The Pension
Forum

Volume 13, Number 1 July 2001

TABLE OF CONTENTS FOR DISCOUNTED VALUE RETURNS ACTUARIAL PRINCIPLES APPLIED TO PERFORMANCE ANALYSIS

Page

DISCOUNTED VALUE RETURNS
ACTUARIAL PRINCIPLES APPLIED TO PERFORMANCE ANALYSIS

by Jon Spain, BSc, FIA, ASA, FCIArb

Abstract: This article is written against the United Kingdom background of occupational defined benefit retirement benefit scheme actuarial valuations over the last 30 years or so. While there has recently been pressure building up towards using market related returns, it is too early to say how far there has been any real change. That will only become apparent over the next two years, following which another article may then be timely.

In the United Kingdom, it has been traditional to treat assets in a similar manner to the liabilities. Bearing in mind that trustees are not forced sellers, pension scheme actuaries have reflected the perceived luxury of being able to take a long-term view rather than being forced to take the assets at market value. The assets are then treated in the same way as the liabilities, namely by discounting anticipated prospective proceeds. How that is done for different asset classes is a matter of detail not dealt with in this article.

In the early 1980s, I became convinced that performance measurement related to market values alone was not giving the trustees (or sponsor) sufficient information. Worse, I felt the results were positively misleading. As a simple example, suppose that two consecutive TWRs (market related time weighted returns, the normal statistic) are 20 % pa and -10 % pa, respectively. Ignoring compounding, the average return was 5 % pa. The first year's statistic was a poor indicator of what was to come.

The volatility of market value returns (or "MVRs") is very familiar to actuaries but the chart in Chart 1 gives a perspective for U.K. equities.

This is by no means my first article on this topic. The original articles were mainly printed in "The Investment Analyst" (1983-87). Around the same time, papers were accepted by the International Association of Consulting Actuaries (Bermuda 1986) and "Trust Law & Practice" (1986). Later on, in association with Nick Ryan, four further articles were published in "The Actuary (U.K. edition)" (1991). Since then, I have been occupied by other things but I have now returned!

The fairly simple algebraic definition of what I call "DVR" (discounted value return) is attached. It is based upon discounting prospective proceeds (capital and income) such that, over the period being analysed, the DVR satisfies a continuum condition over the period as a whole. In practice, other assumptions need to be made, such as dividend growth or when assets are sold. A survey of 27 U.K. schemes over 1979-84 indicated that the results were not unduly influenced by modest changes in such assumptions.

My initial thoughts were that DVR is "better" than MVR because it is far more stable (the volatility is effectively smoothed out). However, this ignores that, in reality, the trustees must have eventual liquidation in mind. For it cannot reasonably be assumed that a scheme will survive for ever. This gives market value some place, but certainly not the

dominant role, in the trustees' long-term planning process. After further thought, I have surmised that trustees might, and should, be interested in market value returns smoothed over, say, 10 years, upon which I have generally concentrated.

In a recent paper to the Institute of Actuaries (28 February 2000; see below), the comment was made that *"it is quite normal for a test of manager skill to require 15 years of data before that skill can be statistically proven"* (§ 3.10.4). This persuaded me that I should also look at periods lasting 15 years rather than 10 years.

A few 10 year curves are shown on my Web site (*www.jonspain.com/dvr*) for different combinations of period and asset class. For this article, I shall concentrate upon U.K. equities for the period starting on 31 December 1977. The portfolio analysed is the reinvested index (actual portfolios are not available).

Over the whole 10 years, the MVR was 21.0 % pa and the DVR was 19.5 % pa. What I am more interested in is how far the DVR is better at tracking the ultimate MVR. Over the first period of 3 years, the MVR and DVR were 17.5 % pa and 21.2 % pa, respectively. As percentages of 21.0 % pa, these represent 83 % and 101 %.

In Chart 2, I show the cumulative DVR (blue) and the cumulative MVR (green) as percentages of the final MVR (the horizontal yellow line) achieved over the whole period. In general, the blue line is nearer to the yellow line than the green line. Overall, this indicates a "better fit", which I have called *"DVR divergence."* The lower the number, the better. The ratio of the two areas (between blue and yellow and between green and yellow) is 0.453, which is pretty good. What about other periods?

