Discussion of Discounting in Oil and Gas Property Appraisal

Because investors prefer immediate cash returns over future cash returns, investors pay less for future cashflows; i.e., they "discount" them. The amount investors discount the future cashflows depends on the length of time until the cash is due, the amount of risk that the cash will not be tendered when due and the rate of return available from alternative investments of comparable risk. This discounting procedure converts future income to present value usually using annual (as opposed to daily or monthly) discount factors. The discount factor for each successive year declines to reflect the reduced value of revenue received in the future. The appraiser calculates the present worth of the forecast revenue stream by multiplying the projected net income (cashflow) for each year by the calculated discount factor for that year. These discount factors are derived from the discount rate (also known as the yield rate), and the process is known as discounted cashflow (DCF) analysis.

The International Association of Assessing Officers in Property Appraisal and Assessment Administration (1990) defines "discount rate" as:

> *A**The rate of return on investment; the rate an investor requires to discount future income to its present worth. It is made up of an interest rate and an equity yield rate. Theoretical factors considered in setting a discount rate are the safe rate earned from a completely riskless investment (this rate may reflect anticipated loss of purchasing power due to inflation) and compensation for risk, lack of liquidity, and investment management expenses. The discount rate is most often estimated by band-of-investment analysis or a sales comparison analysis that estimates typical internal rates of return.@***

The discount rate is a key variable in discounted cashflow analysis, making correct rate selection crucial. The market's expectations are critical when estimating a discount rate. According to the Appraisal of Real Estate by the Appraisal Institute (1992):

> *A**The selection of a yield [discount] rate is critical to DCF analysis. To select an appropriate rate an appraiser must verify and interpret the attitudes and expectations of market participants, including buyers, sellers, advisers, and brokers. Although the actual yield on an investment cannot be calculated until the investment is sold, an investor may set a target yield for the investment before or during ownership. Historical yield rates derived from comparable sales may be relevant, but they reflect past, not future, benefits in the mind of the investor and may not be reliable indicators of current yield. Therefore, the selection of yield rates for discounting cashflows should focus on the prospective or forecast yield rates anticipated by typical buyers and sellers of comparable investments. An appraiser can verify investor assumptions directly by interviewing the parties to comparable sales transactions or indirectly by estimating the income expectancy and likely reversion for a comparable property and deriving a prospective yield rate.@***

The discount rate used in discounted cashflow analysis has several components. These include:

- **$ <u>Inflation rate</u>: The annual rate of price change for a basket of consumer goods. Inflation is normally measured by the Consumer Price Index for All Urban Consumers (CPI-U), calculated by the U.S. Bureau of Labor Statistics. The inflation rate is the most fundamental component of a discount rate. An investor's rate of return must equal the**

rate of inflation just to break even in real dollar terms.

- **$ Risk-free component: Also called the Aliquidity premium,@ this component compensates an investor for an investment in an asset that is then not readily available (like cash) for alternative investment options. This component reflects the time and cost of divesting the asset thus Afreeing@ the value (i.e., the return) for other investment opportunities. This component can also be defined as the risk-free rate minus the inflation rate.**

- **$ Risk-free rate: Also called the Asafe rate,@ the inflation rate plus the risk-free component equals the Arisk-free rate.@ This component mirrors the cost of money that is guaranteed, more or less, to be returned to the investor. It is typically measured by the yield to maturity on Federal government securities with a maturity period comparable to the investment under consideration (oil or gas reserves, or the interests therein, in this case). For oil and gas mineral interests which are held for the long-term, the comparable maturity period is typically taken to be 30 years. The market perceives these securities as risk-free for all practical purposes since they are issued by the United States government.**

- **$ General risk premium: A return to compensate the investor for assuming diversified company-wide risk. The weighted average cost of capital (WACC) minus the risk-free rate is the general risk premium. The WACC is measured by weighting the typical oil company debt and equity costs by the typical oil company debt and equity capital structure percentages, and then adding the weighted costs. If one were appraising companies, the WACC would be the discount rate since it reflects the market's expected yields from the stock and debt of a company.**

  For property tax purposes, appraisers estimate the value of individual mineral reserves, or the interests therein, not the value of oil companies. Buyers of mineral reserves, or the interests therein, usually perceive these individual reserves and interests as riskier than the stock and debt of an entire company. Companies can spread their risk over many individual mineral reserves and interests and often over several kinds of assets (some of which are unrelated to the oil or gas business). This asset diversification reduces the company's risk and, as a result, the WACC derived from company financial data is usually lower than an individual producing property's discount rate. However, the WACC is always higher than the risk-free rate. This increase in the rate is a general risk premium to reward investors for assuming the diversified company-wide risk.

