Chinese Private Equity Fund Characteristics, Returns and Fundraising

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Abstract

Private equity firms have been playing an important role in the global financial market. In 2006, the asset under management was only 1 100 billion CNY, and in 2017, the figure has reached 8654 billion CNY. However, with the economy walking towards a more mature phase, the past driver ---- strong economic growth is no longer the reason to explain the significant growth of private equity firms in China. We think it would be of great interest to look into the possible drivers to give us a better understanding of private equity firms in China. In this paper, we would like to test a number of factors that could possibly drive Chinese PE industry performance, including persistence, size, experience of managers, different type of funds, and industry concentration with a linear mixed effect model. As a result, we find that past performance is positively related with PE performance. Size and performance have a positive and concave relationship but the relationship is not stable. Industry concentration is vital for PE performance in China. Also, we find that past record has a great influence on the GP's next fund raising.

Keywords: Private Equity, Fund Characteristics, Performance Persistence, Experience, Size

Acknowledgements

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Private Equity (PE) is an asset class that consists of investments in the equity of a company that is not publicly traded on a stock exchange (Fraser-Sampson, G., 2011. Private equity as an asset class. John Wiley & Sons.). Private equities are typically organized as limited partnerships and whose investors are normally sovereign wealth funds, large institutional investors, university/college endowments, and wealthy individuals. A private equity investment will typically be made by a private equity firm. Private equity firms purchase companies by using debt financing, then restructure and aim to resell for a higher price.

1.1 Stages of development of a company form a private equity perspective

During a growth of a business, a company will go through different stages of the business life cycle, encounter different challenges and as a result needs different financing sources. The main stages are: seed and development, start-up, expansion, maturity and distressed. Private equity firms are categorized according to their set of strategies, preferences and investment expertise by investing in those different stages of a business. Common investment strategies are leveraged buyout, venture capital, growth capital, distressed investments and mezzanine capital.

1.1.1 Seed stage

This is the very beginning of the business lifecycle. The founder only gets the new business idea that is believed to have a breakthrough invention. At this stage, investments come from venture capital and are normally comparatively small amount of capital provided to founders or entrepreneurs. These early capital may be put towards into product development and testing, market research, building up a management team and form a business plan. Venture Capital at this stage will typically participate in later investment rounds and Investments involves high risk.

1.1.2 Start-up stage

In this phase, companies focus on product development and initial marketing. Generally, such firms have already had key management remembers, more clear business plan and have initial

market knowledge. Financings from venture capital are usually used to support actual product development and commercialize by marketing.

1.1.3 Expansion stage

At this stage, companies are looking for expanding their sales or revenues by growth into new markets or distribution by new channels.   This is the stage that most equity investments are made as companies need new capital to finance their operations, restructure, and enter into new markets or fiance further acquisitions. The management team often sell minor stake in return for both capital and management expertise to private equity firms who are believed to add value by investing.

1.1.4 Maturity stage

Having survived the expansion stage, companies now are seeing stable profits while some other companies are still growing the top line at a slower pace. At this stage, management teams are facing with two choices: push for further expansion through innovative developments or exit the business. Investments from private equity firms go into two sets: a minority or a majority stake investment. In the former case, while it's low probability to influence the company's decision, there is possible to reap significant upsides. In the latter case while private equity invests a major stake, it is defined as leveraged buyout (LBO). Normally, a private equity firm will use a mix of both capital and debt financing to make the deal. Typically, private equity firms provide a small amount of capital and borrow substantial amounts of money from several financial institutions, using the assets of target company as the collaterals. If the target is a listed company, then the company will be delisted from the stock exchange after the LBO and gets re-organized. Private equity firms will have new and experienced expertise in place to restructure the company's assets and liabilities, its management, business plan and strategy.

1.1.5 Distressed stage

Some private equity firms have special focus on distressed companies. Distressed companies are experiencing decline of their business and low cash flow make I impossible to pay back debt, hence severely jeopardizing the company's operations. Specialized private equity firms are there

to invest in this business and aim to turnaround the assets: bringing in experienced management team, new business strategy and thus uncover the intrinsic value of the company.

1.2 Private equity fund structure, investment process and main types of deal structure

1.2.1 Private equity fund structure

Private equity funds are closed-end investment vehicles. Once the raising period has passed, there is no further capital can be committed to the fund. Please see *Figure 1*. Most private equity funds are organized as Limited Partnerships, some are Limited Liability Company as investors are only exposed to limited liability if anything goes wrong. They are governed by the terms set in the limited partnership agreement (LPA). A private equity fund has a General Partner (GP), the people raising, managing and running the fund with capital committed from institutional investors, pensions, foundations, university endowments and high-net-worth individuals, known as Limited Partners (LP). Other terms included are

- Term of the partnership: it is usually a fixed-life investment vehicle which is typically 10 years plus extensions by the consensus of both GPs and LPs
- Management fees: investors need to pay an annual payment to the fund's manager to cover the fund's investment operations which ae typically 2% of the committed capital to the fund.
- Distribution waterfall: the process defines how the returned capital will be allocated between GP and LP. It includes a preferred return, a minimum rate of return (for example 8%) that must be achieved before GP can receive any shares of profit, carried interest, which is typically 20% of the proceeds after LP has received distributions equal to the their original committed capital plus a defined preferred return.
- An interest transfer in the fund: an investor's interest in a fund is normally not for transferrable or traded. But it can be transferred to another investor which is called secondary sale and it needs the consensus from both GP and LP.

EXAMPLE OF STRUCTURE ASSOCIATED WITH A PRIVATE EQUITY FUND
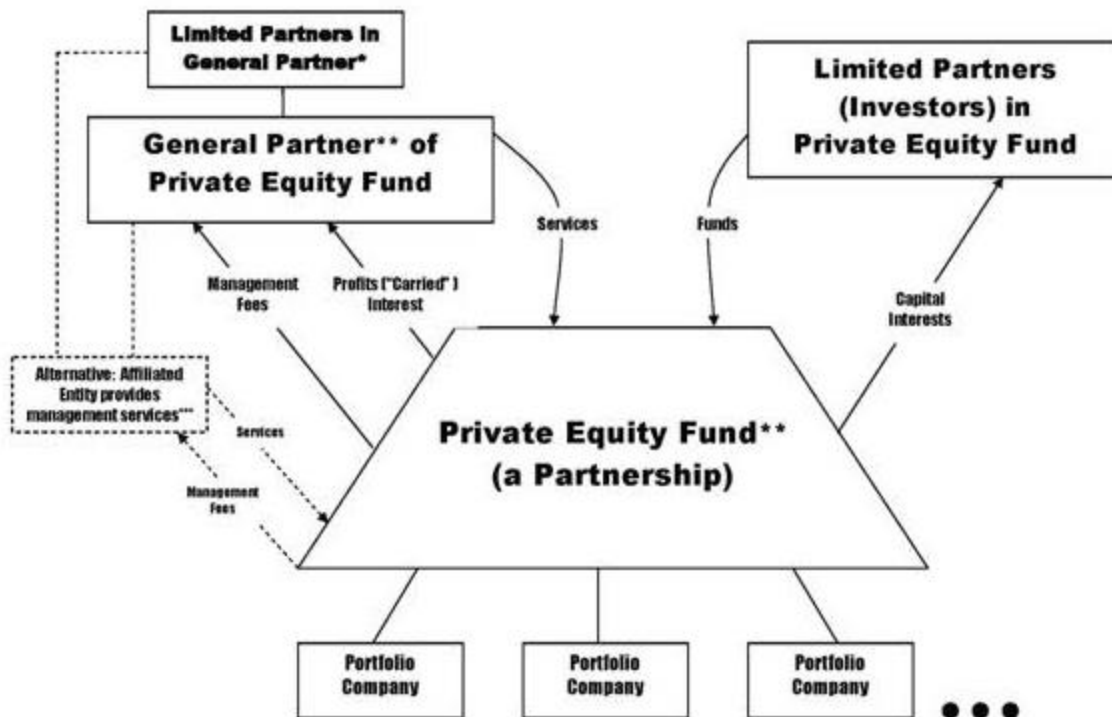
Figure 1: Typical example of private equity fund structure

* The limited partners of the General Partner typically are individuals who oversee the management of the Private Equity Fund including its portfolio companies.

**The General Partner and the private equity fund typically are limited partnerships, but either may be organized as another form of pass-through entity for tax purposes (such as an LLC).   Changes in the form of organization of either entity will change the structure from that shown in the chart.

***In this alternative, an entity affiliated with the General Partner acts as manager and receives the management fees.

Source: August 29, 2007, New York Law Journal

1.2.2 Private equity investment process

PEI (Private Equity International) has mapped out the PE investment process. As *Figure 2* shows, the process consists of six steps and each step entails a set of activities that private equity firms employ.

At the sourcing stage, private equity firms are there to find good investment opportunities. For most of the firms, this means not only having an established reputation, but also an appropriate set of resources with a focus on building relationships and sourcing opportunities. This step consists of assessment of the company in terms of business plan, growth potential, management team etc. Initial negotiation will also be involved in regard to the company's valuation, consideration of the financial structure etc.

Once the good investment opportunities are brought over, the focus is to select the "best" ones. At this stage, in most cases PE firms will bring in external help, such as investment banks, lawyers, tax advisors, accountants etc. which will help PE firms to analyze all aspects of the target company, with a goal to have a thorough assessment of the feasibility and viability of the investment opportunity.

Once the investment has been selected, PE firms will negotiate terms and legal documents with target company in terms of the capital structure, financial instruments to be used, the legal structure, board seats rights etc.

Then the monitoring stage enables PE firms involve and steer in the bought company. It is at this stage that PE firms can create value for its portfolio companies. Some key methods are PE firms' relationships in the industry, experiences running companies, transformation of business, bolt-on acquisitions and creation of platform, and financial engineering that will help optimize the optimal capital structure.

In the end, PE firms buy companies in order to exit at a higher equity value then initially invested. Typical exits routs include Initial Public Offering (IPO), trade sale, secondary buyout and leveraged recapitalization.
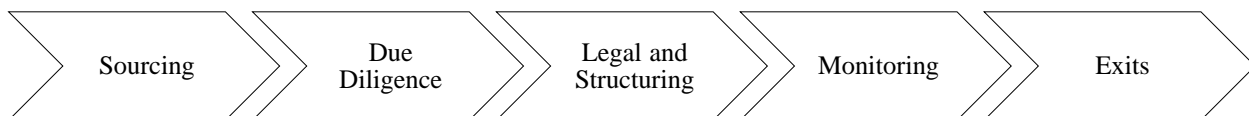
Figure 2: The process of a private equity fund

1.2.3 Main types of deal structure

There are three main types of deal structure that private equity firms employ. The first is the plain-vanilla equity, where PE firms simply buys the equity stake of the target company by paying cash

directly. The second type is convertible bonds, debt securities that can be converted into a specified number of shares of common stock in the target company. Before conversion, PE firms will receive a fixed rate of return. It is a hybrid investment vehicle which protects the debt at start, but shares upside profit if the target company is successful, while avoiding the necessity to value a company at a too early stage. The third type is leveraged buyout, a combination of financed debt with minimum equity investment, which is also the mostly frequently used types when takeovers occur in the fourth stage of the company.

