



## Understanding INPRS's Investment Benchmarks

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## Introduction

One of the biggest challenges that investors face is determining how well their portfolios are performing. To evaluate performance, investors must select one or more benchmarks and continuously monitor the portfolio's performance against the chosen benchmark(s).

In the article, "Are Manager Universes Acceptable Performance Benchmarks?"<sup>1</sup> Jeffery Bailey, CFA, provides investors with a framework for what makes a good benchmark. He outlines six criteria (the "Bailey Criteria") that an appropriate benchmark should display:

1. Unambiguous – The names and weights of all portfolio securities in the benchmark should be clearly defined.
2. Investable – The investors should have the option of adopting a totally passive approach by investing in the benchmark itself in which case the amount invested should not disrupt the market.
3. Measurable – The investor should be able to calculate returns to the benchmark reasonably frequently, but in any case, at least as frequently as its board or other responsible fiduciary measures the investor's results.
4. Appropriate – The benchmark chosen should be consistent with the style or risk profile of the investment manager whose performance is being gauged.
5. Reflective of current investment opinions – All participants in the market in which the investor is participating must be able to have current knowledge of the benchmark.
6. Specified in advance – The benchmark computation should be constructed prior to the start of an evaluation period.

There are many factors that impact the selection of a benchmark, and it is unlikely that any benchmark will be perfect. As a result, there are some instances where all criteria cannot be met. Nonetheless, using the criteria as an evaluation tool will improve benchmark selection<sup>2</sup>.

The subsequent sections of this paper outline the various types of benchmarks available to investors, the decision(s) that each benchmark measures, and the benchmarks utilized by INPRS to evaluate investment performance.

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<sup>1</sup> The Journal of Portfolio Management, Spring 1992.

<sup>2</sup> Please see the final page of the appendix for an evaluation of INPRS's benchmarks using the Bailey Criteria.

## Types of Benchmarks

Benchmarks, generally, are identified as absolute or relative.

Type	Description	Examples
Absolute Benchmark	Measures the portfolio against a fixed (absolute) target.	(1) Portfolio versus a fixed return (e.g., 6.25%) (2) Portfolio versus a spread over cash <sup>3</sup>
Relative Benchmark	Measures the portfolio against a moving target.	(1) Portfolio versus an index (2) Portfolio versus a peer group (3) Portfolio versus another investment option (e.g., opportunity cost)

INPRS utilizes a mixture of absolute and relative benchmarks depending on the strategy or portfolio that is being evaluated. Relative benchmarks are the most common in the investment industry when evaluating individual managers. However, when a strategy with more flexible guidelines is being measured, an absolute benchmark may be more appropriate.

In addition to benchmark selection, it is also important to select a suitable method for calculating returns. The most common method of calculation is Time Weighted Return (“TWR”), which can also be referred to as geometric return. TWR excludes the impact of intra-period cash flows and is most suited for fully funded investment managers (e.g., public market investments) that have little to no control over when they receive cash flows. For private investments, it is often more appropriate to use Money Weighted Return, commonly referred to as the Internal Rate of Return (“IRR”). Private asset classes such as private real estate and private equity provide managers greater discretion in determining when to call capital to make investments. As a result, these asset classes may have large inflows/outflows intra-period, which are more accurately measured with IRR<sup>4</sup>.

<sup>3</sup> A blend of a relative and absolute benchmark can also be referred to as a hybrid benchmark (e.g., an absolute spread over a relative benchmark).

<sup>4</sup> Please see appendix for more information on IRR versus TWR.

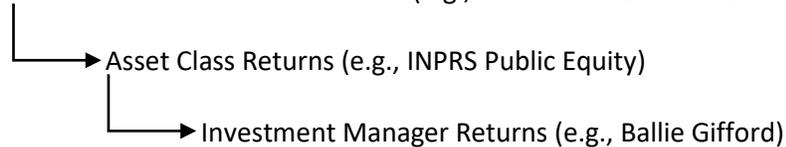
## What decisions are the INPRS’s benchmarks measuring?

INPRS Investment Staff uses a combination of relative and absolute benchmarks to measure the key decisions for which they have been given discretion.

Decision	Description	Measurement
Asset Allocation	INPRS Investment Staff recommends, for Board approval, an asset allocation to achieve the Target Rate of Return.	Absolute benchmark of the Target Rate of Return (currently 6.25%).
Tactical Shifts	INPRS Investment Staff can tactically overweight asset classes within the target allocation ranges.	Relative benchmark using the asset classes’ benchmarks with weights equal to the target asset allocation.
Manager Selection	INPRS Investment Staff selects managers to increase the probability of achieving the Target Rate of Return through either (1) outperformance over a market index or (2) providing uncorrelated, positive returns.	<u>Public Markets</u> : Compare portfolio to a market index with similar exposure. <u>Private Markets</u> : Compare portfolio to a public market equivalent or to funds investing in similar strategies.

