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A Private Investment Benchmark

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EXECUTIVE SUMMARY

- A private investment benchmark should be:
  - Unambiguous
  - Investable
  - Measurable
  - Appropriate
  - Reflective of current investment opinions
  - Specified in advance

We believe that, for private investments, no existing benchmark encompasses all (or even most) of these characteristics. We have therefore designed a custom benchmark that is as inclusive of these characteristics as possible. See Section 1.0 on page 3 below.

- We recommend two courses of action, which we hope are complementary:
  - Given the background cited in Section 2.0 on page 5, investors in the private markets should use the S&P 500 index (or some other index of publicly traded securities deemed more appropriate) as a benchmark, translating the index from a time-weighted basis to a time-weighted dollar-weighted (i.e., IRR) basis using either the total return method described in Section 3.0 on page 7 or the horizon return method described in Section 4.0 on page 8.

    In comparing managers within an asset class, investors in the private markets can make use of the Rosetta stone mechanism of the total return cross-index comparison outlined in Section 5.0 on page 9 or the horizon return cross-index comparison in Section 6.0 on page 10. These comparisons are unbiased estimates of the relative returns of two managers computed by computing the two managers' index comparisons and then comparing the results. See APPENDIX A on page 13 for an example computation.

    This translated index comparison should be assessed by some appropriate statistical measure in order to determine whether the return realized is statistically significant. See Section 7.0 on page 10; also see APPENDIX B on page 14 for numerical examples.

    Please note in the context of statistical validity that whether a given investor requires a premium over the translated S&P index (and, if so, how much of a premium) depends upon the relative risk[1] of the particular private investment evaluated and/or upon the liquidity needs of the investor.

[1] We will deal with this topic in our upcoming paper *Stochastic Models for Optimal Asset Allocation in the Private Investment Portfolio, by Austin M. Long, III and Craig J. Nickels, which will be delivered at the May 18-19 Mezzanine Finance '95 Symposium in New York.*

It is also extremely important to keep in mind that this performance measurement method is only valid over fairly long periods of time, preferably at least one market cycle.

- Investors in the private markets should also establish a single, pooled investment history database with a view to long-term verification and testing of the results of the benchmark proposed in the preceding bullet. See Section 8.0 on page 11.

Study and testing of the combined investment experience of all participants in the private markets may lead to development of a new benchmark based on factor analysis or some other consistent, defensible computational method.

In addition, correlation of the results of the index comparison method proposed above with the history available in the substantial database of the aggregate private investors' portfolios should make it possible to derive and implement a kind of statistical quality control in which portfolio managers would have a rigorous idea of whether their portfolio returns are within or outside the bounds of expected returns.

Finally, this historical database could be used to develop correlation, risk and return characteristics that could enable institutional private investment portfolio managers to conduct asset allocation studies to optimize their portfolios.

1.0 Characteristics of an appropriate benchmark

In his article "Are Manager Universes Acceptable Performance Benchmarks?"[2] Jeffery V. Bailey, CFA, questioned the validity of using manager data as a benchmark on three grounds: conceptual shortcomings, survivor bias and failure to pass benchmark quality tests. The first two reasons cited by Bailey for doubting the usefulness of comparing managers in the same market to one another apply to the private markets as well. The third reason, relating to benchmark quality tests, applies to the private markets only as to a single aspect.

First, in assessing the conceptual shortcomings of the use of manager comparisons as benchmarks, Bailey cited six qualities required for a valid benchmark. Applying Bailey's framework to the private markets, the benchmark ultimately chosen should be:

1.1 Unambiguous

The names and weights of all portfolio securities in the benchmark should be clearly delineated.

1.2 Investable

The investor 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.

1.3 Measurable

The investor should be able to calculate returns to the benchmark reasonably frequently, but in any case at least as frequently as the investor's results are measured by its board or other responsible fiduciary.

1.4 Appropriate

The benchmark chosen should be consistent with the style of the investment manager whose performance is being gauged.

1.5 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.

1.6 Specified in advance

The benchmark computation should be constructed prior to the start of an evaluation period.