1.3 Measurements of performance

1.3.1 The J-curve effect

Measuring the performance of illiquid investments is not as straightforward as measuring that of a traditional asset classes. As such, annual returns do not accurately suit for this purpose (Fraser-Sampson, 2010). Timing the cash flow of pattern of a private equity fund is essential and that leads to what commonly known as the J-Curve effect, as *Figure 3* shows.

Figure 3: The J-curve effect

Source: Danske bank

Committed capital is the amount of capital an investor commits in the LPA to invest in a fund. It stays the same over the entire life of the fund life. Paid-in capital 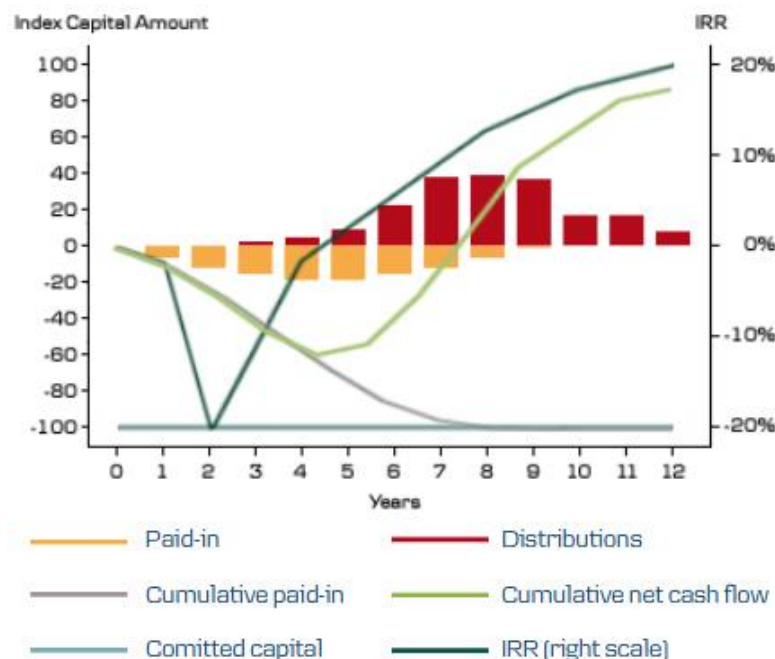is a certain amount of its total commitment, as and when called from investment fund. This is also the cash outflows for an investor and the time horizon of it is typically six to eight years. Distributions, cash inflows, occur when the underlying investment fund realizes and investors get re-distributed returns on a pro-rata basis. Take into account management fee, investment cost over the life of the fund, the cumulative net cash flows show the total effect of the cash outflows and inflows and it is given the name, J-Curve, as it shapes as a "J".

Private equity fund investors know that neither their time nor the exact amount of cash flows are known until the end of the whole investment process. So the returns for the first several years are misleading. Furthermore, the exact cash inflows and outflows period are strictly connected with the characteristics of each fund. As the management fees are based on the committed capital and charged on an annual basis, it will have a stronger impact during the early stages of a fund life. The same goes to the cost. Therefore, because the impact of costs and fees is heavier at the beginning, annual returns, initially, can be easily negative (Fraser-Sampson, 2010).

1.3.2 Measurement metrics

Given the pattern of private equity cash flows, the Internal Rate of Returns (IRR) and investment multiples are used to measure the performance of the private equity investments.

1.3.2.1 IRR

IRR is the discount rate that makes the net present value of all cash flows equal to zero, which calculates the return by looking at all the cash flows over the fund life, taking into account drawdowns, distributions and a valuation if the fund still has residual value. It is particularly suitable for PE industries as it takes into account the irregular timing effect and different size of cash flows.

There are several advantages of IRR. Firstly, it allows investments with irregular cash flows, which are the defining characteristics of PE industries. It can compare and rank different investment projects and clearly show the best one with the best IRR. Secondly, IRR considers the time value

of money which is accounted in the calculations. Finally, it is easy to calculate and very straightforward to interpret.

On the other hand, IRR is also with some limitations, as pointed out by Lerner et al. (2012). Critical ones are that, firstly it is possible to be artificially improved by changing the distribution timings. Quick returns of capital to investors in the early life of a fund, especially big amounts of money, will disproportionally boost the IRR. Secondly, systematization is lacking as different treatment of time, NAV appraisal, taxes etc. are applied when calculating IRR for different funds. Thirdly, due the calculation itself, IRR assumes that cash flows are reinvested at the same rate of return and sometimes it's possible there are two IRRs or no IRR at all. Given above limitations, there are other approaches to measure PE performance along with IRR.

1.3.2.2 Multiples of invested Capital

Money multiples are another metric for PE performance measurements, which are calculated by dividing the value of returns by the amount of invested capital. Common money multiples (Mathonet and Meyer, 2007) are: Distributions to Paid-in Capital (DPI) and Total Value to Paid-in Capital (TVPI). TVPI differs with DPI in regard to whether or not include residual values that is not distributed in the fund.

DPI measures how much capital has been returned to investors against the total money paid into the fund. At the start of investment, it is zero ad will start to increase as distributions are realized. If DPI equals one, which means investments in the fund are broken even. Any number above one means investors are paid back more than the paid.

TVPI measures the overall performance of a PE fund, cumulative distributions plus residual value against the paid-in capital. It measures what multiples investors could have if unrealized were sold out at current valuations plus distributions that had already been realized. Given the difference with DPI, investors tend to look at TVPI in the early life of the fund, then DPI toward the end.

Advantages for money multiples are clear: they offer quick and easy way of showing the PE performance. They can also compare different projects of scales as returns are expressed as a proportion rather than as an absolute number like IRR.

Limitations are that, firstly multiples ignore the time value of money. For example, a 3x multiple is a good return for investors while it is another story if it cost the fund 10 years to realize it. Secondly, they do not offer the insights of the investment scale, and one large deal can have a disproportionately large impact on the fund as a whole.

1.3.2.2 Public Market Equivalent (PME)

PME is a measurement that allows investors to compare PE performance to that of public market benchmark or index giving the same period, same investment timings and same cash flows. The first analysis was proposed by Long and Nickels in 1996. Long and Nickels compared PE fund performance to S&P500 Index by creating a hypothetical investment vehicle which buys and sells shares in the public market index using the PE irregular cash flows. The Long and Nickel PME tells how much equivalent investment in the public market would have performed. If the PE fund IRR exceeds the public market's IRR, the fund outperformed the public market. The difference between the IRR and the PME is called the IRR spread. Other PMEs are KS PME from Kaplan and Schoar (2005), and more Capital Dynamics PME+.

The biggest advantage is that it answers the question that if an investor had made equivalent contributions to an indexed fund instead of a private equity fund, and if contributions and resulting distributions were of the same size and timings as the PE fund, what would the resulting return be? It allows investors to compare their PE investments over the same period. It is also particularly accurate to look at more mature investments where the NAV is a smaller fraction of the distributions, as any errors in calculating the NAV will have a smaller impact on the final result. Limitation is that PME does not try to specially adjust for risk differentials between portfolio cash flows and the public index or the tax impact of returns, for example, higher leverage ratios on private equity companies. Another argument is that PME is reliant on the timings of the PE fund, which means that PME approach might be forced to action on the market that would not normally be chosen, thus adversely affecting the performance of PME and overstating IRR.

In summary, while all of above PE performance measurements are commonly used and popular, none of them can give a full picture of PE performance alone, nor is there single "right" way to measure it. Another challenging work in regard to measurement is that private equity database is based on self-reporting, which means that GPs and LPs report data mostly on a voluntary basis

(Kaplan, Sensoy, and Strömberg, 2002). As a result, lack of data is a big issue. Moreover self-reporting can also have data accuracy issues, as Venture Economics stated "there is no incentive to bias performance data upwards as funds cannot be marketed through the database. Second, there is no incentive for a private equity manager to force early closure and so discontinue reporting returns, as long as fees can be collected" (2011, p.12). However, they also recognize the fact that "Selection bias, as well as the anonymous nature of the database, are an important limitation of our research, and can mean that our results are still biased either upwards or downwards" (2011, p.13).

Chapter 2: Overview of Chinese private equity market

2.1 Background on private equity firms in China

China, as the second largest economy has always been one of the most attractive place for investors. Private equity funds, however, with its relatively shorter history in China, has also offered tremendous opportunities for global investors.

Private equity starts in China as venture capitals. In the mid-1980s, with the implementation of the new reform and opening policy, the old system where the government had the absolute power over economy and where the economy as a whole was relatively closed to the outside world no longer fits the economic development, that was a good opportunity for foreign-owned companies to go into China. As a result, in the 1990s, international venture capitals started to go into Chinese market. The first foreign-owned PE fund was founded in China by IDG, bringing abundant experience to Chinese market. During this time period, the private equity investments were funded by foreign capital and the target companies (most of them were in the IT industry) went public in overseas market. After the internet bubble broke in the late 90s, the target companies changed to more domestic companies such as Mengniu and Xiaofeiyang (both are in the dining industry). When the global financial crisis took place, the market suffered from low capital supply. In 2009, the ChiNest market (Aiming to attract innovative and fast-growing enterprises, especially high-tech firms with less stringent standards compared to Shanghai Market Exchange) was founded in Shenzhen. This step was significant in that it facilitated the exit for private equity managers.

2.2 Understanding China's growth story

China's economy has been on a rise in the 21st century, reaching 10% GDP increase annually. However, recent years' statistics show that GDP has dropped to around 6.5%, and China's economy has now reached a turning point where a more focused economy on will help transitional manufacturing to a more advanced, value-added one with high barriers to entry and high technology.

What's worth mentioning is that debt has been a key driver for China since the global financial crises in 2008. During the crisis, the Chinese government adopted a stimulus program in order to boom the economy, where about 586 billion USD was injected into the economy with a focus on such key areas as housing, rural infrastructure, transportation, health and education, environment, industry, disaster rebuilding, income-building, tax cuts, and finance. However, like in most counties where the debt is mainly paid off by the government, in China it was mostly funded by banks. The program, on one hand, created many job opportunities, on the other hand, it has also increased the China's debt-to-GDP ratio dramatically.

