Direct Investment vs Mergers & Acquisitions in Asia

Applications of Tobin's Q theory in Asian capital markets

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1. Abstract

This paper applies Tobin's Q theory to Asian capital markets. It discovers that Tobin's Q Theory can help explain the merger and acquisition market and the direct investment market in Asia. The primary approach of this paper is empirical. It develops a model exploring the relationship between direct investment and Tobin's Q of a firm, and between mergers and acquisitions and Tobin's Q of a firm, whose major uncertainties are as follows: (1) the differences in the economic atmosphere of countries; (2) the differences between industries; (3) the limited amount of data available.

I find that:

1. In Asia as a whole, both direct investment and mergers and acquisitions of a firm respond positively to its Q.
2. In Asia as a whole, mergers and acquisitions respond more to the firm's Q than does direct investment.
3. In Greater China, mergers and acquisitions respond positively to the firm's Q but direct investment responds negatively to its Q.
4. In Japan, a firm's mergers and acquisitions respond positively to its Q, but it is vague how direct investment responds to a firm's Q.

2. Introduction

The main topic of this paper is Asia's direct investment and merger and acquisition markets. The fundamental question that the remainder of the paper will address is: *How do direct investment and mergers and acquisitions respectively respond to a firm's Tobin's Q in Asia?*

A common way to describe the efficiency of merger and acquisition activity is Tobin's Q of the acquiring and the target company. Tobin's Q is a ratio that describes a firm's value per unit of capital and it is affected by macroeconomic conditions, the country origin of the target and the acquiring companies, and related government policy. The Q-theory of merger and acquisition is based on Tobin's Q theory and it employs Tobin's Q to compare the market valuation of the capital of the target and the acquiring companies.

Previous scholars have conducted research exploring how Tobin's Qs of the target firm and the acquiring firm affect the return of a merger and acquisition (Servaes 1991,Andrade and Stafford 2004). Some others have investigated how the Q theory applies to the capital markets in Europe and the United States (Rousseau 2006). However, no scholar has previously investigated the application of the Q-theory in the Asian market. There is a strong need to explore the application of the Q-theory in Asia because of the important role that Asia currently plays in the global capital market along with the fast growth of Asia. This paper will be the first paper that investigates this issue. It will not only help people better understand how the Q-theory applies to a global context but will also allow people to better understand the application of the Q-theory to developing economies.

The main question of this paper is meaningful particularly due to how active the merger and acquisition market has been in Asia this decade. For instance, Asia Pacific developed

markets have experienced significant growth in deal flow, which is the rate at which investment offers are being received, up to 11% in the last decade. APAC (Asia Pacific) developing markets' deal flow is growing at a slower pace, but still has a quite significant growth trend. Phil Lee, Global Head of APAC investment banking and private equity segments, commented that "APAC has presented a consistent deal flow, with value above $408 billion since 2007" (M&A Markets: Continued Growth For Asia Pacific 2014).

Mergers and acquisitions have supplemented the growth of firms. For instance, on April 1st 2014, Nipponkoa and Sompo Japan, two of the largest Property & Casualty (P&C) companies in Japan, merged into Sompo Japan Nipponkoa and became the largest P&C insurance company in Japan. Because of the decreasing population in Japan, the P&C insurance industry is becoming more and more competitive. This merger allows the firms to better explore new services, operate more efficiently and to survive competitive markets.

Despite the prevalence of mergers and acquisitions, there are many firms that refuse to be acquired. For example, Ourpalm Games is a leading social web and smart mobile game developer in China that was founded in Beijing in 2004. In 2010, in order to maintain control of the company, Ourpalm's cofounders refused to sell 66% of Ourpalm's shares for $110 million to Telstra, Australia's largest telecommunications and media company. In May 2012, the company launched its IPO in China Growth Enterprise Market and its revenue reached 340 million yuan (the equivalent of US$53 million) in the first half year of 2014, a 164% increase from the previous year (Sina 2014).

On the other hand, Christine Lagarde, the current managing director of the International Monetary Fund, mentioned in a speech in September 2015 (Lagarde 2015) that Asian countries should deepen "financial market synergy" to create "larger and more liquid capital markets that

reduce the cost of capital." She also said that the synergy would "advance intra-regional trade", "overcome a legacy of fragmented markets" and would ultimately bring many benefits to Asia.

These examples show that the effectiveness of merger and acquisition has been a main concern for Asian firms. With an increasing availability of funds, the firms now have the ability to decide whether to remain independent, to merge with a more resourceful and bigger firm or to acquire another firm that can help it grow.

Along with the primary question of interest, I hope to answer in my paper the following questions:

1) How does the difference between Tobin's Q of the acquiring firm and the target company affect the value of merger and acquisition?
2) How does the response of mergers and acquisitions and direct investment to a firm's Tobin's Q differ across different countries in Asia?
3) How are direct investment and mergers and acquisitions respectively correlated to time?
4) How are direct investment and mergers and acquisitions respectively correlated to industries?

3. Background on Asian capital markets

3.1 Capital market

Two main ways of investment are direct investment and mergers and acquisitions. To invest, a firm can either invest directly on unbundled capital (either new or old) or acquire bundled capital, such as another firm or a department of another firm.

3.1.1 Asia's role in global economy

As "the fastest growing economic region and the biggest continental economy in the world in terms of Gross Domestic Product (GDP) and Purchasing Power Parity (PPP)" (listabuzz), Asia is playing an increasingly important role in the global economy. According to Figure 1, Asia's share of world trade and world GDP is increasing constantly and will continue to grow until 2030. Notably, the emerging Asia, referring to China, India, Indonesia, Malaysia, the Philippines, Thailand, and Vietnam, is a major reason for the growth in Asian share, as it has maintained a particularly strong growth in share of world trade and of world GDP since 1990 and is projected to continue to do so until 2030.

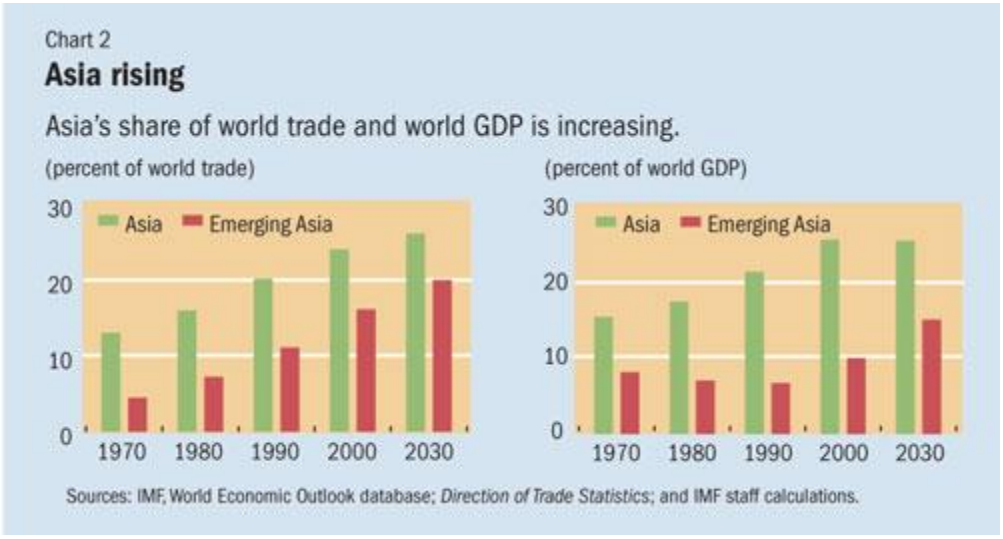

Figure 1 Asia's share of world trade and world GDP is increasing

(International Monetary Fund 2010)

3.1.2 Mergers and acquisitions in Asia

According to Figure 2, for ASEAN (Association of Southeast Asian Nations) and the Asia-Pacific region, the value and the quantity of mergers and acquisitions almost doubled in the

last 20 years. The biggest exception is the drop in merger and acquisition value in both regions from 2007 to 2009, which is most likely due to the 2008 global financial crisis.

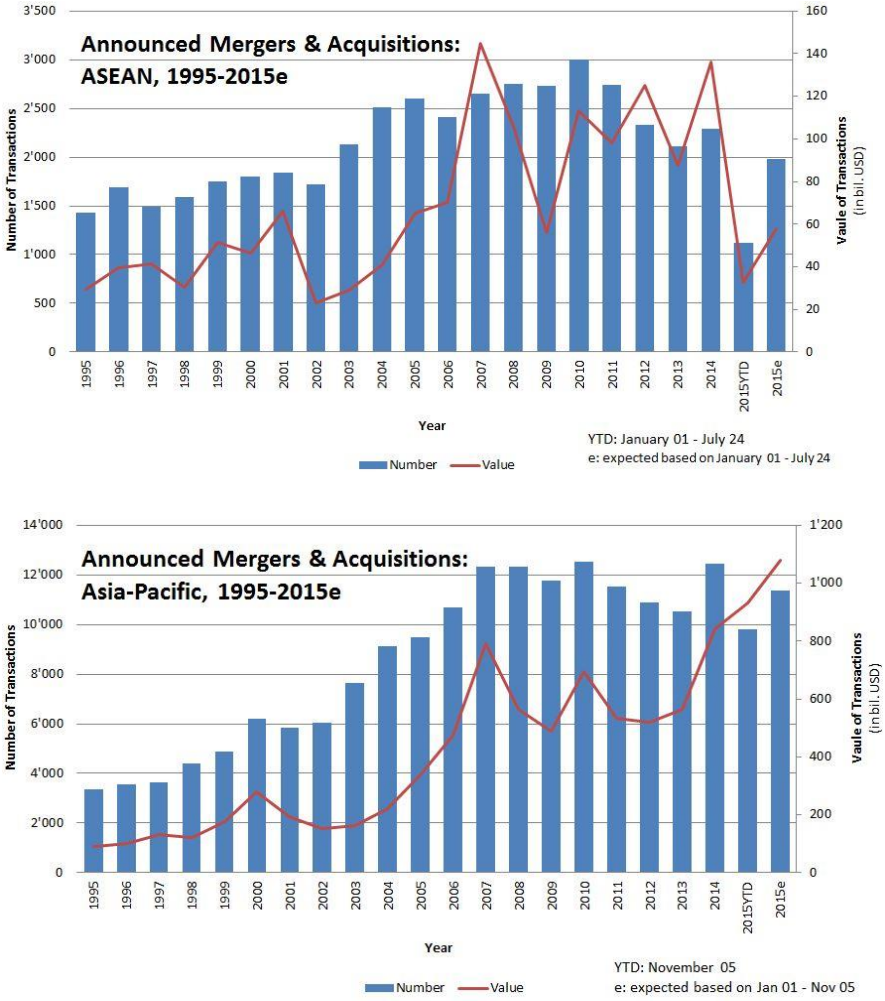

Figure 2 Mergers and Acquisitions 1995-2015e (ASEAN and Asia-Pacific)

(Institute for Mergers, Acquisitions and Alliances 2015)

Asia-Pacific M&As totaled US$1.2 trillion in 2015, up 46 percent from the previous year and past US$1 trillion for the first time. Specifically, mainland China, Hong Kong and Australia were the three most active M&A markets in the Asia Pacific region (SZ daily 2015).

Investment takes place actively cross-country and cross-industry in Asia. For instance, Softbank, a Japanese multinational telecommunications and Internet corporation, has frequently invested in firms outside of Japan. In 2015, it invested $1 billion in the fast-growing Korean e-commerce site Coupang (Russell 2015). Similarly, Alibaba, a Chinese e-commerce leader, acquired South China Morning Post, a Hong Kong English-language newspaper, in December 2015 for a fee of $266 million (Reuters). Moreover, in 2015, Chinese firms spent a record US$102 billion on outbound acquisitions (SZ daily 2015).

3.1.3 Direct investment in Asia

Contrary to the merger and acquisition market, there has not been a strong increase in Asia's capital expenditure. For instance, Figure 3 gives an example of capital expenditure change in the semiconductor industry in North America, Europe, Japan and Asia-Pacific/Others from 1990 to the first half of 2013. While the share of capital expenditure in Japan decreased consistently, that in Asia-Pacific/Others increased. As a result, Asia shows mixed trends for change in the share of capital expenditure.

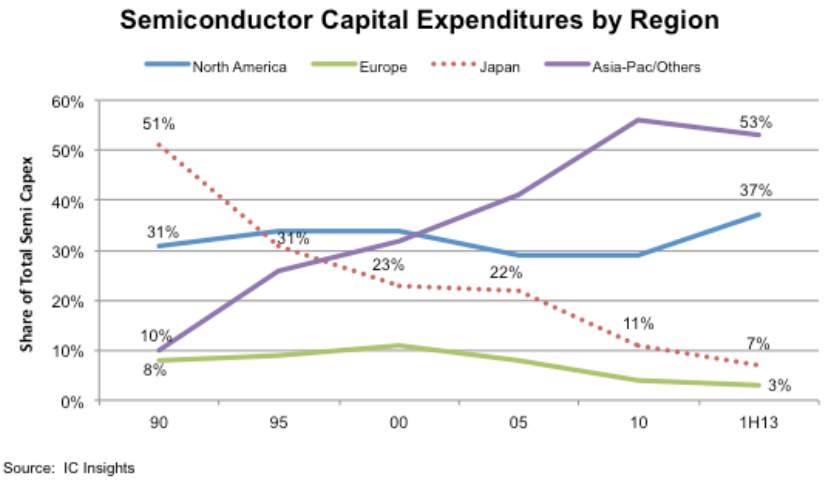

Figure 3 Semiconductor Capital Expenditures by Region (90-1H13)

(Solid State Technology)

3.2 Asian countries

3.2.1 Top economies in Asia in 2015

Rank	Country name	GDP	Developed/Developing
1	China	$10.028 Trillion	Developing
2	Japan	$4.846 Trillion	Developed
3	India	$2 Trillion	Developing
4	South Korea	$1.308 Trillion	Developed
5	Indonesia	$867.468 Billion	Developing
6	Saudi Arabia	$718.472 Billion	Developing
7	Iran	$405.540 Billion	Developing
8	United Arab Emirates	$396,235 Billion	Developed
9	Thailand	$387.156 Billion	Developing
10	Malaysia	$367.712 Billion	Developing

Figure 4 Ranking of top economies in Asia[1]

(Asianranking 2015)

The top 10 economies in Asia, shown in Figure 4, are composed of a mixture of developed and developing countries: while three out of the ten top economies in Asia are developed countries, the other seven are developing countries. Notably, the GDP of the top four

[1] In order to thoroughly represent the Asian economy, all top 10 Asian economies except the Middle East countries are included in the dataset of this paper based on which regressions are conducted.

economies are much higher than the rest, which suggests that Asia has significant inequality in terms of capital and production.

3.2.2 The financial system of Greater China

Greater China refers to the region that consists of mainland China, Hong Kong, Macau and Taiwan. While mainland China, Hong Kong and Macau belong to People's Republic of China (also referred to as China), Taiwan is a sovereign state self-claimed as Republic of China or Taiwan. Despite the existing political confusions in the Greater China region, these four areas are often discussed together because of their close economic relationship.

There is frequent trade activity within Greater China. As shown in Figure 5, Taiwan's import from China (referring to People's Republic of China) makes up over 10% of its total imports, which makes China the second biggest importer for Taiwan after Japan. Similarly, China's import from Taiwan also makes up 7% of its total imports.

Similarly, investment activities also take place very often within Greater China. Figure 6 shows that Taiwan's investment in China has increased constantly and reached $14 billion in 2011, which is as much as 80% of Taiwan's total outward investment. Moreover, China and Taiwan signed ECFA (Cross-Straits Economic Cooperation Framework Agreement) in 2010 and CSSTA (The Cross-Strait Service Trade Agreement) in 2013, both of which encourage cross-strait investment and cross-straits trade activities. These pieces of evidences explain how closely connected the capital markets are in Greater China, which is why I discuss Greater China as an economic entity later in this paper.

