THE PERFORMANCE OF COMPANIES AND CASH HOLDINGS DURING THE CRISIS – CHINA EVIDENCE

by

Zhihao Jiang
B. Econ, Shanghai Ocean University, 2009

and

Shu Liu
B. Econ, Southwestern University of Finance and Economics, 2009

PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE IN FINANCE

In the Master of Science in Finance Program
of the
Faculty
of
Business Administration

SIMON FRASER UNIVERSITY

Fall 2014

Approval

Name: **Zhihao Jiang and Shu Liu**

Degree: **Master of Science in Finance**

Title of Project: **The Performance of Companies and Cash Holdings during the Crisis – China Evidence**

Supervisory Committee:

_____

Dr. Christina Atanasova

Associate Professor, Faculty at Beedie School of Business

Senior Supervisor

_____

Dr. Evan Gatev

Associate Professor, Faculty at Beedie School of Business

Second Reader

Date Approved: _____

Abstract

The effect of cash holdings on the value of a firm has attracted the attention of researchers as well as shareholders. China has been receiving more influence from the world market since it became a member of World Trade Organization (WTO) on December 11th 2001. Affected by the financial crisis in 2008, the cash holdings tend to play different roles on the valuation of a company. This paper attempts to find out whether cash holdings offer positive effects or not on corporate market valuation based on the Chinese context. We apply a modified Tobin's Q as a measure of firm value. Furthermore, the influence of cash holdings on Tobin's Q is analyzed for both pre and post sub-prime crisis period.

Keywords: Cash Holding; Corporate Valuation; China; Tobin's Q; Financial Crisis; Multivariate Regression

Acknowledgements

First and foremost, we would like to show our deepest gratitude to our supervisor, Dr. Christina Atanasova, a respectable, responsible and resourceful scholar, who has provided us with valuable guidance in every stage of the writing of this paper. Without her enlightening instruction, impressive kindness and patience, we could not have completed our thesis. Her keen and vigorous academic observation enlightens us not only in this thesis but also in our future study and work.

We shall extend our thanks to second reader, Dr. Evan Gatev for all his kindness and assistance. I would also like to thank all our teachers who have helped us to develop the fundamental and essential academic competence.

Last but not least, we would like to thank all our friends, for their encouragement and support.

Table of Contents

1. Introduction

Firms, private or public, have items on their books treated as non-operating assets. These assets generally fall into four categories. The first and most obvious type is cash and near-cash investments. A large number of companies with a substantial amount of cash balances make these risk-free or low-risk investments. The second is investments in equities or fixed income securities issued by other institutions in order to follow specific strategies. The third type is private or public holdings in other firms, which can be classified in various ways by accountants. Finally, there are assets that do not generate cash flows but still have a certain values. If little or no serious attention is paid to these assets, the consequences can be quite serious. In this paper, we examine some of the challenges associated with the volume of cash holdings as well as their influence on valuing a firm.

1.1 Reasons for holding cash

1.1.1 Operational (Transactional) Motives

Firms need cash for operations and the needs vary along with different reasons. Generally, we can conclude that the cash needs for operations are a function of the following variables:

- Cash or Credit oriented business: Cash-oriented firms tend to have higher demands for cash than credit-oriented firms.
- Size of transactions: Firms that generate revenues from various small transactions tend to maintain more cash for their business than those that obtain their revenues through a few large transactions. Additionally, some economies of scale would allow larger firms to maintain lower cash balances for operations than smaller firms.
- Dependency on modern banking system: With the fast development of banking system, a decreasing number of transactions are cash-based. Consequently, cash requirements is expected to experience a falling trend as the banking system becomes more sophisticated and comprehensive by allowing customers to pay with credit cards or cheques.

1.1.2 Precautionary Motives

Precautionary motives mainly refer to the capacity of covering unanticipated expenses or meeting unspecified contingencies. This component is expected to be a function of the following variables:

- Volatility in the economy: With other factors remaining unchanged, it is obvious that firms should accumulate more cash under unstable and volatile macro economic conditions than they do under mature and stable macro economic conditions. In other words, shocks are more likely to happen on the former case and thus drive firms to have higher requirements of cash.
- Volatility in operations: All other factors being equal, firms with more volatile operating cash flows are expected to hold higher cash balances in order to meet contingencies than those with stable cash flows.
- Competitive environment: It cannot be ignored that the presence of fierce competition in the industry will add to instability. Firms operating in more intensely competitive sectors tend to hold more cash in hand than those that are immune from competition.
- Financial leverage: Debt ratio is a financial ratio that indicates the percentage of a company's assets that provided via debt (Debt ratio = Total Debt/Total Assets). A firm with higher debt ratio has committed itself to making higher interest payments in the future. The interest payments will in turn lead to higher cash balances.

1.1.3 Potential Capital Investments in the Future

In the real world, firms often face constraints or costs that internally or externally restrict their access to raising new capital to fund good investments. Hence firms set aside certain amount of cash to cover needs for future investments. In this way, firms can seize good opportunities with more confidence. This component is expected to be a function of the following variables:

- Magnitude and uncertainty about future investments: Firms having both substantial needs for potential future investments and high uncertainty about these investment opportunities tend to set aside large amount of cash in order to cover future investment costs. Additionally, firms that have large but predictable investment needs can set aside right amount of cash in advance while those with small investment needs can get away from holding substantial cash balances.

- Access to capital markets: Firms with easier and cheaper access to capital markets should hold less cash for future investments than firms without the access. Cash balances also tend to decrease if with an increase in the financial choices.
- Information asymmetry about investments: Firms will face big challenges to raise capital at a fair price if external investors receive less information about the potential payoffs they would obtain through investments than firms do. For instance, firms are expected to acquire relatively larger cash balances when projects are difficult to assess or monitor.

1.1.4 Strategic Cash Holdings

At times, some companies regard cash as special weapon that can help them take advantage of opportunities that may arise in the future though these opportunities may have not shown up yet. What's more, holding cash is great when cash is a scarce resource or capital market is difficult to access.

1.1.5 Management Interests

One characteristic of publicly traded companies is the separation of management and ownership. In many firms, managers have their own deals that can be funded through cash. If this idea holds, we expect cash balances to vary among companies based on the following reasons:

- Corporate governance: Companies where stockholders have little or no power tend to have larger cash balances.
- Insider holdings: When insiders not only hold a large portion of the company but also are part of the management, we will expect to see larger cash balances accumulating in the firm.

1.2 Value of Cash

Based on traditional method, cash holdings are regarded as zero NPV investments. One-dollar cash will bring about one-dollar increase in the value of the firm. Based on simple corporate finance knowledge, one dollar in the future can be discounted back on the risk-free interest rate in order to find out its present value. In perfect capital markets, it is expected to obtain the result mentioned above. Hence, it is irrelative whether the firm pays out cash as dividends or holds on to it. If the firm pays out the dividends to investors, it could raise value of positive NPV projects. However, the result may not hold if capital market is imperfect or if

agency costs exist in the market between managers and stockholders or if conflicts appear between stock and bondholders. For instance, it is difficult or costly to transfer cash into or out of the firm owing to taxes and floatation costs. Ultimately, borne by the shareholders, these transaction costs will influence the valuations of cash holdings.

