

# PRIVATE EQUITY INDICES

## Approaches, Characteristics and Implications

### 1. INTRODUCTION

Due to private equity's inherent non-public nature, performance measurement for the sector poses special challenges. Prior to any further calculation and deeper analysis, a suitable basis for making statements about value development over time has to be chosen. This places us directly into the realm of index construction.

In the course of this paper, we will explore different possibilities of implementing private equity indices. At first, the two commonly used indexing approaches are presented and some of their methodological details and differences are highlighted. Subsequently, we take a look at their risk/return characteristics displayed over time and during selected phases of market crisis. By employing a mean-variance optimization, we finally stress the importance of making an informed choice before using private equity indices for portfolio allocation purposes. A short summary concludes.

### 2. INDICES FOR THE PRIVATE EQUITY SECTOR

Historical returns (or indices) are required to determine the value-at-risk for capital investments. Indices also serve as the basis for several other applications:

- Performance comparison between different asset classes
- Benchmarking of one's own investments against the market (e. g. when pursuing an active investment strategy in individual asset classes)
- Input for capital allocation models (e. g. when optimizing the portfolio across different asset classes)

The selection of a "suitable" index for each asset class is therefore crucial for defining the right control parameters in the capital investment sector.

Indices mapping liquid asset classes such as public equities and bonds can be easily calculated using their market values and/or stock prices that are available on a daily basis. For illiquid asset classes such as private equity, hedge funds and real estate, up-to-date market appraisals are not generally available. Hence, indices for these asset classes must be computed in a roundabout way.

Two different approaches for index computation have been established in the private equity sector:

1. Listed PE Indices: computed based on the stock prices of exchange-listed private equity managers and fund investments
2. Appraised Value-based Indices: computed based on cumulative cash flows and net asset values (NAV) of closed-end private equity funds

Both approaches will be explained in the subsequent sections, outlining their potential advantages and disadvantages (see also Appendix 1 for a tabular comparison).

## 2.1. LISTED PRIVATE EQUITY INDICES

Listed Private Equity (Listed PE) is the term used for exchange-listed “vehicles” whose underlying business purpose is “private equity style” investments in private equity funds, portfolio companies or, in some cases, the management companies of private equity funds. The first Listed PE stocks were introduced to the stock exchanges in the US in the early 1980s. Today, more than 400 such vehicles are stock-listed worldwide, of which about 100 are liquidly traded.<sup>1</sup> Compared to the current private equity assets under management worldwide of around EUR 2,600 billion<sup>2</sup>, the Listed PE universe is estimated to cover a share of merely about 10%.<sup>3</sup> It is thus not representative of the total private equity market.

The biggest Listed PE stocks (in Europe: 3i Group, Melrose, Partners Group) clock up a market capitalization of EUR 10-15 billion each. However, the market capitalization for the bulk of this segment below the top 10 companies ranges in the sub-billion Euro region.<sup>4</sup>

We can distinguish four types of Listed PE stocks:

FIGURE 1: DIFFERENT TYPES OF LISTED PE STOCKS

|                        | 1   | 2  | 3  | 4   |
|------------------------|---|--|--|---|
|                        | General Partner (GP) stocks   | GP/PE portfolio combined   | PE portfolio   | Listed fund of funds  |
| Includes mgmt. company | ✓   | ✓  |  |   |
| Includes PE assets     |   | ✓  | ✓  | ✓   |
| Examples               | <ul style="list-style-type: none"> <li>• Blackstone</li> <li>• KKR</li> </ul>   | <ul style="list-style-type: none"> <li>• 3i Group</li> <li>• Eurazeo</li> <li>• Wendel</li> </ul>  | <ul style="list-style-type: none"> <li>• Apollo Investment Corp.</li> </ul>                                      | <ul style="list-style-type: none"> <li>• Castle PE</li> <li>• Pantheon Intl.</li> <li>• Partners Group</li> </ul> |
| Evaluation             | <ul style="list-style-type: none"> <li>• Investment is made in proceeds of asset manager</li> <li>• Valuation via AuM- or proceeds multiples</li> </ul> | <ul style="list-style-type: none"> <li>• Investment is made in proceeds of asset manager and PE assets</li> <li>• Valuation via NAV + surcharge</li> </ul> | <ul style="list-style-type: none"> <li>• Investment is made in PE assets</li> <li>• Valuation via NAV</li> </ul> | <ul style="list-style-type: none"> <li>• Investment is made in PE assets</li> <li>• Valuation via NAV</li> </ul>  |

Analysis: AssetMetrix

Listed PE Indices are based on a selection of Listed PE stocks and are publicized by a number of different providers. The LPX Index family is published by LPX AG, a spin-off from the University of Basel/Switzerland. At present, the LPX50® is the most widely circulated index of its kind and includes,

<sup>1</sup> Source: Red Rocks Capital, January 2018.

