing for the tercile ranks of financing deficit and industry concentration. Similar with the system of equations estimation, we only use firms with positive financing deficit (negative free cash flows). When we assess the results using total sample or firms in price competition industries, the amount of debt financing shows inconsistent pattern except when the firms are classified into high financing deficit tercile. However, we find that firms under non-price competition use more debt financing to fund

large financing deficit when industry concentration is high. For instance, when we use *HHI_Census* as a measure of industry concentration, debt financing increases from 0.206 to 0.261 as we move from the lowest to the highest tercile of industry concentration under price competition. Under non-price competition, debt financing changes from 0.205 to 0.352 as we move from the lowest to the highest tercile of industry concentration.

[Insert Table 3 around here]

Table 4 shows the univariate test of equity financing. As for firms under price competition, overall trend seems to be inconsistent. However, except when we use *HHI_Sale*, firms under non-price competition use less equity financing to fund investments as industry concentration increases. When we use *HHI_Census*, equity financing of firms under price competition changes from 0.175 in the lowest industry concentration to 0.085 in the highest industry concentration, whereas that of firms under non-price competition decreases from 0.344 to 0.113 under the same condition.

[Insert Table 3 around here]

[Insert Table 4 around here]

Table 5 illustrates the univariate test of the change in cash holding for the tercile ranks of financing deficit and industry concentration. Unexpectedly, regardless of price / non-price competition partition, the trend in the change in cash holding over industry concentration is inconsistent. However, given that this result is performed without controlling for other firm characteristics that influence the change in cash holding, it would be inadequate to conclude that the use of cash holding in funding investments is unrelated to industry concentration.

[Insert Table 5 around here]

5.2. The estimation of the System of Equations to Test Investment Funding Decision

Table 6 shows the estimation results of the system of equations using the subsamples of price and non-price competition industries. In each panel, Columns (1) to (3) present the results of price competition sample and columns (4) to (6) show the results of non-price competition sample. There is a sharp difference in price and non-price competition industries regarding the relation between industry concentration and financing choices. In Panel A and B, where the measure of industry concentration is *HHI_Asset* or *HHI_Sale*, respectively, the coefficients on *Def*HHI* are statistically insignificant for firms in price competition industries. In contrast, the coefficients on *Def*HHI* are significant for firms in non-price competition industries in each panel. Particularly, the coefficients on *Def*HHI* are significantly positive when the dependent variable is debt financing, and significantly negative for equity financing. Also, the coefficients on *Def*HHI* in cash change regression using firms in non-price competition industries are positive. This indicate that firms in non-price competition industries fund investment using more debt financing, less equity financing, and more cash holding as industry concentration increases. The bottom of each panel presents the difference in coefficients on *Def*HHI* between two competition type. The differences in the coefficients on the interaction of financing deficit and industry concentration are statistically significant except in Panel C, suggesting that the relation between industry concentration and investment funding choice is significantly different between price and non-price competition industries.[12] The sharp difference between price and non-price competition industries raises a concern that industry concentration measure would not capture the product

[12] We test the statistical significance of the differences between the coefficients from the two regression models using *z*-statistic (Clogg et al., 1995). *z*-statistic is calculated as $z = (bG1 - bG2) / \sqrt{[SE(bG1)^2 + SE(bG2)^2]}$, where *bG1* (*bG2*) and *SE*(*bG1*) (*SE*(*bG2*)) refer to the coefficient on the variable of interest and its standard errors in the first (second) regression, respectively.

market competition pressure for price competition industries.[13]

[Insert Table 6 around here]

5.3. Difference between Price and Non-Price Competition when Market Size Increases

We use Sutton's (1991) argument to compare how industry concentration is related to investment funding decision between price and non-price competition. However, we have not considered the industry growth, which can be a very important determinant of the extant that industry concentration captures competition intensity. Sutton (1991) suggests that, as the market size increases, price competition industry becomes fragmented and non-price competition industry becomes concentrated. Thus, high concentration ratio of price competition industry with increasing market size would not be indicative of low competition pressure, whereas high concentration of growing non-price competition industry would imply monopolistic market structure. We explore the effect of market size increase on competition intensity by partitioning the sample into high and low growth industries for price and non-price competition. Particularly, we use all Compustat observations to calculate the industry-level sales and construct the annual growth rate in industry-level sales. We then classify the industry with annual growth rate higher (lower) than the industry-level median as high (low) growth industry.

Table 7 shows the estimation result of the system of equations after partitioning the sample into high and low growth industry. The coefficients on the interaction between industry concentration and financing deficit do not show consistent patterns when we test firms under price competition. For instance, when we use *HHI_Sale* as the measure of industry concentration, the coefficient on $Def_{t+1}*HHI_t$ is significantly negative for debt

[13] Another explanation on the different results between price and non-price competition industries is that firms under price competition do not adjust investment funding decision as a response to the change in industry competition pressure. We examine this explanation in Section 6.2.

financing. In contrast, when we use *HHI_Census* as the measure of industry concentration, the coefficient on Def_{t+1}*HHI_t is significantly positive for debt financing. In contrast, we find more consistent patterns when we test firms under non-price competition. As for non-price competition industries with high industry growth rate, the coefficients on the interaction between industry concentration and financing deficit are positive for debt financing, and negative for equity financing and the change in cash. The comparison between the results using price and non-price competition indicates that the difference in how industry concentration is related to investment funding decision between price and non-price competition industries is statistically significant when industry has higher sales growth rate. This is consistent with the implication in Sutton (1991) that the variation in industry concentration is more likely to capture the change in competition pressure for non-price competition than for price competition.

[Insert Table 7 around here]

We also address the concern that industry-level growth rate would not capture the dynamics of industry concentration. Particularly, we are not able to discard the possibility that some firms drive the industry growth whereas other firms within the same industry suffers from the decrease of sales, resulting in a marginal change in industry size. This would be more prevalent if the industry contains firms with different growth opportunity or different life cycle because growth opportunity and life cycle influence debt-equity choice as well as cash holding policies.[14]

To consider the firm-level growth in the relation between industry concentration

[14] Growth opportunity mitigates underinvestment and free cash flow problems, thus reducing the benefits of debt financing (Jensen, 1986; Barclay et al., 2006). Investment need to capture growth opportunity also increases the value of cash reserves and motivates firms to reduce payouts to outside investors (Opler et al., 1999). Life cycle is another important determinant of leverage and cash holding decision because young firms have more growth options than old firms. (Spence, 1977, 1979; DeAngelo et al., 2006; Dickinson, 2011).

and investment funding decision, we partition the sample based on the tercile rank of growth opportunity or firm life cycle. We use the market-to-book ratio of equity (*M/B*) as the proxy of growth opportunity (Barclay et al., 2006). Following Collins et al. (2014), we capture life cycle by the combined *Z_Score* = *Z_Sale_GR* – *Z_AGE* + *Z_CAPEX* – *Z_SIZE*, where the *Z-variable* is calculated by subtracting the mean from the observation and dividing it by the standard deviation for each variable. We classify firms in the lowest (highest) tercile of *M/B* as firms with low (high) growth opportunity and those in the lower (highest) tercile of *Z_Score* as old (young) firms. *M/B* and *Z_Score* are ranked for the subsample of price and non-price competition industries separately.[15]

Table 8 shows the estimation result of the system of the equations. Since the results using other measures of industry concentration are similar, we present the test results only using *HHI_Asset* as the measure of industry concentration. In each panel, the coefficients on *Def*HHI* are largely insignificant for price competition industries regardless of the level of growth opportunity or life cycle. In contrast, the coefficients on *Def*HHI* are statistically significant in the regressions using non-price competition industries except for the subsamples of firms with low growth opportunity or old firms. Thus, the difference in how industry concentration is related to investment funding decision between price and non-price competition is stronger for growing and young firms. These results deliver two implications. First, growth opportunity and life cycle are the important determinants of financial policies such as funding decision and cash holding policy. Second, more importantly, non-price competition pressure imposes a serious threat to growing and young firms, whereas price competition intensity does not seem to hinder the firm from gearing up the leverage and

[15] Alternatively, we rank *M/B* or *Z_Score* before partitioning the sample into price and non-price competition industries to reduce the concern that *M/B* or *Z_Score* is larger for the industries with one competition type than other industries with the different competition type. The results remain largely unchanged (untabulated).

spending cash to fund investment.[16]

[Insert Table 8 around here]

6. Additional Tests

6.1 The firm-level identification of competition type

The main empirical analyses of this paper use the industry-level advertising expenses-to-sales ratio to identify price and non-price competition industries. Using an industry-level identification of price and non-price competition ignores the possibility that firms within same industry face different types of product market competition. For instance, although several airline companies compete for expensive first- and business-class passengers, other low-cost carriers compete in price by providing cheaper flight services to economy passengers. To address this concern, we develop the firm-level indicator of competition type using the *Z_Score* of the following five firm characteristics.

