Predation Risk, Market Power, and Corporate Cash Policy

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Abstract

This study examines the combined effect of predation risk and firms' market power on cash holdings. As indicated in previous studies, we find that firms' cash holdings increase with a rise in predation risk faced by firms. However, the higher the firm's market power, the weaker the above interplay becomes. Moreover, we find that even when firms' investments are decreased at the industry level, firms with larger cash holdings seek to mitigate predation risk by funding strategic investments with the potential to steal rivals' market share. This evidence adds new dimensions to the understanding of the association between predation risk and corporate cash policy.

JEL Classification: G32, L10, L60

Keywords: Cash holdings; Market power; Industry structure and competition

1 Introduction

Preceding studies in economics and finance have shown why firms hold liquid assets (cash and cash equivalents) even though they yield opportunity costs. There are two major advantages of holding liquid assets.[1] First, firms save transaction costs using liquid assets to make payments in daily operations without liquidating noncash assets. Second, firms use liquid assets to timely finance their investment opportunities when other ways of funding are unavailable or are excessively costly. The first advantage to holding cash is the transactional motive and the second is the precautionary motive.

The transactional motive of cash holdings has been asserted at length in the finance literature. In Miller and Orr's (1955) classic paper, transaction costs that have evolved from brokerage costs could induce firms to hold more cash. By contrast, according to the precautionary motive of cash holdings, Baumol (1952) indicated that firms tend to hold more cash when the cost of raising additional financing is higher. As argued by Myers and Majluf (1984), raising external funds is more costly than using internal funds in the presence of asymmetries. In sum, emphasizing the risk of underinvestment resulting from insufficient liquidity, they argue that firms attempt to retain a certain level of cash reserves. Besides, in prior studies, the precautionary motive has been discussed in the idea that firms aim to accumulate cash reserves to hedge risk associated with future cash flow uncertainty. Opler, Pinkowitz, Stulz, and Williamson (1999) presented that firms with strong growth opportunities

[1] Another explanation for cash policy relates to agency theory. As originally described by Jensen (1986), entrenched managers have a greater preference for cash, because it increases their discretion. Moreover, they would rather hold too much cash than increase payouts to shareholders when the firm has poor investment opportunities. Dittmar, Mahrt-Smith, and Servaes (2003) find firms in countries with greater agency problems between managers and shareholders likely hold more cash. Dittmar and Mahrt-Smith (2007) find that the value of dollar of cash is worth substantially less when agency problems between insiders and outside shareholders are greater. They provide evidence suggesting that entrenched managers are more likely to waste excess cash resources and thus destroy firm value.

and risky cash flows hold relatively large cash reserves. Riddick and Whited (2009) found that firms hold higher precautionary cash balances when income uncertainty due to riskier cash flow is high. In addition to these studies, the precautionary motivation of cash reserve has a new tendency to be discussed in terms of predation risk.

Predation risk is the risk of underinvestment leading to a loss of investment opportunities and market share to rivals. Prior studies have presented that firms can decrease predation risk using cash as a risk management tool. Bolton and Scharfstein (1990) argued that firms hoard cash so that they are better able to resist rivals' predatory attacks. Thus, firms' ability to hold cash, which can mitigate the predation risk, is an important determinant of their success in the product markets. Kim, Maurer, and Sherman (1998) suggested that cash holdings can alleviate underinvestment problems by providing empirical evidence that firms with larger growth opportunities hold significantly greater liquid assets. Mikkelson and Partch (2003) demonstrated that firms holding large cash reserves do not underperform compared with their rival firms. Haushalter, Klasa, and Maxwell (2007), and Fresard (2010) indicate that predation risk is an important determinant of corporate financial policy choices by presenting empirical evidence that the predation risk is positively associated with the level of cash holdings.

These studies have presented that firms increase cash holdings in response to increases in predation risk. However, they do not consider that the impact of predation risk on cash policy is not uniform for all firms within an industry. Each firm in an industry has different market power. A firm's market power is the firm's ability to extract a higher price from its customers. Consequently, firms with higher market power can not only charge higher prices but also obtain larger cash flows by maintaining higher profitability. As a result, firms with greater market power relative to those of its peers in a specific industry should be less concerned about indicating rivals' predatory behavior because they have more resources to resist predatory attacks. Hence, even

if different firms within a specific industry face the same degree of predation risk, the firm with stronger market power relative to other firms needs less cash than the level of cash holdings which is determined by the predation risk which it faces. This suggests that taking the effect of a firm's market power into consideration, there is the possibility that the link between product market power of firms and the level of cash reserves is not a positive linear relationship as presented by the previous studies. However, no studies have directly analyzed the relation among cash holdings, predation risk and market power. Consequently, an open but important question arises: how does a firm's market power within its industry, cash policy, and predation risk interact?

This paper illuminates the effect of firms' market power on the relation between cash holdings and predation risk. To test this, we use the excess price-cost margin (EPCM) to measure firms' market power. EPCM is the difference between firms' price-cost margin (PCM) and the average PCM of its industry. PCM appears in the literature of industrial organization to measure the extent to which firms price above marginal cost. Hence, higher values of EPCM indicate a greater ability to extract profits. Besides, we consider predation risk as the similarity of firms' investment opportunities with rivals as measured by the absolute deviation between firms' capital-to-labor ratio and its industry-year median (Haushalter, Klasa, and Maxwell, 2007). Smaller values of this index indicate that firms' investment opportunities resemble those their rivals and that their operations are more similar to those of their counterparts in an industry. Hence, the larger this interdependence of investment opportunities among firms, the higher is the firm's predation risk. Froot, Scharfstein, and Stein (1993) argued that whether firms hedge predation risk depends on the interdependence of their investment opportunities with rivals.