Second, Bailey also pointed out the long-recognized problem of survivor bias. While this problem is difficult enough in the public markets, it is even more significant in the private markets. The most often-cited example is the self-selected reporting universe of venture capital partnerships used by Venture Economics to compute its venture capital index. In Venture Economics' case, partnerships need not go out of business in order to bias the index; rather, firms with poor returns simply cease to report, leaving the more successful firms to populate the index.

[2] *The Journal of Portfolio Management, Spring 1992.*

I expect the future Venture Economics index, which will include all forms of private equity investment, will have the same problem.

Third, and finally, Bailey lists a number of what he calls benchmark quality tests, including:

- High coverage - a consistently high proportion of a manager's actual portfolio should be in the benchmark.

- Low turnover - the benchmark's turnover should reflect the passive alternative it represents.

- Positive active positions - the position held by the manager should be larger than the same position held in the benchmark, reflecting a positive choice to accentuate one of the benchmark's characteristics.

- Investable position sizes - if the manager liquidated the investor's portfolio to invest in the benchmark, the market benchmark should be capable of absorbing the investment without distorting the market.

- Reduced observed active risk - when comparing the manager's portfolio to the benchmark, volatility should be less than when the same portfolio is compared to the market.

- High extra-market return correlation between the managed portfolio and the benchmark - the benchmark should explain a high proportion of the manager's returns in excess of the market.

- Low extra-market return correlation between the benchmark and the managed portfolio versus the benchmark - whether the manager's style is in or out of favor should have no effect on the benchmark.

- Similar risk exposures - over time, the benchmark should exhibit investment risk similar to that of the managed portfolio.

I mention these quality tests of benchmarks, as described by Bailey, only for the sake of completeness in describing his views. These quality tests, most of which amount to making the development of a benchmark a difficult process which must be applied in a unique way to every conceivable manager style, are designed primarily to make the design of a benchmark the province of a very few highly compensated specialists. We believe that only one of these quality tests applies to the private markets: the requirement of an investable position size. Note that this quality test is essentially redundant to the requirement, detailed above, that a proper benchmark must be investable.

Because no existing private investment benchmark incorporates all of (or even most of) the benchmark criteria set out above, we believe that the institutional private investor community must develop a new benchmark, preferably one which will be usable for the widest possible definition of the private investment marketplace. At The University of Texas System, we have

developed a benchmark based on the S&P 500 index which we use to determine performance compensation. The paragraphs below examine our reasons for the use of the S&P 500 index, detail how we compute the index on both a total return and a horizon return basis, show how we use the benchmark to determine relative performance and propose standards for statistical validity.

2.0 A possible benchmark: the S&P 500

The AIMR Performance Presentation Standards require investment returns on portfolios of listed securities to be computed and presented using the time-weighted rate of return method. The time-weighted rate of return method, which intentionally eliminates the effects of interim cash flows by revaluing the portfolio at each cash flow date, is equivalent to the simple geometric linking of returns which is used to compute benchmark indexes, including the S&P 500. Private (or so-called alternative) investments, including venture capital funds, leveraged acquisition funds, mezzanine funds, oil & gas, etc., on the other hand, are generally reported using the internal rate of return method. The internal rate of return method gives weight to interim cash flows based on their amounts and timing.

While in the marketing of private investment funds these two return measures (i.e., geometric linking of the S&P 500 and a fund's internal rate of return) are commonly presented as comparable, in many cases they are not. The fact that a private market investment fund has achieved an internal rate of return in excess of the total return to the S&P 500 over a particular period of time does not necessarily mean that the private market investment has outperformed the S&P 500. It is true that a given listed investment's return (or, for that matter, the return to an index of listed equities) can be computed both ways (i.e., using time-weighted rate of return and internal rate of return) with approximately equal results. However, a comparison between the internal rate of return to a private market investment and the time-weighted rate of return to a public market index over the same time period does not take into account the timing of the cash flows used to generate the private market return. When the timing of cash flows is taken into account, the return to a private market investment and the return to a public market index over the same time period can diverge significantly, particularly over long time periods, volatile public markets and numerous cash contributions and distributions. Thus, comparison of private market investments with public market indexes requires an analytical method which takes into account the timing and amounts of the relevant cash flows to the private market investment.