(1) *Advertising expenses-to-sales*: A higher advertising expenses-to-sales ratio is a strong indicator of non-price competition.

(2) *R&D expenses-to-sales*: Firms under non-price competition spend more resources on R&D expenditures than firms under price competition.

(3) *Market-to-book ratio*: Firms under non-price competition have higher market-to-book ratios than firms under price competition because spending on intangible assets is an expense item in the income statement, whereas tangible investment is capitalized as assets in the balance sheet.

(4) *Capital expenditure*: Firms under non-price competition rely less on capital expenditures than firms under price competition.

[16] We find similar results with Table 8 when we use alternative measures of life cycle as the ratio of retained earnings on total assets (DeAngelo et al., 2006) or when we partition the sample into different stage of life cycle based on cash flows (Dickinson, 2011).

(5) *Firm age*: Under non-price competition, incumbent firms use intangible investments to establish barriers against potential new entrants. In contrast, new entrants under price competition are attracted by short-term profit which covers the initial investment, meaning that entry barrier of price competition would be lower than that of non-price competition (Sutton, 1991). Thus, young firms are more likely to face price competition than old firms.

Using these five variables, we construct the *Z_Score* as follows: *Z_Score* = *Z_AD* + *Z_R&D* + *Z_MB* – *Z_CAPEX* + *Z_AGE*, where the *Z-variable* is calculated by subtracting the mean from the observation and dividing it by the standard deviation for each variable. We classify firms with a *Z_Score* higher (lower) than the sample median as those facing non-price (price) competition.

Table 9 shows the estimation results of the system of equations using the classification based on the *Z_Score*. Although the coefficients on *Def*HHI* are significant at 10% level in some cases for firms facing price competition, the comparison of the coefficients on *Def*HHI* suggests that the relation between industry concentration and investment funding decision is stronger for firms facing non-price competition than for firms facing price competition. This is consistent with our previous results, thus enhancing our confidence on previous findings.

[Insert Table 9 around here]

6.2 The use of import penetration to capture price competition pressure

Our results so far raise a doubt that industry concentration measure would not capture the product market pressure of price competition because overall results using firms under price competition are weaker than those using firms under non-price competition. To

examine this possibility, we use the import penetration as an exogenous source of price competition pressure. Higher import penetration (i.e., more imports from other countries relative to domestic productions) intensifies product market competition and reduces profit margin (Xu, 2012). If firms under price competition are sensitive to competition pressure and industry concentration measure does not capture such competition pressure, we will find a significant impact of import penetration on financing and cash holding decisions. We follow Xu (2012) to calculate the industry-level import penetration as imports / (imports + domestic production). Industry is defined at 3-digit NAICS classification. Import data is obtained from TradeStatsExpress at the US Government Export Portal. Domestic production data is retrieved from the Bureau of Economic Analysis of the US Department of Commerce. We replace HHI with the industry-level import penetration measure.

Table 10 shows the estimation result of the system of equations using import penetration as an exogenous shock on profitability. For price competition industries, the coefficient on $Def_{t+1}*Penetration_t$ is significantly negative when the dependent variable is debt financing, and they are significantly positive when the dependent variable is equity financing and the change in cash. This suggest that firms under price competition respond to an increase in import penetration with less debt financing, more equity financing, and less use of cash holding. However, the coefficients on $Def_{t+1}*Penetration_t$ for firms under non-price competition are insignificant in debt financing and equity financing regression. These results indicate that firms under price competition change their funding decision when import penetration intensifies price competition. It also signifies that previous insignificant or weaker results using firms under price competition in previous tables are attributable to the failure of industry concentration to capture the dynamics of price competition industry.

[Insert Table 10 around here]

6.3 Do Investment Choice and Collateral Effect Drive Our Results?

A potential reason that the type of product market structure (price vs. non-price competition) influences financing and cash holding decisions is the type of investments. Firms under price competition have more capital expenditure and less advertising and R&D expenditures than firms under non-price competition. Tangible assets arising from capital expenditure is more likely to be used as collateral compared to intangible expenditure such as advertisement and R&D (Frank and Goyal, 2009; Loumioti, 2015). Thus, given that intense product market competition forces firms to maintain their competency through investment (Nielsen, 2002; Akdoğu and MacKay, 2008; Moretto, 2008), the different investment choices will result in different relations between product market competition and investment funding decision between price and non-price competition.

To examine this possibility, we regress investment funding variables (debt financing, equity financing, and the change in cash holding) on the interaction between industry concentration and capital expenditure. The results in Appendix B show that there is a significant difference in funding decision of capital expenditure between firms under price and non-price competition industries. For firms under price competition industries, the most of the coefficients on the interaction of industry concentration and capital expenditure are statistically insignificant. However, the coefficients on the interaction between industry concentration and capital expenditure in equity financing are significantly negative for firms under non-price competition. This indicates that the difference in investment funding decision between price and non-price competition industries is attributable to the different market structure rather than to different investment choices between price and non-price competition.

6.4. Other considerations

To further mitigate the concern of correlated omitted variables, we control for

several firm characteristics additionally. First, several studies report that the use of debt financing increases with the tax benefits of interest payments. To control for the effect of tax benefits on debt financing, we include effective tax rate as a variable in the system of equations. The effective tax rate is calculated as the total tax expenses scaled by pretax income or the tax paid scaled by pretax income. Regardless of which effective tax rate is measured, our previous findings remain largely unchanged (untabulated).

Second, prior studies document that earnings quality is an important determinant of financing choices (e.g., Chang et al., 2009; Chen et al., 2013). Furthermore, there is an ongoing debate on the relation between competition intensity and earnings quality. Several studies argue that competition intensity is positively related with earnings quality because firms in highly concentrated industries tend to avoid the attention of competitors or politicians by deteriorating information environments (Cheng et al., 2013). Other studies report a negative relation between competition intensity and earnings quality based on the argument that intense competition increases proprietary costs related to the disclosure of high-quality information (Ali et al., 2014). By combining these arguments, Guo et al. (2014) document an inverted U-shape relation between competition and earnings quality. To address this concern, we control for the measure of accruals quality in Dechow and Dichev (2002) as an additional control variable in the system of equations. Untabulated results show that our previous findings remain robust after controlling for accruals quality.

7. Conclusion

Based on Sutton's (1991) analysis on price and non-price competition, this study revisits prior studies on the relation between product market competition and financing and cash holding decisions. Focusing on the difference between price and non-price competition, we find that firms under price competition do not seem to significantly change investment

funding decision when industry concentration changes. In contrast, firms under non-price competition use more debt financing, less equity financing, and more cash holding as non-price competition because more intense. We also find that the difference in financing and cash holding decisions between price and non-price competition industries is more pronounced when industry is growing, firm has high growth opportunity, and young firms.

Our findings indicate that industry concentration may not capture the extent that competition pressure changes the firm's financing and cash holding decisions. A significant influence of import penetration on investment funding for firms under price competition also supports a limitation of industry concentration to capture the dynamics of product market competition. Therefore, this study contributes to the literature by shedding light on the importance of competition type in the examination of the firm's behavior.