Confirming prior studies, we also find that firms likely hold large cash balances when they paralell closely the interdependence of investment oppor-

tunities with rivals. Thus, predation risk is an important driver of corporate cash policy. Next, we find that this association between predation risk and cash holdings weakens when firms increase market power. That is, the impact of predation risk on cash holdings matters less among firms with greater market power. This result suggests that firms with higher (lesser) market power are less (more) concerned about inducing rivals' predatory behaviors because they have more resources to resist attacks.

The evidence indicates that firms anticipate predation risk by holding cash. How firms manage predation risk via cash reserves is less clear. We investigate this point by examining on the relations among firms' predation risk, cash holdings, and its investment behavior. Campello (2006) and Fresard (2010) argued that firms with larger cash holdings use them to finance predatory investments of the type that expands market share.[2] Bolton and Scharfstein (1990) argued that cash-rich firms increase investment to drive cash-poor firms from markets and mitigate predation risk.

Drawing on these studies, we argue that if firms aim to manage predation risk, even though rivals' investments are declining at the industry level, they invest more as predation risk rises. Our analysis reveals that predation risk rises the likelihood that firms will invest more, even when rivals reduce investment. Moreover, this likelihood increases with cash holdings. Hence, firms with larger cash holdings seek to mitigate predation risk by funding investments with the potential to steal market share. These results indicate that firms with more cash seek market share by investing more even when competitors reduce investment.

Thus far, we have considered only intra-industry relationships cash holdings and predation risk. Next, we verify whether industry structure, as measured by market concentration, affects this relationship. Some studies have suggested that the degree of industry concentration affects firms'

[2]Campello (2006) details as typical predatory investments the location of stores or plants, construction of efficient distribution networks, advertising targeting rivals, recruitment of more productive workers, and acquisition of suppliers or partners.

predatory behavior because greater concentration indicates greater similarity among rivals' investment opportunities. Kovenock and Phillips (1997), Zingales (1998), and Akdoğu and MacKay (2008) indicated that strategic investments (e.g., deterrence, preemption, exit, or predation) more likely occur in concentrated industries wherein firms have overlapping investment opportunity sets. Akdoğu and MacKay (2008) demonstrated that the first-mover advantage becomes crucial for the firm that engages in preemptive predatory behavior when market concentration is high. These findings imply that firms in highly concentrated industries hold extensive cash reserves to hedge rivals' predatory behavior. Besides, if firms in highly concentrated industries hold extensive cash, they generally invest more during years in which rivals reduce investment. These arguments prompt two hypotheses. First, the effect of predation risk on cash holdings strengthens among firms in concentrated industries. Second, as concentration intensifies, predation risk raises the likelihood that firms will make strategic investments even if rivals reduce investment. Our analysis presents two findings. First, the impact of predation risk on cash holdings is larger in concentrated industries. Second, in more concentrated industries, firms that hold large cash reserves seek to steal market share and drive competitors out of business. These findings imply that differences in industry structure measured by market concentration are key determinants of corporate cash policy.

Our study makes three contributions. First, we show new empirical evidence that the impact of predation risk on cash holdings weakens when firms' market power rises. This result indicates that firms with greater market power need not hold significant cash reserves to reduce predation risk because market power mitigates predation risk. This implication supports results in the study by Gaspar and Massa (2006) that firms with greater market power can smooth cash flow fluctuations resulting from idiosyncratic cost shocks. Second, our study contributes to understanding the associations among predation risk, cash policy, and investment. We argue that firms hoard

cash to resist rivals' predation and tend to use it aggressively in their own predatory behavior. This result complements the finding of Frésard (2010) that large cash reserves lead to market share expansion at the expense of industry rivals. Finally, we find the new evidence greater predation risk on cash holdings among firms in concentrated industries. This evidence provides corporate cash policy with the new insight that not only predation but also industry structure are key determinants of cash holdings.

This paper is organized as follows. Section 2 describes testable hypotheses and empirical predictions. Section 3 describes our data, empirical methodology and variables. Section 4 presents and analyzes empirical findings. Section 5 concludes the study.

2 Interplay between cash holdings and predation risk

This section discusses the interplay between cash holdings and predation risk, and presents testable hypotheses. Our theoretical background is based on the framework presented by Opler et al. (1999). Specifically, firms aim to hold cash reserves that equate the marginal cost of holding liquid assets with the marginal benefit of holding them. Costs of holding liquid assets include wasting capital and increasing agency costs associated with managerial discretion over free cash. On the other hand, benefits from holding liquid assets include saving transaction costs to raise funds, using these assets to finance investments, and reducing predation risk, defined as the risk of underinvestment leading to loss of investment opportunities and market share.

Prior studies have shown that firms can manage predation risk by holding cash as a risk management tool.[3] Haushalter, Klasa, and Maxwell (2007)

[3]Opler et al. (1999) show that firms with greater cash reserves can sustain investment when variance in future cash flows is high, and when cost of external financing is higher than internal capital. Also, Harford, Mikkelson, and Partch (2003) show that firms with

indicated that firms are more likely hold more cash when facing higher predation risk. Bolton and Scharfstein (1990) argued that firms able to finance investments with internally generated funds have greater chance of succeeding in product markets. Fresard (2010) presented that firms with larger cash holdings have the ability to gain market share at the expense of rivals. Based on these prior studies, our main testable hypothesis is that predation risk is positively associated with the size of cash holdings. This hypothesis implies that firms facing higher predation risk tend to hold large amounts of cash to mitigate that risk.