Besides, different jurisdictions and the status of investors will expose effects on the actions of both firms and individuals. First of all, the tradeoff theory indicates that a country's level of investor protection may affect the relative prices or tradeoffs when managers make decisions. The methods that will maximize shareholders' wealth in countries offering outstanding protections may not be the optimal methods for other countries. Consequently, managers tend to make different decisions in countries where investors' rights are poorly protected due to fewer constraints. Secondly, the cost theory claims that it becomes more difficult for non-controlling investors to generate a fair return from their investments because of agency conflicts that are hard to govern. In general, as one of the developing countries, China has become an interesting topic around the entire world due to different policy structure, culture background and way of development. We predict that Chinese companies are expected to hold more cash in hand in order to avoid transaction costs, reduce risks (cash is regarded as a buffer) and comply with cultural thoughts.

Using a sample that includes over eight hundred Chinese listed companies for over ten years, we find that Chinese listed companies tend to hold more cash in hand. From the perspective of industrial sections, commercial sector is found to have more cash balances than the other sectors with a 23.8% Q2 (a cash index that will be explained later in the paper), followed by utilities sector with a 19.2% Q2. The generals sector is found to have the lowest cash balances because of industrial nature.

The structure of the paper lays out as follows: Section 1 provides a brief introduction on the determinants of holding cash and the value of cash. Section 2 is for literature review, which gives a short examination of the basic knowledge for the further study. Section 3 presents detailed methodologies used in this paper. Section 4 includes the data and results based on the methodologies mentioned above. The data from 2004 to 2013 is analysed in details in this section. Section 5 concludes the paper.

2. Literature Review

An interesting fact of the financial market is that firms hold different levels of cash. This phenomenon highlights two questions. Firstly, what value do investors place on the cash holdings of a firm? Secondly, how cash holding influence companies? Undeniably, identifying the effect of cash holding has been a widely debated issue within academic circles and among practitioners. Many economic literatures have mentioned considerations about liquid assets that feature issues over cash holdings.

Most of the previous studies addressed the reasons why firms hold cash and what impacts it would expose to their investment policies, as well as to determine whether managers waste cash or use it to increase firm value. Pinkowitz and Williamson (October 8, 2002) extended their study to the examination of cash value measured by shareholders through using regression approach of Fama and French (1998). They finally concluded that firms should hold cash with a limitation on the total amount. They found that shareholders value a marginal dollar of cash at a significant premium to face value. More specifically, the evidence in this paper seems to support the contentions of both Myers and Majluf (1984) and Jensen (1986). Similarly, Opler et.al (1999) and Harford (1999) also pointed out that several major characteristics, including access to capital market, volatility in cash flows and availability of growth opportunities, provided positive response to holding cash.

In November 2003, Pinkowitz, Stulz and Williamson had their essay published. In this paper, they emphasized the relationship between two theories (trade-off theory and agency theory) and the determinants of liquid asset holdings of firms across countries. They believed that the determinants of liquid asset holdings are largely consistent with both theories according to empirical analysis. Additionally, they also found out that the liquid assets in countries with poor investor protection made less contribution to the value of minority shares than that in countries with better protections. The results provided evidence for the importance of agency costs in how minority investors value cash held by corporations.

Apart from valuation of cash balances, in September 2005, Damodaran stated in his paper that there were generally five motives for holding cash, including operational motive, precautionary motives, future capital investments, strategic cash holdings, and management interests. As it is one of the risk-free assets, cash earns low rate of return, which indicates that the safest way to deal with cash is to separate it from operating assets and to value it respectively in both discounted cash flow and relative valuation.

Ozkan and Ozkan (2003) offered a detailed method about corporate cash holdings among UK companies through a cross-sectional regression. The result suggested that ownership structure of firms played an important role in determining cash holdings of UK firms. Their findings also revealed that there existed a non-monotonic relationship between managerial ownership and cash holdings. Similarly, D.H. Wang and H.G. Wang (2007) proposed a regression method in order to analyze the effects of cash holdings on the valuation of Chinese firms based on data between 2003 and 2006. Through a multi-variable regression, they believed that there existed inverted U-shape relationship between cash holdings and firms' value. They also pointed out that an increase in cash holdings would lead to a rise in firms' value when the amount of cash holdings is within a certain limit. However, if cash holding exceeds a certain level, the existence of agency issues would drive the value of firms downward.

In 2011, Q. Mei and Srinivasan offered a detailed numerical analysis about the situation of holding cash among Canadian companies from 2001 to 2010. Considering the financial crisis of 2008, they hoped to observe differences in pre and post financial crisis period. In summary, they did find some evidence that the valuation of firms is positively related to cash holdings and the relation is affected by market crisis. However, the effect was not uniform across sectors.

Recent years have seen swift developments in Asian economy, and this phenomenon has attracted an increasing number of scholars as well as investors. According to various results listed above, there are no exact conclusions about economies in Chinese mainland. Whether the financial crisis bring about changes to the structure of cash holdings and whether China provides a different result as a developing country are still unknown. Therefore, we will examine the cash holdings among Chinese listed companies with a ten-year span.

Up to now, the effects of cash holdings seem to be ambiguous. The predicaments faced here are whether holding cash is beneficial for Chinese companies and what the suitable amounts of cash holdings are for firms. Our primary objectives in this study are to ascertain: (1) the connections between corporate cash holdings and market valuation of firms in the Chinese market; (2) deviations in the connections between corporate cash holdings and market valuation of firms during financial crisis; (3) the quantitative relations between cash holding and market valuation of firms.

3. Methodology

With this study, we aim to probe into the connection between cash holding and corporate market value. We are especially interested in how the situations differ during the years of financial turbulences.

Faulkender and Wang (2006) pointed out that the higher the level of cash, the less the marginal value it adds to firms. Moreover, for firms suffering from agency issues, a higher level of cash holdings may even indicate negative impacts on the value.

The method that we apply is Tobin's Q. Instead of the standard form of Tobin's Q, we use a modified form which is suggested by a Q. Mei and G. Srinivasan (2011) report that emphasizes cash value to market value of securities.

By definition, if firms have a portion of assets that are hard to capture value objectively from accounting point of view such as intangibles, or the projects that the firms have are value adding, then we can expect our modified Tobin's Q to be higher. Otherwise, if the projects bring undesirable deficits then we can expect modified Tobin's Q to be much lower.

The method, we apply, not only creates a modified Tobin's Q (later we call Q1), but also creates a cash index (later we call Q2). With the connections between Q1 and Q2 we can have an overall understanding on how cash holding contributes to corporate market value.

