Nasdaq

Index Return Series Paper 1:

A Guide for Total, Price, and Excess Return Indexes

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This is part 1 of a multi-part series where we will deep dive into the nuances of Index Returns. This paper will provide an overview of the three primary types of index returns and their role in determining suitability and assessing investment performance.

At a Glance:

- Index Returns are driven by 3 components: Reference Rate, Risk Premium, and Periodic Income.
- The 3 components are combined in various fashions to create Total, Price, and Excess Return Indexes, which all hold unique use cases to use inside financial products.
- The difference in performance between the Indexes is dependent on the relationship between the prevailing reference rate and periodic income being paid by the tracked assets.

Indexes are instrumental for tracking the performance of various assets, and it's essential to understand the different types of return streams that can be calculated for any given index. There are four primary types of index returns: Price Return (PR), Total Return (TR), Net Total Return (NTR), and Excess Return (ER). Each of these returns provides a unique perspective on the performance of an index, and understanding the differences between them is crucial for making informed investment decisions.

In this paper, we will explore the definitions, examples, and performance of total, price, and excess return indexes. While net total returns are important, they are generally only used as a proxy by investors to estimate an after-tax total return.

How Returns are Calculated

Before diving into the specifics of each return type, let's take a step back and understand the three components that contribute to an Index's return profile:

	Reference Rate	Risk Premium	Periodic Income
Definition	• The baseline return an investor can earn in the market.	• The additional return an investor expects to earn for taking on more risk.	• The distributions made by an investment to its holders.
Typical Example	• Risk-Free Interest Rate: SOFR, Federal Funds Rate, US Treasuries, etc.	• The return on an investment exceeding a reference rate.	• Dividends received on an investment.
Context	• The reference rate is embedded in the return of the asset. • Since it is not distinctly visible, it must be defined by a product provider when necessary.	• This premium reflects the increased uncertainty and potential for losses associated with a particular investment. • Because risky assets such as stocks can incur losses, risk premiums can be either positive or negative.	• Periodic income, while not always guaranteed, can reflect the consistent return attributable to an underlying investment.

For example, if a given company's stock produced a loss of -10% over 1 year, its reference rate was +5%, and the stock held a dividend yield of +2%:

- The risk premium taken by investing in the stock would be -15% (i.e. a negative equity risk premium of 15%).
- Upon adding the 2% dividend (assuming no compounding), the stock would have underperformed the reference rate by 13%.

The three components stated above form the foundation for the various index return profiles, which will be examined in the following sections of this paper.

Three Types of Index Returns

When Nasdaq creates an index to track the performance of multiple assets, a choice is implicitly made around which of the above return components should be tracked by multiple versions of the index. Depending on the use case of the index and return profile desired by investors, it might be relevant to reference some or all of them. Nasdaq can create the following three types of indexes through the various combinations of return components:

Price Return Index = Reference Rate + Risk Premium

- Focus solely on the price changes of the underlying assets within the index, excluding any periodic income.