Different decisions are evaluated at each portfolio level. The focus of this paper will be asset allocation, tactical shifts, and manager selection at the INPRS Retirement Funds and global asset class levels. At the manager level, benchmarks are selected for individual strategies, with input from the Investment Team, Consultant, and manager for the strategy in question. Chosen benchmarks are intended to resemble the strategy employed by the manager and aid staff in evaluating manager performance and guideline compliance for the specific mandate in question.

INPRS Retirement Funds’ Returns (e.g., Total INPRS Defined Benefit)



## What are the benchmarks INPRS uses<sup>5</sup>?

### Total INPRS Defined Benefit (“DB”)

*IPS Reference: Section 7.2, five year and ten year rolling annual rate of return equal to INPRS Target Rate of Return, and net of fees, three year and five year rolling investment rate of return of the Retirement Funds, no less than a weighted average of benchmark indices which best describe the Retirement Funds’ asset allocation.*

Benchmark	Reference	What is it measuring?
INPRS Blended Target Return	IPS, Board Presentation	Asset Allocation, Tactical Shifts, Manager Selection
Passive DB Target w Notional Index	IPS, Board Presentation	Tactical Shifts, Manager Selection
DB Manager Selection Index v2	IPS, Board Presentation	Manager Selection

INPRS Investment Staff is continuously analyzing its ability to reach its target rate of return of 6.25%, which is one of the three imperatives for the INPRS Investment Staff<sup>6</sup>. Given INPRS’s target return has periodically changed over time, INPRS Blended Target Return was created to link the historical target return for the funds. In the Passive DB Target w Notional Index, a representative asset class benchmark rolls up and the weighting is fixed to the approved INPRS Target Asset Allocation, as stated in the IPS. INPRS’s global asset classes and their corresponding benchmarks can be found in the table below.

Global Asset Class	Global Asset Class Benchmark
Public Equity	MSCI ACWI ex China IMI Net Index
Private Markets	Neutralized
Fixed Income – Ex Inflation-Linked	Custom Fixed Income ex ILB Bmk
Fixed Income – Inflation-Linked	Custom Fixed Income ILB Bmk
Commodities	Custom Commodities Bmk
Real Assets	Neutralized
Absolute Return	HFRI Custom Bmk
Risk Parity	Neutralized

Private Markets, Real Assets, and Risk Parity lack public market indexes, often are associated with an illiquidity premium, and in some cases, are reported with a lag. These issues can introduce a significant amount of additional risk relative to the benchmark that is not necessarily reflective of the underlying portfolio holdings. To address this, INPRS has neutralized these asset classes in the Passive DB Target w Notional Index and the DB Manager Selection Index v2. Neutralization is a process whereby the portfolio’s holdings (and performance) are utilized as the asset class benchmark which eliminates risk and performance differences due to asset selection. INPRS uses other methods to evaluate manager selection and the efficacy of these programs described later in this paper.

The Passive DB Target w Notional Index aligns with the IPS, reflecting the completion of the three-year ramp-up for Private Markets and Real Assets, with the targets fully matching the IPS weights following

<sup>5</sup> The analysis in the paper focuses on the Defined Benefit benchmarks. For a brief analysis of the DC benchmarks, please see appendix.

<sup>6</sup> (1) Achieve 6.25% Target Rate of Return (2) Achieve the return as efficiently and effectively as possible (3) Always have enough cash on hand to pay the bills

the 2021 Asset Liability Study. Annually, the Passive DB Target w Notional Index weights will be updated based on the established schedule. Plan leverage, as well as an assumed financing rate, is implicitly incorporated within both the Passive DB Target w Notional Index and the DB Manager Selection Index v2 through the asset classes that use explicit leverage; however, leverage residing within any portable alpha strategies in the portfolio has been excluded from both benchmarks.

The variance between the portfolio return and the Passive DB Target w Notional Index will be attributed to manager selection, as well as to any asset class weight deviations from the fixed, Board-approved asset allocation. The table below presents the Board-approved asset allocation and the weights for the Passive DB Target w Notional Index.

Global Asset Class	IPS Target	Passive DB Target w Notional Index
Public Equity	20.0%	20.0%
Private Markets	15.0%	15.0%
Fixed Income – Ex Inflation-Linked	20.0%	17.5%
Fixed Income – Inflation-Linked	15.0%	14.5%
Commodities	10.0%	10.0%
Real Assets	10.0%	10.0%
Absolute Return	5.0%	5.0%
Risk Parity	20.0%	20.0%

The asset class benchmarks that currently roll-up to the Passive DB Target w Notional Index are the same as the DB Manager Selection Index v2, with the exception of the Cash Overlay benchmark, which is included and neutralized in the DB Manager Selection Index v2. The DB Manager Selection Index v2 measures manager selection by, each month, adjusting the representative asset class benchmark weighting to the adjusted beginning market value of that asset class within the Plan. This monthly adjustment removes the tactical shift decision from the evaluation and isolates manager selection. January 2012 marks the merger of the Public Employees Retirement System (“PERF”) and Teachers Retirement System (“TRF”). The former DB Manager Selection Index’s history prior to January 2012 is a market value weighted blend at a plan level between PERF’s benchmark and TRF’s benchmark.

