# Downside Risk Alert and
# Downside Risk Alert International

## Frequently Asked Questions

This document is quite long, but we prefer to provide answers to common questions in a single document.  We encourage you to read the entire document.  But if time is short, browse the document and focus just on those questions of most interest.  Thank you!

1. **How do I know if Downside Risk Alert or Downside Risk Alert International is worth my consideration?**

   - Do you believe avoiding losers can be as important to portfolio performance as finding winners?
   - Do you believe price volatility is an incomplete measure of a stock's downside risk?
   - Do you believe the factors holding back a stock's performance are often different from the factors that drive a stock upward?
   - Do you believe it's often more difficult deciding when to sell a stock than deciding when to buy?

   If you answered 'yes' to these questions, then we believe it's worth your time to take a look at these highly predictive risk management tools.

2. **What are Downside Risk Alert and Downside Risk Alert International?**

   "DRA" and DRA Int'l are subscription services that provides clients with an objective assessment of a stock's probability of underperforming market averages over the next 3 – 24 months.

   DRA provides downside risk ratings for all stocks (excluding REITs) in the MSCI U.S. IMI[1].  The U.S. IMI includes about 2300 U.S. based stocks, almost all of which exceed $200M in market cap.  We also offer a special DRA SmallCap version covering firms from $50M to $5B in market cap.  DRA Int'l provides downside risk ratings for all stocks (excluding REITs) in the MSCI All Country World Index Ex–U.S. IMI.  The ACWI Ex–U.S. IMI includes about 6000 international stocks, almost all of which exceed $200M in market cap.  For client convenience, RIR provides two versions of DRA Int'l: one that covers all 6000 IMI members and the other that covers just the 1750 large and mid-cap stocks included in the MSCI All Country World Index.

   DRA and DRA Int'l evolved from extensive research to identify specific investment attributes that tend to precede poor relative stock returns.  Based on these research findings, DRA and DRA Int'l analyze stock-specific risk from three broad investment perspectives: Valuation (i.e., value plus growth), Financials, and Sentiment.  Stocks are scored against a wide variety of investment criteria that RIR calls "research concepts", each of which has historically predicted downside risk.  The individual research concept scores are aggregated into a DRA composite score.  The lower a stock's current composite score, the more likely that stock will underperform in the future.  More details are provided below.

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[1] MSCI's uses "IMI" (Investable Market Index) to describe any index that includes all large, mid, and small caps stocks that cumulatively comprise 99% of the market capitalization of the geography covered by the index.

**3. How can Downside Risk Alert (and DRA International) help an equity manager's investment process?**

DRA is a risk-oriented stock selection tool designed to help improve equity portfolio performance while saving research time and expense. DRA's versatility makes it useful for analysts and portfolio managers, quants and non-quants alike.

DRA can be employed as an independent stock review tool external to the current investment process to help managers:
- **Make better sell decisions**
  - Identify stocks to immediately sell from portfolios
  - Isolate probable underperformers and their specific risk factors to focus portfolio reviews
  - Reduce behavioral biases associated with evaluating existing holdings
  - Prepare for earnings reporting season
- **Make better purchase decisions**
  - Evaluate new research ideas from a devil's advocate perspective
  - Confirm or veto potential purchase decisions
  - Create a "green light" screen of buy ideas worthy of further research

For highly quantitative managers, DRA can be internally integrated into most stock selection and portfolio management strategies and models in numerous ways. For example, quants can:
- Add the DRA composite as a new factor to an existing multifactor model
- Extract individual DRA research concepts that are powerful or uncorrelated with existing multifactor model components and add them as new factors to the model
- Add the DRA composite score as a new risk factor in the portfolio optimization process
- Use DRA as an integral component to a quantitative, rules-based product such as a new equity strategy, mutual fund, or ETF

**4. What motivated the research behind Downside Risk Alert and DRA International?**

Avoiding losers is just as important to equity portfolio performance as holding winners, yet "underperformance forecasting" doesn't seem to receive the attention it deserves. Why?

From a stock selection standpoint, most analysts focus their research on finding stocks to buy and upside potential, so a downside risk perspective is often lacking. Brokerage firm analysts are notorious for their biased recommendations. Despite stepped-up regulatory requirements, less than 10% of brokerage firm ratings are 'sells' and those few panned stocks perform similarly to analysts' favorite stocks! Independent research providers are often little better.

From a risk management perspective, great progress has been made in equity portfolio risk measurement. But when it comes to individual stocks, even defining risk is a common obstacle. Stock-specific risk is often defined as price volatility (e.g., standard deviation of recent returns), but most volatility measures defy common sense in treating upward and downward price movements as equally risky. The old textbook definition of a stock's risk – beta – is crude, prompting a parade of academic researchers to add more risk factors to their explanatory models. Even in sophisticated portfolio risk management systems (e.g., Barra, Northfield, Axioma), stock-specific risk is defined as price movement that can't be attributed to a stock's

benchmark relative 'exposures' to factors such as size, growth/value, and leverage. These portfolio tools leave it up to the user to manage stock-specific risk the risk models cannot explain. Finally, some investors, often acolytes of Benjamin Graham or Warren Buffett, argue that "permanent loss of capital" is the most important risk to be avoided in equity investing. We agree with this mindset, but a mindset is not a methodology.

*Revelation Investment Research believes that producing reliable forecasts of which stocks are most likely and least likely to lag market averages provides a unique complementary perspective that can help investors make better sell decisions <u>and</u> better buy decisions.* RIR was founded to make this belief become a reality, and DRA and DRA Int'l are those tools.

### 5. Why is it so important to minimize downside risk within an equity portfolio?

As said earlier, avoiding losers can be just as important to improving portfolio returns as holding winners. But there are two other key reasons that money managers should take special care to minimize downside risk.

First, simply reducing a strategy's volatility can increase the strategy's long-term return. Downside volatility harms long-term return compounding. A portfolio that loses 25% in one period and gains 30% the next has a positive average return but a negative compounded return. Since investment returns vary through time, average per-period returns are always less than geometric or compounded returns. This phenomena has been called "variance drain" or "volatility drag" and can be quantified in a simple formula: $G = A - \left(\frac{S^2}{200}\right)$,

Where: G = Geometric return, A = Average return, S = Standard Deviation of returns. Applying this formula, the table below shows how four hypothetical strategies with the same average return but different volatilities generate significantly different compounded returns and wealth accumulation. All things being equal, lower volatility leads to higher compounded returns.

| Impact of Volatility on Return Compounding | | | | |
|---|---|---|---|---|
| Investment Strategy | Avg Return | Stdev of Returns | Geometric Return | 20 Year Growth of $1 |
| 1 (high volatility) | 10% | 22% | 7.58% | $4.31 |
| 2 | 10% | 18% | 8.38% | $5.00 |
| 3 | 10% | 14% | 9.02% | $5.63 |
| 4 (low volatility) | 10% | 10% | 9.50% | $6.14 |

Second, minimizing downside risk can increase client confidence and retention. Money managers conducting portfolio reviews know how client attention always gravitates toward the losers in a portfolio. Discussing losing positions can be a distraction that undermines client confidence. All things being equal, the fewer losing positions and the smaller the losses, the happier the client. Even more important is minimizing losses at the portfolio level. For long-only strategies, it's impossible to always generate positive returns, but a great way to calm skittish clients is to outperform during down markets.