Staying with U.K. equities, Chart 3 shows how the DVR divergence for 10 year periods varies over time. In general, DVR turns out to be a much better estimator of the eventual MVR than for MVR itself. There are, of course, exceptions such as 1979-89. For the 26 values available, the mean was 0.70 with a standard deviation of 0.37.

Turning to 15-year periods, what do the DVR divergence levels for U.K. Equities look like? Well, see Chart 4. Visually, low values being desirable, the DVR divergence levels appear to be better over 15 years than over 10 years (Chart 3). For the 21 values available, the mean was 0.55 with a standard deviation of 0.21.

Finally, I thought I would compare the two series of results. For simplicity, I have looked at periods having a common starting point. Other possible comparisons include having a common end or having the 10 years falling elsewhere within the 15 years. Chart 5 shows that the 15 year DVR divergence levels can be worse than over 10 years, but not by much. However, the extreme values seen in Chart 3 are avoided.

What I have tried to show is that showing short-term performance figures related to market values alone will normally not lead to sensible results over the longer term, which is crucial for trustees. While sponsors may wish to tell shareholders a different story, that should not blind them to the long-term funding consequences. There is an alternative called "DVR", which I advocate should be far more widely used.

A sports analogy may be helpful. In advising trustees, I think investment managers tend to play volleyball, close to the net. Trustees need advisors who play rugby, with the posts in the far distance, aiming at conversion into sustained returns. Going back to the 20 % pa/- 10 % pa example with which I started, being told that I lost a lot of the wonderful return in the second year is simply annoying. The original 20 % pa was certainly not helpful and I would want something better than that.

Comments are invited. For more background, please visit "www.jonspain.com/dvr," or email me at *dvr@jonspain.com.*

The above represents my own views and it should not be taken as being in any way supported by, or representative of, my employer.

Reference

"The Concept of Investment Efficiency and its Application to Investment Management Structures" (TM Hodgson, S Breban, CL Ford, MP Streatfield and RC Urwin).

APPENDIX : THE DEFINITION

Inevitably, the definition is mathematical but it's really not too heavy. Take a time interval (0,t) over which we are monitoring performance (whether the interval is open or closed can be ignored). The term **"DV"** always refers to **"discounted value."**

Define MV_0 *(*MV_t*)* to be the portfolio market value at time 0 (time t). For simplicity, we shall initially exclude net cashflows.

Suppose that the ***"DVR"*** is $100j$ % pa (which is what we're trying to determine).

Define "f' to be a single-valued operator such that, at time u, we define DV_u by

$$DV_u = f\{MV_u, j\}$$

Then, if there are no cash flows, we require

$$DV_0 * ((1+j)^t) = DV_t$$

If there are net cash flows (benefits paid or contributions receivable), then they can be accommodated by accumulating from the payment dates until the end of the interval at the same rate of return.

In practice, for bonds, ***"f"*** would take the form of an amortization formula, allowing for capital and interest. For equities, something along similar lines could be adopted. Such formulae have been commonly adopted in the past. Other parameters may well be needed but the above has been generalized.

