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Cash Policy of Japanese Corporations

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Contents

1. Background and Literature Review

1.1 Introduction

Corporations' cash holding and cash policy have been always one of the emphases of academic research in the field of corporate finance. On one hand, cash is vital for a firm's survival. As the most liquid asset, it is the basis of a firm's daily operations and transactions. An adequate cash holding enables a firm to approach investment projects with much lower capital costs than external financing, and to withstand unexpected external shocks from the industries or macroeconomics, or internal shocks resulted from the misoperation. Meanwhile, if the cash holding is inadequate, the firm may have to sacrifice its valuable assets or investment opportunities to maintain the daily operation, which drastically damages the operating and cash flow stability. On the other hand, cash is also the least productive assets. It does not generate profits like inventory or equipment, nor create potential advantages in the future market shares or cash flow like goodwill or capital expenditure. Therefore, as a rational manager of a firm, it is necessary to maintain a balance between profitability and stability.

Examining the cash holding of firms is fruitful in many ways. First, when focusing on a specific firm's cash holding for a vertical analysis, investors or analysts sketch a profile of the firm's operating conditions. More specifically, if a firm has maintained a stable and increasing cash holding in recent years, it indicates that the firm performs smoothly and seems to have few risks. Meanwhile, if a firm has depicted large fluctuations in cash holding, it is likely that the firm does not have a consistent cash policy or the firm has been experiencing various challenges and uncertainties.

Second, when focusing on a specific firm's cash holding for a horizontal analysis, investors or analysts generate an image of the firm's competitive status. For instance, if a firm has much more cash holding than its major competitors in the same industries, it generally has a stronger capability to withstand the unexpected shocks and industrial fluctuations, while it may also suggest that currently there are lacking profitable investment opportunities in the

industry or the firm is preparing for potential large investments. A firm with significantly less cash holding than its major competitors, however, may indicate a high risk in its operation or aggressive development.

Third, due to the differences in the capital structures and characteristics in different industries, it is also essential to compare the industrial level cash holding policies. For instance, if the average level of cash holding in the industries has been stable and increasing, one may infer that the industry is running from a rapid development period to a mature period. Meanwhile, if the average level has depicted a large fluctuation or continuous decline, one needs to be more cautious in making investment decisions and conduct a more comprehensive analysis.

There are many factors that intuitively have significant influence over a firm's cash holding and its cash policy. At a specific firm level, the capital structure, the scale of the business, the corporate governance, the profitability and the stability of cash flow are all intuitively related to the cash holdings. As mentioned above, different characteristics also contribute to the selection of the optimal cash holding level. On a broader horizon, cash holding and cash policy could be related to the geographical and cultural factors and there have been various discussions over these issues. It would be endless work if the discussion over cash holding and cash policy is not limited to a certain field. Therefore, this doctoral dissertation aims to limit the discussion over cash policies of Japanese corporations, or more specifically, the cash policy of Japanese bank-dependent firms and the response of corporations' cash policies under shocks of the Global Financial Crisis and Abenomics.

Compared to other major developed economies such as the U.S. and Germany, the Japanese market has at least two specific characteristics. First, the main bank may play the role of a major monitor of the corporations, instead of the capital market. Second, the power of the main bank may be strong and due to the strong negotiation power of the main bank, corporations may be encouraged to hold relatively high levels of cash to benefit the bank (Pinkowitz and Williamson, 2001). These characteristics capture our interest to find potential answers to the

following questions. Does the strong negotiation power of the main bank still exist in Japanese corporations so that corporations relying only on indirect financing from banks hold more cash than their counterpart? What are the motives or mechanisms for corporations' cash policy with respect to bank-dependence? In a further study, we are curious about the implications of different corporations' cash policies under various exogenous shocks and we try to answer how these cash policies act on the Japanese macroeconomic operating.

The dissertation is structured as follows. The rest of Chapter 1 examines the background and literature reviews over cash holdings and cash policies. There are mainly four motives to explain why corporations are necessary to hold cash, the transaction motive, precautionary motive, agency motive, and others. Chapter 2 examines the differences in cash policies of bank-dependent corporations and their counterparts. Bank-dependent corporations refer to the corporations that do not have outstanding corporate bonds and rely on banks for debt financing. The hypotheses tested include: (i) Bank-dependent firms hold less excess cash than their counterparts, (ii) Bank-dependent listed firms hold less excess cash than non-dependent listed firms, (iii) Bank-dependent non-listed firms hold less excess cash than non-dependent non-listed firms. The excess cash is defined as the residual of the regression. More specifically, it is the differences between the predicted change in cash holding and the actual change in cash holding. According to the hypotheses, the bank dependency has a negative effect on the cash through the constant term, and it should be consistent in the pooled sample and subgroup of listed and non-listed firms to exclude the potential influences from being public or not. Chapter 3 examines the responses of Japanese corporations' cash allocation when encountering shocks, using the Global Financial Crisis in 2008 and the Abenomics starting from 2013. Under the Global Financial Crisis, there is significant evidence that both export-oriented and domestic-oriented firms increase the cash holding level while they largely decline the cash allocated in investment. Meanwhile, during the period of Abenomics, there is significant evidence that both the export-oriented and domestic-oriented firms continue increasing the cash holding level and decreasing the financial leverage. However, there is no significant evidence to show that during

the positive shock, any subgroup of corporations chooses to increase the investment level as one might expect. Chapter 4 explains the relationship with the data circulation and introduce how other chapters of this dissertation are tightly related to the circulation framework in detail. We mainly utilize the data from corporations, specifically, the financial data from the financial statements. After hypotheses are tested and models/theories are constructed based on the data and analysis, the government can take advantage of the models or theories to better formulate the monitoring and stimulating policies, while corporations can be also benefited from the new models or theories to increase the internal efficiency to achieve better performances. Then a new round of data collection and analysis will be conducted to testify the previous models and theories and hence, formulate a data and information flow circulation. Chapter 5 summarizes the dissertation and discusses the potential research targets in future work.

1.2. Overview of Cash Holding Motives

The mainstream of cash literature research of cash holding motives can be divided into three aspects. The transaction motive and precautionary motive focuses on the functionality of cash itself to explain why firms choose to hold different levels of cash. Meanwhile, agency motive starts from the information asymmetry and inconsistency of interests between managers and shareholders to further explain why firms that may have similar transaction motives and precautionary motives still choose different cash hoarding. The rest of the research aims to explain the different cash policies from other systematic differences, such as capital markets, tax incentives, cultures, and so on.

Now we explain each theory of cash holdings and introduce a series of influential papers according to the different motives.

1.2.1. Transaction Motive

The most fundamental function of cash is a medium of exchange. The research of firms' cash holding for transaction motive starts from Baumol (1952). Baumol specifies that to use cash for payments, a firm holds the optimal amount of cash because holding cash is costly. He sets up a simple prototype of cash holding considering the transaction costs and opportunity costs, of which the optimal cash holding is specified as

$$C = \sqrt{\frac{2bT}{i}} \tag{1}$$

where T represents the steady stream of cash outflow, b represents a fixed amount of "broker's fee" and i represents the interest cost per dollar per period. Under such a framework, the rational individual will demand cash in proportion to the square root of the value of the transactions, given the price level. Despite the fact that the model is oversimplified and static, Baumol's work initiates the research over the transaction motive of cash holding.

In the following years, a number of studies further complete Baumol's framework and theory. Miller and Orr (1966) point out that the Baumol model is less satisfactory when applied to business firms because the cash balance fluctuates irregularly. They further extend the Baumol model via three groups of assumptions, including instantaneous transfer between cash balance and liquid assets, a Bernoulli process of net cash flow, and two decisive variables: the upper bound on cash holding and the intermediate return point. Their model suggests the intermediate return point is always 1/3 of the upper bound on cash holding, regardless of the magnitude of the cost coefficients. Based on the model, they provide the firms' optimal average cash balance in terms of the cost parameters and variance of daily cash flows. It gains more explanatory power than the Baumol framework in explaining and testing the difference of cash holding over different industries.

Mulligan (1997) estimates a money demand function using the volume of sale, the opportunity cost, and the value of the manager's time. The key focus is the coefficient of the

volume of sales. Under the theories of inventory management and the "square root rule" of Baumol's model, the coefficient would be exactly 0.5. A coefficient smaller than one indicates the scale economies in the demand for money and is consistent with Miller and Orr (1966). The firm-level data suggests that the sales elasticity of money demand is about 0.8, and the elasticity of money demand for the cost of labor is about 0.6. Firms headquartered in high wage counties hold more money for a given level of sales. Besides, the firm-level data from 1961 to 1992 indicate large firms hold less cash as a percentage of sales than small ones.

1.2.2. Precautionary Motive

A further development from the transaction motive is the precautionary motive. Except for the steady and expected regular cash outflow, rational firms also save for unexpected events that require a cash outlay. Such events could be unexpected opportunities for profitable investments that require large capital expenditures, or a sudden crisis from the firms' normal operating. To address the concern of the precautionary motive of hoarding cash, Opler et al. (1999) conduct a thorough examination of the determinants and implications of corporate cash holdings, using publicly traded U.S. firms during the period of 1971-1994. They find supportive evidence for a static tradeoff model of cash holdings. The optimal level of cash, according to their conclusions, is determined at a level such that the marginal benefit of cash holdings equals the marginal cost. The costs arise from the lower rate of return of cash and tax disadvantage while the benefits come from two aspects. The first aspect is to save transaction costs which Keynes (1934) and Baumol (1952) called transaction motive. The second aspect is the precautionary motive that the firm can use liquid assets to finance its activities and investments. Their work first identifies that firms are likely to have a target cash level via a first-order autoregressive model,

$$\Delta\left(\frac{Cash}{Assets}\right)_t = \alpha + \beta\Delta\left(\frac{Cash}{Assets}\right)_{t-1} + \varepsilon_t \quad (2)$$

where $\frac{Cash}{Assets}$ is defined as cash and marketable securities divided by assets excluding cash and marketable securities. ε_t is a zero-mean disturbance following i.i.d. α describes the average value. β is the autoregressive coefficient and the distribution of β has a negative median value.

The negative coefficient of β indicates the cash balances are mean-reverting. Further univariate tests and regression over panel data indicate that large firms hold less cash and are also likely to face economies of scale in cash holdings. Besides, firms with high market-to-book ratios, high R&D expenditures, and in an industry where the standard deviation of cash flow to assets is high, generally hold more cash. These findings are consistent with the precautionary motive because firms with high growth potential hold cash to realize the expected future profit and investment projects capital becomes difficult to obtain, and these firms are also likely to face financing problems in economic downturns and suffer from asymmetric information.

In the influential but also controversial work done by Almeida et al. (2004), the research proxy of cash holding motive becomes the cash flow sensitivity and they point out that the cash flow sensitivity of cash is tightly related to the financial constraints. The following equation (3) summarizes their model. $CashHoldings$ is defined as cash holding and marketable securities divided by total assets. $Cashflow$ is defined as earnings before extraordinary items and depreciation excluding dividend divided by total assets. Two alternative specifications are conducted to model the cash flow sensitivity of cash. The first alternative is a parsimonious model that only controls the firm size, which is the natural log of total assets, and Q, which is the market value divided by the book value of the assets. The second alternative is estimated from a specification of firms' sources and uses of funds, with extra control variables of capital expenditures, acquisitions, changes in short-term debt, and changes in non-cash net working capital, which is compacted in $ControlVariables$. α_0 is the intercept and $\varepsilon_{i,t}$ refers to the disturbance item with zero mean and i.i.d. Besides, the paper uses five alternative schemes (Payout ratio, Firm size, Bond ratings, Commercial paper ratings, KZ-Index) to partition the sample into financially constrained and unconstrained firms.

$$\Delta CashHoldings_{i,t} = \alpha_0 + \beta_1 Cashflow_{i,t} + \beta ControlVariables_{i,t} + \varepsilon_{i,t} \quad (3)$$

It draws the conclusion that financial constraints can be captured by a firm's cash flow sensitivity of cash, β_1, as the cash flow sensitivity of cash of financially constrained firms is positive, indicating a precautionary motive of holding cash, while unconstrained firms display no systematic patterns over the cash flow sensitivity of cash. Han and Qiu (2007) further extend the theoretic model by Almeida et al., (2004) to a two-period investment model to analyze the corporate precautionary cash holdings. According to their model, the key driving forces of the precautionary motive is the limited diversifiability of future cash flow uncertainty, as well as the intertemporal trade-off between current and future investments. Financially constrained firms increase the cash holding in response to an increase in cash flow volatility while there is no systematic relationship between cash holding and cash flow volatility.

D'Mello et al., (2007) contribute to the cash hoarding research from the aspect of firms' spin-off. A spin-off refers to the diversification of a firm into a new company and divides the firm's assets and liabilities between the post-spin-off entities. The advantage of focusing on spin-off is that the initial allocation of cash is freely determined so that it does not contain the confounding effects from previous decisions. Their findings suggest that despite the consistent finds from factors such as firm size, R&D expenditure, market-to-book ratio, and capital expenditures are not significant in determining cash ratio. Besides, there is no evidence that financial distress costs directly affect the cash allocation. Several consistent patterns suggest that cash is not simply a negative debt. Meanwhile, they reveal that the actual cash hoarding is generally lower than the level predicted by trade-off theory and the deviation from the predicted level is only due to pecking order effects.

Apart from the studies over cash holding motives, there are also various researches on the optimal level of cash holding in respect to the corporations' value maximization (Palazzo, 2012; Martinez-Sola, 2013; Shipe, 2015; Tahir and Alifiah, 2015) Even though the studies are not directly related to the cash holding motives, the precautionary motive for cash holding generally appears in these studies.

1.2.3. Agency Motive

Agency motive attempts to explain firms' cash behavior from the aspect of information asymmetry and interest's unconformity between managers and shareholders. Jensen (1986) introduces the agency theory and the free cash flow theory. He specifies that managers have incentives to make the firms grow beyond the optimal size, and this is likely to cause the undertaking of low-benefit or even value-destroying mergers. The paper points out that debt reduces agency costs by reducing the cash flow available for spending and it can be a substitute for dividends. Besides, it also discusses the relationship between the market value of the firms and the capital structure, as well as the agency cost of free cash flow.

Dittmar et al., (2003) shed additional light on the role of corporate governance in the determination of cash holdings using international data. They find that firms in countries with the lowest level of shareholder protection hold more than twice the amount of cash than firms in countries with the highest level of protection. Besides, market-to-book ratios, R&D expenditure, and profitability are positively related to cash holdings, while the firm size and net working capital are negatively related to cash holdings. Their empirical research suggests that agency costs are essential factors in determining corporate cash holdings in the world.

Dittmar and Mahrt-Smith (2007) further extend their previous research on the influence of corporate governance on cash holdings. They reveal that 1 dollar of cash in a poorly governed firm only worth 0.42 to 0.88 while in a well-governed firm the value is doubled. Besides, poorly governed firms are more likely to dissipate cash quickly so that the operating performance is reduced. The conclusion is in line with the previous research of the agency costs of holding cash.

Following the method of Fama and French (1998), Pinkowitz et al., (2006) reveal that the relationship between firm value and cash holding is much weaker in countries with poor investor protection than in other countries. This is due to the existence of agency costs of free cash flow, as cash holdings are partly spent to increase the value of controllers rather than

maximize the wealth of all investors. Besides, the relation between firm value and dividends is weaker in countries with strong investor protection, which is also in line with agency theory.

Pinkowitz and Williamson (2001) shed light on the relationship between firms' cash holding and bank power to explain why Japanese firms have much more cash holdings than firms in the U.S and Germany do. Theoretically, the active role played by the main bank and cross-ownership lead to much lower agency costs. Besides, Japanese firms are, on average, larger than U.S. firms. All these characteristics indicate that Japanese firms should hold less cash holdings. The authors point out that the high cash holding is strong evidence of banks extracting rents from firms under a bank-governed system. Besides, firms with excess to non-bank financing significantly hold less cash than those bank-dependent firms do.

Yun (2009) uses the passage of anti-takeover legislation as a natural experiment to analyze the relationship among cash holding, line of credit, and internal governance using a difference-in-difference approach. Credit lines provide firms with liquidity similar to cash but also banking costs. Meanwhile, monitoring and covenants accompanied limit managerial discretion. The regression results suggest that after the passage of anti-takeover legislation, both cash holdings and lines of credit increase significantly while the cash holding of firms with good internal governance increases less. This indicates that the removal of takeover threats leads to the shift of credit lines to cash in poorly governed firms.

Chen et al., (2012) shed light on the cash holding of Chinese listed firms before and after the share-reform which allowed the previously non-tradable shares to be freely traded on the open market. After the reform, the average cash holding of Chinese listed firms decreased significantly, and the effect of reduced cash holding is pronounced for private and financial constraints binding firms, which are more likely to have agency conflicts.

Huang et al. (2012) shed light on the bonding effect and cash holding of cross-listed firms. The bonding effect specifies that the cross-listed firms on the US stock exchange receive heightened scrutiny and monitoring by investors and the U.S. Securities and Exchange

Commission (SEC) so that the agency costs are significantly deducted for these cross-listed firms. Their empirical research reveals that the average cash holding is higher for cross-listed firms than for the matched counterparts listed only in the domestic markets. Besides, firms experience a much higher increase in the cash holding level after cross-listing. Moreover, cross-listed level III American Depositary Receipt (ADR) firms, which require the strictest compliance with US laws and regulations, generally hold more cash than level I or level II ADR firms, indicating that strict scrutiny from the external environment significantly deviates the agency problem.

Gao et al. (2013) compare the cash holding of public firms and private firms in the U.S and reveal that public firms hold cash reserves approximately 4% of assets higher than similar private firms and this is significant evidence of a more severe effect of agency costs of public firms. Besides, public firms tend to spend excess cash in less efficient ways that reduce firm operating performance and in short-sighted ways. The governance quality still plays an important role in cash management, as poorly governed firms bounce down from the boundary much further and appear to adjust towards the cash target much faster than well-governed firms do. These findings are consistent with the extant researches on the agency motive of cash holdings.