We believe DRA and DRA Int'l can be an excellent tools to reduce downside risk among individual holdings and at the aggregate level for equity portfolios (see Questions 14 & 15).

**6. Why do so many investors struggle deciding when to sell a stock?**

Aside from the informational issues outlined in Question 4, RIR would argue that sell decisions are more likely than any other to trigger the psychological biases brought to light by behavioral finance researchers. Psychologists have found that investors aren't just risk averse as finance theory dictates. Investors are extremely loss averse since the pain felt from losses is 2 – 3 times as acute as the pleasure felt from gains.

Unfortunately, loss aversion can trigger many decision-making problems for asset managers. For example, investors tend to anchor on the price paid for a stock, effectively adding cost basis – something unknown to the market and irrelevant to the stock's future prospects – as an additional input to their hold vs. sell decisions. Aversion to losses leads to the disposition effect, the tendency for investors to sell winners too soon (so they can't become losses) and to hold on to losers too long (in hope they recover and become winners). There are other ways investor psychology can hinder sell decisions. Behavioral scientists have found that people tend to place a higher value on things they own than non-owners do – known as the endowment effect. People tend to look for information that supports their ownership decision and discount conflicting information – known as confirmation bias. There is also the tendency for people to sit pat with what they own rather than buying more or selling – known as status quo bias. We could go on, but space doesn't permit.

So what can be done to minimize these psychological biases? The key goal for investors is to retain objectivity and avoid letting emotions drive decisions. Behavioral finance experts recommend employing independent third party reviews, having someone play the devil's advocate role, utilizing checklists, requiring decisions to be data driven, predefining sell rules, and ignoring your cost basis. We suggest that DRA and DRA Int'l can function in any and all of those ways!

**7. What methodology was used to develop Downside Risk Alert (and DRA International)?**

Revelation Investment Research's ("RIR") research mission is to discover ways to anticipate weak market performance for individual stocks and to package our research insights into useful tools for equity managers. Downside Risk Alert is the result of extensive research to identify specific investment characteristics that tend to precede poor future relative stock returns.

RIR would describe its research methodology as 'fundamentally driven, quantitatively executed'. Good old fashioned fundamental and valuation analysis is the backbone of our research. But unlike most research providers, RIR's analysts don't spend their time tackling one stock at a time, searching for one-off fundamental/valuation issues, or developing industry-specific expertise. Instead, RIR focuses its research on finding metrics that can reliably assess the downside risk for all types of companies. We utilize quantitative tools to search for these universal factors and to combine them into a holistic viewpoint (more details in Questions 8, 9, 10 & 12). We believe that DRA scores provide a solid foundation and a great starting point for additional in-depth or top-down research an equity manager may want to conduct on individual stocks and/or industries.

RIR has found underperformance forecasting to be an extremely fruitful area of research inquiry. As evidence, we have found that many of the most reliable indicators of poor performance are distinctly different from those commonly used for making purchase decisions. Yet we know we are far from done. Our current list of future research ideas is lengthy and experience has taught us that the more research we do, the more new ideas we will generate. We expect that DRA will continue to evolve to reflect our latest research findings and as markets and their participants change (see Question 31).

**8. How does RIR research potential components for inclusion in Downside Risk Alert (and DRA International)?**

At RIR, we always formulate a hypothesis for why and how a variable might be related to returns <u>before</u> running any type of backtest. We require financial, economic, structural, or behavioral reasons to hypothesize why a variable might capture some form of market mispricing. By contrast, first observing a variable's historical relationship with returns, and then spinning a story as to why that relationship has existed can be a dangerous way to fool yourself into believing you've discovered something meaningful. We're not saying one can't learn from empirical analysis or that a failed hypothesis is always the end of the road, but it's best to proceed with caution.

We begin researching most potential predictor variables by creating what we call an "excess return profile" to better understand that variable's historical relationship with subsequent returns. To create an excess return profile for a test variable, we rank stocks into cohort portfolios at a point in time and compile the subsequent return for each cohort portfolio relative to the equal weighted test universe for a designated holding period. This process is repeated at each rebalance date in the historical test period. The excess return profile is then created by averaging the relative returns for each cohort over all the rebalancing dates in the test period.

To illustrate, the chart below shows an excess return profile for stocks independently ranked according to three different variables: Mean Estimated 5-Yr EPS Growth, 3-Year Sales Growth, and 3-Month Net Revisions in Current Fiscal Year EPS Estimates (these are simple examples; none are used in Downside Risk Alert).



**Examples of 'Excess Return Profiles'**
**(MSCI U.S. IMI members, 2003-2023)**
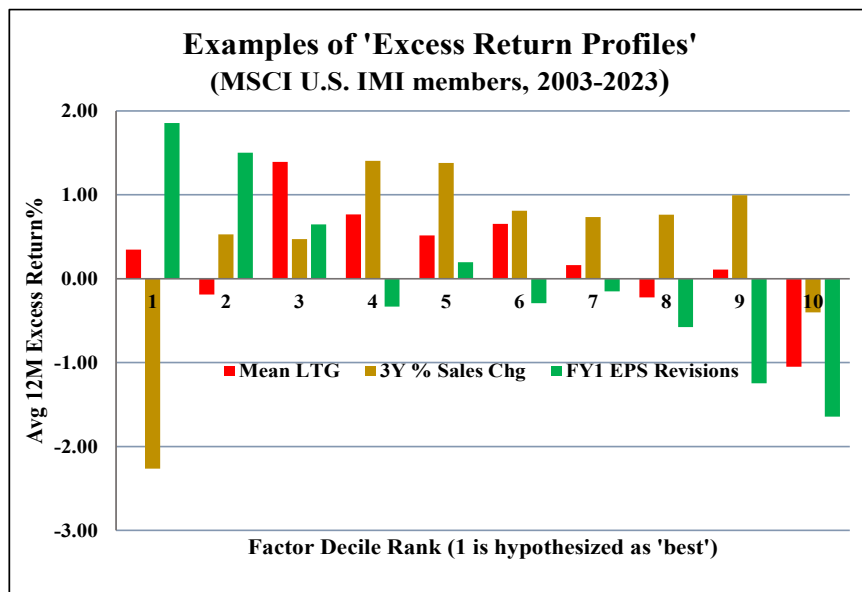
Notice that the excess return profile (red bars) for Mean LTG shows essentially a random relationship between a stock's 5-Year EPS Growth Estimate and subsequent returns. Variables with no systematic relationship to future returns (which describes most variables) are discarded from further research. By contrast, the excess return profile (green bars) for FY1 Estimate Revisions looks more promising, as we see that as recent EPS

revisions become more positive, subsequent returns have been higher.  Variables with essentially linear excess return profiles are usually retained for further research.