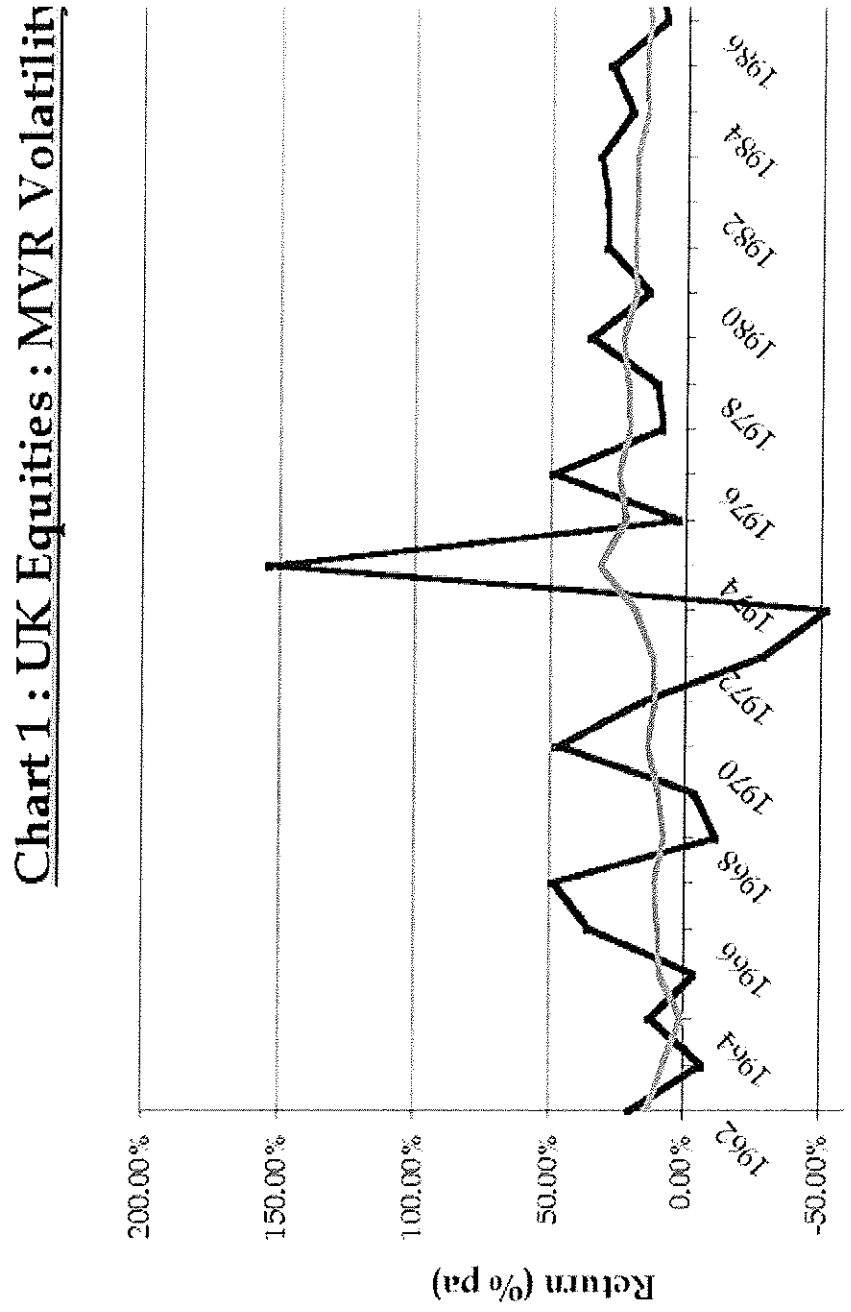
Chart 1 : UK Equities : MVR Volatilit
Return (% pa)
200.00%
150.00%
100.00%
50.00%
0.00%
-50.00%
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986

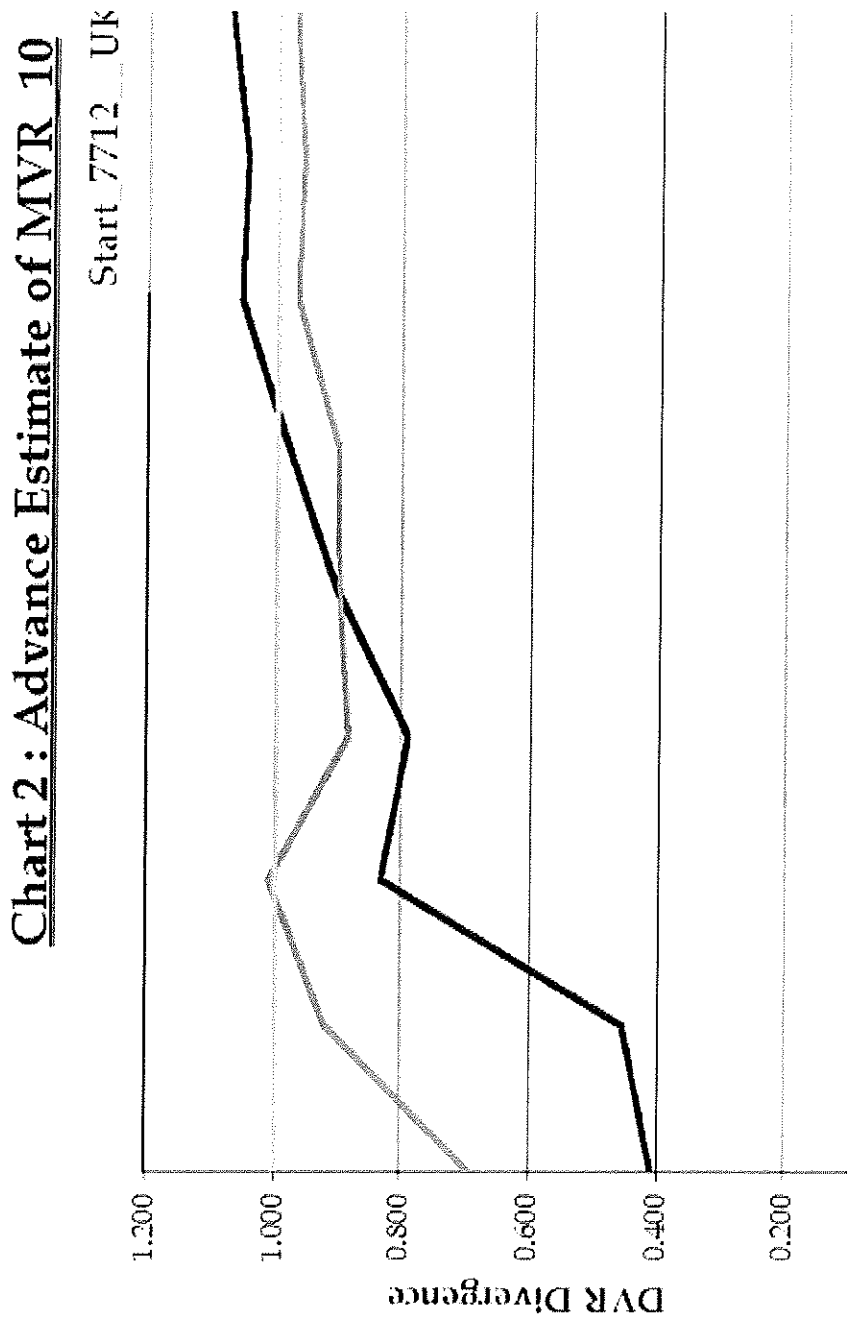
Chart 2 : Advance Estimate of MVR 10
Start 7712 UK
DVR Divergence
1.200
1.000
0.800
0.600
0.400
0.200