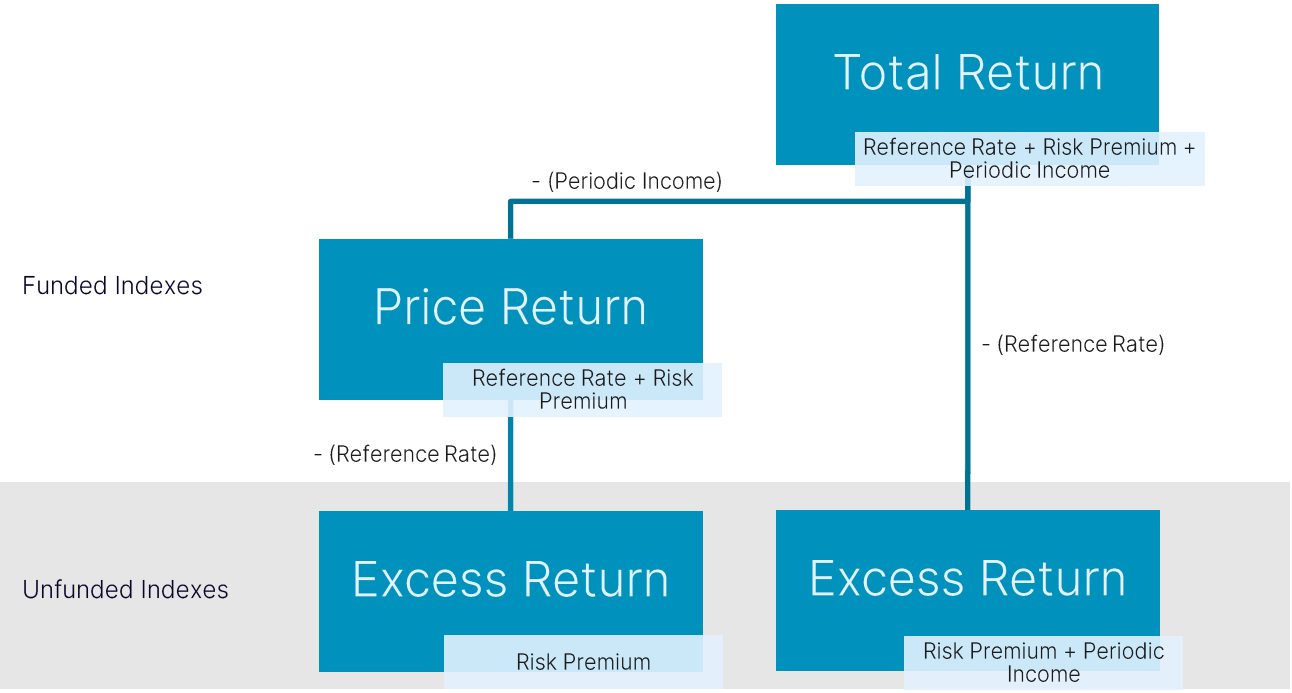
Total Return Index = Reference Rate + Risk Premium + Periodic Income

- Measure the performance of an index by considering both the price changes of the underlying assets and any periodic income generated from those assets.
- This process involves reinvesting the periodic income back into the index value, thereby allowing the index to compound.

Excess Return Index = Total (or Price) Return Index - Reference Rate

- Calculate the performance of a total or price return index above a predetermined reference rate.
- In the index industry, the reference rate is typically referred to as a Risk-Free Rate – such as SOFR, Federal Funds, or US Treasuries – unless *otherwise stated* in the Index Methodology.

As imaginable, these equations closely mirror the numerator of the Sharpe ratio, which measures risk adjusted return. Not only is their performance measured as such, but it also informs how the different indexes are used in the context of financial products.



The above diagram displays the relationship between the three different index return profiles. Total Return, as the name suggests, is comprised of all return components. From there, components are subtracted out to track other variations of Index Return. When periodic income is removed, a Total Return Index turns into a Price Return Index. Meanwhile, when the Reference Rate is subtracted from either variation, it becomes an Excess Return Index.

It is important to consider the inclusion of the Reference Rate in the Index to determine if an asset invests capital upfront. Doing so can determine whether an index is *funded* or *unfunded*, which is displayed in the diagram above. Understanding the nuances between the two can explain the use cases for each, which is shown in the table below:

	Funded Index	Unfunded Index
Definition	• An index whose underlying assets are being fully purchased upfront. • By investing upfront, the investor gains both the reference rate and the index risk premium. The reference rate compensates the investor for providing the full cost of financing upfront.	• An index in which the returns of the underlying assets are replicated through synthetic exposure. • Because there is no upfront investment, investors will not receive exposure to the reference rate. The cost of funding the assets are embedded in the index.
Typical Underlying Assets	• Stocks • Bonds • Real Assets	• Derivatives (Futures and Swaps)
Index Types	• Total Return • Price Return	• Excess Return
Examples	• Nasdaq-100 Index® (NDX®) • Invests in the top 100 non-financial stocks on the Nasdaq exchange.	• Nasdaq-100 Futures Excess Return™ Index (NDXNQER™) • Generates exposure to NDX through the nearest expiring E-mini Nasdaq-100 futures contract.