Next, we verify that firms' market power affects the relation between predation risk and cash holdings. We assume that firms' market power has the potential to influence the firm's cash holdings. Firms with greater market power tend to increase profitability and obtain more stable cash flows since market power enables them to charge higher prices (Peress, 2010). Previous studies have shown that firms with greater market power should be less affected by risk associated with operating cash flows or risks generated in product markets. Gaspar and Massa (2006) indicated that market power works as a hedge that smoothes idiosyncratic volatility. Grullon and Michaely (2007) argued that predation is less likely against dominant firms because these firms have more resources to resist predatory attacks. Hence, firms with high market power are under no pressure to hold liquid assets against predation risk. Besides, agency costs associated with free cash flows increase among firms greater market power because these costs tend to increase in proportion to the degree of cash flows the firm obtains. This suggests that high market power firms have little incentive to keep higher cash holdings. Based on these arguments, we present the next testable hypothesis that the higher the market power of firms, the weaker the effect of predation risk on cash holdings. In other words, firms with greater market power need less

larger cash reserves can invest more during and immediately after downturns. These studies suggest cash benefits hedge against underinvestment that invites predation.

cash reserves than the level determined by predation risk.

Although we verify the interplay between corporate cash policy and predation risk by examining the above hypotheses, it remains unclear how firms concretely mitigate predation risk via cash reserves. Previous studies have suggested that cash reserves potentially affect firms' predatory investment (Bolton and Scharfstein, 1990; Campello, 2006; Fresard, 2010). Based on these studies, to reveal the specific way to mitigate predation risk, we must verify the following hypothesis that firms facing higher predation risk seek to expand market share by increasing investment even when rivals are reducing investments. Besides, the probability of this strategic behavior tends to increase among firms with more cash on hand. This hypothesis implies that firms with larger cash holdings seek to mitigate predation risk by funding predatory investments with the potential to steal rivals' market share.

Finally, we examine how differences in industry structure categorized by market concentration affect the association between predation risk and cash holdings. Several empirical studies have investigated the impact of industry structure on this relation (Kovenock and Phillips, 1997; Zingales, 1998; Akdoğu and MacKay, 2008). These studies have suggested that predatory investment is more likely in more concentrated industries. Hence, this leads to our final testable hypothesis: the association between predation risk and cash holdings is stronger in more concentrated industries. Firms in more concentrated industries tend to hold large amounts of cash to hedge against rivals' predatory behaviors. Besides, if firms in highly concentrated industries hold extensive cash holdings, they tend to increase investment during years in which rivals reduce investments.

3 Data, definitions of variables, and method

To test our hypotheses, we gather consolidated financial data from Nikkei-NEEDS spanning 2001-2011. We exclude financial companies and regulated

utilities, and substitute extreme observations with missing values to minimize the influence of outliers.[4] We classify product markets (industries) according to the 36 Nikkei Industrial Classification (NIC). All firms in an industry are considered to be product market rivals. Finally, the sample comprises 15,386 firm-year observations in which industries are defined by their NIC.

3.1 Proxies for predation risk, market power, and industry concentration

3.1.1 Predation risk

We use the interdependence of firms' investment opportunities with product market rivals as a proxy for the degree of predation risk firms face.[5] This interdependence considers the similarity of firms' investment decisions with its rivals. MacKay and Phillips (2005) argued that this similarity is measured by the absolute difference between firms' capital-to-labor ratio and industry-year median for this ratio.[6] Larger values indicate less similarity among firms' investment decisions with product market rivals and less interdependence of investment opportunities. Hence, firms with larger values for this index face lower predation risk. To limit this measure between 0 and 1 and to compare it among industries, we divide this difference by the industry range of the capital-to-labor ratio. We subtract this value from 1 to facilitate comprehension of this proxy. Consequently, if this proxy comes closer to 1, predation risk to firms increases. We represent this measure as *PDR*.

[4] Specifically, We winsorize all ratio variables at the 1% and 99% values to deal with outliers.

[5] Froot, Scharfstein, and Stein (1993) argue that whether a firm hedges predation risk depends on the interdependence of its investment opportunities with product market rivals.

[6] MacKay and Phillips (2005) is based upon Maksimovic and Zechner's (1991) natural hedge. Their idea is modeled in Williams (1995). Among recent theoretical literature, see Adam, Dasgupta, and Titman (2008).

3.1.2 Market power

Our proxy for market power is the EPCM. EPCM is defined as the difference between firms' PCM, defined as operating profit margin divided by sales, and the industry average PCM (Phillips, 1995).[7] PCM appears used in the literature of industrial organization to measure the extent to which firms raise a price above their marginal cost. Hence, firms with higher EPCM have more market power.

3.1.3 Industry concentration

We use the Herfindahl-Hirschman Index (HHI) to measure industry concentration. We measure HHI based on the 36 NIC. HHI equals the sum of squared market shares over all firms in the industry in a particular year.

3.2 Measures of cash holdings, and other explanatory variables

Cash holdings are measured as the natural logarithm of cash and marketable securities deflated by total assets excluding cash and marketable securities, denoted *CASH* (Opler et al., 1999). We use the sets of other explanatory variables, excluding predation risk, market power, and HHI, that are believed to affect determinants of firms' cash holdings (Opler et al., 1999; Haushalter, Klasa, and Maxwell, 2007). Definitions of these variables and their expected influence on cash holdings appear below.