The excess return profile (gold bars) for the 3Yr Sales Change variable is more unusual.  Note that stocks with either high or low revenue growth rates have underperformed while stocks with average revenue growth have outperformed.  Most researchers seek variables with linear relationships with future returns, and therefore, generally would reject variables like 3Yr Sales Change.  At RIR, we *sometimes* retain variables with a systematic, but non-linear return relationship for further research.  For example, if we have a rationale for why investors might dislike extreme 3Yr Sales Change rates, we could create a new transformed variable with a more desirable excess return profile.  To illustrate, we re-ranked stocks according to how much their 3Yr Sales Change differs from the median stock's growth rate (hypothesis: extreme growth rates are 'bad').  That factor transformation process yielded a new variable with a potentially more useful relationship with subsequent returns, particularly for identifying poor future performers.

DRA's Tail Risk research concept utilizes this "distance from the median" transformation for several financial measures where RIR research has found that stocks with extreme values to have high downside risk (for more details about the benefits and risks of this approach, see RIR's January 2015 Research Brief).

**3Yr Revenue Chg: Transformed Factor**
**(MSCI U.S. IMI members, 2003-2023)**
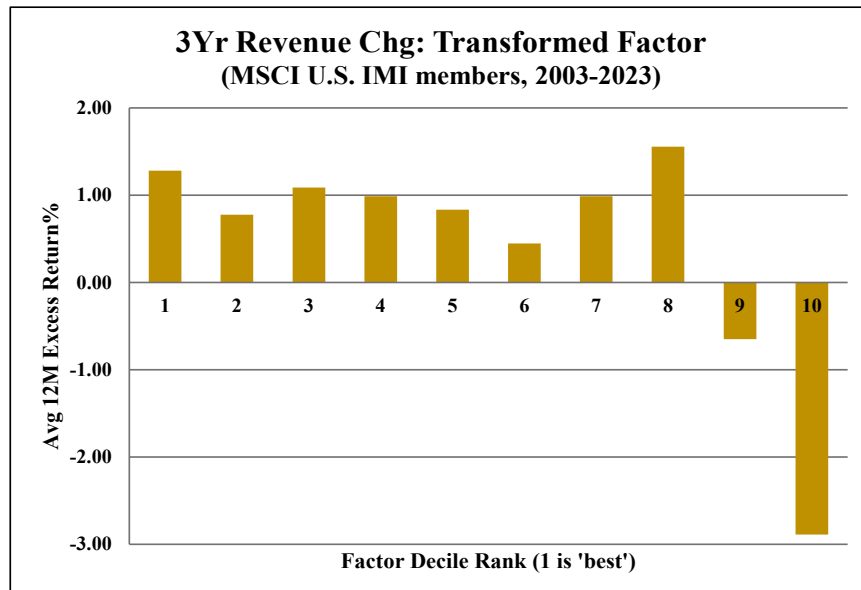


### 9.  How are the component factors selected for Downside Risk Alert (and DRA International)?

The single most important attribute we look for in a potential DRA input is the ability to predict downside risk in the form of negative excess returns over holding periods of 3 – 24 months (ability to predict positive excess returns is also desirable, but of secondary importance). Consistency of predictive power through time and different market environments is also very important in evaluating a potential input to DRA.

Observing that a candidate variable has historically been related to subsequent returns is necessary, but not sufficient.  We also assess whether the mispricing that a variable captures will persist in the future by looking for "barriers to arbitrage".  We believe that factors that make investors do something that's psychologically or institutionally uncomfortable are most likely to persist.  For example, the value anomaly has persisted for

decades because 1) stocks ranked well by value factors often have visible problems with their businesses and have had weak stock price performance making these stocks are uncomfortable to buy, and because 2) the payoff to value factors tends to be lumpy which makes value investing uncomfortable during occasional length periods when it doesn't appear to work. By contrast, the earnings surprise anomaly has largely been arbitraged away over the past two decades. Since it's not uncomfortable to buy stocks that have reported good news, earnings surprise factors came into wide use once investors learned that doing so had historically led to outperformance. Consequently, strategies such as buying stocks that have just reported positive earnings surprises to ride "post-earnings announcement drift" no longer work.

After years of research, RIR has a library of research concepts that have been and are expected to continue to be powerful, consistent predictors of downside risk. From this library, research concept factors are selected for inclusion in DRA according to their ability to independently add to DRA's expected future performance. Relative to other DRA inputs, the more uncorrelated a potential factor's values and the more uncorrelated its effectiveness has been through time, the more likely that factor would be included in the Downside Risk Alert composite model.

**10. What are the underlying component inputs to Downside Risk Alert and DRA International?**

DRA analyzes stock-specific risk using 12 diverse research concepts, each representing a different thread of RIR's ongoing downside risk research. The risk rationale behind DRA's research concept inputs are generally intuitive and most have been validated by independent academic or practitioner research. Each DRA research concept is a multifactor construct (i.e., comprised of 2 – 5 input factors) to be more comprehensive and to yield greater predictive power.

DRA Int'l analyzes stock-specific risk using 16 diverse research concepts which are similar to DRA's inputs. DRA and DRA Int'l inputs differ for two reasons. First, a few DRA research concepts utilize data that is generally unavailable for international stocks. Second, we enhanced the predictive power of DRA Int'l by swapping several DRA inputs for alternative research concepts that were more effective on the international equity universe. Upon special client request, RIR can provide DRA "Global" scores that rate all domestic and international stocks using the DRA Int'l input factors. DRA Global provides direct comparability between U.S. and international stocks, but at the cost of being somewhat less predictive on the U.S. stocks alone.