Applications of Each Index Type

Price Return Index

Price Return (PR) Indexes focus strictly on the capital appreciation of the assets being tracked. An investor can likely receive exposure to the performance of certain PR Indexes through Financial Products such as Annuities, Structured Products, Futures and Options, so long as any dividends or other income distributions by the underlying holdings are withheld. To the extent an Investment Fund such as a Mutual Fund or ETF tracks underlying holdings that do not pay any dividends, the investors in that fund will also receive exposure very similar to the performance of a PR Index. Finally, for an Investment Fund that tracks dividend-paying assets and distributes dividends regularly, the net asset value (NAV) will always get reduced in direct proportion to each distribution of income, producing a return stream that is akin to a PR Index when comparing the change in fund NAVs over time.

PR Indexes are widely used due to the following reasons:

- They are accessible, displaying performance in a similar manner as a single stock's price history.

  Investors can track the full performance of these indexes in real-time and make investment decisions based on the most up-to-date information.

- They are focused solely on capital appreciation instead of uncertain periodic income such as dividends.

The focus on capital appreciation makes them ideal for investors who are primarily interested in the growth potential of their investments, rather than relying on dividend income, which can be uncertain and vary over time.

An example of a widely used Price Return Index is the Nasdaq-100 Index® (NDX®), which tracks the performance of 100 of the top non-financial stocks listed on the Nasdaq Stock Exchange. Through its tracking products including ETFs, mutual funds, options, and futures, NDX represents one of the most liquid trading ecosystems in the world and can be accessed through a number of products. Among the most famous is the Invesco QQQ Trust Series 1 ETF – also known simply as Invesco QQQ – which holds more than $300 billion in assets under management.

An interesting consideration surrounding PR Indexes is the treatment of periodic income produced by the underlying assets tracked in an index. It is important to note that not all financial products tracking the performance of PR Indexes pass through dividends to end investors, and a non-exhaustive list can be displayed below:

Usually Pass Through Dividends	Usually Do Not Pass Through Dividends
• Exchanged-Traded Funds (ETFs) • Mutual Funds • Variable Annuities	• Index-Linked and Fixed Indexed Annuities (RILAs/FIAs) • Structured Products • Futures, Options, and other Derivatives

Total Return Index

Total Return (TR) Indexes represent the most comprehensive form of an index's return profile. They incorporate the value of periodic income directly into the index price, allowing for the compounding effect that mirrors the common, real-world investor practice of reinvesting income or dividends. This methodology ensures that the full value generation of the underlying assets is accurately reflected in the index level.

For example, if the Nasdaq-100 appreciated by 5% during a given period and received a dividend worth 1% on the last day of the period, the PR Index value would grow by 5% while the TR index would grow by 6%.

An example of a widely used Total Return Index is the Nasdaq-100 Total Return™ Index (XNDX™), which tracks the performance of the same underlying assets as NDX, while incorporating dividends and other periodic income into the index level as it is calculated daily. The comprehensiveness of TR Indexes makes it very popular for use in the following areas:

- Benchmarking for Fund Performance

  TR Indexes often serve as benchmarks for mutual funds, ETFs, and other managed portfolios by providing a holistic view of performance, including capital gains and income from dividends or interest. This allows for accurate assessment of the effectiveness of active and passive investment strategies.

  - ETFs like the Invesco QQQ Trust Series 1, whose price movements track the Nasdaq-100 *Price Return* Index and pass through (i.e. do not reinvest) dividends, will "benchmark" against the

Nasdaq-100 *Total Return* Index to account for all sources of return. In other words, an investor considering an allocation to Invesco QQQ can use the TR Index to estimate their final, all-in pretax return assuming constant reinvestment of any dividend distributions back into the same fund.

- Portfolio Analytics

  TR Indexes are utilized in portfolio analysis to offer insights into the impact of income reinvestment on the growth of an investment. Comparing the change in levels of a TR Index to its companion PR Index provides an instant quantification of the cumulative performance attributable to dividends for a given set of assets.