FRS = foreign sales is a dummy equal to 1 if the firm posts foreign sales. Firms operating in foreign countries face higher risk that they must hedge than domestic-only firms (Haushalter, Klasa, and Maxwell, 2007). They are more likely to have incentives to hold extensive excess cash as a risk management tool.

[7] We use EPCM rather than PCM to eliminate the effect of industry specific effects (Gaspar and Massa, 2006).

SIZE = the natural logarithm of total assets. Large firms generally are well known and less vulnerable to capital market imperfections than small firms. As a result, they establish relations with financial institutions easily and access external financial markets smoothly, reducing costs of external financing to meet investment demand. This suggests that they would hold less cash reserves than small firms. We expect a negative relation between firm size and cash holdings.

MTB = market value of firms' growth opportunities measured as book value of assets minus book value of equity plus market value of equity divided by assets. Firms with abundant growth opportunities are likely to keep higher cash holdings so as not to pass up positive investment opportunities. Consequently, firms with higher growth opportunities have higher cash holdings.

DIS = discretionary investment, defined as research and development spending plus advertising expenditure divided by sales. Potential for financial distress cost is measured by the degree of discretionary investment (Opler et al., 1999). The cost of financial distress tends to be larger for firms with high discretionary investments because discretionary investments are intangibles. Firms with higher discretionary investments cannot raise funds easily because the transaction costs associated with external financing increase with increased discretionary investment. We expect that firms with higher discretionary investment hold more cash reserves.

CEX = a firm's capital expenditures measured as capital expenditure divided by total assets. According to financing hierarchy theory, firms prefer to finance first using internal resources. If firms with more profitable projects tend to make capital expenditure, they use cash, including retained earnings, until they require outside financing. We predict a negative relation between cash holdings and capital expenditures.

DEBT = leverage, measured as the ratio of total debt (long-term plus short-term) to book value of assets. Firms with higher leverage should re-

pay debt by exhausting cash reserves. We expect leverage to influence cash holdings adversely.

NWP = net working capital, measured as liquid asset minus liquid debt minus cash divided by book value of assets minus cash. We consider networking capital as a measure of liquid asset substitutes. We predict a negative relation between cash holdings and net working capital.

DIV = dividend payout, a dummy variable that takes 1 if firms pay dividends and 0 otherwise. According to financing hierarchy theory, firms reduce free cash reserves by paying dividends instead of increasing debt. *Ceteris paribus*, cash dividend distributions reduce cash reserves. We predict a negative relation between cash reserves and dividend payout.

$PROF$ = profitability, measured as the ratio of operating income to total assets. We define profitability as average return on assets from year –3 to –1, as predicted by Haushalter, Klasa, and Maxwell (2007). Firms with higher profitability increase cash reserves because profit is the source of liquidity. The higher the average profitability, the more firms tend to increase cash reserves.

$RISK$ = volatility of cash flows, measured as the standard deviation of the ratio of EBITDA to total assets between $t-1$ and $t-5$. Firms with volatile cash flows tend to increase cash reserves because the consequence of financial distress intensify with volatility of cash flow. We predict a positive relation between cash holdings and volatility of cash flows.

4 Empirical results

4.1 Descriptive statistics of predation risk

Table 1 presents descriptive statistics of predation risk for the industry we study. We report the mean and median values of this measure based on the 36-NIC classification. The value of this measure falls between 0 and 1. If this proxy approaches to 1, the predation risk increases.

There is heterogeneity in predation risk level across the industries. The predation risk which approaches to 1 reflects higher similarities between the firm's investment opportunity and the investment opportunities of industry rivals and therefore a higher risk of losing market share. Thus, firms in Services (71), Electric and Electronic Equipment (23), and Machinery (21) face the highest risk of losing own market share to their rivals that belong to these industries.

4.2 Descriptive statistics of the variables

The summary of variables is presented in Table 2. The first part of the table presents descriptive statistics for the whole sample. The second part reports summary statistics for high-predation and low-predation firms and differences in characteristics between them. We define high-predation (low-predation) firms as those for which predation risk is above (below) the industry median.

Average values of *EPCM* and *HHI* for low-predation firms exceed those of high-predation firms. These results present two findings. First, firms with low predation risk occupy more concentrated industries. Second, the lower the firm's predation, the higher its need for market power, that is, the lower the predation risk in more concentrated industries, the more likely a firm has market power. *RISK* for high-predation firms significantly exceeds that of low-predation firms. We recognize that predation risk is reflected in the volatility of cash flow. A rise in the firm's risk tends to increase the cost of debt capital. This is reflected in high-predation firms being significantly less leveraged than low-predation firms.

4.3 Univariate findings

Panels A and B of Table 3 provide mean values of cash holdings, defined as cash and marketable securities, scaled by total assets, excluding cash and marketable securities. Panel A shows the statistics for all samples. Panel

B presents this measure for subsamples based on whether firms' predation risk (PDR) is above or below the median sample value for the year and industry. Panel C reports the mean value of firm's cash flow, which is defined as the ratio of EBITDA to the book value of the assets, for subsamples based on whether a firm's market power ($EPCM$) is above or below the median sample value for the year and each industry. Next, Panel D shows the mean value of profitability for subsamples based on whether a firm's market power ($EPCM$) is above or below the median sample value for the year and each industry. Panel E reports the mean value of predation risk for subsamples based on whether firms strategically increase investment even when rival firms' investments are faced with being decreased or not. Additionally, Panel F reports the mean value of cash holdings with the classification which is based on whether firms strategically increase investment even when rival firms' investments are faced with being decreased or not.