## Public Markets

*IPS Reference: Section 9.3, The Investment Staff shall review the performance of each Public Investment Manager’s Portfolio at least quarterly. Evaluation standards considered may include the following:*

2. *Net of fee performance rates of return exceeding an appropriate market index benchmark, over quarter-to-date, year-to-date, one year, three-year, five year, and since inception time periods;*
3. *Sharpe ratio exceeding an appropriate market index benchmark over quarter-to-date, year-to-date, one year, three-year, five year, and since inception time periods.*

## Public Equity

Benchmark	Reference	What is it measuring?
MSCI ACWI ex China IMI Net Index	Board Presentation	Asset Allocation, Tactical Shifts, Manager Selection

The selection of the MSCI All Country World ex China Investable Markets Net Index (“MSCI ACWI ex China IMI”) was made due to INPRS’s desire to have exposure to global equity markets. Over time, the performance difference between the portfolio and the benchmark will be attributed to: (1) Manager Selection and (2) Region Selection.

Since the Public Equity portfolio utilizes explicit leverage, 25% of the MSCI ACWI ex China IMI Net Index’s return is offset by a financing rate of 3-Month SOFR + 25bps, ensuring proper evaluation of (1) Manager Selection and (2) Regional Selection.

### Fixed Income Ex-Inflation-Linked (“Fixed Income ex ILB”)

Benchmark	Reference	What is it measuring?
Custom Fixed Income ex ILB Bmk	Board Presentation	Asset Allocation, Tactical Shifts, Manager Selection

The portfolio invests in a custom combination of publicly traded treasury and credit opportunities across geographies, and as such, utilizes a static, custom benchmark to measure the performance of the portfolio. The sub-asset classes, their benchmarks, and weights can be found in the table below.

Since the Fixed Income Ex-Inflation-Linked portfolio utilizes explicit leverage, 25% of the Custom Fixed Income ex ILB Bmk’s return is offset- by a financing rate of 3-moth SOFR + 25bps.

Fixed Income ex ILB Sub-Asset Classes	Custom Benchmark Component	Benchmark Weight
US Long Government	Bloomberg Barclays (“BB”) Long Government	28.6%
Developed International Government (excluding US)	FTSE World Government Bond Index, excluding United States, excluding China, 25% Japan Capped, USD Hedged	28.6%
Emerging Markets Debt	50% JPMorgan EMBI ex China (hard currency debt), 50% JPMorgan GBI ex China (local currency debt)	28.6%
Opportunistic Credit	40% S&P UBS Leveraged Loan Index, 25% BofA ML US High-Yield Total Return Index, 25% BofA ML Non-Financial Developed Markets High-Yield Constrained Total Return Index, 10% Morningstar European Leveraged Loan Index	14.30%

### Fixed Income Inflation-Linked (“Fixed Income ILB”)

Benchmark	Reference	What is it measuring?
Custom Fixed Income ILB Bmk	Board Presentation	Asset Allocation, Tactical Shifts, Manager Selection

The current constituents of the Custom Fixed Income ILB benchmark can be found in the table below.

Fixed Income ILB Sub-Asset Classes	Custom Benchmark Component	Benchmark Weight
US TIPS 15+ Years	ICE BofA ML US TIPS 15+ Years	34.5%
US TIPS 1-10 Years	BB US Treasury Inflation Notes 1-10 Years	34.5%
Global Inflation-Linked	Bridgewater Custom <sup>7</sup> : 50% United States, 20% United Kingdom, 10% France, 10% Germany, 4% Canada, 4% Australia, 2% Sweden	13.8%
Global Inflation-Linked 1-10 Years	SSGA Custom: ICE 1-10 Year Developed Markets Inflation-Linked Government ex US, Italy, and Spain, 100% USD Hedged	17.2%

## Commodities

Benchmark	Reference	What is it measuring?
Custom Commodities Bmk	Board Presentation	Manager Selection

INPRS's commodity managers utilize fully collateralized commodity futures positions to gain exposure to various commodity markets. When purchasing \$100 worth of commodity exposure, for example, the entire \$100 is not required but rather a set percentage, commonly referred to as collateral. This ratio is generally 75:25; as a result, in the example above, \$25 of the original \$100 would be required to gain \$100 in commodity exposure with the remaining \$75 used as collateral and invested as the investor deems appropriate.

