〔論　　文〕

『金融経済研究』第43号，2021年３月

Competitive Position and Cash Holdings: Evidence from Japanese Listed Firms*

Yue Cai

1 Introduction

Corporations that hold a large amount of cash have garnered much attention in the academic literature. Many economists have attempted to explore the motivation behind cash holding decisions from different perspectives.[1] Most of the cash holding literature uses a single-firm framework to analyze a firm's cash holding decisions. A firm's cash holding decisions are typically assumed to be determined as a function of financial constraints, investment opportunities, and the status of cash flow. However, also took into consideration is firms also take into account the interactions with other firms. The single-firm framework is overlooking the significance of the strategic interactions among firms in their cash holding decisions.[2]

The extant research shows that cash is used as an insurance mechanism against the risk of liquidity shock when firms face financial constraints. While many explanations have been proposed for the precautionary motivation of cash holdings, in this paper, we argue that the precautionary motivation of the firm is also affected by a key factor of the product market; namely, the competitive position (market power). To see how the cash holding decision varies with the competitive position of each firm, we consider two identical firms: firm 1, with a highly competitive position, and firm 2, with a low competitive position. The equilibrium cash flow of firm 1 is higher thanks to the cost advantage. If a negative cash flow shock arrives, firm 1 suffers less of an impact to its cash flow than firm 2. A natural application of this example is that firms with a low competitive position should hoard cash. The extant literature implies that firms that command a price above marginal cost can pass on a proportion of any risk to its consumer.[3] Hence, a competitive position has an important determinant for the cash holding policy. On the other hand, if the external capital market is perfect, cash policy is irrelevant. Firms could meet any adverse cash flow shock by increasing the amount of

＊ I would like to thank Yoshiaki Ogura for his insightful research guidance. I am grateful to Yukihiro Yasuda, Hideyuki Takamizawa, Hidetaka Mitani, seminar participants at the Hitotsubashi University, and two anonymous referees for their valuable comments and suggestions. All errors are my own.

1) See, Almeida, Campello, Cunha, and Weisbach (2014) for a detailed survey of liquidity management.

2) Various theoretical literature attempts to link industrial organization and firms' capital structures. See Cestone (1999) for a detailed survey. For the empirical literature on the effect of product markets, see, for example, Mackay and Philips (2005), Leary and Roberts (2014).

3) See, Gaspar and Massa (2005), Irvini and Pontiff (2009) and Hou and Robinson (2006).

external financing without an additional cost. However, if the external market is not perfect, firms cannot do so. Therefore, the market power and the external financing markets have an impact on firms' cash holding policies. The theoretical and empirical researches on cash holdings have not fully considered how different competitive positions influence firms' cash holding decisions. The primary purpose of this study is to fill in this gap in the literature.

To understand how the competitive position influences optimal cash policies, we introduce the product market interaction into the cash-holding model by Acharya, Davydenko, and Strebulaev (2012) and show that the heterogeneity in marginal costs brings the heterogeneity in cash policies within each industry. Our augmented model shows that a firm with the cost advantage holds less cash in the equilibrium since it anticipates the higher equilibrium cash flow that will serve as a buffer against the future default risk, and so its precautionary cash demand is smaller. Hence, firms with a highly competitive position hold less cash and vice versa. We test our hypothesis, by the dataset of Japanese listed companies for the period 2006 to 2015.

To measure competitive position, we use the excess price cost margin[4] and the mark-ups constructed by De Loecker and Eeckhout (2017). After controlling for a firm's financing policy (net working capital, bank debt), various firm features (tangibility, market-to-book ratio, investment, cash flow volatility, and sales volatility) and corporate governance factors of firms (ownership structure and board structure), we find that one sigma increase in the competitive position decreases the cash-to-net-asset ratio by 2.2 percentage points on average. Given that the sample median of the cash-to-net-asset ratio is 0.113, the impact of the competitive position is not only statistically but also economically significant. We conduct robustness tests to examine the empirical validity in terms of the diversification, reverse causality, and special events during the sample period. We also explored the non-linear relationship between competitive position and cash holdings. Allowing a non-linear relationship between the two does not affect our main results. Overall, our empirical analysis provides robust evidence in support of our empirical hypothesis.

In addition to the above main result, we also find that financial constraints have a significant effect on the relationship between the competitive position and cash holdings. Consistent with our hypothesis, the estimated coefficients of the interaction terms of the financial constraint (bank dependence) and DLE mark-ups measure are positive and significant. Our empirical results suggest that the effect of a competitive position on cash holdings increases with the level of financial constraints. The results are also robust using a subsample analysis. Following Almeida, Campello, and Weisbach (2004), we split the sample into firms with financial constraints and firms without financial constraints. We find a negative relationship between competitive position and cash holdings that is significant among firms with financial constraints.

The remainder of this paper is organized as follows. Section 2 discusses the related literature. Section 3 develops our empirical hypothesis. Section 4 describes variables and summary statistics. Section 5 presents the empirical results, and Section 6 discusses the robustness check of our main results. Section 7 concludes.

4) This measure is the Lerner Index, or price cost margin, following Aghion *et al.* (2005) and Gaspar and Massa (2006).

2 Related Literature

This paper is related to the existing literature in several areas. First, this paper comments on the precautionary motivation of cash holdings. Almeida *et al.* (2004) argue that financially constrained firms cannot effectively obtain external financing when investment opportunities arise. Financially constrained firms are likely to set aside cash from the cash flow to be used in the event of a future cash flow shortage. Empirical studies in line with Almeida *et al.* (2004) are Opler *et al.* (1999), Almeida *et al.* (2004), Bates *et al.* (2009) and Sufi (2007). Opler *et al.* (1999) find that firms' cash holdings increase with firms' growth opportunities, and the firms with less access to the external capital market hold more cash. Almeida *et al.* (2004) find that financially constrained firms save more cash from their cash flows. Bates *et al.* (2009) provide consistent results to show that precautionary motivation is a key reason for the rising trend in cash holdings. Sufi (2007) uses the bank credit line as a measurement for financial constraints. The author concludes that firms without a bank credit line show positive cash flow sensitivity for cash. These studies provide insights to the precautionary motivation for cash holdings. However, these studies pay little attention to product market interactions among firms.

Second, this paper contributes to the recent literature that offers two different views of the relationship between product market interactions and cash holdings. The first view focuses on the strategic role of cash holding policy. Fresard (2010) uses tariff reductions as an exogenous shock to the product market competition and finds that firms with higher cash holdings gain more future market share. Lyandres and Palazzo (2016) argue that the success rate of firms' R&D efforts is related to the cash holdings of firms. Cash holdings indirectly give firms a competitive advantage. The second view focuses on the precautionary role of cash holdings. The paper that is most related to our paper is Morellec, Zucchi, and Nikolov (2014) (MZN). The authors present a model showing that firms in a more competitive industry tend to hold more cash, and this effect is stronger when firms face tighter financial constraints. Then, the authors use a similar identification strategy (tariff reduction) as Fresard (2010) and show empirical results to justify their theory. The main difference between our paper and that of MZN is that MZN are concerned with the effect of industrial concentration between industries. We, on the other hand, focus on the firm's relative market power within the industry. Another related paper is Haushalter, Klasa, and Maxwell (2007). The authors use the similarity of input technology as the measure of predatory risk and suggest that firms hold more cash when they face the risk of predation. In contrast to Haushalter, Klasa, and Maxwell (2007), we provide empirical results from another perspective and explain how a competitive position drives firms' cash holding policy.

Finally, this paper contributes to the literature on cash holding decision making in Japan. Ando, Hori, and Saito (2009) empirically investigate the determinants of cash holdings using panel data for Japanese listed firms. Pinkowitz and Williamson (2001) find that the main banking system is responsible for larger cash holdings among Japanese firms. The main banks with monopoly power force client firms to hold more cash in the main bank's account. Ogawa (2015) reviews this theory by applying recent data. He finds that a bank relationship helps cash management for client firms. Firms with a tighter relationship with banks hold less cash for precautionary motivation. Sasaki and Suzuki (2017) examine how the soundness of banks affects firms' cash holdings. The main focus of

this literature is on the effect of the banking system on cash holdings, and our contribution is to explore the impact of the product market factor on cash holdings of Japanese firms.

3 Theoretical Motivation and Empirical Hypothesis

This section applies a cash demand model developed by Acharya *et al.* (2012). I borrow this framework and introduce the product market interaction into this framework to derive our testable empirical hypothesis.

There are three dates, $t=\{0, 1, 2\}$. The timeline of this model is as follows:

At $t=0$. A firm's assets in place has two components: 1) non-cash productive assets and 2) cash flow C_0 accumulated before this period. The firm can use cash flow C_0 to invest in a long-term project that requires I at $t=0$ and pays off $f(I)$ at $t=2$. We assume $f(\cdot)$ is increasing, concave, and continuously differentiable where $f'(\cdot)>0$, $f''(\cdot)<0$. Meanwhile, C_0 can also be saved as cash holdings w where $w=C_0-I$.

At $t=1$, firms must repay exogenous debt D. Non-cash productive assets produce an interim period cash flow C_1, which is affected by the product market competitive environment. At the same time, firms face a zero mean random cash flow shock e with support $[e_L, \infty]$. $G(e)$ and a weakly monotonically increasing hazard rate $h(e)=\dfrac{g(e)}{1-G(e)}$. e_L is the minimum cash flow shock that satisfies the manager's limited liability condition. If $w+C_1+e>D$, the firm will continue to operate until the next period. Otherwise, the firm will be liquidated and generate a zero value. At $t=2$. Non-cash productive assets produce cash flow C_2, and $f(I)$ is realized.

Here, to generate a rational cash holding policy, we assume that firms face complete financial constraints. A firm's future revenue $(f(I)+C_2)$ is observable but not verifiable to outside investors, so firms must use internal funds to repay debt D. To simplify the problem, we also make the following assumptions: the manager is risk neutral and acts in the best interests of shareholders. The discount rate is set at one, and the risk-free rate is zero.

An important argument is that a firm with a weak competitive position could reduce its need to hold large amounts of cash by simply not levering itself as much. As Acharya *et al.* (2012) point out, cash adjustments are easier than debt adjustments, variation in cash holdings are much larger than those in leverage. Therefore, we are here to focus only on cash holdings and treat debt as an exogenous variable.