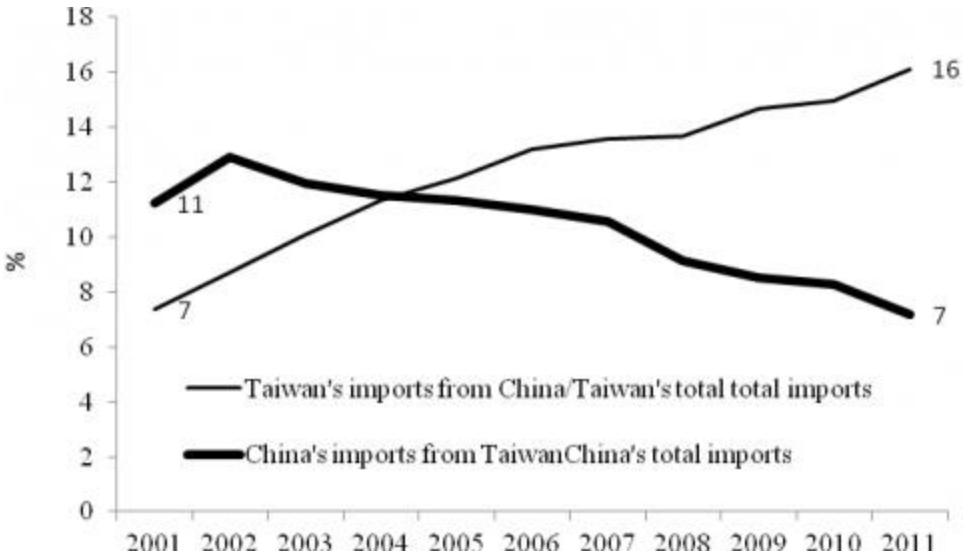

Figure 5 Shares of Taiwan's imports from China and China's imports from Taiwan 2001-2011

(Chiang and Gerbier 2013)

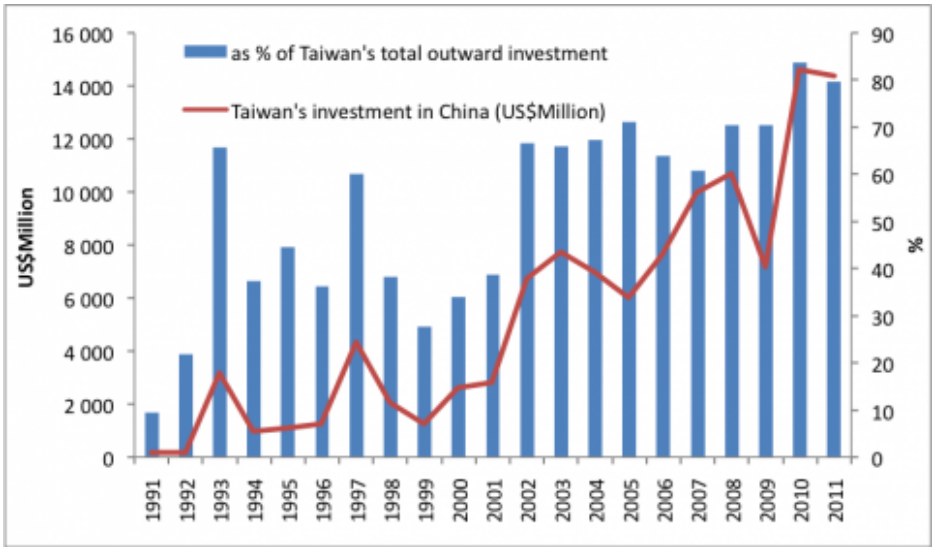

Figure 6 Taiwan's Investment in China 1991-2011

(Chiang and Gerbier 2013)

Next, I would like to introduce the economic background of mainland China, Hong Kong and Taiwan respectively.

1) Mainland China

China's financial system is often described as "highly opaque and evolving rapidly" (Elliott and Yan 2013). Figure 7 shows the complete regulatory framework in China, which clearly shows the strong control that Chinese government has on its financial system. China Securities Regulatory Commission (CSRC) is the institution that regulates securities and stock markets.

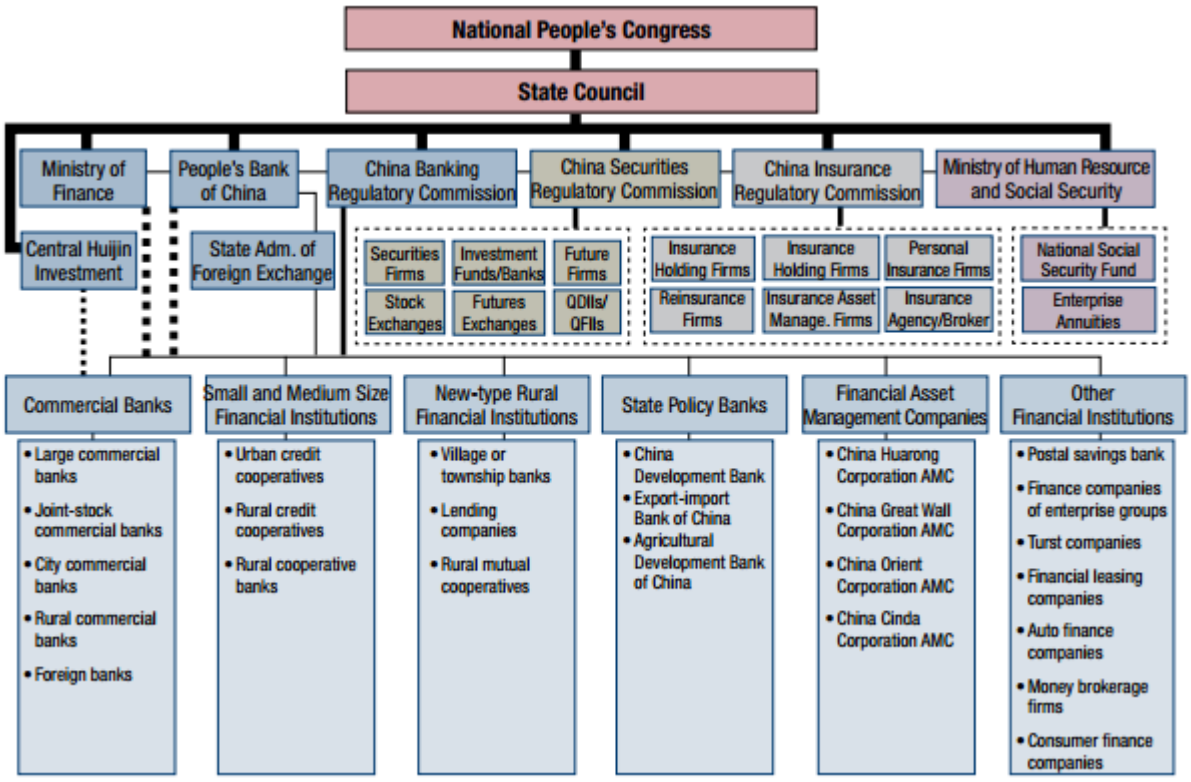

Figure 7 China's Financial System

(Elliott and Yan 2013)

There is much evidence of the Chinese government's "high level of state ownership and control" (Elliott and Yan 2013) over its financial system. For instance, the central government majority-owns the five largest banks and has stakes in many other banks as well. Since the

Communist Party is the only party in mainland China, the government and party leaders have significant influence on the financial industry. An example is that all of the most important bankers in China are appointed by the Party.

The bond market and stock markets are two major sources of funding for businesses in China. The Chinese corporate bond market is less developed than that in the US and Europe but is growing fast: "net issuance of corporate bonds increased by 65% in 2012." There are two stock markets in mainland China: Shanghai Stock Exchange and Shenzhen Stock Exchange. However, the markets are "dominated by speculators to a far greater extent than in Western nations." Shareholders rely less on underlying firm value and more on relative stock price movements. Moreover, Chinese regulators also control the size of the stock markets by controlling Initial Public Offerings (IPO): China only allows the firms to proceed to IPO if they are approved by CSRC, who takes into account, on an ad hoc basis, a wider range of considerations. It was not until 2015 that the administration announced that it planed to change IPO from approval basis to registration basis in near future.

Compared to regulations on IPO, regulations on mergers and acquisitions are relatively loose. Five-year plans are a series of social and economic development initiatives created by the Chinese Communist Party every five years, mapping future strategies and launching new reforms. In the twelvth five-year plan (the plan for 2011-2015), the Chinese government encouraged industrial restructuring and invited foreign investment in specific industries, encouraging firms to carry out more mergers and acquisitions.

Despite the loosening of foreign investment policies, China still has regulations that control ownership by foreign institutions. "An individual foreign investor is limited to a 20%

ownership stake in a bank, and the combined share for investors in a joint venture is limited to 25%. The foreign equity cap in securities joint ventures is set at 49%."

2) Hong Kong

As an international financial center, Hong Kong has a high degree of liquidity, minimum intervention by the government and a sound regulatory framework. The principal regulators of Hong Kong financial markets are the Hong Kong Monetary Authority (HKMA), the Securities and Futures Commission (SFC), the Office of the Commissioner of Insurance (OCI) and the Mandatory Provident Fund Schemes Authority (MPFA) (Investor Education Center 2014).

3) Taiwan (Republic of China)

Taiwan's financial market provides a wide range of financial services and instruments but investments in some sectors are restricted by the government. The presence of foreign banks in Taiwan is small. The princial regulator of Taiwan's financial markets is the Financial Supervisory Commission (FSC) (The Heritage Foundation 2015).

3.2.3 The financial system of Japan

Japan is the third largest economy in the entire world behind the United States and China. There are eight stock exchanges in Japan, in which Tokyo Stock Exchange (TSE) is the biggest. Established in 1978, TSE has over 2,200 listed companies and is home to many Japanese companies with global presence such as Toyota (Japan exchange group). With a long history and the support of a strong economy, the financial system of Japan is mature and internationally connected, which makes Japan a major hub in Asia.

3.2.4 ASEAN (Association of Southeast Asian Nations)

The Association of Southeast Asian Nations, abbreviated as ASEAN, is a political and economic organization of ten Southeast Asian countries. It was established on 8 August 1967 by Indonesia, Malaysia, Philippines, Singapore and Thailand. Brunei Darussalam, Vietnam, Lao, Myanmar and Cambodia joined the institution from 1995 to 1999, making up the ten Member States of ASEAN. Its objectives include accelerating the economic growth and social progress, promoting regional peace and stability, active collaboration between countries and the study of Southeast Asian (ASEAN). Figure 8 presents the location of the ten ASEAN member countries.

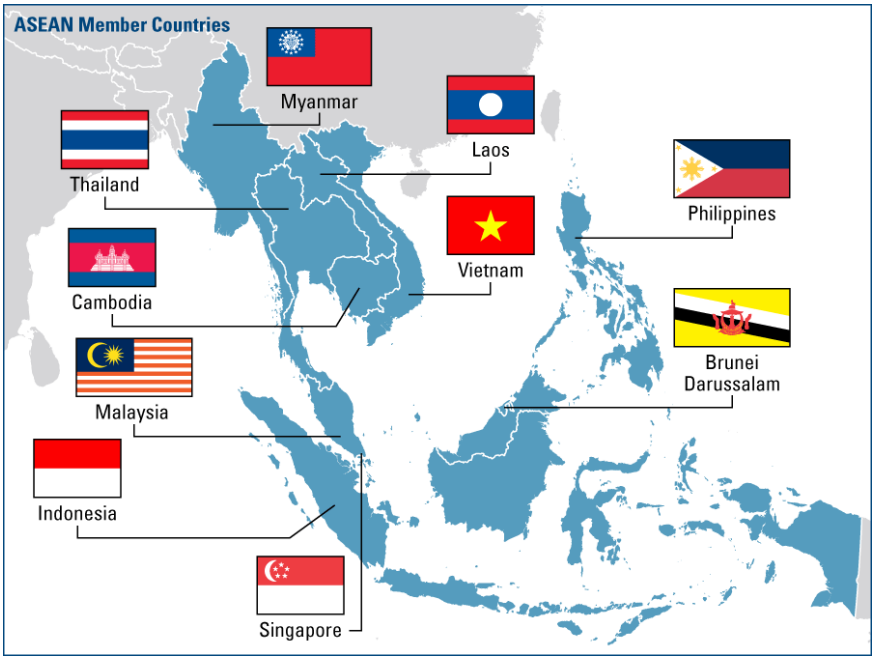

Figure 8 Location of ASEAN Member Countries

(Thailand Economic Forum)

The ASEAN-China Free Trade Area (ACFTA) is a free trade area between the 10 Southeast Asian member states and China. The area came into effect in 2010. According to the agreement, tariffs are reduced to zero on 7,881 product categories, or 90 percent of imported goods. ACFTA is the largest free trade area in the world in terms of population and third largest

in terms of nominal GDP (Xinhuanet 2015). On 22 November 2015, ASEAN and China signed an updated free trade pact, which "is expected to generate two-way trades of $1,000 billion and investments of $150 billion by 2020" (ICIS News 2015).

3.3 Important events in the Asian finance industry

3.3.1 1997-1998 Asian Financial Crisis

The Asian Financial Crisis was a financial crisis that started in July 1997 in Thailand, which later expanded into other Southeast Asian countries. The crisis began as the Thai government defended the Thai baht against speculative attacks from the currency traders. The Thai government soon allowed the baht to float freely against the dollar due to the lack of foreign exchange reserves left to support its fixed exchange rate and this decision resulted in the immediate devaluation of the baht by 20%. At that time, Thailand had already accumulated much foreign debt and its stock market was in a free fall, which worsened the currency crisis. It did not take long for the financial crisis to spread to other countries. Most Southeast Asian countries witnessed devalued currencies, collapsed stock markets and a slowdown of economic growth.

As waves of currency attacks hit other Asian countries, the governments of Malaysia, Singapore and Indonesia all decided to float their specific currencies, which resulted in a significant decline in the value of their currencies. Though unaffected by the currency turmoil, South Korea had a debt problem as multiple major Korean firms filed for bankruptcy starting in 1997. The bankruptcy wave caused the S&P downgrade and stock market collapse. Hong Kong was also hurt by the crisis. Brunei, China, Singapore, Taiwan and Vietnam were less affected, but all of them suffered from a loss of demand.

To calm down the markets, the International Monetary Fund (IMF) gave financial assistance to the most affected countries. It initiated short-term loans over $110 billion to South Korea, Indonesia and Thailand in return for debt restructuring and financial sector reforms. In 1999, the Asian economies started seeing signs of recovery. Despite the significant negative short-term outcomes, the long-term effects of the crisis may actually be good. According to Charles W.L.Hill, "the crisis gives Asian countries an incentive to reform their economic systems, and to initiate some much needed restructuring, they may emerge from the experience not weaker, but stronger institutions and a greater ability to attain sustainable economic growth" (W.L.Hill, Frontline).

3.3.2 2007-2008 Global Financial Crisis

The Global Financial Crisis is considered by many economists to be the worst financial crisis since the Great Depression of the 1930s. The crisis began in 2007 when the sky-high housing prices in the U.S. crashed and led to stock market collapse and insolvency of major financial institutions. The contagion soon spread to the global financial sector, resulting in bankruptcy of major businesses and slowdown of economic growth. By the end of 2008, all of the world's major economies were either in recession or were striving to stay out of one.

Quite a few Asian countries were affected by the crisis. For instance, growth forecasts in Cambodia showed a fall from more than 10% in 2007 to close to zero in 2009. According to Heng Swee Keat, "Asian economies, excluding China and Japan, contracted by an average of about 6.2 percent from peak to trough in the current downturn. This is not far from the 8.3 percent gross domestic product (GDP) contraction during the Asian financial crisis" (Heng 2009). While the contraction was sharp, the economic rebound in Asia was strong. For instance,

in the second quarter of 2009, Asia's GDP rebounded by 9.4 percent on a quarter-on-quarter seasonally adjusted annualized basis.

4. Literature Review

Tobin's Q is a common measure of a firm's market value introduced by James Tobin and William Brainard, two American economists, in 1968. According to Tobin, a firm's Tobin's Q is measured by:

$$q = \frac{\overline{MV}}{K}$$

where $\overline{MV}$ is the firm's market value and K is its replacement cost (Tobin and Brainard 1977).

$\overline{MV}$ is made up of three components: common stock, preferred stock and long-term debt. Moreover, the sum of the book values of common stock, preferred stock and long-term debt, corrected by a common annual index of the ratio of replacement cost to book value, gives us the value of K, which is invested capital at replacement cost.

Fumio Hayashi (1982) derives the optimal rate of investment as a function of Q. He states that the relationship between 1/K and q is described by:

$$\frac{1}{K} = .0980 + 0.423\tilde{q}$$

where K is capital stock and $\tilde{q}$ is modified q, which is the value of average q taking into account the U.S. tax system. Notably, all of the regression equations used in this thesis are derived from Hayashi's equation.