The analytical methods set out below make it possible to make a direct and meaningful comparison between the return on an investment in any index of returns computed on a time-weighted rate of return basis and the return on a private market investment computed on an internal rate of return basis. These methods assume, but are not limited to, quarterly reporting.

We refer to these analytical methods as the **index return comparison** (which measures the performance of a private investment relative to the performance of a public stock index) and the **cross-index return comparison** (which measures the relative performance of two private investments by comparing the two investments' index return comparisons)[3]. These two

[3] We are now using the cross-index comparison method to analyze and compare fund investment opportunities for both U.T.'s private endowment, the Common Trust Fund (on a total return basis) and its public endowment, the Permanent University Fund (on a horizon return basis).

performance measures can be computed on both a total return basis and a horizon return basis[4], depending upon the income reinvestment characteristics of the particular portfolio.

We believe that the index return comparison (or, as applied to distinguishing among individual private investment managers on the basis of relative performance, the cross-index return comparison) possesses all but one of the requirements stated above for a benchmark. Thus, the index return comparison is:

- Unambiguous - every market participant knows the names and weights of all the securities involved.
- Investable - the S&P index is among the most liquid securities in the world; every investor has the totally passive alternative of investing in the index. It therefore follows that every equity investment must be compared to this passive alternative in order to rationalize investing in any other asset class. In short, the S&P 500 is the gold standard of equity investment.
- Measurable - every investor can calculate the return to the S&P 500 or any return based on the S&P 500 on a daily, weekly, monthly, quarterly or any other basis.
- Reflective of current investment opinions - the makeup of the index changes as the market caps of its component companies changes, and all market participants have current knowledge of the makeup of the benchmark.
- Specified in advance - a benchmark promulgated by the institutional private investment community and calculated using the procedures spelled out in this proposal would be known to its users in advance.

Perhaps the only element of a benchmark which is not satisfied by the index comparison method detailed above is the requirement that the benchmark be *appropriate.* The author means that term to apply to a benchmark which is consistent with the style of the manager whose performance is being gauged. I believe that the best that can be said of the index comparison is that it is *equally inappropriate* for all private investments and that it is therefore a neutral factor in judging among them (or judging among managers in a particular asset class). This last statement is the underlying premise on which the cross-index comparison is based. See Section 5.0 on page 9 for the total return cross-index comparison method and Section 6.0 on page 10 for the horizon return cross-index comparison method.

Put simply, whether the investor is analyzing private investments in general, a specific private investment asset class or a specific manager within an asset class, the ultimate question to ask is "Can private investments (or this asset class within private investments or this manager) beat the S&P 500 over the long term by an amount sufficient to make it worthwhile to invest?"

It is extremely important to note that both the index return comparison and the cross-index return comparison are intended to be used over fairly extended time periods, preferably at least one full market cycle. Shorter periods, given the volatility of both the public and private equity markets,

[4] The Permanent University Fund, U.T.'s public endowment, must pay out all income as it is received and therefore is managed on a horizon return (as opposed to a total return) basis.

are simply not meaningful. Private investments, as a whole, are a long-term asset class and it is easy to reach erroneous conclusions in the short run.

3.0 Total return index comparison

There are two steps to determine the total return index comparison:

3.1 Compute the internal rate of return of the private investment portfolio.

• Obtain private investment asset, vintage and/or overall portfolio actual returns by listing their cash flows in columns, each cash flow accompanied by its date, using natural signs (i.e., cash inflows are positive numbers and cash outflows are negative numbers).

• The final cash flow for each investment is its value at the report date (i.e., all valuations are assumed realized at the report date).

• Compute an IRR for the private investment asset, vintage and/or overall portfolios using these cash flows.

3.2 Compute the comparable total return to an index of public stocks had the cash flows in 3.1 been invested in the index.

• List all cash flows as above for actual portfolio returns, but without showing an ending value/cash flow.