Panel B shows that firms with higher predation risk hold large cash reserves. This panel presents that cash reserves are significantly larger among high-predation-risk firms. Panel C provides evidence that firms with higher market power tend to obtain more operating cash flow. Besides, Panel D presents firms with greater product market power relative to other firms within an industry tend to become higher profitability. These evidence suggests that market power gives the firms financial flexibilities, allowing them to enhance their strategic behavior when responding to the predation risk which they face. In other words, firms that enjoy a more powerful market power are easy to fend off their rivals' predatory attacks even if they face greater predation risk. Panel E provides evidence that predation risk is elevated among firms that increase investment even when rivals reduce investment. Besides, Panel F shows that firms making a predatory investment hold significantly more cash than other firms. These results support the idea that firms with larger cash reserves seek to mitigate predation risk by funding predatory investment that potentially can steal rivals' market share.

4.4 Multivariate findings

Next, we examine in a multivariate setting the effect of predation risk on cash holdings. The dependent variable is the natural logarithm of cash and marketable securities deflated by total assets, excluding cash and marketable securities (Opler et al., 1999). Table 4 presents the regression with *PDR* as measure of firms' predation risk using all samples. We include industry and year dummies to control for industry-specific and period-specific factors. The model in Table 4 is pooled regressions. The t-statistics are corrected for heteroscedasticity and serial correlation between multiple observations of the same firm.

Table 4 shows that the effect of predation risk is economically and statistically significant. As shown in prior studies, predation risk tends to increase firms' cash holdings after controlling for all previously established determinants of cash reserves such as profitability, size, leverage, risk, and other characteristics. This result supports the idea that firms hold large cash balances when they are closer to the interdependence of investment opportunities with their rivals. Thus, predation risk is an important driver of the cash policy.

Next, we verify that firms' market power within an industry affects the relation between predation risk and cash holdings. Table 5 provides evidence whether the effect of predation risk which on cash holdings is jointly related to the firm's market power. The result shows that cash holdings are positively associated with market power (*EPCM*). Firms having greater market power can hold large cash reserves because firms with higher market power relative to other firms within an industry tend to obtain higher cash flow easily. By contrast, the coefficient of the interaction term ($PDR \times EPCM$) is significantly negative. This result indicates that the impact of predation risk on cash holdings matters less among firms with greater market power. In sum, even if firms within the same industry face the same level of predation risk, firms with higher market power are less likely to hold a large amount of cash reserves than those with lower market power.

Evidence thus far demonstrates that firms prepare for predation risk by holding cash. It is less clear how firms hedge predation risk using those reserves. To further investigate how management hedges predation risk, we estimate probit regressions to establish whether cash holdings relate to firms' investment decisions. Prior studies suggest that cash holdings potentially affect predatory investment behavior that involves expanding market share at the expense of rivals. Bolton and Scharfstein (1990) argued that cash-rich firms increase investments and drive cash-poor firms from the product market to mitigate predation risk.

Table 6 displays the estimate of probit regression in which the dependent variable equals 1 if firms increase investment even when rivals contemplate reducing it and 0 otherwise. This indicates that if firms hedge predation risk even when rivals reduce investment, the more predation risk (PDR) increases, the higher the probability that firms will increase investment. By contrast, cash holdings ($CASH$) correlate significantly with the likelihood that firms invest strategically. We find that the larger the decrease in industry investment, the less likely a cash-rich firm increases investment. In sum, firms with larger cash holdings are likely to change investments to hedge recession in the same direction as change in their industry's investment.

The coefficient of interest is the interaction term between PDR and $CASH$. It is economically and significantly positive, indicating that the effect of predation risk swells when firms have extensive cash holdings. Firms with larger cash holdings seek to mitigate predation risk by funding investments with potential to steal market share. Even if industry rivals face equal predation risk, firms with more cash seek market share by increasing investment when rivals reduce investment.

Next, we verify the inter-industry investigation by examining whether the impact of predation risk on cash holdings is more pronounced in concentrated industries. We measure industry concentration using the HHI. Table 7 presents the results. Model 1 (Model 2) presents regression results for

subsamples of firms for which HHI is above (below) the industry median.[8] Coefficients of *PDR* in both models are statistically significant at 1%. However, the coefficient of *PDR* in Model 1 exceeds that of *PDR* in Model 2, indicating that predation risk asserts greater effects among firms in more concentrated industries.[9]

Table 8 reveals whether cash holdings and predation risk relate jointly to strategic investment behavior. Classifying all samples into subsamples based on whether the HHI is above or below the sample median, we verify the model is the same as in Table 6 by estimating probit regressions. Coefficients of both *PDR* and *CASH* are significantly at 1% only in Model 1. Moreover, the coefficient of the interaction variable in Model 1 is significant and positive, indicating that predation risk exerts stronger effects on cash reserves among firms in more concentrated industries. That is, cash-rich firms in more concentrated industries invest to steal market share and extinguish rivals, even if all firms face equal predation risk. Hence, the results demonstrate, first, that industry concentration amplifies the effect of predation risk on strategic investment. Second, the combined effect of predation risk and cash holdings on strategic investments is stronger in more concentrated industries.

5 Conclusion

This study adds new dimensions to the literature of cash policy linking firms' market power and degree of predation risk. As in prior studies, we find that predation risk measured by interdependence of investment opportunities with rivals correlates positively with cash holdings. However, this effect weakens when firms' market power strengthens. This finding emphasizes that preda-

[8] Samples in Model 1 (Model 2) are belong to more (less) concentrated industries.