3.1 Optimal Cash Holdings

Assume that firm's interim period cash flow C_1 is generated by the homogeneous Cournot market with n asymmetric firms (with different constant marginal cost c_i). Following Belleflamme and Peitz (2010), we consider a linear demand, $P(Q)=a-b\cdot Q$, where $a>0$, $b>0$. Total output Q is $Q=q_1+\cdots+q_n$, where q_i denoting the output of firm i. The equilibrium cash flow C_1^* is determined by a Nash equilibrium where the payoff function is $C_1=(a-b\cdot Q)q_i-c_iq_i$. The following classic proposition of Cournot competition characterizes the links between the product market interaction and cash flow C_1. The proof of proposition is shown in the appendix unless otherwise noted.

Proposition 1: *The equilibrium output is given by* $q_i^*=(a-n\cdot c_i+c_{-i})/b(n+1)$, *where* $c_{-i}=\sum_{j\neq i}c_j$.

The equilibrium cash flow is $C_1^*=(a-n\cdot c_i+c_{-i})^2/b(n+1)^2$. *We can observe that* $\partial C_1^*/\partial c_i<0$, $\partial C_1^*/\partial c_{-i}>0$ *and* $\partial(q_i^*/Q^*)/\partial c_i<0$, $\partial(q_i^*/Q^*)/\partial c_{-i}>0$.

Proposition 1：state that firm's interim cash flow is related to firm's marginal cost (productive efficiency). Other things held constant, firms with relatively low marginal cost will produce more and obtain higher equilibrium interim cash flow C_1^* and higher equilibrium market share (q_i^*/Q^*).

Manager maximize the equity value V of firm. In order to derive the equity value of an active firm, we need to know the conditions for the firm to repay D and operate until the next period. The minimum shock e that allowing a firm to avoid bankruptcy is given by $e_D=D-w-C_1$. Therefore, consider the active firm shock region $[e_D, \infty]$, the manager sets its investment to maximize the total return to shareholders:

$$\max_I V=\int_{e_D}^{\infty}[C_0-I+C_1+e-D+f(I)+C_2]g(e)de$$

The first order condition is given by[5)]

$$(f'(I)-1)(1-G(e_D))dI=(f(I)+C_2)g(e_D)de_D \tag{1}$$

The left-hand side of equation (1) is the marginal gain of increasing investment, and the right-hand side of equation (1) is the marginal cost of default. The choice faced by the manager is whether investment or hold cash in the first period. Hence, from the first order condition, optimal hoarding policy weight the cost of reducing the marginal gain from long term investment project with the benefit of lower loss from default. How does the product market interaction affect the firm's choice of hoarding? From result 1, we already know that firm enjoys higher interim cash flow in relation to their lower marginal cost (higher productive efficiency). For the firm with relatively lower marginal cost, due to the lower default boundary, the cost of decreasing investment dominates, the manager will reduce hoarding and increase investment.[6)] By contrast, for the firm with relatively higher marginal cost, the benefit of avoiding default dominates, the manager is more likely to hold cash and reduce investment. The following proposition formalizes how marginal cost affects cash holding.

Proposition 2: *If* $h(\cdot)$ *is monotonically increasing, when firm's marginal cost increases or when the marginal cost of any its rival decreases, firm is more likely to hold cash.*

What is worth exploring is that we assume that the interim cash flow is generated by the asymmetric marginal cost Cournot competition. The assumption of this industry structure is somewhat loss of generality, because some manufacturing industries also compete through price. Our empirical hypothesis can also be derived from Bertrand competition (See Spulber (1995)). An important intuition of price competition is that firms that set lower prices are more likely to win market competition. Therefore, at this point the Bertrand competition can also be regarded as an auction in which the lowest bidder supplies all the market demand. Each firm faces a trade-off. On the one hand, firms want their pricing to be closer to the monopoly price, thereby gaining greater

5) The second order condition is $f''(I)-f'(I)h(e_D)-(f(I)+C_2)h'(e_D)<0$. Under the assumption $f''(\cdot)<0$ and $h'(\cdot)\geq 0$, the second order condition is negative.

6) It can be seen that firm enjoy higher interim cash flow in relation to their marginal cost. The proof of Proposition 3 in Acharya *et al.* (2012) implies that $de_D/dC_1<0$. Combined with Result 1, we can obtain that $de_D/dc_i=(de_D/dC_1)\cdot(dC_1/dc_i)>0$.

profits. On the other hand, setting higher prices will make them less likely to win price competition, so firms must consider reducing prices to win the competition. The higher the marginal cost of a firm, the less attractive it is to reduce the price. Follow Proposition 3 of Spulber (1995), the expected profit is decreasing in marginal cost. This is consistent with the intuition we have set out in the Cournot competition. Therefore, our instructions are based on the Cournot competition does not imply that our empirical tests rely on the assumptions that firms compete through Cournot.

3.2 Testable Empirical Hypothesis

Because we can't directly observe the firm's marginal cost, so we use the excess price cost margin to reflect the effect of marginal cost (hereafter, EPCM). We follow Aghion *et al.* (2005), Gaspar and Massa (2006) and construct our measure of EPCM as the difference between a firm's price cost margin and average price cost margin of its industry. In order to see the relationship between marginal cost and EPCM, we write the following first order condition

$$P'(Q)q_i+P(Q)-c_i=0 \tag{2}$$

Equation (2) can be expressed into the price cost margin form

$$\frac{P(Q)-c_i}{P(Q)}=-\left(\frac{P'(Q)q_i}{P(Q)}\right) \tag{3}$$

Summing equation (2) within the industry as

$$P'(Q)Q+n\cdot P(Q)-\sum_{i=1}^{n}c_i=0 \tag{4}$$

Similarly, equation (4) can be expressed into the average price cost margin form

$$\left(P(Q)-\left(\sum_{i=1}^{n}c_i/n\right)\right)/P(Q)=-\left(\frac{P'(Q)Q}{P(Q)n}\right) \tag{5}$$

The EPCM is the difference between equation (3) and equation (5)

$$\text{EPCM}=-\left(\frac{P'(Q)q_i}{P(Q)}\right)+\left(\frac{P'(Q)Q}{P(Q)n}\right)=-\left(\frac{P'(Q)Q}{P(Q)}\right)\left(\frac{q_i}{Q}-\frac{1}{n}\right) \tag{6}$$

Proposition 3: *The EPCM of the firm increases with the decrease of the marginal cost.*

Now we seek to link result 2 and proposition 1 and derive a testable relationship between EPCM and firm's hoarding decisions.

Proposition 4: *Firm's cash holdings decrease with the increase of firm's EPCM.*

Proposition 4 characterizes testable comparative statics of the cash holdings with respect to EPCM. A higher value of EPCM reflects a higher competitive position, and it relates with a lower marginal cost. Analogous to proposition 4, higher competitive position makes the reduce investment to hoard more costly. According to proposition 3 and proposition 4, we obtain our main empirical hypothesis.

Hypothesis 1: *The effect of change in a firm's EPCM on cash holdings is expected to be negative.*

As Almeida *et al.* (2004) have developed in their research, only when the capital market is running imperfect, firm's liquidity decision is not irrelevant. Our previous proposition assumes that the firm's future revenue is not verifiable. If firm's future revenue is verifiable for external investor, firm can obtain fund by using future revenue as collateral. For an external high enough market value of future revenue, raising cash is no longer beneficial to the firm. Therefore, competitive position among financial unconstrained firms has a weaker effect on firm's cash holding decision.

Putting this argument together leads to our additional empirical hypothesis.

Hypothesis 2: *The negative relationship between EPCM and cash holdings is expected to be more strongly for relatively financially constrained firms.*

4 Data and Summary Statistics

4.1 Sample Selection

We begin with two sources of data, which is obtained from the Nikkei Economic Electronic Databank System (NEEDS) and NEEDS Corporate Governance Evalution System (NEEDS cges). Our sample consists of Japanese listed firms with positive total assets and cash holdings. We use the NEEDS and NEEDS cges between 2006 to 2015. The main reason for selecting this time period is that the NEEDS cges that we can use is from 2006 to 2015. We one-to-one merge two datasets by fiscal year and Nikkei firm ID. We exclude all financial firms as their financial data is different from the other firms.[7] We also exclude firms from utilities industry, where competitive position is usually pre-determined. We drop observations with missing total assets, cash holdings and sales. Our final sample includes 22,933 firms-years observations.

4.2 Competitive Position Measure and Industrial Classification

To test our empirical hypothesis, we need to measure competitive position at the firm level. Competitive position measure providing a detail measure of a firm's ability to command a price above marginal cost. We consider two different approaches:

First, a measure of competitive position is the excess price cost margin (hereafter, EPCM). Follow Gaspar and Massa (2006), we define the EPCM as the difference between firm's price cost margin (=Operating Income/Sales) and the average price cost margin within the industry. As Aghion, Bloom, Blundell, Griffith and Howitt (2005) pointed out in the study, EPCM has several advantages over the market shares. Market shares rely more directly on the definition of product markets. Rossi-Hansberg, Sarte and Trachter (2018) find related evidence suggesting that diverging trends ("national concentration, local de-concentration") for several definitions of local market is occurring in some industries across sectors. Hence, market shares may be extremely misleading depending on the market definition. Clark and Davis (1982) show that in theory, EPCM and market shares are jointly determined. Therefore, in the case where these two measures are theoretically equivalent, the use of EPCM can better help us with less misleading results caused by market definition. As with all the measure used for empirical research, EPCM also has its limitations. The main problem with this indicator is that the Operating income-to-profit ratio may only measure firms with higher profit margins and does not fully measure the firm's ability to price above marginal cost. Another problem with using EPCM is that it may not identify competitiveness in certain industries. In the retail industry, firms use their scale to push down margins and prices to gain greater scale. Low margins for these firms are not a sign of low competitiveness.