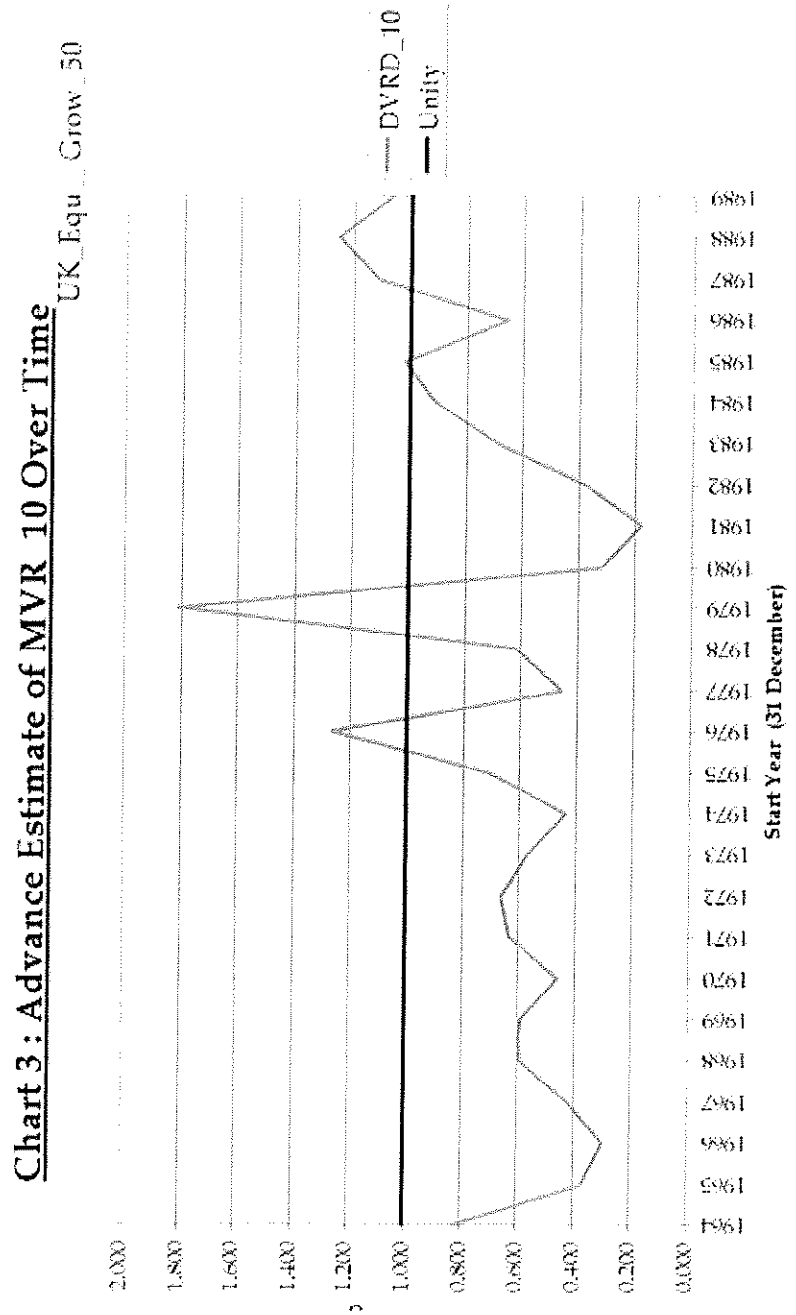
Chart 3 : Advance Estimate of MVR_10 Over Time
UK_Equ_Grow_50
DVRD_10
Unity
2.000
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
Start Year (31 December)

