The impact of the economic crisis on listed private equity

An empirical analysis

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This empirical analysis examines the performance of global listed private equity (LPE) over the period of 2000 to 2013 with special consideration of the economic crisis from 3rd quarter 2007 to 1st quarter 2009. Based on their stock price and net asset value returns, the performance of 108 LPE vehicles has been evaluated and compared to public benchmarks and traditional unlisted private equity. Furthermore, fund-specific, macroeconomic and stock market factors have been tested in order to explain LPE performance. Strong positive correlations of LPE with public benchmarks persist during crisis time and so does a non-normal and asymmetric return pattern. Based on the tested factors, LPE returns are affected by the fundraising in the private equity industry, the borrowing costs and the size and age of the vehicle. The pro-cyclical nature limits the potential of LPE for diversification.

Keywords: Listed private equity, Private equity, Performance, Diversification

1 Introduction

Volatility in international capital markets and the increasing uncertainty of investors during the global economic crisis called for new perspectives with regard to asset classes and their diversification potential. Listed private equity (LPE) could serve the purpose of diversification and stabilization based on its dual nature of publicly traded stock and of a closed-end fund vehicle.

A significant number of private equity structures sought public listing during the last decade, with the earliest listings dating back to the 1970s in the UK. Despite the fact, the existence of listed private equity is not a new phenomenon, the attention of investors and academics was limited to date. Nevertheless, given the ongoing discussion about fees in closed-end structures, the boom of alternative investments and potential diversification benefits fostered interest in listed private equity. Listed private equity is a sub asset class of traditional private equity described from a fund volume perspective. Limitations inherent in traditional private equity funds are mostly resolved by LPE, offering liquidity in a mostly illiquid investment class, lower fees and increased transparency for investors. The enhanced transparency based on better information flow reduces search costs, the accessibility of the vehicles reduces the transaction costs as the investment can be executed by the purchase of a listed share. Moreover, the asset class itself is opened to a broader audience, which cannot bring up the minimum investment for traditional limited partnerships. (Huss & Zimmermann, 2009) Despite the accessibility of LPE, little attention was paid to risk and return characteristics of LPE especially during market turmoil such as the global economic crisis[1].

This paper aims to contribute to the knowledge about LPE risk and return characteristics and performance, in particular during crisis time by examining the net asset value (NAV) and price return of global LPE vehicles over 13 years (2000-2013). Consequently, the quarterly stock prices and net asset values per share are evaluated based on 13 explanatory factors. The sample covers different LPE styles and investment categories and was selected based on the membership in the LPX[2] universe as well as based on liquidity and reliability criteria (LPX, 2014). Therefore, the drawn sample is representative for the global private equity community.

This paper will focus on three questions. Firstly, how does LPE behave relatively to other traditional asset classes, e.g. how do the correlations look like? Secondly, what are the drivers of performance of LPE? Thirdly, how did LPE behave during the crisis years 2007-09 and how did the factors driving the performance change? To account for the comparability of the empirical results, the effects of the crisis mentioned in question 3 are addressed directly in the last part of each section.

Following this introduction a brief overview about the existing body of research on private equity and LPE risk and return characteristics should be given. Afterwards, the research design is presented along with the hypotheses for the empirical analysis. The data sample, constraints and methodological approach are described accordingly. In the analysis part, the first descriptive statistic should give an idea about the risk and return parameters and should answer the question about correlations with traditional financial assets. The second analysis will evaluate the drivers of performance of LPE with regard to two different measures of performance: Net asset value return and stock price return. The third and last analysis eventually sheds light on the factors influencing LPE performance during crisis.

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[1] The term crisis refers to the economic crisis and the time period 3rd quarter 2007 to 1st quarter 2009 in this research (NBER, 2014).
[2] Index sponsor for listed private equity.

The relevance of the LPE topic can be described from two angles. The first important question which reaches well beyond the valuation problem of LPE is whether the pricing of LPE is different from other equity. Earlier findings on LPE concentrate on a single measure[3] of performance, however for LPE investors NAV as well as stock price are relevant. While previous studies mostly focused on the systematic risk comprised in LPE compared to regular equities, this study targets on the performance drivers in the broader context of stock and business cycles. The importance of these determinants seems crucial when focusing on asset's behavior during different market regimes. Secondly, the impact of economic crisis on LPE and its correlation with other asset classes will be analyzed for investors. As private equity as an asset class has grown from just a few strategies[4] to specialized investment vehicle styles, also the predominant structure of a finite-life limited partnership evolved towards the existence of evergreen listed private equity funds. As Preqin (2012) showed in its analysis of the returns of traditional private equity and LPE, the development in the private equity sector let especially private investors benefit. Earlier, this investor group was excluded from getting exposure to private equity returns (LPEQ, 2011). However, with LPE stocks they can gain less expensive access. Therefore, the evaluation of risk and return characteristics of LPE will give private and institutional investors alike insight if LPE serves the purpose of diversification in down markets in a traditionally composed portfolio or as an investment reducing the cash drag in a regular private equity portfolio.

A great amount of research focuses on risk and return of traditional (unlisted) private equity. Only a few studies concentrate on the niche of listed private equity. This paper addresses three unique fields of interests within LPE: Firstly, the performance of LPE is analyzed twofold, once from the stock perspective and once from the closed-end fund and NAV perspective. Secondly, correlations are considered not only with traditional private equity but – based on LPE stock-like nature – also with broad stock and bond markets. Thirdly, the impact of the economic crisis on LPE is considered separately and differentiates the findings between before, during and post-crisis for robustness.

2 Literature review

This chapter gives an overview about studies concentrating on the characteristics of LPE. There has been a lot of research done about the risk and return of traditional private equity and its valuation, but just few empirical studies exist about LPE. The major part of the research body focuses on the differences between traditional private equity and traditional financial assets or LPE, precisely on the difference in risk-adjusted returns. However, only a few studies concentrate on LPE performance and its characteristics. Different studies about drivers of private equity returns are presented. These studies include foremost an analysis of traditional private equity returns. The conclusions drawn however are important for the selection of the determinants of the net asset value of LPE. Consequently, studies which focus on the explanation of stock returns and on listed private equity returns are included.

2.1 Findings on PE and LPE returns

Despite the vast amount of studies on return drivers of regular stocks as well as the return on traditional private equity, a synopsis of both to conclude on LPE returns is still a far fetch as the valuation of traded on non-traded instruments is based on different assumptions.

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[3] Compare Bilo, 2002.

[4] 65% of all PE funds in 2000 were buyout funds (Preqin, 2012).