[9] Standard deviation of *PDR* in Model 1 (Model 2) is 0.0024 (0.0018). In Model 1, an increase of one standard deviation in *PDR* increases the dependent variable denoting the level of cash holdings by 0.0012 (0.511×0.0024). In Model 2, the effect is only 0.0008 (0.428×0.0018).

tion risk exerts less effect on cash holdings among firms with greater market power. In particular, we show that firms with greater market power are less concerned about inciting rivals' predatory behaviors because they have more resources. Moreover, our analysis indicates that predation risk enhances the likelihood that firms will invest more even when rivals reduce investment. This likelihood rises with a cash reserves. These results demonstrate that cash-rich firms seek market share by investing more when rivals invest less, even if all firms in the industry face equal predation risk.

Next, we examined whether industry concentration affects relations among predation risk, cash holdings, and strategic investment. Our empirical evidence indicates, first, that predation risk exerts greater effects on cash holdings in more concentrated industries. Second, in more concentrated industries, cash-rich firms' reserves are more likely to seek market share and to extinguish rivals. Greater industry concentration prompts firms to hedge predation risk aggressively and increases incentives to invest for competitive advantage.

One implication of this study is that cash policy is determined by market power, industry structure, and firm-specific predation risk. A second implication is that extensive cash holdings motivate strategic investment even when rivals reduce investment. This suggests that cash holdings provide strategic benefits.

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Table 1. The Mean and Median values of Predation Risk Based on the 36–Nikkei Industrial Classification

Panel A: **High predation risk Top 5 industries**

36–NIC	Industry name	Mean	Median
71	Services	0.936	0.978
23	Electric and Electronic Equipment	0.924	0.966
21	Machinery	0.913	0.954
53	Real Estate	0.895	0.967
43	Wholesale Trade	0.893	0.923

Panel B: **Low predation risk Bottom 5 industries**

36–NIC	Industry name	Mean	Median
63	Warehousing and Harbor Transportation	0.605	0.607
57	Trucking	0.601	0.653
11	Petroleum	0.570	0.531
25	Shipbuilding and Repairing	0.551	0.603
05	Pulp and Paper	0.514	0.548

This table presents the mean and median values of predation risk based on the 36–Nikkei Industrial Classification(36–NIC). The predation risk which a firm faces is defined as the interdependence of a firm's investment opportunities with product market rivals. The value of this variable takes between zero and one. If this measure comes closer to one, the predation risk becomes higher.

Panel A shows the top 5 industries with the highest predation risk and Panel B shows the bottom 5 industries with the lowest predation risk.

Table 2. Descriptive Statistics for the Entire Sample and Comparison between High-predation and Low-predation Firms

	Whole sample			Sub-samples		Mean comparison
				High-predation	Low-predation	p-value for differences
	Mean	**Median**	**S.D.**	**Mean**	**Mean**	between subsamples
PDR	0.840	0.914	0.202	0.965	0.715	0.000
EPCM	0.000	-0.018	0.116	-0.003	0.003	0.000
HHI	0.090	0.066	0.079	0.076	0.099	0.000
SIZE	11.522	11.330	1.424	11.364	11.647	0.000
MTB	1.133	1.028	0.420	1.152	1.109	0.000
DIS	0.023	0.012	0.030	0.024	0.022	0.000
CEX	0.030	0.022	0.033	0.029	0.033	0.000
DEBT	0.545	0.554	0.203	0.528	0.556	0.000
NWP	0.045	0.041	0.185	0.065	0.028	0.000
PROF	0.054	0.045	0.049	0.057	0.052	0.000
RISK	0.037	0.028	0.036	0.041	0.033	0.000

Table 2 reports the main descriptive statistics for the variables used in the analysis and the mean differences between subsamples. The last part of this table shows p-values for difference of mean between subsamples. High (Low) -predation firms are defined as the firm of which the predation risk is above (below) the median sample value.

PDR, the interdependence of a firm's investment opportunities with product market rivals is a proxy for the degree of predation risk which a frim faces; *EPCM*, the diference between a firm's price-cost margin (PCM) and the average PCM of industry; *HHI*, the Herfindahl-Hirschman Index; *SIZE*, the natural logarithm of book value of assets; *MTB*, (book value of assets – book equity + market value of equity)/book value of assets; *DIS*, research and developing spending, plus advertisement expenditure divided by sales; *CEX*, capital expenditure of the firm divided by total assets; *DEBT*, the ratio of total debt to book value of assets; *NWP*, (liquid asset – liquid debt – cash)/(book value of assets – cash); *PROF*, return on asset (ROA) from year -3 to -1; *RISK*, the standard deviation of (EBITDA/book value of assets between $t-1$ and $t-5$).