Tobin's Q also affects how firms undertake new investment projects, which includes both merger and acquisition investments and non-merger investments. In their paper "Investigating the economic role of mergers", Andrade and Stafford (2004) state that "('high q') firms are significantly more likely to undertake both mergers and non-merger investment projects than 'low q' firms". Additionally, they show that the acquirer's Q is larger than the target's Q in over two-thirds of all mergers since 1973.

Mergers and acquisitions are most effective if there exists a big difference between Q of the targets and Q of the acquirers. Defining total takeover returns as the weighted average abnormal return of targets and bidders, Henri Servaes discovers that "total (takeover) returns are larger when targets have low (Q) and bidders have high (Q)" (1991).

In their paper "Q-Theory of Mergers", Boyan Jovanovic and Peter L Rousseau state that the Q-theory of investment also applies to the merger and acquisition (M&A) market. They prove that a firm's merger and acquisition (M&A) investment also responds to its Q, the firm's value per unit of capital (Jovanovic and Rousseau 2002).

Jovanovic and Rousseau define Q as:

$$Q(z) = \max_{x \geq 0, y \geq 0} \{z - C(x, y) - x - qy + (1 - \delta + x + y)Q^*(z)\}$$

where X is the firm's direct investment in capital (new or used but unbundled), Y is its acquisitions of bundled capital and x and y are respectively X/K and Y/K. Besides, C is the cost incurred, z is a firm's state of technology, Q*(z) is the discounted expected present value of capital tomorrow given the firm's z today and q represents that the firm has the option of selling its capital in the next period on the merger market at a price of q dollars per unit of capital.

Jovanovic and Rousseau first explore how firms with different investment ratios (i) choose between merger and acquisition and direct investment. The investment ratio is the sum of mergers and acquisitions and direct investment, which represents the level of adjustment a firm is making in its own capital stock (i=x+y). According to Figure 9, merger and acquisition (y) overtakes direct investment (x) when i reaches 1.12.

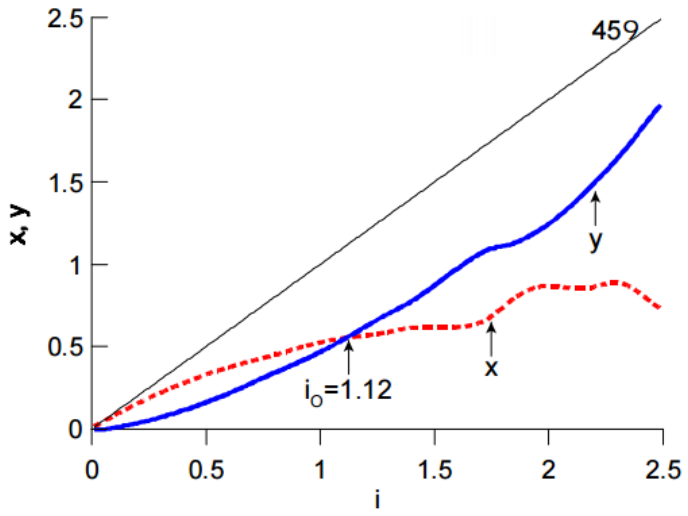

Figure 9 Direct Capital Purchases, x, and Acquired Capital, y, by Investment Ratio, i = x + y, 1971-2000

Their conclusion is that, in the United States, "firm's merger and acquisition (M&A) investment responds to its Q more -- by a factor of 2.6 -- than its direct investment does, probably because M&A investment is a high fixed cost and a low marginal adjustment cost activity."

In his paper "The Q-Theory of Mergers: International and Cross-Border Evidence", Peter L. Rousseau tests the implications of the Q-theory of mergers for the United States and seven continental European countries (Austria, Belgium, France, Germany, Italy, the Netherlands, and Switzerland) (Rousseau 2006).

Rousseau first explores how firms with different investment ratios (i) choose between merger and acquisition and direct investment in the United States and Europe for both domestic and cross-border cases. According to Figures 10 and 11, for all four cases, merger and acquisition (y) overtakes direct investment (x) as the investment ratio increases. Specifically, for the U.S. domestic cases, y overtakes x when i is 0.16; for the U.S. cross-border cases, y overtakes when i is 0.25; for the European domestic cases, y overtakes when i is 0.16; for the European cross-border cases, y overtakes when i is 0.19.

We can easily notice that there is a significant difference in the values of the overtaking i for the United States that are calculated in the two papers written respectively by Jovanovic and Rousseau (2002) and Rousseau (2006), which are presented in Figures 9 and 10. Such discrepancy is likely because the two calculations employ data from different databases: while the former paper is calculated using data for 1971-2000 from the Compustat database, the latter uses data for 1994-2005 from the SDC database.

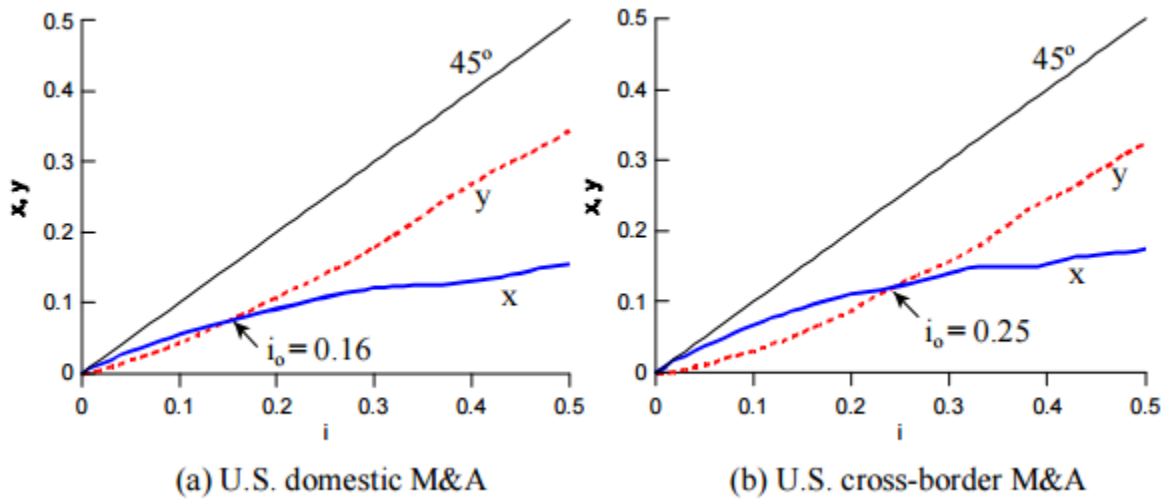

Figure 10 Direct Capital Purchases, x, and Acquired Capital, y, by Investment Ratio, i = x + y, United States 1994-2005

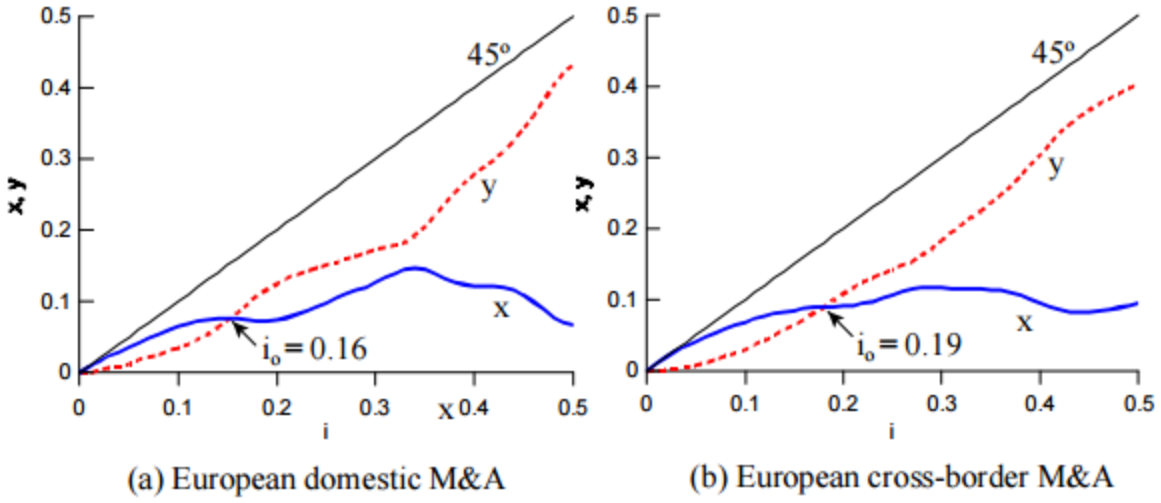

Figure 11 Direct Capital Purchases, x, and Acquired Capital, y, by Investment Ratio, i = x + y, Seven European Nations 1998-2005

Rousseau concludes that for capital markets in the United States and Europe:

1) When making big adjustments to their capital, firms prefer merger and acquisition to direct investment;
2) "High-Q" firms are more likely to carry out mergers and acquisitions;
3) Firms with excess cash on balance sheets are more likely to acquire other firms;
4) Acquirer's Q often exceeds target's Q.

Rousseau's paper only tests Q-theory of mergers in the United States and Europe, which are all developed economies. My thesis supplements it by testifying the Q-theory of mergers for capital markets in Asia, which plays an important role in global capital markets and are composed of both developed and developing economies. In general, my thesis will contribute to a more thorough understanding of the effectiveness of the Q-theory of mergers.

5. Model

5.1 Model Introduction

The model used in this paper is derived from the model used in the paper "The Q-Theory of Mergers" by Boyan Jovanovic and Peter L. Rousseau (2002) and in the paper "The Q-Theory of Mergers: International and Cross-Border Evidence" by Peter L. Rousseau (2006).

Production function is an important part of the model. With its state of technology as z and its capital stock as K, a firm's production function is output = zK. It is important to note that the capital stock includes both labor and physical capital and that z stands for "the quality of organization capital" (Rousseau 2006) and other intangibles such as proprietary inventions or management skill.

The parameter z follows the Markov process

$$\Pr\{z_{t+1} \leq z' | z_t = z\} = F(z', z) \tag{1}$$

which is firm-specific. In the market, firms can buy new or dissembled used capital at a price of unity. Moreover, there is no market for z so a firm must accept whatever z given.

To measure the growth of capital, letting X be the firm's direct investment in unbundled capital and Y its acquisitions of bundled capital, the firm's capital stock in next period will be:

$$K' = (1 - \delta)K + X + Y \tag{2}$$

Aside from payment for X and Y, the firm also faces forgone-output cost of growth:

$$c(x, y)K, \text{ where } x = \frac{X}{K} \text{ and } y = \frac{Y}{K} \tag{3}$$

After purchasing new and used capital, a firm transfers its z to the new entity. Hence, the gain of a merger is largest when the difference between the target's z and the acquirer's z is biggest, that is, the target's z is high and the acquirer's z is low. Assume that the acquirer's state is (z_1, K_1) and the target's state is (z_2, K_2). The output of the combined firm would be $z_1(K_1 + K_2)$, which is higher than the sum of the outputs of the two firms before merger, $(z_1K_1 + z_2K_2)$, by the amount $(\mathrm{z}_1 - z_2)K_2$.

The value of K inside a firm is of the form Q(z)K. A unit of K has a profit of $\mathrm{z} - \mathrm{C}(\mathrm{x}, \mathrm{y}) - \mathrm{x} - \mathrm{qy}$, and a market value of

$$\mathrm{Q}(\mathrm{z}) = \max_{x \geq 0, y \geq 0} \{z - C(x, y) - x - qy + (1 - \delta + x + y)Q^*(z)\} \tag{4}$$

$Q^*(z)$ in the equation is the discounted expected present value of capital in the next period, letting z be the firm's z today:

$$Q^*(z) = \frac{1}{1+r} \int \max\{q, Q(z')\}\, dF(z', z), \tag{5}$$

which shows that the firm has the right to sell its capital in the next period at q dollars per unit.

At an interior maximum, in which condition $Q^* = Q^*(z)$, the optimal x and y would satisfy that

$$\mathrm{c}_1(x, y) = Q^*(z) - 1 \tag{6}$$

and

$$\mathrm{c}_2(x, y) = Q^*(z) - q. \tag{7}$$

These equations show that more productive firms grow faster and they use both x and y to achieve their growth. Moreover, since no variables in the functions depend on K, a big firm grows as easily as a small firm and there is no optimal firm size. Only optimal growth exists.

Assume a fixed cost, ϕ, of acquiring the capital of other firms:

$$\mathrm{C(x,y)} = \begin{cases} c(x,y) + \phi \; if \; y > 0 \\ c(x,0) \qquad if \; y = 0 \end{cases} \tag{8}$$

This cost is per unit of K and returns to scale remain constant. Let i=x+y be the gross investment ratio in efficiency units. A low-I firm will avoid the cost ϕ by setting y=0 and using only x, whereas a high-I firm will use both margins. The value of I, call it i^*, at which the firm is indifferent between buying in the acquisitions market and staying out of it, solves for I in the equation:

$$\mathrm{i} + \mathrm{c(I,0)} = \phi + \min_y\{(i-y) + qy + c(i-y,y)\}. \tag{9}$$

where i depends on the firm's z.

A firm may disappear either by exiting and disassembling its capital, or by being acquired. Either way, it gets q per unit of K. Let z_e be the point of indifference between staying in business and exiting. Then $\mathrm{Q}(\mathrm{z}_e) = q$.

Figure 12 shows the expansion path for x and y as the efficiency-units-investment ratio i rises. At i^*, x drops from i^* to x^*, and y jumps from zero to y_{min}. The assumption is that c_y is small relative to c_x, so that the share of y in the firm's investment portfolio grows, and the expansion path approaches the 45° line. At the overtaking point, $x=y=i_0/2$. Beyond i_0, y exceeds x.

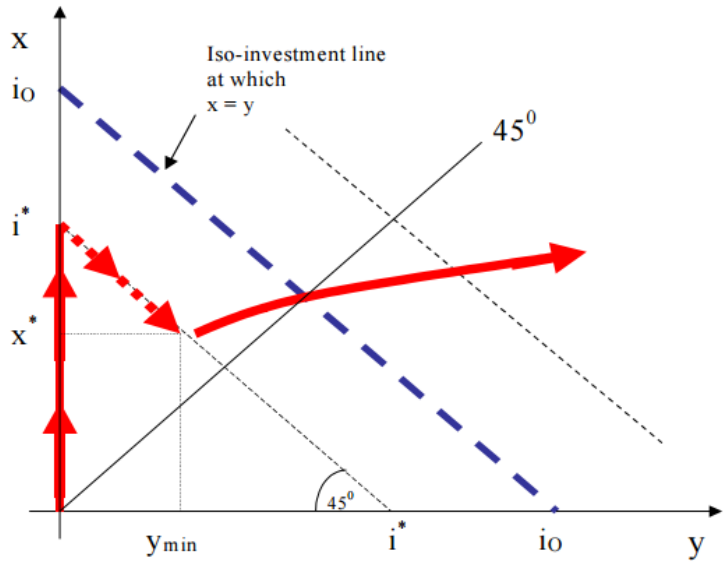

Figure 12 The expansion path of x and y (i=x+y)

(Jovanovic and Rousseau 2002)

With the red line as x and the blue line as y, Figure 13 presents the engel curves of x and y and shows how x and y varies with i. Since i is the sum of x and y, the red and blue lines add up to the 45° line at each i. When i reaches i_0, y overtakes x. The phenomena shown in Figure 13 is confirmed by the evidence in Figure 15 which shows how x and y of Asian firms change with i.

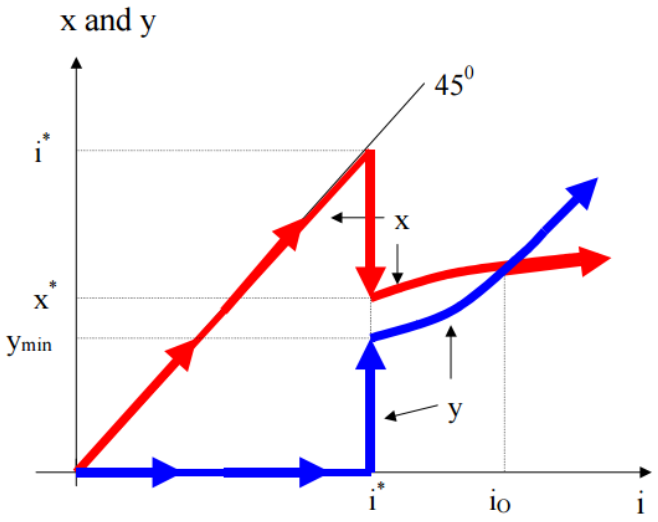

Figure 13 Engel curves

(Jovanovic and Rousseau 2002)

On the basis of this model, regression functions for direct investment and merger and acquisition are constructed and here I will introduce the variables that are used in the regressions.