<sup>2</sup> Source: Preqin, July 2018.

<sup>3</sup> Source: Edison, Listed private capital, June 2018. Estimate based on European Listed PE universe.

<sup>4</sup> Source: Edison, Listed private capital, June 2018.

among others, 3i Group, Blackstone, Eurazeo, KKR, Partners Group, Rocket Internet, and Wendel.<sup>5</sup> Alongside this index, similar Listed PE Indices are publicized by Standard & Poors (S&P LPE Index), Dow Jones/Société Générale (PrivEX) and Red Rocks Capital (Global Listed Private Equity Index).

## 2.2. APPRAISED VALUE-BASED INDICES

In contrast to Listed PE Indices, Appraised Value-based Indices (AVI) are computed directly from the cash flows and net asset values (NAV, i. e. the accumulated net values of the underlying portfolio companies) of closed-end private equity funds. This approach corresponds with the figures an investor would see on its balance sheet. For example, Preqin currently publishes the cash flows (contributions, distributions) and NAVs of over 3,500 private equity funds. Data points amount to over 122,000 cash flow transactions and over 115,000 historical NAVs. This data is provided per fund manager / fund.<sup>6</sup>

The quarterly returns can be calculated from the cumulative cash flows and NAV:

$$Return_t = \frac{NAV_t + Distributions_t}{NAV_{t-1} + Contributions_t} - 1$$

In the equation,  $t$  stands for the quarter, while  $NAV$ ,  $Distributions$  and  $Contributions$  represent the corresponding values, either in EUR or USD.

The Appraised Value-based Index (AVI) can now be deduced by a straightforward linking of the returns:

$$AVI_t = AVI_{t-1}(1 + Return_t), \text{ where } AVI_0 = 100$$

The Preqin database enables many different segmented queries to be made from the cumulative cash flow data (e. g. by vintage years, private equity styles / investment types, regions / countries, fund size, and combinations thereof). With this information, it is possible to define and compute corresponding indices for almost any sub-segment. Preqin thus provides a substantially more representative coverage of the entire private equity market than the Listed PE Indices.

Apart from Preqin, there are also other data providers (e. g. Dow Jones, Cambridge Associates, State Street, The Burgiss Group) that publish cumulative cash flow figures.

## 2.3. ADJUSTING FOR AUTOCORRELATIONS

Appraised Value-based Indices can also be problematic because the return time series are often heavily autocorrelated. The return at time  $t$  can be largely derived from the return recorded in the prior period(s). The reason for this autocorrelation is that performance figures are only published on a quarterly basis and the fact that, as a rule, net asset values are estimated rather than being based on market values (or they are simply updated from the prior period).

Autocorrelation on return time series causes volatility and correlations to be underestimated, thus limiting the significance of most risk measures.

<sup>5</sup> Source: LPX AG, June 2018. LPX AG does not publish the entire composition of its indices, but only the names of the ten biggest underlying private equity stocks.

<sup>6</sup> Source: Preqin, July 2018.

From a statistical viewpoint, the following approach is recommended for adjusting autocorrelations:

- Identification of autocorrelation in a return time series using a statistical test (e. g. Durbin-Watson or Ljung-Box tests)
- If there is a statistically significant autocorrelation: de-smoothing of the return time series (e. g. using the Geltner method)
- Calculation of volatility and correlations based on the de-smoothed return time series

#### Digression: the Geltner method

$$r_t = \frac{r_t^* - a_1 r_{t-1}^*}{1 - a_1}$$

$a_1$  = first-order autocorrelation

$r_t^*$  = observed return

$r_t$  = de-smoothed return

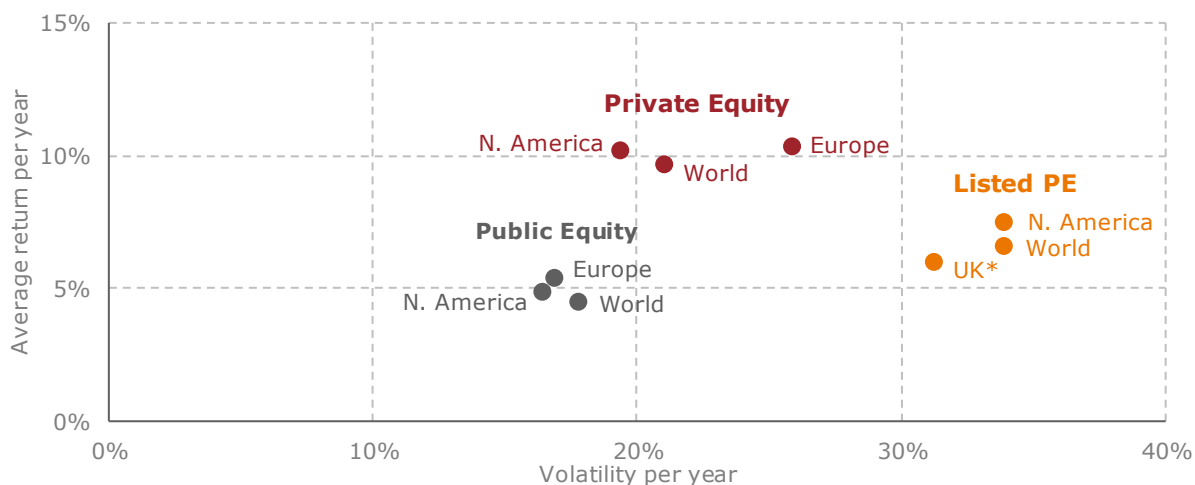
$t$  = time period (e. g. in quarters)