• Compute the ending value/cash flow as follows:

1. Treat the first (negative) cash flow as having been invested in the relevant index.
2. Using an end-of-period assumption, grow that cash flow over the time between the first and second cash flow at the rates indicated by the linked index.
3. At the point of the next cash flow, grow the new net amount (i.e., the amount of the prior cash flow grown by the linked index return plus the new cash flow) by the relevant linked index until the date of the next cash flow.
Note that the next cash flow could be a distribution from the private investment, which would be treated as a withdrawal from the index investment. Thus, the new net amount could be the amount of the prior cash flow grown by the linked index return *minus* the new cash flow.[5]
4. Repeat 3 until the calculation arrives at the current report date.
5. Compute the IRR of the investment using the portfolio value at the current report date, as computed in steps 1-4 above, as the final cash flow/valuation as in the actual portfolio return computation above.

[5] If a private investment greatly outperforms the index because it makes frequent large distributions it is possible for the final value determined by the index comparison to be negative. In effect, frequent large withdrawals from the index result in a net short position in the index comparison. See the numerical example in APPENDIX B on page 14.

These two returns, the actual portfolio internal rate of return on the one hand and the pro forma index comparison return on the other, represent a direct comparison of how net funds invested in the private investment portfolio ***would have performed*** on a ***total return basis*** had they been invested in the applicable public stock index over the life of the particular investment.

4.0 Horizon return index comparison

The horizon rate of return is designed to determine an overall return for an investment with a differential reinvestment rate between capital returns and income returns.

The constitution of the State of Texas requires the Permanent University Fund to pay out all its income currently. The Texas Constitution also forbids the expenditure of Permanent University Fund corpus - U.T. must issue bonds to realize gains in the portfolio, and the interest expense on those bonds are netted out of the income stream. Returns to the PUF portfolio, then, are not total returns in the ordinary sense because interest and dividends cannot be reinvested and the corpus cannot be paid out. In effect, the PUF represents the logical extreme of a forced payout, since it must pay out 100% of its income. Returns to the PUF portfolio are therefore best measured on a horizon return basis. Other endowments and foundations with mandatory payouts may benefit from the same approach, even though the amount required to be paid out may be less than 100% of income.

In general, the horizon rate is determined by splitting the two return streams into two separate computations. The income received is compounded using its particular applicable reinvestment rate to determine its aggregate future value at the final (horizon) period. This future value is then placed into the final period of the capital component as an addition to its terminal value. The internal rate of return of the restated capital component is the horizon rate of return.

There are two steps to determine the horizon return cross-index comparison:

4.1 Compute the horizon rate of return of the private investment portfolio

• Obtain private investment asset, vintage and/or overall portfolio actual horizon returns by listing their cash flows in columns, each cash flow accompanied by its date, using natural signs (i.e., cash inflows are positive numbers and cash outflows are negative numbers), with income returns reported separately from return of capital or capital gains distributions.

• Because the compound reinvestment rate of income returns is zero for the PUF, for example (since all income must be paid out currently), carry all income returns to the final period (presumably the reporting period) at a future value of 1. If the mandatory payout is less than all income received, or if the income reinvestment rate is lower than the reinvestment rate for capital returns and capital gains, carry all income returns forward to the final period at the applicable compound growth rate.

• The final cash flow for each investment is (1) its value at the report date (i.e., all valuations are assumed realized at the report date) plus (2) the sum of all income during the holding period as determined in the previous step.

• Compute an IRR for the private investment asset, vintage and/or overall

portfolios using these cash flows.

This is the horizon IRR for the private investment portfolio.

4.2 Compute the comparable horizon return to an index of public stocks

• List all cash flows as above for actual portfolio returns, but without an ending value/cash flow at the report date.

• Break the public stock index into a capital gain component and a reinvested income return component.