Full details about the DRA and DRA Int'l research concepts and their rationales are provided only to clients, but a few examples for DRA are provided in the table below. Note that some concepts like Valuation may be familiar, but others like Tail Risk stem from DRA's unique focus on predicting downside risk.

| DRA Research Concept | Downside Risk Rationale |
| --- | --- |
| Valuation | Stocks with low adjusted free cash flows relative to their enterprise values, low EPS growth relative to their earnings yield, and low/negative shareholder yields tend to underperform |
| Fundamental Growth | Stocks with weak and inconsistent revenue, income, free cash flow, and dividend growth tend to underperform |
| Financial Stability | Stocks with highly variable revenue and cash flow tend to underperform |
| Surprise Persistency | Stocks that fail to consistently meet or beat EPS forecasts tend to underperform |
| Tail Risk | Stocks with very high or low revenue & EPS growth and gross margins tend to underperform |
| Sector Specific | Stocks with weak scores on highly predictive factors within their sector tend to underperform |

**11. How different are the Downside Risk Alert (and DRA International) inputs from other stock selection approaches?**

To aid client understanding, we sometimes organize DRA's research concepts into valuation, financial, and sentiment groupings. Please don't let these familiar labels fool you into thinking that DRA's input components are simply the same old factors that 'everyone' uses. DRA's objective of predicting negative long-term relative returns has led to a model formulation that's different in many ways:

- DRA includes factors that would never be found in a traditional cross-sectional multifactor model (e.g., factors with stronger ability to predict negative returns than positive returns)
- DRA employs numerous other proprietary non-linear factors selected and formulated to best capture downside risk (e.g., see Question 8)
- DRA excludes many short-term factors often found in equity models (e.g., price momentum)
- DRA also excludes familiar risk measures (e.g., Altman Z-Score) that are outdated (weak) and don't work on all types of companies.

**12. How are the Downside Risk Alert (and DRA International) research concept scores combined to create the DRA composite score?**

DRA's research concepts are assigned scores on a scale of +5 to -5. For most DRA inputs, underlying factor values have been transformed so that the +5 to -5 scores are equivalent to uniform decile rankings. Negative research concept values mean that a stock is expected to underperform according to that factor's independent perspective.

The DRA composite score for each stock is computed by *summing* the individual research concept scores. Though DRA's research concept scores are equal weighted, we noted in Question 10 that these concepts are actually small multifactor models. So at the base level of individual factors, DRA's input factors are not equal weighted – stronger factors have more weight and weaker factors less weight in compiling the DRA composite score.

**13. How stable are Downside Risk Alert and DRA International scores through time?**

Very stable.  DRA and DRA Int'l are designed to provide an objective assessment of a stock's probability of underperforming market averages over the next 3 – 24 months.  With the long-term investor in mind, the DRA research concepts were chosen and calibrated to balance sensitivity to stocks' changing risk prospects with stability that gives users time to review scores and minimize portfolio turnover.
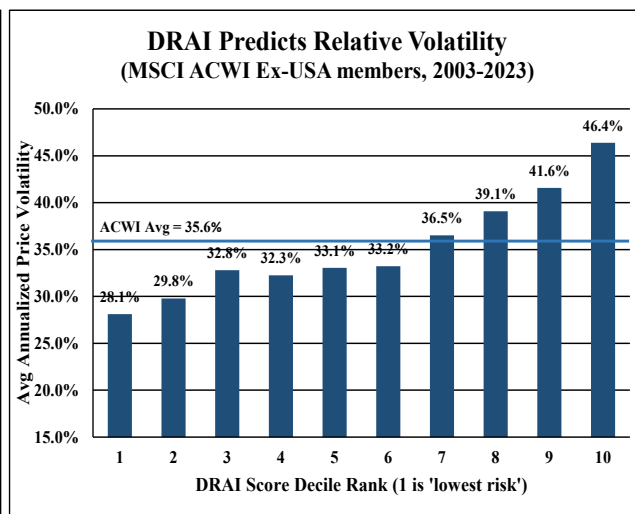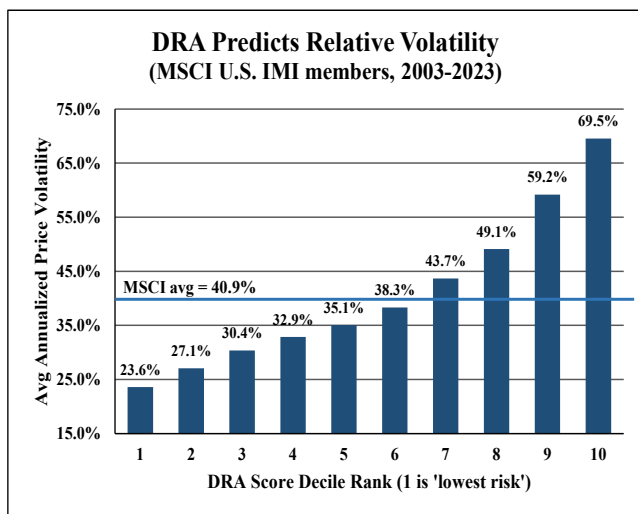
The tables below shows the magnitude and rate of change for DRA and DRA Int'l decile ranks over different time intervals.  Over 55% of stocks have had no change in their decile rankings on a monthly basis, and over 70% of stocks' decile ranks have changed by 2 or less over the following 12 months (green ovals).

| Downside Risk Alert Score Persistence | | | | | |
|---|---|---|---|---|---|
| | Absolute Change (up or down) in DRA Deciles | | | | |
| Time Interval | No Change | 1 | 2 | 3 | 4 or more |
| 1 Month | 55.0% | 37.1% | 6.6% | 1.1% | 0.2% |
| 3 Months | 39.1% | 39.6% | 15.2% | 4.7% | 1.5% |
| 6 Months | 32.2% | 37.1% | 18.5% | 8.0% | 4.1% |
| 12 Months | 27.3% | 33.9% | 20.0% | 10.7% | 8.1% |

| Downside Risk Alert International Score Persistence | | | | | |
|---|---|---|---|---|---|
| | Absolute Change (up or down) in DRAI Deciles | | | | |
| Time Interval | No Change | 1 | 2 | 3 | 4 or more |
| 1 Month | 56.8% | 34.0% | 6.5% | 1.8% | 0.9% |
| 3 Months | 36.8% | 37.7% | 15.8% | 6.2% | 3.5% |
| 6 Months | 29.5% | 34.7% | 18.9% | 9.6% | 7.3% |
| 12 Months | 22.5% | 29.9% | 19.9% | 12.8% | 14.9% |

## 14. How well do Downside Risk Alert and DRA International predict future risk?

The charts below show that DRA and DRA Int'l have been excellent predictors of future 12-month stock price volatility, a simple equity risk measure. Stocks that DRA and DRA Int'l score as having the least downside risk (e.g., deciles 1 – 3) have had the least future price volatility, and stocks scored as having the most downside risk (e.g., deciles 8 – 10) have had the most future volatility. Note that average volatility increases across the DRA and DRA Int'l deciles, but the largest volatility increments are found between deciles 1 & 2 and 9 & 10.
(Note: The DRAI ACWI Ex-US universe excludes small caps, so DRAI risk prediction looks more muted than DRA's in these charts.)