Therefore, in order to confirm the robustness of our results, we also use the mark-ups estimation developed by De Loecker and Eeckhout (2017) (hereafter DLE).[8] The reason we use this

7) This does not include those diversified firms with divisions in the financial industry.
8) Please refer to the appendix and De Loecker and Warzynski (2012) for detailed estimation methods.

approach is that this method requires only firm-level data. DLE estimate firm-level mark-ups rely on the framework by De Loecker and Warzynski (2012). They provide a method in the spirit of Hall (1986): when the price equals marginal cost of production, the elasticity of a variable input of production function is equal to its expenditure share in total revenue. Hence, the wedge between input's revenue share and its output elasticity is driven by the relevant competitive position under any form of imperfect competition. They measure firm-level competitive position $\mu_{i,t}$ using the scaled the scaled series of the sale/Cost of goods sold + selling, general and administrative expenses (SG&A):

$$\mu_{i,t}=\beta_v\frac{\text{Sales}_{i,t}}{\text{Cost of good sold}_{i,t}+\text{SGA}_{i,t}} \tag{7}$$

They follow the control function approach of Olley and Pakes (1996) to estimate the output elasticity of the variable input β_v. One problem of the original DLE mark-ups is that the measure is derived using only physical capital in the production function and such a measure may underestimate the contribution of intangible capital. A high ratio of sales to cost of goods sold ratio will be associated to more tangible assets, that by their own nature have lower cash balances relative to assets. Hence, we also scale sales by the "total expenses" defined as in Imrohoroglu and Tuzel (2014) (the sum of cost of goods sold and SG&A). The SG&A being a proxy to measure flows to organizational capital as suggested by Eisfeldt and Papanikolaou (2013).

To increase the homogeneity of firms within each industry classification group, we set an industry as the group of firms within the same Nikkei small industrial classification. Through the Nikkei small industrial classification, we can obtain a more homogeneous firm groups than other classification. For example, in the medium Nikkei industrial classification, candy-making firms and edible oil firms are in the same industry. In the Nikkei small industrial classification, each of them lays in the independent industry.

4.3 Other Control Variables Definition

The dependent variable is measured as "Cash and its equivalent" scaled by net asset, which is total asset less cash. Other control variables are motivated by the literature of cash holdings (e.g., Pinkowitz and Williamson (2011)). The control variables are motivated by the theoretical hypothesis and the literature of cash holdings:

1 Cash flow. The measure of cash flow is EBITDA divided by net assets. Net assets equal to total assets minus cash and its equivalent.
2 Leverage. Leverage is total liabilities divided by net assets. If firm need to hedge the risk of bankruptcy by hoarding cash, we will see a positive relationship between leverage and cash (see Acharya, Almeida and Campello (2007)). In order to reduce the risk of bankruptcy, firms can not only increase cash holdings, but also reduce debt levels. Hence, another important significance of controlling this variable is to control the debt choice of the firm.
3 Net Working Capital. Net Working Capital is defined as (current assets - current liabilities - cash)/ (net assets). We expect a negative relationship between net working capital and cash holdings.
4 Long-term debt maturity. Long-term debt maturity is defined as (long-term debt due in one year)/ (total debt). Harford, Klasa and Maxwell (2014) find that the maturity of firms' long-

term debt explains a large fraction of the increase in cash holdings.

5 Tangibility. Tangibility is defined by tangible assets divided by net assets. We expect a negative relationship between cash holdings and tangibility.

6 Size. Size is defined by log of total assets. We expect a negative relationship between size and cash holdings.

7 The market-to-book ratio. The market-to-book ratio is defined as market value of equity plus interest-bearing liabilities divided by the book value of total assets. Given higher opportunity cost of inability to fund investment, firms with better growth opportunities will hold more cash.

8 Investment. Investment is defined as capital expenditures divided by net assets. Riddick and Whited (2009) argue that if the investment is motivated by a productivity shock, there is a negative relationship between investment and cash.

9 Cash flow volatility. Cash flow volatility is defined as the standard deviation of cash flow over a rolling 3-year window. Boileau and Moyen (2016) find that an increase of risk best explains the rise in cash holdings.

10 Sales volatility. Sales volatility is defined as the standard deviation of sales over a rolling 3-year window.

11 Investment volatility. Investment volatility is defined as the standard deviation of investment over a rolling 3-year window. In the case of company that makes a large amount of investment temporarily, the amount of cash holdings may be larger than a company that always invests the same amount. Investment volatility may also need to be controlled.

12 Bond. Bond dummy equals to one if firms raise funds through corporate bond reported in a given year, and zero otherwise.

In the theoretical motivation, we follow Acharya *et al.* (2012), and assume that manager working in the interest of shareholders. But if the intercept and coefficient of agency conflicts on competitive position are not zero, the OLS can't consistently estimate β_1. Much of the literature on cash holding decision and product market factors does not consider the agency conflicts. But Giroud and Mueller (2011) has found a link between corporate governance and product market competition. Consider the situation that competitive position is lower for firms with more serious the problem of managerial misbehavior, the bias for $\hat{\beta}_1$ seems will likely be negative. Following structural estimation results of Nikolov and Whited (2014), we control the ownership structure for two main mechanisms of agency conflicts that affect corporate cash policy: managerial perquisite consumption and limited managerial ownership. They find that the managerial perquisite consumption is higher when firm's institutional ownership is lower. Hence, we control the ownership structure (institutional ownership and managerial ownership) and board structure (board size and board independence). Managerial Ownership is defined as total percentage of equity ownership by directors. Institutional investor ownership is defined by institutional investor. Board size is the number of directors divided by logarithm of total assets. Board independence is defined as the number of independent directors on the board divided by total directors. In order to reduce the influence of outliers, I winsorize all variables at the 1th and 99th percentile.

Table 1 Summary Statistics

This table reports summary statistics for variables used in the empirical analysis. All variables are defined in section.

Panel A Statistics for main variables

Variables	Mean	25%	Median	75%	St. Dev.	Observations
Cash/Net Assets	0.203	0.049	0.113	0.231	0.282	22,921
EPCM	0.031	−0.035	0	0.056	0.15	22,933
Mark-Ups	0.92	0.875	0.897	0.934	0.113	22,933
Bank Dependence	0.243	0.033	0.219	0.398	0.21	22,933
Tangibility	0.285	0.134	0.254	0.398	0.196	22,847
Cash Flow	0.051	0.015	0.039	0.075	0.085	22,921
Leverage	0.561	0.386	0.562	0.728	0.235	22,921
Long-term Debt (due in one years)	0.048	0	0.02	0.076	0.069	22,933
Investment	0.02	0	0.003	0.027	0.035	22,921
Net Working Capital	0.058	−0.073	0.061	0.192	0.203	22,921
Size	10.394	9.316	10.252	11.3	1.59	22,933
Market-to-Book	1.081	0.807	0.954	1.157	0.545	22,767
Cash Flow Volatility	0.034	0.007	0.015	0.032	0.194	20,109
Sales Volatility	0.117	0.036	0.068	0.126	0.204	20,121
Investment Volatility	0.155	0.023	0.052	0.121	0.395	17,359
Managerial Ownership	0.07	0.003	0.014	0.083	0.119	22,786
Board Size	2.001	1.791	1.946	2.303	0.388	22,933
Board Independence	0.111	0	0	0.2	0.142	22,933
Institutional Ownership	0.145	0.015	0.089	0.236	0.156	22,777
Payout Ratio	0.014	0.006	0.007	0.013	0.039	19,204

Panel B Correlations

Variable	Cash/Net Assets	EPCM
EPCM	−0.14	
Mark-Ups	−0.121	0.571

Panel C OLS regression across mark-ups measures

Variable	EPCM	Mark-Ups
EPCM		0.871***
		(0.024)
Mark-Ups	0.932***	
	(0.018)	
Observations	22,713	22,713
Firm Fixed Effect	Yes	Yes
Industry-Year Effect	Yes	Yes
Within R-Sqr	0.812	0.812

4.4 Summary Statistics

Table 1 provides the mean, median, standard deviation, 25th percentile, and 75th percentile of the variables in our sample. The mean of the cash-to-net-assets ratio is 0.203, which is slightly higher than the average of that in Ando *et al.* (2009). Our sample begins in 2005, so the result is in line with the increased trend in cash holdings in Japan after 2006. The average EPCM is 0.031 and the median EPCM, as expected, is equal to 0.000. Panel B of Table 1 reports the correlations between the cash-to-net assets ratio and the measures of competitive position. We report the correlation matrix between all variables in Table A1 in the appendix. First, EPCM and mark-ups are positively correlated, with a correlation coefficient of 0.571, suggesting that the two proxies likely capture some aspects of the competitive position. Second, these two proxies are negatively correlated with the cash-to-net assets ratio. We also examine correlations across various competitive position

measures. Following Nishioka and Tanake (2019), we regress the mark-ups on the EPCM. Panel C of Table 1 reports the results. The standard errors are clustered at the firm level. We also control the firm fixed effect and industry-year fixed effect. Using the mark-ups based on the EPCM as a dependent variable, the coefficients of the mark-ups is positive and statistically significant. Similarly, using the EPCM from the mark-ups as a dependent variable result in a coefficient of 0.871. These results suggest that mark-ups and EPCM are highly correlated.[9)]

According to our theoretical assumptions, we need to show the empirical setup based on Japanese listed companies are a proper environment for testing oligopolistic competition. It is difficult to prove this directly, but we can provide some facts to support this. The top three industries with highest cash holdings are: pharmaceuticals, steel industry and machinery. According to the Japan Industrial Productivity Database 2006, the market share of the top four firms in these industries in 2006 was 11.64%, 70.76% and 11.34%. This non-negligible level of the concentration ratio justifies our theoretical assumption of oligopoly.

5 Empirical Methodology and Results

5.1 Panel Regression Methodology

To test our main empirical hypothesis, we follow Bates *et al.* (2009) and estimate the following linear cash demand function using panel data:

$$\left(\frac{\text{Cash}}{\text{Net Assets}}\right)_{i,t} = \beta_0 + \beta_1 \text{CP}_{i,t} + \boldsymbol{\gamma}' \mathbf{X}_{i,t} + v_i + \text{industry}_j \times y_t + \varepsilon_{i,t} \tag{8}$$

where i is the index of each firm and t indicates the year. $\text{CP}_{i,t}$ are the variables that measure competitive position. $\mathbf{X}_{i,t}$ is the vector of the control variables. $\varepsilon_{i,t}$ are the idiosyncratic errors, v_i is the time-constant unobserved effect, and y_t is a separate time period intercept. We assume the v_i is correlated with $\text{CP}_{i,t}$ and $\mathbf{X}_{i,t}$. For example, there may be a correlation between the firm's time-constant unobserved corporate culture and competitive position. Hence, as controls, we include the firm fixed effect. Industry-by-year fixed effect $\text{industry}_j \times y_t$ capture in how industry is exposed to aggregate shocks. We also cluster standard errors at the firm level. In equation (8), the key variable is $\text{CP}_{i,t}$. The coefficient β_1 captures the effect of competitive position on cash holdings. If the empirical results are consistent with hypothesis 1, $\hat{\beta}_1$ will be negative.