However, one thing we cannot ignore is agency issue. Normally, if agency issue is not critical, we can expect stronger positive correlation between Tobin's Q and cash holdings. But if the agency issue is prominent, then the correlation between Q1 and Q2 will be discounted.

Hereby, we would particularly like to address the following concerns with the Chinese background:

(1) Are there any connections between corporate cash holdings and market valuation of firms?

(2) Are there any deviations in the connections between corporate cash holdings and market valuation of firms during turbulent times (i.e. 2008)?

To answer these concerns, we start by examining the standard form of Tobin's Q. One obstacle when applying the standard form is that the market value of assets is hard to determine. To cope with this problem, researchers have searched on the balance sheet and have found that the book value of debt, book value of preferred shares and book value of total assets can be

perfectly applied to the standard form and such a method closely resembles the original Q measure (Chung and Pruitt, 1994). Additionally, in a Chinese setting, book value of preferred shares is eliminated because up to now, Chinese firms have never issued any types of preferred shares and there is no such a column according to Chinese accounting standards.

As is suggested by a Q. Mei and G. Srinivasan (2011) report, in order to highlight the connection between cash holding and corporate market value, we have taken out cash value from the numerator and the denominator of the formula. Therefore, our modified Tobin's Q (Q1) is defined as:

$$Q1 = \frac{Market\ Value\ of\ Equity + Book\ Value\ of\ Debt - Cash}{Total\ Assets - Cash}$$

In addition, our cash index, Q2, measuring the ratio of cash to the rest of the assets is defined as:

$$Q2 = \frac{Cash}{Total\ Assets - Cash}$$

With the above definitions, we can conclude that Q1, the performance indicator, is how the market values all assets other than cash. Therefore, if companies who are devoid of or with limited agency issues dominate the market, we can expect that higher level of cash holdings (Q2) will add value to the modified Tobin's Q (Q1). Otherwise, if the majority of companies within the market suffer serious agency issues, we can expect a negative impact of Q2 on Q1. However, if the two types of companies offset each other over agency issues, we can barely observe any signs of connections.

After calculating Q1 and Q2, we will introduce a multi-variable regression approach to obtain a more specific formula to express the non-linear quantitative relationship between the value of a firm and the amount of cash holdings that is represented by Q2. In this paper, we regard the market value of a firm as dependent variable while use cash holdings (Q2) as one of independent variables. In the regression equation, $(Q2)^2$ is also included in the equation. Additionally, firms' decisions on the amount of cash holdings are also influenced by other factors such as financial leverage, size of firms and cashflows. In this paper, we use Q1 as dependent variable. Considering approaches used in previous studies, we choose cashflows (later we call CFLOW), financial leverage (later we call FLEV) and size of firms (later we call LNA) as the other independent variables. The fluctuations in amount of cashflows represent various levels of

uncertainty. The frequent fluctuations potentially increase the possibility for a firm to give up investment opportunities and face financial distress. FLEV represents the capacity of debt financing. As the larger the size of a firm is, the more possible for a firm to realize scale of economy. The following table summarizes the definitions as well as variables used in the later regression.

Table 1. Definitions and Calculation methods of Related Variables

Type	**Variables**	**Symbol**	**Definitions and Calculation Method**
Dependent Variable	Corporate Market Value	Q1	Q1 represents corporate market value of firms.
Independent Variable	Cash Holdings	Q2	Q2 represents the ratio of cash to other assets.
Controlling Variables	Cashflows	CFLOW	CFLOW=(Net profit + Depreciation and amortization)/Total Assets
	Financial Leverage	FLEV	FLEV = Debt/Total Assets
	Size	LNA	Natural log of total assets

The numerical relationship between these variables are expected to be observed and expressed in the following equation:

$$Q1 = \beta_0 + \beta_1 * Q2 + \beta_2 * (Q2)^2 + \beta_3 * CFLOW + \beta_4 * FLEV + \beta_5 * LNA + \mathcal{E}$$

where β_0 is the constant, β_j are the coefficients for different variables (j=1,2,…, 5), and $\mathcal{E}$ represents the residuals.

4. Data and Statistical Summaries

4.1 Tobin's Q

We select all A Shares (Shares denominated in local RMB, in contrast to B Shares, which are denominated in USD) listed on Shanghai Stock Exchange (SSE), the largest stock exchange in China and fourth largest in the world, as our sample base. We divide all shares into six sectors based on CSRC standards, namely real estate, industrials, utilities, financials, commercial and generals. Due to the fact that the financial sector has different fiscal reporting standards, even though we managed to calculate its Q1 and Q2, we will not include this sector for further analysis. Our study covers a time span of ten years (2004-2013). All our data were obtained from CSMAR Database. Based on the data we collected, we calculate Q1 and Q2 by sectors together with average Q1, Q2 for ten years. To make analysis more convincible and accurate, we eliminate extreme observations by the following two standards:

(1) Q1 greater than 5;

(2) Q2 greater than 1.

These two standards apply to observations only. Therefore, if one company was eliminated in one certain year, it can be in the sample for other years.

The Q1 and Q2 average values by sectors in ten years are provided in the following Table 2 and Table 3:

Table 2. Average Values of Q1 by Sectors

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	**Average**
Real Estate	1.4861	1.3115	1.7225	2.7506	1.4600	2.2050	1.7660	1.3542	1.3985	1.3560	**1.6810**
Industrials	1.6635	1.3858	1.7004	2.7654	1.6097	2.5371	2.5036	1.9163	1.8026	1.8107	**1.9695**
Utilities	2.0301	1.7369	2.0678	2.8574	1.7338	2.4471	2.1467	1.6121	1.5840	1.7207	**1.9937**
Financials	1.7633	1.4596	2.6049	3.3120	1.6394	1.2719	1.6715	1.5683	1.4916	1.6084	**1.8391**
Commercial	1.4539	1.3347	1.8490	3.0699	1.6225	2.6369	2.4518	1.9059	1.8260	1.8830	**2.0034**
Generals	1.6848	1.3182	1.5305	2.7291	1.8306	2.6636	2.6126	2.1214	2.1066	2.1846	**2.0782**

Table 3. Average ratio of cash holdings (Q2) by sectors

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	**Average**
Real Estate	0.1757	0.1534	0.1491	0.1812	0.1498	0.2395	0.2129	0.1620	0.1585	0.1616	**0.1744**
Industrials	0.2116	0.1770	0.1595	0.1490	0.1670	0.1891	0.1971	0.1950	0.2013	0.1828	**0.1829**
Utilities	0.2222	0.2044	0.1878	0.1624	0.1801	0.1781	0.1875	0.1956	0.2165	0.1829	**0.1917**
Financials	0.2825	0.0972	0.1028	0.2332	0.1116	0.0786	0.4623	0.4688	0.4573	0.3382	**0.2633**
Commercial	0.2445	0.2192	0.2026	0.1986	0.2305	0.2549	0.2711	0.2697	0.2577	0.2354	**0.2384**
Generals	0.1533	0.1399	0.1497	0.1485	0.1291	0.1564	0.1572	0.1931	0.1785	0.1341	**0.1540**

From tables above we discover that the generals sector has the highest Q1 and lowest Q2. This is a sample where agency issues dominate the industry and cash holding has a negative impact on overall corporate value. So this sector was eliminated for further analysis. And as mentioned above, financial sector was also eliminated.