**DRA Predicts Relative Volatility**
(MSCI U.S. IMI members, 2003-2023)

MSCI avg = 40.9%

| Decile | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Value | 23.6% | 27.1% | 30.4% | 32.9% | 35.1% | 38.3% | 43.7% | 49.1% | 59.2% | 69.5% |



**DRAI Predicts Relative Volatility**
(MSCI ACWI Ex-USA members, 2003-2023)

ACWI Avg = 35.6%

| Decile | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Value | 28.1% | 29.8% | 32.8% | 32.3% | 33.1% | 33.2% | 36.5% | 39.1% | 41.6% | 46.4% |

Volatility measures bi-directional price movement, but downside volatility is what investors fear. RIR uses a second investment risk measure – probability of a future stock price "blow-up" – to describe a downside risk event investors wish to avoid. As long-term investors, we define a price blow-up as a time period where a stock's price fell significantly and stayed down (not as a large one-day down spike). To illustrate, the charts below show the average proportion of stocks in each DRA and DRA Int'l decile experiencing a 'blow up' defined as a future three-month price drop of 20% or more relative to the test universe. Clearly, large subsequent price drops become more common as DRA or DRA Int'l scores get worse.



**DRA Predicts Stock Price "Blow-ups"**
(MSCI U.S. IMI members, 2003-2023)

| Decile | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Value | 1.1% | 2.1% | 3.4% | 4.8% | 6.3% | 8.0% | 10.9% | 14.5% | 19.7% | 30.9% |



**DRAI Predicts Stock Price "Blow-ups"**
(MSCI ACWI EX-USA members, 2003-2023)

| Decile | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Value | 2.8% | 3.9% | 5.5% | 5.4% | 5.9% | 6.5% | 7.5% | 9.0% | 11.2% | 17.7% |
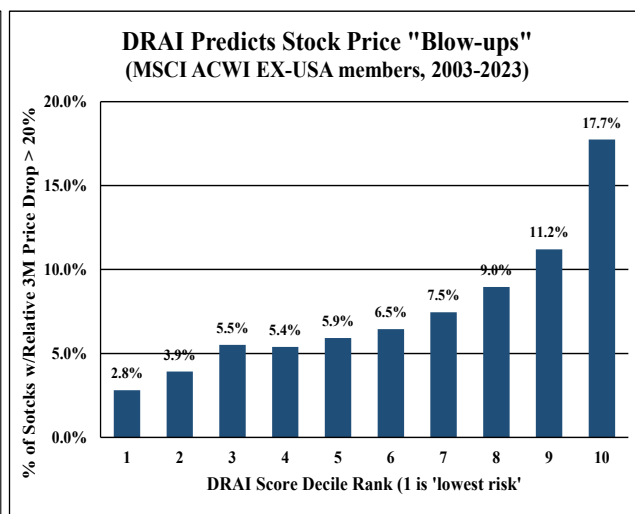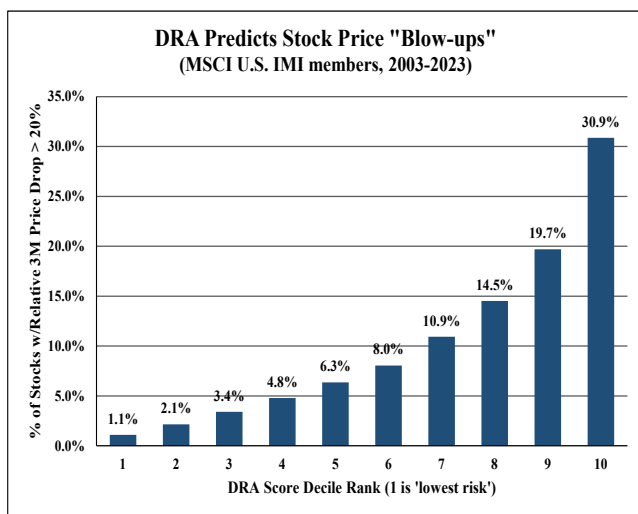
**15. How strong is the relationship between Downside Risk Alert and DRA International scores and subsequent returns?**

Very strong! Generally speaking, the worse a stock's DRA score, the more likely that stock has underperformed and the weaker that stock's return has tended to be. The converse is also true.
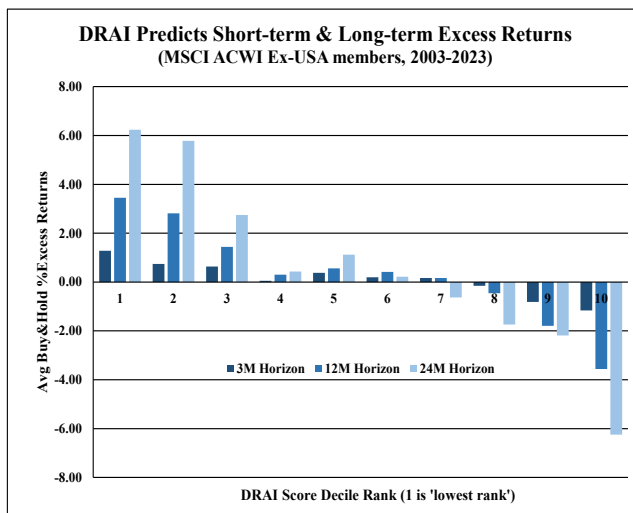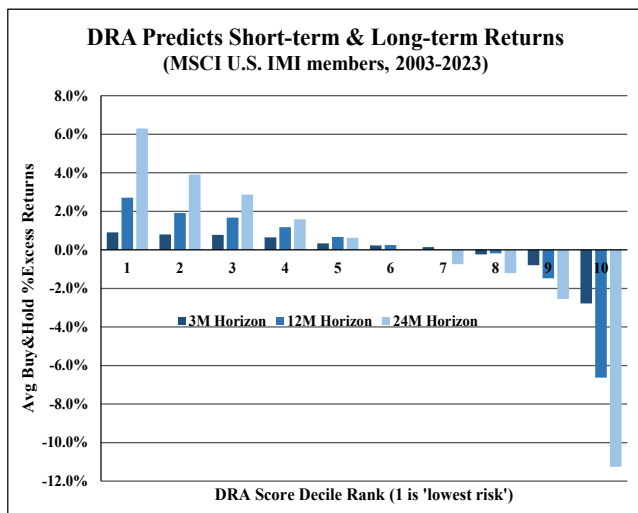
To illustrate, the charts below shows the strong relationship between DRA score and subsequent returns in two different ways. The bars show the average annual return (left Y-axis) of all stocks in each DRA decile portfolio relative to an MSCI coverage universe (i.e., cohort return minus universe return). The line shows the average proportion of stocks (right Y-axis) within a DRA decile cohort that underperformed the test universe. For example, stocks in DRA decile 10 have underperformed by over 500bps for 12-month holding periods and nearly 65% of the individual stocks in that cohort have underperformed. By contrast, stocks in DRA decile 1 have outperformed by over 200bps over 12-month periods and about 53% of the stocks in that cohort have outperformed (note: only ~45% of stocks in the overall universe outperform). Clearly, DRA's ability to deliver strong excess returns in deciles 1 and 10 has not been attributable to a just few big winners and losers. Likewise, DRA International's ability to identify winners and losers has been strong within the MSCI ACWI Ex-US members (and even stronger on the ACWI Ex-US IMI that includes small cap stocks).