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Table 1. Summary Statistics

Panel A. Annual Distribution and Average Values of Competition Intensity Measures

	HHI_Asset		*HHI_Sale*		*HHI_Census*	
Year	n	Mean	n	Mean	n	Mean
1990	2,386	0.108	2,386	0.092		
1991	2,557	0.115	2,557	0.097		
1992	2,553	0.113	2,553	0.093		
1993	2,582	0.107	2,582	0.090		
1994	2,627	0.100	2,627	0.084		
1995	2,695	0.091	2,695	0.082	1,506	1.383
1996	2,850	0.078	2,850	0.072	1,586	1.393
1997	2,999	0.072	2,999	0.066	1,666	1.396
1998	2,958	0.069	2,958	0.064	1,662	1.393
1999	2,858	0.066	2,858	0.062	1,607	1.415
2000	2,910	0.065	2,910	0.063	1,578	1.440
2001	2,805	0.063	2,805	0.060	1,518	1.417
2002	2,809	0.066	2,809	0.063	1,506	1.426
2003	2,832	0.069	2,832	0.065	1,489	1.453
2004	2,916	0.069	2,916	0.065	1,532	1.433
2005	2,784	0.068	2,784	0.064	1,487	1.339
2006	2,632	0.070	2,632	0.066	1,410	1.341
2007	2,447	0.070	2,447	0.066	1,307	1.352
2008	2,354	0.072	2,354	0.069	1,250	1.343
2009	2,366	0.072	2,366	0.068	1,232	1.365
2010	2,357	0.072	2,357	0.068		
2011	2,306	0.072	2,306	0.068		
2012	2,208	0.073	2,208	0.068		

Panel B. Industries with the Lowest or Highest Advertising-to-Sales Ratio

Five SIC 2-Digit Industries with the Lowest Ratio of Advertising Expenses on Sales

SIC2	Description	Advertising Expense-to-Sales Ratio	*HHI_Asset*	*HHI_Sale*	*ROA*	*Std(ROA)*
12	Coal Mining	0.002	0.144	0.125	0.062	0.090
14	Nonmetalic Minerals, Except Fuels	0.002	0.134	0.132	0.056	0.060
42	Trucking and Warehousing	0.004	0.029	0.037	0.034	0.068
17	Special Trade Contractors	0.008	0.077	0.057	-0.006	0.109
16	Heavy Construction, Except Building	0.009	0.076	0.056	0.024	0.100
	Mean	0.005	0.092	0.081	0.034	0.086

Five SIC 2-Digit Industries with the Highest Ratio of Advertising Expenses on Sales

SIC2	Description	Advertising Expense-to-Sales Ratio	*HHI_Asset*	*HHI_Sale*	*ROA*	*Std(ROA)*
82	Educational Services	0.069	0.103	0.066	0.036	0.111
59	Miscellaneous Retail	0.070	0.033	0.040	0.024	0.111
10	Metal Mining	0.071	0.116	0.119	-0.022	0.175
72	Personal Services	0.080	0.103	0.066	0.028	0.076
47	Transportation Services	0.092	0.028	0.036	0.076	0.088
	Mean	0.076	0.077	0.065	0.028	0.112

Panel A presents the annual distribution of observations for competition intensity measure. *HHI_Asset* is the

Herfindahl-Hirschman Index constructed using the total assets of firms in the Compustat Fundamentals Annual data. *HHI_Sale* is the Herfindahl-Hirschman Index constructed using the sales of firms in the Compustat Fundamentals Annual data. *HHI_Census* is the Herfindahl-Hirschman Index based on the Census of Manufactures publications provided by the U.S. Census Bureau, which covers all public and private companies. Since the Census of Manufactures is published in every 5 years, we assume that the HHI values of 1997, 2002, and 2007 are valid for 5 years period centered on 1997, 2002, and 2007. For example, we use HHI in the 1997 Census of Manufactures for observations from 1995 to 1999. Panel B compares five industries with the lowest and highest advertising expenses-to-sales ratio. This panel uses 2-digit SIC industry classification. *ROA* is the industry-level return-on-assets, calculated by the ratio of net income on total assets, within each industry. *Std(ROA)* is the industry-level standard deviation of return-on-assets.

Table 2. The Effect of competition Intensity on Future Performance

	HHI_t = *HHI_Asset*		HHI_t = *HHI_Sale*		HHI_t = *HHI_Census*	
Dep. Var.= OI_{t+1}/AT_t	Price Competition	Non-Price Competition	Price Competition	Non-Price Competition	Price Competition	Non-Price Competition
Intercept	-0.102***	-0.200***	-0.095***	-0.216***	-0.011***	-0.240***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
HHI_t	0.019	0.132***	-0.005	0.163***	0.004	0.005
	(0.620)	(0.000)	(0.903)	(0.000)	(0.176)	(0.456)
$Size_t$	0.030***	0.047***	0.030***	0.047***	0.027***	0.048***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Lev_t	-0.035***	0.033***	-0.034***	0.033***	-0.063***	0.013
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.510)
MB_t	-0.005***	-0.006***	-0.005***	-0.006***	0.001	-0.009***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.503)	(0.000)
Year/Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R2	0.143	0.264	0.143	0.264	0.143	0.305
N	44,340	47,944	44,340	47,944	12,035	10,298
Difference in the coefficient on HHI		-0.113**		-0.168***		-0.001
p-value		(0.015)		(0.001)		(0.361)

This table presents the regression result of future profitability on competition intensity and firm characteristics. Profitability is measured by OI_{t+1}/AT_t, which is the operating income scaled by lagged total assets. Standard errors of estimated coefficients are clustered at the firm level. Definitions of the variables are given in Appendix A. All continuous variables except competition intensity are winsorized at the top and bottom 1% to eliminate the effect of outliers. We use 2-digit SIC classification when industry concentration measure is *HHI_Asset* or *HHI_Sale*, and use 3-digit NAICS classification when industry concentration measure is *HHI_Census*. The *p*-values in parentheses are two-tailed. *, ** and *** denote significance at the 0.10, 0.05 and 0.01 levels, respectively.

Table 3. Univariate Test of Debt Financing

Panel A. HHI = *HHI_Asset*

ΔDebt		Total Sample (n = 31,787)					Price Competition Group (n = 15,660)					Non-Price Competition Group (n = 16,127)				
		Concentration Rank					Concentration Rank					Concentration Rank				
			2	3:High	3-1	p-value	1:Low	2	3:High	3-1	p-value	1:Low	2	3:High	3-1	p-value
Deficit Rank	1:Small	0.014	0.015	0.018	-0.004**	(0.02)	0.013	0.014	0.010	-0.002	(0.20)	0.022	0.015	0.018	-0.004*	(0.06)
	2	0.048	0.049	0.055	0.006***	(0.00)	0.050	0.050	0.041	-0.009***	(0.00)	0.057	0.046	0.063	0.006**	(0.03)
	3:Large	0.526	0.346	0.443	0.001	(0.47)	0.171	0.202	0.174	0.004	(0.33)	0.195	0.120	0.218	0.023**	(0.02)

Panel B. HHI = *HHI_Sale*

ΔDebt		Total Sample (n = 31,787)					Price Competition Group (n = 15,660)					Non-Price Competition Group (n = 16,127)				
		Concentration Rank					Concentration Rank					Concentration Rank				
		1:Low	2	3:High	3-1	p-value	1:Low	2	3:High	3-1	p-value	1:Low	2	3:High	3-1	p-value
Deficit Rank	1:Small	0.016	0.017	0.014	-0.002**	(0.04)	0.008	0.016	0.012	0.003*	(0.08)	0.020	0.016	0.018	-0.002	(0.18)
	2	0.052	0.050	0.049	-0.003*	(0.06)	0.047	0.052	0.042	-0.005*	(0.06)	0.057	0.050	0.058	0.001	(0.38)
	3:Large	0.180	0.156	0.197	0.017***	(0.00)	0.163	0.213	0.168	0.005	(0.27)	0.191	0.138	0.210	0.019***	(0.00)