- **$ Property-specific risk premium: A return that compensates the investor for assuming the unique risks associated with a particular mineral producing property. The discount rate minus the WACC is the property-specific risk premium. Or to put it another way, the discount rate minus the property-specific risk premium is the WACC. Investors demand a premium above the WACC to compensate them for this individual property risk. For certain high-risk properties, this premium can be quite high.**

The components of a discount rate appropriate for discounted cashflow appraisal of single oil and gas properties can thus be summarized:

	INFLATION RATE	Weighted Average Cost of Capital (WACC)
+	RISK-FREE COMPONENT (= LIQUIDITY PREMIUM)	
=	RISK-FREE RATE	
+	GENERAL RISK PREMIUM FOR INDUSTRY	
+	PROPERTY-SPECIFIC RISK PREMIUM	
=	DISCOUNT RATE FOR APPRAISAL	

There are other ways to "build up" a discount rate. This particular method shown above has an advantage in that the first four components are quantifiable from public data. The property-specific risk premium may be derived from available data in some cases, but in general the appraiser must estimate it as a specific component to be added to the overall discount rate. Alternatively, the appraiser can add or subtract property-specific risk to an appraisal by adjustment of other parameters in the discounted cashflow itself (production, price, and/or operating expense projections).

Application of Discounting in Oil and Gas Property Appraisals in Texas

As a general rule, Pritchard & Abbott, Inc., will apply the first four components of the discount rate Abuilt-up@ formula (risk-free safe rate, inflation rate, liquidity premium, and general risk premium), or the Weighted Average Cost of Capital (WACC), uniformly to all oil and gas properties in Texas. Property-specific risk premium will then be added or subtracted as needed at the discretion of the appraiser.

Property-specific risk premium can be incorporated into the appraisal as additional basis points that increase the discount rate. An increased discount rate lowers the derived fair market value by further reducing the present value of all forecasted future net income amounts. Alternatively, or in conjunction with an increased discount rate, property-specific risk can be incorporated into the appraisal by lowering the forecasted amounts of future net income to be discounted. This is accomplished by use of more conservative estimates of future yearly production amounts, total reserves remaining to be produced as of January 1, and/or increased allowance of future lease operating expense. These parameters either directly or indirectly affect derived fair market values for all the owners of a lease=s underlying mineral interests.

Property-specific risk factors can include the following:

- **One well lease;**
- **Oil lease with high water production;**
- **Lease near the end of its economic life;**
- **Gas well reservoir under partial or active water drive (recovery uncertain);**
- **Curtailed gas well;**
- **Rapidly declining lease;**
- **Lease with less than six (6) months production history;**
- **Secondary Recovery Project in early stages before fill-up;**
- **Offshore oil or gas lease;**
- **Unusually high operating expenses (ex: paraffin problems, sour gas, etc.); and/or**
- **Any other property-specific factors that increase the investor's risk.**

When assigning property-specific risk premium in an individual appraisal, the appraiser must be careful not to duplicate risk (or lack of it) already inherently incorporated into the derived value. For example, an overly pessimistic projection of future net income might be generated if the appraiser allows an inordinately high amount of operating expense when in reality sufficient property-specific risk has already been incorporated through a very conservative production decline forecast. This is not to imply that both parameters cannot concurrently incorporate elements of property-specific risk if, at the appraiser=s discretion, that would impart the appropriate amount of overall risk into the appraisal and thus generate a proper estimate of fair market value.

DERIVATION OF WEIGHTED AVERAGE COST OF CAPITAL USING "BUILT-UP" METHOD
PRITCHARD & ABBOTT, INC.

OIL AND GAS PRODUCING PROPERTIES
JANUARY 1, 2024

Component	Value
INFLATION RATE [1]	3.47%
+ LIQUIDITY PREMIUM (derived) [2]	0.71%
= RISK-FREE RATE ("SAFE RATE") [3]	4.18%
+ GENERAL RISK PREMIUM [4]	6.43%
= Subtotal = WACC	**10.61%**
+ PROPERTY-SPECIFIC RISK PREMIUM	varies by property
= DISCOUNT RATE FOR APPRAISAL	

[1] Medium to long-term average Consumer Price Index (CPI) inflation rate, U.S. Bureau of Labor Statistics. Monthly and yearly figures will vary.