To test the dependency between cash holdings and corporate market value, we decide to use the Pearson Chi Squared Independence Test. The first step is to make a contingency table of the joint frequencies of the two events. The joint frequencies was then put into a table shown as following:

	Q2>Q2 Average	Q2<Q2 Average
Q1>Q1 Average	Frequency 1	Frequency 3
Q1<Q1 Average	Frequency 2	Frequency 4

Our null hypothesis is that there is no dependency between Q1 and Q2, so in this way, the frequencies should be proportionally distributed between above or below average cash holding and corporate market valuation. Table 4 illustrates the Chi-squared value, the related P values and dependency results:

Table 4. Pearson Chi Squared Independence Test results

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Chi-Sqr Value	18.4298	5.5028	14.3150	8.4122	2.4095	9.0445	50.0327	18.7530	23.7883	55.1351
P Value	0.0018%	1.9000%	0.0155%	0.3700%	12.0600%	0.2600%	0.0000%	0.0015%	0.0001%	0.0000%
Dependency	Dependent	Dependent	Dependent	Dependent	Independent	Dependent	Dependent	Dependent	Dependent	Dependent

With a significance level of 5%, for all years, if P Value is less than 5% then the null hypothesis is rejected, which means cash holdings and corporate market value are dependent, and otherwise independent. From the above table we can see clearly that during the ten-year period, only the year 2008 showed independence between Q1 and Q2. In 2008, China was severely affected by the global economic downturn then; the biggest growth engine - export was suffocated, SSE Index dropped from nearly 6000 points to 2000 points and investors suffer terrible losses.

The next step is to examine the movements of individual sectors as well as the sign of correlation. We first look at the size of samples for different sectors. Real estate, commercial and generals are relatively too small in sample size to carry a sector wise analysis. However, industrials and utilities have enough sample bases (400+ and 100+ respectively), hence we would like to carry the study within these two sectors as shown in Table 5 below:

Table 5. Chi-squared results for industrial and utility sectors

Year	Chi-Sqr Industrial	P Value	Chi-Sqr Utility	P Value
2004	12.7014	0.04%	13.1742	0.03%
2005	4.7181	2.98%	3.3818	6.59%
2006	5.2006	2.26%	13.4667	0.02%
2007	2.7236	9.89%	12.3413	0.04%
2008	1.2055	27.22%	8.255	0.41%
2009	8.0556	0.45%	7.6547	0.57%
2010	11.4202	0.07%	11.151	0.08%
2011	2.5392	11.11%	15.4757	0.01%
2012	6.5142	1.07%	15.9368	0.01%
2013	33.5291	0.00%	22.5277	0.00%

Using the same Pearson Chi-Squared Independence Test, with a significance level of 5% for all years, if P Value is less than 5% then the null hypothesis is rejected, which means cash holdings and corporate market value are dependent, and otherwise independent. From the above table, we can see in most of the ten years we can reject independent hypothesis.

Then we use the correlation coefficient to determine whether the relation between cash holding and corporate market valuation is positive or negative within the two sectors. The correlations are shown in Table 6:

Table 6. Correlation between cash holding and corporate market valuation

Year	Industrial	Utility
2004	0.34	0.26
2005	0.19	0.28
2006	0.14	0.38
2007	0.09	0.48
2008	0.00	0.31
2009	0.16	0.50
2010	0.21	0.48
2011	0.14	0.54
2012	0.15	0.34
2013	0.32	0.34

From the above table we can see that the correlation between cash holding and corporate market valuation is positive, which means cash holding adds value to the industrial and utility sectors. It appears that for both sectors, there was a decreasing trend in correlation from 2004 to 2008, the correlation was lowest in 2008 and started increasing after the financial crisis. For the industrial sector, the correlation was close to zero in 2008, which suggests that the sector was heavily impacted by the export fatigue caused by the global economic downturn. In addition, base on the figures above, utility sector showed stronger correlation between cash holding and corporate market value than the industrial sector.

4.2 Regression Analysis

Table 7. Descriptive Statistics

Variable	Observations	Mean	Median	Std. Dev.	Min	Max
Q1	4656	1.8776	1.5836	0.8944	0.4860	4.9859
Q2	4656	0.1944	0.1463	0.1661	0.0002	0.9992
Q2 Sq	4656	0.0654	0.0214	0.1212	0.0000	0.9985
CFLOW	4656	0.0512	0.0536	0.1007	-2.3652	2.8865
FLEV	4656	0.5423	0.5372	0.2251	0.0232	3.4012
LNA	4656	21.8799	21.6851	1.3353	18.4749	28.4576

According to the descriptive statistics displayed in Table 7, no significant difference exists between mean and median for each variable. With an average of 19.44% and median of 14.63% for Q2, which represents general level of cash holdings, Chinese listed companies tend to have relatively high level of cash holdings. Considering standard deviation of Q2 which is only 0.1661, we believe that the amount of cash holdings does not vary significantly among different companies. Q1, the indicator for corporate market value of firms, varies between 0.4860 and 4.9859. This surprising result reveals significant diversion among companies in corporate market value.

Before direct analysis of data during the financial crisis, a general multivariate regression result will offer us a more specific view about the whole Chinese market. Referring to previous study, we predict that positive relationship will be found between Q1 and Q2. As we have already excluded the extreme values, we obtain the following regression results that apparently support our prediction with positive coefficients for Q2, CFLOW and FLEV.

We first try the multivariate regression assuming with a constant. The result, however, is not desirable. As we can see from Table 8, R-squared value is 14.06%, indicating only 14.06% of Q1s can be explained through the five independent variables. Moreover, referring to P value for $(Q2)^2$ that is as high as 0.8050, the regression results are not satisfying and comes with rejection of null hypothesis for Q2. Furthermore, as the constant term is relatively big, reaching around 6, we decide to try the multivariate regression without the constant term.

Table 8. Regression Results with Constant

Equation	Observation	Parameters	RMSE	R-Sq	F	P
Q1	4656	6	0.8296048	0.1406	152.0938	0.0000

Q1	Coef.	Std.Err.	t	P	95% Confidence Interval	
Q2	0.950649	0.2069838	4.59	0.0000	0.5448626	1.356435
Q2 Sq	-0.0691969	0.280667	-0.25	0.8050	-0.6194374	0.4810436
CFLOW	1.143789	0.1342541	8.52	0.0000	0.8805877	1.406991
FLEV	0.2947478	0.0606611	4.86	0.0000	0.1758233	0.4136723
LNA	-0.2296259	0.009439	-24.33	0.0000	-0.2481307	-0.2111211
Constant	6.503187	0.2042302	31.84	0.0000	6.102799	6.903575

The multivariate regression results without a constant term are displayed in Table 9. We are surprised to find that the R-squared value hits an amazing 80.64%. We tend to consider non-constant multivariate regression model a good method to describe the relationship among Q1, Q2, $(Q2)^2$, CFLOW, FLEV and LNA. Specifically, the coefficient for Q2 is significantly larger than other coefficients. This obvious result indicates that the amount of cash holdings plays important role in the valuation of Chinese listed companies.