From McKinsey & Company's article "Debt and (not much) deleveraging", China's debt-to-GDP ratio has risen from 160% in 2007 to 250% in 2015. However, compared to most developed countries, China's debt-to-GDP ratio is still relatively low. Also, strong GDP growth, rapid capital market expansion and high trading multiples of the domestic A-share market (the ChiNext market in particular) have accelerated the market's profit growth and valuation arbitrage, two of the most important sources of returns for PE managers in China. However, rapid expansion has caused corporate debt to go up dramatically and Chinese companies can no longer rely on expanding production capacity to grow revenues. Hence, under the new economic situation, operational efficiencies rather than indiscriminate capacity expansion will become the top priority for PE managers as well as investors.

In china, the immature financial market has created tremendous opportunities for private equity funds. Bank loans have always been a major source for companies in China, however, most of the loans go into state-owned companies, resulting a fund inefficiency for small in medium sized companies. Especially after the financial crisis, private companies faced a decline in valuation, and the crash of the stock market together with a rigid, approval-based IPO system made it even

harder for small to medium sized companies to seek funds. Furthermore, the suspension of A-share IPOs from October 2012 to January 2014 has further limited access to capital for companies and narrowed the exit options for private equity managers.

As mentioned above, PE funds have always played an important role in fundraising for companies facing difficulties as well as improving the Chinese economic environment as a whole. Some of the most fast-growing and well-known companies (Mengniu, Alibaba, etc.) have all benefited from capital infusion from PE funds.

2.3 Private equity performance in China

In 2017, 3574 funds were closed in China with newly raised fund of nearly 1800 billion CNY. 10144 investments were made in China with a total volume of 1200 billion CNY. With the rapid growth of private equity it has become an important role in Chinese economic growth. In 2017, investments made by private equity funds have made up 1.5% of Chinese gross GDP, which is 0.5 percentage point higher compared to 2016. In terms of exits, 1069 were IPO, which benefited from the positive change in IPO-related policies (Unlike the registration-based IPO systems in most countries, China has very strict rules towards IPO process. In 2017, some changes were made to accelerate the process. Under the new system, China Securities Regulatory Commission will be only responsible for determining whether applicants have provided full and accurate information and the assessment of risks and valuations are left to the market).

From 2006 to 2017, the number of newly raised funds as well as the amount raised are increasing steadily. In 2017, the number of newly raised funds has reached a history high of 3574, with 1788 billion CNY in total. From this we can see the private equity industry in China is on the rise, and that investors are more willing to allocate their capital into private equity funds. While in the early stage the number of registered managers rise dramatically, in recent years we can clearly see that as private equity managers become more experienced, the capital flows into more high-quality and high-tech areas. In *Figure 5*, we can see that high technology is still PE funds' most favored sector in 2017, followed by industry. In addition, real estate, media and entertainment, consumer, financial services and healthcare were also popular sectors.

Number and amount of newly raised fund 2006-2017
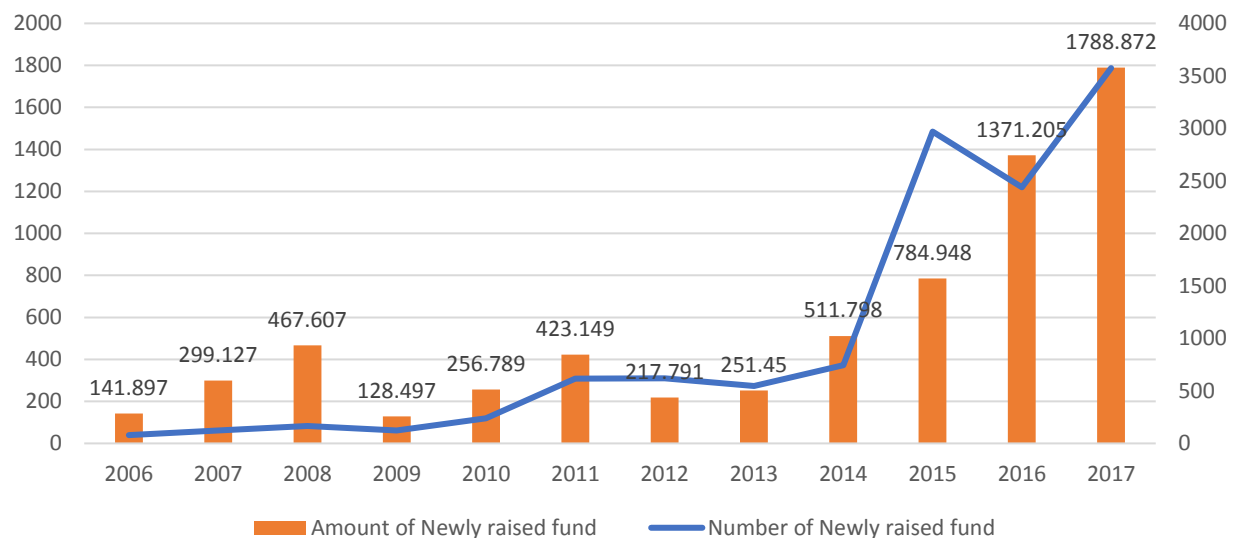
Figure 4: Overview of number and amount (billion CNY) of newly raised fund from 2006 to 2017

Source: Asset Management Associate of China

Breakdown of number of deals by investment by sector in China
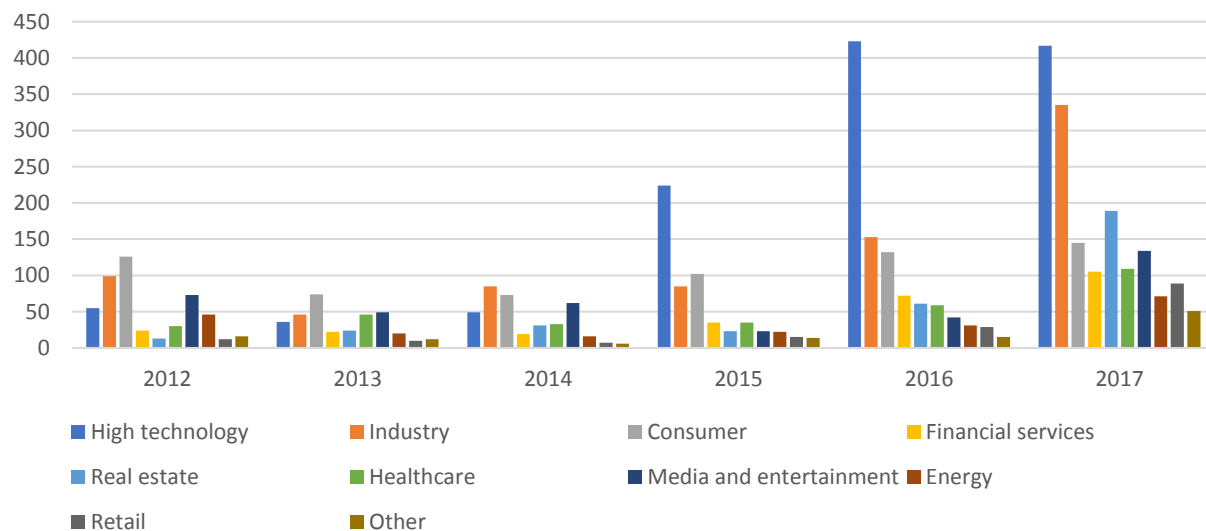
Figure 5: Number of private equity deals breakdown by industry

Source: www.pwc.cn.com

In 2017, asset under management by private equity managers has reached a history high of around 8700 billion CNY, almost 8 times as much as 10 years ago.

Asset Under Management (CNY billion)
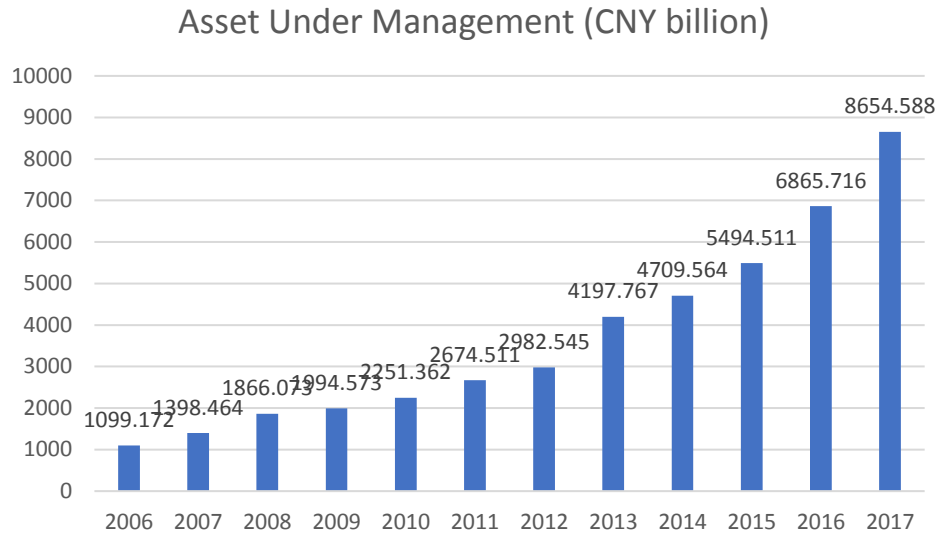
Figure 6: Asset under management by PE/VC funds from 2006 to 2017

Source: Asset Management Associate of China

If we take a look at the comparison between the deals in China and global, we can see that as global trading value fell 38% from 423 to 306 billion USD, total China PE and VC-led M&A deal value continued growing steadily to reach 223 billion US dollars, accounting for 73% of global PE/VC deal values and setting a new record in 2016.