The most foundational use of DRA and DRA Int'l is to "avoid losers", but the power DRA and DRA Int'l to identify 'high risk-low return' stocks to avoid <u>and</u> 'low risk-high return' stocks to consider buying is apparent.
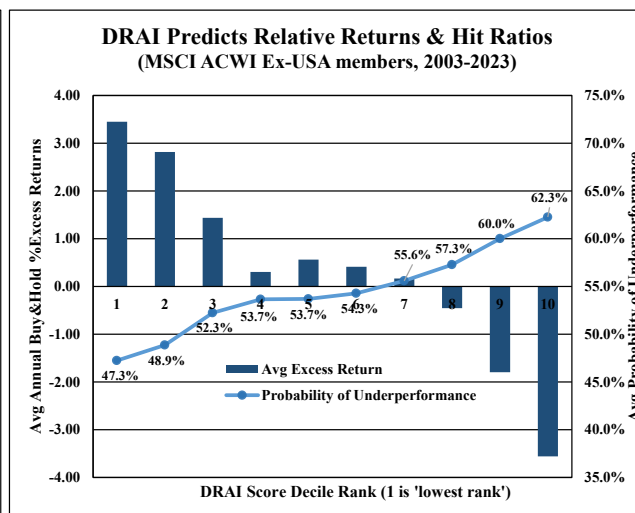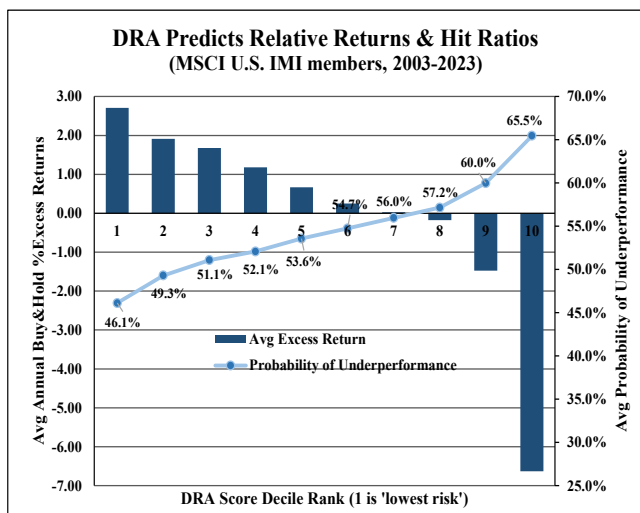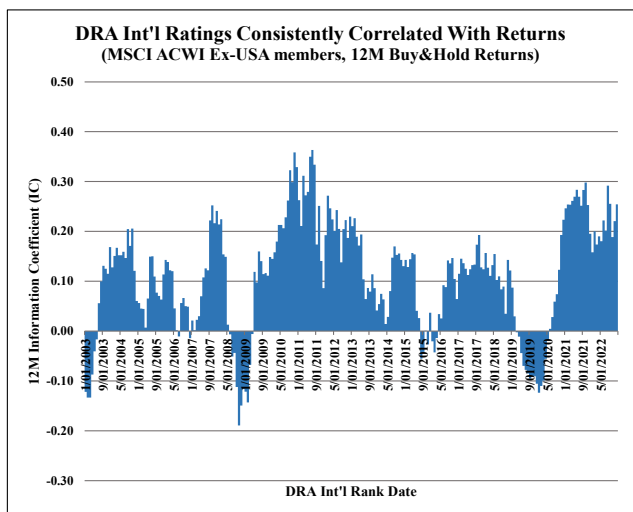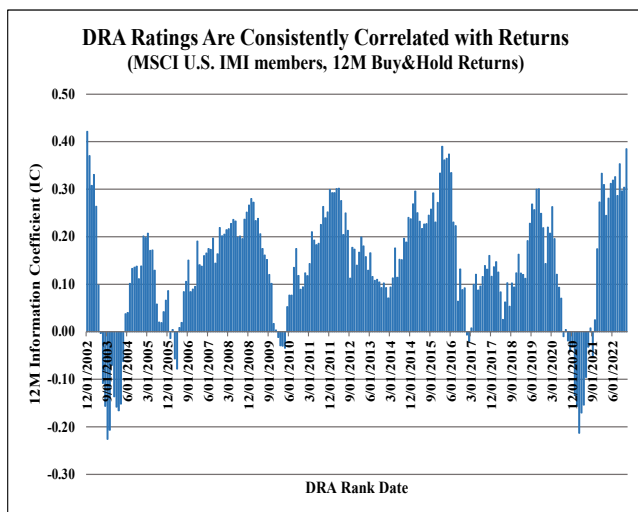
### 16. How well do Downside Risk Alert and DRA Int'l perform over various buy-and-hold time horizons?

The charts below show how DRA and DRA Int'l return prediction power expands significantly as the investment horizon increases. This lack of 'signal decay' is highly desirable, very unusual, and consistent with these models' design as a risk management tools for longer-term investors.