• Compute the ending value/cash flow as follows:

1. Treat the first (negative) cash flow as having been invested in the relevant index.
2. Using an end-of-period assumption, grow that cash flow over the time between the first and second cash flow at the capital growth rates indicated by the linked index.
3. Carry the income return component to the index over the period between the first and second cash flows forward to the final period of the horizon return (presumably the reporting period) dollar for dollar (i.e., with a future value of 1, assuming no reinvestment).
4. At the point of the next cash flow, grow the net amount (the *capital* portion *only)* by the relevant linked index to the next cash flow until the calculation arrives at the current report date.
Note that the next cash flow could be a distribution from the private investment, which would be treated as a withdrawal from the index investment. Thus, the new net amount could be the amount of the prior cash flow grown by the linked index return *minus* the new cash flow.[6]
Remember that the character of the distribution will make a difference: distributions from capital will be taken out of the compounding capital gain portion of the index, while distributions of income will be taken out of the income return to the index for the period in question.
4. Use the portfolio value at the current report date, as computed in steps 1-3 above, as the final cash flow/valuation as in the actual portfolio return computation above and compute an IRR.

These two horizon returns, the actual portfolio horizon return on the one hand and the proforma index horizon return on the other, represent a direct comparison of how net funds invested in the private investment portfolio performed or ***would have performed*** on a ***horizon return*** basis if invested in the applicable public stock index over the life of the particular investment.

6 See APPENDIX B on page 14.

5.0 Total return cross-index comparison

The cross-index comparison, as depicted in APPENDIX A on page 13, involves computing the index comparisons of two private investments. The two index comparisons represent underperformance or overperformance relative to the benchmark index for both investments. A comparison of these two investments using a common standard (i.e., a cross-index comparison in which one index comparison is compared to another) yields an unbiased, realistic view of how each private investment would have performed had its cash flows been invested in or withdrawn from the S&P 500 index. The effect is somewhat like that of the famous Rosetta stone, which enabled scholars to translate two unrelated languages by comparing both to a common translation inscription in a known language. In the case of the cross-index comparison, the common language is the S&P 500.

Note that in APPENDIX A the cross-index comparison makes it clear that Manager B, with an identical IRR to Manager A, underperformed the S&P 500 index comparison by 200 basis points while Manager A *overperformed* by 200 basis points. These index comparison return differentials are the results of the timing and amounts of cash flows employed by the two managers. Comparing the performance of these two private investment managers to a common standard enables the analyst to determine which has actually been superior to the other in terms of beating the S&P 500.

6.0 Horizon return cross-index comparison

The horizon return cross-index comparison is performed exactly like the total return cross-index comparison in Sec. 5.0 above, except that both the private investment and the index comparison are computed on a horizon return basis as shown in Sec. 4.0 above.

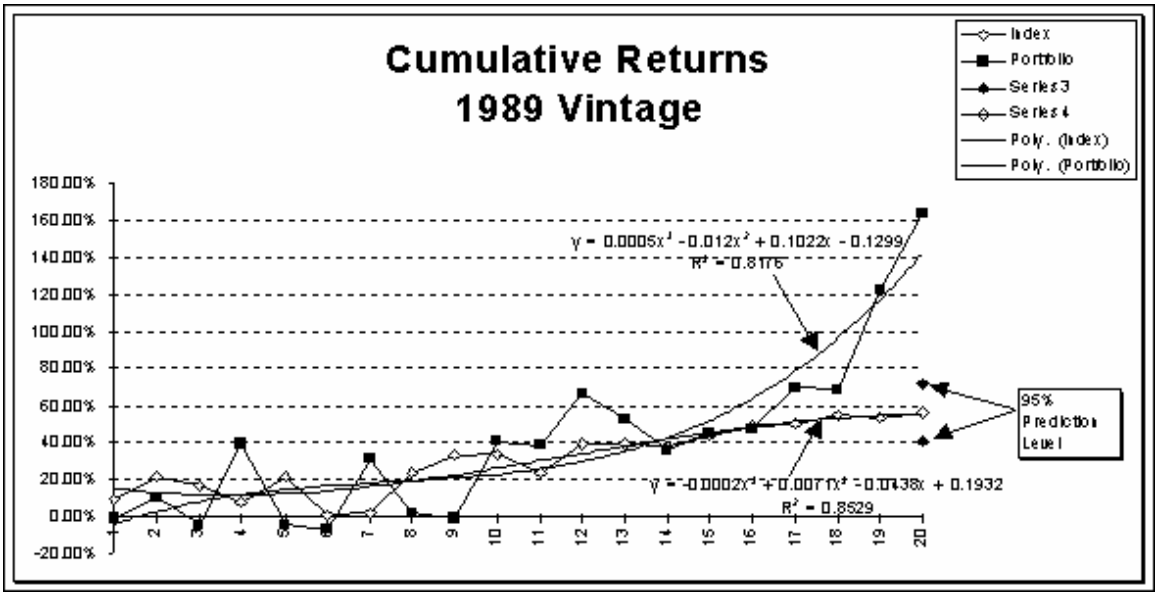
7.0 Statistical measures of the significance of the index return comparison