[2] Liquidity premium is also called the "risk-free component."

[3] 30-Year U.S. Treasury Bond rate as of January 1 (or average of December and January). See: https://home.treasury.gov/resource-center/data-chart-center/interest-rates/TextView?type=daily_treasury_long_term_rate&field_tdr_date_value=2022

[4] Large company stock total returns less long-term government bond income returns, 1926-current, per Kroll's annual "Guide to Cost of Capital" publication ("long-horizon" historical), times Beta (relative volatility index) for oil and gas industry as a whole (not just large cap companies).

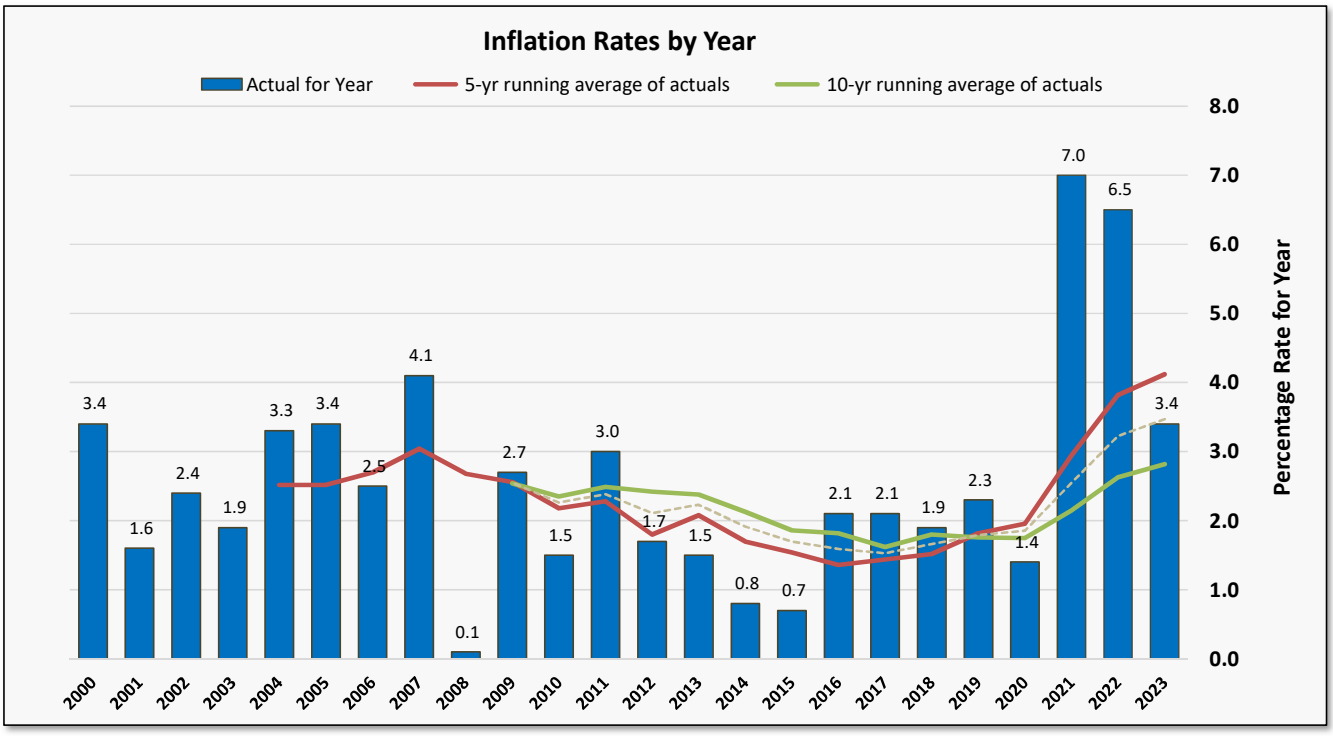
www.usinflationcalculator.com/inflation/current-inflation-rates/