All time series used in this paper were subjected to this procedure. Thereby, evidence was obtained that the Appraised Value-based Indices "Private Equity World", "Europe" and "North America" have a statistically significant autocorrelation. This was eliminated with the Geltner method.

## 2.4. THE RISK-RETURN PARAMETERS OF BOTH APPROACHES

As the Appraised Value-based Indices are derived directly from the cash flows and NAVs of closed-end private equity funds, they do reflect their actual risk-and-return profile. Compared to public equity and Listed PE, they historically show significantly *higher* returns at *lower* volatility (see Figure 2).

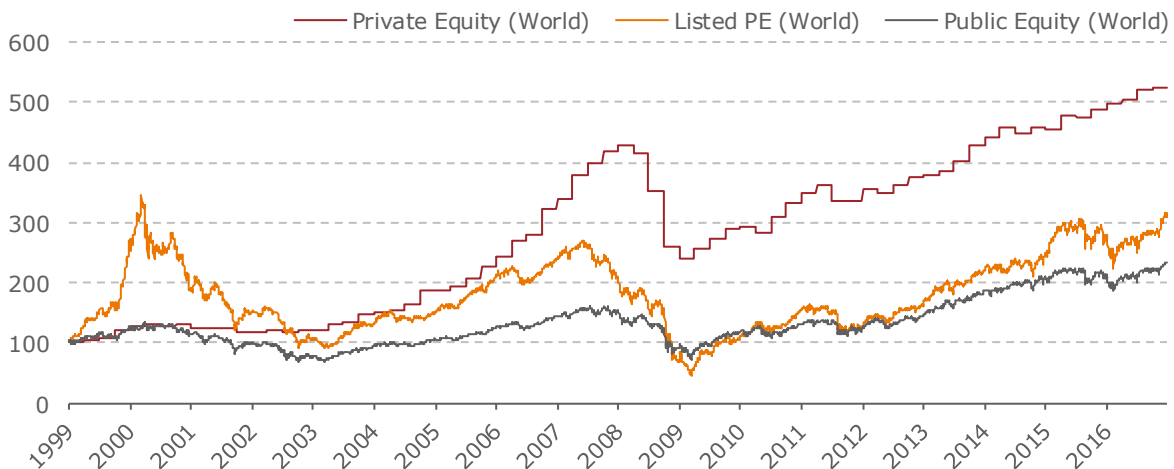
FIGURE 2: RISK-RETURN PROFILES OF DIFFERENT INDICES (Q1 1999 – Q4 2016)



\*Historic data for LPX EU® prior to 2012 were not available. Therefore, the longer time series of LPX UK® was used as a substitute. / Data Source: Thomson Reuters Eikon; Analysis: AssetMetrix

The advantageous performance profile of classic private equity investments is also evident from the index time series for the three asset classes since 1999 (see Figure 3, shown for worldwide diversified portfolios in each case). This chart shows particularly well that the Appraised Value-based Index has not followed the “exaggerated” upward and downward oscillations of the listed asset classes. Instead, it reflects the returns that are actually “received” by the private equity investor, both from balance sheet and performance measurement perspective.

FIGURE 3: INDEX DEVELOPMENT OF DIFFERENT ASSET CLASSES (Q1 1999 – Q4 2016; 01.01.1999 = 100)