Francis et al. (2013) examine the effect of bank deregulation on the U.S. firms' cash holding policy. The staggered timing of deregulation since the 1970s is treated as an exogenous shock so that the difference-in-difference approach becomes available. The results suggest that both interstate and intrastate bank deregulation is significantly and negatively related to the liquid assets held by non-financial firms. Bank deregulation increases the competition among banks so that the equilibrium of loan supply increases and the interest rates becomes lower. As a result, non-financial firms, especially financially constrained firms with low hedging needs are greatly benefited from the deeper access to the external financial channel and hold more cash and liquid assets after the bank deregulation.

Megginson et al., (2014) study the potential relationship between state ownership and cash holding of Chinese private firms from 2000 to 2012. Chinese share-issue privatized (SIP) firms are a special group of publicly traded firms as the government can still wield influence and control over the SIP firms through retained equity, and this characteristic enables the SIP firms to be excellent objectives to examine the soft-budget constraint (SBC) theory, which specifies that firms with state ownership can always turn to the government to bail out when the financial constraint is breached. According to their empirical results, state ownership is negatively associated with cash holding and it is consistent with the SBC theory. Besides, the marginal value of cash increases when the state ownership declines as a high state ownership leads to more agency problems.

Yung and Nafar (2014) make research on the role of creditor rights over firms' cash holdings. Prior studies suggest a diversified influence from creditor rights over firms' liquidity and firms' value. According to their cross-country analysis, stronger creditor rights are associated with a higher level of cash holdings, while the excess cash holding motivated by creditor rights actually hurts the value of the firm. Besides, the positive relationship between creditor rights and cash holdings is mitigated in countries where investor protection is strong, which means, stronger investor protection reduces firms' cash holding and relieves the negative effect of damaging firms' value due to excess cash holdings.

1.2.4. Other Motives

As various and abundant research of cash holding and firms' cash policy appear, scholars have turned their research attention to more specific aspects that are outside of the firm itself. For instance, Fritz-Foley et al., (2007) point out that the magnitude of cash holding in part reflects the tax incentives. The logic behind is that the US and many other countries tax the income of the firms but the taxes can be deferred until earnings are repatriated. Therefore, firms have incentives to retain earnings abroad and hold these funds in cash. The empirical result

suggests that one standard deviation increase in the tax costs associated with repatriations is related to a 7.9% increase in the ratio of cash to net assets.

Haushalter et al., (2007) argue that predation risk is also related to the firms' cash holding. Predation risk arises when a firm has to underinvestment and suffers from loss of growth opportunities and market share. After controlling other well-researched factors, such as profitability and access to external markets, the research suggests that cash holding is positively related to industry concentration and similarity of a firm's operation with its rivals.

Ramirez and Tadesse (2009) focus on the relationship between cash holding and uncertainty avoidance, as well as multi-nationality. Based on a large panel of fifty countries, they reveal that firms in countries with a high level of uncertainty avoidance and the high degree of multinationality of the firm tend to hold more cash when controlling the firm-level variables. Besides, the cultural effect on a firm's cash holding is less for multinational firms.

Iskandar-Datta and Jia (2011) document that the functioning and development of the financial system are essential to the decision of corporate cash policy by examining a long-term pattern of firms in multi-developed countries. Firms in the US, UK, Canada, and France exhibit a secular pattern of decreasing cash holding.

Based on the Upper Echelons Theory (UET)[1], Orens and Reheul (2013) make research on the relationship between the cash holding in SMEs and their CEO's demographics. UET specifies that decisions are usually made on the basis of the decision-makers' cognitive, social, and psychological characteristics owing to the existence of bounded rationality. The authors focus on SMEs in Belgium and make research separately for small firms and medium firms. The results suggest that demographics such as tenure, age, experience, and educations, are only explanatory to the cash holdings in the regressions of small firms' groups. The lower level of CEO discretion in the medium firms is attributed to more efficient governance mechanisms.

[1] The Upper Echelons Theory was proposed by Hambrick, Donald C. and Phyllis A Mason (1984) and it suggests that top executives may have different views about the situations according to their own highly personalized lenses. Such personalized differences are due to their experiences, personalities, values and other factors.

Chen et al., (2014) shed light on the influence of national culture over firms' cash holding. After controlling the governance factors, firm-specific attributes, and country characteristics, they find that corporate cash holding is negatively associated with individualism while positively related to uncertainty avoidance. The two culture level factors have significant influence over the precautionary motive for cash holdings. Besides, within the United States, firms in individualistic states hold less cash than firms in collectivistic states, controlling other firm-specific attributes.

To summarize, there are dozens of researches attempting to explain the difference in cash holdings and the cash policies from other factors that are not related to a specific cash holding motive. They may not be so important and influential as the studies decades ago but they are still instructive to future research over cash holding analyses.

2. Cash Policy of Bank-Dependent Corporations

2.1. Introduction

According to the literature, there are two major motives for corporate cash savings: precautionary (Opler et al., 1999; Bates et al., 2009; McLean, 2011; Harford et al., 2014; Chen et al., 2018) and agency (Jensen, 1986; Harford, 1999; Dittmar et al., 2003; Dittmar and Mahrt-Smith, 2007)[2] motive. The precautionary motive makes firms save cash from internal cash flows to protect themselves from their financial risks. The agency motive hypotheses explain that conflicts between managers and shareholders make firm managers hold free cash flows for empire building (Jensen, 1986; Harford, 1999; Pinkowitz et al., 2006; Harford et al., 2007)3.

In this study, we examine the precautionary and agency motives of cash savings from the viewpoint of bank-dependency. Since banks can provide funds when needed in the future, the precautionary motive of cash for bank-dependent firms is not so strong as their counterparts (Hubbard et al., 2002; Cui et al., 2020). Also, if banks play the monitoring roles (Hoshi et al. 1991), they mitigate the agency problems to prevent firm managers from empire-building activities, which weakens the agency motive for bank-dependent firms. The study aims to show that bank-dependent firms hold less excess cash than their counterparts because of these two reasons.

To test the hypothesis that bank-dependent firms hold less excess cash than their counterparts, we employ multi-equation models of the allocation of internal cash flow (Gatchev et al., 2010; Chang et al., 2014; Drobetz et al., 2017). Firms allocate internal cash flow among various uses: capital expenditure, dividends payout, reducing debt or equity financing, holding cash. Since firms make financing and investment decisions jointly subject to the constraint that financing sources must be equal to the uses of internal cash flow.

[2] The cash literature started from the seminal works of Baumol (1952) and Miller and Orr (1966).
[3] Jensen (1986) argues that entrenched managers in firms with high free cash flow are reluctant to pay out cash to shareholders.

Our main findings are as follows:

(i) Bank-dependent firms hold less excess cash than their counterparts.

(ii) Bank-dependent listed firms hold less excess cash than their counterparts.

(iii) Bank-dependent non-listed firms hold less excess cash than their counterparts.

The main contribution of this study is to provide new evidence that bank-dependency induces firm managers to have less excess cash, instead of less cash holding. The mechanism of bank-dependency affecting firms' cash holding decisions from two sides. On one hand, the existence of the main bank guarantees the liquidity for bank-dependent firms when there is a sudden shock. This indicates that bank-dependent firms are less affected by the precautionary motive and are mainly affected by agency motive. On the other hand, the counterparts are principally subjected to the precautionary motive. Even though they have channels for direct financing from the public market, the market fluctuation or recession could substantially increase the difficulty and costs for direct financing. As a result, the volatility of cash holding of bank-dependent firms is less than that of its counterparts.

Gao et al. (2013) find evidence that private firms hold less cash than public firms do because the former faces lower agency costs than the latter. Private firms have lower agency costs because they have more concentrated ownership than public firms that have a dispersed ownership structure. This study examines the influence of bank-dependency on excess cash, instead of the private/public status of the stock ownership. Our evidence shows that bank-dependency also affects the agency cost or precautionary motive, which makes bank-dependent firms choose less excess cash than their counterparts. For the concerns of the potential influence from private and public firms according to Gao et al. (2013), we also conduct a robustness check and our conclusions are consistent in both private firms and public firms.

Furthermore, we emphasize that bank-dependent firms tend to be concerned with agency motive and their counterparts with a precautionary motive. If a bank-dependent firm were not

bank-dependent with the same investment opportunity as its counterpart, the bank-dependent firm would have more excess cash than its counterpart.

Pinkowitz and Williamson (2001, RFS) is an influential study and it is one of the major researches that arouse our interests in writing this paper. Based on the observations from the 1970s to 1990s (1995), they reveal that Japanese firms tended to hold more cash than the U.S and German firms did, even though the German system, similar to Japanese, is characterized as being bank-centered. Their empirical research suggests the power of the main bank in Japan could be the key to this phenomenon. During the period from World War II to the 1970s, Japanese firms held more cash due to the weak negotiation power and banks' rent-seeking. During the period in the late 1980s and 1990s, after a series of changes in bank regulations and a weaker main bank power, cash holding and debt levels significantly declined and the cash holding level became similar to U.S. levels.

Compared to Pinkowitz and Williamson (2001, RFS), our sample data consist of Japanese firms from 1995 to 2018, when the main bank power has become weak and rent-seeking has become less effective. This could be one of the reasons why bank-dependent firms hold slightly more cash than the counterparts do, and the finding that cash flow sensitivity of cash and cash holding is higher for bank-dependent firms are consistent with the conclusion of research done by Nakajima and Sasaki (2016). Besides, our major hypothesis and finding that bank-dependent firms hoard less excess cash than their counterparts are consistent with that close monitoring by the main bank mitigates the agency costs.

Our finding is different from Hubbard et al. (2002), which argue that small firms with weak banks hold more cash than firms with strong banks do. Our result shows just that the bank-dependency has a negative influence on excess cash, whether a bank is weak or not. Our finding is also different from Cui et al. (forthcoming) which finds evidence that bank health affects a firm's cash policy through the firm-bank relationship.

Nakajima and Sasaki (2016) compare the cash policies of Japanese firms with and without access to bond markets, i.e., weakly bank-dependent firms, and bank-dependent firms. They argue that bank-dependent firms that do not have access to bond markets have higher cash holdings because such firms want to maintain good relationships with banks. Our finding that bank-dependent firms have a higher cash flow sensitivity is consistent with their conclusions.

It is noteworthy that bank-dependent and the firm-bank relationship are two different concepts. The firm-bank relationship is "the connection between a bank and customer that goes beyond the execution of simple, anonymous, financial transactions" (Ongena & Smith, 2000). A non-bank-dependent (or the counterparts of bank-dependent) just indicates that it has corporate bonds issued in the bond market and it does not necessarily mean the firm-bank relationship is weak, as non-dependent firms in the Japanese market also sought and received emergent liquidity from banks during the Global Financial Crisis in 2008 (Uchino,2013). It would be hard to distinguish a firm-bank relationship by whether the company has corporate bonds so that we emphasize "bank-dependence" instead of "firm-bank relationship".

The organization of the chapter is as follows. Section 2.2 explains our econometric methodology and hypotheses. Section 2.3 describes data, explains variables, and report the results of our econometric analyses. Section 2.4 concludes this chapter.

2.2 Methodology and Hypotheses

Our econometric methodology follows the works of Gatchev et al. (2010), Chang et al. (2014), and Drobetz et al. (2017). The analysis of firms' cash allocation starts from the cash flow statement:

$$CF_{it} = \Delta Cash_{it} + I_{it} + DIV_{it} - \Delta D_{it} - \Delta E_{it} \quad (1)$$

CF_{it} is the abbreviation of operating cash flow of firm i at year t, $\Delta Cash_{it}$ is the net change of cash holding, I_{it} denotes the investment expenditure, DIV_{it} is the dividend paid to the

shareholders, ΔD_{it} represents the net debt issuance, and ΔE_{it} is the net equity issuance. The negative values of the last two terms are considered as uses of cash flow. Therefore, equation (1) expresses that firms utilize the cash flow generated from operating activities to save as cash, proceed with the investment, deliver dividend payment, and reduce the external financing from liability and equity instruments.

Following Chang et al. (2014), we consider the following seemingly unrelated regressions (SUR) model[4] consisting of five equations:

$$\begin{aligned}\Delta Cash_{it} = {} & \alpha^{\Delta Cash} + \beta_1{}^{\Delta Cash} Bank\_dependent_{it} + \beta_2{}^{\Delta Cash} CF_{it} + \beta_3{}^{\Delta Cash} Q_{i,t-1} \\ & + \beta_4{}^{\Delta Cash} ln(Assets)_{i,t-1} + \beta_5{}^{\Delta Cash} Risk_{i,t-1} + \beta_6{}^{\Delta Cash} Leverage_{i,t-1} \\ & + \beta_7{}^{\Delta Cash} NWC_{i,t-1} + \beta_8{}^{\Delta Cash} R\&D_{i,t-1} \\ & + Industry\ FEs + Year\ FEs + \varepsilon_{it}{}^{\Delta Cash} \end{aligned} \quad (2)$$

$$\begin{aligned} I_{it} = {} & \alpha^{I} + \beta_1{}^{I} Bank\_dependent_{it} + \beta_2{}^{I} CF_{it} + \beta_3{}^{I} Q_{i,t-1} \\ & + \beta_4{}^{I} ln(Assets)_{i,t-1} + \beta_5{}^{I} Risk_{i,t-1} + \beta_6{}^{I} Leverage_{i,t-1} \\ & + \beta_7{}^{I} NWC_{i,t-1} + \beta_8{}^{I} R\&D_{i,t-1} \\ & + Industry\ FEs + Year\ FEs + \varepsilon_{it}{}^{I} \end{aligned} \quad (3)$$

$$\begin{aligned} DIV_{it} = {} & \alpha^{DIV} + \beta_1{}^{DIV} Bank\_dependent_{it} + \beta_2{}^{DIV} CF_{it} + \beta_3{}^{DIV} Q_{i,t-1} \\ & + \beta_4{}^{DIV} ln(Assets)_{i,t-1} + \beta_5{}^{DIV} Risk_{i,t-1} + \beta_6{}^{DIV} Leverage_{i,t-1} \\ & + \beta_7{}^{DIV} NWC_{i,t-1} + \beta_8{}^{DIV} R\&D_{i,t-1} \end{aligned}$$

[4] The original SUR is proposed by Zellner (1962) and it is a generalization of a linear regression model constituted by several regression equations. The name "seemingly unrelated" comes from the fact that each regression equation is a valid regression and can be estimated separately. The original SUR could be an old-fashioned method, compared to GLS (Generalized Least Square) or FGLS (Feasible Generalized Least Square). However, we use Greene's FGLS estimator.

$$+ \textit{Industry FEs} + \textit{Year FEs} + \varepsilon_{it}^{DIV} \quad (4)$$

$$\Delta D_{it} = \alpha^{\Delta D} + \beta_1{}^{\Delta D}\, \textit{Bank\_dependent}_{it} + \beta_2{}^{\Delta D}\, CF_{it} + \beta_3{}^{\Delta D}\, Q_{i,t\text{-}1}$$
$$+ \beta_4{}^{\Delta D}\, \textit{ln(Assets)}_{i,t\text{-}1} + \beta_5{}^{\Delta D}\, \textit{Risk}_{i,t\text{-}1} + \beta_6{}^{\Delta D}\, \textit{Leverage}_{i,t\text{-}1}$$
$$+ \beta_7{}^{\Delta D} NWC_{i,t\text{-}1} + \beta_8{}^{\Delta D} R\&D_{i,t\text{-}1}$$
$$+ \textit{Industry FEs} + \textit{Year FEs} + \varepsilon_{it}^{\Delta D} \quad (5)$$

$$\Delta E_{it} = \alpha^{\Delta E} + \beta_1{}^{\Delta E}\, \textit{Bank\_dependent}_{it} + \beta_2{}^{\Delta E}\, CF_{it} + \beta_3{}^{\Delta E} Q_{i,t\text{-}1}$$
$$+ \beta_4{}^{\Delta E}\, \textit{ln(Assets)}_{i,t\text{-}1} + \beta_5{}^{\Delta E}\, \textit{Risk}_{i,t\text{-}1} + \beta_6{}^{\Delta E}\, \textit{Leverage}_{i,t\text{-}1}$$
$$+ \beta_7{}^{\Delta E} NWC_{i,t\text{-}1} + \beta_8{}^{\Delta E} R\&D_{i,t\text{-}1}$$
$$+ \textit{Industry FEs} + \textit{Year FEs} + \varepsilon_{it}^{\Delta E} \quad (6)$$

Among these five equations, our main interest lies in the first equation of $\Delta Cash$. In the baseline regression model, we first focus on the dummy $\textit{Bank\_dependent}_{it}$, which takes one for the bank-dependent firm and zero for the counterpart. If the coefficient $\beta_1{}^{\Delta Cash}$ is negative, the bank dependency has a negative effect on the cash through the constant term, and vice versa.

For each equation, we include Tobin's *Q*, the log of total assets (*ln (Assets)*), the volatility of cash flow (*Risk*), leverage (*Leverage*), net working capital (*NWC*), R&D expenses (*R&D*). In addition, we include year dummies (*Year FEs*) and industry dummies (*Industry FEs*)[5]. The definitions of variables are in the Appendix table.

[5] The industrial category is based on the information of the Tokyo Stock Industrial Category Code, which is a 4-digit code specifying the industries a firm belongs to. "0050": Fisheries, agriculture, and forestry; "1050": Mining;"2050": construction; "3050": Foods; "3100": Textiles and Apparels; "3150": Pulp and Paper;"3200": Chemicals; "3250": Pharmaceutical; "3300": Oil and Coal Products;"3350": Rubber Products; "3400": Glass and Ceramics Products; "3450": Iron and Steel; "3500": Nonferrous Metals; "3550": Metal Products; "3600": Machinery; "3650": Electric Appliances; "3700": Transportation Equipment; "3750": Precision Instruments; "3800": Other Products; "4050": Electric Power and Gas; "5050": Land Transportation; "5100": Marine Transportation; "5150": Air Transportation; "5200": Warehousing and Harbor Transportation; "5250": Information & Communication; "6050": Wholesale Trade; "6100": Retail Trade; "7050": Banks; "7100": Securities and Commodities Futures; "7150": Insurance; "7200": Other Financing Business; "8050": Real Estate; "9050": Services; "9999": Others.