Independent variables used in the regressions are $Q_{j,t-1}/\bar{q}_{t-1}$, $\ln(Q_{j,t-1}/\bar{q}_{t-1})$ and $\ln(Q_{weighted})$, where Q and q respectively stand for the acquiring firm's and the target firm's Tobin's Q, $\bar{Q}_t$ and $\bar{q}_t$ respectively represent the average of all Q's in year t and the average of all q's in year t, and finally $Q_{weighted} = Q/\bar{Q}_t$, for a merger and acquisition transaction that happens in year t.

Dependent variables used in the regression functions are $100y_{j,t}$, $100x_{j,t}$, $\ln(100y_{j,t})$ and $\ln(100x_{j,t})$ For the dependent variables, $y_{j,t}$ and $x_{j,t}$ are multiplied by 100 to let the independent and dependent variables to be closer in value. This makes the estimated coefficients be closer to 1 so that it is easier to detect patterns among the regression results.

$\ln\left(Q_{j,t-1}/\bar{q}_{t-1}\right)$, which equals to $\ln Q_{j,t-1} - \ln\bar{q}_{t-1}$, is used as an independent variable to represent the difference between the acquiring firm's and the target firm's Tobin's Qs. As mentioned in "Literature Review", Servaes (1991) argues in his paper that the difference between the two firms' Tobin's Q is positively correlated to the return of the transaction and the independent variable $\ln\left(Q_{j,t-1}/\bar{q}_{t-1}\right)$ in my regression functions tries to reconfirm the validity of Servaes' theory in Asian capital markets.

Here are the regression functions that are used in this paper:

(1) Linear

$$100y_{j,t} \equiv 100\frac{Y_{j,t}}{K_{j,t-1}} = \alpha_1^y Q_{j,t-1}/\bar{q}_{t-1} + \alpha_2^y t + \alpha_3^y D + \varepsilon \quad (10)$$

$$100x_{j,t} \equiv 100\frac{Y_{j,t}}{K_{j,t-1}} = \alpha_1^x Q_{j,t-1}/\bar{q}_{t-1} + \alpha_2^x t + \alpha_3^x D + \varepsilon \quad (11)$$

(2) Log-linear

$$\ln(100y_{j,t}) \equiv \ln(100\frac{Y_{j,t}}{K_{j,t-1}}) = \beta_1^y Q_{j,t-1}/\bar{q}_{t-1} + \beta_2^y t + \beta_3^y D + \varepsilon \quad (12)$$

$$\ln(100x_{j,t}) \equiv \ln(100\frac{X_{j,t}}{K_{j,t-1}}) = \beta_1^x Q_{j,t-1}/\bar{q}_{t-1} + \beta_2^x t + \beta_3^x D + \varepsilon \quad (13)$$

(3) Log-log

$$\ln(100y_{j,t}) \equiv \ln(100\frac{Y_{j,t}}{K_{j,t-1}}) = \gamma_1^y \ln(Q_{j,t-1}/\bar{q}_{t-1}) + \gamma_2^y t + \gamma_3^y D + \varepsilon \quad (14)$$

$$\ln(100x_{j,t}) \equiv \ln(100\frac{X_{j,t}}{K_{j,t-1}}) = \gamma_1^x \ln(Q_{j,t-1}/\bar{q}_{t-1}) + \gamma_2^x t + \gamma_3^x D + \varepsilon \quad (15)$$

$$\ln(100y_{j,t}) \equiv \ln(100\frac{Y_{j,t}}{K_{j,t-1}}) = \delta_1^y \ln(Q_{weighted}) + \delta_2^y t + \delta_3^y D + \varepsilon \quad (16)$$

$$\ln(100x_{j,t}) \equiv \ln(100\frac{X_{j,t}}{K_{j,t-1}}) = \delta_1^x \ln(Q_{weighted}) + \delta_2^x t + \delta_3^x D + \varepsilon \quad (17)$$

where t is a linear time trend which represent the year that the merger and acquisition transaction takes place, with 1998 as 1, 1999 as 2, … 2015 as 18, and ε is the error term.

D is the first two digits of SIC industry code, which identifies the major industry groups of each firm. D is included to take into account the effect of industry level differences. Moreover, t is included as a linear time trend to take into account the effect of time.

Regressions are run on linear, log-linear and log-log functions because since Asian capital markets are different from each other in terms of their respective development phases, financial policies and influencing factors, it is hard to predict which equation would best describe the patterns in Asian capital market. It is also likely that the relationship between investment and Q is nonlinear and since log transformation can linearize non-linear data, log-linear and log-log functions are included to explore such a possibility.

As a result, I want to run regression all possible functional forms firstly to find which functions work the best to describe the Asian capital market and secondly to confirm the authenticity of the conclusion. Specifically, if all functions pointed to the same conclusion, then this conclusion would be strong; if only some of the functions direct to a conclusion while the other functions show a different conclusion, then a consistent and strong conclusion cannot be reached. In terms of which function describes the data best, this is a question that I want to answer after analyzing the regression results.

The model predicts that:

(1) α_1^x, α_1^y, β_1^x, β_1^y, γ_1^x, γ_1^y, δ_1^x, δ_1^y should all be positive;

(2) $\alpha_1^y \geq \alpha_1^x$; $\beta_1^y \geq \beta_1^x$; $\gamma_1^y \geq \gamma_1^x$; $\delta_1^y \geq \delta_1^x$.

5.2 Data Description

Data are extracted from Thomas Reuters Database. After screening, there are in total 2297 useable observations. Figure 11 shows how countries are distributed in the observations. The countries/regions with the most observations are: Japan, South Korea and Hong Kong.

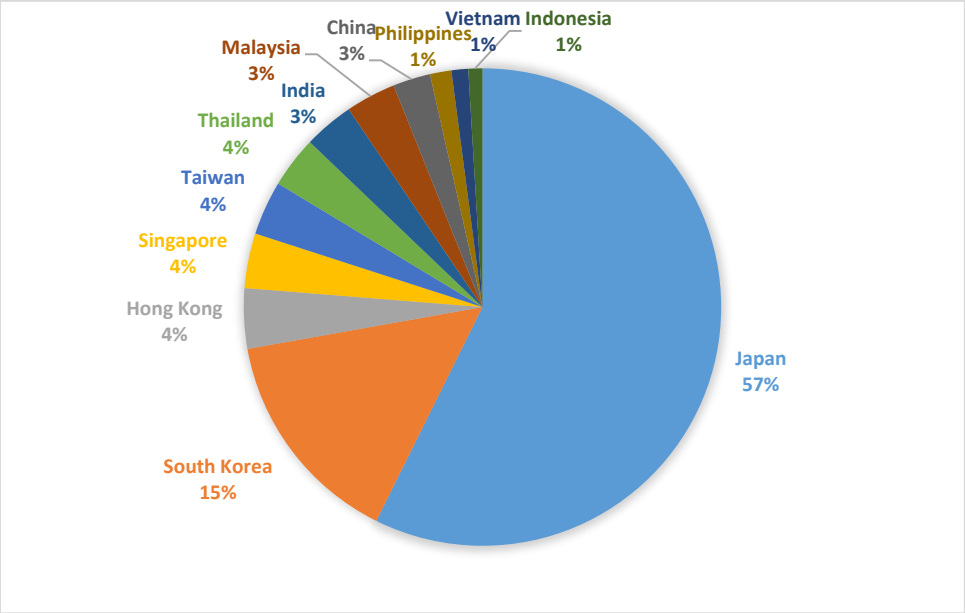

Figure 14 Distribution of countries in the observations

I want to point out that the number of observations from China seems to be skewed downwards given the size of the Chinese economy. Here are two possible reasons behind this result:

1) The lack of public information

Due to the fact that the IPO system in China is approval-based rather than registration-based, going public in China is a complex process and thus many Chinese companies choose to stay private. Hence, since many mergers and acquisitions take place between private companies in China, for which there is little public information, these mergers and acquisitions are not included in the database.

Similarly, the mergers and acquisitions between state-owned firms are often not disclosed to the public and thus are not included in the database.

2) Some mergers and acquisitions of Chinese firms take place in Hong Kong

Many firms with operations both in mainland China and in Hong Kong choose to conduct merger and acquisition investments in Hong Kong because, as introduced in "Background of Asian Capital Markets", Hong Kong has more favorable and freer financial policy and more access to international capital. Because of this, Hong Kong observations may include investments for both Hong Kong companies and companies with operations both in mainland China and in Hong Kong.

More information about data extraction and data screening is included in Appendix III.

6. Results

6.1 Descriptive statistics

Figure 15 shows how x and y varies with i within the 1998-2015 period. The x and y series in Figure 15 are approximated using moving average of 100 periods and are applied h-p filter. Other observations with i greater than 0.5 are not shown because the observations get thinner as i gets larger. From Figure 15, y overtakes x when i reaches 0.16 and the differences between y and x coefficients expand as i increases. This result is consistent with the prediction of the Engel curves for x and y in Figure 13.

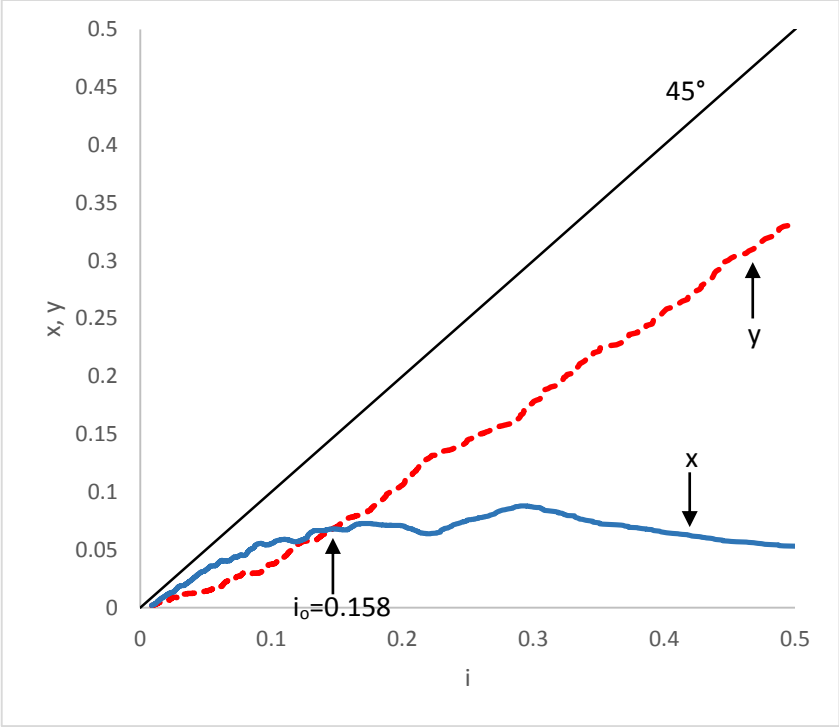

Figure 15 Direct capital purchases, x, and Acquired capital, y, by Investment ratio, i=x+y, 1998-2015

It is also interesting to compare the i_o of Asian countries from 1998-2015, which is 0.158, with i_0 of Europe and the United States, which are presented in Figure 10 and Figure 11. While the i_0 for domestic investment in Europe and in the United States are both 0.16, the i_0 for cross-border investments in Europe and in the United States is 0.19 and 0.25 respectively (Rousseau 2006). Hence, while the i_0 of Asia is as big as the i_0 for domestic investment in Europe and in the United States, it is smaller than that of cross-border investment in Europe and in the United States. In order to get a general sense of the i_0 for all investments in Europe and in the United States, I take the average of the i_0's for domestic and cross-border investments and the result is that $i_{0\text{-average}}$ of Europe is 0.18 and $i_{0\text{-average}}$ of the United States is 0.21, both of which are bigger than i_0 of Asia.

The result shows that small Asian firms favor mergers and acquisitions more than European and American firms of a similar size, and because of this Asian capital markets witness

more mergers and acquisitions at smaller values than European and American markets. Here are some possible explanations for this phenomena:

1) Strong growth in Asia

As described in Figure 1, many Asian economies, especially the emerging economies, are currently undergoing strong growth, which leads to the outburst of many potential but undervalued startups in the market. Because of this, more mature firms will choose to acquire these firms in order to achieve synergies, avoid future competition and gain bigger returns. A good example is Alibaba Group, which, as a Chinese e-commerce leader, acquired and invested in 13 firms just in 2013 (CIW Team 2014). A full list of mergers and acquisitions that Alibaba carried out from 2005 to 2014 is included in Appendix IV. Because of synergy and the undervaluation of the target firms, mergers and acquisitions are more efficient than direct investment for more mature firms.

2) The fragmented nature of Asian customer markets

This is a point made by Soon Ghee Chua, who is a partner of the global management consulting firm A.T.Kearney. He believes that contrary to in the western market where a group of companies dominate most of the industries, Asian markets are not as fully established and, in fact, are significantly fragmented. Thus, there is lots of room for companies to grow and to gain market share, and the merger and acquisition market is wide open (Chua).

3) Some countries have policies that encourage mergers and acquisitions.

As introduced in “Background on Asian Capital Markets”, Chinese government encourages mergers and acquisitions to induce industry restructuring. Such policy support will result in more firms undertaking mergers and acquisitions activities.

Figure 16 shows how the annual $\bar{Q}$ and $\bar{q}$ varies from 1998 to 2015:

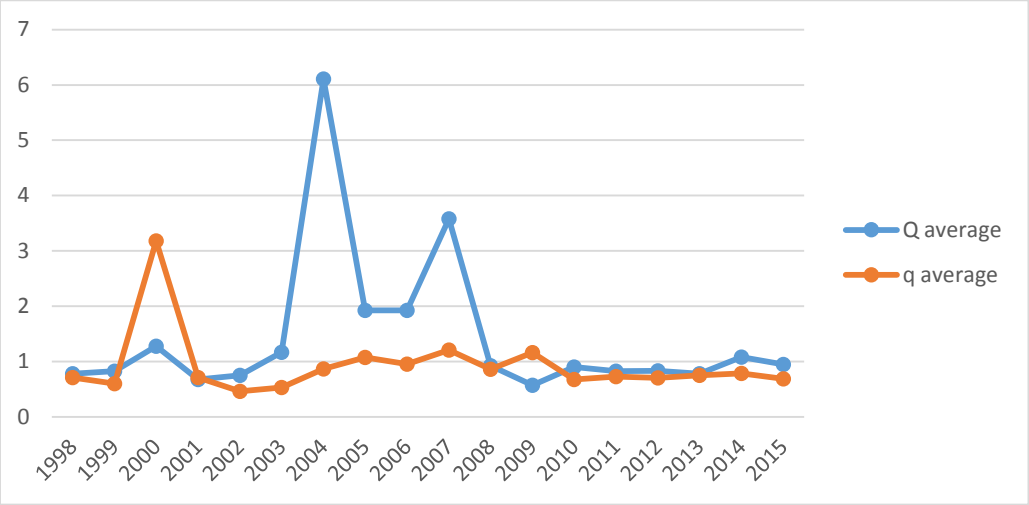

Figure 16 Annual $\bar{Q}$ and $\bar{q}$ (1998-2015)

From Figure 16, we can see that $\bar{Q}$ is larger than $\bar{q}$ in most years, except for 2000, 2001 and 2009. The top three $\bar{Q}$'s are in 2004, 2007 and 2000 and the lowest $\bar{Q}$ is in 2009; the top three $\bar{q}$'s take place in 2000, 2009 and 2007 and the lowest $\bar{q}$ takes place in 2002.

While the rise in $\bar{Q}$ in 2004 is because of global economic recovery from the SARS crisis and the war in Iraq (IMF 2004), the rise in 2010 and 2007 is due to broad-based global expansion (IMF 2000, 2007). On the other hand, the decrease in $\bar{Q}$ in 2005 resulted from the Indian Ocean tsunami in December 2004, which resulted in significant cost to rebuild and drove down GDP growth in Southeast Asia countries. Finally, the reason for the sharp drop in $\bar{Q}$ in 2008 is the global financial crisis, which was introduced in "Background on Asian Capital Markets."

6.2 Regression results for all Asia

Tables 1, 2 and 3 present the results for our panel of pooled observations for all Asia from 1998-2015. Table 1 presents regression results with t as time trend, Table 2 presents results

with 2-digit SICs as dummy variables and Table 3 presents results with both t as time trend and 2-digit SICs as dummy variables. Each column represents one regression, for which the correlation coefficients and t-statistics of the independent variable and the constant, the R-squared and the number of observations are reported. For instance, for the first column of Table 1, the regression result for the linear function with $\boldsymbol{Q_{j,t-1}/\bar{q}_{t-1}}$ as independent variable and $\boldsymbol{100y_{j,t}}$ as dependent variable is reported. The function is as follows:

$$100y_{j,t} = 2.4133\, Q_{j,t-1}/\bar{q}_{t-1} + 0.3083t + 4.2078 \tag{18}$$

and the R-squared of this function is 0.0275.