Since 2012, INPRS has utilized a mixture of inflation-linked bonds and US treasury bills to collateralize its commodity investments. The inflation-linked bond mandates are included in the Fixed Income ILB portfolio listed above. The commodities composite is comprised on an equal split between a diversified mandate and a gold only mandate. As a result, the commodities custom benchmark is an equal combination of the Bloomberg Commodity Excess Return Index and the Bloomberg Commodity Gold Subindex.

Commodities Sub-Asset Classes <sup>8</sup>	Custom Benchmark Component	Benchmark Weight
Commodities Diversified	Bloomberg Commodity Excess Return Index	50.0%
Commodities	Bloomberg Commodity Gold Subindex	50.0%

## Private Markets

*IPS References: Section 10.4: Performance Objectives*

### **Private Equity**

1. Relative Return: the median return for all Private Equity funds as measured by a reputable database provider; and
2. Public Market Equivalent: a custom index based on INPRS's target exposures and using public market indices.

<sup>7</sup> The Bridgewater Custom Index is intended to replicate the individual country indexes of the Barclays Capital World Government Inflation-Linked Bond Index 100% hedged to USD at the weights implied in the table. The index is rebalanced back to these weights monthly.

<sup>8</sup> BNY Mellon utilizes an all-zeros offset with a -100% weight so that the weight of the benchmark components sums to 100%.

### Private Credit

1. Relative Return: the median return for all Private Credit funds as measured by a reputable database provider); and
2. Public Market Equivalent: a custom index based on INPRS's target exposures and using public market indices.

Benchmarking private investments presents numerous challenges for investors. It is difficult to identify the “market” because, by definition, the market is private, and information is not readily available. For performance reporting purposes, INPRS Investment Staff has identified a public market proxy, added an illiquidity premium, and lagged the returns of the PME by one quarter.

As mentioned in the IRR vs. TWR discussion, the most appropriate way to calculate private market returns is the IRR method, and, as a result, the IRRs for both Private Equity and Private Credit are reported separately in the board presentation. However, the TWR for each of the private asset classes is still shown alongside the TWR for each of the public asset classes, merely for reference. In addition, the IPS states that the managers are to be measured against the median peer returns for similar strategies. There is no ideal way to capture the “market” index return for private asset classes. However, the peer-relative benchmark does provide measurement against the market of managers investing in similar strategies.

### Private Markets

Benchmark	Reference	What is it measuring?
Private Markets Custom Bmk	Board Presentation	Asset Allocation, Tactical Shifts, Manager Selection

### Private Equity

Benchmark	Reference	What is it measuring?
<u>Relative Return</u> : median IRR for private equity funds (excluding Real Estate, Timber, and Infrastructure) measured by Cambridge Associates <sup>9</sup>	IPS, Board Presentation	Asset Allocation, Tactical Shifts, Manager Selection
<u>Public Market Equivalent</u> (“PME”): MSCI ACWI ex China IMI Net Index + 3.00%, lagged one quarter.	IPS, Internal Reporting	Asset Allocation, Tactical Shifts, Manager Selection

The Private Equity Custom PME uses an equity public market proxy designed to reflect the geographical opportunities available to be invested in by the portfolio. The 3.00% that is added is a generally accepted illiquidity premium that investors demand for investments in private equity opportunities<sup>10</sup>. Additionally, INPRS compares itself to the PME lagged one quarter which better aligns the performance of the PME with the valuation data received by INPRS and its managers.

<sup>9</sup> According to Aksia, “VYs used in the Relative Return index match those of funds in the INPRS PE portfolio” (where “VYs” refers to vintage years).

<sup>10</sup> Please see appendix for more information on illiquidity premium.

## Private Credit

Benchmark	Reference	What is it measuring?
<u>Relative Return</u> : median IRR for Senior Debt funds measured by Cambridge Associates	IPS, Board Presentation	Asset Allocation, Tactical Shifts, Manager Selection
<u>Public Market Equivalent ("PME")</u> : S&P UBS Leveraged Loan +1.50%, lagged one quarter.	IPS, Internal Reporting	Asset Allocation, Tactical Shifts, Manager Selection

The Private Credit Custom PME uses a public market proxy that reflects the size, geographical, and capital structure opportunities targeted by the portfolio. The 1.50% that is added is a generally accepted illiquidity premium that investors demand for investments in private credit opportunities<sup>11</sup>. Additionally, INPRS compares itself to the PME lagged one quarter which lines up the performance of the PME with the valuation data received by INPRS and its managers.

## Real Assets

*IPS Reference: Section 11.4:* The following return objectives shall be reviewed:

1. Absolute Return (net of fees): a real rate of return (adjusted for inflation) of five percent (5%);
2. Relative Return: the median return for all Real Assets funds within a corresponding sub-asset class as measured by a reputable database provider; and
3. Public Market Equivalent: a custom index based on INPRS's target exposures and using public market indices.