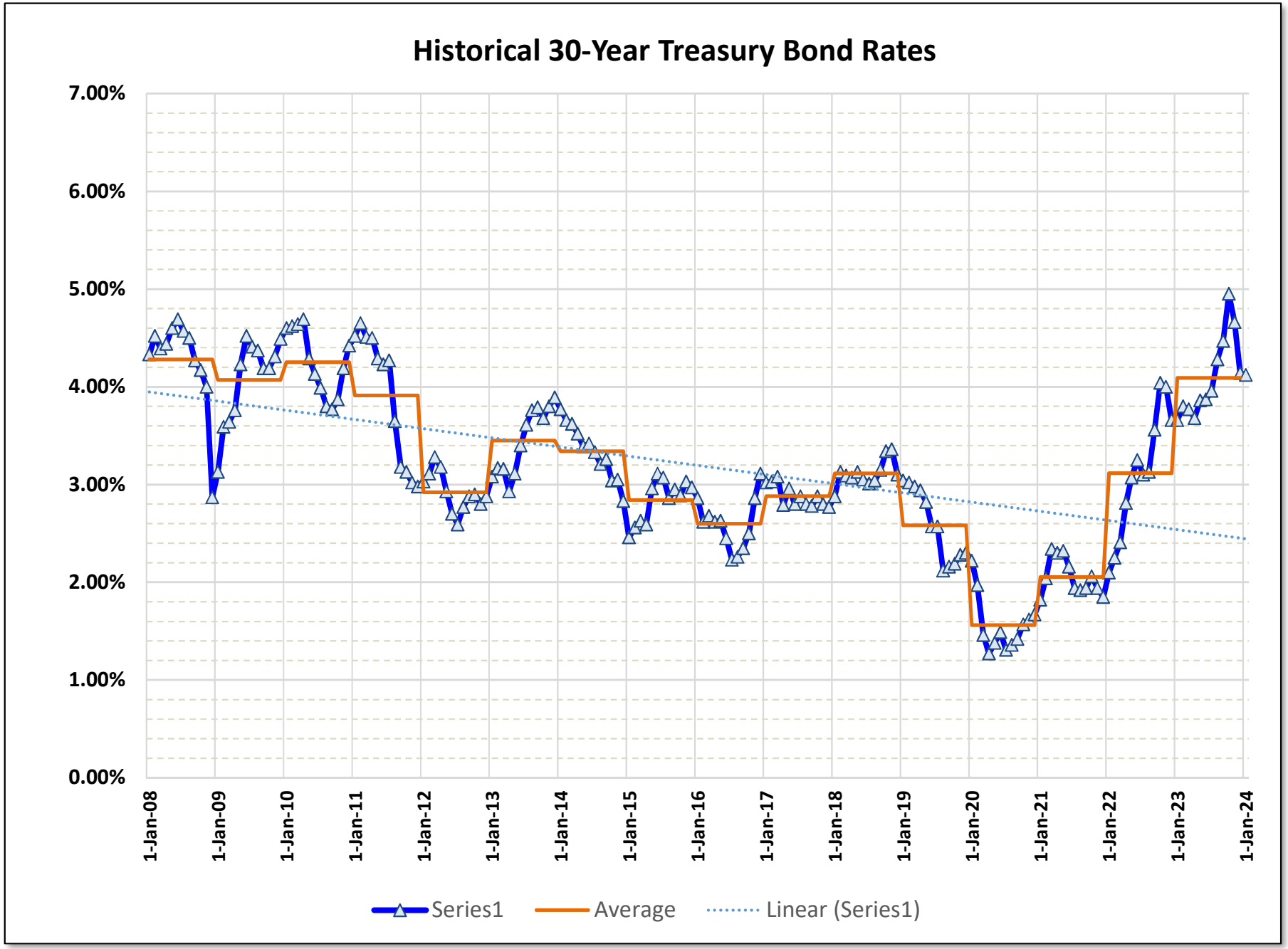
Table of Inflation Rates (%) by Month and Year (2000-2023)