If the error terms ε_{it} are not correlated across the equations, the standard ordinary least squares (OLS) estimate is consistent and unbiased. However, when error terms are probably correlated, the OLS estimate is consistent but generally not as efficient as the SUR estimate. The SUR model is estimated by Feasible Generalized Least Squares (FGLS). In the equations from (2) to (6), the error terms are very likely to be correlated with each other because for example, other factors that may affect how much amount of cash put into investment may also have some influences on how much cash firms prefer to hold[6]. Besides, since all the usages of cash flow consist of the operating cash flow according to equation (1), the following constraints must hold:

$$\beta_2^{\Delta Cash} + \beta_2^{\mathrm{I}} + \beta_2^{\mathrm{DIV}} - \beta_2^{\Delta D} - \beta_2^{\Delta E} = 1 \tag{7}$$

$$\beta_j^{\Delta Cash} + \beta_j^{\mathrm{I}} + \beta_j^{\mathrm{DIV}} - \beta_j^{\Delta D} - \beta_j^{\Delta E} = 0 \qquad (j = 3, 4, \ldots, 8) \tag{8}$$

Equation (7) reflects the requirement that the use of cash flow should be equal to the source of cash flow. The sources of cash are operating activities and external financing, while the usages of cash are investments, dividend payments, and net cash holding. There are no more other sources or usages in the model so that equation (7) must hold compulsorily. Equation (8) describes that the general effects from other variables must be zero because those variables only explain parts of cash allocation patterns, but they never generate or utilize cash flows by themselves.

We define the bank-dependent firm as a firm that does not issue bonds. Otherwise, a firm is called non-dependent, hereafter. The main hypothesis of this study is stated as:

Hypothesis 1: Bank-dependent firms hold less excess cash than their counterparts.

To test this hypothesis, we define excess cash as the difference between the actual $\Delta Cash_{it}$ and the predicted $\Delta Cash_{it}$, following Gao et al. (2013). We test Hypothesis 1 by examining the difference between the sample mean of the excess cash for bank-dependent firms and that of

[6] See, for example, Carpenter et al. (1998), Dasgupta and Sengupta (2007), and Hovakimian (2009).

their counterparts. There are two reasons behind Hypothesis 1. First, as the precautionary motive hypothesis (Opler et al., 1999; Bates et al., 2009; McLean, 2011; Harford et al., 2014) implies, the bank as a liquidity provider can be a substitute for cash savings. A bank-dependent firm does not need to hold much of the precautionary savings because the bank will provide cash when needed in the future. Hence, the precautionary motive of cash for bank-dependent firms is not so strong as their counterparts.

Second, as the agency motive hypothesis (Jensen, 1986; Harford, 1999; Dittmar et al., 2003; Pinkowitz et al., 2006; Dittmar and Mahrt-Smith, 2007; Harford et al., 2007) and the bank monitoring hypothesis (Hoshi et al. 1991) implies, firm managers of bank-dependent firms are not able to enjoy the empire-building activities because the banks monitor their activities intensively. Hence, the agency motive of cash holdings for bank-dependent firms is weaker than their counterparts.

For the robustness check, we examine the following two hypotheses by splitting our sample into two subsamples: listed subsample and non-listed subsample.

Hypothesis 2: Bank-dependent listed firms hold less excess cash than non-dependent listed firms.

Hypothesis 3: Bank-dependent non-listed firms hold less excess cash than non-dependent non-listed firms.

Throughout the empirical analyses, our main interests lie in the regressions where the dependent variable is the change in cash holding. To explain the expected sign of the coefficient of each variable, we take equation (2) as an example. The coefficient $\beta_1{}^{\Delta Cash}$ measures the influence of whether a firm is bank-dependent or non-dependent. We expect the coefficient to be negative, according to Hypothesis 1 that bank-dependent firms hold less excess cash than non-dependent firms.

The coefficient $\beta_2{}^{\Delta Cash}$ measures the cash flow sensitivity, indicating when a firm increases one-unit of cash flow, how much proportion will be saved as cash. It is supposed to

be positive and less than one, consistently with the previous research (Almeida et al. 2004, 2011; Chen et al. 2012).

Tobin's Q measures investment opportunities (Opler et al. 1999). As usual, we use the market value over the book value as a proxy for investment opportunities. As the precautionary motive, we expect firms with high market-to-book ratios to hold more cash because such firms incur higher costs when their financial condition worsens. In contrast, as the agency motive, we expect firms with low market-to-book ratios to hold more cash because the managers of such firms intend to hold more cash to facilitate entrenchment activities which is difficult to finance through the capital markets (Opler et al. 1999(p13); Stulz 1990).

Since there are economies of scale with the transaction motive of cash, large firms hold less cash. The variable *ln (Assets)* measures the scale effect of firms in respective to total assets. The variable *Risk* is defined as the volatility of cash flow in a specified industry and year. Firms increase cash as the volatility of cash flow becomes higher.

The variable *Leverage* is defined as the debt-to-equity ratio. Leverage has a negative effect on cash because firms use cash to reduce leverage if the debt is sufficiently constraining. However, the hedging argument of Acharya et al. (2007) is consistent with a positive relationship between leverage and cash holdings. *NWC* considers the impacts of the change in net working capital. We expect a negative relation between NWC and cash holdings because NWC works as a substitute for cash (Opler et al.1999, p16). R&D also measures growth opportunities. Firms with greater R&D expenses have greater costs of financial distress, which leads to a positive relationship between cash and R&D spending.

2.3 Empirical results

2.3.1 Data and Variables

Our analysis employs the Nikkei NEEDS-Financial QUEST database. The original data have a sample period from 1995 to 2018 and contain 20,878 firm-year observations. The sample includes non-listed firms as well as listed firms, but it does not include financial firms.

2.3.2 Summary Statistics

Table 1 compares the summary statistics by bank-dependence. The definitions of variables are in the Appendix. In Table 1, we report the t-test statistics on the null hypothesis that there is no difference in the means between bank-dependent firms and their counterparts (non-dependent firms). It can be observed clearly that for the bank-dependent group, the mean level of change in cash holding is slightly higher than that of the non-dependent group, which contradicts our Hypothesis 1. However, the difference is so small relative to other variables and the significance level is only at 10%. Therefore, we need to carefully examine how bank-dependence affects firms' cash holdings in the regression analyses.

Meanwhile, there are several significant differences in other aspects. More specifically, bank-dependent group firms, on average, spend less on investments, pay more dividends, utilize more debt financing than non-dependent groups do. Besides, the mean levels of other variables also show several significant differences. Therefore, to reveal the relationship of change in cash holdings for two groups, it is necessary to conduct further regression analysis and sample matches.

Table 1. Summary statistics

Variables	Bank-dependent Mean	Standard deviation	Non-dependent Mean	Standard deviation	Difference
ΔCash	0.005	0.052	0.004	0.041	0.001*
I	0.004	0.073	0.008	0.060	-0.005***
DIV	0.012	0.018	0.010	0.019	0.002***
ΔD	-0.005	0.099	0.000	0.084	-0.005***
ΔE	0.016	0.071	0.016	0.058	0.001
Cash flow	0.080	0.056	0.079	0.048	0.001
Q	1.082	0.694	1.124	0.552	-0.042***
Ln (Assets)	10.784	1.144	11.767	1.589	-0.982***
Risk	0.267	0.496	0.223	0.439	0.044***
Leverage	1.483	10.795	1.946	2.571	-0.463***
NWC	0.006	0.059	0.005	0.059	0.001
R&D	0.024	0.032	0.025	0.030	-0.001***
Number of observations	14,111		6,767		

(Notes) This table presents the means and standard deviations of the variables for bank-dependent firms and their counterparts. Definitions of variables are in the Appendix. ***, **, and * indicate the significance of the mean equality hypothesis between the two groups at 1%, 5%, and 10% level respectively.

Table 2 presents the correlation matrix for the independent variables and dependent variables of five regressions. None of these correlations shows the appearance of collinearity problems for the multivariate analysis.

Table 2. Correlation matrix

Variables	ΔCash	I	DIV	ΔD	ΔE	Bank-dependent	CF	Q	Ln (Asset)	Risk	Leverage	NWC	R&D
ΔCash	1.000												
I	0.127*	1.000											
DIV	0.015*	0.038*	1.000										
ΔD	0.335*	0.606*	0.043*	1.000									
ΔE	0.333*	0.543*	0.027*	0.154*	1.000								
Bank-dependent	0.013	-0.031*	0.054*	-0.024*	0.005	1.000							
CF	0.228*	0.283*	0.272*	0.161*	0.523*	0.008	1.000						
Q	0.027*	0.062*	0.153*	0.012	0.120*	-0.030*	0.200*	1.000					
Ln (Asset)	-0.014*	0.062*	0.048*	0.012	0.052*	-0.332*	0.173*	0.078*	1.000				
Risk	0.025*	0.045*	-0.005	0.014*	0.052*	0.043*	-0.023*	-0.050*	-0.008	1.000			
Leverage	-0.006	-0.013	-0.045*	-0.003	-0.027*	-0.024*	-0.051*	0.007	0.005	-0.005	1.000		
NWC	0.036*	0.100*	0.011	0.100*	0.043*	0.009	0.115*	0.038*	-0.023*	0.002	-0.014*	1.000	
R&D	0.008	0.017*	0.104*	0.029*	0.005	-0.021*	0.093*	0.128*	0.103*	0.005	-0.036*	-0.038*	1.000

(Note) * shows significance at the 0.05 level

2.3.3 Regression Analyses

To conduct the SUR (seemingly unrelated regression) analysis, we match each bank-dependent firm in our sample with a non-dependent firm in the sample. We use the propensity score matching method to obtain the matched sample. The matched bank-dependent firm is the nearest neighbor of a non-dependent firm within the same industry in the same year. Using the sample consisting of the control (non-dependent firms) and the matched (bank-dependent firms), we estimate the SUR model.

In Table 3, we present the results for the cash equation in panel A, capital expenditure I in B, dividend payout DIV in C, ΔD in D, and ΔE in E, respectively. For each panel, we use the full sample (model 1) as well as the combination of the matched bank-dependent firms and the counterparts (model 2).

In models 1 and 2, the coefficients of the bank-dependent dummy are significantly negative, consistently with Hypothesis 1. We also see that the cash flow sensitivity of cash is positive and that large firms hold less cash.

In models 3 and 4, we estimate the cash equation separately using the matched bank-dependent firm subsample and the non-dependent firm subsample, respectively. In column 5, we report the Chi-squared statistics associated with the Chow-test for different coefficients on the same firm characteristics across two subsamples.

Among the variables, the cash flow sensitivity of cash is greater for bank-dependent firms than for non-dependent firms. The coefficient of Tobin's Q is significantly negative for bank-dependent firms while it is positive for non-dependent firms. Tobin's q contributes much to making bank-dependent firms hold less cash than their counterparts. We consider that bank-dependent firms tend to be concerned with agency motive because the coefficient of Q is negative[7]. On the other hand, non-dependent firms are concerned with the precautionary motive

[7] However, the negative effect of Tobin's q on cash is not usual in the empirical literature. Nakajima and Sasaki (2016) report negative results.

because the coefficient is positive. If bank-dependent firms were non-dependent with the same investment opportunity, we can say that they have more cash than otherwise, from these two coefficients. In this sense, Tobin's q contributes much to making bank-dependent firms hold less cash than their counterparts.

Table 3. SUR regression analysis

Panel A: ΔCash equation

Model	1	2	3	4	5
Sample	Full sample	Matched bank-dependent firms and non-dependent firms	Matched bank-dependent firms	Non-dependent firms	Chow test (3)-(4)
Dependent var.	ΔCash	ΔCash	ΔCash	ΔCash	ΔCash
Independent var.					
Bank-dependent dummy	-0.003***	-0.002***			
	(0.001)	(0.001)			
CF	0.402***	0.259***	0.309***	0.197***	29.575
	(0.007)	(0.008)	(0.012)	(0.012)	0.000
Q	-0.002***	0.001	-0.002**	0.006***	28.762
	(0.001)	(0.001)	(0.001)	(0.001)	0.000
Ln (Asset)	-0.003***	-0.002***	-0.003***	-0.002***	0.893
	(0.000)	(0.000)	(0.001)	(0.000)	0.345
Risk	-0.026	-0.244**	-0.565***	0.048	0.158
	(0.117)	(0.124)	(0.189)	(0.159)	0.691
Leverage	0.000	0.000	0.000	-0.000*	3.434
	(0.000)	(0.000)	(0.000)	(0.000)	0.064
NWC	0.006	-0.021***	-0.036***	-0.001	6.493
	(0.006)	(0.006)	(0.009)	(0.008)	0.011
R&D	0.014	0.008	-0.034	0.045**	2.568
	(0.014)	(0.017)	(0.026)	(0.023)	0.109
Constant	0.018*	0.033***	0.062***	0.007	
	(0.009)	(0.010)	(0.015)	(0.012)	
Number of Observations	20,878	13,534	6,767	6,767	
R-squared	0.046	0.013	0.023	0.016	

Panel B: I equation

Model	1	2	3	4	5
Sample	Full sample	Matched bank-dependent firms and non-dependent firms	Matched bank-dependent firms	Non-dependent firms	Chow test (3)-(4)
Dependent var.	I	I	I	I	I
Independent var.					
Bank-dependent dummy	-0.004***	-0.005***			
	(0.001)	(0.001)			
CF	0.361***	0.219***	0.295***	0.126***	32.255
	(0.009)	(0.011)	(0.015)	(0.016)	0.000
Q	0.001	0.006***	0.006***	0.007***	0.194
	(0.001)	(0.001)	(0.001)	(0.001)	0.660
Ln (Asset)	0.000	0.000	0.000	0.001*	41.574
	(0.000)	(0.000)	(0.001)	(0.000)	0.000
Risk	-0.109	-0.125	-0.347	0.012	0.165
	(0.162)	(0.160)	(0.230)	(0.221)	0.685
Leverage	0.000	0.000	0.000***	-0.002***	32.259
	(0.000)	(0.000)	(0.000)	(0.000)	0.000
NWC	0.087***	0.041***	0.048***	0.033***	0.555
	(0.008)	(0.008)	(0.011)	(0.012)	0.456
R&D	-0.006	-0.093***	-0.174***	-0.036	0.042
	(0.019)	(0.022)	(0.031)	(0.032)	0.837
Constant	-0.007	-0.010	-0.004	-0.012	
	(0.013)	(0.013)	(0.018)	(0.017)	
Number of Observations	20,878	13,534	6,767	6,767	
R-squared	0.155	0.154	0.167	0.151	

Panel C: **DIV equation**

Model	1	2	3	4	5
Sample	Full sample	Matched bank-dependent firms and non-dependent firms	Matched bank-dependent firms	Non-dependent firms	Chow test (3)-(4)
Dependent var.	DIV	DIV	DIV	DIV	DIV
Independent var.					
Bank-dependent dummy	0.001***	0.001			
	(0.000)	(0.000)			
CF	0.251***	0.254***	0.267***	0.234***	11.476
	(0.002)	(0.004)	(0.005)	(0.005)	0.001
Q	0.002***	0.001***	0.000	0.003***	36.553
	(0.000)	(0.000)	(0.000)	(0.000)	0.000
Ln (Asset)	-0.000	-0.000	0.000	-0.000**	0.191
	(0.000)	(0.000)	(0.000)	(0.000)	0.662
Risk	0.408***	0.329***	0.239***	0.399***	5.372
	(0.043)	(0.054)	(0.082)	(0.069)	0.020
Leverage	-0.000***	-0.000***	-0.000	-0.001***	48.181
	(0.000)	(0.000)	(0.000)	(0.000)	0.000
NWC	-0.004*	0.001	0.007*	-0.006*	4.992
	(0.002)	(0.003)	(0.004)	(0.004)	0.025
R&D	0.038***	0.036***	0.056***	0.008	10.838
	(0.005)	(0.007)	(0.011)	(0.010)	0.001
Constant	-0.036***	-0.027***	-0.025***	-0.029***	
	(0.004)	(0.004)	(0.007)	(0.005)	
Number of Observations	20,878	13,534	6,767	6,767	
R-squared	-0.079	-0.049	-0.036	-0.046	

Panel D: ΔD equation

Model	1	2	3	4	5
Sample	Full sample	Matched bank-dependent firms and non-dependent firms	Matched bank-dependent firms	Non-dependent firms	Chow test (3)-(4)
Dependent var.	ΔD	ΔD	ΔD	ΔD	ΔD
Independent var.					
Bank-dependent dummy	-0.005***	-0.013***			
	(0.001)	(0.002)			
CF	-0.411***	-0.601***	-0.573***	-0.652***	17.432
	(0.011)	(0.014)	(0.019)	(0.019)	0.000
Q	-0.005***	0.002	0.001	0.004***	3.889
	(0.001)	(0.001)	(0.001)	(0.002)	0.049
Ln (Asset)	-0.000	0.000	0.000	0.000	41.662
	(0.000)	(0.000)	(0.001)	(0.001)	0.000
Risk	0.534***	0.265	-0.231	0.674**	0.439
	(0.195)	(0.199)	(0.294)	(0.266)	0.507
Leverage	0.000	-0.000**	0.000**	-0.004***	98.923
	(0.000)	(0.000)	(0.000)	(0.000)	0.000
NWC	0.120***	0.072***	0.071***	0.070***	0.000
	(0.009)	(0.010)	(0.014)	(0.014)	0.996
R&D	0.100***	0.067**	0.066*	0.051	0.654
	(0.023)	(0.028)	(0.040)	(0.038)	0.419
Constant	-0.019	-0.019	-0.005	-0.036*	
	(0.016)	(0.016)	(0.024)	(0.021)	
Number of Observations	20,878	13,534	6,767	6,767	
R-squared	-0.045	-0.021	0.005	-0.026	