Table 1-Investment Regressions with t as time trend

	y				**x**			
	$\boldsymbol{100y_{j,t}}$	$\boldsymbol{\ln 100y_{j,t}}$	$\boldsymbol{\ln 100y_{j,t}}$	$\boldsymbol{\ln 100y_{j,t}}$	$\boldsymbol{100x_{j,t}}$	$\boldsymbol{\ln 100x_{j,t}}$	$\boldsymbol{\ln 100x_{j,t}}$	$\boldsymbol{\ln 100x_{j,t}}$
$\boldsymbol{Q_{j,t-1}/\bar{q}_{t-1}}$	2.4133 (7.96) ***	.1624 (10.35) ***			.0386 (0.90)	.0097 (0.92)		
$\boldsymbol{\ln(Q_{j,t-1}/\bar{q}_{t-1})}$			.5835 (16.61) ***				.2421 (10.12) ***	
$\boldsymbol{\ln(Q_{weighted})}$				.5842 (16.55) ***				.2466 (10.27) ***
t	.3083 (1.51)	.0312 (2.96) **	.0221 (2.17) *	.0110 (1.08)	.0241 (0.83)	.0098 (1.38)	.0076 (1.10)	.0029 (0.42)
Constant	4.2078 (1.83)	-.0226 (-0.19)	.5184 (4.56) ***	.7850 (6.70) ***	4.0132 (12.31) ***	.6993 (8.74) ***	.8310 (10.74) ***	.9456 (11.86) ***
R-squared	*0.0275*	*0.0471*	*0.1097*	*0.1091*	*0.0006*	*0.0012*	*0.0434*	*0.0447*
Number of observations	2297	2297	2297	2297	2297	2297	2297	2297

Notes: The table presents estimates with T-statistics in parentheses.
The regressions include t as time trend for years 1998-2015.
p<0.05: *; p<0.01: **; p<0.001 ***

Table 2-Investment Regressions with 2-digit SICs as dummy variables

	y				X			
	$100y_{j,t}$	$\ln 100y_{j,t}$	$\ln 100y_{j,t}$	$\ln 100y_{j,t}$	$100x_{j,t}$	$\ln 100x_{j,t}$	$\ln 100x_{j,t}$	$\ln 100x_{j,t}$
$Q_{j,t-1}/\bar{q}_{t-1}$	2.1889 (6.86) ***	.1185 (7.39) ***			.0433 (1.00)	.0067 (0.75)		
$\ln(Q_{j,t-1}/\bar{q}_{t-1})$			.5096 (12.85) ***				.0784 (3.51) ***	
$\ln(Q_{weighted})$				.5099 (12.81) ***				.0825 (3.68) ***
Constant	0.7991 (0.02)	.3353 (0.17)	1.5808 (0.81)	1.8595 (0.96)	3.2307 (0.60)	1.1747 (1.07)	1.7674 (1.61)	1.8066 (1.65)
R-squared	*0.0540*	*0.1266*	*0.1669*	*0.1666*	*0.1159*	*0.3837*	*0.3870*	*0.3873*
Number of observations	2297	2297	2297	2297	2297	2297	2297	2297

Notes: The table presents estimates with T-statistics in parentheses.
The regressions include dummy variables for 2-digit SICs (not reported).
p<0.05: *; p<0.01: **; p<0.001 ***

Table 3-Investment Regressions with 2-digit SICs as dummy variables and t as time trend

	y				x			
	$100y_{j,t}$	$\ln 100y_{j,t}$	$\ln 100y_{j,t}$	$\ln 100y_{j,t}$	$100x_{j,t}$	$\ln 100x_{j,t}$	$\ln 100x_{j,t}$	$\ln 100x_{j,t}$
$Q_{j,t-1}/\bar{q}_{t-1}$	2.2136 (6.92) ***	.1203 (7.48) ***			.0433 (1.00)	.0055 (0.62)		
$\ln(Q_{j,t-1}/\bar{q}_{t-1})$			.5114 (12.89) ***				.0771 (3.45) **	
$\ln(Q_{weighted})$				.5093 (12.78) ***				.0842 (3.75) ***
t	.2134 (1.01)	.01527 (1.45)	.0138 (1.34)	.0041 (0.40)	.0000 (0.00)	-.0101 (-1.74)	-.0097 (-1.67)	-.0112 (-1.94)
Constant	2.5994 (0.07)	1.6685 (0.84)	1.4398 (0.74)	1.8186 (0.93)	3.4635 (0.64)	1.4084 (1.28)	1.8664 (1.70)	1.9175 (1.75)
R-squared	*0.0545*	*0.1274*	*0.1676*	*0.1666*	*0.1159*	*0.3846*	*0.3877*	*0.3883*
Number of observations	2297	2297	2297	2297	2297	2297	2297	2297

Notes: The table presents estimates with T-statistics in parentheses.
The regressions include time trend for years 1998-2015 and dummy variables for 2-digit SICs (not reported).
p<0.05: *; p<0.01: **; p<0.001 ***

The regression results in Table 1-3 show many meaningful characteristics:

While the correlation coefficients of Q in both x regressions and y regressions are positive, the coefficients in y regressions are bigger than in x regressions. Moreover, while all correlation coefficients in y regressions are statistically significant, only some of the coefficients in x regressions are statistically significant.

The correlation coefficient of Q in y regressions is the most statistically significant with time trend as the only dummy variable in the function, less significant when both time trend and 2-digit SIC dummy variables are included, and the least significant when only 2-digit SICs are included as dummy variables. Moreover, t is positively correlated to x and y in all regressions.

As for the R-squared, with time trend as the only dummy variable, the R-squared of y regressions is bigger than the R-squared of x regressions for all functions; with first two digits of SIC code included as the only dummy variable, the R-squared of y regressions is smaller than the R-squared of x regressions for all functions; with both time trend and first two digits of SIC code as dummy variables, the R-squared of y regressions is smaller than the R-squared of x regressions for all functions. The general smaller R-squared of y regressions shows that the merger and acquisition observations are more scattered than the direct investment observations.

Comparing the three functional forms, with their dummy variables kept the same, the log-log functions have bigger R-squared than log-linear functions or linear functions for both x regressions and y regressions, which means that the log-log functional form fits data the best. Hence, log-log functions best describe the relationship between x and Q and between y and Q in Asia.

Table 4 Difference between coefficients of y and x

Dependent variable	Independent variable	Industry as dummy	t as dummy	Industry and t as dummies	Average
$\boldsymbol{Q_{j,t-1}/\overline{q}_{t-1}}$	100x or 100y	2.1456	2.3747	2.1703	2.2302
$\boldsymbol{Q_{j,t-1}/\overline{q}_{t-1}}$	ln100x or ln100y	0.1118	0.1527	0.1148	0.1264
$\boldsymbol{\ln(Q_{j,t-1}/\overline{q}_{t-1})}$	ln100x or ln100y	0.4312	0.3414	0.4343	0.4023
$\boldsymbol{\ln(Q_{weighted})}$	ln100x or ln100y	0.4274	0.3376	0.4251	0.3967

Table 4 shows how big the difference is between the correlation coefficients of Q in y regressions and the according x regressions, which is calculated by subtracting the independent variable's coefficient in the x regressions from the according y regressions. As presented in the table, the difference between y and x is always positive. Specifically, for linear functions, the correlation coefficients of the y-regressions are approximately 55 times that of the x-regressions; for log-linear functions, the correlation coefficients of the y-regressions are approximately 15 times that of the x regressions; for log-log functions, the correlation coefficients of the y-regressions are approximately 5 times that of the x regressions.

The result confirms that the Q-theory of mergers works in Asia: as the acquiring firm's Tobin's Q increases, the value of both direct investment and mergers and acquisitions increases. Moreover, mergers and acquisitions respond to Q more than direct investment. With one unit increase in $Q_{j,t-1}/\overline{q}_{t-1}$ ($\ln(Q_{weighted})$), there is a bigger increase in 100y (or ln100y) than in

100x (or ln100x). Hence, the correlation between the acquiring firm's Tobin's Q and merger and acquisition is more significant than the correlation between that and direct investment. With a certain level of Tobin's Q, a firm conducts a larger value of mergers and acquisitions than direct investments. Thus, merger and acquisition is a more popular way of investment than direct investment. Additionally, the bigger the difference between Tobin's Q of the acquirer and the target, the bigger the value of merger and acquisition. This is shown in the regressions on $\ln(Q_{j,t-1}/\bar{q}_{t-1})$. With one unit increase in $\ln(Q_{j,t-1}/\bar{q}_{t-1})$, the value of both direct investment and merger and acquisition increases.

Robust regressions (Attached in the appendix) have also been conducted to investigate the possibility of heteroscedastic errors. The results of robust regressions are consistent with these of the OLS regressions, which strengthens the validity of the previous conclusions.

6.3 Greater China

The paper also tries to discover patterns in the capital market that are specific to Greater China, because Greater China is a developing economic region with unique political, social and financial characteristics and big market capitalization. Hence, the paper wants to discover how the Q-theory works specifically in Greater China. In the following regressions, the acquirers are restricted to be from China, Hong Kong and Taiwan but the targets are not restricted. There are 227 observations in total, which accounts for approximately 10% of all the observations in Asia.

Figure 17 shows how the observations are distributed between China (mainland China), Hong Kong and Taiwan.

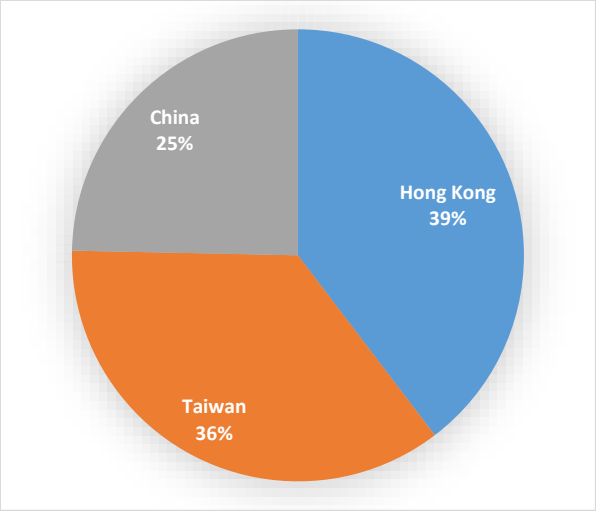

Figure 17 Breakdown of the acquiring firms

Tables 4, 5 and 6 present the results for observations in Greater China from 1998-2015. Contents of Tables 4, 5 and 6 can be interpreted similarly to Tables 1, 2 and 3.

Table 4-Investment Regressions with t as time trend

	Y				x			
	$100y_{j,t}$	$\ln 100y_{j,t}$	$\ln 100y_{j,t}$	$\ln 100y_{j,t}$	$100x_{j,t}$	$\ln 100x_{j,t}$	$\ln 100x_{j,t}$	$\ln 100x_{j,t}$
$Q_{j,t-1}/\bar{q}_{t-1}$	1.2114 (3.45) ***	.0429 (2.61) **			-.0346 (-0.64)	-.0407 (-2.84) **		
$\ln(Q_{j,t-1}/\bar{q}_{t-1})$			.5362 (6.10) ***				.1166 (1.41)	
$\ln(Q_{weighted})$				.4090 (4.86) ***				.0824 (1.07)
t	-.0577 (-0.09)	.0053 (0.18)	-.0112 (-0.41)	-.0153 (-0.54)	-.0581 (-0.61)	.0089 (0.35)	.0091 (0.35)	.0085 (0.33)
Constant	15.6581 (2.25) *	1.1558 (3.55) ***	1.5748 (5.13) ***	1.6969 (5.25) ***	5.5206 (5.17) ***	.5981 (2.11) *	0.5477 (1.90)	.5675 (1.92)
R-squared	*0.0507*	*0.0295*	*0.1425*	*0.0954*	*0.0033*	*0.0356*	*0.0098*	*0.0060*
Number of observations	227	227	227	227	227	227	227	227

Notes: The table presents estimates with T-statistics in parentheses.
The regressions include t as time trend for years 1998-2015.
p<0.05: *; p<0.01: **; p<0.001 ***

Table 5-Investment Regressions with 2-digit SICs as dummy variables

	y				x			
	$100y_{j,t}$	$\ln 100y_{j,t}$	$\ln 100y_{j,t}$	$\ln 100y_{j,t}$	$100x_{j,t}$	$\ln 100x_{j,t}$	$\ln 100x_{j,t}$	$\ln 100x_{j,t}$
$Q_{j,t-1}/\bar{q}_{t-1}$	1.6176 (1.85)	.0873 (1.60)			-.0745 (-0.45)	-.0119 (-0.32)		
$\ln(Q_{j,t-1}/\bar{q}_{t-1})$			.4649 (4.14) ***				-.0347 (-0.43)	
$\ln(Q_{weighted})$				.2990 (2.80) **				-.0404 (-0.54)
Constant	-110.20 (-1.06)	-5.6395 (-0.87)	2.1015 (1.09)	2.4033 (1.18)	8.4855 (0.43)	-3.2175 (-0.72)	-4.4095 (-3.20) **	1.2353 (0.87)
R-squared	*0.4771*	*0.2156*	*0.2716*	*0.2369*	*0.3075*	*0.5169*	*0.5171*	*0.5174*
Number of observations	227	227	227	227	227	227	227	227

Notes: The table presents estimates with T-statistics in parentheses.
The regressions include dummy variables for 2-digit SICs (not reported).
p<0.05: *; p<0.01: **; p<0.001 ***

Table 6-Investment Regressions with 2-digit SICs as dummy variables and t as time trend

	Y				x			
	$100y_{j,t}$	$\ln 100y_{j,t}$	$\ln 100y_{j,t}$	$\ln 100y_{j,t}$	$100x_{j,t}$	$\ln 100x_{j,t}$	$\ln 100x_{j,t}$	$\ln 100x_{j,t}$
$Q_{j,t-1}/\bar{q}_{t-1}$	1.6468 (1.86)	.0853 (1.55)			-.1277 (-0.78)	-.0208 (-0.56)		
$\ln(Q_{j,t-1}/\bar{q}_{t-1})$			.4654 (4.14) ***				-.0336 (-0.42)	
$\ln(Q_{weighted})$				.3039 (2.84) **				-.0309 (-0.42)
t	.1503 (0.28)	-.0103 (-0.31)	-.0173 (-0.54)	-.0226 (-0.69)	-.2734 (-2.76) **	-.0457 (-2.02)	-.0442 (-1.96)	-.0436 (-1.94)
Constant	-114.89 (-1.09)	-5.3175 (-0.81)	2.2555 (1.15)	2.5956 (1.26)	17.0030 (0.87)	-1.7934 (-0.40)	-4.0170 (-2.91) **	1.6063 (1.13)
R-squared	*0.5675*	*0.2160*	*0.2728*	*0.2388*	*0.3346*	*0.5272*	*0.5269*	*0.5269*
Number of observations	227	227	227	227	227	227	227	227

Notes: The table presents estimates with T-statistics in parentheses.
The regressions include time trend for years 1998-2015 and dummy variables for 2-digit SICs (not reported).
p<0.05: *; p<0.01: **; p<0.001 ***

Similar to Asia's regression results, Q and y shows positive correlations in all functions, the majority of which are statistically significant. However, what is unique to the regression results for Greater China is that Q and x generally show negative correlation, although the correlations are not statistically significant. Specifically, in linear functions, the correlation coefficients of the independent variables in the y regressions are around 1.5 bigger than those in the x regressions; in log-linear functions, the correlation coefficients of the independent variables in the y regressions are around 0.1 bigger than those in the x regressions; in log-log functions, the correlation coefficients of the independent variables in the y regressions are around 0.4 bigger than those in the x regressions.

As for dummy variables, it is unclear what the time trend's correlation with Q is. With 2-digit SICs as dummy variables, t is negatively correlated with Q for both direct investment and mergers and acquisitions, but the reverse is true when the dummy variables are not included.