5.2 The Effect of Competitive Position

We report the results from our basic regression in equation (9) in Table 2. In each specification, we find a significant negative effect of competitive position on the average cash-to-net assets ratio. Specification (1) shows that the coefficient of $\text{EPCM}_{i,t}$ is -0.233 and significant at below the 1% level. Given that the standard deviation of EPCM is 0.150, a one-standard-deviation increase in

9) Nishioka and Tanaka (2019) use plant-product matched data from Japan, and empirically compares two measures of product mark-ups. One measure is DLE mark-ups. An alternative measure is derived from the revenues divided by the total cost. They pointed out that the DLE mark-ups do not follow the theoretical predictions. Although, the latter measure is consistent with the theoretical predictions. Based on this result, we may not be able to classify these two measures as theoretically equivalent. However, the data used in our paper is different from them. Their data is more comprehensive and includes many SMEs, and we focus on listed companies. It is not clear whether we can apply their results to our research.

Table 2 Effect of Competitive Position: Panel Regression

This table reports empirical links between excess price cost margin and cash holdings. The dependent variable is cash-to-net-assets ratio (cash/total asset − cash). Excess price cost margin (EPCM) is the difference between a firm's price cost margin (operating income/sales) and the average price cost margin within the industry. The column 1 through 2 report the coefficient estimates from an OLS estimation using the different competitive position measures. Follow Gormley and Masta (2013), we estimate models with multiple high-dimensional fixed effects (firm and industry-year). Firm-level cluster s. e. are in parentheses. Standard errors are clustered at the firm level. ***,**,* means statistically different from zero from 1, 5, and 10% levels of significance.

Dependent Variable	Cash/Net Assets	Cash/Net Assets
Independent Variable	Coef. (1)	Coef. (2)
EPCM	−0.233*** (0.062)	
Mark-Ups		−0.194** (0.058)
Bank Dependence	−0.207*** (0.024)	−0.208*** (0.024)
Tangibility	−0.002 (0.092)	−0.008 (0.093)
Cash Flow	0.671*** (0.088)	0.622*** (0.083)
Long-term debt (due in one years)	−0.244*** (0.032)	−0.247*** (0.033)
Leverage	0.523*** (0.043)	0.526*** (0.043)
Investment	−0.021** (0.010)	−0.021** (0.009)
Net Working Capital	−0.122** (0.041)	−0.125** (0.041)
Size	−0.034** (0.017)	−0.036** (0.017)
Market-to-Book	−0.027** (0.013)	−0.026** (0.013)
Cash Flow Volatility	0.132*** (0.024)	0.127*** (0.025)
Sales Volatility	0.032** (0.016)	0.037** (0.016)
Investment Volatility	−0.008 (0.007)	−0.009 (0.007)
Managerial Ownership	−0.116** (0.053)	−0.12** (0.052)
Board Size	−0.01 (0.007)	−0.009 (0.007)
Board Independence	0.027 (0.025)	0.026 (0.025)
Institutional Ownership	0.111 (0.040)	0.113** (0.040)
Board Dummy	−0.008 (0.010)	−0.009 (0.010)
Firm Fixed Effect	Yes	Yes
Industry-Year Fixed Effect	Yes	Yes
Observations	17,146	17,146
Clusters (firms)	2,416	2,416
Within R-Sqr	0.215	0.213

EPCM leads to a 3.5% ($=(0.150)\times(-0.233)$) decrease in the firm's cash holdings. This result is consistent with Hypothesis 1, which suggests that firms with a lower competitive position will have higher cash holdings.

Specifications (2) reports the robustness checks of our main results using different measures of competitive position. Specification (2) uses the DLE mark-ups as a measure of competitive position. The point estimate for DLE mark-ups is around -0.194, implying that a one standard deviation increase in DLE mark-ups implies a 2.2% ($=(0.113)\times(-0.194)$) decrease in cash holdings. We obtain qualitatively similar results and the coefficients on the measure of competitive position remain negative and statistically significant. This essentially implies that our basic estimated effect is consistent across competitive position measurements. The coefficients on the other control variables have the expected signs, which we explain in detail in the following chapter.

5.3 Other Determinants of Cash Holdings

While we do not focus on the various determinants of cash holdings, we believe that a brief review of the results is necessary, as there are few analyses of cash holdings in Japan during our sample period. The other significant coefficient estimates in Table 2 suggest that net working capital has a negative effect on cash holdings. The result is consistent with Petersen and Rajan (1997), who find that firms lean on trade credit more when the external financial markets are limited. Therefore, there is a substitution relationship between the credit relationship among firms and cash holdings. Our result also suggests that sales volatility has a strong positive effect on cash holdings. This result is consistent with Boileau and Moyen (2016), who find that firms' cash holdings are positively related to the risk they face. Jensen (1986) argues that managers have an incentive to hold cash for private benefit and to act against the shareholder's interests. At the same time, managerial ownership is thought to ease the problem of manager-shareholder conflicts. We expect a negative relationship between managerial ownership and cash holdings. The result in Table 2 also implies that levels of managerial ownership have a significant negative relationship with cash holdings for Japanese firms.

5.4 The Effect of Financial Constraints

To construct the empirical tests of Hypothesis 2, we run a regression with an extended version of equation (8):

$$\left(\frac{\text{Cash}}{\text{Net Assets}}\right)_{i,t}=\beta_0+\beta_1\text{CP}_{i,t}+\beta_2\text{FC}_{i,t}+\beta_3(\text{CP}_{i,t}\cdot\text{FC}_{i,t})+\gamma'\mathbf{X}_{i,t}+v_i+\text{industry}_j\times y_t+\varepsilon_{i,t} \tag{9}$$

here i is the index of each firm and t indicates the year. $\text{CP}_{i,t}$ are the variables that measure competitive position. $\text{FC}_{i,t}$ represents several variables that measure financial constraints. $\mathbf{X}_{i,t}$ is the vector of the control variables. $\varepsilon_{i,t}$ are the idiosyncratic errors, v_i is the time constant unobserved effect, and $\text{industry}_j\times y_t$ is a separate industry-by-time period intercept. The coefficient β_3 captures the relationship between cash holdings and the measure of competitive position $\text{CP}_{i,t}$ which varies with the level of a measure of financial constraints $\text{FC}_{i,t}$. Most prior studies explain financial constraints using indirect proxy variables. In addition, the common measures are based on U.S. listed firms (as in Kaplan and Zingales (1997); Whited and Wu (2006)). These financial constraint measures are hard to apply directly to listed firms in Japan. Therefore, in

Table 3 Effect of Financial Constraints

This table differentiates the results of column (1) and column (2) in Table 2 according to measures of financial constraints. The payout dummy equals to one if their payout ratio is greater than the median value in a given year. The dependent variable is cash-to-net-assets ratio (cash/total asset-cash). Regression includes the control variables in Table 2. We estimate models with firm and industry-year fixed effects. Firm-level clustered s.e. are in parentheses. ***,**,* means statistically distinct from 0 at 1, 5, and 10% levels of significance.

Dependent Variables	Cash/Net Assets	Cash/Net Assets	Cash/Net Assets	Cash/Net Assets
	Coef. (1)	Coef. (2)	Coef. (3)	Coef. (4)
EPCM	−0.187***		−0.1**	
	(0.049)		(0.047)	
Mark-Ups		−0.174***		−0.149***
		(0.041)		(0.039)
EPCM*Payout	0.171			
	(0.148)			
Mark-Ups*Payout		0.076**		
		(0.037)		
EPCM*Bank Dep			0.062	
			(0.063)	
Mark-Ups*Bank Dep				0.052**
				(0.020)
Payout Dummy	−0.017	−0.028		
	(0.007)	(0.042)		
Bank Dep			−0.25***	−0.221***
			(0.025)	(0.025)
Other Controls	Yes	Yes	Yes	Yes
Firm Fixed Effect	Yes	Yes	Yes	Yes
Industry-Year Fixed Effect	Yes	Yes	Yes	Yes
Observations	14,528	13,902	17,146	17,008
Clusters (firms)	2,180	2,122	2,416	2,405
Within R-Sqr	0.183	0.187	0.178	0.182

the following analysis, we select two measures that can apply to Japan. Our first proxy for financial constraints is the payout ratio dummy. Following Fazzari *et al.* (1988), firms with a higher payout ratio are likely have greater access to external capital markets and do not have issues with financial constraints. The payout ratio is dividends divided by operating income. Payout ratio dummy that is equal to one if the payout ratio of a firm is greater than the average payout ratio in a given year and zero otherwise. Our second proxy for financial constraints is bank dependence. The early literature on the cash holding decisions of Japanese firms points out that in a bank-oriented market such as Japan, banks have a significant impact on a firm's cash holdings (e.g., Pinkowitz and Williamson (2001), Ogawa (2015), Sasaki and Suzuki (2017)). The more closely the relationship between the firm and bank is, the lower the incentive for firms to hoard cash is. Following Ogawa (2015), we use the ratio of debt outstanding with banks to total liabilities to measure a firm's dependence on banks. Bank dependence is defined as total bank debt (= short-term bank debt + long term bank debt) divided by total liabilities. According to our empirical hypothesis, the coefficient $\hat{\beta}_3$ should be positive.

The findings in Table 3 partially support hypothesis 2. In columns (1) and (3) of Table 3, the coefficient β_3 in equation (9) is positive but insignificant. In columns (2) and (4), the coefficients are mostly significant and positive. The effect of mark-ups is $(-0.174+0.076\times\text{Payout})$ and significant at 5% level. In column (4), the effect of markups is now $(-0.149+0.052\times\text{Bank Dependent})$ and significant at 5% level. It is beyond the scope of this research to explore why different $\text{CP}_{i,t}\cdot\text{FC}_{i,t}$

embody a different significance results for cash holdings. More relevant to our research is that the positive coefficients β_3 remains regardless of which interaction terms is controlled for.

6 Robustness Check

6.1 Effect of Diversification

When we use EPCM to measure a firm's competitive position, we assume that the firm's earns operating income from its industry. However, diversified firms may have higher operating income in division A and lower operating income in division B. Therefore, this firm should only have a higher competitive position in division A. However, according to our current industry classification, we can only observe the competitive position of a diversified firm within an industry. Therefore, we may only observe that the firm also has a highly competitive position in division B. Since each firm in Japan has different definitions for a division, it is difficult to measure competitive position at the division-year level through Nikkei segment files. Therefore, as a robustness check, we reduce the sample object to include only non-diversified firms, which we define as firms that do not have multiple segments. This subgroup can help us to measure the competitiveness of a firm's given segment in its industry and compare that to the cash that the firms holds for the segment. We obtain segment information from the Nikkei NEEDS database. The results of the robustness checks in Table 4 address the effect of diversification. We show that the non-diversified results are similar to our main results in Tables 2. In Table 4, we report the replication results of Table 2. The effect of the competitive measures is negative and statistically significant. Controlling for the effect of diversification does not significantly change our main results.