For listed private equity, Bilo (2002) analyzed publicly traded vehicles, whose core business is selecting and holding private companies. In total, the author started the analysis with a sample of 229 companies, which shrinked due to liquidity constraints to 124 instruments. The benchmark adopted from VentureXpert showed a correlation of 79 percent with traditional private equity. Furthermore, Bilo (2002) showed that the average annual return from 1985 to 2000 was about 21.47 percent. She identified correlations ranging from 0.3 to 0.5, indicating limited diversification potential. The last finding is especially important in the portfolio context as Bilo (2002) observed strong positive correlations in down but not in up-markets. This finding is not to the advantage of the investor, as it reduces the benefit from diversification when investors most need it. Degosciu (2012) also studied the relation of LPE NAV returns and traditional private equity returns[5] over the period of 2002 to 2009, working with listed private equity indices provided by LPX. The author found a strong correlation between LPX50 NAV returns and those of a set of unlisted private equity provided by Preqin. In contrast to Bilo (2002), he found that unlisted PE returns are mainly driven by the performance of the LPX50 NAV return. Stock market influence, proxied by the return of the MSCI World, is only of minor importance. Bilo, Christophers, Degosciu & Zimmermann (2005) based their study on the performance of LPE with regard to their market prices, not the book value of investments. Up to 2003, the authors found that only if the equally weighted portfolio is fully rebalanced, the performance is superior over the MSCI World performance (Sharpe ratio 0.57 vs. 0.09). These findings highlighted the importance of rebalancing with regard to the performance of LPE. Degosciu (2012) concludes due to the similar performance measured by NAV returns that LPE can be used as a substitute for traditional private equity. Brown and Kraeussl (2012) analyzed LPE and found that during bull markets LPE, measured by the LPX index return, outperforms regular stocks however it lost significantly during the downturn in 2007 to 2008. LPX Europe and FTSE Europe total annual returns have been -22.1 percent and -11.6 percent, respectively, with standard deviations of 40.4 and 26.9 percent. For the entire period of 1993 to 2010, this amounts to a LPE return of 8.1 percent, against 7.5 percent from the FTSE Europe with a standard deviation of 23.0 and 17.8 percent annually. Diller & Kaserer (2005) analyzed a comprehensive data set of listed European private equity funds. The performance measure the authors sought to explain is the book value[6], hence the NAV of the fund's investment. Diller & Kaserer (2005) showed that valuations are driven by fund inflows into the industry. Furthermore, the valuations could not be assigned to the stock market return, but were found to be negatively correlated with the growth rate of the overall economy.

For traditional private equity, earlier approaches of measuring risk and performance for venture capital funds are diverse. Chen, Baierl and Kaplan (2002), Emery (2003) as well as Gompers & Lerner (2000) analyzed return based on fund-level data using quarterly return measures. Chen et al. (2002) explained long-term risk return characteristics of venture capital based on quarterly returns reported by Thomson Venture Economics and in comparison to the market return using S&P500 as a proxy. The authors found a beta of 0.0034 and a correlation of only 0.04 percent. Quigley & Woodward (2003) found substantial higher volatility in venture returns than in S&P500 returns and higher volatility compared to Nasdaq. The gross return of 5 percent per quarter is clearly less than the returns of the mentioned benchmark indices over the same period. Woodward & Hall (2003) found annual venture returns of 8.5 percent with a standard error of 68 basis points. This suggests only slightly higher returns than Nasdaq. Unlike the findings of Quigley and Woodward (2003), which found a beta close to zero, Woodward and Hall (2003) found a beta of 0.86. Cochrane (2005) measures return, volatility, alpha and beta for venture

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[5] Hence equally NAV returns.
[6] Please refer to the findings of Barth et al. (1995; 2001) and Barth (2005) for findings on volatility in NAV based on different valuation approaches (cost, fair value).

capital funds from 1987 to 2000. After correcting for selection bias, he found a mean log return of 15% what corresponds to an uncorrected return of 108 percent. The standard deviation is found to be 107 percent. For the same time period Peng (2001) found an average geometric return of 55.18% similar to the result of Cochrane (2005) showing an arithmetic average return of 59 percent. Peng (2001) highlighted the volatility of returns, presenting the lowest annual return of -5.94% in 1990 and the highest in 1999 of 681.22 percent. Both authors applied company-level data, however Peng (2001) did not account for selection bias.

Robinson and Sensoy (2011) investigated the behavior of traditional private equity, capital commitments and performance. They found an outperformance of the sample on annual basis of 1.5% over the S&P500. Also, they concluded that commitments are larger when equity valuation rises. Controlling for public equity valuations, Robinson and Sensoy (2011) found only little evidence that private equity draws more capital than it returns, acting as a liquidity sink. However, they confirmed this effect during the economic crisis and the following recession 2007 to 2009. Additionally, the impact of market conditions on contractual terms was confirmed. Emery (2003) stated that traditional quarterly PE returns are subject to sluggish adjustment of NAV. Consequently, standard deviation is understated as so is correlation with public returns. This problem is also evident to Anson (2002). A major NAV determinant for private equity investments is the stale pricing nature of valuation. The NAV is dependent on the parameters adopted for valuation. Hence, general partners can value investments at their discretion as for traditional private equity no market rate implies an objective value. Anson (2002) analyzed NAV valuation and based it on the assumption that fund managers change portfolio valuations only if there is an event such as an IPO or a financing round. However, if there is no event which determines the value of the investments, the NAV incorporates no new information. This aspect is known for other illiquid or unlisted alternatives investments as stale pricing. Anson (2002; 2007) mentions a second pricing aspect for the difference between NAV and implied market value, which is not based on the unique characteristic of private equity but is mainly related by intentional favorable pricing by the fund manager. So called managed pricing is adopted when valuation has the purpose to benefit the general partner. This means, in weakening markets, the NAV decreases with delay at a slow depreciation rate. However, in strong markets, appreciation happens quickly. Documentation of the stale pricing problem and the influence of non-synchronous pricing on private equity returns was early analyzed by Dimson (1979) and Scholes and Williams (1977). Both authors vote for the inclusion of lagged market returns in order to get a realistic beta value.

Gompers & Lerner (2000) identified inflows into venture funds as a main driver of venture capital valuations especially in states when venture financing activity is high. Phalippou & Zollo (2005) showed that the performance of private equity funds is pro-cyclical as it positively co-varies with both, business cycles and public stock-markets. They include business cycle proxies such as credit spread, BAA bond yields, GDP growth as well as proxies for stock market cycle such as market performance, IPO activity and fund flows. Aigner et al. (2008) demonstrated that high returns of PE funds persist over time. Besides the fund performance, they analyzed the influence of public market returns, GDP growth and the average interest rate and found a dependence of PE returns on the public stock market development as well as a significant influence of interest rate levels especially for leveraged investment styles such as buyouts. Kaplan & Schoar (2005) defined as the main drivers of private equity performance the past fund performance, its performance persistence and the fund size. Jones & Rhodes-Kropf (2003) analyzed venture capital data and argue that due to the principal-agent problem comprised in private equity returns, idiosyncratic risk is partially priced and therefore part of the fund returns. Ljungqvist & Richardson (2003) estimated the betas of investment portfolios based on Fama French industry betas assuming leverage is correlated to industry. They calculated an average buyout beta of 1.08, identifying systematic risk as an important driver of private equity returns.

2.2 Findings on stock returns

Various factor groups can be identified which evidentially drive stock returns. Stock price reflects market-level, industry-level and firm-specific information. Dependency on market risk is documented earliest by Black, Jensen and Scholes (1972). They find that in the period from 1931 through 1965 low beta stocks in the United States performed better than high beta stocks. Several authors confirmed this pattern, e.g. Miller & Scholes (1972) and most influential Fama & French in 1990 (Fama & French, 1990). Fama and French (1995) provided additional factors based on the company's fundamental characteristics. They found that size and book-to-market ratio influence stock prices and therefore extended the findings on factors affecting stock prices and returns. Carhart (1995) developed the pricing model further by identifying a factor known as stock momentum, which describes the tendency of the stock price to continue rising if it has already risen and to continue declining if already has depreciated.