## Real Assets

Benchmark	Reference	What is it measuring?
Real Asset Custom Bmk	Internal Reporting, Board Presentation	Asset Allocation, Tactical Shifts, Manager Selection

## Real Estate

Benchmark	Reference	What is it measuring?
<u>Absolute Return (net of fees)</u> : 5% Real Rate of Return (net of inflation)	IPS, Internal Reporting	Asset Allocation, Tactical Shifts, Manager Selection
<u>Relative Return</u> : NCREIF ODCE NFI Net 1 Qtr in Arrears	IPS, Board Presentation	Asset Allocation, Tactical Shifts, Manager Selection
<u>Public Market Equivalent ("PME")</u> : 70% FTSE NAREIT All Equity REITs, 30% BB US CMBS Index	IPS, Board Presentation	Asset Allocation, Tactical Shifts, Manager Selection

<sup>11</sup> Please see appendix for more information on illiquidity premium.

The NCREIF ODCE NFI Index<sup>12</sup> is a market-capitalization weighted, gross of fee index that presents time-weighted returns. Much of the INPRS Real Estate portfolio is comprised of private investments, and it is difficult to capture the “market.” The NCREIF ODCE NFI attempts to capture the performance of private, open-ended (infinite-life) core equity funds; however, this index is not an investable benchmark but is shown in the INPRS Board Presentation because it is a widely accepted core equity Real Estate benchmark.

Because the NCREIF ODCE NFI Index does not closely reflect the underlying exposure of Real Estate portfolio, Investment Staff has constructed a Custom Public Market Equivalent<sup>13</sup> (“PME”) benchmark. The PME is constructed with two public indexes, weighted to approximately capture the target capital structure exposures of the INRPS Real Estate portfolio: 70% FTSE National Association of Real Estate Investment Trusts (“NAREIT”) All Equity Real Estate Investment Trusts (“REITS”) and 30% BB Commercial Mortgage Backed Bond Securities(“CMBS”) Index. This benchmark is reported separately in the Board presentation as an IRR calculation.

The IPS states that Real Estate investments should also be measured against an Absolute Benchmark of five percent (5%), adjusted for inflation. This benchmark is considered when evaluating potential opportunities internally.

**Infrastructure**

Benchmark	Reference	What is it measuring?
<u>Absolute Return (net of fees):</u> 5% Real Rate of Return (net of inflation)	IPS, Internal Reporting	Asset Allocation, Tactical Shifts, Manager Selection
<u>Public Market Equivalent (“PME”):</u> Global Listed Infrastructure Organization Index (GLIO)	IPS, Board Presentation	Asset Allocation, Tactical Shifts, Manager Selection

The GLIO Index<sup>14</sup> is a market-cap weighted, free floating index of publicly traded companies that derive at least 75% of EBITDA from energy transportation and storage, communications, transportation, renewable energy, and regulated network utilities. The index is provided by Global Property Research (GPR).

The IPS states that Real Assets investments should also be measured against an Absolute Benchmark of five percent (5%), adjusted for inflation. This benchmark is considered when evaluating potential opportunities internally.

Currently, there is not a widely accepted Relative Return benchmark available for Infrastructure investments.

<sup>12</sup> Source: NCREIF.org  
<sup>13</sup> Please see appendix for more information on PME benchmarks.  
<sup>14</sup> Source: GLIO.org

## Absolute Return

*IPS Reference: Section 12.4, The aim in building the ARS Program is to select the highest-quality funds and vehicles to form a diversified portfolio capable of meeting targeted performance objectives. The risk and return objectives for the ARS Program, as noted below, shall be reviewed:*

1. *Target an annualized return (net of fees): Cash + 2.5%;*
2. *Relative Return: a custom index based on the ARS Program target exposures and using HFRI indices.*

Benchmark	Reference	What is it measuring?
Cash plus 2.50%	IPS, Internal Reporting	Asset Allocation, Tactical Shifts, Manager Selection
HFRI Custom Bmk	Board Presentation	Asset Allocation, Tactical Shifts, Manager Selection

Within the INPRS Absolute Return portfolio, managers have flexibility in their investment process. This, along with not sharing holdings and proprietary information in real-time, contribute to benchmarking challenges. For these reasons, a cash plus 2.50% will be the absolute measuring stick for the portfolio. To capture relative performance versus a market, INPRS Investment Staff also measures the Absolute Return portfolio versus a Custom Hedge Fund Research Index (“HFRI”) benchmark. HFRI collects returns from various hedge funds and attempts to bucket them into certain categories or strategies<sup>15</sup>. See below for the Custom HFRI Bmk and corresponding static weights.