Panel E: ΔE equation

Model	1	2	3	4	5
Sample	Full sample	Matched bank-dependent firms and non-dependent firms	Matched bank-dependent firms	Non-dependent firms	Chow test (3)-(4)
Dependent var.	ΔE	ΔE	ΔE	ΔE	ΔE
Independent var.					
Bank-dependent dummy	-0.002**	-0.000			
	(0.001)	(0.001)			
CF	0.425***	0.333***	0.444***	0.208***	51.607
	(0.007)	(0.009)	(0.012)	(0.013)	0.000
Q	0.005***	0.007***	0.004***	0.012***	26.325
	(0.001)	(0.001)	(0.001)	(0.001)	0.000
Ln (Asset)	-0.002***	-0.002***	-0.002***	-0.002***	0.725
	(0.000)	(0.000)	(0.001)	(0.000)	0.395
Risk	-0.261**	-0.305**	-0.442**	-0.215	0.678
	(0.127)	(0.130)	(0.190)	(0.175)	0.410
Leverage	-0.000	0.000**	0.000	0.001***	12.812
	(0.000)	(0.000)	(0.000)	(0.000)	0.000
NWC	-0.030***	-0.051***	-0.052***	-0.044***	0.349
	(0.006)	(0.006)	(0.009)	(0.009)	0.555
R&D	-0.054***	-0.117***	-0.218***	-0.034	1.313
	(0.015)	(0.018)	(0.026)	(0.025)	0.252
Constant	0.034***	0.036***	0.047***	0.029**	
	(0.010)	(0.010)	(0.015)	(0.014)	
Number of Observations	20,878	13,534	6,767	6,767	
R-squared	0.348	0.328	0.373	0.294	

(Note) The five panels present estimated coefficients of independent variables for five equations. Column (1) reports the regression results for the full sample data. Column (2) reports the regression results for the sample of matched bank-dependent firms and non-dependent firms using the propensity score matching method. Column (3) and Column (4) report the regression results, using subsamples of matched bank-dependent firms and subsamples of non-dependent firms, respectively. The numbers in parenthesis for column (1) to (4) represent the standard errors. Column (5) reports the Chi-squared-statistics of the Chow test over the difference of (3) and (4), and the number below denotes the p-value accordingly. Definitions of variables are in the Appendix. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

Now we look at other panels of Table 3, which report the coefficients for equations other than cash. Bank-dependent firms tend to invest less compared to non-dependent firms according to Panel B. Under the regression which includes all sample data, the bank-dependent dummy is -0.004 and it is significant at a 1% significance level. Similarly, in column (2) which

uses the sample of matched bank-dependent firms and non-dependent firms, the bank-dependent dummy is -0.005 and it is also significant at a 1% significance level. According to the column (3) and (4), the investment of bank-dependent firms is more limited to the R&D expenditure while more sensitive to the NWC and cash flow.

Besides, the bank-dependent firm utilizes less debt financing (or reduces outstanding debts more) compared to non-dependent firm according to Panel D, and debt financing decision for non-dependent firms is heavily sensitive to the risk of the firms according to column (3) and (4) in Panel D.

In Table 4, we can estimate how bank-dependent firms should behave if they were a non-dependent firm. To test Hypothesis 1, we use excess cash calculated as the difference between the actual $\Delta Cash_{it}$ and the predicted $\Delta Cash_{it}$. We test Hypothesis 1 by examining the difference between the sample mean of the excess cash for bank-dependent firms and that of their counterparts.

From Table 4, it can be observed that the mean difference of excess cash holding is -0.196 and it is significant at 1% significance level. In other words, the results suggest that bank-dependent firms would hold more excess cash if they were the same firm but non-dependent. Table 4 also reports each median to confirm that there is not much difference between the mean and the median. The result supports Hypothesis 1 so that we can say that bank-dependent firms hold less excess cash than their counterparts.

Table 4 also reports the excess amount of other usages of internal cash flow. Consistent with the previous table, the mean difference of excess investment is -0.525. The result indicates that bank-dependent firms would have more investment if they were non-dependent. The mean difference in excess debt increasing is -1.342, indicating that bank-dependent firms would have more debt financing if there were the same firm but non-dependent. All these findings are consistent with our hypotheses.

Table 4: Comparison of the Mean and Median of Excess Amount for Each Equation

	Mean	Median
Excess ΔCash	-0.196***	-0.185
Excess I	-0.525***	-0.555
Excess DIV	0.026	-0.068
Excess ΔD	-1.342***	-0.968
Excess ΔE	-0.018	0.010

(Note) The excess amount of each variable is calculated from the coefficients of non-dependent firms of Table 2, using the sample of the matched bank-dependent firms. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

2.3.4 Robustness Check

Gao et al. (2013) find evidence that private firms hold less cash than public firms do because the former faces lower agency costs than the latter. This finding suggests that the agency issues of private firms may be different from those of public firms. Hence, as a robustness check, we conduct the SUR regression analysis for the subsample of the listed firms and the subsample of the non-listed firms.

Table 5 reports the frequency distributions of our sample firms. We divide the original sample into two groups: listed subsample and non-listed subsample[8]. The original sample includes 20,878 observations and 14,111 are bank-dependent. The subsamples of listed and non-listed consist of 18,863 and 441 observations, respectively. The total number of listed subsample and non-listed subsample is 19,304. This number of observations is smaller than that of the original sample because we exclude industry-year observations where the total number of the individual number of firms is less than 20, to make it easier to match the sample. Even though the number of observations of non-listed subsample is much smaller than the listed group, the regression results are still effective in the aspect of statistics.

[8] The stock exchanges in Japan include Tokyo, Osaka, Nagoya, Kyoto, Hiroshima, Fukuoka, Niigata, Sapporo, and as long as a firm is listed in any of the stock exchanges above, it is counted as a listed subsample.

Table 5. Frequency distributions

	Bank-dependent	Non-dependent	Total
A) Original sample	14,111	6,767	20,878
B) Listed subsample	12,682	6,181	18,863
C) Non-listed subsample	307	134	441
D) Total (B+C)	12,989	6,315	19,304

(Note) The total number of Row D is smaller than the original of Row A because we exclude the sample of some industry-year observations where the total sum of the individual number of firms is less than 20.

Table 6 reports the SUR regression results for the sample consisting of the listed firms. The results for the listed subsample in Table 6 are similar to those of the original sample shown in Table 3. In particular, the coefficients of the bank-dependent dummy are significantly negative in models 1 and 2 and the mean value in panel B is significantly negative. Thus, the result supports Hypothesis 2 that bank-dependent listed firms hold less excess cash than non-dependent listed firms.

Table 7 reports the SUR regression results for the sample consisting of the non-listed firms. The coefficient of the bank-dependent dummy is negative, but not significant in model 1. However, it is significantly negative in model 2. Also, the mean value in panel B is significantly negative. Thus, the result supports Hypothesis 3 that bank-dependent non-listed firms hold less excess cash than non-dependent non-listed firms. The other results also are much similar to those of the previous two tables.

Table 6. SUR regression analysis with matched sample (Listed firms only)

Panel A: ΔCash equation

Model	1	2	3	4	5
Sample	Full sample	Matched bank-dependent firms and non-dependent firms	Matched bank-dependent firms	Non-dependent firms	Chow test (3)-(4)
Dependent var.	ΔCash	ΔCash	ΔCash	ΔCash	ΔCash
Independent var.					
Bank-dependent dummy	-0.003***	-0.002**			
	(0.001)	(0.001)			
CF	0.383***	0.249***	0.303***	0.186***	33.103
	(0.007)	(0.008)	(0.012)	(0.012)	0.000
Q	-0.002***	0.000	-0.003***	0.005***	32.987
	(0.001)	(0.001)	(0.001)	(0.001)	0.000
Ln (Asset)	-0.003***	-0.002***	-0.003***	-0.002***	3.996
	(0.000)	(0.000)	(0.001)	(0.000)	0.046
Risk	-0.007	-0.218*	-0.549***	0.109	0.026
	(0.120)	(0.116)	(0.167)	(0.158)	0.873
Leverage	0.000	-0.000	0.000	-0.000**	4.632
	(0.000)	(0.000)	(0.000)	(0.000)	0.031
NWC	0.022***	0.002	0.007	-0.004	1.545
	(0.006)	(0.006)	(0.008)	(0.009)	0.214
R&D	0.027*	0.041**	0.037	0.045**	1.060
	(0.014)	(0.017)	(0.026)	(0.023)	0.303
Constant	0.017*	0.032***	0.064***	0.002	
	(0.010)	(0.009)	(0.014)	(0.012)	
Number of Observations	18,863	12,362	6,181	6,181	
R-squared	0.046	0.015	0.032	0.012	

Panel B

	Mean	Median
Excess Cash	-0.148***	-0.099

(Note) Panel A presents estimated coefficients of independent variables for the cash equation, using the subsample of listed firms. Definitions of variables are in the Appendix. The standard errors are in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively. Panel B presents the excess amount of ΔCash calculated from the coefficients of non-dependent firms of Panel A, using the sample of the matched bank-dependent firms.

Table 7. SUR regression analysis with matched sample (Non-Listed firms only)
Panel A: ΔCash equation

Model	1	2	3	4	5
Sample	Full sample	Matched bank-dependent firms and non-dependent firms	Matched bank-dependent firms	Non-dependent firms	Chow test (3)-(4)
Dependent var.	ΔCash	ΔCash	ΔCash	ΔCash	ΔCash
Independent var.					
Bank-dependent dummy	-0.001	-0.011*			
	(0.006)	(0.006)			
CF	0.612***	0.548***	0.742***	0.450***	1.166
	(0.051)	(0.064)	(0.091)	(0.090)	0.280
Q	-0.018**	-0.025**	-0.088***	0.003	4.920
	(0.007)	(0.012)	(0.022)	(0.014)	0.027
Ln (Asset)	-0.001	-0.006	-0.016**	-0.005	1.273
	(0.004)	(0.004)	(0.008)	(0.005)	0.259
Risk	-0.002	0.003	0.009	0.001	3.409
	(0.008)	(0.008)	(0.011)	(0.011)	0.065
Leverage	0.000	0.001	0.004	-0.001	0.420
	(0.000)	(0.003)	(0.004)	(0.003)	0.517
NWC	0.087**	0.093**	0.063	0.162***	1.317
	(0.044)	(0.044)	(0.058)	(0.061)	0.251
R&D	0.018	-0.146	-0.274**	0.118	2.890
	(0.078)	(0.097)	(0.125)	(0.166)	0.089
Constant	0.005	0.055	0.186**	0.008	
	(0.040)	(0.046)	(0.081)	(0.057)	
Number of Observations	441	268	134	134	
R-squared	0.129	0.192	0.406	0.240	

Panel B

	Mean	Median
Excess Cash	-1.260**	-0.371

(Note) Panel A presents estimated coefficients of independent variables for the cash equation, using the subsample of non-listed firms. The definition of variables is in the Appendix. The standard errors are in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively. Panel B presents the excess amount of Δcash calculated from the coefficients of non-dependent firms of Panel A, using the sample of the matched bank-dependent firms.

2.4 Conclusions

In this chapter, we provide an empirical analysis of the cash holding behavior of bank-dependent firms and non-dependent firms based on Japanese firms' data from 1995 to 2018. The results show that bank-dependent firms significantly hold less excess cash than non-dependent firm. The subsample of listed and non-listed also provide robust supporting evidence. The findings are consistent with the findings of the previous research that larger firms generally hold more cash due to the greater agency conflicts. Besides, bank-dependent and non-dependent firms decrease the cash holding when total assets increase, indicating a significant characteristic of the economy to scale. Bank-dependent firms are significantly sensitive to the fluctuation of cash flow at the industry level while non-dependent firms have more incentives for cash saving when there are more investment opportunities. The influence of leverage remains ambiguous in our observations.

The findings also provide innovative information for future research in corporations' cash policy and potential connections with the pattern of macroeconomics, as well as the measurement of government policymaking. The analysis framework in this chapter is mainly aimed at the cash policy of corporations, but it is also effective in analyzing the cash allocations. For instance, the cash flow sensitivity of cash holding and investment reflect the potential expectations over future economics. If the level of investment depicts a significant increase, then the macroeconomics is expected to experience a rapid recovery. On the contrary, if the cash flow sensitivity of cash holding remains at a high level, then there will be more uncertainty and divergence towards the expectation of future economics. Another implication of the research framework and findings is to analyze the reactions of corporations' cash policy under specific policy changes or exogenous shocks. For example, it will be interesting to analyze the reactions in corporations' cash policy under the exogenous shocks in the Global Financial Crisis in 2008 and the pandemic of COVID-19 in 2020. Besides, on account of the rapid development of the Japanese bond market, it deserves further observations and research that whether the proportion of bank-dependent corporations in the Japanese market will see a gradual decline;

whether the strong power of negotiation from the main banks will weaken so that the cash flow sensitivity of cash holding for the bank-dependent corporations' decreases; and whether the liquidity provided from the corporate bond market can demonstrate enough tenacity in the face of ongoing large volatility so that the counterparts will not hold more excess cash than the bank-dependent corporations do.

3. Cash Allocation of Japanese Firms: Impacts of Financial Crisis and Macroeconomic Policy

3.1 Introduction

Cash allocation refers to how a firm allocates its internally generated cash flow to different uses. Specifically, firms could allocate the cash flow to reducing the debt or equity financing, paying dividends, investing, or holding cash as precautionary savings. This study mainly focuses on cash flow sensitivity of cash and cash flow sensitivity of investment, and how they change according to the demand shocks.

There are plenty of previous researches related to cash flow sensitivity and fierce debates on investment-cash flow sensitivity. Almeida et al. (2004) suggest that constrained firms have a positive cash flow sensitivity of cash, while unconstrained firms' cash savings are not systematically related to cash flows. They provide a model showing a firm's demand for liquidity and a new test of the effect of financial constraints on corporate policies. Hovakimian (2009) suggests that investment-cash flow sensitivity is nonmonotonic with financial constraints, cash flows, and growth opportunities. He points out that firms with negative cash flow sensitivity have the lowest cash flows, highest growth opportunities, and appear the most financially constrained. This negative relationship between cash flow and investment is driven by the opposite trends as firms grow through stages of their life cycle.

Gatchev et al. (2010) develop a dynamic multi-equation model where firms make financing and investment decisions jointly subject to the constraint that sources must equal the uses of cash. They argue that there is no relation between investment and cash flow. Rather, firms insulate capital expenditures from cash flow fluctuations by changing net debt. When cash flows are low, firms increase debt and reduce cash balance. When cash flows are high, firms reduce debt and increase cash balance.

Similarly using a multi-equation model, Chang et al. (2014) find that more financially constrained firms allocate more transitory cash flow to cash savings and direct less towards

investment than do less constrained firms by decomposing cash flow into a transitory and a permanent component and then focusing on the cash allocation of the transitory component.

Meanwhile, there are also increasing focuses other than financially constrained or unconstrained groups. Hoshi et al. (1991) examine two sets of Japanese firms, one of which has close financial ties to large Japanese banks and the other one does not, and find the investment is more sensitive to liquidity for the set of firms with weaker links to the main bank and presumably greater problems raising capital. Khurana et al (2006) find that firms in financially underdeveloped countries have a greater marginal propensity to save cash and that the cash flow sensitivity decreases with a country's financial development.

Riddick and Whited (2009) regard that firms with an increase in cash flow are likely to turn cash holdings into investment as a positive cash flow shock implies higher productivity of physical assets and a firm tends to accumulate cash holdings when faced with less profitable projects. Dasgupta and Sengupta (2007) argue that a lower interest rate can lead to less current investment due to the interaction of future financial constraints and the discounting of cash flows. Their results also suggest that the effect of monetary policy aimed at stimulating firm investment through the balance sheet channel may be more muted than usually supposed, especially if firms already have accumulated significant liquid balances. They point out this channel is especially relevant in the Japanese market, where firms have steadily increased liquidity through the 90s.

The objective of studying cash allocation in the context of the Global Financial Crisis in 2007, abbreviated as GFC hereafter, and Abenomics, which is explained shortly, is to examine how firms react to the demand impacts from external circumstances. The GFC and Abenomics provide an ideal pair of a negative and positive demand shock. The GFC is considered the worst financial crisis since the 1930s and is described as an unexpected, world-wide negative demand shock from non-policy activity. Kawai and Takagi. (2011) point out that Japan was particularly vulnerable during the GFC because over 90% of Japan's exports consist of highly-income elastic industrial supplies and products, and because the ratio of exports to gross domestic

product increased significantly since the 2000s, with a declining share for the non-tradable sector.

Abenomics refers to the economic policy advocated by prime minister Shinzo Abe since the December 2012 general election. Abenomics is based upon "three arrows" of aggressive monetary policy, fiscal consolidation, and structural reforms and described as a positive demand shock from policy tools.

To analyze the effect of shocks on the corporate cash allocation, we focus on the domestic-oriented/export-oriented firms because the exchange rate moved dramatically after the GFC and Abenomics, while these two types of firms respond to exchange rate movement differently. Besides, these two types of firms are facing different markets and are probably in different life cycle stages. We predict that export-oriented firms hold less cash than domestic-oriented firms do because export-oriented firms have more growth opportunities and broader channels to get financed. We also predict that export-oriented firms spend more on investment activities than domestic-oriented firms do because export-oriented firms are faced with internationalized competitions. A higher investment input will contribute to the leading place in the industries.

We predict that the firms increase cash holding and decrease investments after the negative shock because market uncertainties arise in the negative shock and a higher cash holding level enables a firm to cope with any emergency. We expect that the positive demand shocks from Abenomics could drive Japanese firms to increase investments and decrease the cash holding.