DRA Predicts Short-term & Long-term Returns
(MSCI U.S. IMI members, 2003-2023)



DRAI Predicts Short-term & Long-term Excess Returns
(MSCI ACWI Ex-USA members, 2003-2023)

### 17. Does Downside Risk Alert (and DRA International) only work in down market periods?

No. Downside Risk Alert is a stock selection methodology, not a market timing tool. That said, DRA's risk avoidance perspective historically has worked best when investors become more risk averse, which typically occurs during short-term market corrections or during more protracted bear markets. But over full market cycles, DRA and DRA Int'l have been solid in both up and down markets. To illustrate, the charts below show that the correlation (i.e., Information Coefficient or IC) between DRA and DRA Int'l ratings and subsequent twelve-month returns has generally been positive and significant through time.



DRA Ratings Are Consistently Correlated with Returns
(MSCI U.S. IMI members, 12M Buy&Hold Returns)



DRA Int'l Ratings Consistently Correlated With Returns
(MSCI ACWI Ex-USA members, 12M Buy&Hold Returns)

**18. Why is Downside Risk Alert (and DRA International) such a powerful predictor of returns?**

Downside Risk Alert is an excellent stock selection tool for two reasons:
- DRA scores are correlated with the direction of future news reports on companies' fundamentals, especially negative news.
- More importantly, DRA scores are strongly correlated with investor reaction to future news, especially when that news is negative.

Let's take a step back to better understand how Downside Risk Alert ability to highlight stocks' relative riskiness translates into an ability to predict relative returns. Textbooks define the fair price of an investment as the sum of all future cash flows discounted back to the present according to the risk or uncertainty of receiving those cash flows. This relationship can be expressed in simplified form in the equation: $Price = \sum_{t=1}^{\infty}[CF_t / (1+r)^t]$. For stocks, prices reflect investors' current collective expectations of future cash flows and an appropriate discount rate. Therefore, the key to finding mispriced stocks is identifying where investor cash flow expectations and/or risk perceptions will most likely prove to be inaccurate.

Most investment research focuses (directly or indirectly) on estimating the numerator of the valuation equation, usually by forecasting future earnings rather than cash flows. But it is very difficult to consistently produce earnings forecasts that are meaningfully more accurate than consensus expectations. Most sell-side analysts don't do it well, though a few quantitative approaches that have had some success (e.g., Schwab's Equity Ratings). Furthermore, RIR's research suggests that the payoff to anticipating earnings surprises has been shrinking over time.

Frankly, RIR is puzzled why so little research has been aimed toward developing better forecasts for the denominator of the fair value equation: the discount rate. Risk perception changes move stocks prices just as directly as do cash flow (or EPS) expectations changes. Furthermore, stock returns often are asymmetric in time, well expressed in the familiar phrase, 'bad news travels fast'. DRA and DRA Int'l were designed specifically to predict potential "risk perception surprises". In fact, RIR believes that <u>the riskiest stocks are those where consensus risk perceptions are too low</u>. Any news (sometimes even positive announcements) on one of these highly vulnerable stocks can lead to a negative risk reassessment that triggers a stock price drop.

**19. What are the common characteristics of the stocks Downside Risk Alert (and DRA International) identify as 'risky'?**

DRA and DRA Int'l both utilize a diverse, weight-of-the-evidence approach in arriving at their downside risk assessments, meaning that individual stocks rarely share the same profile. However, poorly-rated stocks collectively tend to possess many of the same negative, perhaps even speculative risk attributes.
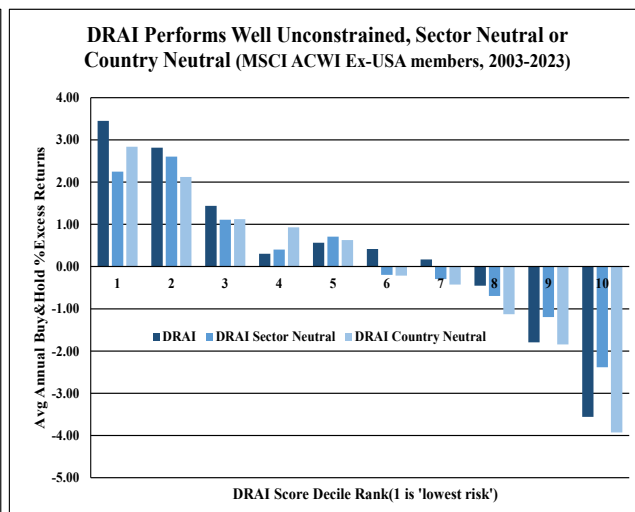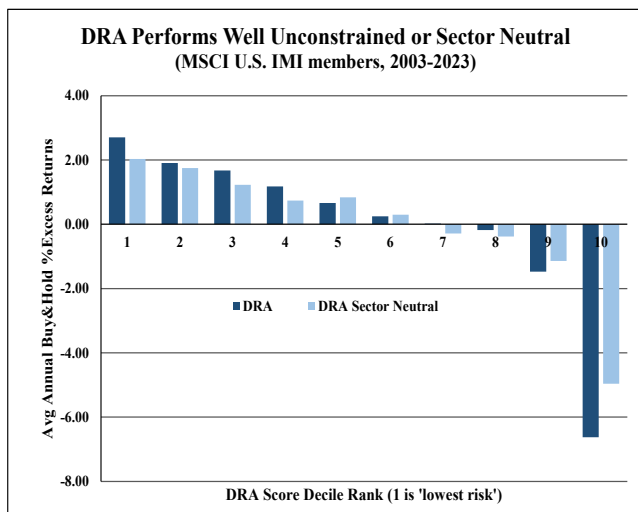- Valuation perspective: high valuation multiples, lower market capitalization
- Financials perspective: weak profitability, unstable or cyclical financials, poor free cash flow generation, high external financing needs
- Sentiment perspective: negative analyst forecast revisions, high stock price volatility, and high short interest (DRA only)

**20. Do Downside Risk Alert and DRA International scores tend to favor or disfavor particular industries or sectors? Do DRA International scores favor particularly countries?**

Yes, they typically do to some extent. DRA and DRA Int'l scores are compiled using valuation, financials, and sentiment indicators that ignore a stock's sector or industry group, with the important exception of DRA's Sector Specific Research Concept. As a result, the average DRA and DRA Int'l score can and usually will differ across GICS industries and sectors. For example, DRA and DRA Int'l currently rate industries such as Biotechnology and Oil Gas & Consumable Fuels as having high downside risk, assessments that we believe are consistent with most investors' intuition. However, the DRA and DRA Int'l scores at the group level do change over time according to market and economic conditions. Similarly, DRA Int'l scores are derived without considering a stock's home country (though input data are converted to U.S. dollars), so average DRA Int'l scores can and will differ across countries.