The following table shows the main previous empirical research which had a major influence on the development of this research project:

Table 1: Literature synopsis

Main topic	Author	Year	Main findings
Drivers of market prices and NAV – PE and LPE returns	Barth et al.	1995	Earnings at fair value exhibit higher volatility than earnings valued at cost. Increased volatility doesn't result from higher economic risk.
	Gompers & Lerner	2000	Their analysis showed that valuations of venture capital are mainly driven by fund inflows.
	Peng	2001	His results showed an annual return of 55% and a β of 0.8 when examining VC index.
	Anson	2002	Major NAV determinant for PE investments is the stale pricing nature of valuation.
	Emery	2003	Solving the stale pricing problem in PE with the usage of lagged values, he finds a β of 0.0165.
	Quigley & Woodward	2003	Their analysis of VC index showed gross returns of 5% per quarter, which was less than the return of Nasdaq.
	Woodward & Hall	2003	Their analysis of VC returns showed a return of 20% and a β of 0.86.
	Jones & Rhodes-Kropf	2003	Their assumption is that idiosyncratic risk is partially priced and therefore part of the fund returns.
	Ljungqvist & Richardson	2003	They identify the underlying companies' systematic risk as the main driver of PE fund returns.
	Diller & Kaserer	2005	Their results made obvious that valuations are driven by fund inflows into the industry.
	Phalippou & Zollo	2005	They analysis showed that PE fund performance is pro-cyclical, positively correlated to business cycles and public stock markets.
	Cochrane	2005	His assumption is that changes in company's valuations are dependent on log-CAPM.
	Kaplan & Schoar	2005	According to them main drivers of PE performance are the past performance, its persistence and the fund size.
	Bilo et al.	2005	Their empirical findings about 114 LPE highlighted the importance of rebalancing.
	Barth	2005	His research is based on the differentiation between different types of volatility resulting from fair value accounting.
	Anson	2007	His results showed that lagged market returns have a significant impact when explaining PE returns.

As LPE has a hybrid character, pricing characteristics from different asset classes must be evaluated in order to identify price drivers of LPE.

Main topic	Author	Year	Main findings
Drivers of market prices and NAV – LPE implications	Bilo	2002	Empirical findings showed an overall similarity of LPE in risk-return characteristics to regular stocks.
	Brown & Kraeussl	2012	Their results showed that LPE prices fluctuate with public market.
	Degosciu	2012	His results showed a strong correlation between LPX50 NAV and unlisted PE returns.

LPE has two sources of return: changes in NAV and market price. This implies different reactions of NAV and price to factors driving the change in value.

Based on the previous findings on risk and return characteristics of traded private equity, traditional private equity and stocks, LPE should be analyzed considering both valuations, stock price as well as NAV. Hence, for the first time the comparability of results to unlisted PE and publicly traded assets is provided. Given the mixed results on performance measures of traditional PE, the examination will rely on sub-periods with special consideration of the global economic crisis. Furthermore, it should be contributed to the knowledge about LPE as diversifying asset with the evaluation of business and stock market cycle factors and their influence on LPE.

3   Empirical framework

3.1 Research Design

In order to answer the three research questions mentioned earlier, different econometric analyses will be conducted. A mix of descriptive as well as explorative statistics will be used to explain the behavior of LPE during different market conditions and in relation to other asset classes. Firstly, descriptive statistics show mean returns and standard deviations of LPE and benchmarks over the total observation period and for the three crisis-related time windows. Additionally, the returns are tested for normality[7] beyond the description of the higher moments. In a second step, Pearson and Spearman Rank correlations are computed on median quarterly returns of LPE and quarterly returns of benchmark indices. To evaluate performance drivers of LPE, panel regressions with n-entity specific intercepts and fixed effects[8] are applied to price and stock returns of LPE. To answer the third question, separate panel regressions with fixed effects will be run to differentiate return drivers before, during and after the crisis (1st quarter 2000 to 2nd quarter 2007, 3rd quarter 2007 to 1st quarter 2009, 2nd quarter 2009 to 4th quarter 2013)[9]. The performance drivers of LPE returns were analyzed by a set of 13 criteria. As the authors are interested in the impact of the global economic crisis on LPE returns, the approach of Phalippou and Zollo (2005) was followed, whose applied covariates are based on business and stock-market cycles.

3.2 Evaluation Criteria

Private Equity in the traditional sense as well as LPE can serve as a catalyst for economic growth and as an investment vehicle alike. Therefore, a thorough assessment of the risk return characteristics is interesting in the context of portfolio allocation. The applied covariates were chosen based on the before mentioned factors of Phalippou and Zollo (2005). They tested three subjects in order to explain traditional private equity fund returns: (1) aggregated betas for which they could not find a significant relation with fund performance, (2) macroeconomic conditions and (3) public stock market performance. For which both a significant relation could be detected.

3.3 Hypotheses

Based on the literature review, performance drivers were identified and their relation to stock price return and NAV return was evaluated for the overall observation period and the economic crisis from 3rd quarter 2007 to 1st quarter 2009. The following hypotheses were developed:

H1: LPE specific factors (beta, age, size) are positively related to price return and NAV return

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[7] sktest in Stata was applied to for drawbacks of the Jarque-Bera test, which is extremely sensitive to outliers.

[8] Hausman test for differences between fixed and random effects was applied

[9] The time windows were defined after Robinson and Sensoy (2011). The NBER identified December 2007 as the turning point from the peak and notes a recent expansion from June 2009 (NBER, 2014).

H.1.1 A driver of performance should be the degree of systematic risk carried by the LPE vehicles. Unlike traditional private equity for which betas must be computed based on their respective industry the fund is investing in, LPE is publicly traded and therefore *beta* is reported. Brophy and Guthner (1988) measured beta of 12 public funds of funds against the S&P500 over four years and could confirm superior returns over the benchmark. Bilo et al. (2005) presented betas of 0.60 to 0.70 arguing for less risk than assumed in LPE. During crisis it is assumed that beta has a pronounced positive effect on returns than during the adjacent periods.

H1.2 LPE vehicle's *age* subsumizes under the J-curve theory[10] of private equity (Phalippou & Gottschalg, 2009). NAV and returns drop during the first years of a fund's existence and increases over lifetime due to excess fees over realized profits, due to early undertaken investments incurring investment costs during the early low profit years or due to aggressive depreciation of weakly performing investments (Lahr and Kaserer, 2010). Therefore, a positive relation of age and price as well as fund returns is hypothesized and a pronounced effect in times of crisis is expected as older funds usually are managed by a team with well-established track record, which can proof helpful in deteriorating markets and foster investors' trust.

H1.3 Traditional private equity funds show a concave *size* and return relationship due to the closed-end fund structure of limited partnerships, which close the investment vehicle for new investors after reaching a specific threshold. LPE are evergreen investments and therefore it is hypothesized that there is a strict positive relationship between fund size and performance during the observation period. As Lahr and Kaserer (2010) pointed out, a size covariate based on market cap would cause spurious correlation in price return as the change in the dependent variable occurs due to variation in the market value. Hence, assets instead of market capitalization are applied as size factor. Phalippou and Zollo (2005) and Gompers and Lerner (2000) tested for the influence of fund size and find that larger funds slightly outperform and proxies for "superior future prospects" (p. 304). This implies also a greater financial buffer and resistance during time of crisis, resulting in a pronounced positive effect.

H2: GDP growth is positively related to price return and NAV return

GDP growth is applied by Phalippou and Zollo (2005) as a variable determining private equity performance and is related to both business and stock market cycles. This positive relationship is assumed to persist during crisis, as GDP growth declines so do LPE returns.

H3: Borrowing costs (credit spread, BAA bond yields) are negatively related to price return and NAV return

H3.1 *Credit spread* is the difference between corporate bond yields and long-term treasury bonds.[11] As Phalippou and Zollo (2005) note, the variable captures the probability of default and the expected recovery in case of default. High yields BAA corporate bond yields and large credit spread can usually be observed in a weak economic environment, increasing the financing costs (especially of highly leveraged buyout funds), coherently lowering returns. During crisis, credit spreads are assumed to widen what decreases returns, therefore a pronounced negative relation is assumed.

H3.2 A negative relationship of *BAA bond yields* as well as credit spreads with returns is hypothesized with a pronounced effect during the third and last quarter of 2007 up and including

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[10] Kaplan and Schoar (2005), Diller and Kaserer (2005)).