6.2 Consistency Between Theoretical Model and Empirical Results

The theoretical motivation assumes a relationship where a company's competitive position affects cash holdings through changes in cash flow. On the other hand, the baseline equation of the empirical analysis is formulated such that the competitive position of the company directly affects the cash holding. In order to confirm the mechanism, we proposed in the model, we use the competitive position as an instrument for the changes of cash flow. The first stage is how the competitive position affects firms' cash flows, using a regression of the form:

$$\Delta \text{CashFlow}_{i,t} = \lambda_1 \text{CP}_{i,t} + \gamma' \mathbf{X}_{i,t} + v_i + y_t + \varepsilon_{1,t} \tag{10}$$

the second stage estimates how the changes in cash flow affects firms' cash holdings in a regression of the form:

$$\left(\frac{\text{Cash}}{\text{Net Assets}}\right)_{i,t} = \beta_1 \widehat{\Delta \text{CashFlow}}_{i,t} + \gamma' \mathbf{X}_{i,t} + v_i + y_t + \varepsilon_{2,t} \tag{11}$$

here i is the index of each firm and t indicates the year. $\mathbf{X}_{i,t}$ is the vector of the control variables. $\varepsilon_{i,t}$ are the idiosyncratic errors, v_i is the time constant unobserved effect, and y_t is a separate time period intercept. Here, we assume that the instrumental variable $\text{CP}_{i,t}$ satisfies the exclusion condition i. e., $\text{Cov}(\text{CP}_{i,t}, \varepsilon_{2,t}) = 0$. We cannot test this assumption because the true $\varepsilon_{2,t}$ is unobservable. However, our model gives a justification for this assumption since the model shows that the competitive position affects the cash holdings only through the operating cash flow.

The coefficient of our interest is β_1 in equation (11). A negative and significant β_1 is consistent with our theoretical hypothesis. Table 5 displays the IV estimates. Column (2) and (4) reports the

Table 4 Effect of Diversification

This table reports the replication results of table 2 for specialized firms. Our definition of specialized firms is those that do not have multiple segment. The dependent variable is cash-to-net-assets ratio (cash/total asset-cash). We estimate models with firm and year fixed effects. Firm-level clustered s.e. are in parentheses. ***,**,* means statistically different from zero at the 1, 5, and 10% levels of significance.

Dependent Variables	Cash/Net Assets	Cash/Net Assets
	Coef.	Coef.
EPCM	−0.067**	
	(0.033)	
Mark-Ups		−0.111**
		(0.054)
Other Controls	Yes	Yes
Firm Fixed Effect	Yes	Yes
Year Fixed Effect	Yes	Yes
Observations	2,565	2,565
Clusters (firms)	316	316
Within R-Sqr	0.135	0.138

Table 5 Consistency Between Theoretical Model and Empirical Results

This table presents results of panel regression reveals how competitive position affects cash holdings through cash flow. The dependent variable is Cash/Net assets. Column (1) and (3) report the IV estimates, where changes in cash flow are instrumented by competitive position. Column (2) and (4) reports the coefficients of the first-stage estimation. First stage F-value shows the F statistics for the test with the null hypothesis that the coefficient of IV (EPCM, Mark-Ups) is zero. Heteroskedasticity-robust s.e. are in parentheses. ***,**,* means statistically different from zero at the 1, 5, and 10% levels of significance.

Dependent Variable	Cash/Net Assets		Cash/Net Assets	
	2SLS	First-Stage	2SLS	First-Stage
	(1)	(2)	(3)	(4)
EPCM		0.086***		
		(0.008)		
Mark-Ups				0.357***
				(0.027)
Δ Cash Flow	−0.565***		−0.56***	
	(0.137)		(0.084)	
Other Controls	Yes	Yes	Yes	Yes
Firm Fixed Effect	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes
First Stage F-Value	82.63		61.43	
Observations	17,043	17,043	17,043	17,043
Within R-Sqr	0.084	0.204	0.085	0.108

first stage estimation results of the IV regression. We observe positive effects of two competitive position measures on the change in cash flows at the 1% level. Column (1) and (3) report that the increase in cash flow caused by the increase in competitive position reduced cash holdings significantly. The F-value of the excluded instrument in the first stage is bigger than 10 which also supports our premise. Although the IV estimates here do not have a causal interpretation, it supports our theoretical mechanism to some extent.

6.3 Reverse Causality

The empirical results so far suggest that firms with a low competitive position hold more cash. However, our results could be explained in the opposite direction: cash holdings can also affect a firm's competitive position. Cash-rich firms may be less competitive and therefore have a lower

Table 6 Reverse Causality

This table presents results of panel regression examining the effect of relative-to-rivals cash holdings on competitive position share. The dependent variable is Δ EPCM and Δ Mark-Ups. The annual competitive position growth is given by $(y_{i,t}-y_{i,t-1}/y_{i,t-1})$. Follow Fresard (2010), we compute the ZCash=($Cash_{i,t}$ −industry year mean of cash)/(industry year standard deviation of cash). Column (1) and (3) report the IV estimates, where cash holdings are instrumented by lagged cash values and tangibility. Column (2) and (4) reports the coefficients of the first-stage estimation. First Stage F-value shows the F statistics for the test with the null hypothesis that the coefficient of IV is zero. Heteroskedasticity-robust s.e. are in parentheses. All regression controls for firm and year fixed effect. ***,**,* means statistically different from zero at 1, 5 and 10% level of significant.

Dependent Variable	Δ EPCM		Δ Mark-Ups	
	2SLS	First-Stage	2SLS	First-Stage
	(1)	(2)	(3)	(4)
Tangibility		−0.152**		−0.154**
		(0.075)		(0.075)
Cash/Net Assets_(i,t−1)		0.057		0.058
		(0.052)		(0.075)
Cash/Net Assets_(i,t−2)		3.561***		3.559***
		(0.075)		(0.075)
ZCash_(i,t−2)	−0.002		−0.001	
	(0.003)		(0.002)	
Size_(i,t−1)	−0.019		−0.034**	
	(0.021)		(0.013)	
Leverage_(i,t−1)	0.038**		0.034**	
	(0.018)		(0.019)	
Leverage_(i,t−2)	0.012		0	
	(0.019)		(0.012)	
Δ EPCM_(i,t−1)	−0.895***			
	(0.014)			
Δ EPCM_(i,t−2)	−0.155***			
	(0.011)			
Δ Mark-Ups_(i,t−1)			−0.535***	
			(0.027)	
Δ Mark-Ups_(i,t−2)			−0.066**	
			(0.023)	
Firm Fixed Effect	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes
Observations	16,962	16,962	16,962	16,962
First Stage F-Value	5.22		8.07	
Within R-Sqr	0.378	0.694	0.507	0.694

competitive position. However, the literature on the strategic effects of cash holdings indicates that this is rather unlikely. Fresard (2010) argues that firms use their cash reserves to fund their product market strategies. An empirical view that is consistent with Bolton and Scharfstein (1990) is that cash-rich firms use their cash holdings to challenge a product market rival's bottom line. Therefore, we should observe that cash-rich firms gain a competitive position. The contrary logic of our empirical result is not consistent with the strategic use of cash holdings.

To analyze the existence of the opposite relationship through a regression analysis, we follow Fresard (2010) and specify the following model:

$$\Delta \mathrm{CP}_{i,t}=\alpha_i+y_t+\beta_1(\mathrm{zCash}_{i,t-2})+\gamma'\mathbf{X}_{i,t}+\varepsilon_{i,t} \tag{12}$$

where i is the index of each firm and t indicates the year. $\mathrm{CP}_{i,t}$ are the variables that measure competitive position. $\mathrm{zCash}_{i,t}$ is the difference between the cash-to-net asset ratio and its industry-year mean, divided by the industry-year standard deviation.

Through this model, we can examine whether firms with large cash holdings had a lower competitive position compared to their rivals. Following Fresard (2010), we use the set of

Table 7 The Effects of Financial Constraints: Subgroup Approach

This table differentiates the results in table 2 according to measures of financial constraints. The estimation follows that of the previous analysis, which we describe in our equation (9) and table 2. We split the sample based on payout (Column (1) and Column (2)), size (Column (3) and Column (4)). We consider rms as high payout (size) if their payout ratio (asset size) falls into the bottom (top) three quartiles of the annual payout (size) distribution. Firm-level clustered s.e. are in parentheses. We estimate models with multiple high-dimensional fixed effects (firm and industry-year). ***,**,* means statistically different from zero at 1%, 5% and 10% level of significant.

Dependent Variables Subgroup	Cash/Net Assets Low Payout	Cash/Net Assets High Payout	Cash/Net Assets Low Size	Cash/Net Assets High Size
	Coef. (1)	Coef. (2)	Coef. (3)	Coef. (4)
EPCM	−0.527** (0.163)	−0.068 (0.048)	−0.152* (0.079)	0.01** (0.030)
Other Controls	Yes	Yes	Yes	Yes
Firm Fixed Effect	Yes	Yes	Yes	Yes
Industry-Year Fixed Effect	Yes	Yes	Yes	Yes
Observations	4,345	4,598	5,299	5,685
Clusters (firms)	871	870	855	817
Within R-sqr	0.274	0.185	0.182	0.175
Mark-Ups	−0.483*** (0.232)	−0.072* (0.043)	−0.161* (0.097)	0.093* (0.031)
Other Controls	Yes	Yes	Yes	Yes
Firm Fixed Effect	Yes	Yes	Yes	Yes
Industry-Year Fixed Effect	Yes	Yes	Yes	Yes
Observations	4,345	4,598	5,299	5,685
Clusters (firms)	871	870	890	817
Within R-sqr	0.269	0.186	0.181	0.175

instruments for $zCash_{i,t}$ (the lags of the cash-to-net asset ratio and asset tangibility) and estimate equation (12) using an instrumental variable (IV) approach. The results reported in Table 6 indicate no statistical correlation to support the effect of cash holdings on the change in competitive position in our sample of Japanese listed firms.