Comparison between global and China VC and PE deal values
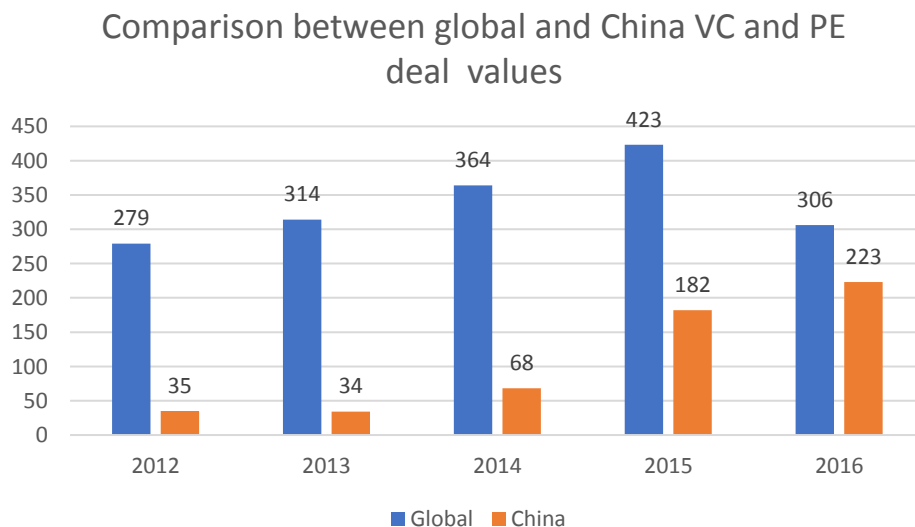
Figure 7: Comparison between deal values of China and global (bn USD)

Source: www.pwc.cn.com

Figure 8 shows the change in the number and amount of funds raised in foreign currency and domestic currency in China. We can see that from 2006 to 2017, the number of funds raised in RMB in growing dramatically while the ones raised in foreign currency stay almost unchanged. At the same time, the same trend also applies for the amount of funds raised.
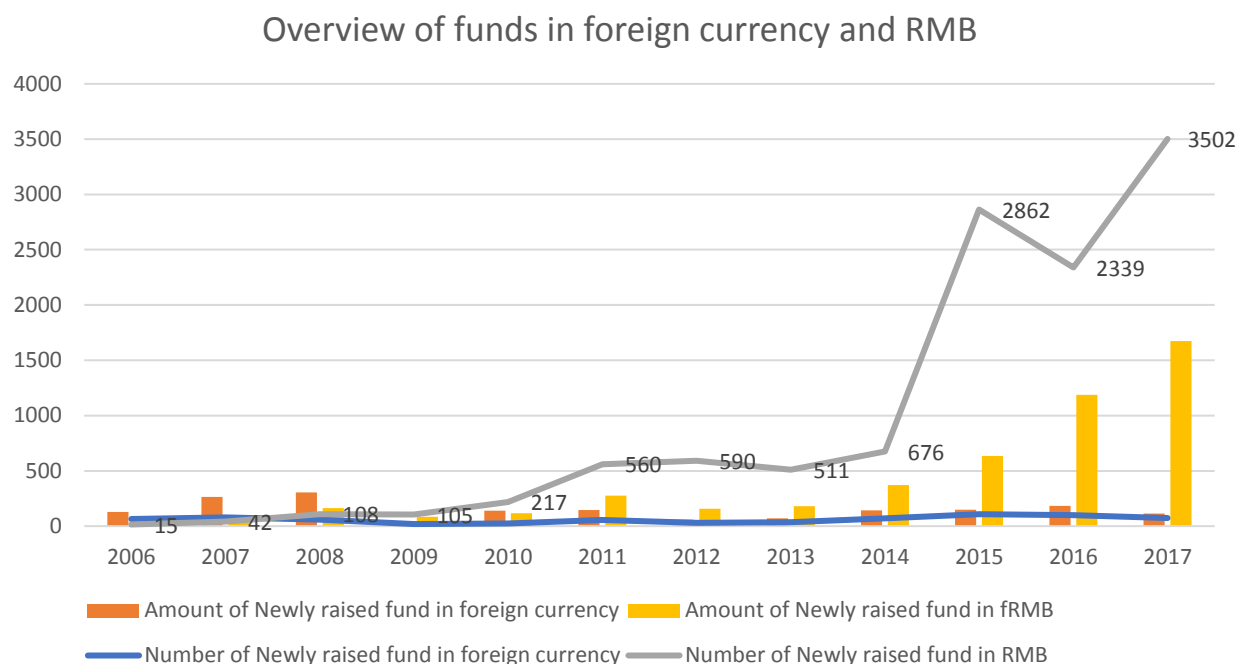
Figure 8: Comparison of funds in foreign currency and RMB

Source: Asset Management Associate of China

Figure 9 shows the investments made in China by private equity funds from 2006 to 2017. While the number of investments have grown dramatically over the past ten years, the amount invested grows more steadily compared to the number of the investments. The average invested amount per new fund, has grown from 4 billion to 8 billion. This figure almost doubled in the last decade.

Figure 10 shows the break-down of the investments by industry. We can see that electronics among all is the most popular industry, totaling around 180 billion CNY, followed by IT and bio and health care.

Overview of investments in 2006-2017
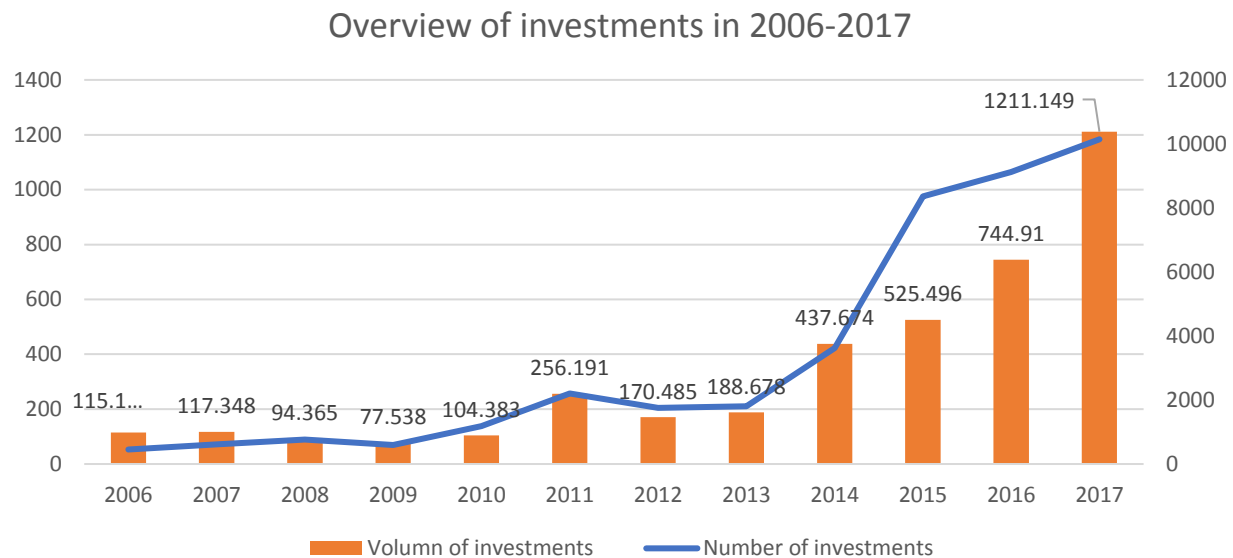
Figure 9: Overview of investments from 2006 to 2017

Source: Asset Management Associate of China

Investments by industry in 2017 (billion CNY)
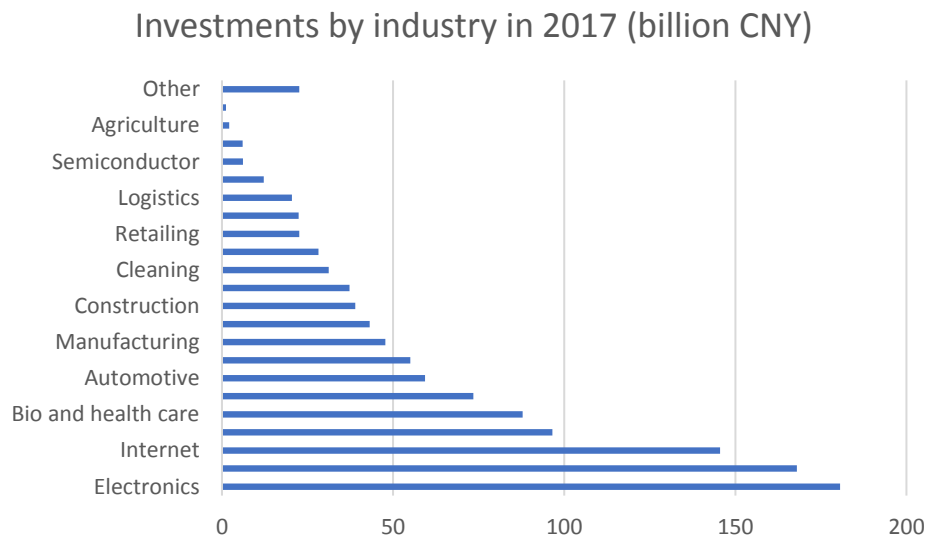
Figure 10: Overview of private equity investments by industry

Source: www.pedata.cn

Chapter 3: Literature Review

There have been quite a few papers exploring the private equity industry. In China, however, most of the work has been focusing on the general trends in the PE industry. This is due to the fact that firstly, the history of private equity is quite short in the Chinese market and secondly, the data is not public hence very hard to obtain. In this paper, we would like to start with papers with a focus on global market, and further analyze the Chinese market with an eye on the global experience. We expect to learn more about the factors that would potentially have an impact in Chinese private equity sector, and hopefully to have an insight on the outlook of the industry as a whole in China.

Global studies have suggested that persistence, experience, fund size, industry concentration and fund type are impacting fund performance. Other macroeconomics factors such as economic condition, interest rate and stock market performance also seem to have an impact on fund performance.

Gompers and Lerner (1998) studied the relationship between aggregate return and capital flows. Their study shows that macroeconomics factors such as past industry performance and the overall economic performance would have an impact on the capital flows for private equity firms. Kaplan and Schoar (2005) finds that fund flows are positively related to fund performance. Also it is stated in their paper that persistence is an important factor for private equity fund performance. Better GPs, in general, are more likely to have better investments. This has to do with several factors like the GP's experience, and the fund manger's competence and so on. In their paper, they also found evidence of persistence in net-of-fee PE performance.

There are some contrary conclusions regarding private equity performance among different papers. For example, Ljungqvist and Richardson (2003) suggest that the outperformance of private equity funds compared to index is around 5% to 8% per year. Also, they estimated a beta of more than 1 for the private equity industry. At the same time, Kaplan and Schoar (2005) suggested that PE performance was worse than that of S&P 500, measuring the performance by IRR and PME. Even more, Phalippou and Gottschalg (2006) suggested a negative PE underperformance of -3.83% with regard to S&P 500. In Phalippou and Gottschalg (2009)'s work, they indicated that the underperformance could actually be justified. Due to the nature of private equity, the data source

is very limited and may not be 100% accurate. Also, private equity sector in comparison with stocks or bonds, is very opaque, making it difficult for LPs to identify the good investments. Hence, it is like a price LPs have to pay before they actually get a chance to have good investment opportunities, by investing in inexperienced and most likely poor performing funds first. Looking at these very contrary conclusions, we are very interested in finding out the situation in Chinse market, to see what holds for this particular market.