Moreover, with time trend as the only dummy variable, the R-squared of the y regressions is bigger than that of the x regressions in most functions; with the first two digits of SIC code included as the only dummy variable, the R-squared of the y regressions is smaller than that of the x regressions for log-linear functions and log-log functions, yet the R-squared of the y regressions is bigger than that of the x regressions for linear functions; with both time trend and first two digits of SIC code as dummy variables, the R-squared of the y regressions is smaller than that of the x regressions for all functions.

Comparing the t statistics and the R-squared of different functions, we can find that, with dummy variables kept the same, for the y regressions, the linear functional form fits data the best; for the x regressions, the log-log and log-linear functional forms fit the data better. Hence, while linear functions describe the relationship between x and Q the best, log-log functions and

log-linear functions describe the relationship between y and Q better. However, to find a function that works the best for both the y regressions and the x regressions, the answer would be log-log functions.

The results convey that, in Greater China, the Q-theory of investment works for merger and acquisition market but not for direct investment market. Specifically, if a firm's Tobin's Q increases, the value of mergers and acquisitions that the firm conducts increases but the value of direct investment that the firm conducts decreases or does not change. This means that in Greater China, a firm with high Tobin's Q conducts higher value of mergers and acquisitions but lower value of direct investment. The result confirms that firm's merger and acquisition activity responds to its Tobin's Q more than its direct investment does, but the decreasing trend of direct investment sets apart the result of Greater China from that of Asia. Here are some possible explanations for the decreasing trend of direct investment:

1) Merger and acquisition as a cheaper way of expansion

As introduced before, mergers and acquisitions are encouraged by the Chinese government. Hence, the favorable policies attract more firms to conduct mergers and acquisitions rather than directly invest in unbundled capital.

2) The presence of large state-owned enterprises (SOE's)

The strong presence of state-owned enterprises in Greater China makes it hard for firms to expand mainly by direct investment. State-owned enterprises have a strong presence in China. According to Elliott and Yan (2013), "in recent years, firms with majority state ownership reportedly represented 35% of business activity in China, but earned 43% of the profits." The state-owned enterprises have a strong control on client basis and resources in their specific

industries, which limit other firms from expanding their operations simply by investing more money on capital expenditure. Because of this, after reaching a certain size, Chinese firms may decrease the amount that they invest in their own businesses and instead expand by merging with or acquiring other firms.

6.4 Japan

I also ran regressions on data for Japan in order to compare the regression results of Japan with those of China. Japan is suitable for such a comparison because:

1) Economies and capital markets of similar size.

Globally, China and Japan are the second and the third largest economy respectively based on GDP (Knoema 2015). Moreover, while the third, fifth and sixth largest stock exchanges by market cap are located in Greater China, the fourth largest stock exchange is located in Japan (Yan 2015).

2) Difference in maturity of economy and capital market

Japan is a developed economy and has been a major Asian financial center since the 1980s. On the contrary, China is a developing economy and its financial market is still growing and reforming. Despite their differences, Japan and China, however, are now “racing to become Asia's 2020 financial hub” (Nikkei Asia Review 2014). Hence, in order to see which country would actually become “Asia’s 2020 financial hub”, it is interesting to analyze the differences and similarities of their activities in the direct investment and merger and acquisition markets.

For the following regressions, I restricted the acquirers of observations to Japan while not setting any restrictions for the target. With this criteria, we find 1265 observations in total, which accounts for approximately 55% of all the observations in Asia.

Tables 7, 8 and 9 presents the results for observations in Japan from 1998-2015. The contents of Tables 7, 8 and 9 can be interpreted similarly to Tables 1-6.

Table 7-Investment Regressions with t as time trend

	y				**x**			
	$\mathbf{100y_{j,t}}$	$\mathbf{ln100y_{j,t}}$	$\mathbf{ln100y_{j,t}}$	$\mathbf{ln100y_{j,t}}$	$\mathbf{100x_{j,t}}$	$\mathbf{ln100x_{j,t}}$	$\mathbf{ln100x_{j,t}}$	$\mathbf{ln100x_{j,t}}$
$\mathbf{Q_{j,t-1}/\bar{q}_{t-1}}$	.0652 (2.27) *	.0096 (2.85) **			-.0055 (-1.05)	-.0012 (-0.66)		
$\mathbf{ln(Q_{j,t-1}/\bar{q}_{t-1})}$			.5858 (12.40) ***				.1305 (4.85) ***	
$\mathbf{ln(Q_{weighted})}$				.4461 (9.67) ***				.1259 (4.89) ***
t	.0865 (0.66)	.0083 (0.54)	.0036 (0.25)	-.0156 (-1.04)	-.0296 (-1.24)	.0009 (0.11)	.0005 (0.06)	-.0051 (-0.61)
Constant	5.2764 (3.83) ***	-.1541 (-0.95)	0.2279 (1.46)	0.5328 (3.13) **	4.1218 (16.40) ***	.8777 (9.94) ***	.9507 (10.71) ***	1.0573 (11.13) ***
R-squared	*0.0043*	*0.0065*	*0.1087*	*0.0691*	*0.0020*	*0.0004*	*0.0183*	*0.0186*
Number of observations	1265	1265	1265	1265	1265	1265	1265	1265

Notes: The table presents estimates with T-statistics in parentheses.
The regressions include t as time trend for years 1998-2015.
p<0.05: *; p<0.01: **; p<0.001 ***

Table 8-Investment Regressions with 2-digit SICs as dummy variables

	y				x			
	$100y_{j,t}$	$\ln 100y_{j,t}$	$\ln 100y_{j,t}$	$\ln 100y_{j,t}$	$100x_{j,t}$	$\ln 100x_{j,t}$	$\ln 100x_{j,t}$	$\ln 100x_{j,t}$
$Q_{j,t-1}/\bar{q}_{t-1}$	.0443 (1.33)	.0035 (0.94)			-.0074 (-1.34)	-.0013 (-0.74)		
$\ln(Q_{j,t-1}/\bar{q}_{t-1})$			.3981 (7.45) ***				.0816 (3.25) **	
$\ln(Q_{weighted})$				.2300 (4.59) ***				.0857 (3.71) ***
Constant	8.7162 (0.60)	2.0107 (1.24)	-1.3497 (-1.57)	-1.5232 (-1.75)	5.4816 (2.26) *	1.2167 (1.62)	1.2582 (3.13) **	1.2843 (3.19) **
R-squared	*0.0940*	*0.1918*	*0.2267*	*0.2050*	*0.2515*	*0.4175*	*0.4223*	*0.4238*
Number of observations	1265	1265	1265	1265	1265	1265	1265	1265

Notes: The table presents estimates with T-statistics in parentheses.
The regressions include dummy variables for 2-digit SICs (not reported).
p<0.05: *; p<0.01: **; p<0.001 ***

Table 9-Investment Regressions with 2-digit SICs as dummy variables and t as time trend

	y				x			
	$100y_{j,t}$	$\ln 100y_{j,t}$	$\ln 100y_{j,t}$	$\ln 100y_{j,t}$	$100x_{j,t}$	$\ln 100x_{j,t}$	$\ln 100x_{j,t}$	$\ln 100x_{j,t}$
$Q_{j,t-1}/\bar{q}_{t-1}$	.0437 (1.31)	.0033 (0.88)			-.0077 (-1.39)	-.0013 (-0.77)		
$\ln(Q_{j,t-1}/\bar{q}_{t-1})$			.3950 (7.38) ***				.0809 (3.22) **	
$\ln(Q_{weighted})$				.2407 (4.79) ***				.0885 (3.80) ***
t	-.0498 (-0.38)	-.0204 (-1.40)	-.0153 (-1.07)	-.0287 (-1.98) *	-.0268 (-1.23)	-.0048 (-0.71)	-.0033 (-0.50)	-.0073 (-1.09)
Constant	9.2682 (0.63)	2.2371 (1.37)	-1.2620 (-1.47)	-1.3339 (-1.53)	5.7781 (2.37) *	1.2695 (1.68)	1.2772 (3.16) **	1.3324 (3.29) **
R-squared	*0.0941*	*0.1931*	0.2274	*0.2076*	*0.2525*	*0.4177*	*0.4224*	*0.4243*
Number of observations	1265	1265	1265	1265	1265	1265	1265	1265

Notes: The table presents estimates with T-statistics in parentheses.
The regressions include time trend for years 1998-2015 and dummy variables for 2-digit SICs (not reported).
p<0.05: *; p<0.01: **; p<0.001 ***

The regression results for Japan display the following characteristics:

Q and y shows positive correlations in all functions, the majority of which are statistically significant. The correlation between Q and x, however, shows mixed results, as in some functions the correlation coefficients are positive but in others the coefficients are negative. However, none of the negative correlations between Q and x are not statistically significant. Comparing the correlation coefficients of the x regressions and the y regressions, we can discover that, in linear functions, the correlation coefficients of the independent variables in the y regressions are around 0.06 bigger than those in the x-regressions; in log-linear functions, the correlation coefficients of the independent variables in the y-regressions are around 0.004 bigger than those in the x-regressions; in log-log functions, the correlation coefficients of the independent variables in the y-regressions are around 0.3 bigger than those in the x-regressions.

It is vague what time trend's correlation with Q is. With 2-digit SICs as dummy variables, t is negatively correlated with Q for both direct investments and mergers and acquisitions, but when the industry dummy variables are not included, the correlation shows mixed result.

Moreover, similar to results for Asia and Greater China, with time trend as the only dummy variable, the R-squared of y regressions is bigger than the R-squared of x regressions for linear functions, log-linear functions and log-log functions; with first two digits of SIC code as the only dummy variable, the R-squared of y regressions is smaller than the R-squared of x regressions for all functions; with both time trend and first two digits of SIC code as dummy variables, the R-squared of y regressions is smaller than the R-squared of x regressions for all functions.

In general, with their dummy variables kept the same, the log-log functions have bigger the R-squared than log-linear functions or linear functions for both x regressions and y regressions, which means that the log-log functional form fits the data best. Hence, log-log functional form describes the relationship between y and Q and between x and Q the best.

6.5 Comparison of Japan and Greater China

Comparing the regression results doe Japan and Greater China, we discover that, in general, the regression results for Japan and Greater China are similar. Specifically, all results confirm that the Q-theory of mergers works for the merger and acquisition market but does not necessarily work for the direct investment market and show that the log-log model fits data the best among the three models and that the bigger the difference is between the target's and the acquirer's Q, the bigger the value of merger and acquisition is.

However, if we look more in depth, there are definitely some differences between the regression results of the two regions. First of all, with one unit increase in the target firm's Q, there is generally less increase in the value of merger and acquisition for Japan than for Greater China. This means that Chinese firms respond more to a change in Tobin's Q when deciding if they will conduct merger and acquisition activities.

Moreover, in Greater China, the value of direct investment drops as the acquirer's Q increases, but, in Japan, different results are shown in different models, while only regressions that show positive correlations between x and Q are statistically significant.

There are a few factors that may contribute to the similarity between the capital markets of Japan and Greater China. First of all, there is a strong presence of cross-border mergers and

acquisitions in Japan. For instance, as shown in Figure 18, from 2004-2015, both the outbound value and outbound number of cross-border mergers and acquisitions remain high (Outbound investment is the investment from Japanese firms to foreign firms and inbound investment is the investment from foreign firms to Japanese firms). The outbound number of cross-border mergers and acquisitions also grows quite constantly throughout the decade. According to Lewis and Inagaki from Financial Times (2015), Japanese firms actively acquire firms from both developed and developing countries because of "the lack of strong domestic growth" in Japan and the formation of the Trans-pacific Partnership, which makes cross-border mergers easier to conduct.

Hence, it is likely that the involvement of firms of developing countries in transactions make the transactions in Japan behave more similarly to those in China.

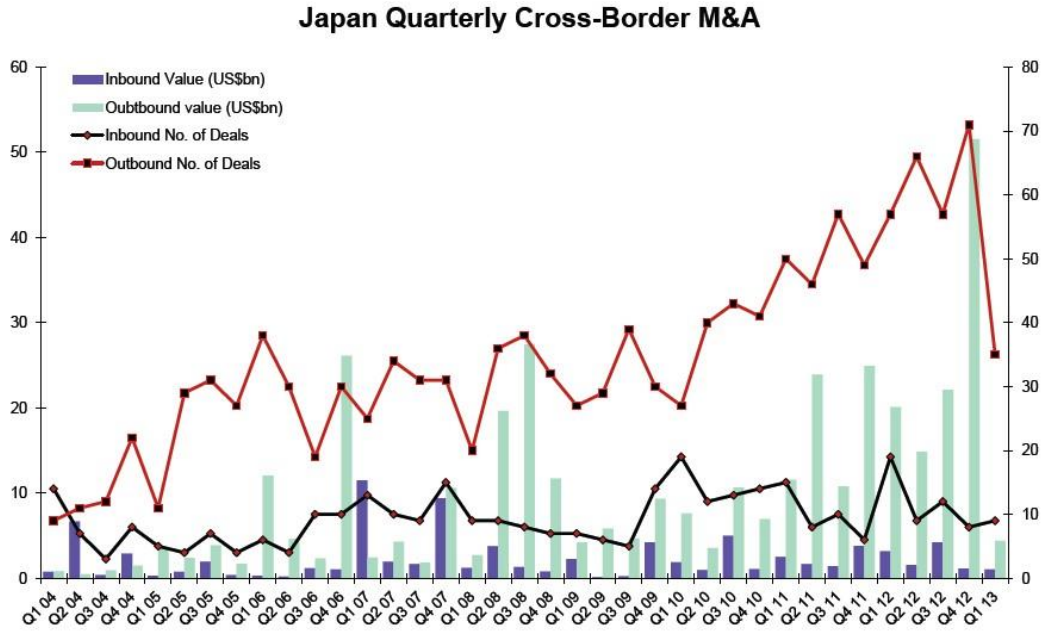

Figure 18 Japan Quarterly Cross-Border M&A

(ChinaGoAbroad)

Moreover, China and Japan are not two insulated entities, since lots of investment activities and collaborations take place between firms in China and in Japan. Figure 19 presents that from 2001-2012, Japanese firms have invested billions of dollars in China every year, while year-on-year growth stays positive. Because of those interactions, the capital markets of the two countries are more integrated.

I predict that if we restrict both the acquiring firm and the target firm to be Japanese firms, the distinction between investments of the two countries will be more obvious. In order to check if my prediction is right, I run regression on data with both the acquiring firm and the target firm restricted as Japanese firms, which brings us 929 observations, and the regression results are shown in Table 10: [2]

[2] Due to time limitation, I didn't run regression with only 2-digit SICs as dummy variables or only t as time trend. However, I think the regression results with 2-digit SICs as dummy variables and t as time trend can give us a thorough enough understanding of the cases with both targets and acquirers as Japanese firms.

Table 10-Investment Regressions with 2-digit SICs as dummy variables and t as time trend

	y				x			
	$100y_{j,t}$	$\ln 100y_{j,t}$	$\ln 100y_{j,t}$	$\ln 100y_{j,t}$	$100x_{j,t}$	$\ln 100x_{j,t}$	$\ln 100x_{j,t}$	$\ln 100x_{j,t}$
$Q_{j,t-1}/\bar{q}_{t-1}$	.0152 (0.32)	.0023 (0.46)			-.0041 (-0.56)	.0006 (0.28)		
$\ln(Q_{j,t-1}/\bar{q}_{t-1})$			.4018 (5.97) ***				.0799 (2.66) **	
$\ln(Q_{weighted})$				.1995 (3.15) **				.0847 (3.05) **
t	-.0104 (-0.06)	-.0201 (-1.14)	-.0144 (-0.83)	-.0267 (-1.51)	-.0235 (-0.89)	-.0044 (-0.57)	-.0033 (-0.42)	-.0071 (-0.91)
Constant	0.4004 (0.02)	-1.0433 (-0.51)	.9611 (0.47)	2.6782 (1.31)	2.5076 (0.82)	-.2878 (-0.21)	-.5062 (-0.56)	-.3436 (-0.38)
R-squared	*0.0880*	*0.1859*	*0.2175*	*0.1947*	*0.2368*	*0.4387*	*0.4431*	*0.4445*
Number of observations	929	929	929	929	929	929	929	929

Notes: The table presents estimates with T-statistics in parentheses.
The regressions include time trend for years 1998-2015 and dummy variables for 2-digit SICs (not reported).
p<0.05: *; p<0.01: **; p<0.001 ***

From Table 10, we can see that both y and x are generally positively correlated to Q and that the sensitivity of y to Q is much bigger than that of x in all regressions.