Absolute Return Sub-Asset Class <sup>16</sup>	HFRI Component	Benchmark Weight
Tactical Trading	Macro	40.0%
Relative Value	Relative Value	50.0%
Fund of Funds	Fund of Funds	10.0%
Event Driven	Event Driven	0.00%
None	Equity Hedge	0.0%

## Risk Parity

*IPS Reference: Section 13.4, The risk and return objectives for the RP Program, as noted below, shall be reviewed:*

1. *Target annualized return (net of fees): The Target Rates of Return.*

Benchmark	Reference	What is it measuring?
INPRS Blended Target Rate	IPS, Internal Reporting	Asset Allocation, Tactical Shifts, Manager Selection
Global 60/40 Index	Board Presentation	Asset Allocation, Tactical Shifts, Manager Selection

<sup>15</sup> Please see appendix for more information on HFRI Indices.

<sup>16</sup> Source: BNY Mellon reporting as of June 30, 2020.

Much like INPRS's target asset allocation, Risk Parity invests in multiple asset classes with an absolute goal of earning a better risk-adjusted return. Risk Parity attempts to achieve this goal by constructing a diversified asset allocation without making tactical bets. As a result of this quickly changing, diversified allocation, it is difficult to evaluate the manager selection within Risk Parity. Over the long-term, the Risk Parity portfolio will be judged against the INPRS Blended Target Return, currently a 6.25% rate of return.

In addition to INPRS Blended Target Return, a traditional asset allocation of 60% Equity (MSCI ACWI IMI Index) and 40% Bonds (Barclays Global Aggregate Bond Index) is used to measure the portfolio. Risk Parity is often regarded as a more efficient way to construct investment portfolios while achieving a return similar to that of a traditional portfolio. As such, benchmarking against a global 60/40 allows staff to assess the opportunity cost of not investing in a more traditional portfolio. The Global 60/40 Index has a larger concentration in equity risk than the Risk Parity allocation, and consequently, there may be significant differences in returns at any point in time.

## Conclusion

INPRS, in conjunction with the System's General Consultant, will continue to monitor and evaluate the suitability of its total plan benchmarks and global asset class benchmarks. In accordance with Section 7.2 of INPRS's IPS, any changes to the total plan and/or global asset class benchmarks will be communicated to the Board of Trustees at their next regularly scheduled meeting, following thorough research supporting such change(s).

# Appendix

## Internal Rate of Return (“IRR”) versus Time Weight Return (“TWR”)

Chicago ILPA Members-Only Fall Conference 2009 Presentation by Adams Street Partners

### IRR

- Take size and timing of cash flows into consideration
- Annualized Return
- Need to de-annualize or use change-in-value for return less than one year
- No simple way to compute a combined return from two IRR numbers without getting down to the cash flow level

### TWR

- Time only; Size of cash flow is irrelevant
- Link daily, monthly, quarterly, or yearly returns
- Explicit step to annualize numbers
- Very easy to calculate weighted return for an aggregate portfolio and do performance attribution

### IRR makes sense for Private Equity, Private Credit, and Private Real Estate

- Managers control size and timing of cash flows
- Helps to appropriately evaluate private portfolios with J-curve effect (J-curve is when the fund incurs negative returns for the first few years due to capital draw downs and an immature portfolio)
- Inability to rebalance

### Example

INPRS makes a \$1,000 investment at the beginning of the year for two shares of Company ABC for \$500 per share. At the end of the first year of the investment, the valuation of ABC went to \$400 per share, down 20%. INPRS makes an additional investment for 10 more shares of ABC at \$400. Over the next year the valuation of ABC goes up to \$460 per share, up 15%. INPRS decides to sell all the shares at the end of the second year. In order to calculate the TWR, the return for the first period and the return for the second period are geometrically linked. However, the large investment after the first year is not taken into account. Alternatively, the IRR calculation accounts for the fact that the investment was larger during the best return period.

Time	Action	Market Price / Share	Cash Flow	Position	IRR	TWR
January 1 <sup>st</sup> , 2012	Buy 2 Shares	\$500	-\$1,000	2 shares ABC @ \$500		
January 1 <sup>st</sup> , 2013	Price Securities	\$400		2 shares ABC @ \$400	-20%	-20%
January 1 <sup>st</sup> , 2013	Buy 10 Shares	\$400	-\$4,000	12 shares ABC @ \$400		
December 31 <sup>st</sup> , 2013	Sell 12 Shares	\$460	+\$5,520			+15%
<b>Annualized Portfolio Return</b>					<b>+8.5%</b>	<b>-4.0%</b>

Use IRR formula.  

$$\$0 = -\$1000 + -\$4,000/(1+IRR) + \$5,520/(1+IRR)^2$$

Geometrically link the annual returns.  

$$[(1+(-20%)) * (1+15%)]^{1/2} - 1 = -4.0%$$

## Defined Contribution (“DC”) Benchmark Analysis

The Defined Contribution plan is offered to members and either 1) supplements their defined benefit option or 2) serves as their only INPRS-provided retirement benefit. Within the DC plan, members are offered multiple funds to invest in at their discretion, found in the table below. The funds contain a mixture of active and passive management based on input from outside consultation and INPRS investment staff. The benchmarks shown below were selected to evaluate the funds and are reported to the INPRS Board of Trustees.