The threshold question is whether the horizon return or the total return of a particular private investment portfolio vintage as computed above is statistically significantly different from the horizon return or total return to the S&P index comparison. In other words, the question is whether the private investment portfolio vintage has statistically outperformed the returns which could have been obtained by investing in or withdrawing funds from the S&P 500 index with the same cash flows invested into or distributed from the private investments actually chosen. A quantitative answer to this question yields an objective measure of relative underperformance or overperformance (as opposed to an arbitrary differentiation based on some static measure or a simple comparison with historical returns).

Briefly, we propose the following steps to compute the statistical validity of overperformance:

- Assess the volatility of the index comparison by computing the regression equation with the best R2.
- Use the resulting equation to compute a point prediction of the returns expected for the final time period.
- Using the standard error of the estimate for the regression equation, calculate the standard deviation of the predicted value of the point prediction of the final value of the index.

Private investment vintage performance in excess of 2 standard deviations from this point estimate should be considered overperformance of the index comparison because there is less than a 5% chance that the difference between the two returns is due to chance. Private investment vintage performance which results in a negative final index comparison value should be considered overperformance in every case (see APPENDIX B on page 14). The graph below shows the PUF 1989 vintage and the S&P index return comparison for the same cash flows:



Whether a particular investor requires some stated premium over the index comparison will depend in part upon the investor's judgment of the relative risk[78] of private investments and in part on the investor's liquidity needs.

8.0 Another possible benchmark: comparison with historical data

If the combined private investment return data of a sizable number of institutional investors in the private equity markets (including a look-through view of the companies making up the portfolios of limited partnerships) were available on a database, investors could research private investments in general, as well as each private investment asset class. Such a database could be resident in an encrypted form on a secure server, available for query by authorized members. This resource and the lessons it could teach could be a substantial competitive advantage in the increasingly competitive private investment market. The following possible research emphases

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8 We will deal with this topic in our upcoming paper *Stochastic Models for Optimal Asset Allocation in the Private Investment Portfolio*, by Austin M. Long, III and Craig J. Nickels, which will be delivered at the May 18-19 Mezzanine Finance '95 Symposium in New York. Also see *Alternative Asset Allocation Using Monte Carlo Simulation*, by the same authors, presented to the First Annual Endowments & Foundations Symposium in New York, March 28, 1995.

represent a small fraction of the knowledge to be gained by studying the proposed institutional private investor database:

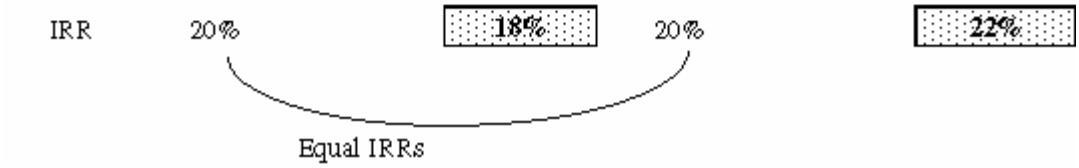
- Study and testing of the combined investment experience of the institutional private investment community may lead to development of a new benchmark based on factor analysis or some other consistent, defensible computational method.

- In addition, correlation of the results of the index comparison method proposed above with the history available in the substantial database of the aggregate portfolios should make it possible to derive and implement a kind of statistical quality control in which portfolio managers would have a rigorous idea of whether their portfolio returns are within or outside the bounds of expected returns.

- Finally, this historical database could be used to develop correlation, risk and return characteristics which could enable the institutional private investment portfolio managers to conduct asset allocation studies to optimize their portfolios. See footnote 8. on page 11.