The positive correlation of x and Q makes Japan's results more similar to the results for Asia and less similar to the results for Greater China. Moreover, Comparing Table 9 and 10, we can find that restricting the targets as Japanese firms results in a general decrease in the sensitivity of y and a slight increase in the sensitivity of x. This is consistent with the fact that Japanese firms are large outbound investors and that many Japanese firms, such as SoftBank Corp, are more prone to invest in foreign firms than in Japanese firms as their own market values increase. Moreover, comparing Table 10 with Table 3 and Table 6, it is clear that the sensitivity

of y in Japan is less than that in Asia and in Greater China, which means that Japanese firms respond to a change in acquirer's Tobin's Q less than firms of other countries in Asia. A possible reason for this phenomena is that since Japan is a more mature economy than most other Asian countries, Japanese capital market is not fragmented and thus there are not many undervalued target firms in the Japanese market. Hence, Japanese firms may be more cautious when deciding to conduct more mergers and acquisitions and thus appear to respond less to a change in Tobin's Q.

As a result, I conclude that the differences between the capital markets of Japan and Greater China result in some, but not significant, differences in firms' activities in the merger and acquisition market and the direct investment market. Japan's regression result is also more similar to Asia's result than Greater China's China. Moreover, Japan's mergers and acquisitions are the least sensitive to the acquirers' Q among the three markets.

Finally, according to Xi of Global Times (2015), Japanese investment in China have dropped by 25.1% and 38.8% in the first ten months of 2015 and in 2014 respectively. Such a drop might increase the differences between the patterns of investment in the two countries. Although the regressions in this thesis does not attempt to investigate into the impact of such a sharp drop, it would be interesting to see what the impact will be.

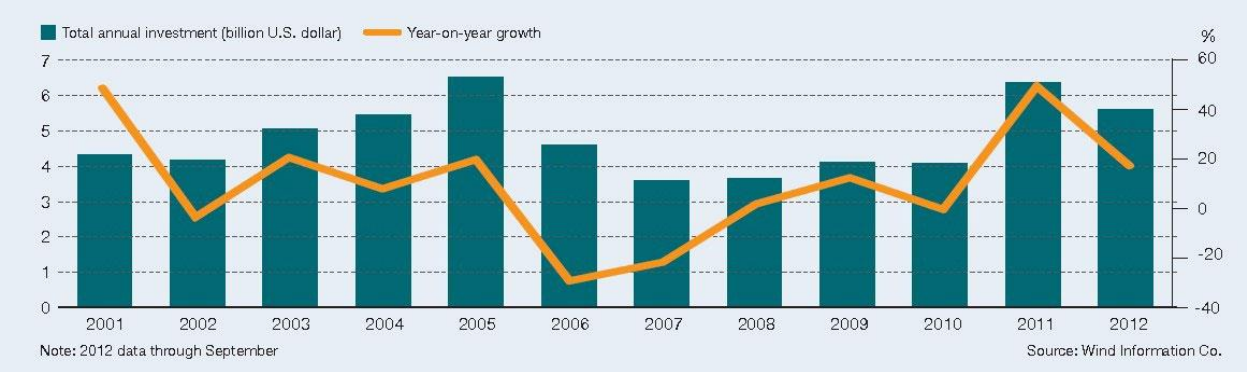

Figure 19 Japanese direct investment in China

(Caixin Online 2012)

7. Conclusion

7.1 Summary

This paper first looks to apply Tobin's Q theory to Asian capital markets. It builds a model to describe patterns of direct investment and merger and acquisition activities among Asian firms. It looks at the impact of changes in Tobin's Q of a firm (that is, the acquiring firm of the mergers and acquisitions) respectively on the value of direct investment and mergers and acquisitions. The regression results convey that in Asia, (1) value of both direct investment and mergers and acquisitions are positively correlated to a firm's Tobin's Q; (2) one unit of increase in Tobin's Q results in a bigger increase in merger and acquisition value than in direct investment value. This suggests that Asian firms prefer mergers and acquisitions to direct investment as a mean of investment.

The paper also looks at patterns of direct investment and merger and acquisition activities specifically in Greater China. The regression results convey that in Greater China, (3) mergers and acquisitions are positively correlated to a firm's Tobin's Q but direct investment is negatively correlated to a firm's Tobin's Q; (4) one unit of increase in Tobin's Q results in a bigger increase in merger and acquisition value than in direct investment value; (5) in a majority of cases, time trend is negatively correlated to both direct investment and mergers and acquisitions.

Similarly, the paper looks at patterns of direct investment and merger and acquisition activities specifically in Japan in order to compare its results with results in Greater China. The regression results show that in Japan, (6) mergers and acquisitions are positively correlated to a firm's Tobin's Q but it is vague what direct investment's correlation is with a firm's Tobin's Q;

(7) one unit of increase in Tobin's Q will result in a bigger increase in merger and acquisition value than in direct investment value.

Despite some minor differences, the regression results of Japan and Greater China are in fact quite similar and the reasons behind this phenomena could be: (1) frequent business interaction between Greater China and Japan; (2) the strong presence of cross-border mergers and acquisitions in Japan. These reasons are proved valid by the fact that, with both acquirers and targets restricted to Japanese firms, the regression results of Japan become less similar to those of Greater China.

Moreover, the log-log functions are the functions that best describe the relationships respectively between mergers and acquisitions and a firm's Tobin's Q and between direct investment and a firm's Tobin's Q in Greater China, Japan and Asia overall.

In general, this paper confirms that the Q-theory of mergers works in Asia and helps explain merger and acquisition and direct investment activities in Asian capital markets.

7.2 Policy suggestions

For the Chinese government, I suggest that it should reconsider its policies on mergers and acquisitions and direct investment. While supportive policies on mergers and acquisitions did manage to encourage Chinese firms to conduct more mergers and acquisitions, they may negatively impact dynamics between the merger and acquisition market and the direct investment market, which is described in Figure 12: for some cases, especially when firms are small and conduct few investment, direct investment is more effective than merger and

acquisition, but many Chinese firms choose the latter due to policy supports. Hence, loosening these policies may potentially increase the effectiveness of the Chinese capital market.

For the Asian governments in general, their investment policies are quite efficient as the Q theory works well for the Asian capital market. The governments should try to maintain the current dynamics in their capital markets by keeping their current policies.

7.3 Limitations

The occurrence of merger and acquisition transactions depend on government regulation and whether there exist suitable target firms in the market. Some firms also conduct mergers and acquisitions for reasons other than increasing their market value. Moreover, this paper doesn't analyze how a firm's q changes after a direct investment or a merger and acquisition has been completed.

Additionally, the remaining limitation deals with a lack of data to test the accuracy of the conclusions. It must be noted that private companies are not included in the data and it is likely that their investment activities are in some level different from public firms because they have less capital market liquidity, smaller size and less publicity or pressure from shareholders.

7.4 Recommendations for future study

Many additional opportunities for study exists within the Asian capital market, which has many unique and interesting characteristics. Industry-wide data analysis can be conducted to discover industry-wide characters in mergers and acquisitions and direct investment markets.

Moreover, it would also be interesting to investigate patterns unique to developed and developing markets, to certain distinctive economies (such as India, as a developing economy with significant capital market value, Singapore, as a developed economy playing a key role in both Asian and international market) or groups of economies (such as ASEAN). Essentially, future study could look to understand patterns in investment for more specific types of Asian firms. Finally, it will be interesting to analyze how a firm's q changes after an investment has taken place and if there exists a pattern in the change in q, why such a change takes place.

8. References

Andrade, Gregor, and Erik Stafford. 2004. "Investigating the economic role of mergers." *Journal of Corporate Finance* 1-36.

ASEAN. n.d. *Overview.* Accessed 1 16, 2016. http://www.asean.org/asean/about-asean/overview/.

Asianranking. 2015. *Top 10 Largest Economies in Asia 2015.* Accessed 1 1, 2016. http://www.asianranking.com/top-10-largest-economies-in-asia/.

Caixin Online. 2012. *Japanese Investment in China.* 11 23. Accessed 1 31, 2016. http://english.caixin.com/2012-11-23/100464496.html.

Chiang, Min-Hua, and Bernard Gerbier. 2013. "Cross-Strait Economic Relations: Recent Development and Implications for Taiwan." *Revue de la regulation.* Accessed 1 14, 2016. https://regulation.revues.org/10177?lang=en.

ChinaGoAbroad. n.d. *Japan.* Accessed 1 31, 2016. http://www.chinagoabroad.com/en/article/japan.

Chua, Soon Ghee, interview by A.T.Kearney. n.d. *Asian Companies Rewrite the Rules of M&A* Accessed 1 26, 2016. http://www.southeast-asia.atkearney.com/mergers-acquisitions/ideas-insights/article/-/asset_publisher/ldXqklJHnwU3/content/asian-companies-rewrite-the-rules-of-m-a/10192.

CIW Team. 2014. *INFOGRAPHIC: Alibaba Investment Timeline 2005-2014.* 9 30. Accessed 1 26, 2016. http://www.chinainternetwatch.com/9217/alibaba-investment-timeline-2014/.

Elliott, Douglas J., and Kai Yan. 2013. "The Chinese Financial System." *Brookings.* 7. Accessed 1 17, 2016. http://www.brookings.edu/~/media/research/files/papers/2013/07/01-chinese-financial-system-elliott-yan/chinese-financial-system-elliott-yan.pdf.

Frontline. n.d. *Timeline of the panic.* Accessed 1 16, 2016. http://www.pbs.org/wgbh/pages/frontline/shows/crash/etc/cron.html.

Fumio, Hayashi. 1982. "Tobin's Marginal q and Average q: a neoclassical interpretation." *Econometrica, Vol. 50, No. 1.* 213-224.

Heng, Swee Keat. 2009. "The Global Financial Crisis: Impact on Asia and Policy Challenges Ahead." *ASIA ECONOMIC POLICY CONFERENCE.* 267-276.

ICIS News. 2015. *ASEAN, China sign upgraded free trade agreement.* 11 23. Accessed 1 16, 2016. http://www.icis.com/resources/news/2015/11/23/9946129/asean-china-sign-upgraded-free-trade-agreement/.

IMF. 2000. "Global Economic Outlook." *IMF.org.* 10. Accessed 2 9, 2016. https://www.imf.org/external/pubs/ft/weo/2000/02/pdf/chapter1.pdf.

—. 2004. "World Economic Outlook." *IMF.org.* 9. Accessed 2 9, 2016. http://www.imf.org/external/pubs/ft/weo/2004/02/pdf/chapter1.pdf.

—. 2007. "World Economic Outlook." *IMF.org.* 10. Accessed 2 9, 2016. https://www.imf.org/external/pubs/ft/weo/2007/02/pdf/text.pdf.

Institute for Mergers, Acquisitions and Alliances . 2015. *Mergers & Acquisitions (M&A) Statistics.* Accessed 11 28, 2015. http://www.imaa-institute.org/recources/statistics-mergers-acquisitions/#MergersAcquisitions_Asia-Pacific.

International Monetary Fund. 2010. *Asia Leading the Way.* Accessed 1 26, 2016. http://www.imf.org/external/pubs/ft/fandd/2010/06/singh.htm.

Investor Education Center. 2014. "A Quick Guide to Hong Kong's Financial System and Services." *HKIEC.* Accessed 1 17, 2016. https://www.hkiec.hk/web/common/pdf/publication/en/IEC-quick-guide-to-hk-financial-system-and-services.pdf.

Japan exchange group. n.d. *Japan exchange group.* Accessed 3 12, 2016. http://www.jpx.co.jp/english/.

Japan Finance Corporation. n.d. *Japan Finance Corporation-Profile.* Accessed 3 12, 2016. https://www.jfc.go.jp/n/english/profile.html.

Jovanovic, Boyan, and Peter L. Rousseau. 2002. *The Q-Theory of Mergers.* Boston: NATIONAL BUREAU OF ECONOMIC RESEARCH.

Knoema. 2015. *World GDP Ranking 2015.* 11 10. Accessed 1 29, 2016. http://knoema.com/nwnfkne/world-gdp-ranking-2015-data-and-charts.

Lagarde, Christine. 2015. *International Monetary Fund.* 9 2. Accessed 11 28, 2015. https://www.imf.org/external/np/speeches/2015/090215.htm.

Lewis, Leo, and Kana Inagaki. 2015. *Japan Inc: M&A's big spenders.* 12 22. Accessed 1 31, 2016. http://www.ft.com/cms/s/0/ad7d340e-a4c0-11e5-a91e-162b86790c58.html#axzz3yqjah8eh.

listabuzz. n.d. *Latest Ranking Of Top 10 Largest Economies Setting The Pace In Asia.* Accessed 4 7, 2016. http://listabuzz.com/latest-ranking-of-top-10-largest-economies-setting-the-pace-in-asia/.

2014. *M&A Markets: Continued Growth For Asia Pacific.* November 13. https://www.spcapitaliq.com/insights/m-a-markets-europe-at-best-recovery-phase-exciting-times-for-north-america-and-continued-growth-for-asia-pacific.

Nikkei Asia Review. 2014. *Japan, China race to become Asia's 2020 financial hub.* 9 18. Accessed 1 29, 2016. http://asia.nikkei.com/magazine/20140918-MARKETS-IN-YOUR-PALM/Markets/Japan-China-race-to-become-Asia-s-2020-financial-hub?page=1.

Reuters. n.d. Accessed 12 24, 2015. http://www.reuters.com/article/us-scmp-group-alibaba-idUSKBN0TX01S20151214#Ylf0ADsqvCm4wB2U.97.

Rousseau, Peter L. 2006. "The Q-Theory of Mergers: International and Cross-Border Evidence." *Repec.* 1. Accessed 1 22, 2016. http://repec.org/sed2006/up.10982.1138858117.pdf.

Russell, Jon. 2015. *SoftBank Invests $1B In Korean E-Commerce Firm Coupang At A $5B Valuation.* 6 2. Accessed 4 7, 2016. http://techcrunch.com/2015/06/02/coupangzillion/.

Servaes, Henri. 1991. "Tobin's Q and the Gains from Takeovers." *The Journal of Finance* 409-419.

Sina. 2014. *掌趣科技：上半年收入 3.4 亿元 净利 1.2 亿元.* 8 27. http://chuangye.cyz.org.cn/2014/0205/46570.shtml.

Solid State Technology. n.d. *Asia-Pac soars, Japan drops in regional semiconductor capex spending.* Accessed 11 28, 2015. http://electroiq.com/blog/2013/09/asia-pac-soars-japan-drops-in-regional-semiconductor-capex-spending/.

SZ daily. 2015. *China's outbound M&As set to hit new heights in 2016.* 12 23. Accessed 1 1, 2016. http://szdaily.sznews.com/html/2015-12/23/content_3421825.htm.

Thailand Economic Forum. n.d. *ASEAN Community.* Accessed 1 22, 2016. http://thailand-economic-forum.blogspot.com/p/asean-community.html.

The Heritage Foundation. 2015. *Taiwan.* Accessed 1 17, 2016. http://www.heritage.org/index/country/taiwan.

Tobin, James, and William C. Brainard. 1977. "Asset Markets and the Cost of Capital." *Cowles Foundation Paper 440* 235-261.

W.L.Hill, Charles. n.d. *The Asian Financial Crisis.* Accessed 1 16, 2016. http://www.wright.edu/~tdung/asiancrisis-hill.htm.

Xinhuanet. 2015. *Backgrounder: Upgraded version of ASEAN-China FTA.* 11 22. Accessed 11 12, 2016. http://news.xinhuanet.com/english/2015-11/22/c_134841426.htm.

Yan, Sophia. 2015. *China's stock market is now worth over $10 trillion.* 6 15. Accessed 1 29, 2016. http://money.cnn.com/2015/06/15/investing/china-stocks-10-trillion/.

Yu Xi. 2015. *Japanese investment in China drops sharply.* 11 17. Accessed 1 31, 2016. http://www.globaltimes.cn/content/953265.shtml.

Appendix I: Robust Regressions

Tables 11, 12 and 13 show the results of robust regressions on all Asia data. Their contents can be interpreted in the same fashion as Tables 1-10.