[11] For the US 10-year Treasury bond yield was applied. For the other domicile countries of the LPE sample the respective long-term government and corporate bond yields were applied.

the first quarter 2009. Higher borrowing costs for companies are assumed during crisis, which makes funding more expensive, therefore reducing LPE returns.

H4: Private equity and stock market performance indicators (S&P500 market capitalization, industry fund flows, IPO activity) are positively related to price return and NAV return

4.1 LPE due to its publicly traded characteristic is part of the broad stock market and therefore directly affected by stock *market performance*. Therefore, a positive relationship between stock market performance (S&P500) and LPE returns is hypothesized. This effect should be persistent during crisis.

4.2 According to Gompers and Lerner (2000) and the "money chasing deals" theory, cash flows to private equity funds can be evidence of hot markets and hence influence returns of LPE. If more capital is raised in the private equity industry, this might be triggered by historical LPE performance. Investors decide to allocate additional funds based on past positive returns. Quarterly global private equity fundraising is hypothesized to have a positive relationship with LPE performance. During times of crisis, we expect a diminished effect of *industryflows* due to less available capital and reduced willingness of investors to invest.

4.3 As the IPO is the most favorable exit strategy for private equity funds, the activity in the global IPO market is identified as a performance driver by Phalippou and Zollo (2005). Lahr and Kaserer (2010) apply IPO volume as a measure of investor sentiment. Therefore, a positive impact of *IPO activity* is assumed which is hypothesized to persist during times of crisis.

H5: Option-risk factors are negatively related to price return and NAV return

Agarwal and Naik (2004) stress the importance of option-like features to evaluate risk in hedge funds. As private equity as well as LPE have a similar payoff as options: Buyout funds are highly levered and venture investments in steps to different stages each time involving a new round of financing. Cochrane (2005) compared the payout to a call option: "Venture capital investments are like options; they have a small chance of a huge payoff" (p. 5). Therefore, it is assumed that LPE returns show an asymmetric pattern in returns as beneficial exits are feasible when valuations are strong, e.g. in up-markets (Gottschalg, Phalippou & Zollo, 2004). Due to the evergreen nature of LPE in contrast to the finite life of traditional PE, option risk should be detected by non-linear price return. Hence, a negative relationship[12] between *option-risk* factors (S&P500 BuyWrite Index) and performance measures of LPE is expected over the adjoining periods and the crisis.

H6: Reported performance measures in the first and last quarter of a fiscal year are higher than the reported measures in the second and third quarter

Due to the public listing of LPE and reporting requirements, LPE is hypothesized to report higher performance measures by the end of the fiscal year. As quarterly performance measures are applied and the analyzed vehicles mostly end their fiscal year by the fourth or first quarter of the calendar year, a dummy variable for the 4th and 1st quarter is included (1Q=1, 2Q=0, 3Q=0, 4Q=1). During crisis, higher NAV returns are expected. For the other observation periods, NAV returns are assumed to be higher during reporting season, a pronounced effect is likely in times of crisis. The hypothesis is based on Ball and Brown (1968) and Ball and Kothari's (1991)

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[12] Buy-Write strategies provide option premium income, which cushions downside moves in an equity portfolio. They often underperform stocks in rising markets. (CBOE, 2014) The hypothesis is based on the assumption that positive LPE returns are dependent on positive stock market returns and consequently negative buy-write strategy returns.

Earnings Announcement Effect indicating that earnings are higher than some average earnings or stock's price appreciation during earnings announcement period. With regard to NAV a window dressing effect around fiscal year's end is assumed as analyzed by Lakonishok et al. (1991).

H7: Reported performance measures during crisis time are lower compared to the remaining time of the observation period

In order to capture the effect of the economic crisis a dummy variable was set for the observations made during the third quarter 2007 to the first quarter 2009 (dummy = 1). Obviously this dummy variable only applies to the analysis over the total sample period.

3.4 Data sample and covariates

108 listed private equity vehicles were analyzed and collected from the LPX composite universe[13]. The major part of the sample is composed of UK LPE vehicles, in total 61 funds. 26 vehicles are domiciled and listed in Europe (ex-UK), 5 in Asia including Japan and 16 vehicles are domiciled and listed in the US. Data for market prices are retrieved from Datastream, net asset values are manually collected from 10Q files from the SEC filing database EDGAR for US vehicles and from quarterly reports for the rest of the sample. Return measures are logarithmic. Price and NAV were collected on quarterly basis as most funds report NAV only on quarterly basis and not with greater granularity. The time consuming manual collection is necessary if originary data wants to be retrieved, unlike aggregate NAV data stemming from LPE indices. If a vehicle reported its NAV different than on calendar fiscal year quarter end, e.g. March, June, September, December, it was assigned to the nearest quarter. Explanatory variables were collected from various sources. IPO dates to calculate a vehicle's age were collected from Datastream, so were corporate bond yields as well as Treasury bond and T-bill rates. This was done for every region or country respectively. BAA bond yields[14] were obtained from the Federal Reserve Bank of St. Louis. From Datastream's economic files, country-level annual GDP at constant prices was retrieved. Information about vehicles total assets was retrieved from Worldscope and was adjusted based on 10Q files or quarterly reports. To capture the effect of the market portfolio, the market cap changes of the S&P500 were calculated from data retrieved via CRSP. Data on S&P500 BuyWrite Index was obtained from the Chicago Board Options Exchange (CBOE). The CBOE S&P500 BuyWrite Index is a benchmark index designed to track the performance of a hypothetical buy-write strategy on the S&P500 Index. (CBOE, 2014)

The covariates are grouped by fund specific variables, macroeconomic variables and stock market variables. All the chosen variables are stock market and business cycle related as shown by Phalippou and Zollo (2005), e.g. fund age can prove positive during crisis as investors believe the fund's management can benefit on its track record in order to handle challenging investment decision during crisis.

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[13] Preqin (2012) identifies 108 LPE globally with a market cap of USD 65bn.
[14] BAA bond yields reflect the cost of borrowing what in particular affects buyout funds as they are highly levered. BAA bond yields are reported by Moody's and retrieved from the Federal Reserve Bank of St. Louis (FRED, 2014).

Table 2: Covariate Description

	Covariate	Description
Fund specific	Size	Quarterly total assets (log)[15]
	Age	Respective year minus IPO year
	Beta	Quarterly measured systematic risk
Macroeconomic	GDP Growth	Logarithmic quarterly year-over-year growth rate
	Credit Spread	BAA corporate bond index yield minus long-term government bond index yield (qrt.)
	BAA Bond Yield	Respective BAA corporate bond yield (qrt.)
Stock market	IPO Activity	Quarterly global IPO proceeds (log)
	Market Performance	Quarterly market capitalization of S&P500
	Industry Flow	Global quarterly raised private equity capital (commitments)
	Option Risk	Quarterly logarithmic return of S&P500 BuyWrite Index

4 Empirical results

This chapter will be presenting all results of the research project. For the moment, LPE vehicles have been collected on a global scale. Constraints regarding core business operations and liquidity were maintained for this analysis to reflect a consistent LPE sample (LPX, 2014).

4.1 Distributional characteristics and correlation

In a first step the risk and return characteristics of LPE are presented for the total observation period (1st quarter 2000-4th quarter 2013) as well as for the crisis (3rd quarter 2007-1st quarter 2009) and the adjacent periods. Due to the differing periods of time when data is available for the vehicles, the results are based on an unbalanced panel with gaps.

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[15] Log transformed data offers advantages in particular when analyzing skewed data, however coefficients must be transformed into original metric for interpretation (Yang, 2012). The natural logarithm ln is used in this paper.