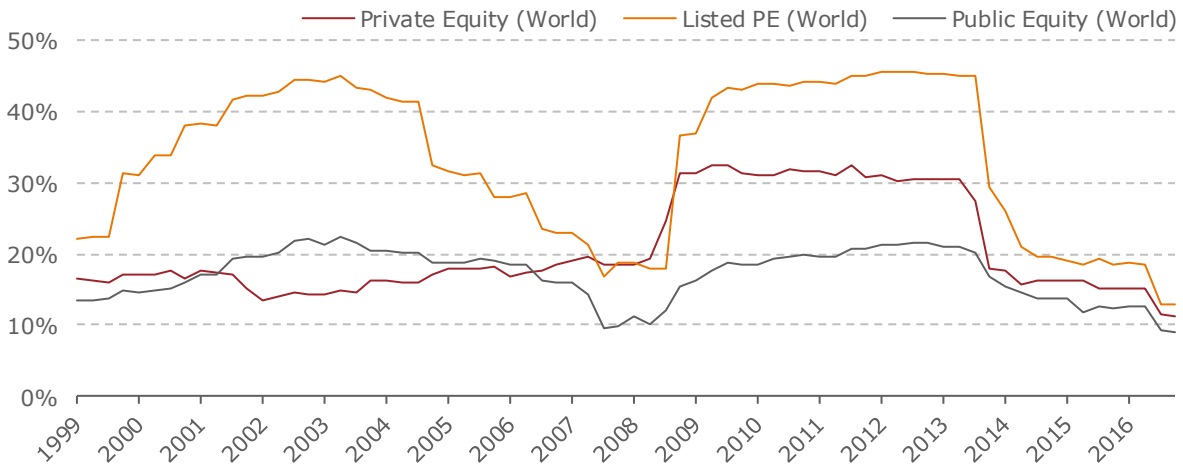


Data Source: Thomson Reuters Eikon

The high volatility of the Listed PE Index is explained by the fact that the underlying private equity stocks are extremely dependent on the oscillations and “moods” of the stock exchange. In a certain sense, this increased volatility is the “price of liquidity”, i. e. the opportunity to trade the underlying papers daily on the stock exchanges.

A more detailed analysis shows that the volatility of the Listed PE Index “explodes” especially in times of crisis (see Figure 4). By contrast, the Appraised Value-based PE Index only shows elevated volatility during the crisis from 2008 onwards, and is more in line with the stock market otherwise.

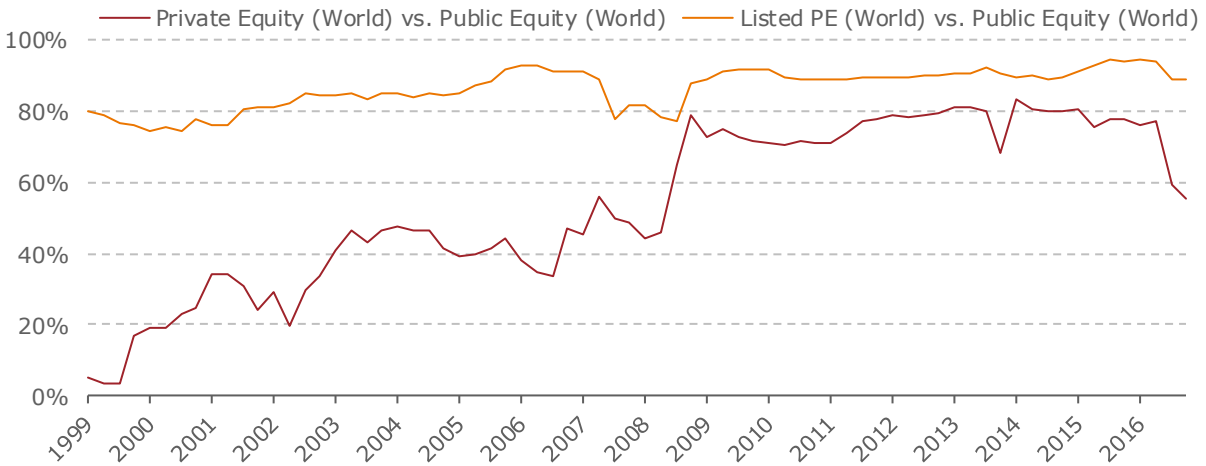
FIGURE 4: COMPARISON OF VOLATILITY DEVELOPMENTS OF DIFFERENT ASSET CLASSES (Q1 1999 – Q4 2016)<sup>7</sup>



Data Source: Thomson Reuters Eikon; Analysis: AssetMetrix

In observing the correlation development, it is evident that the Listed PE Index in particular – but also the Appraised Value-based Index since 2008 – has taken its “cues” to a large degree from the stock market. The three asset segments stocks, Listed PE, and private equity are all “equity” classes and accordingly they have corporate risk as a largely common “value driver” (see Figure 5).