Table 9. Regression Results without Constant

Equation	Observation	Parameters	RMSE	R-Sq	F	P
Q1	4656	5	0.915498	0.8064	3875.328	0.0000

Q1	Coef.	Std.Err.	t	P	95% Confidence Interval	
Q2	1.844174	0.2263051	8.15	0.0000	1.400508	2.287839
Q2 Sq	-0.998594	0.3080466	-3.24	0.0010	-1.602511	-0.3946765
CFLOW	0.4807438	0.1463613	3.28	0.0010	0.1938063	0.7676814
FLEV	0.2993488	0.0669415	4.47	0.0000	0.1681118	0.4305858
LNA	0.062818	0.0024042	26.13	0.0000	0.0581047	0.0675313

Referring to Table 9, the relationship among Q1, Q2, $(Q2)^2$, CFLOW, FLEV and LNA can be expressed in the following way:

$$Q1 = 1.844174 * \mathrm{Q2} - 0.998594 * (Q2)^2 + 0.4807438 * CFLOW + 0.2993488 * FLEV + 0.062818 * LNA$$

Now, we turn to the case during financial crisis between 2008 and 2009. The following Table 10 summarizes the regression results without constant. Although the R-squared value hits a 0.8087 high, we cannot ignore that for the two specific coefficients of CFLOW and FLEV, of which the P values exceeds 10%, reaching 88.40% and 24.50% respectively, signifying the rejection of null hypothesis, we then decide to try the case with constant.

Table 10. Regression Results during Financial Crisis without Constant

Equation	Observation	Parameters	RMSE	R-Sq	F	P
Q1	1509	5	0.9826878	0.8087	1271.623	0.0000

Q1	Coef.	Std.Err.	t	P	95% Confidence Interval	
Q2	2.566854	0.4475388	5.74	0.0000	1.688988	3.44472
Q2 Sq	-2.430722	0.6772245	-3.59	0.0000	-3.759127	-1.102317
CFLOW	-0.0480464	0.3288734	-0.15	0.8840	-0.6931455	0.5970527
FLEV	0.1504725	0.1294688	1.16	0.2450	-0.1034861	0.4044311
LNA	0.0723035	0.0046201	15.65	0.0000	0.063241	0.0813659

We then run a multivariate regression for the case with constant. While the R-squared value is a moderate 0.1531, we find that all the P values of five coefficients small and satisfying, no P value rejects the null hypothesis that independent variable are significantly correlated with the dependent variable at 95% confidence interval.

From the table below, we can find that the coefficients for Q2 experienced a falling trend, decreasing from 1.844174 to 1.448201. This phenomenon indicates that the level of cash holdings exerts less influence on the valuation of firms during financial crisis.

Table 11. Regression Results during Financial Crisis with Constant

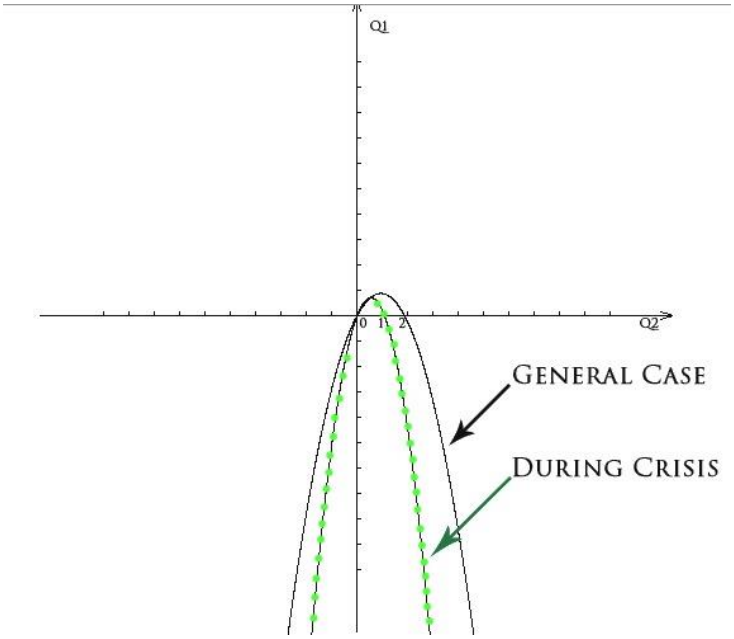
Equation	Observation	Parameters	RMSE	R-Sq	F	P
Q1	1509	6	0.8737443	0.1531	54.33097	0.0000

Q1	Coef.	Std.Err.	t	P	95% Confidence Interval	
Q2	1.448201	0.4018407	3.6	0.0000	0.6599729	2.236429
Q2 Sq	-0.9966913	0.6064055	-1.64	0.1000	-2.186182	0.1927996
CFLOW	0.8980796	0.2962208	3.03	0.0020	0.3170296	1.47913
FLEV	0.2227634	0.1151724	1.93	0.0530	-0.0031522	0.448679
LNA	-0.2692134	0.0175747	-15.32	0.0000	-0.303687	-0.2347399
Constant	7.57397	0.3789655	19.99	0.0000	6.830613	8.317327

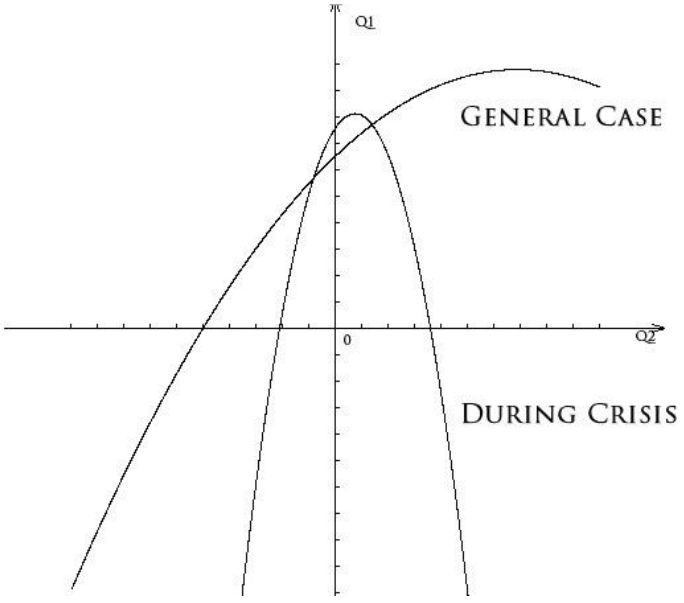
For both cases, we also find that the coefficients $Q2^2$ are negative. This finding coincides with D.H. Wang and H.G. Wang (2007) that there exists an inverted U-shape relationship

between cash holdings and firms' value. We managed to plot the general relation between Q1 and Q2 in both with and without constant situations. The plots show very clear inverted U-shapes. Also, for the during crisis situations, the inverted U-shapes seem to be more compressed than the general cases, which also proves that during the crisis, cash holding casts less influence on firm valuation.