Panel C. HHI = *HHI_Census*

ΔDebt		Total Sample (n = 11,917)					Price Competition Group (n = 6,058)					Non-Price Competition Group (n = 5,859)				
		Concentration Rank					Concentration Rank					Concentration Rank				
		1:Low	2	3:High	3-1	p-value	1:Low	2	3:High	3-1	p-value	1:Low	2	3:High	3-1	p-value
Deficit Rank	1:Small	0.014	0.07	0.012	-0.002	(0.18)	0.013	0.010	0.015	0.002	(0.34)	0.018	0.018	0.019	0.001	(0.43)
	2	0.055	0.046	0.040	-0.014***	(0.00)	0.053	0.031	0.065	0.012**	(0.03)	0.062	0.039	0.083	0.022***	(0.00)
	3:Large	0.211	0.107	0.163	-0.048***	(0.00)	0.206	0.126	0.261	0.055***	(0.00)	0.205	0.081	0.352	0.148***	(0.00)

This table presents the amount of net debt issuance for the tercile ranks of financing deficit and industry concentration measures. Note that the sample of this table consists of firms with positive financing deficit (i.e., negative free cash flows). Net debt issuance (*ΔDebt*) is the change in debt from year *t* to year *t*+1, scaled by total assets in year *t*. *Def* is the financing deficit, calculated as the sum of capital expenditure, changes in working capital, dividend payments, and acquisitions, minus operating cash flows and sales of plant, property, and equipment, all scaled by the previous year's total assets. All continuous variables except competition intensity are winsorized at the top and bottom 1% to eliminate the effect of outliers. We use 2-digit SIC classification when industry concentration measure is *HHI_Asset* or *HHI_Sale*, and use 3-digit NAICS classification when industry concentration measure is *HHI_Census*. *, ** and *** denote the significance of difference between high and low competition intensity tercile at the 0.10, 0.05 and 0.01 levels, respectively.

Table 4. Univariate Test of Equity Financing

Panel A. HHI= *HHI_Asset*

ΔEquity		Total Sample (n = 31,787)					Price Competition Group (n = 15,660)					Non-Price Competition Group (n = 16,127)				
		Concentration Rank					Concentration Rank					Concentration Rank				
		1:Low	2	3:High	3-1	p-value	1:Low	2	3:High	3-1	p-value	1:Low	2	3:High	3-1	p-value
Deficit Rank	1:Small	0.013	0.016	0.016	0.004*	(0.08)	0.013	0.009	0.014	0.001	(0.40)	0.022	0.026	0.011	-0.011***	(0.00)
	2	0.044	0.058	0.043	-0.001	(0.36)	0.039	0.032	0.042	0.003	(0.25)	0.052	0.083	0.044	-0.008**	(0.03)
	3:Large	0.242	0.356	0.283	-0.041***	(0.00)	0.229	0.194	0.215	-0.014	(0.15)	0.348	0.456	0.281	-0.067***	(0.00)

Panel B. HHI = *HHI_Sale*

ΔEquity		Total Sample (n = 31,787)					Price Competition Group (n = 15,660)					Non-Price Competition Group (n = 16,127)				
		Concentration Rank					Concentration Rank					Concentration Rank				
		1:Low	2	3:High	3-1	p-value	1:Low	2	3:High	3-1	p-value	1:Low	2	3:High	3-1	p-value
Deficit Rank	1:Small	0.012	0.020	0.012	0.000	(0.47)	0.007	0.014	0.013	0.006**	(0.04)	0.019	0.022	0.018	-0.001	(0.46)
	2	0.040	0.060	0.045	0.005*	(0.06)	0.035	0.035	0.041	0.006*	(0.09)	0.052	0.068	0.065	0.013**	(0.01)
	3:Large	0.258	0.369	0.246	-0.012	(0.11)	0.203	0.219	0.208	0.005	(0.35)	0.335	0.427	0.369	0.034**	(0.03)

Panel C. HHI = *HHI_Census*

ΔEquity		Total Sample (n = 11,917)					Price Competition Group (n = 6,058)					Non-Price Competition Group (n = 5,859)				
		Concentration Rank					Concentration Rank					Concentration Rank				
		1:Low	2	3:High	3-1	p-value	1:Low	2	3:High	3-1	p-value	1:Low	2	3:High	3-1	p-value
Deficit Rank	1:Small	0.000	0.025	0.018	0.018***	(0.00)	0.000	0.025	-0.004	-0.004	(0.23)	0.004	0.045	-0.002	-0.006*	(0.09)
	2	0.040	0.089	0.059	0.019***	(0.00)	0.029	0.061	0.014	-0.015**	(0.01)	0.064	0.160	0.019	-0.045***	(0.00)
	3:Large	0.250	0.489	0.286	0.036	(0.30)	0.175	0.274	0.085	-0.090***	(0.00)	0.344	0.611	0.231	-0.113***	(0.00)

This table presents the net equity issuance for the tercile ranks of financing deficit and industry concentration measures. Note that the sample of this table consists of firms with positive financing deficit (i.e., negative free cash flows). Net equity issuance (*ΔEquity*) is new equity issue sales minus equity repurchases in year *t*+1, scaled by total assets in year *t*. *Def* is the financing deficit, calculated as the sum of capital expenditure, changes in working capital, dividend payments, and acquisitions, minus operating cash flows and sales of plant, property, and equipment, all scaled by the previous year's total assets. All continuous variables except competition intensity are winsorized at the top and bottom 1% to eliminate the effect of outliers. We use 2-digit SIC classification when industry concentration measure is *HHI_Asset* or *HHI_Sale*, and use 3-digit NAICS classification when industry concentration measure is *HHI_Census*. *, ** and *** denote the significance of difference between high and low competition intensity tercile at the 0.10, 0.05 and 0.01 levels, respectively.

Table 5. Univariate Test of the Change in Cash

Panel A. HHI = *HHI_Asset*

ΔCash		Total Sample (n = 31,787)					Price Competition Group (n = 15,660)					Non-Price Competition Group (n = 16,127)				
		Concentration Rank					Concentration Rank					Concentration Rank				
		1:Low	2	3:High	3-1	p-value	1:Low	2	3:High	3-1	p-value	1:Low	2	3:High	3-1	p-value
Deficit Rank	1:Small	0.005	0.007	0.003	-0.002	(0.25)	0.006	0.003	0.006	0.000	(0.48)	0.006	0.009	0.001	-0.005*	(0.07)
	2	-0.023	-0.009	-0.016	0.007**	(0.01)	-0.009	-0.012	-0.011	-0.002	(0.31)	-0.033	-0.013	-0.021	0.012***	(0.00)
	3:Large	-0.005	0.036	-0.004	0.001	(0.43)	-0.002	-0.011	-0.004	-0.002	(0.45)	0.009	0.063	0.003	-0.006	(0.30)

Panel B. HHI = *HHI_Sale*

ΔCash		Total Sample (n = 31,787)					Price Competition Group (n = 15,660)					Non-Price Competition Group (n = 16,127)				
		Concentration Rank					Concentration Rank					Concentration Rank				
		1:Low	2	3:High	3-1	p-value	1:Low	2	3:High	3-1	p-value	1:Low	2	3:High	3-1	p-value
Deficit Rank	1:Small	0.002	0.008	0.002	0.000	(0.47)	0.000	0.007	0.004	0.004*	(0.08)	0.003	0.006	0.005	0.002	(0.27)
	2	-0.022	-0.014	-0.016	0.006**	(0.03)	-0.012	-0.011	-0.016	-0.004	(0.19)	-0.028	-0.027	-0.016	0.012***	(0.00)
	3:Large	-0.014	0.023	-0.009	0.005	(0.19)	-0.026	-0.002	-0.020	0.006	(0.17)	0.013	0.032	0.016	0.003	(0.38)

Panel C. HHI = *HHI_Census*

ΔCash		Total Sample (n = 11,917)					Price Competition Group (n = 6,058)					Non-Price Competition Group (n = 5,859)				
		Concentration Rank					Concentration Rank					Concentration Rank				
		1:Low	2	3:High	3-1	p-value	1:Low	2	3:High	3-1	p-value	1:Low	2	3:High	3-1	p-value
Deficit Rank	1:Small	-0.001	0.016	0.008	0.009***	(0.00)	0.002	0.011	-0.003	-0.004	(0.12)	-0.005	0.023	-0.004	0.001	(0.38)
	2	-0.014	-0.012	-0.012	0.002	(0.33)	-0.007	-0.008	-0.009	-0.002	(0.38)	-0.019	-0.005	-0.027	-0.008	(0.21)
	3:Large	0.000	0.073	-0.007	-0.007	(0.28)	-0.008	-0.017	-0.025	-0.017	(0.13)	0.004	0.102	0.062	0.058**	(0.04)