FIGURE 5: COMPARISON OF CORRELATION DEVELOPMENTS (Q1 1999 – Q4 2016)<sup>8</sup>



Data Source: Thomson Reuters Eikon; Analysis: AssetMetrix

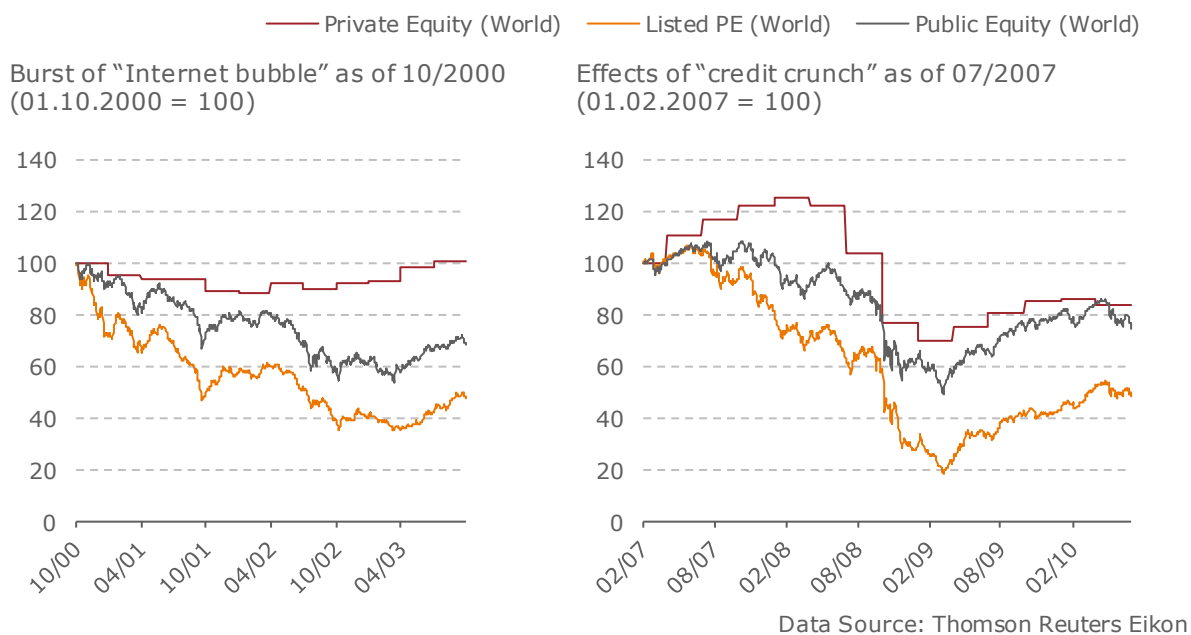
<sup>7</sup> Rolling computation of volatilities based on quarterly returns for 20 quarters each.

<sup>8</sup> Rolling computation of correlations based on quarterly returns for 20 quarters each.

## 2.5. BEHAVIOR DURING CRISES IN THE FINANCIAL MARKETS

The extent to which Listed PE Indices underestimate the “real” value development of closed-end private equity funds becomes evident especially during financial crises. The drop in stock prices of Listed PE was significantly sharper than that of comparable public equity indices, both in 2000 when the Internet bubble burst as well as during the financial crisis. Private equity valuations, on the other hand, were less affected by these markdowns (see Figure 6).

FIGURE 6: COMPARATIVE STOCK PRICE DEVELOPMENTS DURING FINANCIAL MARKET CRISES



## 3. IMPLICATIONS FOR CAPITAL INVESTMENT MANAGEMENT

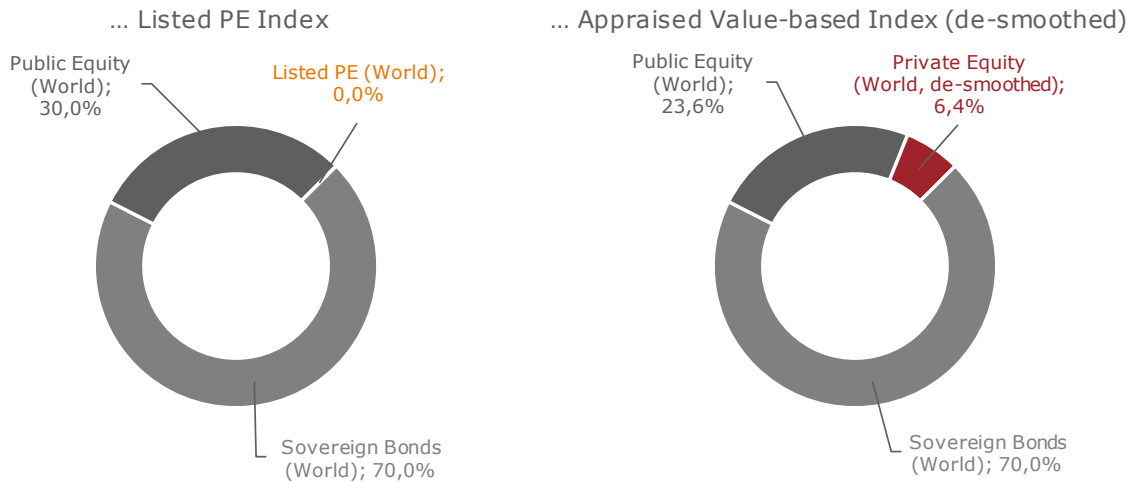
The potential negative impact of a poor index choice on capital investment management is also significant. For example, in the case of asset allocation models, if Listed PE Indices are utilized, the results are heavily under-weighted allocation proposals for private equity (see minimum-variance optimization in Figure 7) and hence an unfavorable mixture of asset classes. For the period analyzed (1999 to 2016), Listed PE would not receive any allocation at all under constrained optimization.<sup>9</sup>

The analyses are shown in the same manner without constraints on the sovereign bond asset class in Appendix 2.