The results show that export-oriented firms hold less cash, spend more on investment activities, and rely more heavily on debt financing than domestic-oriented firms do. Under negative demand shocks during the GFC and before Abenomics, both groups significantly increase the cash holding level and decrease the investment activities. Export-oriented firms manifest an even larger fluctuation in the pattern of cash allocated into investment and cash holding. Under positive policy shocks when Abenomics push-out, both groups still choose to increase the cash holding level while there is no significant evidence showing the portion of

investment increase. We also reveal that control variables have different impacts on cash allocations for different groups. Under massive impact such as the GFC, control variables may lose their efficacy.

We make contributions to the study of cash allocation and cash flow sensitivity via looking through the reaction of Japanese firms under negative demand shock and positive demand shock. There is little previous research on the changes in cash allocation under different external shocks and this may become a new theme of research over cash allocation and cash flow sensitivity. Our new evidence confirms that firms increase cash holding while they decrease investments after the negative shock. The positive shock of Abenomics significantly drives firms to increase cash holding, but there is no significant increase in investment activities.

The structure of this chapter is as follows. Section 3.2 describes the methodology and hypotheses. Section 3.3 presents the regression results and Section 3.4 concludes the chapter with interpretations of the findings.

3.2 Methodology and Hypotheses

3.2.1 Methodology

The analysis of firms' cash allocation starts from the cash flow statement:

$$CF_{it} = \Delta Cash_{it} + I_{it} + DIV_{it} - \Delta D_{it} - \Delta E_{it} \quad (1)$$

CF_{it} is the abbreviation of operating cash flow of firm i at year t and I_{it} denotes the investment expenditure. DIV_{it} is the dividend paid to the shareholders. ΔD_{it} represents the cash flow from liability instruments and ΔE_{it} is the cash flow from issuing new stock or disposing of current stocks. The dividend, net cash flow from liability, and equity consist of net financing cash flow. In equation (1), -ΔD_t and -ΔE_t represent the net reductions in external financing, which are considered as uses of cash flow. $\Delta Cash_{it}$ is the net change of cash holding. Therefore,

equation (1) expresses that firms utilize the cash flow generated from operating activities to save as cash, proceed with the investment, deliver dividend payment, and reduce the external financing from liability and equity instruments.

Following Chang et al. (2014), we consider the following seemingly unrelated regressions (SUR) as the benchmark:

$$I_{it} = \beta_1^I CF_{it} + \beta_2^I X_{it-1} + y_t + \varepsilon_{it}^I \quad (2)$$

$$\Delta Cash_{it} = \beta_1^{\Delta Cash} CF_{it} + \beta_2^{\Delta Cash} X_{it-1} + y_t + \varepsilon_{it}^{\Delta Cash} \quad (3)$$

$$DIV_{it} = \beta_1^{Div} CF_{it} + \beta_2^{Div} X_{it-1} + y_t + \varepsilon_{it}^{Div} \quad (4)$$

$$\Delta D_{it} = \beta_1^{\Delta D} CF_{it} + \beta_2^{\Delta D} X_{it-1} + y_t + \varepsilon_{it}^{\Delta D} \quad (5)$$

$$\Delta E_{it} = \beta_1^{\Delta E} CF_{it} + \beta_2^{\Delta E} X_{it-1} + y_t + \varepsilon_{it}^{\Delta E} \quad (6)$$

In the regression model, X_{it-1} refers to a series of control variables, including the sales growth rate, Tobin's q, leverage, the increased rate of the asset, net profit margin, tangibility, and the standard deviation of operating cash flow centralized by asset at an industry level. y_t is the year dummy to account for time effects.

In the equations from (2) to (6), the error terms are very likely to be correlated because for example, other factors that may affect how much amount of cash put into investment may also have some influences on how much cash firms prefer to hold. Besides, since all the usages of cash flow consist of the operating cash flow according to equation (2), the following constraints must be held:

$$\beta_1^{\Delta Cash} + \beta_1^I + \beta_1^{Div} - \beta_1^{\Delta D} - \beta_1^{\Delta E} = 1 \quad (7)$$

$$\beta_2^{\Delta Cash} + \beta_2^I + \beta_2^{Div} - \beta_2^{\Delta D} - \beta_2^{\Delta E} = 0 \quad (8)$$

Equation (7) reflects the requirement that the use of cash flow should be equal to the source of cash flow. The sources of cash are operating activities(CF), external financing ($\Delta D, \Delta E$)

while the usages of cash are investments, dividend payment, and net cash holding. There are no more other sources or usages in the model so that Equation (7) must be held compulsorily. Equation (8) describes that the general effects from control variables must be zero because control variables only explain parts of cash allocation patterns, but they never generate or utilize cash flows by themselves. Besides, the influence from control variables will be offset by other items as Equation (7) holds. For instance, suppose the coefficient of Tangibility in equation (2) is 0.1, which means when tangibility increases by 0.1, the investment will increase by 1%, and the net effect of increasing tangibility will be summed up to -1%.

3.2.2 Hypotheses

Japan is heavily relied on trade exportation to drive its growth, which makes it the fourth largest export economy in the world[9]. The lack of natural resources leads Japan to a high reliance on imported fuels and raw materials for its industrial sectors. Therefore, the Japanese industrial sector has a high sensitivity to the exchange rate fluctuation.

Figure 1. The exchange rate of Japanese yen from 2001 to 2015 with U.S Dollars.

(Note) The data is from BOJ (Bank of Japan). The vertical axis is the exchange rate of one U.S Dollar to Japanese Yen. The figure is illustrated with the monthly average data.

[9] The United States and China are the two most important partners in Japanese export and import, with Japan importing 27% from China and 12% from the United States and exporting 22% to the United States and19% to China. The data is from OEC (the Observatory of Economic Complexity) and detailed information can be referred in http://atlas.media.mit.edu/en/visualize/tree_map/hs92/export/jpn/all/show/2016/

Figure 1 shows how the exchange rate of Japanese Yen to U.S Dollars fluctuates from 2000 to 2015. During the period of 2000 to 2007, the Japanese yen maintained a relatively stable movement of over 120 yen to one U.S dollar. After the GFC in 2007 and before the Abenomics in 2012, the Japanese yen went into a continuing appreciation path from 120 to lower than 80. After the Abenomics inauguration in 2013, the Japanese yen sharply depreciated from 80 to 120 in less than two years.

We categorize firms into two groups, the export-oriented and domestic-oriented group, according to the major markets to which they belong. For domestic-oriented firms, most of the revenues are from Japan domestic market, while for the export-oriented group the revenues of foreign markets take up massive shares.[10] Domestic-oriented firms are less affected by the fluctuation of the exchange rate.

[10] This category is not telling about export or import-oriented because the export and import appear most of the time in pairs, especially in Japan. And since we are interested in the demand shock, it would be more instructive to examine the different markets.

Table 1. The list of industries that belong to export-oriented or domestic-oriented groups.

Export-oriented	Domestic-oriented
Ceramics	Air transportation
Chemistry	Communication
Electric apparatus	Construction
Steel	Pharmaceutical products
Machine	Food
Car	Gas
Nonferrous metal	Fisheries
Other production	The mining industry
Pulp	Oil
Precision instrument	Real estate
Rubber	Retail trade
Transportation equipment	Railroad bus
	Marine transportation
	Shipbuilding
	Service
	Fiber
	Land transport
	Warehouse
	Electricity

Table 1 lists the detailed industries of each group. Represented as electronic apparatus manufacturing and car-making, industries involving manufacturing and high technology are regarded as export-oriented, while industries mainly focusing on providing services domestically are identified as domestic-oriented, which includes real estate, retail trading, and so on. Firms that cannot be identified as domestic-oriented or export-oriented are omitted in the regressions related to the two groups. Previous research from Ito et al. (2015) also provides

some supportive accordance with the categorization. Although they do not use the term oriented or domestic, the research suggests that the scale exposing on the exchange rate differs across Japanese industries and manufacturing industries have higher exposures. They calculate the exchange rate exposure by the industry on a monthly basis from January 2005 to December 2009 and the level of exposure is consistent with our two groups' classification. Therefore, the classification of export-oriented and domestic-oriented is not conventional but reasonable.

Table 2. The summary description of domestic-oriented and export-oriented groups

	Domestic		Export		
Variables	Obs.	Mean1	Obs.	Mean2	MeanDiff
CF	12234	0.0530	9868	0.0590	-0.006***
I	12234	0.0350	9868	0.0410	-0.006***
$\Delta Cash$	12234	0.00400	9868	0.00500	-0.001**
DIV	12234	0.00800	9868	0.00800	0.000**
ΔE	12234	-0.00100	9868	-0.00100	0.000**
ΔD	12234	-0.00800	9868	-0.00600	-0.002***
$Sales$	12234	0.0260	9868	0.0320	-0.005***
$Asset$	12234	0.0100	9868	0.0130	-0.003***
$Leverage$	12234	0.526	9868	0.502	0.024***
$Profit$	12234	0.0510	9868	0.0530	-0.002***
$Tobin' sq$	12234	0.551	9868	0.492	0.058***
$Tangibility$	12234	0.489	9868	0.460	0.029***
$Fluctuation$	12234	0.0640	9868	0.0470	0.017***

(Note) The dependent variables are uses of operating cash flow, including investment (I), the net change in cash holdings (ΔCash), dividend (Div), net equity issued (ΔE), and net debt issued (ΔD). These variables are all centralized by total assets. Sales is the growth rate of a firm's sales and Asset refers to the growth rate of total assets. Leverage is described by debt over assets. Profit is the net profit ratio, calculated by the net income divided by sales. Tobin's q is calculated by total market value over the total asset value of a firm. Tangibility is a firm's tangibility, calculated by fixed assets over total assets. Fluctuation is the fluctuation of an industries' operating cash flow. It is described by the standard deviation of CF in the industry.

Table 2 depicts the summary statistics of investment, the net change in cash holdings, dividend, net equity issued, and net debt issued. These variables are all normalized by total assets. As control variables, we include seven variables. $Sales$ is the growth rate of a firm's sales and $Asset$ is the growth rate of total assets. $Leverage$ is the ratio of debt over assets. $Profit$ is the net profit ratio, calculated by the net income divided by sales. $Tobin's\ q$ is calculated by total market value over the total asset value of a firm. $Tangibility$ is a firm's tangibility, calculated by fixed assets over total assets. $Fluctuation$ is the fluctuation of an industries' operating cash flow, defined as the standard deviation of CF in the industry. The

summary statistics describe that export-oriented firm has a higher growth rate of sales, higher rate of asset growth, less leverage utilized, and less cash flow fluctuation than the domestic-oriented group.

Table 3. The correlation matrix of variables related to the regressions.

	CF	I	$\Delta Cash$	DIV	ΔE	ΔD	$Sales$	$Asset$	$Leverage$	$Profit$	$Tobin'q$	$Tangibility$	$Fluctuation$
CF	1.000												
I	0.297	1.000											
$\Delta Cash$	0.387	-0.082	1.000										
DIV	0.283	0.181	0.034	1.000									
ΔE	-0.112	0.061	0.126	-0.203	1.000								
ΔD	-0.300	0.489	0.265	0.109	-0.107	1.000							
$Sales$	0.117	0.116	0.129	0.006	0.067	0.064	1.000						
$Asset$	0.110	0.312	0.343	0.073	0.119	0.402	0.498	1.000					
$Leverage$	-0.163	-0.120	-0.063	-0.518	0.111	-0.079	-0.018	-0.092	1.000				
$Profit$	0.420	0.189	0.174	0.458	-0.127	0.017	0.296	0.368	-0.372	1.000			
$Tobin'q$	0.210	0.161	0.091	0.414	0.016	0.035	0.183	0.221	-0.392	0.435	1.000		
$Tangibility$	0.101	0.207	-0.097	-0.117	0.004	-0.011	-0.062	-0.042	0.144	-0.011	-0.098	1.000	
$Fluctuation$	-0.107	-0.099	0.004	-0.031	0.039	0.008	-0.027	-0.087	0.061	-0.004	-0.019	-0.236	1.000

(Note) The data set is from Nikkei Financial Quest from 2001 to 2015. The dependent variables are uses of operating cash flow, including investment (I), the net change in cash holdings (ΔCash), dividend (Div), net equity issued (ΔE), and net debt issued (ΔD). These variables are all centralized by total assets. Sales is the growth rate of a firm's sales and Asset refers to the growth rate of total assets. Leverage is described by debt over assets. Profit is the net profit ratio, calculated by the net income divided by sales. Tobin's q is calculated by total market value over the total asset value of a firm. Tangibility is a firm's tangibility, calculated by fixed assets over total assets. Fluctuation is the fluctuation of an industries' operating cash flow. It is described by the standard deviation of CF in the industry.

Furthermore, Table 3 presents the correlation matrix of variables related to regressions. It is clear that all variables present certain levels of correlations and there is no multicollinearity among the variables.

Table 4. The correlation matrix of two groups with the exchange rate.

Domestic-Oriented Groups							
	CF	I	$\Delta Cash$	Div	ΔE	ΔD	$Exchange$
CF	1.000						
I	0.281	1.000					
	0.000						
$\Delta Cash$	0.388	-0.092	1.000				
	0.000	0.000					
Div	0.286	0.166	0.027	1.000			
	0.000	0.000	0.002				
ΔE	-0.132	0.045	0.132	-0.211	1.000		
	0.000	0.000	0.000	0.000			
ΔD	-0.301	0.490	0.250	0.094	-0.111	1.000	
	0.000	0.000	0.000	0.000	0.000		
$Exchange$	-0.031	-0.007	-0.072	-0.064	-0.025	-0.036	1.000
	0.001	0.471	0.000	0.000	0.009	0.000	
Export-Oriented Groups							
	CF	I	$\Delta Cash$	Div	ΔE	ΔD	$Exchange$
CF	1.000						
I	0.315	1.000					
	0.000						
$\Delta Cash$	0.386	-0.069	1.000				
	0.000	0.000					
Div	0.278	0.203	0.044	1.000			
	0.000	0.000	0.000				
ΔE	-0.077	0.091	0.118	-0.190	1.000		
	0.000	0.000	0.000	0.000			
ΔD	-0.304	0.489	0.289	0.132	-0.099	1.000	
	0.000	0.000	0.000	0.000	0.000		
$Exchange$	0.003	-0.002	-0.058	-0.037	-0.058	-0.040	1.000
	0.789	0.847	0.000	0.001	0.000	0.000	

(Note) The exchange rate data is from https://www.oanda.com/currency/average, calculated yearly with a base currency of the US Dollar. An increase in the exchange rate suggests a depreciation of the Japanese Yen.

We also examine the correlation coefficient of the cash flow and the exchange rate by the group in Table 4. There are some important findings from the correlation matrix for the two

groups. First, the operating cash flow of domestic-oriented groups is significantly correlated with the exchange rate, suggesting that when the Japanese Yen depreciates, the operating cash flow of domestic-oriented firms will decrease slightly. Although the correlation coefficient is small, the relationship is significant. However, there is no significant relationship between the export-oriented groups' operating cash flow and exchange rate. Second, the correlation coefficient of the export-oriented group in Investment is higher than the one of the domestic-oriented group. This may imply that export-oriented firms may generally allocate more operating cash flow in investment activities.

Table 5. The correlation matrix of residuals for the general SUR.

	I	$\Delta Cash$	Div	ΔE	ΔD
I	1				
$\Delta Cash$	-0.234	1			
Div	0.0084	-0.1081	1		
ΔE	0.1069	0.1905	-0.1444	1	
ΔD	0.6056	0.4623	0.0725	-0.1258	1
Breusch-Pagan test of independence: chi2(10)		17068.039,			

(Note) The dependent variables are uses of operating cash flow, including investment (I), the net change in cash holdings (ΔCash), dividend (Div), net equity issued (ΔE), and net debt issued (ΔD).

Table 5 presents the correlation matrix of residuals for the general SUR based on the Breusch-Pagan test[11]. The results suggest that the correlation of the residuals in I and ΔD equations is 0.6056, so we reject the hypothesis that the correlation is zero. This result is also in line with equation (1) and these are the reasons why instead of simple linear regression, the SUR method is adopted.

Hence, the first hypothesis we examine is:

Hypothesis 1: Export-oriented firms have different patterns of cash allocation from domestic-oriented firms do. More specifically, export-oriented firms generally have a higher portion of

[11] Breusch-Pagan test is generally used to test for heteroscedasticity in a linear regression model.

the investment than domestic-oriented firms do and accordingly, export-oriented firms hold less cash than domestic-oriented firms do.

To test the hypothesis, we utilize the grouped regressions to compare the coefficients of cash flow in the regressions. Our focuses are mainly on the coefficients of cash flow in the regressions of investment and cash holding levels. We predict:

$$\beta_1^I(domestic-oriented) < \beta_1^I(export-oriented)$$

$$\beta_1^{\Delta Cash}(domestic-oriented) > \beta_1^{\Delta Cash}(export-oriented)$$

Because export-oriented firms are supposed to have more investments than domestic-groups to cope with fierce competition in the global market. Besides, the features of high degree internationalization enable the export-oriented group to approach more investment opportunities with positive net present value.

After the GFC, there was a negative demand shock in the market, and firms were confronted with more uncertainties over the domestic and global markets. Meanwhile, global investors sought shelter in safe assets like the Japanese yen, resulting in a large appreciation of the Japanese yen in the period 2007 and 2012. Firms will likely increase their cash holding level during this period, but we are curious about whether firms will increase the investment due to the appreciation of the Japanese Yen and more feasible projects with positive NPV, or they will decrease the investment because of uncertainties in the future markets. After Abenomics in 2013, the Japanese Yen started a new turn of depreciation along with an expansionary fiscal policy to stimulate the markets and inflation. Our interest rises that how the cash allocation pattern will reply to such a positive demand shock. Besides, we also wonder whether there are significant differences between export-oriented groups and domestic-oriented groups under such impacts, or the partial effects from demand shocks.