Fund(s)	Benchmark	Active Investment	Passive Investment	What is it measuring?
Target Date	Custom <sup>17</sup>	Varies	Varies	Asset Allocation, Manager Selection
Large Cap Equity Index*	S&P 500 Index	0.0%	100.0%	Manager Selection
Small/Mid Cap Equity*	Russell Small Cap Completeness Index	10.0%	90.0%	Asset Allocation, Manager Selection
International Equity*	MSCI ACWI ex US ex-China IMI Index	40.0%	60.0%	Asset Allocation, Manager Selection
Fixed Income*	Bloomberg Barclays US Aggregate Bond Index	50.0%	50.0%	Asset Allocation, Manager Selection
Inflation-Linked Fixed Income*	Bloomberg Barclays US TIPS Index	0.0%	100.0%	Manager Selection
Stable Value*	3-Year Constant Maturity Treasury	100.0%	0.0%	Manager Selection
Money Market	FTSE 3-Month US T-Bill Index	100.0%	0.0%	Manager Selection

\*Funds are included in the target date funds.

<sup>17</sup> The returns for the custom target date indices are sent to INPRS investment staff on a monthly basis from the consultant for the Defined Contribution. The custom target date index returns are calculated by keeping the similar weight but assume 100% passive investment in order to evaluate the active managers' performance.

## Illiquidity Premium

The term “illiquidity premium” is often used to explain any difference in performance between liquid and illiquid markets, such as across public and private equity or public fixed income and private credit. A performance difference, or “premium,” of between 1.50% and 3.00% seems to be a defensible and standard assumption for private credit and private equity performance, respectively, above and beyond public markets. But research suggests that a wide variety of private market characteristics could be leading to this performance “premium,” rather than simply illiquidity. These characteristics include different levels of leverage (private equity managers tend to employ higher leverage), portfolio concentration (fewer investments within each vehicle), active manager skill, and style factor concentration in size and value factors (these managers tend to acquire small businesses that are cheap).

Cornelius, P., Diller, C., Guennoc, D., & Meyer, T. (2013). *Mastering Illiquidity: Risk Management for Portfolios of Limited Partnership Funds*. Wiley.

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## Public Market Equivalent (“PME”) Benchmarks

Henly, Samuel. PME Benchmark Methods (August 12, 2013). *PitchBook*.

The two most common measures of PE performance, IRR and cash multiples, are adequate measurements of fund performance when used judiciously. However, IRR and cash multiples cannot be directly compared to indices that use TWR to evaluate performance in mainstream asset classes. The purpose of public market equivalent benchmarks (PMEs) is to make fund performance directly comparable to the performance of indexed asset classes.

PME metrics benchmark the performance of a fund (or group of funds) against an indexed alternative investment. For example, one could use a PME to compare the performance of a PE fund to the performance of publicly traded stocks indexed by the Russell 3000 Index. When PME values are generated for many funds, the PME values can be used to rank fund performance controlling for broader market behavior.

First proposed in 1996, the Long-Nickels PME (hence, simply 'PME') benchmark answers the question: if an investor had made contributions to an indexed fund instead of a PE fund, and if these contributions (and the resulting distributions) were the same size and made at the same time as they were for the PE fund, what would the return be? In this sense, it is a relative measure of performance. When using PME benchmarks, a PE fund is compared to a hypothetical alternative investment, the PME vehicle. The idea is to take cash flows of a PE fund, redirect them to (or from) the PME vehicle, and obtain the vehicle's net asset value (or NAV) for use in an IRR calculation.

## Hedge Fund Research Indices (“HFRI”)

[www.hedgefundresearch.com](http://www.hedgefundresearch.com)

### **HFRI Monthly Indices Methodology and Construction**

The HFRI Monthly Indices are a series of benchmarks designed to reflect hedge fund industry performance by constructing equally weighted composites of constituent funds, as reported by the hedge fund managers listed within the HFR Database. The HFRI range in breadth from the industry level view of the HFRI Fund Weighted Composite Index, which encompasses over 2200 funds, to the increasingly specific level of the sub-strategy classifications.

In order to be considered for inclusion in the HFRI, a hedge fund manager must submit a complete set of information to HFR Database (the listing of required fields for Database inclusion are available [here](#)). Funds are eligible for inclusion in the HFRI the month after their addition to HFR Database. For instance, a fund that is added to HFR Database in June is eligible for inclusion in the indices upon reporting their July performance. Additionally, all HFRI constituents are required to report monthly, net of all fee’s performance and assets under management in U.S. dollars. Constituent funds must have either (a) \$50 million under management or (b) a track record of greater than twelve (12) months.