6.4 The Effect of Financial Constraints: Subsample Analysis

In this section, we test the robustness of the empirical results of Hypothesis 2. Following Almeida *et al.* (2004), we empirically test equation (8) by sorting the sample into financially constrained and financially unconstrained groups based on the measure of financial constraints. We create each subgroup by splitting the full sample of firms into thirds based on its asset size and payout ratio. We adopt the asset size measure in Gilchrist and Himmelberg (1995) and Hadlock and Pierce (2010). Small firms have relatively less information disclosure ability, which implies a high wedge between external and internal finance. We consider firms as financially constrained (unconstrained) if their asset size (payout ratio) falls into the bottom (top) three quartiles of the annual size (payout ratio) distribution. In Table 7, the odd-numbered columns show the empirical results for the financially constrained firms and the even-numbered columns show the empirical results for financially unconstrained firms. From Table 7, we see that the effects of mark-ups on cash holdings are more pronounced when financial constraints are more binding. Smaller firms and firms with a high payout ratio hold more cash when their competitive position is low. The mark-ups in columns (1) and (3) have a significant effect on cash holdings. The coefficient of mark-ups for low payout group is −0.483 and significant at 1% significance levels. However, for high payout group, the coefficient of mark-ups is −0.072, which is smaller than low payout firms. These effects are consistent across

Table 8 Subsample Periods

This table differentiates the results of column (4) in Table 2 according to three subperiods (March 2006 to March 2009, March 2010 to March 2011 and March 2012 to March 2015). We estimate models with multiple high-dimensional fixed effects (firm and industry-year). Firm-level clustered s.e. are in parentheses. ***,**,* means statistically different from zero at 1, 5 and 10% level of significance.

Dependent Variables Subsample Periods	Cash/Net Assets 2006-2009	Cash/Net Assets 2010-2011	Cash/Net Assets 2012-2015
	Coef. (1)	Coef. (2)	Coef. (3)
EPCM	−0.086** (0.042)	−0.117** (0.035)	−0.132*** (0.032)
Other Controls	Yes	Yes	Yes
Firm Fixed Effect	Yes	Yes	Yes
Industry-Year Fixed Effect	Yes	Yes	Yes
Observations	4,260	4,280	8,252
Within R-sqr	0.283	0.346	0.15
Mark-Ups	−0.043 (0.042)	−0.109** (0.039)	−0.109** (0.032)
Other Controls	Yes	Yes	Yes
Firm Fixed Effect	Yes	Yes	Yes
Industry-Year Fixed Effect	Yes	Yes	Yes
Observations	4,260	4,280	8,252
Within R-sqr	0.282	0.345	0.149

other financial constraint measures.

6.5 Subsample Periods

The sample period is from 2006 to 2015. However, during our sample period, Japan suffered the U. S. financial crisis (2008) and the Japanese Northeast earthquake (2011), which likely affected corporate cash management. We check that these events did not a cause of our main results by splitting the sample period into three sub-periods: 2006 to 2009, 2010 to 2011, and 2012 to 2015). The results in Table 8 suggest that the estimated coefficients of EPCM are significant in the all sub-period groups. The estimated coefficient is higher after 2012 (−0.132) than during 2010-2011 (−0.117). However, the estimated coefficients of mark-ups are insignificant during 2006-2008. From this result, the effect and significance appear related to the specific period in our sample. Although we cannot rule out the impact of special events during the sample period, the negative relationship between EPCM and cash holdings is still consistent with our theoretical motivation.

6.6 Nonlinear Relationship

Another important argument is that there may be a U shape correlation between competitive position and cash holdings. The possibility of a U shape relationship was hinted by Ma, Mello and Wu (2018). They find that the relation between industry competition and cash holdings is ambiguous. As discussed in this section, if firms differ in their marginal cost and markets are imperfectly competitive firms with lower marginal cost will have bigger market shares. Therefore, firms with lower marginal cost will tend to have higher future cash flow C_2. An increase in future cash flow C_2 increase the value of equity conditional on survival. This makes the firms with lower marginal cost motivated to hold cash. From the theoretical analysis, we can't directly judge which effect dominate, so this is a problem we need to consider in the empirical analysis. In column (1) and (2) of Table 9, we include the measures of competitive position in a quadratic fashion. In the estimated equations with the negative coefficient of EPCM and positive coefficient of EPCM

Table 9 The U-shape Relationship Between Competitive Position and Cash Holdings

This table reports the replication results of table 2 by adding the squared terms of EPCM and Mark-Ups. Columns (1) and (2) report the results of using the entire sample. The dependent variable is cash-to-net-assets ratio (cash/total asset-cash). We estimate models with multiple high-dimensional fixed effects (firm and industry year). Firm-level clustered s.e. are in parentheses. ***,**,* means statistically different from zero at the 1, 5, and 10% levels of significance.

Dependent Variables	Cash/Net Assets	Cash/Net Assets
	Coef.	Coef.
EPCM	−0.251***	
	(0.061)	
EPCM Squared		−1.482***
		(0.319)
Mark-Ups	0.126	
	(0.092)	
Mark-Ups Squared		0.561**
		(0.133)
Other Controls	Yes	Yes
Firm Fixed Effect	Yes	Yes
Industry-Year Fixed Effect	Yes	Yes
Observations	17,146	17,146
Clusters (firms)	2,416	2,416
Within R-Sqr	0.215	0.22

squared. Column (1) shows that the U shape correlation is not as statistically reliable, given that the effect of mark-ups squared is not significant. Column (2) of Table 9 shows that the coefficient of mark-ups squared is positive and significant at 5% level. The turning point is achieved at $1.321(\approx|-1.482/(2\times0.561)|)$. Only 1% of the firms in our sample have reached this level. The above results show that the existence of nonlinear relationships does not affect our main results.

7 Conclusions

We theoretically and empirically show how competitive position affects cash holding decisions. We show that firms with a lower competitive position have higher cash holdings. We find significant support for the testable hypothesis from the model in our empirical analysis of Japanese non-financial listed firms. The negative relationship between competitive position and cash holdings is robust to alternative measures of competitive position and is stronger among firms with financial constraints.

Our analysis carries economics implication. First, the mechanism we have outlined in the paper may have an impact on the effectiveness of monetary policy. Ottonello and Winberry (2018) show that firms with low default risk are the most responsive to monetary policy. Firms with a lower competitive position, however, maybe not increase their investment over the monetary policy resulting from the high default risk. Second, we can also provide an explanation for the common phenomenon among corporations in the developed countries in terms of the increased cash holding. Dorn *et al.* (2017) find that industry sales are increasingly concentrate in a small number of firms (Superstar firms) not only in U.S. firms, but also many other countries. Superstar firms tend to have higher mark-ups then more output is allocated to these firms. The rise of superstar firms may affect other firms' cash holding policies in each industry. Companies with lower competitive positions need hold more cash to cope with the potential cash flow shock of the rise of superstar firms.

Despite of the fairly clear results, there remain problems in our analysis to be addressed in future

studies. First, even after controlling for the industry × year fixed effect, we cannot completely deny the possibility that other unobservable factors affect both the competitive position and cash holding. An ideal exogeneous shock on the competitive position may help us obtain more convincing results.[10] Second, we focus on listed firms, but understanding the change in corporate cash holdings among private firms is also important. There are important empirical questions regarding how competitive position affects the cash holding decisions of private firms.

（Waseda University）

投稿受付2019年 6 月18日，最終稿受理2019年10月17日

[References]

Acharya, V., Davydenko, S. A., & I. A. Strebulaev (2012) "Cash holdings and credit risk," *The Review of Financial Studies*, *25*(12), 3572-3609.

Aghion, P., Bloom, N., Blundell, R., Griffith, R., & P. Howitt (2005) "Competition and innovation: An inverted-U relationship," *The Quarterly Journal of Economics*, 120(2), 701-728.

Almeida, H., Campello, M., & M. S. Weisbach (2004) "The cash flow sensitivity of cash," *The Journal of Finance*, 59(4), 1777-1804.

Almeida, H., Campello, M., Cunha, I., & M. S. Weisbach (2014) "Corporate liquidity management: A conceptual framework and survey," *Annual Review of Financial Economics*, 6(1), 135-162.

Ando, K., Hori, K., & M. Saito (2009) "On the Determinants of Corporate Cash Holdings in Japan: Evidence from Panel Analysis of Listed Companies" [in Japanese] (No. gd09-081), Institute of Economic Research, Hitotsubashi University.

Bates, T. W., Kahle, K. M., & R. M. Stulz (2009) "Why do US firms hold so much more cash than they used to?" *The Journal of Finance*, 64(5), 1985-2021.

Belleflamme, P., & M. Peitz (2015) *Industrial Organization: Markets and Strategies*, Cambridge University Press.

Boileau, M., & N. Moyen (2016) "Corporate cash holdings and credit line usage," *International Economic Review*, 57(4), 1481-1506.

Bolton, P., & D. S. Scharfstein (1990) "A theory of predation based on agency problems in financial contracting," *The American Economic Review*, 93-106.

Cestone, G. (1999) "Corporate financing and product market competition: An overview," *Giornale degli Economisti e Annali di Economia*, 269-300.

Clarke, R., & S. W. Davies (1982) "Market structure and price-cost margins," *Economica*, 49(195), 277-287.

De Loecker, J., & J. Eeckhout (2017) "The rise of market power and the macroeconomic implications" (No. w23687), National Bureau of Economic Research.

De Loecker, J., & F. Warzynski (2012) "Markups and firm-level export status," *American Economic Review*, 102(6), 2437-71.

Dorn, David, *et al.* (2017) "The fall of the Labor share and the rise of superstar firms," No. w23396, National Bureau of Economic Research.

Eisfeldt, A. L., & D. Papanikolaou (2013), "Organization capital and the cross‐section of expected returns," *The Journal of Finance*, 68(4), 1365-1406.

Fazzari, S., Hubbard, R. G., & B. Petersen (1988) "Investment, financing decisions, and tax policy," *The American Economic Review*, 78(2), 200-205.

10) For example, Hau, Huang and Wang (2018) explores the productivity response of Chinese firms exposed to minimum wage shocks. Using the minimum wage changes in different regions, they identified the exogeneous impact on the competitive position. Local minimum wage increase represents a negative competitive position shocks to firms if their competitors in other locations do not face the same increased labor costs.