Because the dividends of the underlying assets are accounted for in the calculated index levels, investors in TR Index-tracking financial products will know with certainty that any dividends/income will be passed through. As a result, TR Indexes such as XNDX are also used for more customized financial products, particularly for investors in Annuities and Structured Products who want exposure to the underlying assets' dividends.

A notable variation of a TR Index is the Net Total Return (NTR) Index, which subtracts a standard withholding tax from dividends before reinvestment. This makes NTR Indexes useful for investors subject to dividend taxes, providing a realistic estimate of after-tax investment performance. They are also often used for benchmarking purposes in international funds and cross-border investment products.

Excess Return Index

Excess Return (ER) Indexes provide a nuanced perspective on the performance of an investment by isolating the returns that exceed those of a benchmark. By comparing the returns of the underlying assets to a reference rate, excess return indexes highlight the portion of returns that are attributable to the risk premium.

For example, if an index achieves a 9% return in a given period while the reference rate returns 5%, the excess return would be 4%.

The Nasdaq-100 Index Suite does not have a marketable Excess Return Index variation. This is because they are considered funded indexes, which include the full value of the assets they track, thereby reflecting the actual capital investment needed to hold these assets. As a result, any interpretable reference rate is baked into the returns of the index and can only synthetically be taken out (also known was "unfunding" in index). To do so would require a change in the index methodology, resulting in a brand new index. Investors can receive exposure to several variations of Nasdaq-100 Excess Return through both futures indexes and index of indexes:

- An example of a futures index is the Nasdaq-100 Futures Excess Return™ Index (NDXNQER™).
  - It provides exposure to the nearest expiring E-mini Nasdaq-100 futures contract, which as a futures contract, does not have the return of any reference rate embedded.
- An example of an index of index is the Nasdaq-100 Volatility Control 10%™ Index (XNDX15E™), where the component index is the Nasdaq-100 Total Return™ Index (XNDX™)

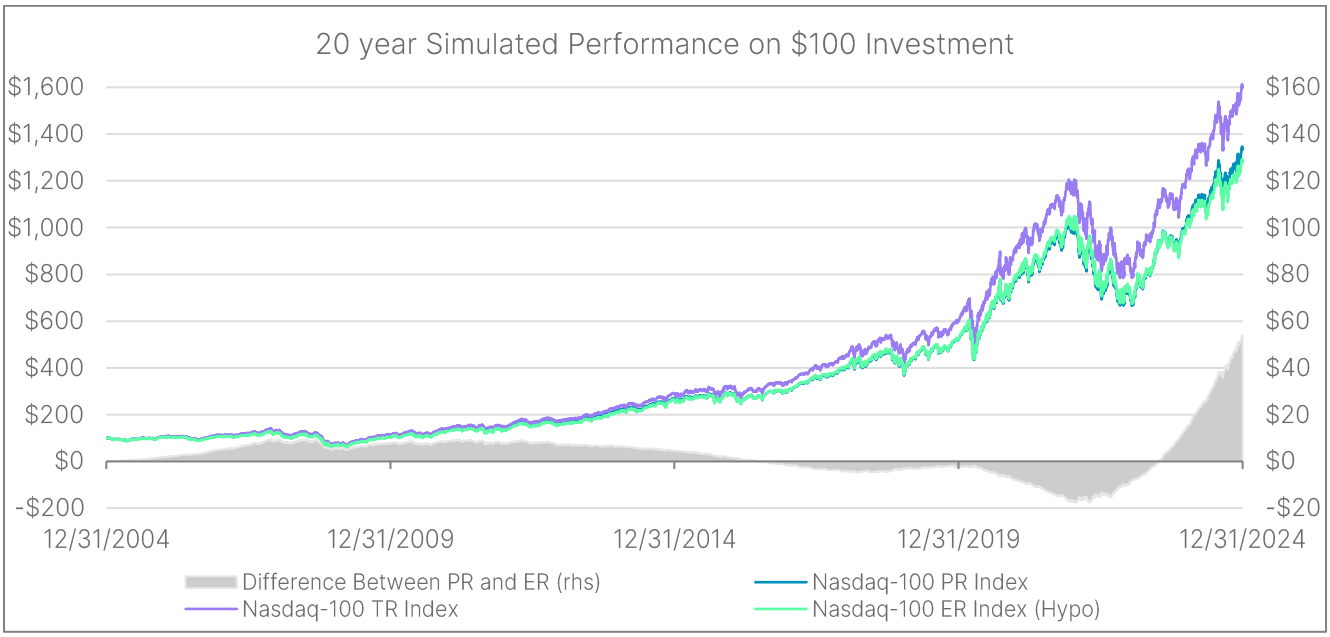
- XNDX15E subtracts out the daily effective federal funds rate (reference rate) from Nasdaq-100 Total Return Index (XNDX) and does not provide any exposure to the rate through any unallocated exposure.
- A component index is an index whose performance is derived from the performance of another index. For example, XNDX is a component index of the XNDX15E Index.