Graph 1. General Relation between Q1 and Q2 (without constant)



Graph 2. General Relation between Q1 and Q2 (with constant)



However, as we can see from the plots that the discrepancy between the cases with and without a constant is quite large. The reason for such a difference lies in the absolute value of the constant. From previous tables we find that the constants for the general case and during crisis period are 6.503187 and 7.57397 respectively, and they are multiple times larger than any of the other coefficients.

Based on previous studies, we believe that a lack of related variables for regression is a cause for such a discrepancy. In order to narrow down the difference, we decide to add one more related variable, Percentage of State Ownership (PSO) to our regression. Due to China's communist regime, entities with a state ownership background have an advantage in obtaining financing (especially cash) from financial institutions over the ones with private ownership. And the market views differently on the cash holdings of SOEs (Stated Owned Enterprises) and private enterprises. We obtained the percentage of shares owned by the state for all A Shares listed on Shanghai Stock Exchange from the same CSMAR database from 2004-2013. Based on the new data, we did the regression for both the general case and during the crisis period. And the results are shown in the following Table 12 and Table 13.

Table 12. Regression Results for General Case with Constant and PSO

Equation	Observation	Parameters	RMSE	R-Sq	F	P
Q1	4656	7	0.814671	0.1714	160.2974	0.0000

Q1	Coef.	Std.Err.	t	P	95% Confidence Interval	
Q2	0.874354	0.203386	4.30	0.0000	0.475621	1.273087
Q2 Sq	-0.055847	0.275822	-0.20	0.8400	-0.708283	0.596589
CFLOW	1.162622	0.131846	8.82	0.0000	0.904142	1.421102
FLEV	0.244263	0.059693	4.09	0.0000	0.127236	0.361290
LNA	-0.220512	0.009296	-23.72	0.0000	-0.238738	-0.202287
PSO	-0.623914	0.047342	-13.18	0.0000	-0.716728	-0.531101
Constant	4.803131	0.247315	19.42	0.0000	4.318171	5.288091

The result seems similar to the previous situation with moderate R-squared value and relatively satisfactory P value except for Q2 Sq. However, the constant term experienced a downward trend from 6.503187 to 4.803131. This phenomenon indicates that PSO is a related variable which helps to bring down the discrepancy.

Table 13. Regression Results during Financial Crisis with Constant and PSO

Equation	Observation	Parameters	RMSE	R-Sq	F	P
Q1	1509	7	0.867958	0.1651	49.48659	0.0000

Q1	Coef.	Std.Err.	t	P	95% Confidence Interval	
Q2	1.367397	0.399845	3.42	0.0010	0.583083	2.151712
Q2 Sq	-0.874339	0.603252	-1.45	0.1001	-2.057644	0.308967
CFLOW	0.939977	0.294400	3.19	0.0010	0.362499	1.517456
FLEV	0.221453	0.114426	1.94	0.0530	-0.002999	0.445905
LNA	-0.245647	0.018168	-13.52	0.0000	-0.281285	-0.210009
PSO	-0.486852	0.103732	-4.69	0.0000	-0.690327	-0.283378
Constant	5.914803	0.485537	12.18	0.0000	4.961769	6.867837

Similarly, the constant for the during crisis situation dropped from 7.57397 to 5.91480, which also proves PSO a relevant variable that helps to narrow the difference.

However, the constants for both cases are still quite large comparing to other coefficients, which means that maybe more variables should be considered or added to the regression. To obtain better results needs further researches based on Chinese contents.

In conclusion, during a longer time horizon, the level of cash holdings expose significant influence on Chinese listed companies with high correlation and high positive coefficient. During financial crisis, holding cash has fewer effects on the Chinese listed companies with lower positive coefficient. However, we cannot deny the significant relationship between corporate market value and cash holdings.

5. Conclusion

In conclusion, our study proves that corporate market valuation is positively related to cash holdings in China. We also discover that the correlation is not uniform between sectors and is affected by the financial crisis. The null hypothesis (independency) was rejected by and large with a base of considerable amount of data by the Pearson Chi-Squared Independency Test.

What is more, we find a numeric way to express the relationship among Q1, Q2, $Q2^2$, CFLOW, FLEV and LNA. That is

$$Q1 = 1.844174 * \mathrm{Q2} - 0.998594 * (Q2)^2 + 0.4807438 * CFLOW + 0.2993488 * FLEV + 0.062818 * LNA$$

However, to obtain better results, more variables should be considered or added to the regression, which needs further researches based on Chinese contents.

The general relation between Q1 and Q2 fits an inverted U-shape, which coincides D.H. Wang and H.G. Wang's finding in 2007. This shape means that an increase in cash holdings would lead to a rise in firm value when the amount of cash holdings is within a certain limit. However, if cash holding exceeds a certain level, the existence of agency issues would drive the value of firms downward. Moreover, during financial crisis in 2008, the Chinese market tended to receive less influence from cash holdings, but the positive relationship between Q1 and Q2 still exists.

However, due to the imperfection of Chinese stock market and a rather implosive market-oriented economy, our study results may not be universal. A wider time span covering a greater number of market crises will enhance our findings. Meanwhile, by extending the study to more settings featuring both developed and developing countries will also enhance our research findings.

References:

Chung, K. H., and Pruitt, S.W. (1994). "A simple approximation of Tobin's Q" Financial Management, 23 (August), 70–74

Damodaran, A. (September 2005). "Dealing with Cash, Cross Holdings and Other Non-Operating Assets: Approaches and Implications" Retrieved from http://people.stern.nyu.edu/adamodar/pdfiles/papers/cashvaluation.pdf

Fama, E. F. and K. R. French. (1998). "Taxes, Financing Decisions, and Firm Value" Journal of Finance 53, 819-843

Faulkender, M., and Wang, R. (2006). "Corporate Financial Policy and the Value of Cash" Journal of Finance, 61, 1957–1990

Harford, J. (1999). "Corporate cash reserves and acquisitions" Journal of Finance 54, 1969-1997

Mei, Q. and Srinivasan, G. (2011). "Cash Holdings and Firm Value During Turbulent Times – Canadian Evidence" Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2430169

Myers, S. and N. Majluf. (1984). "Corporate financing and investment decisions when firms haveinformation that investors do not have" Journal of Financial Economics 13, 187-221

Opler, T., L. F. Pinkowitz, R. M. Stulz and R. Williamson. (1999). " The determinants and implications of corporate cash holdings" Journal of Financial Economics 52, 3-46