However, it is good to keep in mind that the performance of PE funds are always difficult to measure. Stucke (2011) suggests that in Kaplan and Schoar (2005) and Phalippou and Gottschalg (2009)'s work, the data they use is biased in that cash flows are missing. As a result, the calculated IRR is also downward biased, leading to poorer performance measurements.

There are quite a few papers focusing on the persistency of private equity funds. Korteweg and Sorensen (2017) argue that although PE performance seem to be very persistent, it is still very hard for investors to identify PE funds with higher expected rate of return due to the fact that performance is in general noisy and that the LPs have to observe a large number of past funds to identify PE funds with higher returns. Moreover, they also argue that smaller funds have greater long-term persistence than larger funds. In Gompers and Lerner (2000)'s work, they suggest that GPs usually start to raise a new fund every two to five years into the existence of the current fund. This overlap to some extent creates correlations in returns, because the funds are exposed to the same macroeconomics and systematic factors. Hence, it is suggested that there is actually little investable persistence, especially for VC funds. They argue that VC funds are mostly driven by luck, which makes it difficult to quantify.

Braun Jenkinson and Stoff (2017) argue that persistence is in fact a very poor indicator for future performance, suggesting that the persistence of fund managers has declined substantially as private equity industry has matured and become more and more competitive. This is partly due to the fact that private equity funds usually have lives in excess of ten years. Ultimate performance is not known until all the investments have exited, but the speed with which the funds are liquidated can vary drastically (Metrick and Yasuda, 2010). And also, Jenkinson, Sousa and Stucke have suggested that the estimates of asset values reported by the funds themselves can be a very biased predictor of future cash flows. Meanwhile, Harris, Jenkinson, Kaplan and Stucke (2014) find that long-term persistence and investible persistence are greater for smaller funds.

Kaplan and Schoar (2005) suggested a concave relationship between fund size and performance. Fund tend to perform better as size increases, but the performance decreases as size increases when the fund is too large. The relationship stays still for the full sample group but when the samples are split into BO and VC groups, it only holds for VC group. Also, Ljungqvist and Richardson (2003) suggested a positive relationship between fund size and its performance. However, the result is not significant for BO funds. Last but not least, Robinson and Sensoy (2011) found a concave relationship between PME and the logarithm form of the fund's size. And the quadratic form is more significant than Kaplan and Schoar's work, which could be explained by a stronger competition during the time span of Robinson and Sensoy's samples, leading to a wourse performance for very large funds.

Experience is of great importance to a private equity fund. In most the previous works, experience is measured by the fund's sequence number (the number of funds prior to the current fund under the same GP). Gompers and Lerner (1999) found a positive relationship between a fund's sequence number and its performance. Kaplan and Schoar (2005) also found that a fund with higher logarithm sequence number has significantly higher PME.

Theoretically, a fund with a focus in one specific industry should have better performance. This is justified by Gompers, Kovner and Lerner (2009) arguing that specialized VC funds have better performance than the ones without any specialization. Phallipou and Zollo (2005) also argues that GPs benefit from being focused on one industry because this gives them the possibility to learn faster through a large number of similar deals.

Our expectation in this paper is that, the study with global market would also apply for Chinese market. Hence, we start our work with looking at fund size, experience (measured by sequence number), previous performance, industry concentration, fund type and stock market returns for the same time period. We expect to find these factors to have a strong explanatory power towards fund performance as they did with global funds.

Chapter 4: Empirical Analysis

The main purpose of this paper is to have a thorough research on Chinese private equity markets and how and why they are performed since inception. Before showing our main findings, we now first describe the data we chose, the rational of our models and the variables in our analysis.

4.1 Data description

Data for this paper have been mainly obtained from Preqin: IRR, quartile, TVPI, DPI, fund sequence number and industry focus. Historical market returns in China, SSEC (Shanghai Stock Exchange Composite Index) were collected via Shanghai Stock Exchange.

A first notion is that each database has its own drawback and biases. In our research, selection and survivorship biases are largely reduced as Preqin collects data not only from GPs voluntary contributions but also from LPs. Another is that as we only consider data from Greater China, due to the development stage of Chinese private equity market and its short history, the sample we can use is relatively limited, which is 143 funds ranging from 1982 to 2017. In specific models, we delete some data that is not available in order to have a more complete analysis. For example, TVPI and DPI are more reported than IRR, so we do the analysis in terms of TVPI, we will have more funds at hands to run the analysis. The same rule applies to when we run past performance analysis while we delete first time funds as there is no past performance for them.

As mentioned above, we have three different ways to measure performance: IRR, PME and TVPI. Starting from 142 samples from Preqin, which are funds with a focus in Greater China, excluding the ones without IRR data, and the ones which are first time funds (because no measurement for past performance could be found), we are down to 79 samples; excluding the non-first-time funds without PME, we have 63 samples; excluding the non-first-time funds without TVPI, we have 141 funds.

Out of the 142 samples, 76% of them realized their targeted fund value. In terms of geography, 35% of the funds have their GP located in the US, 30% in Asia, 27% in China and the rest in UK

and Europe. In *Table 1* we can see the detailed break-down of the industries the investments are targeted in. Technology comes first, followed by diversified and health care.

Industry	Number	Percentage
Technology	54	38%
Diversified	19	20%
Telecom	13	9%
Pharmacueticals	13	9%
Consumer products	11	8%
Communication	9	6%
Communication	5	4%
IT	4	3%
Other	4	3%

Table 1: Investments by industry

Source: Preqin

Table 2 compares the descriptive data for IRR of our samples in China and the data for funds with globally geographic focus, whose vintage year is between 1993 and 2017 (where our samples lie in). Our samples, on one hand, have around the same internal rate of rate as the global funds within the same time period; on the other hand, our samples are less disperse than the global funds we have here. However, in terms of mode, our samples have higher return than global data. By looking at the average and standard deviation, private equity funds with a focus on Chinese market seems to be a better investment on a risk-return basis.

Table 3 describes the comparison between PME of our sample funds in China and global ones. The PME data for global funds are reported as of September 30 2017. This corresponds to the fact that the PME data for our sample funds are the latest reported ones. As shown below, global funds have slightly higher average PME than China. However, just as in IRR, our samples are much less disperse then global data. The data set of our samples are as whole much lower than global data, with the exception of the minimum.

IRR(%)	China	Global
Average	14.24	14.27
Standard deviation	16.88	26.76
1st quartile	18.70	20.5
Median	11.10	11.00
Mode	1.10	8.00
3rd quartile	5.80	2.8
Minimum	-14.50	-100.00
Maximum	105.00	514.30

Table 2: Descriptive data for IRR of China market and global market

Source: Preqin

PME	China	Global
Average	1.00	1.13
Standard deviation	0.27	0.44
1st quartile	1.13	1.43
Median	0.95	1.14
Mode	0.99	0.95
3rd quartile	0.86	0.88
Minimum	0.43	0.31
Maximum	1.85	2.46

Table 3: Descriptive data for PME of China market and global market

Source: Preqin

Table 4 shows the descriptive data for TVPI of our samples and global funds respectively. What holds for PME also holds for TVPI. Our Chinese market data set, in general, have lower return than global funds with the same vintage year. However, in terms of the minimum, Chinese market has much higher figure than global market, which shows the fact that Chinese market is much less disperse than global market.

TVPI(%)	China	Global
Average	159.71	164.14
Standard deviation	112.43	165.45
1st quartile	170	188.50
Median	138.30	138.85
Mode	130.00	100.00
3rd quartile	108.7	100.00
Minimum	49.00	0.00
Maximum	1026.80	4245.00

Table 4: Descriptive data for three performance measurements

Source: Preqin

Table 5 shows the descriptive data with regard to fund size in comparison with global data. We can see that the average size in Chinese market is 1034.7 million US dollars while in global market the average size is 752.7 million US dollars. And the median for our samples is also much higher than that of global funds (400 million compared to 255 million dollars). Also, it is shown that our sample data is much less disperse than global data, with higher minimum and lower maximum, also with much smaller standard deviation.

	China	Global
Average	1034.69	752.74
Standard deviation	1436.35	1693.36
1st quartile	1423.00	628.69
Median	400.00	255.00
3rd quartile	130.00	100.00
Mode	350.00	500.00
Minimum	9.00	1.00
Maximum	9000.00	20365.00

Table 5: Descriptive data for fund size (in USD million)

Source: Preqin

4.2 Rational of the model

In this paper, we would like to test several analysis. Firstly, we would like to investigate the drivers of Chinese private equity markets. Drivers discussed in prior literatures from international experiences, such as persistence, size of the fund, experience, industry focus, fund type and local hot market will all be examined in our paper. Secondly, we will use different measures of fund performance to assess the robustness of our results. Thirdly, we will investigate how the past fund performance would impact the fundraising of next fund with the same GP. Therefore, we have below hypotheses:

- *Hypothesis 1*: Funds' IRR correlates with each other positively within the same GP. This indicates persistence in fund performance.
- *Hypothesis 2*: There is a positive and concave relationship between the fund's size and its performance
- *Hypothesis 3*: PE firms with more experience deliver better performance
- *Hypothesis 4*: Funds that has industry focus tend to perform better than diversified funds

- **_Hypothesis 5_**: Past fund performance have important influences for later fundraising and fund size within the same GP

4.3 Methodology and descriptions of variables

In order to test our hypotheses, we will apply Linear Mixed Effects model (MLE). In particular, we have two models:

$$IRR_{it} = \alpha_t + \beta(IRR_{i,t-1}) + \lambda(FundSize_{it}) + \eta(FundSize_{it}{}^2) + \gamma(Sequence_{it}) + \rho(Sequence_{it}{}^2) + \mu(Indusrty\ focus) + \delta(vc) + \kappa(public\ market\ condition) + \epsilon_{it} \ldots\ldots\ldots\ldots\ (1)$$

$$Nextfundsize_{it} = \alpha_t + \phi(IRR_{i,t}) + \beta(IRR_{i,t-1}) + \lambda(IRR_{i,t-2}) + \kappa(IRR_{i,t}{}^2) + \gamma(IRR_{i,t-1}{}^2) + \mu(IRR_{i,t-2}{}^2) + \delta(FundSize_{it}) + \kappa(Sequence_{it}) + \eta vc + \epsilon_{it} \ldots\ldots\ldots\ldots\ (2)$$

In the model (1), the dependent variable y_i is the $Ln(1 + IRR - Preqin's\ benchmark)$. the benchmark is obtained from Preqin, determined by the vintage year, region and fund type. The independent variables include previous fund performance, size, experience, industry concentration, fund type and local public market. We then will apply robustness check to see which results are robust. For fund performance, we will substitute IRR with TVPI and PME separately. In model (3), we analyze the relationship between past performances and the capital inflow of the next fundraise. Detailed variables descriptions and according adjustments are below:

- Previous performance: the natural logarithm of one plus the previous fund's IRR. This is to measure the GP's persistence in fund. When we use $TVPI$, past performance indicator will be past fund's $TVPI$ as well.
- Size: the natural logarithm of the fund's size (in $M) and its quadratic form. The square is used to test the concavity of the relationship between size and performance
- Experience: the natural logarithm of the fund's sequence number and its square. As the sequence numbers are absolute, we also substitute with a dummy variable which takes value one if the sequence is over 5, zero otherwise.
- Industry concentration: a dummy variable which takes one if the fund is a diversified fund, zero if it's an industry focus fund. This is determined by fund characteristics in Preqin directly.