Fresard, L. (2010) "Financial strength and product market behavior: The real effects of corporate cash holdings," *The Journal of Finance*, 65(3), 1097-1122.
Gaspar, J. M., & M. Massa (2006). "Idiosyncratic volatility and product market competition," *The Journal of Business*, 79(6), 3125-3152.
Gilchrist, S., & C. P. Himmelberg (1995) "Evidence on the role of cash flow for investment," *Journal of monetary Economics*, 36(3), 541-572.
Giroud, X., & H. M. Mueller (2011) "Corporate governance, product market competition, and equity prices," *The Journal of Finance*, 66(2), 563-600.
Gormley, Todd, A., and David, A. Matsa (2013) "Common errors: How to (and not to) control for unobserved heterogeneity," *The Review of Financial Studies*, 27.2, 617-661.
Hadlock, C. J., & J. R. Pierce (2010) "New evidence on measuring financial constraints: Moving beyond the KZ index," *The Review of Financial Studies*, 23(5), 1909-1940.
Hall, R. E. (1988) "The relation between price and marginal cost in US industry," *Journal of Political Economy*, 96(5), 921-947.
Harford, J., Klasa, S., & W. F. Maxwell (2014) "Refinancing risk and cash holdings," *The Journal of Finance*, 69(3), 975-1012.
Hau, H., Huang, Y., & G. Wang (2018) "Firm response to competitive shocks: Evidence from China's minimum wage policy," *Swiss Finance Institute Research Paper*, (16-47).
Haushalter, D., Klasa, S., & W. F. Maxwell (2007) "The influence of product market dynamics on a firm's cash holdings and hedging behavior," *Journal of Financial Economics*, 84(3), 797-825.
Hou, Kewei, and David, T. Robinson (2006) "Industry concentration and average stock returns," *The Journal of Finance*, 61.4, 1927-1956.
İmrohoroğlu, A., & Ş. Tüzel (2014) "Firm-level productivity, risk, and return," *Management Science*, 60(8), 2073-2090.
Irvine, Paul, J., and Jeffrey Pontiff (2008) "Idiosyncratic return volatility, cash flows, and product market competition," *The Review of Financial Studies*, 22.3, 1149-1177.
Jensen, M. C. (1986) "Agency costs of free cash flow, corporate finance, and takeovers," *The American Economic Review*, 76(2), 323-329.
Kaplan, S. N., & L. Zingales (1997) "Do investment-cash flow sensitivities provide useful measures of financing constraints?" *The Quarterly Journal of Economics*, 112(1), 169-215.
Leary, M. T., & M. R. Roberts (2014) "Do peer firms affect corporate financial policy?" *The Journal of Finance*, 69(1), 139-178.
Lyandres, E., & B. Palazzo (2016) "Cash holdings, competition, and innovation," *Journal of Financial and Quantitative Analysis*, 51(6), 1823-1861.
Ma, L., Mello, A. S., & Y. Wu (2018) "First mover advantage, time to finance, and cash holdings."
MacKay, P., & G. M. Phillips (2005) "How does industry affect firm financial structure?" *The Review of Financial Studies*, 18(4), 1433-1466.
Morellec, E., Nikolov, B., & F. Zucchi (2014) "Competition, cash holdings, and financing decisions."
Nikolov, B., & T. M. Whited (2014) "Agency conflicts and cash: Estimates from a dynamic model," *The Journal of Finance*, 69(5), 1883-1921.
Nishioka, S., & M. Tanaka (2019) *Measuring Markups from Revenue and Total Cost: An Application to Japanese Plant-Product Matched Data*. Research Institute of Economy, Trade and Industry (RIETI).
Ogawa, K. (2015) "What do Cash Holdings Tell us About Bank-Firm Relationships? A Case Study of Japanese Firms," In *The Economics of Interfirm Networks* (pp. 215-235). Springer, Tokyo.
Opler, T., Pinkowitz, L., Stulz, R., & R. Williamson (1999) "The determinants and implications of corporate cash holdings," *Journal of Financial Eeconomics*, 52(1), 3-46.
Ottonello, Pablo, and Thomas Winberry (2018) "Financial Heterogeneity and the Investment Channel of Monetary Policy," No. w24221, National Bureau of Economic Research.
Petersen, M. A., & R. G. Rajan (1997) "Trade credit: Theories and evidence," *The Review of Financial Studies*, 10(3), 661-691.
Pinkowitz, L., & R. Williamson (2001) "Bank power and cash holdings: Evidence from Japan," *The*

Review of Financial Studies, 14(4), 1059-1082.
Riddick, L. A., & T. M. Whited (2009) "The corporate propensity to save," *The Journal of Finance*, 64(4), 1729-1766.
Rossi-Hansberg, E., Sarte, P. D., & N. Trachter (2018) *Diverging trends in national and local concentration* (No. w25066), National Bureau of Economic Research.
Sasaki, T., & K. Suzuki (2017) "Bank Soundness and Cash Holdings: Evidence from a Bank-Centered Financial Market."
Spulber, D. F. (1995) "Bertrand competition when rivals' costs are unknown," *The Journal of Industrial Economics*, 1-11.
Sufi, A. (2007) "Bank lines of credit in corporate finance: An empirical analysis," *The Review of Financial Studies*, 22(3), 1057-1088.
Whited, T. M., & G. Wu (2006) "Financial constraints risk," *The Review of Financial Studies*, 19(2), 531-559.

Appendix A.

Appendix A1. (Proof of Propositions)

A1.1 Proof of Proposition 1

Firm's best response function is

$$q_i(Q_{-1})=\frac{1}{2b}(\alpha-c_i-b\cdot Q_{-i}) \tag{13}$$

Summing the previous equation for n firms, we can write the equation as

$$\sum_{i=1}^{n}q_i=\frac{1}{2b}\left(n\cdot\alpha-\sum_{i=1}^{n}c_i-b\cdot\sum_{i=1}^{n}Q_{-i}\right) \tag{14}$$

By the definition, we know that

$$\sum_{i=1}^{n}Q_{-i}=(n-1)Q \tag{15}$$

Where $Q=\sum_{i=1}^{n}q_i$. Using equation (13) and (14), we can write down the total quantity and quantitiy that firm i produces at the Nash equilibrium

$$Q^*=\frac{n\cdot\alpha-\sum_{i=1}^{n}c_i}{b(n+1)}\Leftrightarrow q_i^*=\frac{\alpha-n\cdot c_i+c_{-i}}{b(n+1)}$$

where $c_{-i}=\sum_{j\neq i}c_j$. We can obtain the equilibrium cash flow C_1^*

$$C_1^*=\frac{(\alpha-n\cdot c_i+c_{-i})^2}{b(n+1)^2}$$

Therefore

$$\frac{\partial C_1^*}{\partial c_i}=\frac{2(\alpha-n\cdot c_i+c_{-i})(-n)}{b(n+1)}<0$$

$$\frac{\partial C_1^*}{\partial c_{-i}}=\frac{2(\alpha-n\cdot c_i+c_{-i})}{b(n+1)}>0$$

From the definition of EPCM, we can write the market share as

$$\frac{q_i^*}{Q^*}=\frac{\alpha-n\cdot c_i+c_{-i}}{n\cdot\alpha-\sum_{i=1}^{n}c_i} \tag{16}$$

Equation (16) imply that

$$\partial\left(\frac{q_i^*}{Q^*}\right)/\partial c_i=\frac{(-n)(n\alpha-\sum_{i=1}^{n}c_i)+(\alpha-n\cdot c_i+c_{-i})}{(n\alpha-\sum_{i=1}^{n}c_i)^2}<0$$

$$\partial\left(\frac{q_i^*}{Q^*}\right)/\partial c_i=\frac{(n\alpha-\sum_{i=1}^{n}c_i)+(\alpha-n\cdot c_i+c_{-i})}{(n\alpha-\sum_{i=1}^{n}c_i)^2}>0$$

Q.E.D.

A1.2 Proof of Proposition 2

Following Acharya *et al.* (2012), we can write the first order condition as

$$f'(I)=1+(f(I)+C_2)h(e_D)$$

We define function $m(I, C_1)$ as

$$m(I, C_1)=f'(I)-1-(f(I)+C_2)h(e_D) \tag{17}$$

From the definition $w=C_0-I$

$$\frac{\partial w}{\partial C_1}=\left(\frac{\partial w}{\partial I}\right)\left(\frac{\partial I}{\partial C_1}\right)=(-1)\cdot\left(-\frac{\partial m}{\partial C_1}/\frac{\partial m}{\partial I}\right) \tag{18}$$

From equation (16), we can know that

$$\frac{\partial m}{\partial I}=f''(I)-f'(I)h(e_D)-(f(I)+C_2)h'(e_D)<0, \text{ where} f''(\cdot)<0, h'(\cdot)\geq 0$$

$$\frac{\partial m}{\partial C_1}=-(f(I)+C_2)h'(e_D)\left(\frac{\partial e_D}{\partial C_1}\right)>0, \text{ where}\frac{\partial e_D}{\partial C_1}=(-1)$$

From equation (16) and (17), we can see that

$$\frac{\partial w}{\partial C_1}<0$$

Therefore,

$$\frac{\partial w}{\partial c_i}=\left(\frac{\partial w}{\partial C_1}\right)\left(\frac{\partial C_1}{\partial c_i}\right)>0, \text{ where}\frac{\partial w}{\partial C_1}<0, \frac{\partial C_1}{\partial c_i}<0$$

$$\frac{\partial w}{\partial c_{-i}}=\left(\frac{\partial w}{\partial C_1}\right)\left(\frac{\partial C_1}{\partial c_{-i}}\right)<0, \text{ where}\frac{\partial w}{\partial C_1}<0, \frac{\partial C_1}{\partial c_{-i}}>0$$

Q.E.D.