Table 3: Distributional Characteristics

	Category	Return Measure	Mean (quart. %)	Median (quart. %)	Volatility (quart. %)	Skewness	Kurtosis
Pre-crisis	LPE	NAV	1.20%	1.05%	8.17%	0.76	7.03
		Price	0.48%	1.91%	15.60%	-0.78	5.49
	Nasdaq	Price	-1.84%	0.95%	15.87%	-0.78	3.33
	EuroStoxx50	Price	0.78%	3.41%	11.27%	-1.52	5.17
	S&P500	Price	0.33%	2.21%	7.69%	-0.83	3.26
	MSCI	Price	0.72%	1.09%	8.01%	-0.7	3.05
	Russell2000	Price	1.65%	1.95%	9.98%	-0.41	3.31
	Global Gov Bond	Price	1.49%	1.52%	3.50%	0.59	2.82
	Euro Gov Bond	Price	2.20%	1.23%	5.70%	0.18	2.05
	US Treasury	Price	0.05%	-0.13%	2.30%	0.3	2.32
	Thomson PE	Price	2.32%	1.58%	9.62%	0.91	5.4
Crisis	LPE	NAV	-2.70%	-0.72%	11.36%	-0.019	10.51
		Price	-12.70%	-6.70%	22%	-0.019	7.57
	Nasdaq	Price	-6.13%	-3.29%	11.74%	-0.6	2.57
	EuroStoxx50	Price	-6.59%	-6.71%	10.37%	-0.01	2.08
	S&P500	Price	-5.96%	-5.89%	9.88%	-0.67	2.98
	MSCI	Price	-6.48%	-4.20%	10.73%	-0.49	2.27
	Russell2000	Price	-6.79%	-2.93%	10.90%	-1.39	4.02
	Global Gov Bond	Price	2.72%	3.78%	4.71%	-0.09	1.29
	Euro Gov Bond	Price	0.95%	1.69%	5.34%	-0.01	1.89
	US Treasury	Price	1.53%	2.47%	3.02%	-0.16	2.28
	Thomson PE	Price	-7.25%	-8.34%	10.01%	0.72	2.27
Post-Crisis	LPE	NAV	0.05%	0.60%	8.07%	-0.83	6.27
		Price	2.60%	2.54%	17.20%	0.17	4.85
	Nasdaq	Price	4.65%	5.86%	9.71%	-0.89	3.23
	EuroStoxx50	Price	2.11%	4.59%	11.36%	-1.2	4.28
	S&P500	Price	3.86%	5.99%	9.44%	-1.1	3.29
	MSCI	Price	3.46%	6.33%	10.26%	-1.01	3.4
	Russell2000	Price	4.10%	6.89%	12.78%	-1.34	4.55
	Global Gov Bond	Price	0.68%	0.30%	3.18%	0.16	2.22
	Euro Gov Bond	Price	2.16%	3.77%	5.56%	-0.27	2.56
	US Treasury	Price	-0.64%	-0.84%	2.80%	0.64	3.36
	Thomson PE	Price	6.89%	6.98%	9.57%	-0.3	2.2
Overall	LPE	NAV	0.09%	0.55%	8.52%	-0.99	6.83
		Price	0.85%	1.03%	20.56%	0.67	5.65
	Nasdaq	Price	-0.14%	2.22%	13.84%	-0.92	3.83
	EuroStoxx50	Price	0.30%	3.33%	11.33%	-0.01	4.02
	S&P500	Price	0.75%	2.27%	8.97%	-0.79	3.14
	MSCI	Price	0.75%	2.47%	9.51%	-0.75	3.11
	Russell2000	Price	1.42%	3.22%	11.42%	-0.82	3.86
	Global Gov Bond	Price	1.37%	1.41%	3.55%	0.043	2.43
	Euro Gov Bond	Price	2.02%	1.69%	5.52%	0.02	2.23
	US Treasury	Price	0%	-0.36%	2.61%	0.36	2.7
	Thomson PE	Price	2.68%	2.34%	10.43%	0.27	3.22

LPE shows a modest median quarterly price return over the whole time period of only 1.03%. The NAV median is even lower at 0.55%. If we look at the categories (direct investing/fund of fund) and investment styles (venture-growth/buyout) the highest median price return exhibit funds of funds with 1.9% and surprisingly buyout funds with 1.3%. Also funds of funds and buyouts exhibit higher NAV return than directly investing vehicles and venture funds with 1.32% and 0.7% respectively.

Table 3 summarizes the moments of return distribution. Both performance measures were tested for skewness and kurtosis. If the returns follow a normal distribution the coefficients of skew-

ness and excess kurtosis would be 0 and 3. Category returns[16] as well as the overall sample were tested for normality, however none of the return series is normally distributed. With price return the highest skewness and kurtosis exhibit fund of funds with -1.51 and 10.25 respectively. Buy-out funds have higher kurtosis (6.29) than venture funds (4.51) and higher negative skewness (-0.9 and -0.18). For NAV return the pattern applies to fund of funds as well but ventures show higher kurtosis and skewness than buyouts. This is reasonable due to either very high returns of ventures or due to fat tails induced extreme losses. The overall sample exhibits positive (negative) skewness of price (NAV) returns 0.67 (-0.99) and kurtosis of 5.65 (6.83) for price (NAV) returns.

Analyzing the periods before the global economic crisis, crisis and post-crisis separately, it can be observed that LPE emerged from the crisis stronger than it entered it related to price return. Median return developed from 1.91% quarterly to -6.7% during crisis to 2.54% post-crisis. This pattern is also valid for the standard deviation. The most interesting observation is the slight positive skewness price returns show during post-crisis period. Before the price return had been skewed to the left, entailing a greater chance of negative outcomes. However, the distribution shows still fat tails with a post-crisis kurtosis of 4.85. NAV returns suffered during crisis as well but could not recover to the extent of price returns. Additionally, NAV returns exhibit almost the same negative skewness and leptokurtic distribution as before the economic crisis.

With regard to performance of LPE against benchmark indices, no outperformance could be detected. Quarterly mean price returns as well as quarterly mean NAV returns (0.11% and 0.09%) are substantially below the return of traditional private equity with 2.71% quarterly mean (NAV) return. This applies also to standard deviation. However, the risk of traditional private equity is not clear cut as the book values usually do not reflect relevant risk exposure. Additionally, due to different return measurement approaches a direct comparison with listed benchmarks is difficult. LPE should be a better indicator of the real exposure. However concerns due to illiquidity induced measurement error still remain.

Next, the results on the correlation structure should be presented. As the returns of LPE are non-normal, non-parametric Spearman rank correlations and Pearson correlations were computed. In accordance to Bilo (2002) only the higher and therefore more conservative values are reported, in this case the Pearson correlation coefficients.

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[16] Due to the unbalanced sample, further category-based analysis was refrained from.