This table presents the change in cash for the tercile ranks of financing deficit and industry concentration measures. Note that the sample of this table consists of firms with positive financing deficit (i.e., negative free cash flows). The change in cash (*ΔCash*) is the annual change in cash and short-term investment from year *t* to year *t*+1, scaled by total assets in year *t*. *Def* is the financing deficit, calculated as the sum of capital expenditure, changes in working capital, dividend payments, and acquisitions, minus operating cash flows and sales of plant, property, and equipment, all scaled by the previous year's total assets. All continuous variables except competition intensity are winsorized at the top and bottom 1% to eliminate the effect of outliers. We use 2-digit SIC classification when industry concentration measure is *HHI_Asset* or *HHI_Sale*, and use 3-digit NAICS classification when industry concentration measure is *HHI_Census*. *, ** and *** denote the significance of difference between high and low competition intensity tercile at the 0.10, 0.05 and 0.01 levels, respectively.

Table 6. The System of Equations: Test of Competition Intensity, Competition Type, and Investment Funding Decision

Panel A. HHI = *HHI_Asset*

	Price competition (n = 15,660)			Non-price competition (n = 16,127)		
Dep. Var.=	(1) $\Delta Debt_{t+1}$	(2) $\Delta Equity_{t+1}$	(3) $\Delta Cash_{t+1}$	(4) $\Delta Debt_{t+1}$	(5) $\Delta Equity_{t+1}$	(6) $\Delta Cash_{t+1}$
Intercept	0.012**	-0.071***	-0.059***	0.000	-0.075***	-0.074***
	(0.049)	(0.000)	(0.000)	(0.954)	(0.000)	(0.000)
Def_{t+1}	0.601***	0.363***	-0.036**	0.494***	0.554***	0.049**
	(0.000)	(0.000)	(0.036)	(0.000)	(0.000)	(0.010)
Def_{t+1} * HHI_Asset_t	-0.045	0.075	0.031	0.301***	-0.977***	-0.667***
	(0.751)	(0.731)	(0.833)	(0.005)	(0.000)	(0.000)
HHI_Asset_t	-0.004	0.007	0.003	-0.037*	0.145***	0.108***
	(0.848)	(0.838)	(0.918)	(0.062)	(0.000)	(0.000)
$Size_t$	0.005***	-0.008***	-0.002***	0.008***	-0.013***	-0.004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MB_t	-0.006***	0.016***	0.011***	-0.004***	0.017***	0.013***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$SalesVola_t$	0.015***	-0.020**	-0.004	0.021***	-0.024**	-0.003
	(0.002)	(0.013)	(0.496)	(0.002)	(0.019)	(0.757)
$CFVola_t$	-0.136***	0.123***	-0.013	-0.119***	0.084***	-0.035
	(0.000)	(0.000)	(0.638)	(0.000)	(0.005)	(0.220)
$Loss\%_t$	-0.059***	0.066***	0.006	-0.060***	0.081***	0.021***
	(0.000)	(0.000)	(0.223)	(0.000)	(0.000)	(0.001)
Dep_t	-0.067	0.369***	0.302***	-0.047	0.222***	0.175***
	(0.142)	(0.000)	(0.000)	(0.282)	(0.000)	(0.008)
$Tangible_t$	0.026***	0.028***	0.054***	0.027***	0.060***	0.087***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)
$R\&D_t$	-0.019***	0.017***	-0.002	-0.010***	0.014***	0.004**
	(0.000)	(0.000)	(0.541)	(0.000)	(0.000)	(0.010)
$R\&D\_D_t$	-0.013***	0.012***	-0.001	-0.014***	0.018***	0.004
	(0.000)	(0.000)	(0.832)	(0.000)	(0.000)	(0.223)
$RetVola_t$	-0.055***	0.029	-0.026	-0.069***	-0.041	-0.109***
	(0.003)	(0.290)	(0.292)	(0.003)	(0.243)	(0.000)
Ret_t	-0.002	0.037***	0.036***	0.003	0.048***	0.051***
	(0.343)	(0.000)	(0.000)	(0.151)	(0.000)	(0.000)
Difference in Interactions						
Difference				0.355**	-1.052***	-0.698***
p-value				(0.023)	(0.001)	(0.000)

Panel B. HHI = *HHI_Sale*

	Price competition (n = 15,660)			Non-price competition (n =16,127)		
Dep. Var.=	(1) $\Delta Debt_{t+1}$	(2) $\Delta Equity_{t+1}$	(3) $\Delta Cash_{t+1}$	(4) $\Delta Debt_{t+1}$	(5) $\Delta Equity_{t+1}$	(6) $\Delta Cash_{t+1}$
Def_{t+1}	0.601***	0.358***	-0.041**	0.490***	0.559***	0.048***
	(0.000)	(0.000)	(0.018)	(0.000)	(0.000)	(0.009)
Def_{t+1} * HHI_Sale_t	-0.057	0.150	0.093	0.401***	-1.117***	-0.716***
	(0.689)	(0.532)	(0.558)	(0.001)	(0.000)	(0.000)
Controls	yes	yes	yes	yes	yes	yes
Difference in Interactions						
Difference				0.458***	-1.267***	-0.809***
p-value				(0.007)	(0.000)	(0.000)

Panel C. HHI = *HHI_Census*

Dep. Var.=	Price competition (n =6,058)			Non-price competition (n = 5,859)		
	(1) $\Delta Debt_{t+1}$	(2) $\Delta Equity_{t+1}$	(3) $\Delta Cash_{t+1}$	(4) $\Delta Debt_{t+1}$	(5) $\Delta Equity_{t+1}$	(6) $\Delta Cash_{t+1}$
Def_{t+1}	0.510***	0.433***	-0.057**	0.477***	0.498***	-0.024
	(0.000)	(0.000)	(0.038)	(0.000)	(0.000)	(0.369)
Def_{t+1} * HHI_Census_t	0.029***	-0.036***	-0.007	0.046***	-0.044***	0.002
	(0.000)	(0.000)	(0.290)	(0.000)	(0.007)	(0.914)
Controls	yes	Yes	Yes	yes	Yes	Yes
Difference in Interactions						
Difference				0.017	-0.009	0.008
p-value				(0.043)	(0.325)	(0.249)

This table presents the results of the system of equations to test the association between industry concentration and investment funding decision among cash holdings, debt financing and equity financing under price and non-price competition. In each panel, Columns (1) to (3) ((4) to (6)) show the results of firms with financing deficit under price (non-price) competition. The system of equations is estimated using the maximum likelihood method, and the standard errors are clustered at the firm level (Gould et al., 2006). Coefficients on other variables are abbreviated for the brevity. Definitions of the variables are given in Appendix A. All continuous variables except competition intensity are winsorized at the top and bottom 1% to eliminate the effect of outliers. We use 2-digit SIC classification when industry concentration measure is *HHI_Asset* or *HHI_Sale*, and use 3-digit NAICS classification when industry concentration measure is *HHI_Census*. The *p*-values in parentheses are two-tailed. *, ** and *** denote significance at the 0.10, 0.05 and 0.01 levels, respectively.