The second hypothesis is:

Hypothesis 2: After the GFC in 2007 and after Abenomics in 2013, the cash allocation patterns of Japanese firms change significantly. Specifically, both the domestic-oriented and export-oriented group increase their cash holding and decrease the investment during the GFC. After the policy of Abenomics push-out, both groups increase the cash holding.

We predict that for each group:

$$\beta_1^I(before\ the\ GFC) > \beta_1^I(during\ the\ GFC)$$
$$\beta_1^{\Delta Cash}(before\ the\ GFC) < \beta_1^{\Delta Cash}(during\ the\ GFC)$$
$$\beta_1^{\Delta Cash}(before\ Abenomics) < \beta_1^{\Delta Cash}(after\ Abenomics)$$

Table 6. The benchmark regressions for two groups with a uniform set of independent variables.

	Domestic					*Export*				
Dependent	I_t	$\Delta Cash_t$	Div_t	ΔE_t	ΔD_t	I_t	$\Delta Cash_t$	Div_t	ΔE_t	ΔD_t
Independent										
CF_t	0.193***	0.352***	0.022***	-0.019***	-0.413***	0.220***	0.341***	0.015***	-0.009***	-0.415***
	(0.008)	(0.007)	(0.001)	(0.003)	(0.009)	(0.009)	(0.008)	(0.001)	(0.003)	(0.010)
$Sales_{t-1}$	0.009**	0.010***	-0.001***	0.003***	0.014***	0.005	0.010***	-0.002***	0.005***	0.007*
	(0.004)	(0.003)	(0.000)	(0.001)	(0.004)	(0.003)	(0.003)	(0.000)	(0.001)	(0.004)
$Asset_{t-1}$	0.070***	-0.004	-0.001	0.001	0.064***	0.098***	-0.023***	0.000	0.004***	0.071***
	(0.005)	(0.004)	(0.001)	(0.002)	(0.005)	(0.005)	(0.005)	(0.001)	(0.002)	(0.006)
$Leverage_{t-1}$	-0.010***	-0.013***	-0.002***	0.004***	-0.029***	-0.009***	-0.017***	-0.005***	0.008***	-0.039***
	(0.002)	(0.002)	(0.000)	(0.001)	(0.002)	(0.002)	(0.002)	(0.000)	(0.001)	(0.002)
$Profit_{t-1}$	0.041***	-0.024***	0.041***	-0.044***	0.101***	0.044***	-0.020**	0.044***	-0.020***	0.089***
	(0.008)	(0.007)	(0.001)	(0.003)	(0.009)	(0.010)	(0.009)	(0.001)	(0.003)	(0.011)
$Tobin's\ q_{t-1}$	0.012***	-0.005***	0.005***	0.002***	0.010***	0.008***	-0.004***	0.004***	0.000	0.009***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)
$Tangibility_{t-1}$	0.038***	-0.012***	0.002***	-0.001	0.029***	0.057***	-0.016***	0.005***	-0.001	0.048***
	(0.002)	(0.002)	(0.000)	(0.001)	(0.002)	(0.003)	(0.003)	(0.000)	(0.001)	(0.003)
$Fluctuation_{t-1}$	0.016	0.024***	0.022***	0.005	0.058***	-0.042*	0.071***	0.056***	-0.058***	0.143***
	(0.010)	(0.009)	(0.001)	(0.003)	(0.012)	(0.024)	(0.022)	(0.003)	(0.007)	(0.028)
Observations	11,271	11,271	11,271	11,271	11,271	9,145	9,145	9,145	9,145	9,145
R-squared	0.469	0.166	0.717	0.056	0.192	0.592	0.176	0.803	0.048	0.199

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

(Note) The dependent variables are uses of operating cash flow, including investment (I), the net change in cash holdings (ΔCash), dividend (Div), net equity issued (ΔE), and net debt issued (ΔD). These variables are all centralized by total assets. Sales is the growth rate of a firm's sales and Asset refers to the growth rate of total assets. Leverage is described by debt over assets. Profit is the net profit ratio, calculated by the net income divided by sales. Tobin's q is calculated by total market value over the total asset value of a firm. Tangibility is a firm's tangibility, calculated by fixed assets over total assets. Fluctuation is the fluctuation of an industries' operating cash flow. It is described by the standard deviation of CF in the industry. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

3.3 Regression Analyses

3.3.1 The benchmark regression result

Table 6 presents the benchmark regression results with all control variables and a uniform set of independent variables. The cash allocation patterns of domestic-oriented and export-oriented groups manifest some differences over the coefficients of cash flow in the regressions of investments and cash holding levels. In general, domestic-oriented firms hold more cash than export-oriented firms, with a coefficient of 0.352 to 0.341 in the regressions of cash holdings. Besides, export-oriented firms invest more than domestic-oriented firms do. The coefficient of cash flow in the regression of investment for export-oriented firms is 0.22 while that for domestic-oriented firms is 0.193. We notice that the independent variables are not all significant in the multiple regressions. For instance, Assets are not significant in the regression of cash holdings, dividend payment, and equity financing in the domestic-oriented group. However, we cannot neglect the influences from the constraints of equations (7) and (8). If an independent variable is not significant in one sub regression while its coefficient is still effective in the constraints' equation, the effects from other significant factors could be distorted in order to satisfy the constraints.

Table 7. The regression results for two groups with different sets of independent variables.

	Domestic					*Export*				
Dependent	I_t	$\Delta Cash_t$	Div_t	ΔE_t	ΔD_t	I_t	$\Delta Cash_t$	Div_t	ΔE_t	ΔD_t
Independent										
CF_t	0.194***	0.354***	0.023***	-0.016***	-0.414***	0.217***	0.341***	0.015***	-0.013***	-0.414***
	(0.008)	(0.007)	(0.001)	(0.003)	(0.009)	(0.009)	(0.008)	(0.001)	(0.003)	(0.010)
$Sales_{t-1}$		0.006***	-0.002***	0.005***			0.009***	-0.002***	0.007***	
		(0.001)	(0.000)	(0.001)			(0.001)	(0.000)	(0.001)	
$Leverage_{t-1}$	-0.008***	-0.013***	-0.002***	0.004***	-0.027***	-0.010***	-0.020***	-0.005***	0.003***	-0.038***
	(0.001)	(0.002)	(0.000)	(0.000)	(0.002)	(0.002)	(0.002)	(0.000)	(0.000)	(0.002)
$Profit_{t-1}$	0.047***	-0.021***	0.040***	-0.035***	0.102***	0.048***	-0.038***	0.044***	-0.029***	0.083***
	(0.008)	(0.007)	(0.001)	(0.002)	(0.009)	(0.009)	(0.008)	(0.001)	(0.002)	(0.011)
$Tobin's\ q_{t-1}$	0.012***	-0.006***	0.005***		0.011***	0.008***	-0.004***	0.004***		0.008***
	(0.001)	(0.001)	(0.000)		(0.001)	(0.001)	(0.001)	(0.000)		(0.001)
$Tangibility_{t-1}$	0.038***	-0.012***	0.002***		0.028***	0.056***	-0.014***	0.005***		0.047***
	(0.002)	(0.002)	(0.000)		(0.002)	(0.003)	(0.002)	(0.000)		(0.003)
$Fluctuation_{t-1}$		0.026***	0.023***		0.048***		0.102***	0.054***		0.156***
		(0.009)	(0.001)		(0.009)		(0.021)	(0.003)		(0.021)
$Asset_{t-1}$	0.073***				0.073***	0.094***				0.094***
	(0.004)				(0.004)	(0.004)				(0.004)
Observations	11,271	11,271	11,271	11,271	11,271	9,145	9,145	9,145	9,145	9,145
R-squared	0.468	0.166	0.717	0.049	0.191	0.591	0.174	0.802	0.039	0.198

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

(Note) The dependent variables are uses of operating cash flow, including investment (I), the net change in cash holdings (ΔCash), dividend (Div), net equity issued (ΔE), and net debt issued (ΔD). These variables are all centralized by total assets. Sales is the growth rate of a firm's sales and Asset refers to the growth rate of total assets. Leverage is described by debt over assets. Profit is the net profit ratio, calculated by the net income divided by sales. Tobin's q is calculated by total market value over the total asset value of a firm. Tangibility is a firm's tangibility, calculated by fixed assets over total assets. Fluctuation is the fluctuation of an industries' operating cash flow. It is described by the standard deviation of CF in the industry. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

Therefore, we eliminate insignificant independent variables in each sub regressions and design a multiple regression with different sets of explanatory variables. The results are not much different compared to the results in Table 6 if we remove some of the control variables, but the coefficients in Table 7 are not distorted by the constraints and are unbiased.

Table 7 exhibits the regression results with different sets of control variables. All the independent variables are significant at a significant level of 0.01. Although the exact effects from control variables in the two groups are not the same, the direction of how they influence the dependent variables are consistent. For example, the coefficients of net profit margin, Profit, are 0.047 and 0.048 in the regressions of investment in a domestic-oriented and export-oriented group, implying that one unit increase in net profit margin will lead to 0.047 and 0.048 unit increase in the cash flow infusing to investment activities. And similarly, one unit increase in net profit margin will lower the cash holding level by 0.021 and 0.038 units in the domestic-oriented and export-oriented group. According to the constraint of equation (8), the coefficients of control variables sum up to zero. Neither provides an extra source of cash flow nor constitutes use of cash flow, control variables just impact how the cash flow is allocated among various uses and the net effect of changes in the control variable is zero.

The coefficients of cash flow in investment are 0.194 and 0.217 in the domestic-oriented and export-oriented groups. It suggests that a one-unit increase in cash flow will result in a 0.194 and 0.217 increase in investment for two groups and the export-oriented group infuses more cash flow in investment than domestic-groups do. Meanwhile, the coefficients of cash flow in cash holding are 0.354 and 0.341, respectively. This implies that the domestic-oriented group holds more cash than export-oriented groups do.

3.3.2 The Impact of the GFC and Abenomics

Table 8 and Table 9 show the impact of the GFC for both domestic-oriented and export-oriented groups. During the GFC, both groups significantly increase the cash holding level. For the domestic-oriented group, before the GFC the average cash holding level is 0.338 and the

coefficient of investment is 0.207. Due to the impact of the GFC, the cash holding level increases to 0.362 while the coefficient of investment is 0.166. Similarly, for the export-oriented group, before the GFC the average cash holding level is 0.281 and the coefficient of investment is 0.280. During the period of GFC, the cash holding level remarkably increases to 0.371. accompanied by a large decline in investment to 0.144.

Table 8. The regression results examining the influence of the GFC for domestic-oriented groups

	Domestic before GFC					*Domestic during GFC*				
Dependent	I_t	$\Delta Cash_t$	Div_t	ΔE_t	ΔD_t	I_t	$\Delta Cash_t$	Div_t	ΔE_t	ΔD_t
Independent										
CF_t	0.207***	0.338***	0.015***	-0.022***	-0.418***	0.166***	0.362***	0.022***	-0.014***	-0.436***
	(0.012)	(0.011)	(0.001)	(0.004)	(0.014)	(0.012)	(0.012)	(0.002)	(0.004)	(0.015)
$Sales_{t-1}$		0.007***	-0.000	0.007***			0.003	-0.001**	0.002	
		(0.002)	(0.001)	(0.002)			(0.002)	(0.001)	(0.002)	
$Leverage_{t-1}$	-0.017***	-0.013***	-0.002***	0.005***	-0.037***	-0.000	-0.015***	-0.001**	0.004***	-0.020***
	(0.002)	(0.002)	(0.000)	(0.000)	(0.003)	(0.002)	(0.003)	(0.000)	(0.000)	(0.003)
$Profit_{t-1}$	0.034***	-0.043***	0.032***	-0.031***	0.054***	0.057***	-0.023*	0.048***	-0.042***	0.123***
	(0.012)	(0.011)	(0.001)	(0.004)	(0.014)	(0.013)	(0.012)	(0.002)	(0.004)	(0.015)
$Tobin's\ q_{t-1}$	0.014***	-0.004***	0.004***		0.014***	0.016***	-0.007***	0.008***		0.017***
	(0.001)	(0.001)	(0.000)		(0.001)	(0.002)	(0.002)	(0.000)		(0.002)
$Tangibility_{t-1}$	0.042***	-0.011***	0.003***		0.034***	0.034***	-0.011***	0.001***		0.025***
	(0.003)	(0.003)	(0.000)		(0.003)	(0.003)	(0.003)	(0.000)		(0.003)
$Fluctuation_{t-1}$		0.003	0.021***		0.024*		0.030**	0.013***		0.042***
		(0.014)	(0.002)		(0.014)		(0.013)	(0.002)		(0.012)
$Asset_{t-1}$	0.087***				0.087***	0.059***				0.059***
	(0.006)				(0.006)	(0.007)				(0.007)
Observations	4,845	4,845	4,845	4,845	4,845	3,975	3,975	3,975	3,975	3,975
R-squared	0.470	0.142	0.723	0.047	0.216	0.478	0.184	0.744	0.065	0.199

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

(Note) The dependent variables are uses of operating cash flow, including investment (I), the net change in cash holdings (ΔCash), dividend (Div), net equity issued (ΔE), and net debt issued (ΔD). These variables are all centralized by total assets. Sales is the growth rate of a firm's sales and Asset refers to the growth rate of total assets. Leverage is described by debt over assets. Profit is the net profit ratio, calculated by the net income divided by sales. Tobin's q is calculated by total market value over the total asset value of a firm. Tangibility is a firm's tangibility, calculated by fixed assets over total assets. Fluctuation is the fluctuation of an industries' operating cash flow. It is described by the standard deviation of CF in the industry. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

Table 9. The regression results examining the influence of the GFC for export-oriented groups

	Export before GFC					*Export during GFC*				
Dependent	I_t	$\Delta Cash_t$	Div_t	ΔE_t	ΔD_t	I_t	$\Delta Cash_t$	Div_t	ΔE_t	ΔD_t
Independent										
CF_t	0.280***	0.281***	0.010***	-0.012***	-0.417***	0.144***	0.371***	0.013***	-0.013***	-0.458***
	(0.014)	(0.013)	(0.001)	(0.005)	(0.016)	(0.014)	(0.013)	(0.002)	(0.004)	(0.017)
$Sales_{t-1}$		0.014***	-0.002***	0.012***			0.005***	-0.000	0.005***	
		(0.002)	(0.001)	(0.002)			(0.001)	(0.001)	(0.001)	
$Leverage_{t-1}$	-0.018***	-0.019***	-0.005***	0.003***	-0.044***	-0.004	-0.018***	-0.004***	0.003***	-0.029***
	(0.003)	(0.003)	(0.000)	(0.001)	(0.003)	(0.003)	(0.003)	(0.000)	(0.000)	(0.004)
$Profit_{t-1}$	-0.027*	-0.026**	0.034***	-0.035***	0.016	0.108***	-0.031**	0.036***	-0.026***	0.139***
	(0.015)	(0.013)	(0.002)	(0.004)	(0.017)	(0.015)	(0.014)	(0.002)	(0.003)	(0.018)
$Tobin's\ q_{t-1}$	0.014***	-0.003**	0.005***		0.016***	0.014***	-0.011***	0.010***		0.013***
	(0.002)	(0.002)	(0.000)		(0.002)	(0.003)	(0.003)	(0.000)		(0.003)
$Tangibility_{t-1}$	0.052***	-0.010***	0.005***		0.048***	0.056***	-0.013***	0.006***		0.049***
	(0.004)	(0.004)	(0.000)		(0.004)	(0.005)	(0.005)	(0.001)		(0.006)
$Fluctuation_{t-1}$		0.042	0.041***		0.083***		0.113***	0.028***		0.141***
		(0.032)	(0.004)		(0.032)		(0.034)	(0.004)		(0.034)
$Asset_{t-1}$	0.134***				0.134***	0.057***				0.057***
	(0.007)				(0.007)	(0.007)				(0.007)
Observations	4,070	4,070	4,070	4,070	4,070	3,166	3,166	3,166	3,166	3,166
R-squared	0.603	0.111	0.825	0.046	0.247	0.595	0.227	0.817	0.041	0.212

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

(Note) The dependent variables are uses of operating cash flow, including investment (I), the net change in cash holdings (ΔCash), dividend (Div), net equity issued (ΔE), and net debt issued (ΔD). These variables are all centralized by total assets. Sales is the growth rate of a firm's sales and Asset refers to the growth rate of total assets. Leverage is described by debt over assets. Profit is the net profit ratio, calculated by the net income divided by sales. Tobin's q is calculated by total market value over the total asset value of a firm. Tangibility is a firm's tangibility, calculated by fixed assets over total assets. Fluctuation is the fluctuation of an industries' operating cash flow. It is described by the standard deviation of CF in the industry. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

Therefore, we may suggest that under the impact of the GFC, both domestic-oriented and export-oriented groups significantly increase their cash holding level in case of large fluctuations and uncertainties in the market. Accordingly, investments in both groups largely decline and the export-oriented group manifests an even larger shrink to almost half of the pre-GFC level. Other changes in dividend payment and external financing are relatively trivial and are not the main focuses of our research. Before we make conclusions that during the GFC period, both groups decrease the investment and increase the cash holding level, it is noteworthy that some control variables become insignificant in the subgroups. For instance, in table 9, the coefficient of net profit margin in the regression of investment before the GFC is -0.027, which is not quite significant (only significant in 0.1 level), and it is apparently flawed or, illogical. The relationship between the net profit margin and investment should be positive, and we observe a coefficient of 0.108 in the regression after the GFC. This problem could potentially arise due to coefficient distortion.