Since figures in table below are 12-month periods (running averages), look to the December column to find actual inflation rates by calendar year. For example, the rate of inflation in 2016 was 2.1%. The very last column, "Ave," shows the average inflation rate using CPI data for each of the twelve reporting periods of the previous year. They are published by the BLS but are rarely discussed in news media, taking a back seat to a calendar year's **actual** rate of inflation.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave
2024													
2023	6.4	6.0	5.0	4.9	4.0	3.0	3.2	3.7	3.7	3.2	3.1	3.4	4.1
2022	7.5	7.9	8.5	8.3	8.6	9.1	8.5	8.3	8.2	7.7	7.1	6.5	8.0
2021	1.4	1.7	2.6	4.2	5.0	5.4	5.4	5.3	5.4	6.2	6.8	7.0	4.7
2020	2.5	2.3	1.5	0.3	0.1	0.6	1.0	1.3	1.4	1.2	1.2	1.4	1.2
2019	1.6	1.5	1.9	2.0	1.8	1.6	1.8	1.7	1.7	1.8	2.1	2.3	1.8
2018	2.1	2.2	2.4	2.5	2.8	2.9	2.9	2.7	2.3	2.5	2.2	1.9	2.4
2017	2.5	2.7	2.4	2.2	1.9	1.6	1.7	1.9	2.2	2.0	2.2	2.1	2.1
2016	1.4	1.0	0.9	1.1	1.0	1.0	0.8	1.1	1.5	1.6	1.7	2.1	1.3
2015	(0.1)	-	(0.1)	(0.2)	-	0.1	0.2	0.2	-	0.2	0.5	0.7	0.1
2014	1.6	1.1	1.5	2.0	2.1	2.1	2.0	1.7	1.7	1.7	1.3	0.8	1.6
2013	1.6	2.0	1.5	1.1	1.4	1.8	2.0	1.5	1.2	1.0	1.2	1.5	1.5
2012	2.9	2.9	2.7	2.3	1.7	1.7	1.4	1.7	2.0	2.2	1.8	1.7	2.1
2011	1.6	2.1	2.7	3.2	3.6	3.6	3.6	3.8	3.9	3.5	3.4	3.0	3.2
2010	2.6	2.1	2.3	2.2	2.0	1.1	1.2	1.1	1.1	1.2	1.1	1.5	1.6
2009	-	0.2	(0.4)	(0.7)	(1.3)	(1.4)	(2.1)	(1.5)	(1.3)	(0.2)	1.8	2.7	(0.4)
2008	4.3	4.0	4.0	3.9	4.2	5.0	5.6	5.4	4.9	3.7	1.1	0.1	3.8
2007	2.1	2.4	2.8	2.6	2.7	2.7	2.4	2.0	2.8	3.5	4.3	4.1	2.8
2006	4.0	3.6	3.4	3.5	4.2	4.3	4.1	3.8	2.1	1.3	2.0	2.5	3.2
2005	3.0	3.0	3.1	3.5	2.8	2.5	3.2	3.6	4.7	4.3	3.5	3.4	3.4
2004	1.9	1.7	1.7	2.3	3.1	3.3	3.0	2.7	2.5	3.2	3.5	3.3	2.7
2003	2.6	3.0	3.0	2.2	2.1	2.1	2.1	2.2	2.3	2.0	1.8	1.9	2.3
2002	1.1	1.1	1.5	1.6	1.2	1.1	1.5	1.8	1.5	2.0	2.2	2.4	1.6
2001	3.7	3.5	2.9	3.3	3.6	3.2	2.7	2.7	2.6	2.1	1.9	1.6	2.8
2000	2.7	3.2	3.8	3.1	3.2	3.7	3.7	3.4	3.5	3.4	3.4	3.4	3.4

SHORT-TERM	MEDIUM-TERM	LONG-TERM	LONG-TERM
3-yr running average of Dec. actuals	5-yr running average of Dec. actuals	10-yr running average of Dec. actuals	Avg of 5-yr and 10-yr running averages
5.63	4.12	2.82	3.47
4.97	3.82	2.63	3.23
3.57	2.94	2.15	2.55
1.87	1.96	1.75	1.86
2.10	1.82	1.76	1.79
2.03	1.52	1.80	1.66
1.63	1.44	1.62	1.53
1.20	1.36	1.82	1.59
1.00	1.54	1.86	1.70
1.33	1.70	2.13	1.92
2.07	2.08	2.38	2.23
2.07	1.80	2.42	2.11
2.40	2.28	2.49	2.39
1.43	2.18	2.35	2.27
2.30	2.56	2.54	2.55
2.23	2.68		
3.33	3.04		
3.07	2.70		
2.87	2.52		
2.53	2.52		
1.97			
2.47			




Historical 30-Year Treasury Bond Rates
7.00%
6.00%
5.00%
4.00%
3.00%
2.00%
1.00%
0.00%
1-Jan-08
1-Jan-09
1-Jan-10
1-Jan-11
1-Jan-12
1-Jan-13
1-Jan-14
1-Jan-15
1-Jan-16
1-Jan-17
1-Jan-18
1-Jan-19
1-Jan-20
1-Jan-21
1-Jan-22
1-Jan-23
1-Jan-24
Series1
Average
Linear (Series1)