Table 7. The Effect of Industry Growth on the Relations between Industry Concentration and Investment Funding Decision

Panel A. Coefficients on $Def_{t+1}*HHI_t$ when HHI = *HHI_Asset*

	Price competition (n= 16,224)			Non-price competition (n= 15,638)			Difference		
Dep.Var.=	(1) $\Delta Debt_{t+1}$	(2) $\Delta Equity_{t+1}$	(3) $\Delta Cash_{t+1}$	(4) $\Delta Debt_{t+1}$	(5) $\Delta Equity_{t+1}$	(6) $\Delta Cash_{t+1}$	(4)-(1)	(5)-(2)	(6)-(3)
Low Industry Growth	0.012	-0.240**	0.228**	-0.121*	-0.159*	-0.280***	-0.133*	0.081	-0.052
	(0.880)	(0.046)	(0.027)	(0.066)	(0.090)	(0.001)	(0.098)	(0.299)	(0.345)
High Industry Growth	-0.121	0.415	0.294**	0.388	-1.337***	-0.989**	0.509**	-1.792***	-1.285***
	(0.109)	(0.157)	(0.012)	(0.117)	(0.003)	(0.029)	(0.025)	(0.001)	(0.003)

Panel B. Coefficients on $Def_{t+1}*HHI_t$ when HHI = *HHI_Sale*

	Price competition (n= 16,224)			Non-price competition (n= 15,638)			Difference		
Dep.Var.=	(1) $\Delta Debt_{t+1}$	(2) $\Delta Equity_{t+1}$	(3) $\Delta Cash_{t+1}$	(4) $\Delta Debt_{t+1}$	(5) $\Delta Equity_{t+1}$	(6) $\Delta Cash_{t+1}$	(4)-(1)	(5)-(2)	(6)-(3)
Low Industry Growth	0.040	-0.161	-0.121	-0.044	-0.298***	-0.342***	-0.084	-0.137	-0.221*
	(0.604)	(0.172)	(0.232)	(0.552)	(0.004)	(0.000)	(0.216)	(0.192)	(0.052)
High Industry Growth	-0.185**	0.517***	0.332***	0.580**	-1.631***	-1.051**	0.765***	-2.148***	-1.383***
	(0.016)	(0.000)	(0.005)	(0.047)	(0.003)	(0.049)	(0.006)	(0.000)	(0.006)

Panel C. Coefficients on $Def_{t+1}*HHI_t$ when HHI = *HHI_Census*

	Price competition (n=6,058)			Non-price competition (n=5,829)			Difference		
Dep.Var.=	(1) $\Delta Debt_{t+1}$	(2) $\Delta Equity_{t+1}$	(3) $\Delta Cash_{t+1}$	(4) $\Delta Debt_{t+1}$	(5) $\Delta Equity_{t+1}$	(6) $\Delta Cash_{t+1}$	(4)-(1)	(5)-(2)	(6)-(3)
Low Industry Growth	-0.004	-0.014	-0.018	0.038***	-0.041***	0.002	0.042***	-0.027*	0.020
	(0.648)	(0.264)	(0.121)	(0.000)	(0.001)	(0.787)	(0.000)	(0.064)	(0.183)
High Industry Growth	0.049***	-0.051***	0.002	0.051***	-0.138***	-0.087**	0.002	-0.087***	-0.085***
	(0.000)	(0.000)	(0.701)	(0.002)	(0.000)	(0.013)	(0.441)	(0.000)	(0.009)

This table presents the coefficient on financing deficit and industry concentration measure from the estimation of the system of equations. It uses firms with financing deficit (positive cash shortfalls from operation and investment activities). Industry growth is measured using the annual change in industry-level sales from year *t*-1 to year *t*. Industry with growth rate higher than the median value is classified as high growth industry. To calculate industry-level aggregate sales, we use all available observations from Compustat rather than our financial sample to avoid the potential bias due to our sample selection. In each panel, Columns (1) to (3) ((4) to (6)) show the results using firms under price (non-price) competition. The system of equations is estimated using the maximum likelihood method and the standard errors are clustered at the firm level (Gould et al., 2006). Coefficients on other variables are abbreviated for the brevity. Definitions of the variables are given in Appendix A. All continuous variables except competition intensity are winsorized at the top and bottom 1% to eliminate the effect of outliers. We use 2-digit SIC classification when industry concentration measure is *HHI_Asset* or *HHI_Sale*, and use 3-digit NAICS classification when industry concentration measure is *HHI_Census*. The *p*-values in parentheses are two-tailed. *, ** and *** denote significance at the 0.10, 0.05 and 0.01 levels, respectively.

Table 8. The Effect of Growth Opportunity and Life Cycle on the Relations between Competition Intensity and Financing and Payout Policies

Panel A. Partitioning the Sample Based on Growth Opportunity

Coefficients on Def_{t+1}*HHI_Asset_t	Price competition (n= 16,224)			Non-price competition (n= 15,638)			Difference		
	(1) $\Delta Debt_{t+1}$	(2) $\Delta Equity_{t+1}$	(3) $\Delta Cash_{t+1}$	(4) $\Delta Debt_{t+1}$	(5) $\Delta Equity_{t+1}$	(6) $\Delta Cash_{t+1}$	(4)-(1)	(5)-(2)	(6)-(3)
Low Growth Opportunity	0.126	-0.392*	-0.266	-0.032	-0.208	-0.240	-0.158	0.184	0.026
	(0.503)	(0.093)	(0.209)	(0.854)	(0.408)	(0.199)	(0.268)	(0.296)	(0.464)
Middle Growth Opportunity	-0.363	0.131	-0.232	0.343	-1.116***	-0.772***	0.706**	-1.245***	-0.540**
	(0.126)	(0.659)	(0.176)	(0.132)	(0.002)	(0.003)	(0.019)	(0.004)	(0.041)
High Growth Opportunity	0.130	0.080	0.210	0.518***	-1.299***	-0.781***	0.388*	-1.379***	-0.991***
	(0.475)	(0.802)	(0.341)	(0.005)	(0.000)	(0.007)	(0.067)	(0.001)	(0.003)

Panel B. Partitioning the Sample Based on Life Cycle

Coefficients on Def_{t+1}*HHI_Asset_t	Price competition (n= 16,224)			Non-price competition (n= 15,638)			Difference		
	(1) $\Delta Debt_{t+1}$	(2) $\Delta Equity_{t+1}$	(3) $\Delta Cash_{t+1}$	(4) $\Delta Debt_{t+1}$	(5) $\Delta Equity_{t+1}$	(6) $\Delta Cash_{t+1}$	(4)-(1)	(5)-(2)	(6)-(3)
Old Firms	-0.009	-0.014	-0.023	-0.272	-0.408*	-0.680	-0.263	-0.394	-0.657***
	(0.957)	(0.953)	(0.864)	(0.113)	(0.095)	(0.001)	(0.135)	(0.128)	(0.005)
Middle Firms	-0.185	0.208	0.023	1.100***	-1.870***	-0.770**	1.285***	-2.078***	-0.793**
	(0.480)	(0.566)	(0.931)	(0.000)	(0.000)	(0.020)	(0.000)	(0.000)	(0.030)
Young Firms	-0.083	0.219	0.137	0.419***	-1.143***	-0.724***	0.502**	-1.363***	-0.861**
	(0.666)	(0.548)	(0.656)	(0.023)	(0.000)	(0.002)	(0.029)	(0.001)	(0.012)

This table presents the results of the system of equations to examine the effects of growth opportunity and life cycle on the relations between financing and payout policies. It uses firms with financing deficit (positive cash shortfalls from operation and investment activities). Growth opportunity is measured using the market-to-book ratio of equity. Firms in the highest (lowest) tercile of the market-to-book ratio are classified as having high (low) growth opportunity. Life cycle is measured using Z-score = *Z_Sale_GR – Z_AGE + Z_CAPEX – Z_SIZE*, where Z-score for each variable is calculated by subtracting its mean and dividing it by its standard deviation (Collins et al. 2014). We classify the firms in the lowest (highest) tercile of Z_score as firms with old (young) firms. M/B or Z_score are ranked using the full sample to avoid the case that firms in one type of competition has higher values of M/B or Z_score than firms in other type of competition. In each panel, Columns (1) to (3) ((4) to (6)) show the results using firms under price (non-price) competition. The system of equations is estimated using the maximum likelihood method and the standard errors are clustered at the firm level (Gould et al., 2006). *Def* is the financing deficit, calculated as the sum of capital expenditure, change in working capital, dividend payments, and acquisitions, minus operating cash flows and sales of plant, property, and equipment, all scaled by the previous year's total assets. Coefficients on other variables are abbreviated for the brevity. Definitions of the variables are given in Appendix A. All continuous variables except competition intensity are winsorized at the top and bottom 1% to eliminate the effect of outliers. We use 2-digit SIC classification when industry concentration measure is *HHI_Asset* or *HHI_Sale*, and use 3-digit NAICS classification when industry concentration measure is *HHI_Census*. The *p*-values in parentheses are two-tailed. *, ** and *** denote significance at the 0.10, 0.05 and 0.01 levels, respectively.