<sup>9</sup> In order to show asset allocation effects more clearly, we limited exposure to the sovereign bond asset class to a maximum of 70%.

FIGURE 7: RESULTS OF PORTFOLIO OPTIMIZATION (LISTED PE VS. APPRAISED VALUE-BASED INDEX)<sup>10</sup>

Optimal private equity shares in portfolio when using the parameters of...

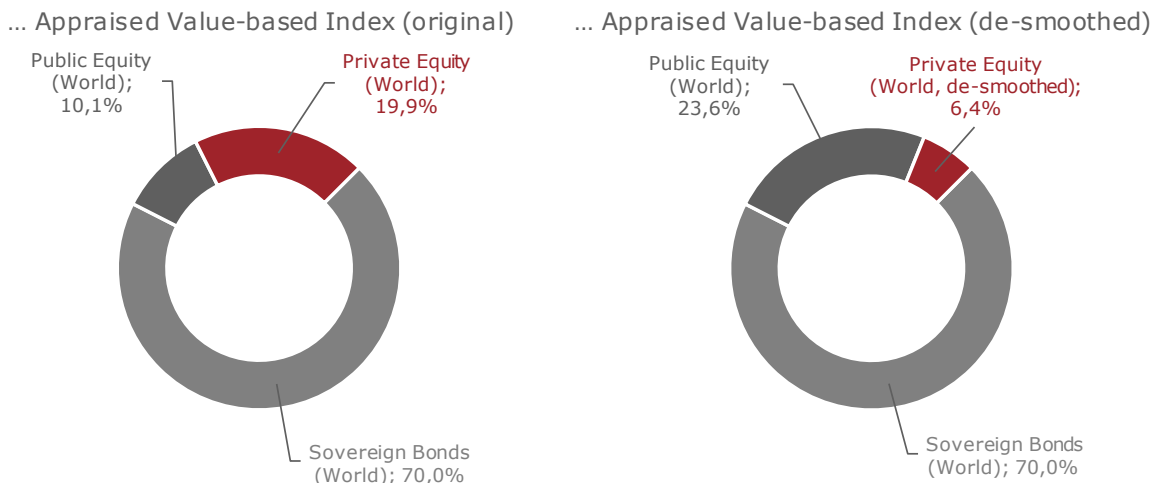


Data Source: Thomson Reuters Eikon; Analysis: AssetMetrix

Based on the same minimum-variance optimization, it is also apparent that using the Appraised Value-based Index in its original form leads to over-allocation towards the private equity class. Increased standard deviations after de-smoothing result in significantly lower, but realistic PE allocations (see Figure 8).

FIGURE 8: RESULTS OF PORTFOLIO OPTIMIZATION (ORIGINAL VS. DE-SMOOTHED APPRAISED VALUE-BASED INDEX)<sup>10</sup>

Optimal private equity shares in portfolio when using the parameters of...



Data Source: Thomson Reuters Eikon; Analysis: AssetMetrix

<sup>10</sup> Optimal portfolio shares in the minimum variance portfolio, calculated based on quarterly returns from 1999 to 2016. Sovereign Bonds were constrained to a maximum of 70%.



#### 4. SUMMARY

This paper demonstrated the two main approaches to index construction in the private equity context. It is argued that Appraised Value-based Indices, after applying a suitable de-smoothing procedure, are the preferred way to correctly track the risk/return characteristics of closed-end private equity investments. Using this basis, proper decisions in risk and asset allocation models can be made.

AssetMetrix computes indices of this kind on a quarterly basis for key private equity segments, split e. g. by geography and style. They are used internally for various quantitative models and solutions offered as part of the Analytics services.