APPENDIX A

S&P 500	Manager A			Manager B		
return	IRR	S&P	S&P IRR	IRR	S&P	S&P IRR
10.00%	($1,000,000)	$1,100,000	($1,000,000)	($200,000)	$220,000	($200,000)
5.00%	$0	$1,155,000	$0	($200,000)	$441,000	($200,000)
-10.00%	$0	$1,039,500	$0	($200,000)	$576,900	($200,000)
-5.00%	$0	$987,525	$0	($200,000)	$738,055	($200,000)
10.00%	$0	$1,086,278	$0	($200,000)	$1,031,861	($200,000)
40.00%	$0	$1,520,789	$0	$0	$1,444,605	$0
30.00%	$0	$1,977,025	$0	$0	$1,877,986	$0
30.00%	$0	$2,570,133	$0	$0	$2,441,382	$0
30.00%	$0	$3,341,172	$0	$0	$3,173,797	$0
30.00%	$5,156,765	$4,343,524	$4,343,524	$3,693,510	$4,125,935	$4,125,935
	$4,156,765		$3,343,524	$2,693,510		$3,125,935



Equal IRR*s*

The Cross-Index Return Comparison

Manager A drew a $1 million investment commitment at the close and immediately invested it in a private investment yielding $5.1 million and an IRR of about 20%. Manager A can therefore appropriately claim to have beaten the S&P 500's return of 18%.

Manager B, on the other hand, drew a $1 million commitment in five installments. Manager B may also claim to have beaten the S&P by the same margin since he or she also has achieved a 20% IRR over the same period. However, had Manager B invested the same cash flows in the S&P 500 index, he or she would have achieved an IRR of 22%. Manager B, instead of outperforming the S&P 500 by 200 basis points, has instead underperformed the index comparison by 200 basis points.

APPENDIX B

The numerical example below shows a private investment with an IRR of 3.18% which has apparently underperformed the S&P's 5.63% compound return over the same period. However, when the same cash flows are invested into or taken out of the S&P, the returns to the same cash flows **had they been invested into and withdrawn from the S&P with the same timing** would have resulted in an IRR (i.e., an index comparison return) of 2.09%. The $200 distribution of cash in the final period of the IRR computation is a withdrawal from the S&P 500 for purposes of the index comparison computation.

(using an end of period assumption)

Period	Cash flow	S&P	Cumulative S&P	Index Comparison	Index Comparison Return
0	($100)				($100)
1	$0	5.00%	1.050000	105.000	$0
2	($300)	-10.00%	0.945000	394.500	($300)
3	$0	-15.00%	0.803250	335.325	$0
4	$0	20.00%	0.963900	402.390	$0
5	$270	-10.00%	0.867510	92.151	$270
6	$0	5.00%	0.910886	96.759	$0
7	$0	15.00%	1.047518	111.272	$0
8	$0	25.00%	1.309398	139.090	$0
9	$200	25.00%	1.636747	173.863	$174
	$70				$44
IRR	3.18%	Compound	5.63%		2.09%

Note that the purpose of the Index Comparison column is solely to compute the final value of the S&P 500 assuming the same cash flows as those in the Cash Flow column (i.e., the same cash flows as the private investment).