- Fund type: a dummy variable which takes value one if the fund is a venture capital, zero otherwise.

- SSEC: natural logarithm of average return from Shanghai Stock Exchange Composite Index following the fundraising. It is a control number to indicate the market conditions in which the PE firm make their investments. Although we include benchmark in the dependent variable, we still believe stock returns are more general for macro-economic conditions as benchmark is more for PE industry.

- Next fund size: natural logarithm of the amount of capital committed to the next fund of the same GP. We use a Tobit regression, since the size variable is censored at 0. If the GP does not raise a follow-on fund, the size of the next fund is 0.4.

4.4 Results

4.4.1 Regression model one: IRR as the performance measurement

In our basic specification of model one, we look into the effects that previous fund's IRR, sequence number and fund's type have on the performance of the current fund (see *Table 6*). Then we expand our specification gradually to include the fund's industry focus in order to test hypothesis 4.

Then we try to add in control factors such as local public market condition to see how the "hot market" can affect the performance. Here we include SSEC index (Shanghai Stock Exchange Composite Index). Lastly, instead of using natural logarithm of the fund sequence, we substitute it with a dummy variable which takes value one if the fund is an early fund (Here we used two specifications, with specification 4 using dummy one if the fund sequence is less than 5 and specification 5 using dummy one if the fund sequence is less than10). Overall, the goodness of fit is increasing as we add in more explanatory variables and controlling factor, specifically with adjusted R^2 from 8.36% to 26.49% as we add in industry concentration. And the significance of the overall model gets gradually higher too, with specification (4) and (5) significant at 10% confidence level. Please note that as we included past performance, we reduced our sample to 79 (Past performance and fund sequence number for first time funds are not available). Another thing worth noting is that we applied firm and year fixed effects in our model.

Table 6

Regression Model 1: Performance (IRR) and fund's characteristics

The table reports the Linear Mixed Fixed model analysis for fund's characteristics. The dependent variable is the natural logarithm of the fund's IRR, differenced from the Preqin's emerging markets benchmark. Previous fund IRR is the natural logarithm of (1+IRR). Size is the amount of capital a fund has under management. Fund sequence is the sequence number of the fund within the same GP and it gives us a picture of the GP's experience. Fund sequence dummy [1] is dummy variable which takes value one if the fund sequence is over 5, Fund sequence dummy[2] is dummy variable which takes value one if the fund sequence is over 10. We also applied dummy variable to Industry Concentration which takes value one is the fund has diversified investments. Venture Capital dummy variable takes value one if the fund is a venture capital. SSEC 3-year average is the average stock returns in three years beginning from the vintage of the fund, which controls the macroeconomic conditions of China. We fixed firm year as the same GP has multiple funds in our sample. Year fixed is not necessary here as we already include benchmark in dependent variable, however we believe it is useful to insert this fixed effects. All data are obtained from Preqin.

	Dependent Variable: Ln(1+IRR-benchmark)				
Specification(n)	(1)	(2)	(3)	(4)*	(5)*
(Constant)	-0.117	-0.124	-0.026	-0.049	-0.098
IRR Previous fund	0.224**	0.260**	0.234**	0.242**	0.230**
	(0.11)	(0.12)	(0.12)	(0.12)	(0.11)
Ln (Size)	0.008	-0.031	-0.031	-0.007	0.011
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Ln (Size)^2	-0.000	0.002	0.002	0.001	-0.001
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Ln (Fund sequence)	0.051	0.122	0.108		
	(0.08)	(0.08)	(0.08)		
Ln (Fund sequence)^2	-0.014	-0.029	-0.027		
	(0.02)	(0.02)	(0.02)		
Fund sequence dummy [1]				0.043	
				(0.04)	
Fund sequence dummy[2]					-0.014
					(0.03)
Industry Concentration		-0.048	-0.040	-0.028	-0.023
		(0.03)	(0.034)	(0.03)	(0.03)
Venture Capital Dummy	0.057*	0.023	0.266	0.043	0.043
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Average 3-year SSEC			0.136	0.166	0.185*
			(0.09)	(0.11)	(0.11)
Firm F.E.	Yes	Yes	Yes	Yes	Yes
Year F.E	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	8.36%	26.49%	25.07%	7.49%	9.51%
Number of Obs.	79	79	79	78	79

(Standard Error); ***** significant at 10% confidence; ****** significant at 5% confidence; ******* significant at 1% confidence

In *Table 3*, *Table 4* and *Table 5* in the Appendix, we applied the same model without fixing firm and year fixed effects, but whose goodness of fit and significance of the model decreased largely.

Firstly, as expected, previous fund performance plays an important role. Across five specifications, the coefficient is from 0.224~0.260 and they are all significant at 5% confidence level. Standard error are all 0.12. This implies that 1% higher performance of the previous fund is associated with an around 22 basis point in the basic specification. If we consider industry concentration, as showed in specification (2), then around 30 basis point is associated. So according to our research, previous fund performance has an effect on the current fund performance. This is possible and can be explained. The first one is that there is indeed persistence on fund manager performance. If a GP manages a fund well, their next fund will tend to perform better as well. The pitfall with this theory is with doubts though. As LPs do not necessarily know the previous fund IRR when they invest in the current while the next fund is very close to the current fund. Also overlap in performance between current and previous fund might result from the same macroeconomic conditions. The second explanation is that there might be some common investments within the same GP, which is true for many GPs that if one of their fund doesn't have enough exposure to some investments, they will leverage more capital from another fund. Overall, the result that previous fund's IRR has important and significant impact on the current fund performance applies in China as it does for global private equity markets.

A second important finding is that size has positive and concave relationship with fund performance, which is not in line with that of Kaplan and Schoar (2005). This implies that performance increases with fund size, but up to a certain point, the effect goes away. The beta, however, is not significant and is smaller than 0.01, even around zero for size quadratic form. When we add in the effect of Industry Concentration in specific (2) to (4), unexpected results appeared: size has negative and convex relationship with performance, which is not in line with prior literatures. It could be that in China the PE market is not mature yet so returns are still increasing in size because a lack of capital invested in PE.

Thirdly, experience comes in as another important effect. The coefficient for Ln (sequence) and Ln (sequence) [2] are respectively positive and negatively, though not significantly. As we add in more control factors, such as industry concentration and market condition, the coefficient becomes bigger. This implies important insights that as GP gets more experienced, they tend to manage funds better and deliver better results, however as more funds open, the benefits of experience are

outweighed by other elements such as dispersed management ability, decreased operating efficiency and complicated office hierarchy etc.

Last but least, we found that fund type is of important effect on fund performance, at least in our simple. The coefficient is 0.057, which is significant at 10% confidence level. According to our result, venture capital tend to outperform buyout. However, Antonio (2017) mentioned they didn't find the evidence between VC and BO, and the winner will be determined by the time period and measurement employed.

In order to test our hypothesis 4 – how fund's industry focus could impact the fund performance – we expand our model to include fund industry dummy, which takes value one if the fund's investments are diversified. See specification (2). The most interesting finding is that we found the goodness of fit of the model increased a lot, with adjusted R^2 from 8.36% to 26.49%. This result gave us insights that in Chinese PE market, industry focus is an important factor. This is in line with the fact that, emerging GPs would focus on a specific industry first, as then they get more experienced, they will then diversify their investments in more industries by employing more industry focused professionals. The coefficient is -0.044 with standard error of 0.04. Negative relationship implies that, as the same fact found with global data, in china diversified funds, in general, tend to perform worse than industry focus fund as well. Although our data is not significant. Moreover, we found that the significance of previous fund's IRR increased with bigger coefficient. Most of other variables' coefficient also increased. This gives us insights that industry fund might intensify impacts other elements have on the fund performance.

In specification (4) and (5), we substitute the fund sequence number with a dummy variable. In specification (4), dummy variable takes value one if the fund sequence is over 5, namely experienced fund, which gives us the positive coefficient.   In specification (5), dummy variable takes value one if the fund sequence is over 10, which gives us the negative coefficient. Combined, we can see the same implication from specification (1) with the fund sequence number, that is – experienced GPs tend to manage fund better, but the benefits will be outweighed by other elements if the opening too many funds.

4.4.2 Robustness checks on performance: TVPI and PME

Now we would like to know, whether different performance measurements will deliver the same results as we found in IRR, when we keep other variables unchanged.

So firstly we replace Ln (1+IRR-benchmark) with the TVPI multiple, see *Table 6* in the Appendix. As more funds report TVPI, we have a larger sample of 106. Overall we think our model is quite robust. Firstly, the overall significance of the model gets increased to 10% confidence level. Secondly, as for dependent variables, as expected, we find that previous fund TVPI has same important impact on the performance across all specifications in the table. In specification (6), we get coefficient 0.051 with a standard error 0.03, which is significant at 10% confidence level. The relationship between size and fund performance has the same trend as one in IRR table: positive and concave for the first column, then negative and convex as we add in more independent variables. Fund type shows the same positive relationship, though it lost its significance. Contrarily, experience and performance now shows a negative relationship, and industry concentration also changed its sign in terms of TVPI.

For a second check, we substitute Ln(1+IRR-benchmark) with PME (public market equivalent), which compares the fund performance with a public index. In this table (*Table 4*) we used MSCI emerging market is the public index, since China is an emerging market. PME is calculated by discounting all cash flows if the fund at the total return of the index. A fund with a PME greater 1 means that the fund outperforms the index (net of all fees), and vice versa. Firstly, size and performance has positive and concave relationship across specifications, which is strongly significant at 5% confidence level, compared to that of previous performance measurements (the form of relationship changed after adding more independent variables). Experience and performance shows negative and convex relationship. Fund type keeps the same relationship. Hence, from this research we can conclude that if you compare your private equity returns with that of public market, it seems size extremely matters while funds you opened does not matter that much.