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## APPENDIX 1

FIGURE 9: LISTED PE INDEX VS. APPRAISED VALUE-BASED INDEX – COMPARISON OF ADVANTAGES AND DISADVANTAGES

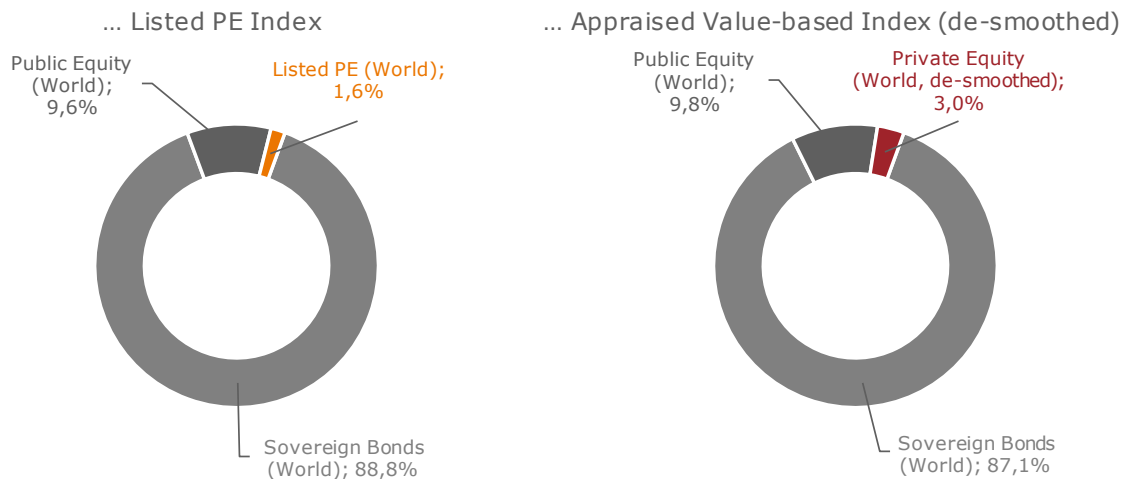
|  | Listed PE Index   | Appraised Value-based Index   |
|--|---|---|
| <b>Investability</b>                           | <ul style="list-style-type: none"> <li>• Yes, multiple listed ETFs are available.</li> <li>• However, only few of the underlying Listed PE stocks are liquidly traded.</li> </ul>    | <ul style="list-style-type: none"> <li>• No, index is based on (illiquid) closed-end fund investments.</li> <li>• Limited liquidity on secondaries market</li> </ul>   |
| <b>Representativeness for closed-end funds</b> | <ul style="list-style-type: none"> <li>• No, only representative for listed PE stocks</li> <li>• PE volatility and correlation with public equity is exaggerated</li> <li>• Index composition is distorted (e. g. overweight of UK and BO)</li> </ul>    | <ul style="list-style-type: none"> <li>• Yes</li> <li>• Correct representation of PE returns, volatilities and correlations</li> <li>• Index composition (by regions, BO/VC, ...) representative for overall market</li> </ul>   |
| <b>Survivorship bias</b>                       | <ul style="list-style-type: none"> <li>• Yes</li> <li>• Listed PE indices limited to "living" funds</li> </ul>   | <ul style="list-style-type: none"> <li>• No</li> <li>• "Non-surviving" funds are contained in historical data</li> </ul>   |
| <b>Data availability</b>                       | <ul style="list-style-type: none"> <li>• Daily</li> </ul>    | <ul style="list-style-type: none"> <li>• Quarterly with time lag of approx. three to four months</li> </ul>    |
| <b>Data history</b>                            | <ul style="list-style-type: none"> <li>• LPX50® data available since 1994</li> <li>• Many GPs/funds only listed during later years, hence high fluctuation in index</li> </ul>   | <ul style="list-style-type: none"> <li>• Preqin data available for funds since vintage year 1969, Cambridge Associates since vintage year 1981</li> <li>• Stable history for well over 25 years for all key sub-segments</li> <li>• Robust data across multiple cycles, hence better coverage of distr. "tails"</li> </ul>                     |
| <b>Granularity of index family</b>             | <ul style="list-style-type: none"> <li>• LPX®: only limited selection of variants available <ul style="list-style-type: none"> <li>– Selection of style indices (BO, VC, Direct, ...)</li> <li>– Three regional indices (America, Europe, UK)</li> <li>– <b>No</b> flexible mix for regions/styles (e. g. no US BO)</li> <li>– <b>No</b> vintage year benchmarking</li> </ul> </li> </ul>  | <ul style="list-style-type: none"> <li>• (Nearly) any cross-section of segment possible to adjust to individual requirements <ul style="list-style-type: none"> <li>– Regions/countries</li> <li>– PE styles (VC incl. sub-styles, BO)</li> <li>– Fund Sizes</li> <li>– Performance quartiles</li> <li>– Vintage years</li> </ul> </li> </ul>  |
| <b>Comments</b>                                | <ul style="list-style-type: none"> <li>• Indices contain not only Listed PE portfolios but also pure holdings in management companies; this leads to distortions in the evaluation.</li> <li>• Part of the volatility is induced "purely" by stock exchange; results in overstatement of actual PE volatility</li> </ul>   | <ul style="list-style-type: none"> <li>• NAV-based approach, hence compatible with actual balance sheet reporting on investor level</li> </ul>   |