Ozkan, A. and Ozkan, N. (September 2003). "Corporate cash holdings: An empirical investigation of UK companies" Journal of Banking and Finance

Pinkowitz, L., Stulz, R., and Williamson, R. (November 2003). "Do firms in countries with poor protection of investor rights hold more cash?" Retrieved from http://www.nber.org/papers/w10188.pdf

Pinkowitz, L., and Williamson, R. (October 8, 2002). "What is a Dollar Worth? The Market Value of Cash Holdings" Retrieved from http://faculty.msb.edu/lfp/mvcash030504.pdf

Wang, D.H. and Wang, H.G. (2007). "Corporate cash holdings: An empirical investigation of Chinese listed companies" Retrieved from http://www.docin.com/p-734148804.html

Appendices

MatLab Codes[1]

1. Script for inputs

```
close all;
clear all;
clc;

tab = [28 16;12 52]; % This is a sample contingency table of the joint frequencies
[hNull, pVal, X2] = PearsonChi2Test(tab, 0.05) % Set significance level to 5%
```

2. Function for Pearson Chi-Squared Independency Test

```
function [hNull, pValue, Chi2] = PearsonChi2Test(cotab, a)
   %#  CHISQUARETEST  Pearson's Chi-Square test of independence
   %#
   %#    @param cotab      The Contingency Table of the joint frequencies
   %#                      of the two events (attributes)
   %#    @param a          Significance level for the test
   %#
   %#    @return hNull     hNull = 1: null hypothesis accepted (independent)
   %#                      hNull = 0: null hypothesis rejected (dependent)
   %#    @return pValue    The p-value of the test (the prob of obtaining
   %#                      the observed frequencies under hNull)
   %#    @return Chi2      The value for the chi square statistic

   [r, c] = size(cotab);
   % degree of freedom
   dof = (r-1)*(c-1);

   % expected frequency
   e = sum(cotab,2)*sum(cotab,1) / sum(cotab(:));
```

[1] The MatLab function is adapted from http://stackoverflow.com/questions/3356128/matlab-test-of-independence

```
% Get Chi2 value
Chi2 = sum(sum( (cotab-e).^2 ./ e ));

% Compare P Value with a to get hNull
pValue = 1 - chi2cdf(Chi2, dof);
hNull = (pValue > a);

end
```

Table 1. Definitions and Calculation methods of Related Variables

Type	Variables	Symbol	Definitions and Calculation Method
Dependent Variable	Corporate Market Value	Q1	Q1 represents corporate market value of firms.
Independent Variable	Cash Holdings	Q2	Q2 represents the ratio of cash to other assets.
Controlling Variables	Cashflows	CFLOW	CFLOW=(Net profit + Depreciation and amortization)/Total Assets
	Financial Leverage	FLEV	FLEV = Debt/Total Assets
	Size	LNA	Natural log of totall assets

Table 2. Average Values of Q1 by Sectors

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	**Average**
Real Estate	1.4861	1.3115	1.7225	2.7506	1.4600	2.2050	1.7660	1.3542	1.3985	1.3560	**1.6810**
Industrials	1.6635	1.3858	1.7004	2.7654	1.6097	2.5371	2.5036	1.9163	1.8026	1.8107	**1.9695**
Utilities	2.0301	1.7369	2.0678	2.8574	1.7338	2.4471	2.1467	1.6121	1.5840	1.7207	**1.9937**
Financials	1.7633	1.4596	2.6049	3.3120	1.6394	1.2719	1.6715	1.5683	1.4916	1.6084	**1.8391**
Commercial	1.4539	1.3347	1.8490	3.0699	1.6225	2.6369	2.4518	1.9059	1.8260	1.8830	**2.0034**
Generals	1.6848	1.3182	1.5305	2.7291	1.8306	2.6636	2.6126	2.1214	2.1066	2.1846	**2.0782**

Table 3. Average ratio of cash holdings (Q2) by sectors

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	**Average**
Real Estate	0.1757	0.1534	0.1491	0.1812	0.1498	0.2395	0.2129	0.1620	0.1585	0.1616	**0.1744**
Industrials	0.2116	0.1770	0.1595	0.1490	0.1670	0.1891	0.1971	0.1950	0.2013	0.1828	**0.1829**
Utilities	0.2222	0.2044	0.1878	0.1624	0.1801	0.1781	0.1875	0.1956	0.2165	0.1829	**0.1917**
Financials	0.2825	0.0972	0.1028	0.2332	0.1116	0.0786	0.4623	0.4688	0.4573	0.3382	**0.2633**
Commercial	0.2445	0.2192	0.2026	0.1986	0.2305	0.2549	0.2711	0.2697	0.2577	0.2354	**0.2384**
Generals	0.1533	0.1399	0.1497	0.1485	0.1291	0.1564	0.1572	0.1931	0.1785	0.1341	**0.1540**

Table 4. Pearson Chi Squared Independence Test results

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Chi Sqr Value	18.4298	5.5028	14.3150	8.4122	2.4095	9.0445	50.0327	18.7530	23.7883	55.1351
P Value	0.0018%	1.9000%	0.0155%	0.3700%	12.0600%	0.2600%	0.0000%	0.0015%	0.0001%	0.0000%
Dependency	Dependent	Dependent	Dependent	Dependent	Independent	Dependent	Dependent	Dependent	Dependent	Dependent

Table 5. Chi-squared results for industrial and utility sectors

Year	**Chi-Sqr Industrial**	**P Value**	**Chi-Sqr Utility**	**P Value**
2004	12.7014	0.04%	13.1742	0.03%
2005	4.7181	2.98%	3.3818	6.59%
2006	5.2006	2.26%	13.4667	0.02%
2007	2.7236	9.89%	12.3413	0.04%
2008	1.2055	27.22%	8.255	0.41%
2009	8.0556	0.45%	7.6547	0.57%
2010	11.4202	0.07%	11.151	0.08%
2011	2.5392	11.11%	15.4757	0.01%
2012	6.5142	1.07%	15.9368	0.01%
2013	33.5291	0.00%	22.5277	0.00%

Table 6. Correlation between cash holding and corporate market valuation

Year	**Industrial**	**Utility**
2004	0.34	0.26
2005	0.19	0.28
2006	0.14	0.38
2007	0.09	0.48
2008	0.00	0.31
2009	0.16	0.50
2010	0.21	0.48
2011	0.14	0.54
2012	0.15	0.34
2013	0.32	0.34

Table 7. Descriptive Statistics

Variable	Obs	Mean	Median	Std. Dev.	Min	Max
Q1	4656	1.8776	1.5836	0.8944	0.4860	4.9859
Q2	4656	0.1944	0.1463	0.1661	0.0002	0.9992
Q2 Sq	4656	0.0654	0.0214	0.1212	0.0000	0.9985
CFLOW	4656	0.0512	0.0536	0.1007	-2.3652	2.8865
FLEV	4656	0.5423	0.5372	0.2251	0.0232	3.4012
LNA	4656	21.8799	21.6851	1.3353	18.4749	28.4576