Table 10. The regression results examining the influence of Abenomics for domestic-oriented groups

	Before Abenomics					*After Abenomics*				
Dependent	I_t	$\Delta Cash_t$	Div_t	ΔE_t	ΔD_t	I_t	$\Delta Cash_t$	Div_t	ΔE_t	ΔD_t
Independent										
CF_t	0.194***	0.351***	0.020***	-0.018***	-0.416***	0.193***	0.362***	0.031***	-0.008	-0.407***
	(0.009)	(0.008)	(0.001)	(0.003)	(0.010)	(0.017)	(0.015)	(0.002)	(0.006)	(0.018)
$Sales_{t-1}$		0.006***	-0.002***	0.005***			0.004	-0.002*	0.003	
		(0.001)	(0.000)	(0.001)			(0.003)	(0.001)	(0.002)	
$Leverage_{t-1}$	-0.010***	-0.015***	-0.002***	0.005***	-0.032***	-0.001	-0.007*	-0.003***	0.004***	-0.015***
	(0.002)	(0.002)	(0.000)	(0.000)	(0.002)	(0.003)	(0.004)	(0.001)	(0.001)	(0.004)
$Profit_{t-1}$	0.044***	-0.034***	0.040***	-0.036***	0.087***	0.051***	0.012	0.040***	-0.034***	0.136***
	(0.009)	(0.008)	(0.001)	(0.003)	(0.010)	(0.017)	(0.015)	(0.002)	(0.005)	(0.018)
$Tobin's\ q_{t-1}$	0.014***	-0.006***	0.005***		0.013***	0.006***	-0.006***	0.004***		0.004**
	(0.001)	(0.001)	(0.000)		(0.001)	(0.002)	(0.001)	(0.000)		(0.002)
$Tangibility_{t-1}$	0.039***	-0.011***	0.003***		0.031***	0.033***	-0.017***	0.001		0.017***
	(0.002)	(0.002)	(0.000)		(0.002)	(0.004)	(0.003)	(0.001)		(0.004)
$Fluctuation_{t-1}$		0.026***	0.021***		0.046***		0.065**	0.047***		0.112***
		(0.009)	(0.001)		(0.009)		(0.028)	(0.005)		(0.028)
$Asset_{t-1}$	0.071***				0.071***	0.085***				0.085***
	(0.004)				(0.004)	(0.010)				(0.010)
Observations	8,820	8,820	8,820	8,820	8,820	2,451	2,451	2,451	2,451	2,451
R-squared	0.469	0.160	0.713	0.052	0.201	0.472	0.206	0.738	0.038	0.167

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

(Note) The dependent variables are uses of operating cash flow, including investment (I), the net change in cash holdings (ΔCash), dividend (Div), net equity issued (ΔE), and net debt issued (ΔD). These variables are all centralized by total assets. Sales is the growth rate of a firm's sales and Asset refers to the growth rate of total assets. Leverage is described by debt over assets. Profit is the net profit ratio, calculated by the net income divided by sales. Tobin's q is calculated by total market value over the total asset value of a firm. Tangibility is a firm's tangibility, calculated by fixed assets over total assets. Fluctuation is the fluctuation of an industries' operating cash flow. It is described by the standard deviation of CF in the industry. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

Table 11. The regression results examining the influence of Abenomics for export-oriented groups

	Before Abenomics					*After Abenomics*				
Dependent	I_t	$\Delta Cash_t$	Div_t	ΔE_t	ΔD_t	I_t	$\Delta Cash_t$	Div_t	ΔE_t	ΔD_t
Independent										
CF_t	0.216***	0.332***	0.013***	-0.013***	-0.427***	0.211***	0.383***	0.023***	-0.017**	-0.366***
	(0.010)	(0.009)	(0.001)	(0.003)	(0.012)	(0.019)	(0.019)	(0.003)	(0.007)	(0.022)
$Sales_{t-1}$		0.010***	-0.002***	0.008***			0.005*	0.000	0.006**	
		(0.001)	(0.000)	(0.001)			(0.003)	(0.001)	(0.002)	
$Leverage_{t-1}$	-0.013***	-0.021***	-0.005***	0.003***	-0.041***	-0.002	-0.015***	-0.005***	0.005***	-0.026***
	(0.002)	(0.002)	(0.000)	(0.000)	(0.003)	(0.004)	(0.004)	(0.001)	(0.001)	(0.005)
$Profit_{t-1}$	0.042***	-0.036***	0.038***	-0.030***	0.074***	0.010	-0.030*	0.056***	-0.024***	0.061***
	(0.011)	(0.009)	(0.001)	(0.003)	(0.012)	(0.018)	(0.017)	(0.003)	(0.006)	(0.021)
$Tobin's\ q_{t-1}$	0.013***	-0.007***	0.005***		0.012***	-0.002	-0.000	0.002***		0.000
	(0.001)	(0.001)	(0.000)		(0.002)	(0.002)	(0.002)	(0.000)		(0.002)
$Tangibility_{t-1}$	0.056***	-0.012***	0.005***		0.049***	0.051***	-0.017***	0.003***		0.037***
	(0.003)	(0.003)	(0.000)		(0.004)	(0.005)	(0.005)	(0.001)		(0.006)
$Fluctuation_{t-1}$		0.117***	0.048***		0.165***		0.042	0.071***		0.113**
		(0.023)	(0.003)		(0.023)		(0.054)	(0.008)		(0.053)
$Asset_{t-1}$	0.093***				0.093***	0.126***				0.126***
	(0.005)				(0.005)	(0.011)				(0.011)
Observations	7,236	7,236	7,236	7,236	7,236	1,909	1,909	1,909	1,909	1,909
R-squared	0.589	0.162	0.803	0.043	0.212	0.626	0.239	0.817	0.031	0.147

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

(Note) The dependent variables are uses of operating cash flow, including investment (I), the net change in cash holdings (ΔCash), dividend (Div), net equity issued (ΔE), and net debt issued (ΔD). These variables are all centralized by total assets. Sales is the growth rate of a firm's sales and Asset refers to the growth rate of total assets. Leverage is described by debt over assets. Profit is the net profit ratio, calculated by the net income divided by sales. Tobin's q is calculated by total market value over the total asset value of a firm. Tangibility is a firm's tangibility, calculated by fixed assets over total assets. Fluctuation is the fluctuation of an industries' operating cash flow. It is described by the standard deviation of CF in the industry. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

Table 10 and Table 11 present the impact of Abenomics on both domestic-oriented and export-oriented groups. For the domestic-oriented group, there seems no significant change before and after Abenomics in the coefficients of investment and cash holding. For the export-oriented group, the cash holding level is 0.383 and it is significantly higher than the one in the pre-Abenomics period. The coefficients of investment maintain stable in the two periods and the increase in cash holding is mainly driven by debt financing. Still, there are some control variables insignificant in the subgroups again so that the coefficients could be distorted by the constraints. It is noteworthy that Leverage, net profit margin, and Tobin's q are not significant in the regression of investment after Abenomics for the export-oriented group, shown in table 11. Therefore, the result is not referable to the regressions before Abenomics nor with the regressions for the domestic-oriented group in the same period.

3.3.3 Robustness Test

To make sure the findings are robust, we conduct the following tests. Instead of using grouped regression, we make an attempt to include the dummy variables and cross terms with cash flow. Meanwhile, as we noticed that there could be different effects from the control variables in two groups, we decide to reduce the uses of control variables and only maintain the ones that are significant all the way. Control variables maintained are $Leverage$, $Profit$, and $Tangibility$. $Leverage$ is the ratio of debt over assets. $Profit$ is the net profit ratio, calculated by the net income divided by sales. $Tangibility$ is a firm's tangibility, calculated by fixed assets over total assets.

We incorporate three dummy variables to analyze the differences between the two groups and the differences between the two external shocks. D_1 takes zero for domestic-oriented firms and one for export-oriented firms. We include the cross-terms of cash flow with this dummy to allow the different coefficients for the export-oriented firms. D_2 takes zero for observations from 2001 to 2007 and one for observations from 2008 to 2012, and the dummy D_3 takes zero

for observations from 2001 to 2012 and one for observations from 2013 to 2015. The influence of the GFC and Abenomics are tested in separate regressions.

Table 12. The regression result of examining the influence of the GFC

Dependent	I_t	$\Delta Cash_t$	Div_t	ΔE_t	ΔD_t
Independent					
CF_t	0.187***	0.325***	0.011***	-0.015***	-0.462***
	(0.010)	(0.009)	(0.001)	(0.003)	(0.011)
$D_1 * CF_t$	0.089***	-0.037***	0.003**	0.002	0.052***
	(0.012)	(0.011)	(0.002)	(0.004)	(0.014)
$D_2 * CF_t$	-0.001	0.036***	0.022***	-0.002	0.059***
	(0.012)	(0.010)	(0.002)	(0.004)	(0.013)
$D_1 * D_2 * CF_t$	-0.019	0.039**	-0.002	-0.001	0.019
	(0.017)	(0.015)	(0.002)	(0.006)	(0.020)
$Leverage_{t-1}$	-0.009***	-0.013***	-0.001***	0.005***	-0.028***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.002)
$Profit_{t-1}$	0.151***	-0.041***	0.064***	-0.027***	0.201***
	(0.006)	(0.005)	(0.001)	(0.002)	(0.007)
$Tangibility_{t-1}$	0.044***	-0.013***	0.006***	-0.002***	0.039***
	(0.002)	(0.001)	(0.000)	(0.001)	(0.002)
Observations	16,056	16,056	16,056	16,056	16,056
R-squared	0.494	0.163	0.700	0.044	0.184

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

(Note) The dependent variables are uses of operating cash flow, including investment (I), the net change in cash holdings (ΔCash), dividend (Div), net equity issued (ΔE), and net debt issued (ΔD). These variables are all centralized by total assets. Sales is the growth rate of a firm's sales and Asset refers to the growth rate of total assets. Leverage is described by debt over assets. Profit is the net profit ratio, calculated by the net income divided by sales. Tobin′s q is calculated by total market value over the total asset value of a firm. Tangibility is a firm's tangibility, calculated by fixed assets over total assets. Fluctuation is the fluctuation of an industries' operating cash flow. It is described by the standard deviation of CF in the industry. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

Table 12 presents the regression result of examining the influence of the GFC. The coefficients of investment and cash holding levels of the domestic-oriented group before the GFC are 0.187 and 0.325, suggesting that one unit increase in cash flow will be allocated into investment and cash holding by 0.187 and 0.325 unit, respectively. The cross term of D_1 and CF is significant in the regressions of I, $\Delta Cash$, Div, and ΔD, suggesting that export-oriented companies infuse more cash flows into investing, holding less cash, delivering more dividend payment, and utilizing more external financing from liabilities. The coefficients of investment and cash holding for the export-oriented group are 0.276 and 0.288 before the GFC, which is

highly consistent with the findings in the grouped regression. The cross term of D_2 and CF is significant in the regressions of $\Delta Cash$, Div, and ΔD, suggesting that during the GFC, domestic-oriented firms significantly increase the cash holding level, pay more cash dividend, and utilize more external financing from liabilities. The cross term of D_1, D_2 and CF denotes the partial effect from the GFC to the export-oriented groups and it is only significant in the regression of $\Delta Cash$ with a 0.05 significance level. This implies that the export-oriented groups are affected by the GFC almost in the same patterns as domestic-oriented are, but export-oriented companies may hold more cash during the GFC. The most important finding in the robustness test is the cash flow infusing to investment activities is not affected by the external shock and the extra demand for cash holding is satisfied by liability financing. This is inconsistent with the findings in grouped regression that both groups significantly decrease the portion of the investment.

Table 13. The regression result of examining the influence of Abenomics

Dependent	I_t	$\Delta Cash_t$	Div_t	ΔE_t	ΔD_t
Independent					
CF_t	0.186***	0.338***	0.023***	-0.017***	-0.435***
	(0.007)	(0.007)	(0.001)	(0.002)	(0.008)
$D_1 * CF_t$	0.080***	-0.021***	0.002	0.002	0.059***
	(0.009)	(0.008)	(0.001)	(0.003)	(0.010)
$D_3 * CF_t$	0.004	0.062***	0.011***	0.010**	0.067***
	(0.012)	(0.011)	(0.002)	(0.004)	(0.014)
$D_1 * D_3 * CF_t$	-0.021	0.001	-0.001	-0.001	-0.021
	(0.019)	(0.017)	(0.003)	(0.006)	(0.021)
$Leverage_{t-1}$	-0.007***	-0.011***	-0.001***	0.005***	-0.024***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)
$Profit_{t-1}$	0.143***	-0.035***	0.064***	-0.027***	0.198***
	(0.005)	(0.005)	(0.001)	(0.002)	(0.006)
$Tangibility_{t-1}$	0.042***	-0.014***	0.005***	-0.002***	0.035***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.002)
Observations	20,416	20,416	20,416	20,416	20,416
R-squared	0.496	0.171	0.699	0.041	0.172

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

(Note) The dependent variables are uses of operating cash flow, including investment (I), the net change in cash holdings (ΔCash), dividend (Div), net equity issued (ΔE), and net debt issued (ΔD). These variables are all centralized by total assets. Sales is the growth rate of a firm's sales and Asset refers to the growth rate of total assets. Leverage is described by debt over assets. Profit is the net profit ratio, calculated by the net income divided by sales. Tobin's q is calculated by total market value over the total asset value of a firm. Tangibility is a firm's tangibility, calculated by fixed assets over total assets. Fluctuation is the fluctuation of an industries' operating cash flow. It is described by the standard deviation of CF in the industry. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

Table 13 presents the regression result of examining the influence of Abenomics. The coefficients of investment and cash holding levels of the domestic-oriented group before the GFC are 0.186 and 0.338, suggesting that one unit increase in cash flow will be allocated into investment and cash holding by 0.186 and 0.338 unit, respectively. The cross term of D_1 and CF is significant in the regressions of I, $\Delta Cash$, and ΔD, suggesting that export-oriented companies infuse more cash flows into investing, holding less cash, and utilizing more external financing from liabilities. There are no significant differences in the dividend payment and equity financing in the period of 2001 to 2012. The cross term of D_3 and CF is significant in the regressions of $\Delta Cash$, Div, ΔE, and ΔD, suggesting that after Abenomics, domestic-oriented firms significantly increase the cash holding level, pay more cash dividend, and utilize more external financing from both equity and liability tools. The cross term of D_1, D_3 and CF denotes the partial effect from Abenomics to the export-oriented groups and it is not significant in any regression, implying the export-oriented groups react to Abenomics in the same patterns with domestic-oriented groups. Still, the cash flow allocated to investment activities is relatively stable and the demand for holding more cash is satisfied merely by increasing liability financing.

The advantages of using the same set of control variables are that there are no insignificant control variables so that the coefficients will not be distorted, and it is easier to compare the coefficients of different groups in different periods. However, one of the problems is that we assume the control variables have the same effects on the dependent variables, though we have already observed that the control variables have slightly different impacts on different dependent variables in the sub-regressions. This could be one of the reasons to explain why the findings in the robustness test are inconsistent with the ones in grouped regression. In the robustness test, the differences between the domestic-oriented and export-oriented groups in investment are ironed with a larger amount of observations. Besides, the impacts from the GFC are covered by a more significant difference between the characteristics of the two groups themselves. Another important reason could be the emit of control variables, which is implied

from the R-square in the grouped regression and robustness tests. The R-square in grouped regression of investment for the export-oriented group is around 0.6 and it is much higher than the one in grouped regression of investment for domestic-oriented group or in robustness tests. This convinces us that the control variables have different impacts on the dependent variables for different groups.

Therefore, the conclusions are that during the GFC, both groups have suffered from the negative demand shock so that they both increase the cash holding level while decrease the portion of the investment. Export-oriented firms seem to be more vulnerable under such a world-wide impact and manifest large fluctuations in cash holding and investment activities. However, the effect of Abenomics is relatively small, as firms are not responding to the simulating policies by increasing investment input. Instead, both groups continuing increasing the cash holding level and tend to utilize more debt financing than ever before. Hence the effectiveness of Abenomics over stimulating the firms' investment is still to be evaluated with more time. However, it is noteworthy that there are general differences in the cash allocation patterns and decisive factors between domestic-oriented and export-oriented groups. Domestic-oriented firms hold more cash and investment less than export-oriented firms do, and export-oriented firms are more sensitive to external shocks. Besides, traditional control variables have less explanatory power in the aspect of investment activities in the domestic-oriented group than in the export-oriented group.

3.4 Conclusions

In the research, we examine the cash allocation of firms listed in the Japanese market by separating them into domestic-oriented and export-oriented groups. Different from the traditional researches that focus on financially constrained or unconstrained firms, we provide a new idea analyzing firms' cash allocation patterns according to the major markets they face.

We reveal that export-oriented firms are more likely to hold less cash and contribute more generated cash flow to investment than domestic-oriented firms do. This phenomenon is

probably related to a higher competitive global market faced by export-oriented firms. To maintain the leading positions in the global competitions and continuous growth, Japanese export-oriented firms infuse more cash flow to investment activities. Besides, the promising performance and stable growth enable the export-oriented groups to utilize more debt financing than domestic-oriented firms do. Another proper explanation could be involving the theory of Product Life Cycle Stages. Export-oriented firms benefited from continuous input in investment and much broader global markets, are able to maintain a growth stage for a longer period. The features of domestic-oriented firms, however, are more similar to the patterns of "cash-cow" firms. They are usually in the maturity stage and there are barely any potentials in their industries. Therefore, they decrease investment in their industries while increase the cash holding, in case of new investment opportunities to diversify their business and to create new growth chances.

Another important finding over the two group firms is that control variables do not have a uniform effect on deciding firms' cash allocation. Previous studies related to cash allocation or cash flow sensitivity rely on the use of control variables massively. In a long-period scale, control variables may be functioning well. However, the impacts of control variables are not always the same. They are different in different groups of firms and sometimes lose efficiency during some external shocks, such as the GFC. It is reasonable that under a massive external shock like the GFC, firms will put survival in the first place, instead of considering theoretical optimal capital structure or financial stability.