In summary, from the data of Chinese private equity markets, different fund performance measurements do lead us to different insights. And our findings are valid independently from how we measure fund's performance. However one thing we need to point out is that because the

Chinese market has just started hence we do not have accurate estimates for performance. As mentioned earlier, private equity funds usually have lives in excess of ten years. Ultimate performance is not known until all the investments have exited, but the speed with which the funds are liquidated can vary drastically (Metrick and Yasuda, 2010). In Kaplan and Schoar's work, only funds for which the cash flows have been finalized are included, restricting the sample to funds with vintage year before 1996. However, since private equity industry only started in the 80s, and our sample data spreads from 1993 to 2017, we cannot adopt this method in our studies or otherwise we would lose a lot of data points.

4.4.3 Regression Model Two: Later fund fundraising

Now we would like to understand how GP's track record would affect its next fundraising. By using the Ln(next fund size) as the dependent variable and prior performances, industry fund types as the independent variables, we have very nice and strongly significant results as *Table 7* shows.

At a glance it is easy to see that the goodness of fit increases substantially as we add more variables as independent variables. By looking at specifications (2) and (3), we can see that by adding size and IRR_{t-1} did not increase the goodness of fit for our model. However, when we include IRR_{t-2} in the model, the adjusted R square increased to 14%. Moreover, when all variables listed on the table above are introduced in the model, the goodness of fit increased to 17%. This tells us that the GP's track record matters a lot when it comes its later fund raising.

The variable IRR is always positive, and the same for IRR_{t-1} and IRR_{t-2} and this conclusion is significant for the first two previous funds. This implies that the previous three funds' returns have significant and positive impact on the next fund's raising. As we can see that the current IRR is the most significant across 5 specifications and the coefficient is the biggest, an expected insight is the influence of track record is of critical importance when it comes to its next fundraising. More previous funds have less impact.

By looking at the quadratic forms for the three variables, the relationship between previous IRRs and next fund's raising is positive but concave, meaning that the top performing funds grow less proportionally than do lower performing funds. There are two possible reasons why top-performing PE managers choose to do so. Firstly, there is a limited number of good deals in the market. By choosing to grow relatively less rapidly they can avoid to get into diminishing returns.

Table 7

Regression Model 2: Firm's Track Record and Next Fundraising

The dependent variable is the natural logarithm of the size of the next fund belonging to the same GP. If the same GP has not raised any fund up to the date of our data collection (May 2018), the next fund size is 0. IRR_t is the natural logarithm of (1+the IRR of the current fund), and IRR_{t-1} is the same thing but for the fund the previous one, and IRR_{t-2} for the fund prior to the previous one. IRR_t^2, IRR_{t-1}^2 and IRR_{t-2}^2 are the quadratic form of IRR_t, IRR_{t-1} and IRR_{t-2}, respectively. Size is the fund size of the current fund under the same GP, and sequence is the sequence number of the current fund under the same GP. Size is also a control factor for our model hence we do not add firm fixed effect any more. Venture Capital Dummy is a dummy variable which takes 1 is the fund is VC, and 0 if the fund is BO.

	Dependent Variable: Ln(Next Fund Size)				
Specification(n)	(1)***	(2)**	(3)*	(4)***	(5)***
(Constant)	3.457***	3.176**	3.175**	2.254	2.648*
IRR_t	7.112**	7.052**	7.049**	8.189***	18.964***
	(3.03)	(3.04)	(3.10)	(2.10)	(6.98)
IRR_t^2					-37.678*
					(21.75)
IRR_{t-1}			0.145	-5.493	0.895
			(2.91)	(3.63)	(5.23)
IRR_{t-1}^2					-22.845*
					(13.31)
IRR_{t-2}				6.031**	3.381
				(2.56)	(3.549)
IRR_{t-2}^2					6.945
					(7.34)
Ln (Size)		0.049	0.049	0.087	-0.009
		(0.21)	(0.21)	(0.20)	(0.20)
Ln(Sequence)	0.771**	0.753**	0.754**	0.941***	0.802**
	(0.37)	(0.37)	(0.38)	(0.37)	(0.37)
Venture Capital Dummy	-0.529	-0.473	-0.473	-0.341	-0.452
	(0.57)	(0.61)	(0.61)	(0.59)	(0.58)
Firm F.E.	No	No	No	No	No
Year F.E	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	11.14%	9.52%	7.75%	14.27%	17.30%
Number of Obs.	57	57	57	57	57

(Standard Error); ***** significant at 10% confidence; ****** significant at 5% confidence; ******* significant at 1% confidence

Secondly, for top-performing funds, their human capital is hard to scale. Considering these two factors, it is easier to understand the concave relationship we got in our results.

Sequence number is economically and strongly statistically significant for next fund's raising. This is plausible in that the more experienced a fund manager is, the easier it is for it to raise capital.

Venture capital dummy is negatively related with fund raising. This might be due to the fact that venture capitals in general are more difficult to scale, because venture capitals normally invest in very small, early-stage and emerging businesses. These companies usually need more than just financing support by the VCs. Often times more work and attention of industry professions are needed to progress and develop early-stage companies than mature companies do, hence making it more difficult for venture capitals to scale.

Chapter 5: Conclusion

In this paper, we investigate the private equity market in China, the characteristics, the fund performances and the next fund fundraising using a set of data from Preqin. The data ranges from 1982 to 2017 with 142 funds managed by 66 GPs. Our main purpose is to understand Chinese private equity in China: how the performance is related to fund's characteristics and how it will affect its next fundraising. After applying linear mixed effects regressions through different models, we tested our hypotheses and reached interesting and some different conclusions from what prior papers found in global funds.

Firstly, consistent with the hypothesis in global PE industry, we found that in China performance persistence, measured in terms of previous fund's IRR, is also an economically and statistically significant impact for the current fund's performance. The coefficient of the previous fund IRR was found to be positive and significant at different confidence levels, depending on what variable and controlling factors we add. Why persistence exists and how it affects future funds, are hardly to explain within our paper. And there are also pitfalls in terms of this persistence theory as well as described in earlier model one.

Secondly, we have found that relationship between size and performance is not stable in our sample: it is positive and concave in our basic specification, then changed its sign completely when we add in more independent variables. This is unexpected and not in line with other findings reported by previous papers within global funds (size has positive and concave relationship and is very robust).

This is interesting and gives us a fresh insight. It might be the case that Chinese PE industry is still developing, thus performance is still increasing with size.

Our third finding is that industry concentration is another important factor to fit the performance model. When we added in the industry concentration variable in specification (2), the goodness of the fit of the model increased a lot, from 8.36% to 26.49%. This is specific in China while we compare the results with global funds. A possible reason is that in the early developments of PE industry, GPs tend to open industry focused funds only. Until up to some point when they get more experienced and have a larger team, they might consider diversify their investments. Also in our model, venture capital funds tend to perform better than diversified funds, though all models. Which is not in line with Antonio (2017) who mentioned they didn't find the evidence between VC and BO. This might be true that venture funds tend to have boosted performance in the fast growing Chinese market. Another pitfall indicated by previous paper is that this difference might be misleading as it is largely dependent on the timing and the market conditions.

Next, we try to understand how the next fundraising will be influenced by a GP's prior track record in China. We found that most recent fund has the biggest influence to its next fundraising. The influence dies out as years go. Second, venture capitals are more difficult to scale compared to buyout funds. This could be due to the fact that venture capitals normally invest in very small, early-stage and emerging companies. Hence, we think more work and attention of industry professions are needed for these companies to progress and develop, making it hard for venture capitals to scale.

In conclusion, we would like to state that this paper gives a contribution to the current literature in terms of Chinese private equity market. On the one hand, it reaches some results that are in line with prior findings within global funds. On the other hand, it gives some new angles for Chinese private equity market. However, we would also like to state that the sample characteristics and data quality still affect our analysis: missing information from Preqin and limited set of data etc. It is also possible that misspecifications of our model might also affect our analysis. However, we need to live with the fact that in PE industry, especially in China, precise and complete data are not available. And our findings highlight the need for future work that aims to complete the sample and better understand the Chinese private equity industry.

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Appendix

Table 1: Firms involved in the sample

Table 1 shows the firms involved in our samples. We have a total of 142 funds, with an average of 2.15 funds per firm, and a median of 2 funds.

500 Startups	1	Gobi Partners	1	Mandarin Capital Partners	1
Actis	3	Golden Gate Ventures	1	MBK Partners	3
Affinity Equity	2	GSR Ventures	1	Morgan Stanley Private Equity Asia	1
Apax Partners	1	Helix China	1	Navis Capital Partners	11
Bain Capital	3	Highland Capital	1	NewMargin Ventures	1
Bay City Capital	1	Hony Capital	3	PAG Asia Capital	1
Bioscience	1	Hopu Investment	1	Pittsford Ventures Management	1
Capital Group	3	HPEF Capital Partners	3	Quintana Capital Group	1
Carlyle Group	3	ICCP Venture	2	Riverside Company	1
CDH Investments	5	iD TechVentures	4	RRJ Capital	2
Ceyuan Ventures	1	IDG Capital	1	Softbank China Venture Capital	3
ChinaVest	1	Infinity Group	1	The Jordan Company	2
CITIC Capital	3	IPV Capital	2	The Rohatyn Group	1
CITIC Private	1	JAFCO (Japan)	6	Top Taiwan Venture Capital	1
CRCM Ventures	4	JD Capital	1	TPG	3
CVC Capital	3	Joy Capital	2	Trident Capital	1
DCM	4	KAILAI Investments	1	Ventech	2
Draper Fisher	1	KKR	2	Ventech China	2
DT Capital Partners	2	Legend Capital	2	Vickers Venture Partners	5
ePlanet Capital	1	Lightspeed Venture	3	Vivo Capital	2
EQT	2	Lilly Asia Ventures	1	Walden International	2
GGV Capital	7	Longreach Group	1	Warburg Pincus	1

Source: Preqin

Table 2: Private equity performance by vintage year

The table below describes the average IRR, TVPI and PME of the funds based on their vintage year. Most of our funds are scattered from 2004 to 2008.