Table 8. Regression Results with Constant

Equation	Observation	Parameters	RMSE	R-Sq	F	P
Q1	4656	6	0.8296048	0.1406	152.0938	0.0000

Q1	Coef.	Std.Err.	t	P	95% Confidence Interval	
Q2	0.950649	0.2069838	4.59	0.0000	0.5448626	1.356435
Q2 Sq	-0.0691969	0.280667	-0.25	0.8050	-0.6194374	0.4810436
CFLOW	1.143789	0.1342541	8.52	0.0000	0.8805877	1.406991
FLEV	0.2947478	0.0606611	4.86	0.0000	0.1758233	0.4136723
LNA	-0.2296259	0.009439	-24.33	0.0000	-0.2481307	-0.2111211
Constant	6.503187	0.2042302	31.84	0.0000	6.102799	6.903575

Table 9. Regression Results without Constant

Equation	Observation	Parameters	RMSE	R-Sq	F	P
Q1	4656	5	0.915498	0.8064	3875.328	0.0000

Q1	Coef.	Std.Err.	t	P	95% Confidence Interval	
Q2	1.844174	0.2263051	8.15	0.0000	1.400508	2.287839
Q2 Sq	-0.998594	0.3080466	-3.24	0.0010	-1.602511	-0.3946765
CFLOW	0.4807438	0.1463613	3.28	0.0010	0.1938063	0.7676814
FLEV	0.2993488	0.0669415	4.47	0.0000	0.1681118	0.4305858
LNA	0.062818	0.0024042	26.13	0.0000	0.0581047	0.0675313

Table 10. Regression Results during Financial Crisis with Constant

Equation	Observation	Parameters	RMSE	R-Sq	F	P
Q1	1509	6	0.8737443	0.1531	54.33097	0.0000

Q1	Coef.	Std.Err.	t	P	95% Confidence Interval	
Q2	1.448201	0.4018407	3.6	0.0000	0.6599729	2.236429
Q2 Sq	-0.9966913	0.6064055	-1.64	0.1000	-2.186182	0.1927996
CFLOW	0.8980796	0.2962208	3.03	0.0020	0.3170296	1.47913
FLEV	0.2227634	0.1151724	1.93	0.0530	-0.0031522	0.448679
LNA	-0.2692134	0.0175747	-15.32	0.0000	-0.303687	-0.2347399
Constant	7.57397	0.3789655	19.99	0.0000	6.830613	8.317327

Table 11. Regression Results during Financial Crisis without Constant

Equation	Observation	Parameters	RMSE	R-Sq	F	P
Q1	1509	5	0.9826878	0.8087	1271.623	0.0000

Q1	Coef.	Std.Err.	t	P	95% Confidence Interval	
Q2	2.566854	0.4475388	5.74	0.0000	1.688988	3.44472
Q2 Sq	-2.430722	0.6772245	-3.59	0.0000	-3.759127	-1.102317
CFLOW	-0.0480464	0.3288734	-0.15	0.8840	-0.6931455	0.5970527
FLEV	0.1504725	0.1294688	1.16	0.2450	-0.1034861	0.4044311
LNA	0.0723035	0.0046201	15.65	0.0000	0.063241	0.0813659

Table 12. Regression Results for General Case with Constant and PSO

Equation	Observation	Parameters	RMSE	R-Sq	F	P
Q1	4656	7	0.814671	0.1714	160.2974	0.0000

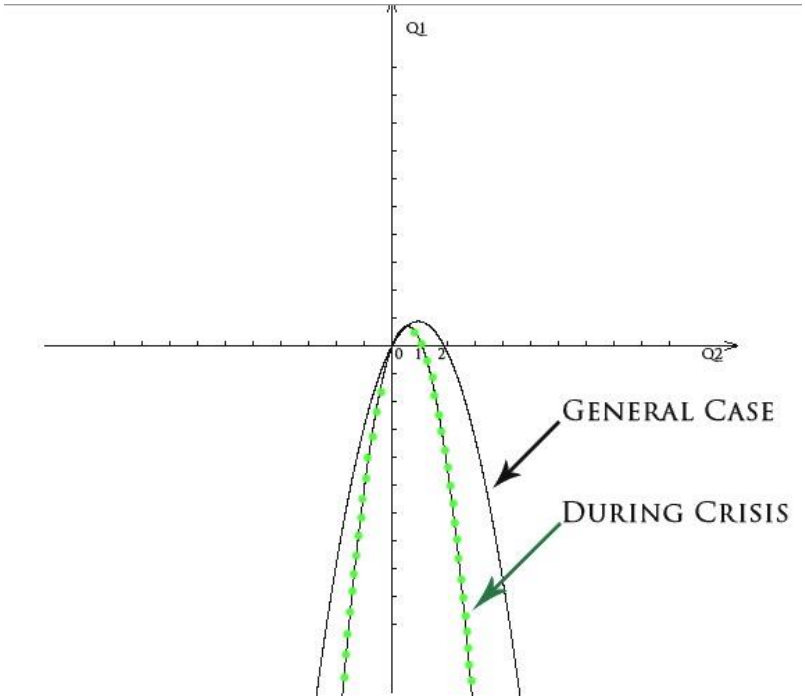
Q1	Coef.	Std.Err.	t	P	95% Confidence Interval	
Q2	0.874354	0.203386	4.30	0.0000	0.475621	1.273087
Q2 Sq	-0.055847	0.275822	-0.20	0.8400	-0.708283	0.596589
CFLOW	1.162622	0.131846	8.82	0.0000	0.904142	1.421102
FLEV	0.244263	0.059693	4.09	0.0000	0.127236	0.361290
LNA	-0.220512	0.009296	-23.72	0.0000	-0.238738	-0.202287
PSO	-0.623914	0.047342	-13.18	0.0000	-0.716728	-0.531101
Constant	4.803131	0.247315	19.42	0.0000	4.318171	5.288091

Table 13. Regression Results during Financial Crisis with Constant and PSO

Equation	Observation	Parameters	RMSE	R-Sq	F	P
Q1	1509	7	0.867958	0.1651	49.48659	0.0000

Q1	Coef.	Std.Err.	t	P	95% Confidence Interval	
Q2	1.367397	0.399845	3.42	0.0010	0.583083	2.151712
Q2 Sq	-0.874339	0.603252	-1.45	0.1001	-2.057644	0.308967
CFLOW	0.939977	0.294400	3.19	0.0010	0.362499	1.517456
FLEV	0.221453	0.114426	1.94	0.0530	-0.002999	0.445905
LNA	-0.245647	0.018168	-13.52	0.0000	-0.281285	-0.210009
PSO	-0.486852	0.103732	-4.69	0.0000	-0.690327	-0.283378
Constant	5.914803	0.485537	12.18	0.0000	4.961769	6.867837

Graph 1. General Relation between Q1 and Q2 (without constant)



Graph 2. General Relation between Q1 and Q2 (with constant)