Table 3. Univariate Analysis of Cash Holdings

Panel A: Cash holdings for all samples	Mean
All samples	0.196

Panel B: Cash holdings for a firm's predation risk-based subsamples	Mean
$PDR <$ median subsample	0.174
$PDR >$ median subsample	0.219
p-value for differences between subsamples	0.000

Panel C: $\frac{\text{EBITDA}}{\text{the book value of otal assets}}$ for a firm's market power-based subsamples	Mean
$EPCM <$ median subsample	0.052
$EPCM >$ median subsample	0.066
p-value for differences between subsamples	0.000

Panel D: $PROF$ for a firm's market power-based subsamples	
$EPCM <$ median subsample	0.040
$EPCM >$ median subsample	0.064
p-value for differences between subsamples	0.000

Panel E: PDR for a firm's predatory investment-based subsamples	Mean
Firms with taking a predatory investment	0.859
Firms with not taking a predatory investment	0.844
p-value for differences between subsamples	0.003

Panel F: Cash holdings for a firm's predatory investment-based subsamples	Mean
Firms with taking a predatory investment	0.200
Firms with not taking a predatory investment	0.188
p-value for differences between subsamples	0.003

Panel A reports the mean value of cash holdings, which is defined as cash and marketable securities scaled by total assets not including cash and marketable securities, for all samples. Panel B reports the mean value for cash holdings, which is defined as cash and marketable securities scaled by total assets not including cash and marketable securities, with the classification which is based on whether a firm's predation risk (PDR) is above or below the median industry value. Panel C reports the mean value for $\frac{\text{EBITDA}}{\text{book value of assets}}$ with the classification which is based on whether a firm's market power ($EPCM$) is above or below the median industry value. Panel D reports the mean value for profitability, which is defined as return on asset from year -3 to -1, with the classification which is based on whether a firm's market power ($EPCM$) is above or below the median industry value. Panel E reports the mean value for predation risk which a firm faces with the classification which is based on whether a firm takes a strategic behavior that the firm increases own investment even when a rival firm's investment is faced with being decreased or not. Panel F reports the mean value for cash holdings with the classification which is based on whether a firm takes a strategic behavior that the firm increases own investment even when a rival firm's investment is faced with being decreased or not.

p-value for whether mean differs between subsamples is for the two-tailed difference in mean test.

Table 4. Effect of Predation Risk on Cash Holdings

	Coefficient	p-value
INTERCEPT	-0.825	0.000
PDR	0.494	0.000
FRS	0.077	0.063
SIZE	-0.031	0.017
MTB	0.217	0.000
DIS	4.220	0.000
CEX	-4.516	0.000
DEBT	-2.228	0.000
NWP	-0.819	0.000
DIV	-0.212	0.000
PROF	1.851	0.000
RISK	2.434	0.000
Year Dummies	Yes	
Indstry Dummies	Yes	
N. of observations	12,085	
R-squared	0.412	

Table 4 reports the estimated coefficients from pooled OLS regressions. The t-statistics are estimated using standard errors robust to clustering at the firm level and heteroscedasticity using the White (1980) corrected standard errors. Significance levels for whether estimates are different from zero in parentheses.

The dependent variable is the natural logarithm of cash and marketable securities deflated by total assets not including cash and marketable securities. The explained variables are defined as follows; *PDR*, the interdependence of a firm's investment opportunities with product market rivals is a proxy for the degree of predation risk which a frim faces; *FRS*, a dummy variable takes on a value of one if the firms posts foreign sales; *SIZE*, the natural logarithm of book value of assets; *MTB*, (book value of assets – book equity + market value of equity)/book value of assets; *DIS*, research and developing spending, plus advertisement expenditure divided by sales; *CEX*, capital expenditure of the firm divided by total assets; *DEBT*, the ratio of total debt to book value of assets; *NWP*, (liquid asset – liquid debt – cash)/(book value of assets – cash); *PROF*, return on asset (ROA) from year -3 to -1; *RISK*, the firm's risk.

Table 5. Joint Effect of Predation Risk and Market Power on Cash Holdings

	Coefficient	p-value
INTERCEPT	-0.699	0.002
PDR	0.433	0.000
EPCM	2.091	0.002
PDR×*EPCM*	-2.016	0.007
FRS	0.083	0.046
SIZE	-0.032	0.015
MTB	0.205	0.000
DIS	3.296	0.000
CEX	-4.367	0.000
DEBT	-2.207	0.000
NWP	-0.807	0.000
DIV	-0.215	0.000
PROF	1.612	0.000
RISK	2.295	0.000
Year Dummies	Yes	
Indstry Dummies	Yes	
N. of observations	11,776	
R-squared	0.415	

Table 5 reports the estimated coefficients from pooled OLS regressions. The t-statistics are estimated using standard errors robust to clustering at the firm level and heteroscedasticity using the White (1980) corrected standard errors. Significance levels for whether estimates are different from zero in parentheses.

The dependent variable is the natural logarithm of cash and marketable securities deflated by total assets not including cash and marketable securities. The explained variables are defined as follows; *PDR*, the degree of predation risk which a frim faces; *EPCM*, a firm's market power; *PDR*×*EPCM*, the interaction term that include the predation risk which a firm faces and the firm's market power; *FRS*, a dummy variable takes on a value of one if the firms posts foreign sales; *SIZE*, the firm size; *MTB*, growth opportunity of the firm; *DIS*, research and developing spending, plus advertisement expenditure divided by sales; *CEX*, capital expenditure of the firm; *DEBT*, the ratio of total debt to book value of assets; *NWP*, a firm's net working capital; *PROF*, profitability; *RISK*, the firm's risk.