A1.3 Proof of Proposition 3

The definition of EPCM imply that

$$\text{EPCM}=\left(-\frac{P'(Q)Q}{P(Q)}\right)\left(\frac{q_i}{Q}-\frac{1}{n}\right)$$

From the q_i^*, Q^*, $P(Q)=a-b\cdot Q$ we can see that

$$\text{EPCM}=\frac{n\cdot c_{-i}-n^2\cdot c_i+\sum_{i=1}^n c_i}{n\cdot a+n\sum_{i=1}^n c_i}$$

where $c_{-1}=\sum_{j\neq i}c_j$. Therefore

$$\frac{\partial \text{EPCM}}{\partial c_i}=\left(\frac{-n^2(n\cdot a+n\sum_{i=1}^n c_i+c_{-i})+n\cdot a+n^3c_i}{(n\cdot a+n\sum_{i=1}^n c_i)^2}\right)$$

From some algebra, we obtain

$$\frac{\partial \text{EPCM}}{\partial c_i}=\frac{a\left(\frac{1-n^2}{n}\right)-c_{-i}(n+1)}{(a+\sum_{i=1}^n c_i)^2}<0$$

where $\left(\frac{1-n^2}{n}\right)<0$, when $n>1$ and $c_{-i}(n+1)>0$, $(a+\sum_{i=1}^n c_i)^2>0$. From the similar process, we obtain

$$\frac{\partial \text{EPCM}}{\partial c_{-i}}=\left(\frac{a(n^2+n)+c_i(n^2+n^3)}{(n\cdot a+n\sum_{i=1}^n c_i)^2}\right)>0$$

Q.E.D.

A1.4 Proof of Proposition 4

Result 1, proposition 1 and result 2 imply that

$$\frac{\partial w}{\partial c_i}=\left(\frac{\partial w}{\partial \text{EPCM}}\right)\left(\frac{\partial \text{EPCM}}{\partial c_i}\right)>0\Rightarrow\left(\frac{\partial w}{\partial \text{EPCM}}\right)\left(\frac{\partial \text{EPCM}}{\partial c_i}\right)>0$$

$$\frac{\partial \text{EPCM}}{\partial c_i}<0\Rightarrow\frac{\partial w}{\partial \text{EPCM}}<0$$

Q.E.D.

Appendix A2. (Robustness to the Other Competition Models)

Our results are derived within a Cournot model. The main intuition can also be derived from a Bertrand model, as we now show. Following Spulber (1995), we consider a Bertrand model of competition when rival's costs are unknown. There n firms compete by setting price p_i, $i=1, \ldots, n$. Firm's cost function is $c(q, \theta_i)$ where q is output and θ_i is marginal cost parameter. Market demand is given by $D(p)$. The profit function $\pi(p, \theta)$ which is concave in price p. The marginal cost is the private information of firm i which are drawn from C.D.F. $F(\theta)$. The probability that θ is thw lowest marginal cost across firms is given by

$$G(\theta)=(1-F(\theta))^{n-1}$$

Let $H(p_i, p_{-i})$ represent the probability of winning the market for firm i set price p_i and other firms follow strategies p_{-i}. Then the expected interim cash flow in our model is given by

$$C_1=\pi(p_i, \theta_i)\,\mathbb{E}(H(p_i, p_{-i}))$$

where $\mathbb{E}$ denote the expectation over $(\theta_1, \ldots, \theta_{i-1}, \theta_{i+1}, \ldots, \theta_n)$. At the equilibrium, funciton $p(\cdot)$ maps marginal cost into prices. Hence, the probability of winning the market is the distribution of order statistic $G(\theta)$ for $\theta \leq \theta^1$. According to Proposition 2 due to Spullber (1995), there exist a symmetric equilibrium $p^*(\theta)$, the expected cash flow can be written as follows:

$$C_1(\theta)=\int_{\theta}^{\theta_1} c_2(D(p^*(\theta)), \theta)G(\theta)d\theta$$

According to the Proposition 3 of Spulber (1995):

$$\frac{\partial C_1}{\partial \theta}<0$$

The expected interim cash flow is decreasing in marginal cost. Using this property, we can get the same result as the main empirical hypothesis.

Appendix B. (Mark-Ups Estimates)

In this appendix, we discuss estimates of the mark-ups. Our estimation uses the methodology developed in De Loecker and Warzynski (2012), De Loecker and Eeckhout (2017) (hereafter, DLE) and we refer the reader to these papers for the technical details of the estimation. We only do a simple summary and introduction here.

Consider an economy with n firms. Consider the cost minimization behavior of producer, firm i minimizes the cost of production given the production function:

$$Q(\Omega_{i,t}, V_{i,t}, K_{i,t})=\Omega_{i,t}F_{i,t}(V_{i,t}, K_{i,t})$$

where V capture the set of inputs of production, K is the capital stock and Ω is the firm-specific Hicks-netural productivity. Consider the following Lagrangian function:

$$L(\Omega_{i,t}, V_{i,t}, K_{i,t})=P^V_{i,t}V_{i,t}+r_{i,t}K_{i,t}-\Lambda_{i,t}(Q(\cdot)-Q_{i,t}) \tag{19}$$

Where P^V is the price of input, r is the user cost of capital, $Q(\cdot)$ is the technology, $Q_{i,t}$ is scalar and $\Lambda_{i,t}$ is the Largrangian multiplier. The F.O.C. of equation (19) is:

$$\frac{\partial L}{\partial V_{i,t}}=P^V_{i,t}-\Lambda_{i,t}\frac{\partial Q(\cdot)}{\partial V_{i,t}}=0 \tag{20}$$

Equation (20) can be rearranging into a form of the output elasticity of input V:

$$\theta_{i,t}=\frac{\partial Q(\cdot)}{\partial V_{i,t}}\frac{V_{i,t}}{Q_{i,t}}=\frac{1}{\Lambda_{i,t}}\frac{P^V_{i,t}V_{i,t}}{Q_{i,t}}$$

Because here this multiplier shows the change in the objective function when the constraint is relaxed, it can be used to measure marginal costs. Hence, the markup can be defined by

$$\mu=\frac{P}{\Lambda} \tag{21}$$

where P is the price for the output good. Replace $\Lambda=P/\mu$ in the equation (21), we obtain a measure for the mark-ups:

Table A1 Correlation Matrix

NWC is net working capital. MTB is market to book ratio. sd_invest is investment volatility. sd_cashflow is the cash flow volatility. sd_sales is the sales volatility. DIR is managerial ownership. BRD is board size. IDRTO is board independence. INST is institutional ownership.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
(1) Cash/Net Assets	1.000																			
(2) EPCM	−0.140	1.000																		
(3) Mark-Ups	−0.121	0.571	1.000																	
(4) LTDD	−0.140	0.003	−0.035	1.000																
(5) Tangibility	−0.214	−0.047	0.000	0.218	1.000															
(6) Cash Flow	0.342	0.450	0.585	−0.101	−0.072	1.000														
(7) Leverage	−0.033	−0.112	−0.176	0.314	0.056	−0.116	1.000													
(8) Bank Dependence	−0.291	−0.052	−0.036	0.368	0.246	−0.234	0.451	1.000												
(9) Investment	0.039	0.065	0.095	−0.009	0.008	0.126	0.011	0.006	1.000											
(10) NWC	0.041	0.028	−0.007	−0.305	−0.399	0.067	−0.599	−0.431	−0.003	1.000										
(11) size	−0.366	0.012	0.126	−0.082	0.017	−0.034	0.010	0.048	−0.015	−0.012	1.000									
(12) MTB	0.254	0.185	0.264	−0.000	−0.147	0.326	0.113	−0.020	0.112	−0.123	−0.032	1.000								
(13) sd_invest	0.157	0.040	0.039	0.018	−0.139	0.013	0.058	0.036	0.422	−0.020	−0.139	0.151	1.000							
(14) sd_cashflow	0.215	−0.029	−0.042	−0.006	−0.078	−0.062	0.026	−0.035	0.016	−0.011	−0.136	0.178	0.152	1.000						
(15) sd_sales	0.071	0.007	0.082	0.053	−0.117	−0.093	0.005	0.079	0.089	−0.016	−0.077	0.117	0.299	0.207	1.000					
(16) DIR	0.285	0.121	0.084	0.095	−0.008	0.185	0.041	0.014	0.074	−0.075	−0.369	0.103	0.104	0.064	0.056	1.000				
(17) BRD	−0.254	−0.008	0.055	−0.079	0.045	0.002	0.008	0.016	−0.006	−0.024	0.597	−0.024	−0.128	−0.108	−0.113	−0.246	1.000			
(18) IDRTO	0.068	0.000	0.045	−0.028	−0.098	0.014	−0.016	−0.033	0.019	0.022	0.053	0.205	0.093	0.029	0.066	−0.082	0.021	1.000		
(19) INST	−0.121	0.096	0.183	−0.127	−0.139	0.103	−0.166	−0.076	0.016	0.108	0.697	0.181	−0.046	−0.034	0.009	−0.222	0.378	0.139	1.000	
(20) Bond Dummy	0.011	0.022	−0.005	0.072	0.046	−0.007	0.082	0.027	0.016	−0.044	−0.070	0.013	0.023	0.012	0.021	0.073	−0.048	−0.001	−0.057	1.000

$$\mu_{i,t}=\theta_{i,t}^{V}\frac{P_{i,t}Q_{i,t}}{P_{i,t}^{V}V_{i,t}}$$

where $\frac{P_{i,t}Q_{i,t}}{P_{i,t}^{V}V_{i,t}}$ is the revenue share of the variable input, and $\theta_{i,t}^{V}$ is the output elasticity of the variable input. We can directly obtain sales, $S_{i,t}=P_{i,t}Q_{i,t}$ and total variable cost of production, $C_{i,t}=\sum_{j}P_{i,t}^{Vj}V_{i,t}^{j}$ from Nikkei NEEDS. In order to estimate the output elasticity of input, DLE consider the following production function:

$$q_{i,t}=\beta_{v}v_{i,t}+\beta_{k}k_{i,t}+\omega_{i,t}+\varepsilon_{i,t}$$

where $q_{i,t}$ is firm level sales, and the $v_{i,t}$ is the cost-of-goods sold. For the specific estimate process of this production function, please refer the original paper. DLE measure firm-level mark-ups using the estimate of the β_{v}:

$$\mu_{i,t}=\beta_{v}\frac{S_{i,t}}{C_{i,t}}$$

In our analysis, we estimate these mark-ups using total expenses (the sum of cost-of-goods sold and SG&A) instead of cost-of-goods sold.

《SUMMARY》

COMPETITIVE POSITION AND CASH HOLDINGS: EVIDENCE FROM JAPANESE LISTED FIRMS

By YUE CAI

This paper empirically analyzes the relationship between firms' competitive position and cash holdings. Firms with a low competitive position have a lower expected cash flow. Therefore, such firms set aside cash from cash flows to avoid default. We estimate a linear cash demand function using two measures for a competitive position. We find a negative relationship between a competitive position and cash holdings, which is consistent with our empirical hypothesis, and larger responses for those who face financial constraints. The results show that firms choose a cash holding policy that is closely linked to their competitive position.

（Waseda University）