The HFRI are fund-weighted (equal-weighted) indices. Unlike asset-weighting, the equal-weighting of indices presents a more general picture of performance of the hedge fund industry. Any bias towards the larger funds potentially created by alternative weightings is greatly reduced, especially for strategies that encompass a small number of funds.

## Benchmark Quick Reference

Asset Class	Benchmark	Bailey Criteria <sup>18</sup>						Description
		#1	#2	#3	#4	#5	#6	
Total INPRS DB	INPRS Blended Target Return	Yes	No	Yes	Yes	Yes	Yes	INPRS's Target Rate of Return through time.
Total INPRS DB	Passive DB Target w Notional Index	No	No	Yes	Yes	No	No	The individual asset class benchmarks roll up with the weights fixed to the INPRS Target Asset Allocation.
Total INPRS DB	DB Manager Selection Index v2	No	No	Yes	Yes	No	No	The individual asset class benchmarks roll up with their weights adjusted to the market value weight of that asset class within the Plan monthly.
Public Equity	MSCI ACWI ex China IMI Market Net Index	Yes	Yes	Yes	Yes	Yes	Yes	A global equity market index.
Private Markets	Private Markets Custom Bmk	Yes	No	Yes	No	Yes	Yes	Custom neutralized benchmark.
Private Equity	Private Equity Custom PME	Yes	No	Yes	No	Yes	Yes	Utilizes a public index in an attempt to best capture INPRS's exposure, adds 3.00% reflecting the illiquidity premium, and lags returns to align with manager reporting.
Private Equity	Cambridge Associates Peer Index	No	No	Yes	No	No	No	The median peer's return as measured by Cambridge Associates.
Private Credit	Private Credit Custom PME	Yes	No	Yes	No	Yes	Yes	Utilizes a public index in an attempt to best capture INPRS's exposure, adds 1.50% reflecting the illiquidity premium, and lags returns to align with manager reporting.
Private Credit	Cambridge Associates Peer Index	No	No	Yes	No	No	No	The median peer's return as measured by Cambridge Associates.
Fixed Income Ex Inflation-Linked	Custom Fixed Income ex ILB Bmk	Yes	Yes	Yes	Yes	Yes	Yes	Custom benchmark constructed with INPRS's sub-asset class benchmark components.
Fixed Income Inflation-Linked	Custom Fixed Income ILB Bmk	Yes	Yes	Yes	Yes	Yes	Yes	Custom benchmark constructed with INPRS's sub-asset class benchmark components.
Commodities	Custom Commodities Bmk	Yes	Yes	Yes	Yes	Yes	Yes	Custom benchmark constructed with INPRS's sub-asset class benchmark components.
Real Assets	Real Asset Custom Bmk	Yes	No	Yes	No	Yes	Yes	Custom neutralized benchmark.
Real Estate	NCREIF NFI-ODCE Net 1 Qtr in Arrears	No	No	Yes	No	No	No	NCREIF is a not for profit organization that collects real estate data. NFI-ODCE Net 1 Qtr in Arrears is a core equity index they compile.
Real Estate	Real Estate Custom PME	Yes	Yes	Yes	Yes	Yes	Yes	Utilizes public indexes in an attempt to best capture INPRS's exposure.
Real Estate	5% Real Rate of Return	Yes	No	Yes	Yes	Yes	Yes	Absolute real (excluding inflation) return target.
Infrastructure	Infrastructure Custom PME	Yes	Yes	Yes	Yes	Yes	Yes	Utilizes public indexes in an attempt to best capture INPRS's exposure.
Infrastructure	5% Real Rate of Return	Yes	No	Yes	Yes	Yes	Yes	Absolute real (excluding inflation) return target.
Absolute Return	Cash plus 2.50%	Yes	No	Yes	Yes	Yes	Yes	Absolute benchmark reflecting the additional return, above cash, absolute return managers are expected to generate.
Absolute Return	HFRI Custom Bmk	No	No	Yes	No	No	No	Peer returns as measured by HFRI and weighted based on INPRS's sub-asset class weights.
Risk Parity	INPRS Blended Target Rate	Yes	No	Yes	Yes	Yes	Yes	INPRS's Target Rate or Return through time.
Risk Parity	Global 60/40 Index	Yes	Yes	Yes	No	No	Yes	A commonly cited general asset allocation approach used to measure the efficacy of risk parity through time.

<sup>18</sup> Bailey Criteria: (1) Unambiguous (2) Investable (3) Measurable (4) Appropriate (5) Reflective of current investment options (6) Specified in advance  
INPRS staff completed Bailey Criteria evaluation. As with any analysis, there is room for subjectivity.