Analysis: AssetMetrix

## APPENDIX 2: UNCONSTRAINED MINIMUM-VARIANCE OPTIMIZATION

FIGURE 10: RESULTS OF PORTFOLIO OPTIMIZATION (LISTED PE VS. APPRAISED VALUE-BASED INDEX)<sup>11</sup>

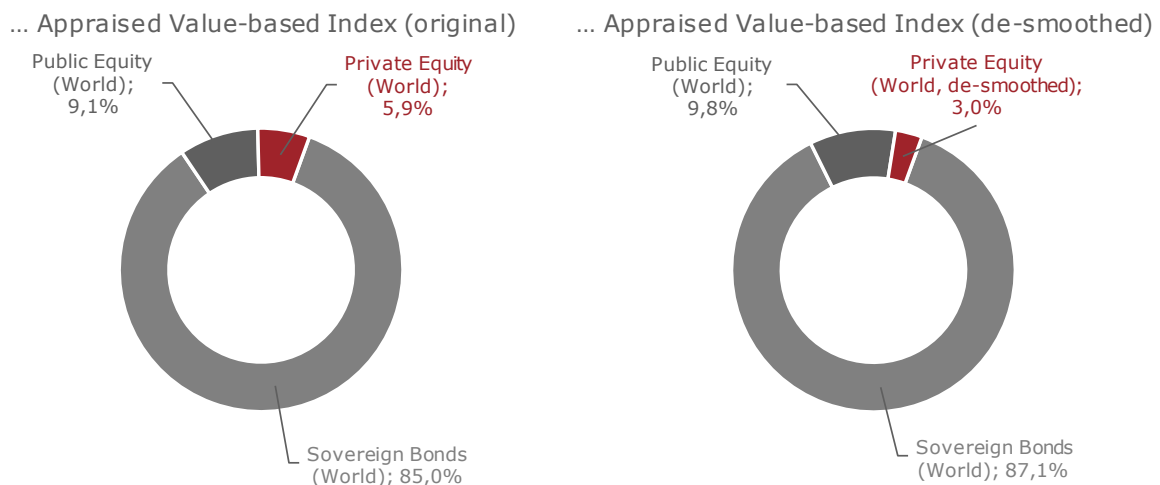
Optimal private equity shares in portfolio when using the parameters of...



Data Source: Thomson Reuters Eikon; Analysis: AssetMetrix

FIGURE 11: RESULTS OF PORTFOLIO OPTIMIZATION (ORIGINAL VS. DE-SMOOTHED APPRAISED VALUE-BASED INDEX)<sup>11</sup>

Optimal private equity shares in portfolio when using the parameters of...



Data Source: Thomson Reuters Eikon; Analysis: AssetMetrix

<sup>11</sup> Optimal portfolio shares in the minimum variance portfolio, calculated based on quarterly returns from 1999 to 2016.

## APPENDIX 3: DATA USED FOR ANALYSES MADE IN THIS PAPER

### Appraised Value-based Indices

- Provider: Cambridge Associates
- Source: Thomson Reuters Eikon, Benchmark Calculator
- Calculation: Quarterly returns, based on the quarterly reported cumulative cash flows and net asset values of all private equity funds registered by Cambridge Associates / Thomson Reuters Eikon for the respective segment. De-smoothing and index calculation done by AssetMetrix.
- Availability of data: quarterly figures Q1/1990 to Q3/2017
- Segments: worldwide (total return in USD), North America (total return in USD), Europe (total return in USD)

### Listed private equity indices

- Provider: LPX AG
- Source: Thomson Reuters Eikon
- Calculation: based on Listed PE stocks
- Availability of data: Daily figures from December 31, 1993 to June 26, 2018 (LPX50<sup>®</sup>), from June 28, 1998 to June 26, 2018 (LPX America<sup>®</sup>), from December 31, 1998 to June 26, 2018 (LPX UK<sup>®</sup>), and from November 19, 2012 to June 26, 2018 respectively (LPX Europe<sup>®</sup>)
- Segments: worldwide (LPX50<sup>®</sup> total return in EUR), North America (LPX America<sup>®</sup> total return in EUR), United Kingdom (LPX America<sup>®</sup> total return in EUR), Europe (LPX Europe<sup>®</sup> total return in EUR)

### Stock indices

- Provider: MSCI Inc.
- Source: Thomson Reuters Eikon
- Calculation: based on public equity listed on the stock exchanges
- Availability of data: Daily and/or quarterly figures from December 31, 1979 to June 26, 2018 (MSCI World<sup>®</sup>, MSCI North America<sup>®</sup>, MSCI Europe<sup>®</sup>)
- Segments: worldwide (MSCI World<sup>®</sup> total return in local currency), North America (MSCI North America<sup>®</sup> total return in USD), Europe (MSCI Europe<sup>®</sup> total return in local currency)