Sample year	obs.	Average IRR(%)	obs.	Average TVPI	obs.	Average PME
1982			1	311		
1993	1	-3.3	1	79.9		
1994	2	-1.05	2	105.95		
1998	3	10.63	3	168.93	1	1.33
1999	1	27.2	1	282.7		
2000	1	5.3	1	128.4		
2001	2	18.45	2	226.15	1	0.76
2002	1	5.8	1	130.4		
2003	1	11.9	1	159.3		
2004	9	21.42	8	249.33	2	1.26
2005	2	11.8	3	145.6	1	0.58
2006	8	8.82	9	177.54	3	1.01
2007	19	7.08	21	149.77	13	0.97
2008	13	8.67	13	154.05	10	1.11
2009	3	3.77	4	140.1	2	0.65
2010	3	10.83	5	150.88	2	0.85
2011	6	19.02	7	169.46	4	0.97
2012	9	16.38	11	173.25	3	0.96
2013	14	21.46	15	186.1	7	1.02
2014	6	22.48	9	145.43	5	1.29
2015	4	37.23	8	131.1	1	0.47
2016			12	102.76	8	0.92
2017			3	96.9		

Source: Preqin

Table 3

Multiple Linear Model: Performance (IRR) and fund's characteristics

The table reports the Multiple Linear Model analysis for fund's characteristics. The dependent variable is the natural logarithm of the fund's IRR, differenced from the Preqin's emerging markets benchmark. Previous fund IRR is the natural logarithm of (1+IRR). Size is the amount of capital a fund has under management. Fund sequence is the sequence number of the fund within the same GP and it gives us a picture of the GP's experience. Fund sequence dummy [1] is dummy variable which takes value one if the fund sequence is over 5, Fund sequence dummy[2] is dummy variable which takes value one if the fund sequence is over 10. We also applied dummy variable to Industry Concentration which takes value one is the fund has diversified investments. Venture Capital dummy variable takes value one if the fund is a venture capital. SSEC 3-year average is the average stock returns in three years beginning from the vintage of the fund, which controls the macroeconomic conditions of China. All data are obtained from Preqin.

	Dependent Variable: Ln(1+IRR-benchmark)				
Specification(n)	(1)	(2)	(3)	(4)	(5)*
(Constant)	-0.069	-0.03	-0.049	-0.03	-0.043
IRR Previous fund	0.25**	0.3***	0.268**	0.248**	0.248**
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
Ln (Size)	-0.007	-0.028	-0.03	-0.013	-0.09
	(0.08)	(0.08)	(0.08)	(0.08)	(0.07)
Ln (Size)^2	0.001	0.003	0.003	0.001	0.001
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Ln (Fund sequence)	0.042	0.081	0.076		
	(0.08)	(0.09)	(0.09)		
Ln (Fund sequence)^2	-0.011	-0.012	-0.019		
	(0.02)	(0.02)	(0.02)		
Fund sequence dummy [1]				0.004	
				(0.04)	
Fund sequence dummy2					-0.09
					(0.03)
Industry Concentration		-0.044	-0.035	-0.026	-0.025
		(0.04)	(0.04)	(0.04)	(0.03)
Venture Capital Dummy	0.057	0.044	0.046	0.045	0.047
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Average 3-year SSEC			0.123	0.153	0.158
			(0.09)	(0.10)	(0.10)
Adjusted R^2	4.31%	4.84%	5.99%	5.53%	6.70%
Number of Obs.	79	79	79	78	79

(Standard Error); ***** significant at 10% confidence; ****** significant at 5% confidence; ******* significant at 1% confidence

Table 4

Multiple Linear Model: Performance (TVPI) and fund's characteristics

The table reports the Multiple Linear Model results for TVPI (Total Value to Paid-in Capital) as the performance measurement. The dependent variable is the natural logarithm of the fund's TVPI. TVPI Previous fund is the natural logarithm of previous fund's TVPI. Size is the amount of capital a fund has under management. Fund sequence is the sequence number of the fund within the same GP and it gives us a picture of the GP's experience. Fund sequence dummy [1] is dummy variable which takes value one if the fund sequence is over 5, Fund sequence dummy[2] is dummy variable which takes value one if the fund sequence is over 10. We also applied dummy variable to Industry Concentration which takes value one is the fund has diversified investments. Venture Capital dummy variable takes value one if the fund is a venture capital. SSEC 3-year average is the average stock returns in three years beginning from the vintage of the fund, which controls the macroeconomic conditions of China. All data are obtained from Preqin.

	Dependent Variable: TVPI				
Specification(n)	(6)*	(7)	(8)	(9)	(10)*
(Constant)	1.804	1.958	1.857	1.556	1.927
TVPI Previous fund	0.051	0.048	0.043	0.046	0.048
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Ln (Size)	0.030	-0.132	-0.117	-0.047	-0.198
	(0.45)	(0.48)	(0.48)	(0.48)	(0.45)
Ln (Size)^2	-0.009	0.008	0.007	-0.000	0.013
	(0.04)	(0.04)	(0.04)	(0.04)	(0.01)
Ln (Fund sequence)	-0.164	-0.115	-0.147		
	(0.48)	(0.49)	(0.49)		
Ln (Fund sequence)^2	0.003	-0.008	-0.003		
	(0.11)	(0.11)	(0.11)		
Fund Sequence Dummy [1]				-0.176	
				(0.20)	
Fund Sequence Dummy2					-0.235
					(0.20)
Industry Concentration		0.231	0.250	0.243	0.231
		(0.24)	(0.24)	(0.24)	(0.24)
Venture Capital Dummy	0.204	0.236	0.258	0.238	0.233
	(0.19)	(0.20)	(0.20)	(0.20)	(0.20)
Average 3-year SSEC			0.495	0.391	0.437
			(0.60)	(0.59)	(0.59)
Adjusted R^2	4.46%	4.41%	4.10%	3.76%	4.43%
Number of Obs.	106	106	106	106	106

(Standard Error); ***** significant at 10% confidence; ****** significant at 5% confidence; ******* significant at 1% confidence

Table 5

Multiple Linear Model: Performance (PME) and fund's characteristics

The table reports the Multiple Linear Model results for PME (Public Markets Equivalent) as the performance measurement. The dependent variable is the PME is calculated by discounting the actual cash outflows and cash inflows that the fund received with the returns on the MSCI emerging market index over the same time period and forming the ratio of the discounted cash inflows over the discounted outflows. Size is the amount of capital a fund has under management. Fund sequence is the sequence number of the fund within the same GP and it gives us a picture of the GP's experience. Fund sequence dummy [1]is dummy variable which takes value one if the fund sequence is over 5. Venture Capital dummy variable takes value one if the fund is a venture capital. All data are obtained from Preqin.

Dependent Variable: PME (Public Market Equivalent)		
Specification(n)	(11)	(12)
(Constant)	-2.711	-2.669
Ln (Size)	1.203**	1.118**
	(0.59)	(0.53)
Ln (Size)^2	-0.088**	-0.082**
	(0.04)	(0.04)
Ln (Fund sequence)	-0.405	
	(0.25)	
Ln (Fund sequence)^2	0.102	
	(0.07)	
Fund Sequence Dummy		-0.096
		(0.08)
Venture Capital Dummy	0.048	0.006
	(0.12)	(0.12)
Adjusted R^2	0.07%	2.19%
Number of Obs.	61	63

(Standard Error); ***** significant at 10% confidence; ****** significant at 5% confidence; ******* significant at 1% confidence

Table 6

Robustness check: Performance (TVPI) and fund's characteristics

The table reports the robustness test results for TVPI (Total Value to Paid-in Capital) as the performance measurement. The dependent variable is the natural logarithm of the fund's TVPI. TVPI Previous fund is the natural logarithm of previous fund's TVPI. Size is the amount of capital a fund has under management. Fund sequence is the sequence number of the fund within the same GP and it gives us a picture of the GP's experience. Fund sequence dummy [1] is dummy variable which takes value one if the fund sequence is over 5, Fund sequence dummy[2] is dummy variable which takes value one if the fund sequence is over 10. We also applied dummy variable to Industry Concentration which takes value one is the fund has diversified investments. Venture Capital dummy variable takes value one if the fund is a venture capital. SSEC 3-year average is the average stock returns in three years beginning from the vintage of the fund, which controls the macroeconomic conditions of China. We fixed firm and year as the same GP has multiple funds in our sample and there are several funds are in the same year. All data are obtained from Preqin.

Dependent Variable: TVPI					
Specification(n)	(6)*	(7)*	(8)*	(9)	(10)*
(Constant)	1.774	1.908	1.835	1.553	1.904
Previous fund TVPI	0.051*	0.048	0.044	0.047	0.048
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Ln (Size)	0.032	-0.138	-0.121	-0.047	-0.192
	(0.44)	(0.46)	(0.46)	(0.46)	(0.43)
Ln (Size)^2	-0.009	0.008	0.007	-0.000	0.012
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Ln (Fund sequence)	-0.134	-0.059	-0.111		
	(0.47)	(0.23)	(0.47)		
Ln (Fund sequence)^2	-0.004	-0.022	-0.123		
	(0.11)	(0.11)	(0.11)		
Fund Sequence Dummy [1]				-0.176	
				(0.19)	
Fund Sequence Dummy2					-0.240
					(0.19)
Industry Concentration		0.251	0.258	0.244	0.237
		(0.23)	(0.23)	(0.23)	(0.23)
Venture Capital Dummy	0.200	0.233	0.254	0.237	0.231
	(0.19)	(0.19)	(0.23)	(0.23)	(0.19)
Average 3-year SSEC			0.470	0.386	0.415
			(0.59)	(0.57)	(0.58)
Firm F.E.	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	4.79%	5.14%	4.47%	3.81%	4.77%
Number of Obs.	106	106	106	106	106

(Standard Error); * significant at 10% confidence; ** significant at 5% confidence; *** significant at 1% confidence

Table 7

Robustness Check: Performance (PME) and fund's characteristics

The table reports the robustness test results for PME (Public Markets Equivalent) as the performance measurement. The dependent variable is the PME is calculated by discounting the actual cash outflows and cash inflows that the fund received with the returns on the MSCI emerging market index over the same time period and forming the ratio of the discounted cash inflows over the discounted outflows. Size is the amount of capital a fund has under management. Fund sequence is the sequence number of the fund within the same GP and it gives us a picture of the GP's experience. Fund sequence dummy [1]is dummy variable which takes value one if the fund sequence is over 5. Venture Capital dummy variable takes value one if the fund is a venture capital. We fixed firm and year as the same GP has multiple funds in our sample and there are several funds in the same year. All data are obtained from Preqin.

Dependent Variable: PME (Public Market Equivalent)		
Specification(n)	(11)	(12)
(Constant)	-2.677	-2.688
Ln (Size)	1.189**	1.133**
	(0.56)	(0.51)
Ln (Size)^2	-0.087**	-0.084**
	(0.04)	(0.04)
Ln (Fund sequence)	-0.400	
	(0.24)	
Ln (Fund sequence)^2	0.101	
	(0.06)	
Fund Sequence Dummy		-0.082
		(0.07)
Venture Capital Dummy	0.051	0.025
	(0.12)	(0.11)
Firm F.E.	Yes	Yes
Year.F.E.	Yes	Yes
Adjusted R^2	1.48%	9.94%
Number of Obs.	61	63

(Standard Error); ***** significant at 10% confidence; ****** significant at 5% confidence; ******* significant at 1% confidence