Table 11-Investment Robust Regressions with t as time trend

	y				**x**			
	$100y_{j,t}$	$\ln 100y_{j,t}$	$\ln 100y_{j,t}$	$\ln 100y_{j,t}$	$100x_{j,t}$	$\ln 100x_{j,t}$	$\ln 100x_{j,t}$	$\ln 100x_{j,t}$
$Q_{j,t-1}/\bar{q}_{t-1}$	.3944 (21.32) ***	.2593 (16.14) ***			-.0128 (-0.55)	-.0031 (-0.33)		
$\ln(Q_{j,t-1}/\bar{q}_{t-1})$			.6080 (16.84) ***				.1816 (8.36) ***	
$\ln(Q_{weighted})$				.6090 (16.78) ***				.1812 (8.29) ***
t	.0319 (2.56) *	.0334 (3.09) **	.0259 (2.47) *	.0147 (1.40)	.0076 (0.49)	.0054 (0.86)	.0068 (1.08)	.0033 (0.52)
Constant	1.0640 (7.59) ***	-.0997 (-0.82)	.5453 (4.67) ***	.8183 (6.79) ***	3.2431 (18.44) ***	.9684 (13.69) ***	.9972 (14.18) ***	1.0808 (14.90) ***
Number of observations	2297	2297	2297	2297	2297	2297	2297	2297

Notes: The table presents estimates with T-statistics in parentheses.
The regressions include t as time trend for years 1998-2015.
p<0.05: *; p<0.01: **; p<0.001 ***

Table 12-Investment Robust Regressions with 2-digit SICs as dummy variables

	y				x			
	$100y_{j,t}$	$\ln 100y_{j,t}$	$\ln 100y_{j,t}$	$\ln 100y_{j,t}$	$100x_{j,t}$	$\ln 100x_{j,t}$	$\ln 100x_{j,t}$	$\ln 100x_{j,t}$
$Q_{j,t-1}/\bar{q}_{t-1}$	.3488 (17.70) ***	.1588 (9.54) ***			-.0045 (-0.23)	.0070 (0.92)		
$\ln(Q_{j,t-1}/\bar{q}_{t-1})$			.5306 (12.88) ***				.0736 (3.82) ***	
$\ln(Q_{weighted})$				.5335 (12.91) ***				.0753 (3.89) ***
Constant	1.3449 (0.55)	.3233 (0.16)	1.5502 (0.77)	1.8382 (0.91)	3.2449 (1.33)	1.1746 (1.24)	1.7743 (1.88)	1.8130 (1.92)
Number of observations	2297	2297	2297	2297	2297	2297	2297	2297

Notes: The table presents estimates with T-statistics in parentheses.
The regressions include dummy variables for 2-digit SICs (not reported).
p<0.05: *; p<0.01: **; p<0.001 ***

Table 13-Investment Robust Regressions with 2-digit SICs as dummy variables and t as time trend

	y				x			
	$100y_{j,t}$	$\ln 100y_{j,t}$	$\ln 100y_{j,t}$	$\ln 100y_{j,t}$	$100x_{j,t}$	$\ln 100x_{j,t}$	$\ln 100x_{j,t}$	$\ln 100x_{j,t}$
$Q_{j,t-1}/\bar{q}_{t-1}$	.3580 (18.18) ***	.1654 (9.90) ***			-.0073 (-0.37)	.0061 (0.79)		
$\ln(Q_{j,t-1}/\bar{q}_{t-1})$			.5343 (12.99) ***				.0724 (3.75) ***	
$\ln(Q_{weighted})$				.5330 (12.89) ***				.0767 (3.96) ***
t	.0251 (1.94)	.0196 (1.79)	.0181 (1.69)	.0082 (0.77)	-.0276 (-2.11) *	-.0086 (-1.71)	-.0082 (-1.63)	-.0096 (-1.91)
Constant	6.6382 (2.72) **	1.5741 (0.76)	1.3641 (0.68)	1.7564 (0.87)	3.9338 (1.60)	1.3837 (1.45)	1.8577 (1.96)	1.9075 (2.02) *
Number of observations	2297	2297	2297	2297	2297	2297	2297	2297

Notes: The table presents estimates with T-statistics in parentheses.
The regressions include time trend for years 1998-2015 and dummy variables for 2-digit SICs (not reported).
p<0.05: *; p<0.01: **; p<0.001 ***

From Tables 10, 11 and 12, we can see that changing from OLS regression to robust regression doesn't change the regression result. Hence, there is no significant heteroskedastic errors in the original regression results presented in Tables 1, 2 and 3.

Appendix II Qualitative Research Methods Used

1) Web search

I search news events, opinions, analyses and data online to confirm the validity of my findings through data analysis.

2) Internship

In summer 2013 and summer 2014, I completed three internships in finance firms in Shanghai and Hong Kong: one in a major Singapore bank, one in a Chinese portfolio management firm and one in a Hong Kong private equity firm. I also completed leadership training held by multiple finance firms in Hong Kong in the summer 2014. Through those experiences, I interacted with finance professionals in different Asian countries and asked them about their opinions on the investment market. Moreover, I directly participated in investment deals when interning in the private equity firm. Fluent in Chinese, I was able to carry out conversations freely with the professionals. Those experiences gave me firsthand experience with Asian capital market and helped me more effectively make decisions when building the model and better justify the regression results.

Here are my findings from these internship experiences:

1) Sizable informal financial sector

Many unregistered financial intermediaries are operating illegally in mainland China. For instance, some of these intermediaries are Hong Kong trusts that provide wealth management products to high net worth individuals in mainland China. High net worth individuals are individuals with $1 million in liquid financial assets. However, Chinese government hasn't been effective in eliminating these firms.

2) Inner reference that takes place in China's major state-owned banks;

China's major state-owned banks often refer their corporate clients in other functions to their investment firms to manage mergers and acquisitions and direct investment transactions. Hence, reference serves as the major source of deals of the investment companies affiliated with the state-owned banks. The size of these banks ensure that their investment companies are well-sustained. This phenomena contributes to the oligopoly of China's investment services industry.

3) Hong Kong and Singapore serving as "the free zone" for Asian financial institutions.

For instance, similar to the US, China has a policy that restricts banks from doing investment using their own money. Banks escape the restrictions of this policy by registering and operating their investment company in Hong Kong or Singapore.

Appendix III Data Description

I ran regressions on data of Asian firms to discover patterns of the Asian capital markets. Data used for regressions are extracted from the Thomas Reuters database using the following keywords as search criteria:

Database	Include	All Mergers & Acquisitions
Acquiror Nation (Code)	Include	China South Korea Singapore Thailand Taiwan Vietnam Hong Kong India Indonesia Macau Malaysia Japan Philippines

Target Nation (Code)	Include	China South Korea Singapore Taiwan Vietnam Thailand Hong Kong India Indonesia Macau Malaysia Japan Philippines
Deal Status (Code)	Include	Completed
Deal Value ($ Mil)	Between	0.0001 to HI
Equity Value at Announcement ($ mil)	Between	0.0001 to HI
Enterprise Value Based on Financials ($ Mil)	Between	0.0001 to HI
Acquiror Public Status (Code)	Include	Public
Target Public Status (Code)	Include	Public

The countries are selected based on their importance to the Asian capital market, their GDP and the development status of their economies in order to imitate the percentage distribution of developing and developed countries in Asia. Middle East countries are not included in this research because of their independence from other Asian countries and the distinctiveness of their economies.

I also restrict both acquiring firms and target firms to be public firms so that their financial information is publically accessible. Finally, the deals must be completed, report positive values, and the involved firms should have positive equity values and enterprise values, to eliminate any error (negative value) or unusable (incomplete deals) data.

Among the 7386 initial observations, I do the following things to eliminate problematic data:

1) Eliminate observations that cannot be used calculate Q and q values. Specifically, these observations:
    - Have negative values
    - Miss certain data items
2) For acquirers that have done more than one transaction every year, combine the transactions in the same year into one observation. Specifically:
    - Value of all transactions are summed up
    - Acquirer Total Assets ($mil) of the last transaction of the year is used as the Acquiror Total Assets ($mil) of the year.
    - Target firms' q is left blank.
3) Eliminate observations with ln100x and ln100y that are 3 standard deviations away from mean.

	ln100x	ln100y
Mean (μ)	0.804794	0.483019
Standard deviation (σ)	1.384036	2.17658
Upper limit (μ+3σ)	4.9569	7.012761
Lower (μ-3σ)	-3.34731	-6.04672

After these steps, I got a total of 2297 observations, based on which further analyses and regressions are conducted.

As for dummy variables, among data for all Asia, there are 69 major industries groups and time trend ranges from 1 to 18.

Data Extraction

Data for regressions are extracted from Thomas Reuters and the variables in the functions are calculated using the following data items in the database (the underlined terms are the exact wording of the terms in the database):

- X=Acquiror Capital Expend LTM ($ mil)
- Y=Value of Transaction ($ mil)
- K=Acquiror Total Assets ($ mil)
- Q=Acquiror's Tobin's Q

$$=\frac{\text{Acquiror Market Val 4 Weeks Prior to Announcement (\$ mil)}}{\text{Acquiror Total Assets (\$ mil)}}$$

- q=Target firm's Tobin's Q

$$=\frac{\text{Tgt.Market Val 4 Weeks Prior to Announcement (\$ mil)}}{\text{Target Total Assets LTM (\$ mil)}}$$

Appendix IV Alibaba Domestic and Foreign Investment Timeline 2005-2014

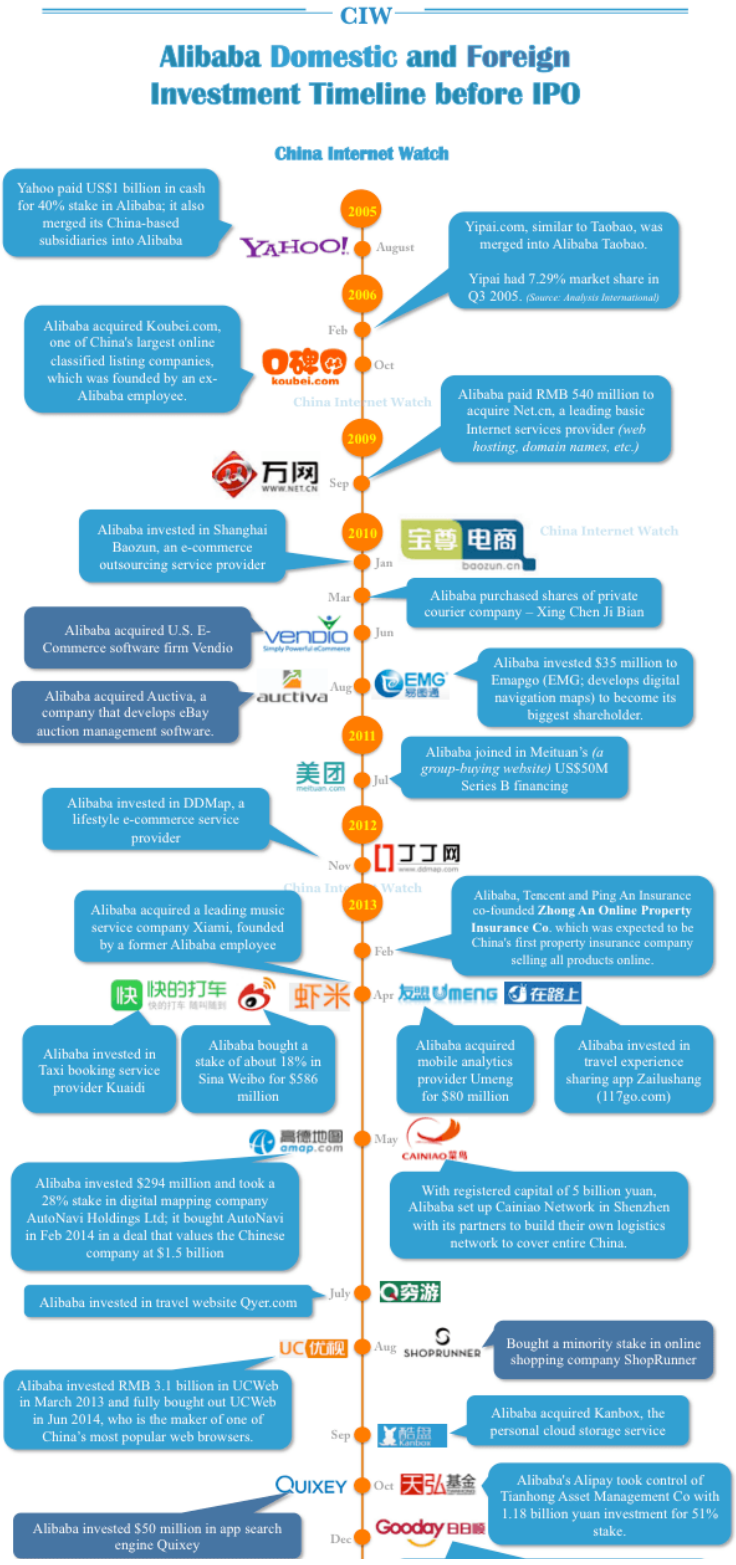

Figure 20 2005-2012 Alibaba Domestic and Foreign Investment Timeline (CIW Team 2014)

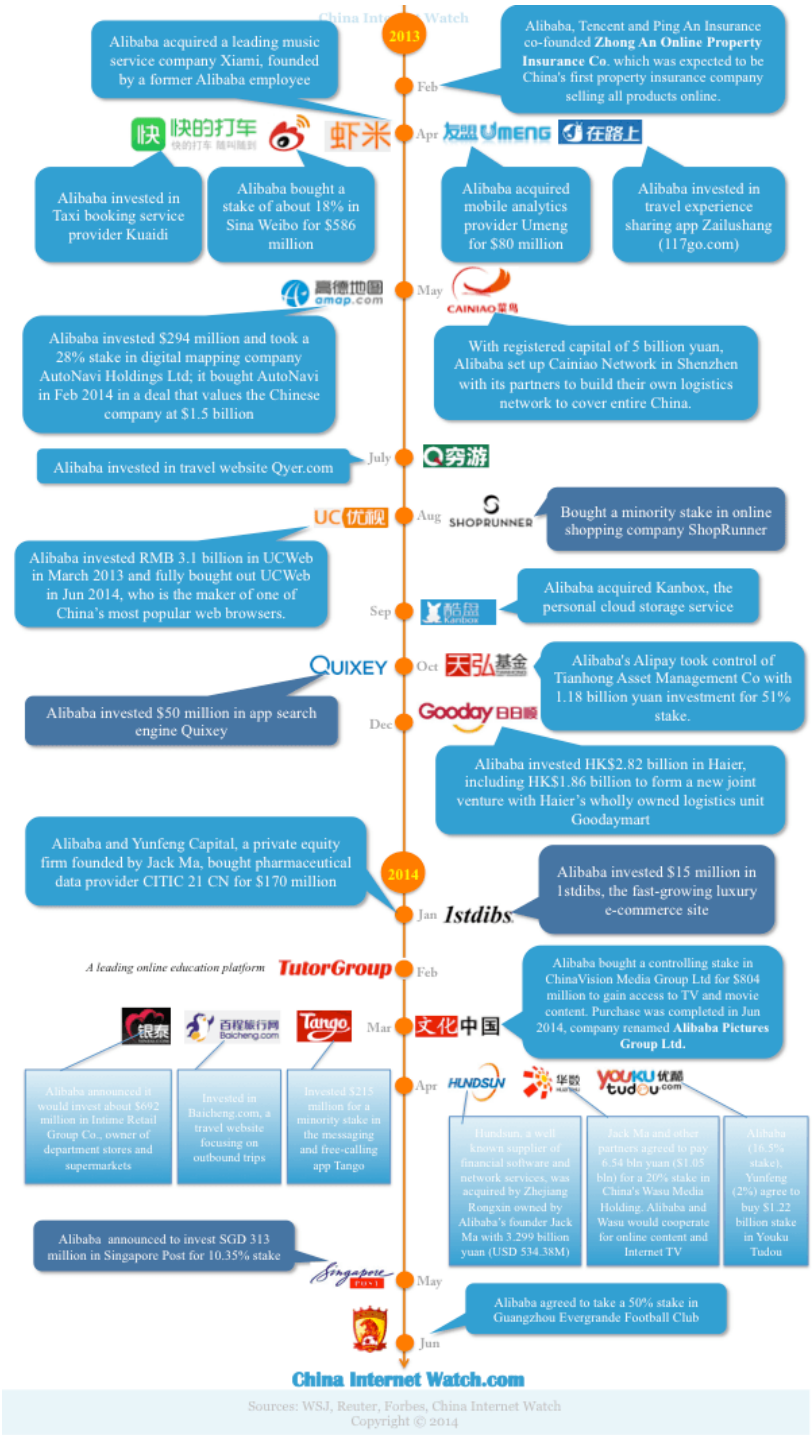

Figure 21 Alibaba Domestic and Foreign Investment Timeline 2013-2014

(CIW Team 2014)

Alibaba conducted 32 transactions in total from 2005 to 2014, and its target firms are of different industries, countries and sizes.