Table 4: Correlation Overall

| | Alternative Assets | | | Traditional Assets | | | | | | | |
| | LPE | | PE | Bonds | | | Stocks | | | | |
	LPE Price	LPE NAV	Thomson PE	Global Gov Bond	Euro Gov Bond	US Treasury	Nasdaq	EuroStoxx50	S&P500	MSCI	Russell2000
LPE Price	1										
LPE NAV	0.9288	1									
Thomson PE	0.6087	0.5407	1								
Global Gov Bond	-1.1784	-0.2353	-0.0697	1							
Euro Gov Bond	-0.0502	-0.1413	0.0289	0.2858	1						
US Treasury	-0.5424	-0.4592	-0.3817	0.5512	-0.0397	1					
NASDAQ	0.7385	0.718	0.6144	-0.2562	0.0315	-0.6298	1				
EuroStoxx50	0.823	0.8232	0.5876	-0.2437	-0.0428	-0.59	0.7423	1			
S&P500	0.847	0.8022	0.6778	-0.2102	0.0106	-0.6292	0.8955	0.8671	1		
MSCI	0.8769	0.8156	0.6968	-0.0945	0.0562	-0.6364	0.8548	0.8862	0.971	1	
Russell2000	0.8292	0.7814	0.6264	-0.2481	-0.018	-0.6667	0.8398	0.887	0.945	0.895	1

Table 5: Correlation Crisis

| | Alternative Assets | | | Traditional Assets | | | | | | | |
| | LPE | | PE | Bonds | | | Stocks | | | | |
	LPE Price	LPE NAV	Thomson PE	Global Gov Bond	Euro Gov Bond	US Treasury	Nasdaq	EuroStoxx50	S&P500	MSCI	Russell2000
LPE Price	1										
LPE NAV	0.8696	1									
Thomson PE	0.8767	0.916	1								
Global Gov Bond	-0.0262	-0.3341	-0.1993	1							
Euro Gov Bond	-0.0479	-0.1306	0.1805	0.4773	1						
US Treasury	0.0221	-0.2538	-0.0939	0.8805	0.6919	1					
NASDAQ	0.6074	0.7901	0.8993	-0.4623	0.2004	-0.3418	1				
EuroStoxx50	0.6812	0.8331	0.8928	-0.3476	0.3215	-0.0667	0.8741	1			
S&P500	0.8551	0.8628	0.9874	-0.2409	0.2013	-0.1238	0.9106	0.8806	1		
MSCI	0.8254	0.9077	0.9846	-0.3437	0.1416	-0.2165	0.9479	0.9101	0.983	1	
Russell2000	0.7716	0.915	0.8536	-0.5171	-0.3117	-0.5449	0.8342	0.6892	0.6892	0.835	1

First, over the total sample period, there is a negative correlation of LPE price returns with government bonds and a positive and strong correlation with public stock market indices. In between is the correlation with traditional private equity. The highest correlation is observed within the return structure of LPE, e.g. the vehicles NAV and the stock price. This is followed by descending magnitude of the correlation with the MSCI World, S&P500, Russell2000, EuroStoxx50 and the NASDAQ. This can be explained by the broadness of the specific index. The MSCI World represents 23 developed markets and has 1615 constituents (MSCI, 2014). Hence the index covers approximately 85% of the free float market cap of each country leading to greater explanatory power. The observed correlation order caters to the theory about broadness and the number of constituents of the benchmark index as the next highest correlation exhibits the S&P500 and the EuroStoxx50. However, the lower correlation with the NASDAQ does not fit into this explanation of constituents but could be explained by the lack of industry broadness, e.g. focus on technology companies. Interestingly, the correlation with the Russell2000 is strongly positive. The index represents stocks of small to medium sized companies. As LPE vehicles are mostly of small to medium size, the high correlation seems reasonable. Concentrating on NAV returns, weaker positive correlations with the stock indices and stronger negative correlations with the bond indices can be observed. Surprisingly, the NAV returns of LPE are weaker positively correlated with traditional private equity than LPE price returns.

During crisis we can observe smoothened correlations. Unlike other asset classes which exhibit stronger correlations in down markets, LPE stock returns exhibit lower positive correlations with stock indices. Correlation with bonds increases though correlations are still negative. With traditional private equity, price returns of LPE are stronger correlated during crisis. In contrast, NAV returns strongly correlate with traditional private equity during crisis so do they with broad stock indices. With bonds, there is a somewhat mixed picture. With broad government bonds, the negative correlation increases offering diversification potential. However, with European and US focus the negative correlation diminishes. The findings imply that LPE cannot serve as a diversification asset in a stock portfolio as the correlations remain positive and strong during the crisis. The correlations with bond indices are not significantly negative enough to achieve a substantial diversification effect in order to reduce volatility. Consequently, when diversification is most needed it cannot be obtained with LPE.

4.2 Performance drivers

4.2.1 Total sample period

The models for performance drivers of LPE price and NAV return over the total observation period are weakly significant[17] and the influence[18] of the explanatory variables differ widely.

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[17] Asteriks (*, ** and ***) indicate statistical significance at the 10%, 5% and 1% level. T-statistics are calculated using robust White error terms.

[18] If the independent variable is in its original metric, beta can be interpreted directly, e.g. influence = $\beta*100$, otherwise transformation $100*(1.01^{\beta}-1)$ applies based on a 1 percentage change. However, for coefficients less 0 the transformation can be approximated by β. (Yang, 2012)

Table 6: Performance Drivers Overall

		Model 1a	1a		Model 1b		
	NAV return	**Coefficient**	**Stand. Error robust**	**Price return**	**Coefficient**	**Stand. Error robust**	
Explanatory	Dummy Crisis	-0.026***	0.008		-0.075***	0.018	
	Dummy 1Q	0.009**	0.004		-0.003	0.007	
	Dummy 4Q	0.008**	0.004		0.006	0.006	
	Age	-0.001***	0.001		0.002**	0.001	
	GDP growth	1.353**	0.624		1.014	1.101	
	IPO Activity	0.002	0.002		0	0.003	
	Credit Spread	-0.004	0.004		-0.033***	0.006	
	Market Performance	0.005	0.02		0.042	0.052	
	Size	0.026***	0.007		0.027***	0.007	
	Industryflow	0.017***	0.005		-0.014*	0.008	
	BAA Yield	0.001	0.002		-0.02***	0.004	
	Option-Risk	-0.019	0.033		-0.269***	0.045	
	Beta	0.001	0.004		-0.003	0.007	
Statistics	R^2	5.98%			6.98%		
	Adjusted R^2	3.76%			1.78%		
	Within	6.38%			9.82%		
	Between	13.17%			9.52%		

For both performance measures can be stated that the quarters of economic crisis had a significant negative impact, hence reducing the returns (table 6, model 1a and 1b). For the dummies signaling pronounced effects in the quarters around fiscal year end, we found positive significant results but only for NAV returns. Given that fund managers have great discretion in valuing their investments as long as there is not a pricing event such as a new round of financing or an exit, the leg room can be used to make beneficial valuations. Therefore for quarters where research analysts' and investors' attention is the highest, usually around annual reporting season (4th and 1st quarter for the analyzed vehicles), valuations of net asset values are adapted. As stock prices are public and available, no such discretion is given to fund managers, leading to the insignificant higher (lower) price returns during reporting season. Age shows also a mixed effect with a positive relationship towards price return but with a negative one towards NAV return. Usually, a positive relation between NAV and age is assumed due to the J-curve effect. A positive relationship with price return might be the consequence of long-term stable realizations and distributions, fostering trust of investors in the ability of the management team and the persistence of returns leading to a catch up of stock prices to NAV similar to traditional PE. Additionally, as age describes public life in years, a positive relation with the stock price rather than the NAV return (the fund might have existed before as a traditional private partnership) might be a different explanation. Nevertheless, this argument is not valid during crisis period. The surprisingly negative relationship of age with NAV might be induced due to the age distribution of the sample and the dominant number of buyout funds in the total sample of 108 LPE vehicles (73.15% of the sample is comprised of buyouts). Venture and growth LPE are on average 13.66 years old compared to the buyout funds of 9.97 years. As buyout funds have a shorter valley of tears than ventures, the younger buyout funds increase their net asset value earlier. If the pronounced negative effect of age on NAV return cannot only be explained by the sample structure is not clear cut as the mean age of both LPE styles are statistically different from zero but price returns are not. GDP growth positively increases NAV returns by 1.36% for 1% change in growth but shows only a weak effect on price returns. As expected, the size of a vehicle increases NAV and price returns. Fundraising of the private equity industry increases NAV returns slightly but works in the opposite direction with price returns, hence, industry flow towards private equity negatively influences price returns. This might be due to the fact that even when LPE benefits from increased fundraising per quarter, the major amount of funds commit-

ted is channeled towards traditional private equity. LPE is still a niche of the private equity industry. The negative relationship of the BAA bond yield with the price return is reasonable due to the increased borrowing costs when faced with high yields. The same argumentation applies to the impact of credit spreads, whose extent indicates lowered borrower quality and usually weak economic environment. With regard to the option-risk comprised in LPE returns, the results are reasonably clear. The negative relationship of the return of the S&P BuyWrite Index with the price return (significant) and the NAV return (negative but insignificant) indicates that LPE funds similar to traditional private equity funds bear left tail risk. This is an important finding. In line with the findings of Phalippou and Zollo (2005) regarding traditional PE returns, LPE price return is mainly realized when stock market is high. BuyWrite strategies outperform the stock market during down- or sideways trending markets. The negative relation therefore implies that LPE price return increases when BuyWrite returns decrease, e.g. in a strong stock market. With regard to NAV no significant relation could be detected. As LPE are evergreen investments in contrast to the finite life of limited partnerships of traditional private equity, the option like risk and payoff is altered.