Table 6. Probit Model of Strategic Investment Behavior

	Marginal effect	p-value
PDR	0.092	0.013
CASH	-0.021	0.083
PDR×*CASH*	0.031	0.021
GIS	-0.312	0.000
SIZE	-0.004	0.052
DIV	-0.017	0.117
PROF	0.295	0.000
RISK	0.113	0.184
Industry-adj. *INV*	-4.583	0.000
Industry-adj. *DEBT*	-0.011	0.542
Year Dummies	Yes	
Industry Dummies	Yes	
N. of observations	12,288	
The pseudo-R^2	0.177	

Table 6 reports the marginal effect from probit regression. The dependent variable is a dummy variable equals one a firm increases the firm's own investment even if rival firm's investment is faced with being decreased. The explained variables are defined as follows; *PDR*, the degree of predation risk which a frim faces; *CASH*, cash holdings; *EPCM*, a firm's market power; *PDR*×*CASH*, the interaction term that include the predation risk which a firm faces and the firm's cash holdings; *GIS*, the change in sales from year$_{t-1}$ to year$_t$; *SIZE*, the firm size; *DIV*, the dividend dummy takes on a value of one if the firms pays dividend; *PROF*, profitability; *RISK*, the firm's risk; Industry-adj. *INV,* industry–adjusted investment is a median value of the change in a firm's investment in each year and each industry which is classified by the 36-Nikkei Industrial Classification (36–NIC); Industry-adj. *DEBT*, industry–adjusted leverage is a firm's leverage, which is defined as the ratio of total debt to book value of assets, minus the median value for leverage in each year and each industry which is classified by the 36-Nikkei Industrial Classification (36–NIC). Marginal effects coefficients are presented. Significance levels for whether estimates are different from zero are in parentheses.

Table 7. The Effect of Predation Risk on Cash Holdings Indicated by Industry Concentration

Model	**1**		**2**	
	Coefficient	p-value	Coefficient	p-value
INTERCEPT	-0.211	0.589	-1.004	0.001
PDR	0.511	0.000	0.428	0.003
FRS	0.084	0.179	0.042	0.437
SIZE	-0.062	0.004	-0.022	0.260
MTB	0.217	0.006	0.185	0.000
DIS	6.092	0.000	3.563	0.000
CEX	-5.357	0.000	-4.252	0.000
DEBT	-2.098	0.000	-2.189	0.000
NWP	-0.652	0.008	-0.947	0.000
DIV	-0.220	0.001	-0.185	0.006
PROF	1.672	0.016	2.369	0.000
RISK	1.017	0.130	3.800	0.000
Year Dummies	Yes		Yes	
Indstry Dummies	Yes		Yes	
N. of observations	5,762		5,055	
R-squared	0.369		0.392	

Table 7 reports the estimated coefficients from pooled OLS regressions. The t-statistics are estimated using standard errors robust to clustering at the firm level and heteroscedasticity using the White (1980) corrected standard errors. Significance levels for whether estimates are different from zero in parentheses.

Model 1 is calculated by using samples which are classified as the firms of which the Herfindahl-Hirschman Index is above the median value (samples in more concentrated industries). Model 2 is calculated by using samples which are classified as the firms of which the Herfindahl-Hirschman Index is below the median value (samples in less concentrated industries).

The dependent variable is the natural logarithm of cash and marketable securities deflated by total assets not including cash and marketable securities. The explained variables are defined as follows; *PDR*, the degree of predation risk which a firm faces; *FRS*, a dummy variable takes on a value of one if the firms posts foreign sales; *SIZE*, the firm seize; *MTB*, growth opportunity of the firm; *DIS*, discretionary investment of the firm; *CEX*, capital expenditure of the firm; *DEBT*, leverage of the firm; *NWP*, a firm's net working capital; *PROF*, profitability; *RISK*, the firm's risk.

Table 8. Probit Model of Strategic Investment Behavior Indicated by Industry Concentration

Model	**1**		**2**	
	Marginal effect	p-value	Marginal effect	p-value
PDR	0.179	0.000	-0.009	0.903
CASH	-0.046	0.001	0.043	0.129
PDR×*CASH*	0.068	0.000	-0.028	0.367
GIS	-0.301	0.000	-1.413	0.000
SIZE	-0.005	0.130	-0.000	0.907
DIV	-0.043	0.006	-0.010	0.560
PROF	0.233	0.041	0.182	0.058
RISK	0.121	0.299	0.080	0.573
Industry-adj. *INV*	-3.957	0.000	-10.044	0.000
Industry-adj. *DEBT*	-0.043	0.391	0.004	0.888
Year Dummies	Yes		Yes	
Indstry Dummies	Yes		Yes	
N. of observations	5739		5284	
The pseudo-R^2	0.160		0.166	

Table 8 reports the marginal effects from probit regression. Model 1 is calculated by using samples which are classified as the firms of which the Herfindahl-Hirschman Index is above the median value (samples in more concentrated industries). Model 2 is calculated by using samples which are classified as the firms of which the Herfindahl-Hirschman Index is below the median value (samples in less concentrated industries).

The dependent variable is a dummy variable equals one a firm increases the firm's own investment even if rival firm's investment is faced with being decreased. The explained variables are defined as follows; *PDR*, the degree of predation risk which a frim faces; *CASH*, cash holdings; *EPCM*, a firm's market power; *PDR*×*CASH*, the interaction term that include predation risk and cash holdings; *GIS*, the change in sales from year_{t-1} to year_t; *SIZE*, the firm size; *DIV*, the dividend dummy takes on a value of one if the firm pays dividend; *PROF*, profitability; *RISK*, the firm's risk; Industry-adj. *INV,* industry–adjusted investment is a median value of the change in a firm's investment in each year and each industry which is classified by the 36-Nikkei Industrial Classification; Industry-adj. *DEBT*, industry–adjusted leverage is a firm's leverage, which is defined as the ratio of total debt to book value of assets, minus the median value for leverage in each year and each industry which is classified by the 36-Nikkei Industrial Classification.

Marginal effects are presented. Significance levels for whether estimates are different from zero are in parentheses. Marginal effects coefficients are presented. Significance levels for whether estimates are different from zero are in parentheses.