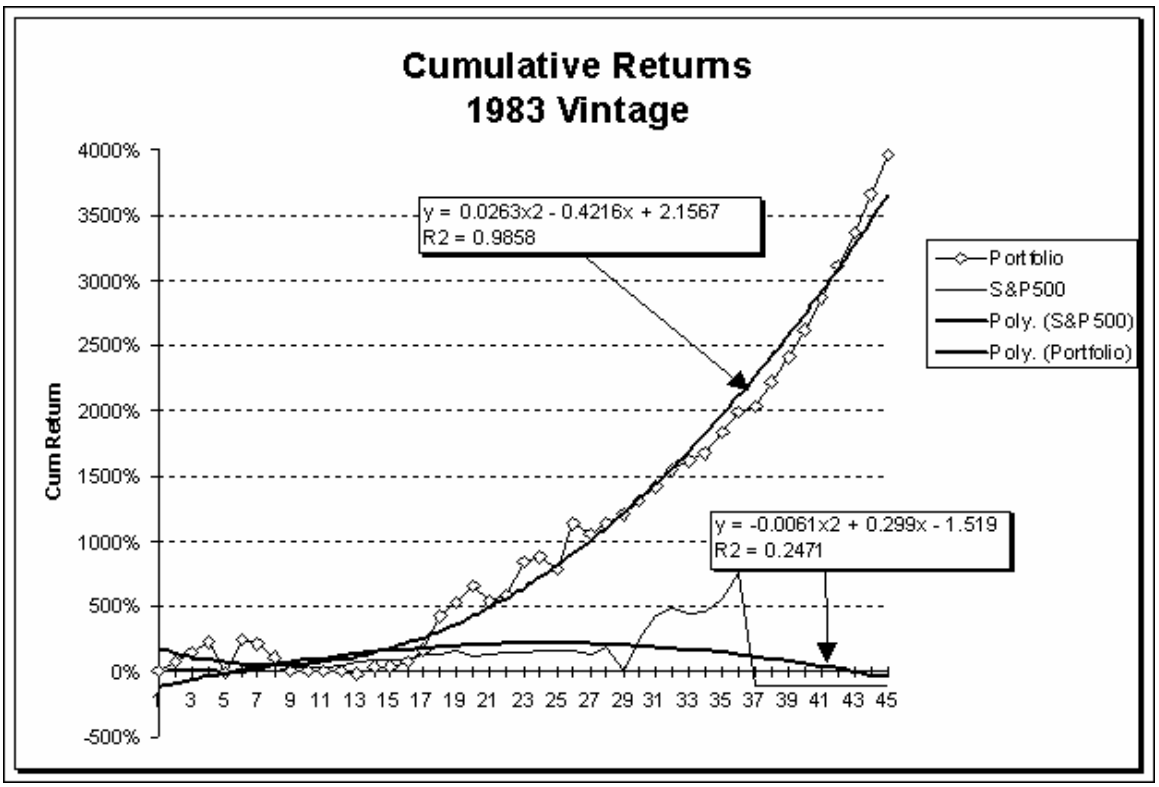
If a private investment greatly outperforms the index because it makes frequent, large distributions it is possible for the final value determined by the index comparison to be negative. This is possible because in the index comparison method, large distributions (whether of return of capital, capital gains or income) are subtracted from the current value of the index comparison. If a particular distribution is in excess of the compound value remaining in the index comparison after taking into account all the contributions and distributions of prior periods, the result is, in effect, a short position on the S&P. Thus, as is the case in any short position, the better the S&P does in periods after the index comparison has gone negative the worse the comparison portfolio does and the better the private investment performs by comparison.

In the example below, the large distribution in period 5 is in excess of the cumulative value of the S&P 500 up to that point. The result is that the value of the S&P 500 after the distribution is a

negative 42.849 and the final value of the S&P 500 compounds to negative 80.844. Using this final, negative value of the S&P 500 results in an index comparison return of negative 9.24%, as compared to an IRR to the investment of 9.19% as follows:

Period	Cash flow	S&P	Cumulative S&P	Index Comparison	Index Comparison Return
0	($100)				($100)
1	$0	5.00%	1.050000	105.000	$0
2	($300)	-10.00%	0.945000	394.500	($300)
3	$0	-15.00%	0.803250	335.325	$0
4	$0	20.00%	0.963900	402.390	$0
5	$405	-10.00%	0.867510	(42.849)	$405
6	$0	5.00%	0.910886	(44.991)	$0
7	$0	15.00%	1.047518	(51.740)	$0
8	$0	25.00%	1.309398	(64.675)	$0
9	$200	25.00%	1.636747	(80.844)	($81)
	$205				($76)
IRR	9.19%	Compound	5.63%		-9.24%

The 1983 vintage below illustrates the same principle in an actual portfolio:



As the graph above indicates, the 1983 index so outperformed its index comparison that the index comparison's return dropped to -100% (i.e., a total loss) due to large cash distributions from the private investment.