Excess Return Indexes are often used in Annuities and Structured Products and are particularly popular in Fixed Indexed Annuities (FIA). By excluding the interest yield on cash, these indexes reflect pure market growth, offering transparency between annuity returns and market movements. Additionally, the lack of cash yields means that the traders do not need to hedge the associated interest rate risk or take on borrowing costs for the cash, allowing for cost savings for both the insurance carrier and policyholder.

Nasdaq-100 Index Performance

To better understand the use cases and structural implications of different index return streams, a 20-year hypothetical performance simulation was conducted on variations of the Nasdaq-100®. This simulation examined an investor's performance when investing $100 in either a Price Return Index, a Total Return Index, or a Simulated Excess Return Index.

- The Simulated Excess Return Index for the Nasdaq-100 was created by taking the daily returns of the Nasdaq-100 *Total Return* Index and subtracting out the daily return of the Effective Federal Funds Rate. By doing so, the effects of dividends and underlying interest rates on the Index Returns was examined.



Source: Bloomberg. Data as of 12/31/2024. Index Performance on Left-Hand Y-Axis, Difference on Right-Hand Y-Axis (rhs).

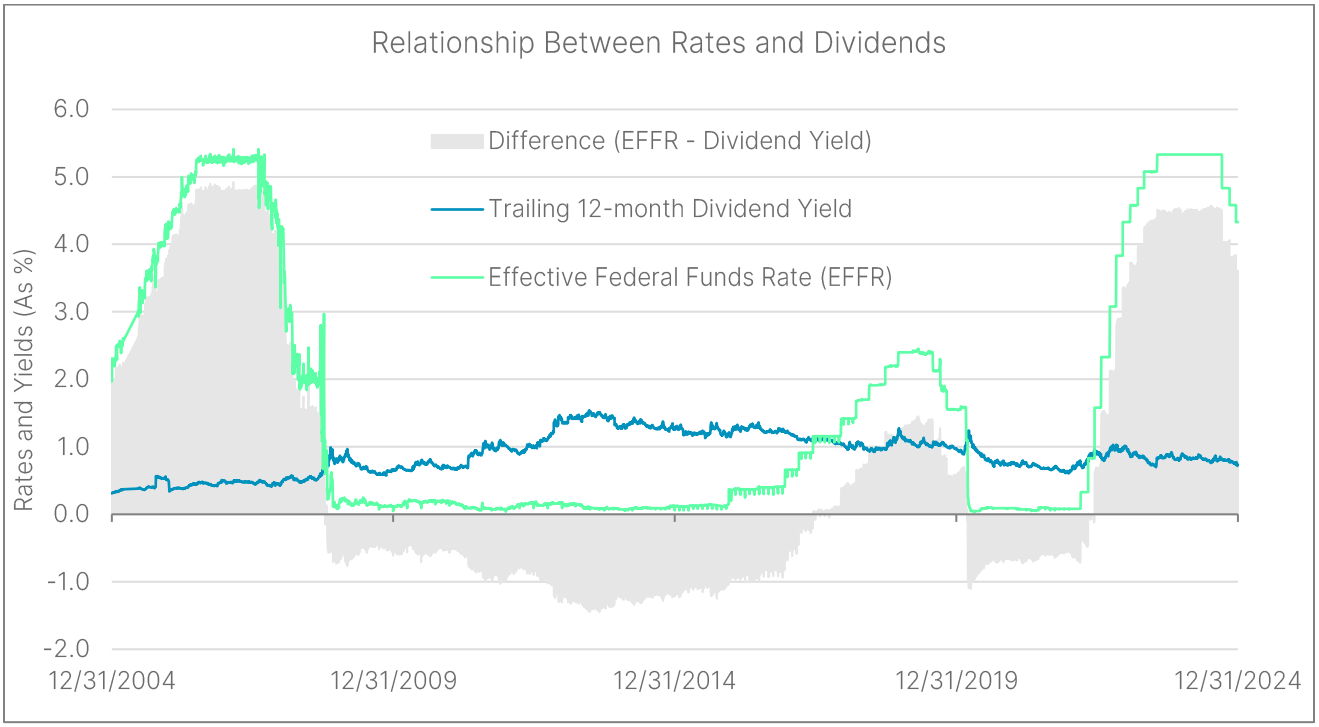
As expected, the Total Return Index consistently outperformed both the Price Return and Excess Return Indexes because it consisted of all return components (reference rate, risk premium, and periodic income in