We shed light on how firms respond to the external impacts of the GFC and Abenomics. According to our findings, both groups significantly increase the cash holding and decrease the investment portions during the GFC. Export-oriented firms are more vulnerable in such massive negative shock and manifest larger fluctuations in investment and cash holding. However, the impact or effectiveness of Abenomics is still worth observing in a longer time, as after 2013, the portions of investment for both groups do not appear a significant increase. Both domestic-oriented and export-oriented firms choose to continue increasing cash holding and to increase

debt financing after the inauguration of Abenomics. It is not likely for both domestic-oriented and export-oriented firms to hold excessive cash acquiring from operating activities and external financing for a long time because it will result in inefficient use of cash flow. The large accumulation of cash holding and capital makes it possible to undertake massive investments in the future and we are optimistic to see a rapid increase in investment activities in the coming years.

4. Data Circulation and Future Research

In this chapter, we will demonstrate the relationship between the doctoral dissertation and data circulation and discuss the potential implications in future research.

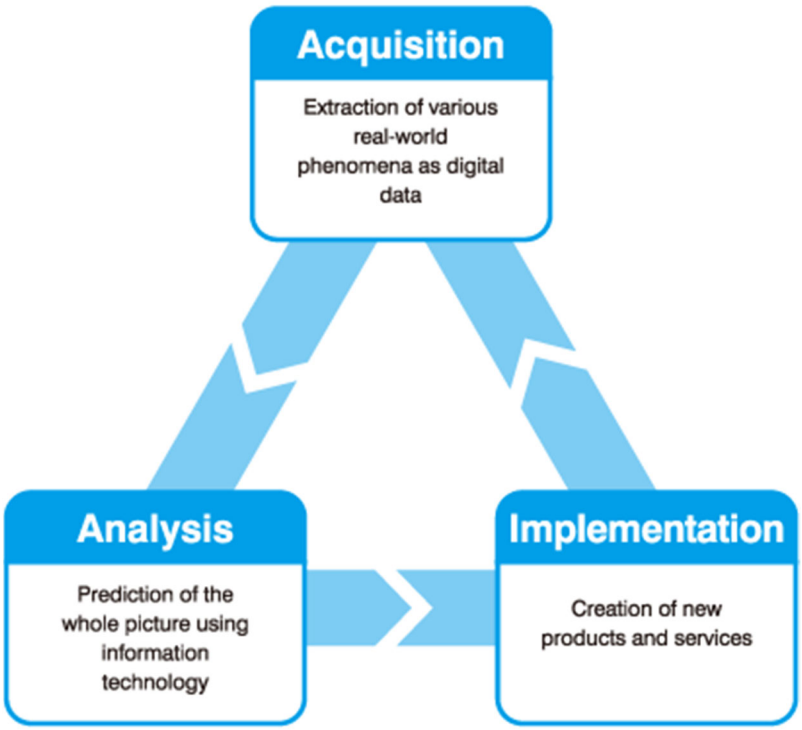
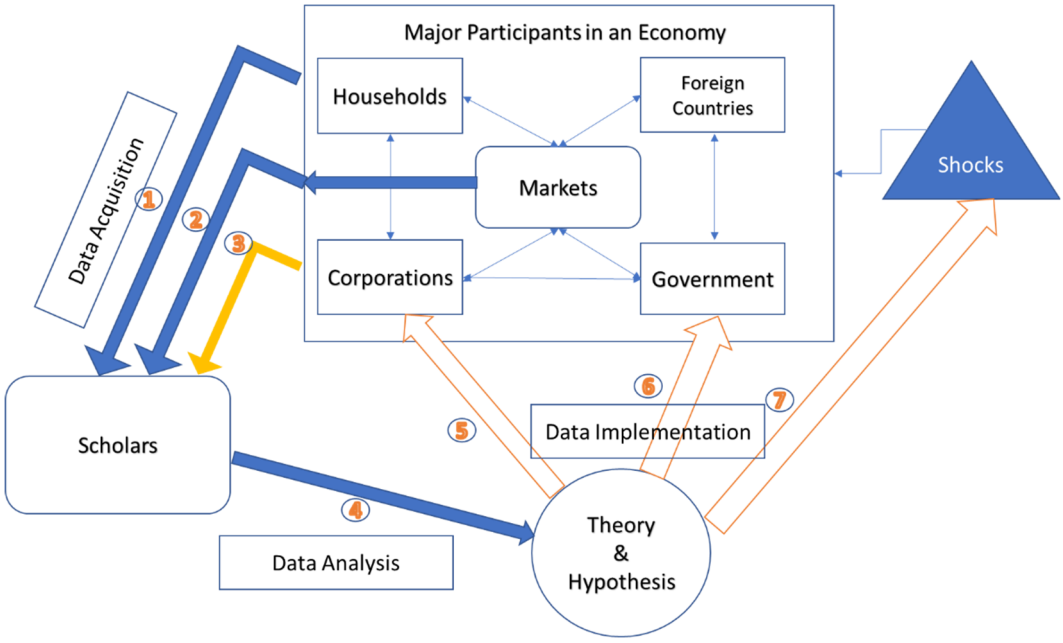


Figure 1. The prototype of the concept of data circulation

Figure 1 can be accessed from the official website of the Graduate Program for Real-World Data Circulation, Nagoya University (https://www.leading.nagoya-u.ac.jp/eng/program/program05.html). The prototype of data circulation consists of three flows: data acquisition refers to the extraction of various real-world phenomena as digital data; data analysis refers to the prediction of the whole picture using various technologies, such as mathematics, statistics, or the frontier of machine learning and artificial intelligence; implementation refers to the process of creation of new products and services according to the result of the data analysis. The three flows of data operate as a circulation. In a large variety of manufacturing and designing process, the data circulation has great adaptability and greatly contributes to the improvement of the product and manufacturing process.



(Notes) The figure is a simplified framework of how the data and information circulation operates in economic studies. Major participants in an economy include households, corporations, markets, government, and foreign countries. Markets include goods markets, financial markets, etc. Arrow ①-③ represent the data acquisition process; Arrow ④ represents the data analysis process; Arrow ⑤-⑦represent the data implementation process.

Figure 2. The generalized data and influence circulation of the macroeconomics

However, the data circulation in the field of economic and empirical research is more outstanding yet much more complicated than the industrial level. The most significant problem is that there are so many participants in the daily economic activities and these activities simultaneously cointegrate with each other and constitute continual screenshots of the economic condition, *i.e.*, the yearly financial statements of corporations, the quarterly or monthly macroeconomic statistics, and national census in an even longer period. Therefore, in our dissertation, we attempt to propose a potential inference or application of data circulation in terms of economic and empirical research as shown in Figure 2. Figure 2 is closely related to Chapter 3, the discussion of corporations' cash allocation when encountering shocks and changes in economic policy. We simplify the major structures using four major constitutes, macroeconomy, scholars, theory & hypothesis, and shocks. The slim arrow represents the

potential influence, while the solid thick arrow represents the actual data flow observed. The hollow thick arrow represents the data and information predicted.

Before introducing how the data circulation framework operates, it is necessary to briefly examine the basic relationship diagram of Macroeconomics. We simplify the key roles in the operation of macroeconomics as families, corporations, the government, various markets, as well as import and export. It can be clearly seen that these major roles are mutually influenced. For example, families or citizens take part in economic activities as laborers and work for corporations. Meanwhile, families are also the major destinations for the products or services produced by corporations. The mutual relationship is mainly reflected by commonly known economic indicators, such as wage levels, corporations' sales, profits, and other economic indicators. Besides, the government acts as a monitor and corrector aiming for stable economic growth and promotion of social justice. More specifically, the government may formulate specific supportive policies to improve the national competitiveness in key industries, and it can also directly intervene in the markets to avoid market panics or market deficiency. Indeed, the inner relationships among the major constitutes of an economy are extremely grand topics and there are a large number of studies over any specific relationship. For instance, Boivin et al., (2010) review the theory development in turns of the monetary policy transmission mechanisms. Claessens et al., (2012) use the information from firms' financial statements to investigate how the global financial crisis propagates in the economic entities, such as firms and banks. Due to the limitation of the length and not being the major concerns of the dissertation, we do not look into the specific relationships nor extend the explanations in detail.

Similar to the prototype, the first step in the data circulation is data collection, which is represented by the solid thick arrows. Due to the complexity of macroeconomic systems, there are actually various data that may potentially help to explain how the systems work. In addition, potentially for different research interests, the different data flows may have their explanatory power.

Arrow① represents the data flow related to the families and one of the most intuitive data is the national census, which provides a rather detailed profile of each family. However, there are also many disadvantages to using the national census as a major database. The national census works as a screenshot of continuous economic activities, policy changes, and social changes with a long interval so that the depth for research is questionable, even though it is highly referable when judging the government's long-term performance.

Arrow② represents the data flow related to various forms of markets and these data are usually reported and reflected in rapid frequencies. For example, the stock index, futures index, interest rates are reliably recorded every minute and they are most sensitive to any unexpected shock or new information. The second data flow is of great essence in research over the market's short-term response to a sudden shock or event.

Arrow ③ represents the data flow from the corporations. There are many forms of data correspondent to corporations while the most important information source is corporations' financial statements. There are many advantages to utilize the information of the financial statements as economic and empirical research. First, the data flow is relatively reliable and objective when compared to data flow from the market or data flow from a long period. The financial statements are disclosed under a series of standardized requirements from the accounting aspect so that they accurately and objectively reflect the operating outcomes during a specific period. Second, the data flow is convenient to collect and analyzed. The information from the financial statements are well defined and by examining the specific items, we are able to have a clear idea of how the corporation operates. More specifically, the patterns behind the figures can help investors, managers, or scholars form a reliable expectation over the future period. For instance, if a firm exhibits a considerable accounting profit but a suspiciously low operating cash flow, there is a chance that the firm sacrifices its future profitability to make current conditions not so disappointing. Third, as the major participants in economic activities, the performances of corporations largely reflect the conditions of the macroeconomics.

Therefore, based on these merits, we formulate the data circulation from the corporations' financial statements.

Arrow ④ represents the process of data analysis. Different from other scientific studies that formulate accurate equations, economic studies largely rely on assumptions, theories, and hypotheses. We utilize the observations from economic data and to establish and testify reasonable hypotheses and then further develop into new theories. More specifically, in Chapter 2, we testified the hypothesis that bank dependent firms hold less excess cash than the counterpart do; in Chapter 3, we testified the hypothesis that during the shocks of the Global Financial Crisis in 2008, corporations tend to increase the cash holding while decline the level of investment.

The third step of the data circulation is the implication of the analysis, which is represented in the fifth, sixth, and seventh arrows.

Arrow ⑤ represents that corporations utilize the information to conduct better internal management, sale prediction, and financial planning, etc. More specifically, in Chapter 2 we documented that bank-dependent corporations should hold less cash holding than non-dependent corporations to achieve more efficient management in liquidity.

Arrow ⑥ represents that the government could take advantage of the improved theories or models to design better corresponding policies and conduct targeted adjustments. In Chapter 3, we found evidence that during the Abenomics period, Japanese corporations continue increasing the cash holding level while the investment intentions are not significantly improved. Besides, a weakened yen policy seems to be less effective in stimulating Japanese corporations than expected as there is no significant difference in terms of the cash allocation of domestic-oriented and export-oriented firms. Therefore, the government needs to be cautious when setting the exchange rate as a target in future policy design.

Arrow ⑦ represents that through the development and findings in the theories and hypotheses, we may have a better understanding of the potential reasons and potential solutions to unexpected shocks. For instance, as documented in the discussion of Chapter 3, corporations significantly increase the cash holding and decrease investment expenditure as a defense of the Global Financial Crisis. Besides, the liquidity provided by banks plays an important role in helping corporations to survive.

As mentioned above, the data flow is not actually observed but estimated, and on a more general basis, it could be just information flow instead of data flow because, instead of deriving a not accurate nor reliable estimation, we may be more interested in a logical and persuasive expectation over the potential results under some policy changes or unexpected shocks. For example, what are the intentions of corporations' holding excess cash instead of utilizing the cash holding for new investment? How the corporations react according to their financial statements to an unexpected shock such as the Global Financial Crisis or COVID-19 and why they have to do so? What could be the potential evidence for a systematic economic crisis? After we provide possible explanations to these questions in hypothesis and theory development, various participants of the economic activities can take advantage of the findings and development of theories.

In the next data circulation, the whole process is repeated but in the process of data analysis, we examine whether the newly observed data follow our expectations, whether the theory previously developed fits the practice so that we will have a better understanding of the economy's operation.

Meanwhile, the relationship between data circulation and Chapter 2, the discussion of cash policy of bank-dependent corporations, is relatively weak when compared to Chapter 3. The analysis of the cash policy of bank-dependent corporations is more about revealing facts, instead of making improvements. The differences in cash policy of bank-dependent and non-dependent corporations are one of the exhibitions in different cash holding motives.

The framework of data and information circulation in the economic research field provides an intuitive image of how economic theories are developed and how they change our life gradually. Economics has long been regarded as a social science without strictly proof or accurate estimation. However, it is no doubt based on observations, data, proposal, and construction of model and testification. Due to the extreme complexity of the economic system, we may find that there is a still long way to go before we have a clear and accurate image of the black box, but under such a framework of data and theory circulation, the studies over economic have been more and more innovative and instructive.

5. Summary and conclusion

The dissertation starts by reviewing the previous studies on cash policy and cash holding motives. Two motives, the precautionary motive and agency motive, are tightly related to the research. Precautionary motive refers to the need of saving cash for unexpected cash outlay. Agency motive is related to agency theory and the free cash flow theory, and it specifies that managers have incentives to make the firms grow beyond the optimal size, and this is likely to cause the undertaking of low-benefit or even value-destroying mergers. The purpose of the dissertation is to examine the motives and mechanisms for corporations' cash policy with respect to bank-dependence, as well as the implications of different corporations' cash policies under various exogenous shocks.

In chapter 2 of *Cash Policy of Bank-Dependent Corporations*, I examine the differences in the cash policies of bank-dependent firms and their counterparts. Bank-Dependent firms are described as firms that do not have bonds outstanding. In general, bank-dependent firms hold less excess cash than their counterparts do. Besides, there is robust evidence that the conclusion is still valid for the subsample of listed and non-listed firms. Other control variables provide consistent interpretations with the previous studies. For instance, there is a significant characteristic of the economy to scale as both bank-dependent and non-dependent firms decrease the cash holding when total assets increase. Meanwhile, bank-dependent firms more sensitive to the fluctuation of the cash flow at the industry level while non-dependent firms have more incentives for saving cash when there are more investment opportunities, indicated by a significant positive coefficient of Tobin's Q.

In chapter 3 of *Cash Allocation of Japanese Firms: Impacts of Financial Crisis and Macroeconomic Policy*, I examine the responses from Japanese corporations' cash allocation over the negative external shock of the Global Financial Crisis in 2008 and the positive shock of Abenomics. There is robust evidence that during the Global Financial Crisis period, both domestic-oriented and export-oriented firms decreased the investment while significantly

increased the cash holding level. However, when corresponding to the positive shock of Abenomics, the investment level for both groups did not exhibit an outstanding increase, whereas the cash holding level still increases. Further studies using a difference-in-difference design are conducted to capture the potential differences in the cash allocation patterns over cash holding and investment. However, there is no significant evidence to show that during the positive external shock, any subgroup of corporations chooses to increase the investment level.

Chapter 4 introduces the framework of data circulation and its relationship with the dissertation. Data circulation describes a cyclical data flow consisting of data acquisition, data analysis, and data implementation. The chapter sketches a simplified framework of data and information flow in empirical research in economics and corporate finance. Besides, I introduce how other chapters of this dissertation are tightly related to the circulation framework in detail. We mainly utilize the data from corporations, specifically, the financial data from the financial statements. After hypotheses are tested and models/theories are constructed based on the data and analysis, the government can take advantage of the models or theories to better formulate the monitoring and stimulating policies, while corporations can be also benefited from the new models or theories to increase the internal efficiency to achieve better performances. Then a new round of data collection and analysis will be conducted to testify the previous models and theories and hence, formulate a data and information flow circulation.

There are still many pieces of research that could be done in future research work. For instance, even though corporations increase cash holding levels and decrease the investment spending during the Global Financial Crisis, it remains unclear about the mechanism of how the shock transmits in the economy and to the corporations. In addition, a curious question is what are the intentions behind corporations' cash allocation in terms of the investment activities. During the shock of the Global Financial Crisis, some financially constrained corporations have to give up investment opportunities or liquidize their promising assets for survival. At the same time, for corporations with abundant capital reserves, it would be a great chance for expanding the business scale for future development. It would be interesting to examine the stock

performance of corporations that increases investment activities during the negative shock. Besides, the potential implications for policymakers remain unclear. As indicated by the conclusions in Chapter 3, the investment intentions do not significantly increase during the Abenomics period, and a weakened yen policy to stimulate the export does not turn effective as expected. It is worthy of further examination of how to encourage corporations' investment activities. In turns of the bank-dependency, more studies should be done over the marginal cash value of bank-dependent and non-dependent corporations.

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Appendix: Definition of variables

Variables	
ΔCash	Change in the cash holdings divided by the total assets of beginning balance (abbr. total assets following)
I	Change in the fixed assets divided by the total assets
DIV	Amount of Cash dividend and stock dividend divided by the total assets
ΔD	The net change in liabilities divided by the total assets, a positive value represents cash inflow from debt instruments
ΔE	The net change in capital divided by total assets
CF	Net income plus non-cash items (depreciation and amortization) divided by total assets
Q	The market value of assets divided by the total assets
Ln (Assets)	The Napierian logarithm of total assets
Risk	The standard deviation of cash flow in a certain industry and a certain fiscal year
Leverage	D/E ratio, liability divided by net assets
NWC	Change in net working capital divided by the total assets
R&D	R&D expenditure divided by sales
Bank_dependent dummy	If a firm does not have an outstanding bond, then *Bank_dependent dummy* is equal to 1 and 0 otherwise.