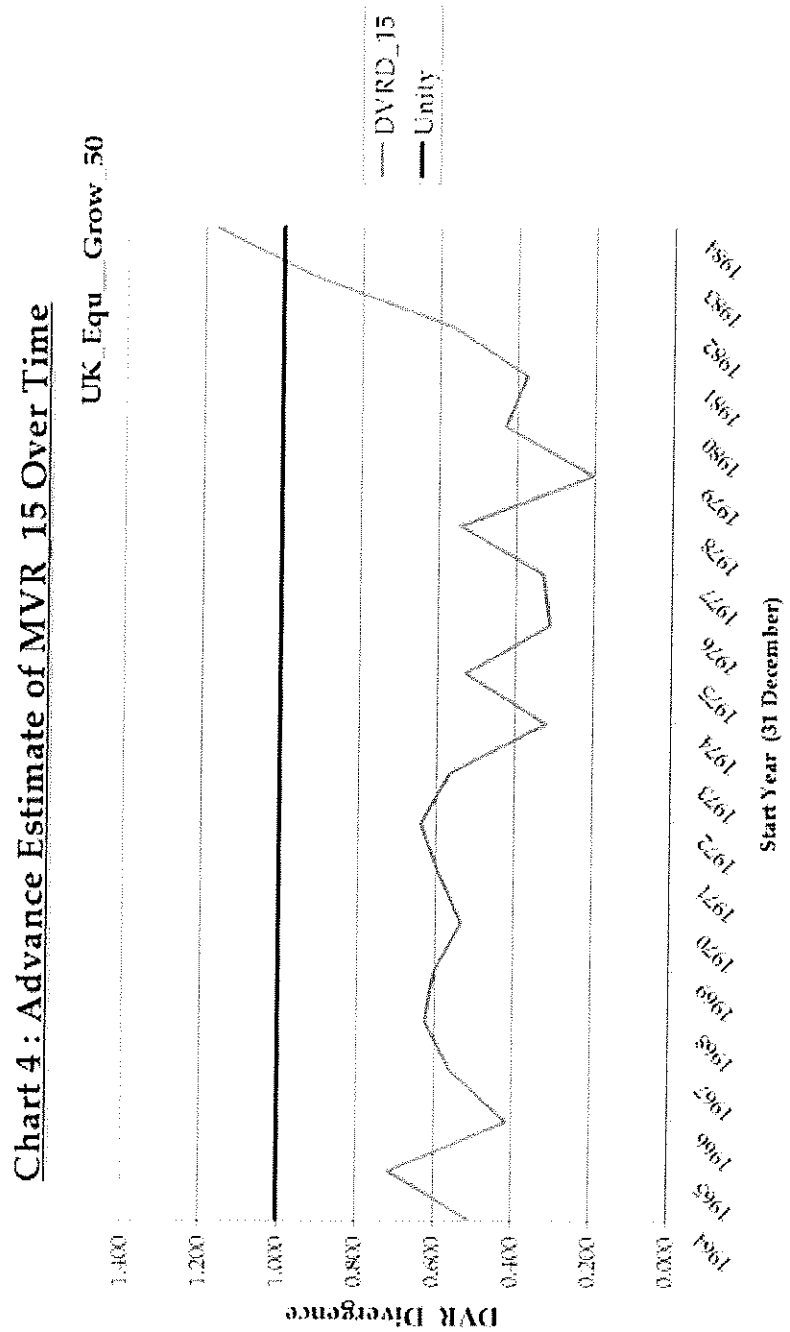
Chart 4 : Advance Estimate of MVR_15 Over Time
UK_Equ_Grow_50
DVRD_15
Unity
DVR Divergence
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
Start Year (31 December)