the form of dividends). Where things begin to get interesting is understanding in which market regimes the Price Return vs. the Simulated Excess Return Index outperformed.

The above chart also shows the difference in return between the Price Return and simulated Excess Return Index (i.e. Excess Return of the Nasdaq-100 Total Return Index), represented by the y-axis on the right hand side. There are a few factors to keep in mind:

- A positively sloping line in the above chart means that PR is outperforming (and a reading above 0 means it has some amount of cumulative outperformance), while a negatively sloping line means ER is outperforming (and a reading below 0 means ER has cumulative outperformance).
- When PR is outperforming, it means that the return on the reference rate exceeds the return arising from dividends distributed by the Nasdaq-100 constituents. The opposite is true for periods of outperformance for ER, which includes the return of the dividends instead of the reference rate.

The performance of PR vs. ER can be split into three different market regimes, December 2004 – October 2008, October 2008 – June 2022, and June 2022 – December 2024. All three regimes had dividend yields mostly between 0% and 2%, while interest rates existed in a much larger band of 0 to 6%. The yields during this time are displayed in the chart below.



Source: Bloomberg. Data as of 12/31/2024.

The first and third regimes experienced high interest rates that exceeded the dividend yield. During these periods, the PR Index outperformed the ER Index. Specifically, a significant increase in capital appreciation due to a higher risk premium during the third regime resulted in a more noticeable divergence in performance.

Conversely, the second regime was characterized predominantly by near-zero interest rates while the dividend yield mostly exceeded these rates. As a result, the ER Index started to outperform the PR Index. Both regime changes were the result of systemic shocks to the financial markets, with the Financial Crisis of 2008 causing the Federal Reserve to lower interest rates and the 2022 Inflation Surge causing the Federal Reserve to raise interest rates.

These findings can be used to assess the primary drivers of returns in an index or its tracking product. For the Nasdaq-100, the dividend yield can mostly explain the difference in performance between the Price and Total Return Index. On the other hand, the interest rate environment can show how much of the Nasdaq-100's performance is attributed to its risk premium versus the return of a reference rate. This information enables investors to make informed decisions when investing in a product that tracks any Nasdaq index.

Conclusion

In conclusion, understanding the nuances between Price Return, Total Return, Net Total Return, and Excess Return indexes is crucial for making informed investment decisions. Each index serves a unique purpose and offers different insights into the performance of underlying assets. By recognizing the distinct components measured by each type of return—whether it be the comprehensive view of a Total Return Index, the capital appreciation-focused perspective of a Price Return Index, or the benchmark-relative analysis of an Excess Return Index—investors can better tailor their strategies to meet specific financial goals. As demonstrated by the historical performance of the Nasdaq-100 index variations, market conditions and interest rate environments play significant roles in determining which type of index exposure may be most beneficial.

Therefore, a thorough grasp of these concepts is required for investors to navigate the complexities of the market with greater precision and confidence.

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