4.2.2 Economic crisis

The models analyzing performance drivers of LPE during crisis time (3rd quarter 2007 to 1st quarter 2009) as well as those describing the pre- and post-period show higher explanatory power than the models for the overall sample period. The coefficient of determination within the crisis panel is 38.86% and 28.36% for the price and NAV return respectively. Moreover, one can state that the number of significant explanatory variables increased over time, beginning with five significant return drivers in the pre-crisis period to twelve significant explanatory variables in the post-crisis period. With regard to the explanatory variables the economic crisis dummy was dropped for the three time period regressions as it is redundant due to the restriction of the specific observation period based on the economic crisis.

Table 7: Performance Drivers Pre-Crisis

	Model 2a			Model 2b		
	NAV return	Coefficient	Stand. Error robust	Price return	Coefficient	Stand. Error robust
Explanatory	Dummy 1Q	-0.024*	0.014		0.023	0.026
	Dummy 4Q	-0.006	0.019		0.017	0.016
	Age	0.008	0.005		0.009	0.006
	GDP growth	-0.84	1.25		3.45	2.58
	IPO Activity	0.002	0.008		0.015	0.01
	Credit Spread	0.023***	0.004		-0.013	0.027
	Market Performance	0.08	0.063		0.389	0.269
	Size	0.064*	0.036		0.099***	0.038
	Industryflow	0.01	0.017		-0.042	0.04
	BAA Yield	-0.035***	0.009		-0.05***	0.019
	Option-Risk	-0.182	0.148		-0.034*	0.196
	Beta	-0.017	0.021		-0.023	0.017
Statistics	R^2	20.22%			18.86%	
	Adjusted R^2	8.52%			7.98%	
	Within	15.25%			16.23%	
	Between	18.86%			7.00%	

In the *pre-crisis period* from 1st quarter 2000 up to 2nd quarter 2007, only one fund-specific factor influenced NAV and price return (table 7, model, model 2a and 2b). For both returns, size had a positive relationship with performance, indicating that larger LPE vehicles exhibit higher positive returns. Obviously, even before the economic crisis hit, the borrowing costs faced by

the funds substantially affected returns. Hence, if BAA bond yields are high, both performance measures deteriorate. Unlike the crisis period, option-risk similar to traditional PE risk seems to be part of LPE returns during pre-crisis, however, only significance related to price return could be detected. For this period an in-depth analysis of other variables as for example technical factors would be beneficial to identify performance drivers.

Table 8: Performance Drivers Crisis

		Model 3a			Model 3b	
	NAV return	**Coefficient**	**Stand. Error robust**	**Price return**	**Coefficient**	**Stand. Error robust**
Explanatory	Dummy 1Q	-0.03	0.018		-0.119***	0.023
	Dummy 4Q	-0.017*	0.012		-0.047***	0.017
	Age	0.01*	0.001		-0.002	0.001
	GDP growth	0.957	1.006		0.691	0.685
	IPO Activity	-0.002	0.009		0.003	0.012
	Credit Spread	0.017*	0.01		-0.014	0.021
	Market Performance	0.136**	0.062		0.039	0.098
	Size	0.095*	0.051		0.158	0.102
	Industryflow	0.073**	0.028		0.257***	0.046
	BAA Yield	0.004	0.01		-0.018	0.014
	Option-Risk	0.131	0.098		-0.52***	0.121
	Beta	0.009	0.008		-0.001	0.017
Statistics	R^2	47.54%			47.47%	
	Adjusted R^2	32.72%			35.49%	
	Within	28.36%			38.86%	
	Between	1.44%			2.78%	

During *crisis*, a potential window dressing effect diminishes as we detect for both price as well as NAV return negative influences of the year's first and last quarter (table 8, model 3a and 3b). This could be assigned to the rule of conservatism (Anson, 2002) when valuing net asset values. Managers depreciate investment values quickly and increase valuation slowly when profits and exits are feasible. This could be seen in contrast to the positive significance of the dummies for the overall period as those indicate the possibility of managed earnings regarding NAV returns. The funds allocated to the private equity industry also drove price returns during crisis almost to the same extent as they drove the NAV returns by 0.25% increase for every 1% increase in funds raised. With regard to size and age, it can be concluded that larger and older LPE vehicles showed higher NAV returns than smaller funds. An interesting observation is the positive but weak significance of market performance for price and NAV return. As the S&P500 market cap lost by the end of the 4th quarter 2007 to the end of the 1st quarter 2008 11 percent what corresponds to a cumulative loss of 64.4% and in the median a loss of 8.6% per quarter, LPE lost 6.76% in the median on the stock price and 0.7% on NAV per quarter. The observed relation is highlighted by the positive strong correlations overall and slightly reduced positive correlations during crisis. The option-risk variable shows still a negative relation to price return as we observed for the overall sample period indicating nonlinear price returns. NAV returns show no significant relation to a covered call strategy inherent in the BuyWrite return, hence indicates that asymmetry is lower during crisis. The finding needs further clarification regarding the reasons for the direction change of the statistical relation during the crisis period. It can be a sign of intentionally lagged depreciation of net asset value valuations.

Table 9: Performance Drivers Post-Crisis

		Model 4a			Model 4b		
	NAV return	**Coefficient**	**Stand. Error robust**	**Price return**	**Coefficient**	**Stand. Error robust**	
Explanatory	Dummy 1Q	0.023***	0.005		0.018*	0.009	
	Dummy 4Q	0.028***	0.006		-0.002	0.011	
	Age	-0.007***	0.006		0.002***	0.001	
	GDP growth	0.453	0.286		-1.023***	0.312	
	IPO Activity	0.003	0.002		0.008	0.005	
	Credit Spread	0.003	0.005		-0.044**	0.019	
	Market Performance	-0.028	0.025		0.026	0.067	
	Size	0.026**	0.01		-0.005	0.02	
	Industryflow	-0.009	0.008		-0.224***	0.027	
	BAA Yield	0.005	0.005		-0.07***	0.167	
	Option-Risk	-0.187***	0.044		-0.495***	0.067	
	Beta	0.008	0.02		0.049	0.033	
Statistics	R^2	19.32%			15.80%		
	Adjusted R^2	12.93%			8.99%		
	Within	4.97%			11.09%		
	Between	7.99%			1.07%		

With the 2nd quarter 2009 the *post-crisis* period begins (table 9, model 4a and 4b). Two explanatory variables and the direction of the coefficient are noteworthy and reflect a material change to the earlier periods. Firstly, GDP growth, which was only significant for the overall observation period, is positively related to NAV returns but negatively to price returns, it reduces the latter by approximately 1.01%. The mixed effect might be somehow explained by weak GDP growth during the crisis induced recession. Analyzing the median and mean GDP growth, we detect a weak positive growth of 0.5% and 0.4% and a NAV and price return of 0.6% and 2.7% respectively. Overall, a positive correlation would be assumed, nevertheless outliers such as price returns of -98% and -10.9% in GDP growth of Greece in the 4th quarter 2011 (quarter-over-quarter) could be an explanation. Secondly, the industry flow is negatively related to price return. Cross-checking for fundraising levels before, during and after crisis no significant difference in means can be detected. Average global fundraising over the three time periods was USD 10.87bn, 11.65bn and 11.10bn. Adjusted for market capitalization, e.g. total fundraising in global private equity to S&P500 market capitalization, no other conclusion could be drawn. One can hypothesize that funds raised were allocated into traditional private equity, hence to benefit LPE and their returns. Additionally, adjusted fund flows count LPE twice, one way as they are part of the included total market capitalization, the other as the volume identified in fundraising included traditional as well as listed private equity vehicles. In comparison to the crisis period, dummy variables for the first and last quarter are positive and significant for NAV returns, indicating higher net asset values when fiscal year ends. Option-risk persists for both performance measures. Borrowing costs as well as default risk measured by credit spread show still a negative impact on price return.