Table 9. The Firm-Level Measure of Price vs. Non-Price Competition

Panel A. HHI = *HHI_Asset*

	Price competition (n=14,119)			Non-price competition (n=13,889)		
Dep. Var.=	(1) $\Delta Debt_{t+1}$	(2) $\Delta Equity_{t+1}$	(3) $\Delta Cash_{t+1}$	(4) $\Delta Debt_{t+1}$	(5) $\Delta Equity_{t+1}$	(6) $\Delta Cash_{t+1}$
Def_{t+1}	0.649***	0.369***	0.018	0.445***	0.572***	0.017
	(0.000)	(0.000)	(0.286)	(0.000)	(0.000)	(0.405)
Def_{t+1} * HHI_Asset_t	-0.021	-0.373*	-0.394**	0.226*	-0.701***	-0.475***
	(0.880)	(0.088)	(0.019)	(0.061)	(0.000)	(0.000)
Controls	yes	yes	yes	yes	yes	yes
Difference in Interactions						
Difference				0.247*	-0.328	-0.081
p-value				(0.088)	(0.126)	(0.358)

Panel B. HHI = *HHI_Sale*

	Price competition (n=14,119)			Non-price competition (n=13,889)		
Dep. Var.=	(1) $\Delta Debt_{t+1}$	(2) $\Delta Equity_{t+1}$	(3) $\Delta Cash_{t+1}$	(4) $\Delta Debt_{t+1}$	(5) $\Delta Equity_{t+1}$	(6) $\Delta Cash_{t+1}$
Def_{t+1}	0.650***	0.360***	0.010	0.445***	0.568***	0.013
	(0.000)	(0.000)	(0.567)	(0.000)	(0.000)	(0.561)
Def_{t+1} * HHI_Sale_t	-0.027	-0.274	-0.301	0.246*	-0.699***	-0.453***
	(0.885)	(0.268)	(0.106)	(0.055)	(0.005)	(0.001)
Controls	yes	yes	yes	yes	yes	yes
Difference in Interactions						
Difference				0.273*	-0.425*	-0.152
p-value				(0.080)	(0.083)	(0.253)

Panel C. HHI = *HHI_Census*

	Price competition (n=5,446)			Non-price competition (n=5,413)		
Dep. Var.=	(1) $\Delta Debt_{t+1}$	(2) $\Delta Equity_{t+1}$	(3) $\Delta Cash_{t+1}$	(4) $\Delta Debt_{t+1}$	(5) $\Delta Equity_{t+1}$	(6) $\Delta Cash_{t+1}$
Def_{t+1}	0.640***	0.314***	-0.046	0.368***	0.659***	0.027
	(0.000)	(0.000)	(0.109)	(0.000)	(0.000)	(0.484)
Def_{t+1} * HHI_Census_t	0.015*	-0.023*	0.008	0.056***	-0.084***	-0.028**
	(0.053)	(0.059)	(0.301)	(0.000)	(0.000)	(0.041)
Controls	yes	yes	yes	yes	yes	yes
Difference in Interactions						
Difference				0.041***	-0.061***	-0.020
p-value				(0.004)	(0.001)	(0.101)

This table presents the results of the system of equations based on the partition using the firm-level indicator of non-price competition. The firm-level indicator of non-price competition is a composite index of five firm characteristics (=*Z_AD* + *Z_R&D* + *Z_MB* – *Z_CAPEX* + *Z_AGE*). *AD* is the advertising expenses-to-sales ratio, *R&D* is the R&D expenses-to-sales ratio, *MB* is the market-to-book ratio, *CAPEX* is the ratio of capital expenditure on lagged total assets, and *AGE* is the firm age. *Z_var* is the rank of specific variable, *var*, in each year. We partition the firm into non-price competition if firm-level indicator of non-price competition is higher than its mean value. In each panel, Columns (1) to (3) ((4) to (6)) show the results using firms under price (non-price) competition. The system of equations is estimated using the maximum likelihood method and the standard errors are clustered at the firm level (Gould et al., 2006). Coefficients on other variables are abbreviated for the brevity. Definitions of the variables are given in Appendix A. All continuous variables except competition intensity are winsorized at the top and bottom 1% to eliminate the effect of outliers. We use 2-digit SIC classification when industry concentration measure is *HHI_Asset* and use 3-digit NAICS classification when the industry concentration measure is *HHI_Census*. The *p*-values in parentheses are two-tailed. *, ** and *** denote significance at the 0.10, 0.05 and 0.01 levels, respectively.

Table 10. Using the Import Penetration to Capture Competition Intensity

	Price competition (n = 2,159)			Non-price competition (n =16,127)		
Dep. Var.=	(1) $\Delta Debt_{t+1}$	(2) $\Delta Equity_{t+1}$	(3) $\Delta Cash_{t+1}$	(4) $\Delta Debt_{t+1}$	(5) $\Delta Equity_{t+1}$	(6) $\Delta Cash_{t+1}$
Intercept	-0.016	-0.032	-0.048***	0.014	-0.116***	-0.102***
	(0.245)	(0.122)	(0.007)	(0.392)	(0.000)	(0.000)
Def_{t+1}	0.809***	0.047	-0.144**	0.469***	0.612***	0.081
	(0.000)	(0.534)	(0.035)	(0.000)	(0.000)	(0.297)
Def_{t+1} * $Penetration_t$	-0.883***	1.324***	0.441*	-0.089	-0.543	-0.632**
	(0.000)	(0.000)	(0.095)	(0.679)	(0.113)	(0.026)
$Penetration_t$	0.155***	-0.140***	0.015	0.020	0.005	0.025
	(0.000)	(0.010)	(0.759)	(0.615)	(0.940)	(0.685)
$Size_t$	0.005***	-0.009***	-0.004**	0.008***	-0.015***	-0.007***
	(0.000)	(0.000)	(0.023)	(0.000)	(0.000)	(0.004)
MB_t	-0.008***	0.017***	0.009***	-0.004***	0.029***	0.025***
	(0.000)	(0.000)	(0.008)	(0.005)	(0.000)	(0.000)
$SalesVola_t$	0.041***	-0.038	0.003	0.023	-0.050	-0.027
	(0.004)	(0.125)	(0.869)	(0.174)	(0.158)	(0.410)
$CFVola_t$	-0.125***	0.179**	0.054	-0.143***	0.067	-0.076
	(0.009)	(0.013)	(0.457)	(0.000)	(0.441)	(0.363)
$Loss\%_t$	-0.053***	0.073***	0.020	-0.064***	0.110***	0.046**
	(0.000)	(0.000)	(0.216)	(0.000)	(0.000)	(0.014)
Dep_t	-0.194*	0.533**	0.339	-0.171	1.455***	1.284***
	(0.080)	(0.022)	(0.109)	(0.230)	(0.000)	(0.000)
$Tangible_t$	0.039**	0.066**	0.105***	0.011	0.020	0.031
	(0.023)	(0.039)	(0.000)	(0.589)	(0.616)	(0.426)
$R\&D_t$	-0.015***	0.018	0.003	-0.009***	0.017***	0.008**
	(0.000)	(0.138)	(0.760)	(0.000)	(0.000)	(0.014)
$R\&D\_D_t$	-0.017***	0.015*	-0.002	-0.022***	0.017***	-0.005
	(0.002)	(0.057)	(0.777)	(0.000)	(0.000)	(0.573)
$RetVola_t$	-0.099***	-0.076	-0.175***	-0.031	-0.150	-0.181*
	(0.004)	(0.268)	(0.005)	(0.435)	(0.169)	(0.077)
Ret_t	0.004	0.040***	0.044***	0.002	0.086***	0.088***
	(0.199)	(0.007)	(0.002)	(0.699)	(0.000)	(0.000)
Difference in Interactions						
Difference				0.794***	-1.867***	-1.073***
p-value				(0.007)	(0.000)	(0.003)