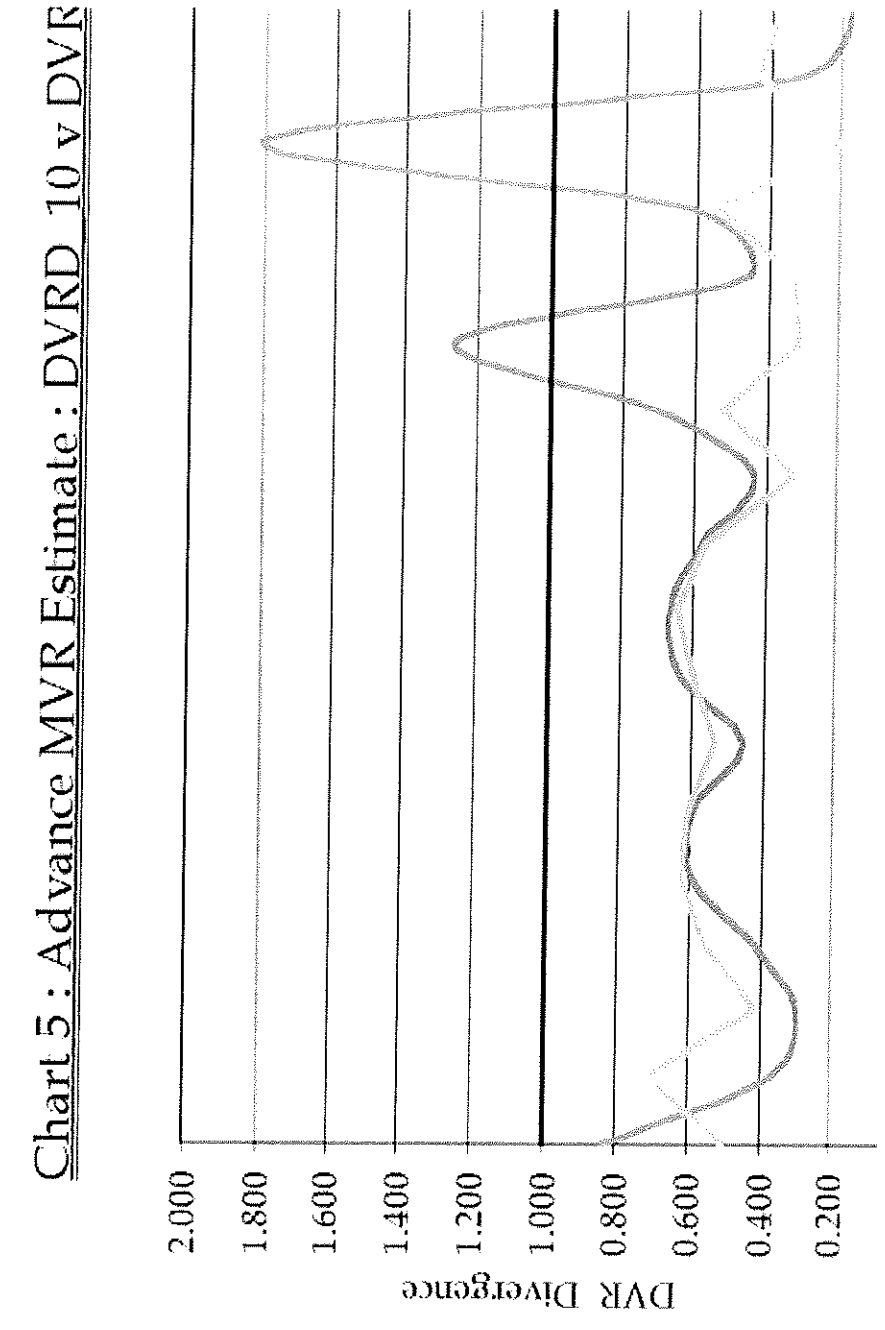
Chart 5 : Advance MVR Estimate : DVRD 10 v DVR
DVR Divergence
2.000
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200