5 Hypotheses Review & Conclusion

5.1 Hypotheses Review

In order to accept a hypothesis, the coefficient must be significant on the 10 percent level. Additionally, the acceptance of a hypothesis depends on the suggested direction (positive or negative) of the effect and will be evaluated in general (whole observation period) and for the crisis.

Table 10: Hypotheses Review

	Period	Variable	Decision	Comments
H1.1	Overall	Price	Rejected	Systematic risk measured by *beta* has no significant impact on LPE performance. These findings were also made by Phalippou and Zollo (2005) for traditional private equity.
		NAV	Rejected	
	Crisis	Price	Rejected	During crisis a positive impact of systematic risk, e.g. *beta* on NAV return could be detected however the influence is statistically neglectable.
		NAV	Rejected	
H1.2	Overall	Price	Accepted	*Age* influences returns not in a clear direction. The public life of LPE has a pronounced effect over the total observation period.
		NAV	Rejected	
	Crisis	Price	Rejected	During crisis, NAV returns are positively related to the LPE vehicles *age*. This does not apply to price return.
		NAV	Accepted	
H1.3	Overall	Price	Accepted	The *size* of a LPE vehicle positively affects price as well as NAV return measured for the total observation period.
		NAV	Accepted	
	Crisis	Price	Rejected	The *size* of a LPE vehicle significantly positively affects NAV return during crisis.
		NAV	Accepted	
H2	Overall	Price	Rejected	*GDP growth* affects price as well as NAV return positively however the results were not statistically significant for price return over the total observation period.
		NAV	Accepted	
	Crisis	Price	Rejected	*GDP growth* positively influenced both returns but not statistically significant.
		NAV	Rejected	
H3.1	Overall	Price	Accepted	*Credit spread* affects price return as well as NAV return negatively however the results were not statistically significant for NAV return over the total observation period.
		NAV	Rejected	
	Crisis	Price	Rejected	The *credit spread* is not statistically related during the crisis to price return. The positive significant relation led to the rejection of the hypothesis based on the hypothesized effect of credit spread on NAV return.
		NAV	Rejected	
H3.2	Overall	Price	Accepted	*BAA bond yields* incorporate borrowing costs affecting the returns of LPE in particular buyouts. Only with regard to price return a statistically robust negative effect could be observed over the observation period.
		NAV	Rejected	
	Crisis	Price	Rejected	*BAA bond yields* incorporate borrowing costs affecting the returns of LPE in particular buyouts. No statistically robust effect could be observed during crisis.
		NAV	Rejected	
H4.1	Overall	Price	Rejected	*Market performance* affects price as well as NAV return positively however the results were not statistically significant for NAV and price return over the total observation period.
		NAV	Rejected	
	Crisis	Price	Rejected	*Market performance* affects price return as well as NAV return positively however the results were not statistically significant for price return during crisis.
		NAV	Accepted	
H4.2	Overall	Price	Rejected	*Industryflow* describing global PE fundraising is positively related to NAV return but statistically negatively related to price return.
		NAV	Accepted	
	Crisis	Price	Accepted	During crisis period *industryflow* is highly significant and

		NAV	Accepted	affects both LPE returns positively.
H4.3	Overall	Price	Rejected	*IPO activity* should affect returns positively as an IPO is the most favorable exit strategy. Overall it is positively related but not significantly.
		NAV	Rejected	
	Crisis	Price	Rejected	*IPO activity* showed mixed results, affecting NAV return negatively and price return positively but not on a statistical significant level.
		NAV	Rejected	
H5	Overall	Price	Accepted	LPE price returns contains *option-like risk* as it is part of traditional private equity. This applies also to NAV return but not on a statistical significant level.
		NAV	Rejected	
	Crisis	Price	Accepted	During crisis, the *option-like risk* characteristic is pronounced towards price return. Hence, option-risk is present in price returns but not significantly comprised in NAV returns.
		NAV	Rejected	
H6	Overall	Price	Rejected	The 4th and 1st quarter dummies indicate higher NAV returns in the first and last quarter. This does not apply to price return.
		NAV	Accepted	
	Crisis	Price	Rejected	During crisis, dummies are significant for both NAV return and price return however indicating a negative relationship, hence lower earnings can be observed during reporting season of the economic crisis.
		NAV	Rejected	
H7	Overall	Price	Accepted	The *economic crisis dummy* showed a significant negative impact on NAV and price returns, thus indicating that both returns were lower during the quarters of economic crisis.
		NAV	Accepted	

5.2 Conclusion

The aim of this paper was to analyze the characteristics of listed private equity over the last thirteen years and with special consideration of the global economic crisis. The intention was to analyze if LPE could be a safe haven asset for private and institutional investors alike. Hence, the composed empirical work should clarify if investors could create stability in their portfolios during volatile markets such as during the period from 3rd quarter 2007 to 1st quarter 2009 by investing in this accessible and liquid asset class due to favorable risk and return parameters.

The conducted tests gave insight into the behavior and the performance of listed private equity taking into account its hybrid character by analyzing net asset value and stock price returns. Furthermore, special emphasis was laid on the impact of the global economic crisis.

Private equity as well as LPE is believed to be uncorrelated with other traditional asset classes. For traditional private equity, the assumption is challenging to test due to the inexistence of available market prices. LPE however can reveal real correlations and exposure based on the availability of market prices. The first part of the analysis showed that price as well as NAV performance of LPE is pro-cyclical on average. This relation also holds in down markets albeit less pronounced. For risk and return characteristics, the analyzed LPE sample is not an attractive investment compared to public index benchmarks. Neither compared to traditional PE, however due to the absence of market prices, this comparison might be flawed.

Given the short history of LPE performance data, the discretion in valuation and data availability of net asset values and the discount of public market prices to NAV, the full picture of LPE characteristics could not be grasped with this research project.

The partial dependence of LPE on public benchmarks is further analyzed by the evaluation of performance drivers during crisis. We can state that fundraising in the private equity sector determines LPE returns in down markets making it less different from traditional PE. This is con-

firmed by the non-linear price return pattern. Similar to traditional PE, LPE vehicles' age and size can affect returns positively as larger and older funds might indicate a good track record what fortifies investors' trust in the management team and its skills to weather through crisis.

For the near-term future, based on the findings about correlations with public stock markets, it would be interesting to examine technical factors usually applied to single stock analysis and peer group valuations. Moreover, as NAV and price measures provided mixed results, a holistic analysis of both measures based on a single variable such as premium/discount of price to NAV would give further insight. For the long-term future of LPE, it would be of value to analyze the behavior of the asset class over different market regimes and if possible with greater granularity of observations.

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