This table presents the results of the system of equations to test the association between import penetration and investment funding decision among cash holdings, debt financing and equity financing. Columns (1) to (3) ((4) to (6)) show the results using firms under price (non-price) competition. The system of equations is estimated using the maximum likelihood method and the standard errors are clustered at the firm level (Gould et al., 2006). *Def* is the financing deficit. Financing deficit is calculated as the sum of capital expenditure, change in working capital, dividend payments, and acquisitions, minus operating cash flows and sales of plant, property, and equipment, all scaled by the previous year's total assets. *Penetration* is the industry-level import penetration, which is calculated as imports / (imports + domestic production) (Xu, 2012). Industry is defined at 3-digit NAICS classification. Import data is obtained from TradeStatsExpress at the US Government Export Portal. Domestic production data is retrieved from the Bureau of Economic Analysis of the US Department of Commerce. Coefficients on other variables are abbreviated for the brevity. Definitions of the variables are given in Appendix A. All continuous variables except competition intensity are winsorized at the top and bottom 1% to eliminate the effect of outliers. We use 3-digit NAICS classification to partition the sample into price and non-price competition industries. The *p*-values in parentheses are two-tailed. *, ** and *** denote significance at the 0.10, 0.05 and 0.01 levels, respectively.

Appendix A: Variable Definition

Variable	Definition
HHI_Asset(*Sale*)	Herfindahl-Hirschman Index for 2-digit SIC industries, constructed using the total assets (sales) of U.S. listed companies in the Compustat database.
HHI_Census	Herfindahl-Hirschman Index from the U.S. Census Bureau. Since the Census of Manufactures is published in every 5 years, we assume that the HHI values of 1997, 2002, and 2007 are valid for 5 years period centered on 1997, 2002, and 2007. We match this data to Compustat database using 3-digit NAICS (North American Industry Classification System).
ΔCash	The change in cash and short-term investments (Compustat code: CHE), scaled by one-year lagged total assets (AT).
ΔDebt	Net debt issue, calculated as the change in the sum of short-term debt (DLC) and long-term debt (DLTT), scaled by one-year lagged total assets.
ΔEquity	Net equity issue, calculated as new equity issue (SSTK) minus equity repurchase (PRSTKC), scaled by one-year-lagged total assets.
Def	Financing deficit. The sum of capital expenditure (CAPX), change in working capital (annual change in (ACT-CHE)-(LCT-DLC)), acquisitions (AQC) and dividend payments (DVC+DVP) minus sales of property, plant and equipment (SPPE) and cash flows from operations (OANCF), scaled by one-year-lagged total assets (Frank and Goyal 2003).
Size	The natural log of total assets (AT).
Lev	The ratio of interest-bearing debt (DLC+DLTT) to total assets.
BM	The ratio of the book value of equity to the market value of equity (CSHO*PRCC_F).
CFVola	The standard deviation of cash flows from operations (OANCF) scaled by total assets over the past five years.
Loss%	The percentage of years that the firm reported losses in net income (NI) over at least three of the past five years.
Dep	The ratio of depreciation and amortization expenses (DP) to the previous year's total assets.
R&D	Research and development expenses (XRD), scaled by sales. Zero for firms that do not report R&D expenses.

R&D_D	An indicator variable that equals one for firms reporting R&D expenses, and zero otherwise.
RetVola	The standard deviation of daily stock returns over the fiscal year, obtained from CRSP database.
Ret	Stock returns over the fiscal year.
ROA	Return-on-assets, calculated by net income (NI) scaled by one-year-lagged total assets.

Appendix B: Capital Expenditure, Industry Concentration, and Competition Type

Table 6 shows that firms under non-price competition use more debt financing relative to equity financing when industry concentration is higher, whereas industry concentration does not have a significant influence on investment funding decision for firms under price competition. To investigate whether this finding is attributable to the difference in the type of investment between firms under price and non-price competition, we estimate the following regression for the subsample of price and non-price competition industries.

$$\Delta Debt_{i,t+1} \text{ or } \Delta Equity_{i,t+1} = b_1\, HHI_{i,t} + b_2\, Capex_{i,t+1} + b_3\, HHI_{i,t}{*}Capex_{i,t+1} + Controls + Industry\ FE + Year\ FE + e_{i,t+1} \quad \text{(B.1)}$$

where *Capex* is the capital expenditure scaled by lagged total assets. We use capital expenditure rather than an aggregate measure of investments because capital expenditure is not related to intangible assets and thus less likely to have different influences on financing choices under price and non-price competition. Here, we do not use the system of equations because using capital expenditure as the independent variable does not allow us to maintain the accounting identity in Equation (1).

The results in Table B.1 show that there is a significant difference in financing choices to fund capital expenditure between price and non-price competition industries. For price competition industries, the interaction of industry concentration and capital expenditure does not have a significant coefficient. However, capital expenditure is related with less equity financing as industry concentration increases, whereas it has no significant relation with debt financing. This indicates that the positive relation between non-price competition industry concentration and the reliance on debt financing relative to equity financing is attributable to the difference in the market structure rather than to the difference in investment choices between price and non-price competition.

Table B.1. The Difference in Financing Choices to Fund Capital Expenditures between Firms under Price and Non-Price Competition

Panel A. Debt Financing

	Price competition			Non-price competition		
Dep. Var.=	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta Debt_{t+1}$	*HHI= HHI_Asset*	*HHI= HHI_Sale*	*HHO= HHI_Census*	*HHI= HHI_Asset*	*HHI= HHI_Sale*	*HHI= HHI_Census*
$Capex_{t+1}$	0.595***	0.593***	0.706***	0.645***	0.634***	0.657***
	(0.000)	(0.000)	(0.000)	(0.006)	(0.000)	(0.000)
$Capex_{t+1}*HHI_t$	0.438	0.472	0.015	-0.401	-0.290	0.106**
	(0.214)	(0.214)	(0.545)	(0.184)	(0.405)	(0.039)
Controls	yes	yes	yes	yes	yes	yes
Industry/Year FE	yes	yes	yes	yes	yes	yes
Adj. R2	0.108	0.108	0.086	0.097	0.097	0.075
N	32,681	32,681	8,740	30,924	30,924	13,404

Panel B. Equity Financing

	Price competition			Non-price competition		
Dep. Var.=	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta Equity_{t+1}$	*HHI= HHI_Asset*	*HHI= HHI_Sale*	*HHO= HHI_Census*	*HHI= HHI_Asset*	*HHI= HHI_Sale*	*HHI= HHI_Census*
$Capex_{t+1}$	0.372***	0.331***	0.579***	0.401***	0.392***	0.597***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Capex_{t+1}*HHI_t$	0.747	0.703	-0.056**	-1.062***	-1.047***	-0.121***
	(0.206)	(0.288)	(0.022)	(0.002)	(0.007)	(0.002)
Controls	yes	yes	yes	yes	yes	yes
Industry/Year FE	yes	yes	yes	yes	yes	yes
Adj. R2	0.216	0.216	0.213	0.300	0.300	0.332
n	32,681	32,681	8,740	30,924	30,924	13,404

This table presents the result of the regression of debt and equity financing on capital expenditure, industry concentration, and the interaction between capital expenditure and industry concentration. In each panel, Columns (1) to (3) ((4) to (6)) show the results using firms with financing deficits under price (non-price) competition. The standard errors are clustered at the firm level. Coefficients on other variables are abbreviated for brevity. Definitions of the variables are given in Appendix A. All continuous variables are winsorized at the top and bottom 1% to eliminate the effect of outliers. We use 2-digit SIC classification when our measure of competition intensity is *HHI_Asset* or *HHI_Sale*, and use 3-digit NAICS classification when the competition intensity measure is *HHI_Census*. The *p*-values in parentheses are two-tailed. *, ** and *** denote significance at the 0.10, 0.05 and 0.01 levels, respectively.