Of course, any client who would like to neutralize the industry or sector preferences of DRA can easily do so without losing DRA's predictive power. For example, the left chart below shows that DRA score performance has been similar on an unconstrained (i.e., as delivered) or sector neutral (i.e., re-ranked within sector) basis. Sector neutral DRA decile ranks are included in the weekly data provided to clients (see question 32).

Similarly, any client who would like to neutralize the industry, sector, or country preferences of DRA Int'l can easily do so. Sector neutral and country neutral DRAI decile ranks are included in the weekly data provided to clients. The right chart below shows that neutralizing the sector and country preferences of DRA Int'l somewhat dampens average performance, but performance consistency through time improves (not shown).



DRA Performs Well Unconstrained or Sector Neutral (MSCI U.S. IMI members, 2003-2023)



DRAI Performs Well Unconstrained, Sector Neutral or Country Neutral (MSCI ACWI Ex-USA members, 2003-2023)

**21. How do Downside Risk Alert and DRA International work <u>within</u> subsets of the broad market, such economic sectors or investment style universes?**

DRA Int'l have historically been able to separate winners from losers within every major market segment, meaning that these tools can help managers of any investment style: large cap, small cap, value, growth, and even sector specialists.  For example, the charts below shows that DRA and DRA Int'l scores have had highly significantly Information Coefficients (i.e., the correlation between model ranks and subsequent returns) within all sector and style groups.  For those unfamiliar with the Information Coefficient measure, RIR's rule of thumb is that IC's >= 0.04 are economically significant.
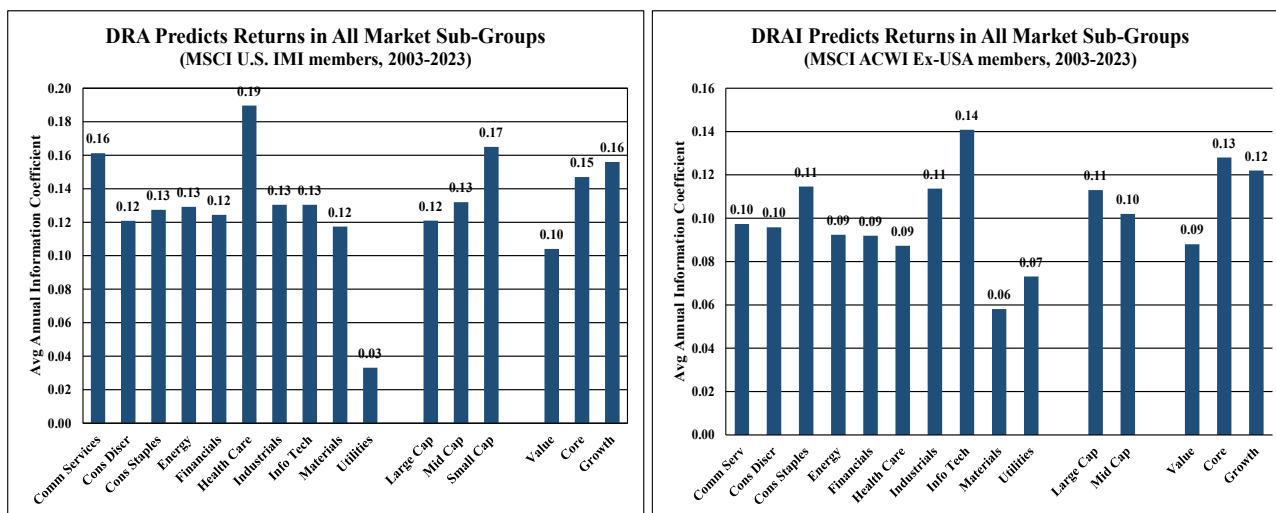


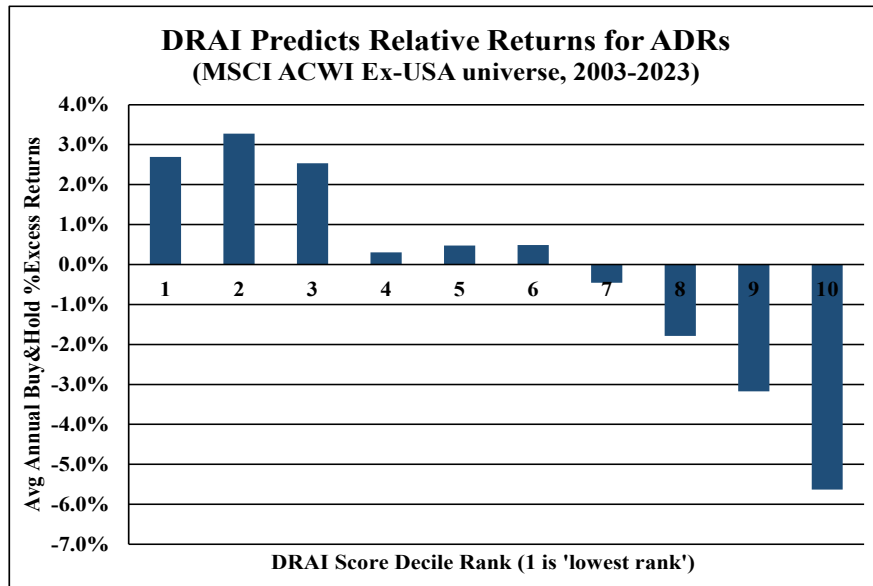**22. Does Downside Risk Alert work within narrower market subsets, such as industry groups?**

Yes.  DRA has generally been effective in separating relative winners and losers (i.e., had a positive average IC) in 52 of 56 S&P GICS industry groups with an average of 10 or more members through time (exceptions were Air Freight & Logistics, Containers& Packaging, Electric Utilities, and Trading & Distribution Cos). Given that DRA uses the same input factors for every stock, we believe that DRA scores provide a common ground for evaluating stocks across industries and an excellent starting point for within-industry stock analysis.

**23. Does DRA International work within individual countries?**

Yes.  DRA Int'l has generally been effective in separating relative winners and losers (i.e., had a positive average Information coefficient) in every country with an average of 10 or members through time.  Since DRA Int'l uses the same input factors for every stock, DRA Int'l scores facilitate direct comparisons of the investment merit of stocks from different countries.  For clients who prefer to evaluate stocks within countries and/or construct country neutral portfolios, RIR also includes country neutral DRA Int'l composite decile ranks and country neutral research concept scores.

**24. How does DRA Int'l perform just on international stocks that have ADR's trading in the U.S.?**

Investing internationally via American Depository Receipts offers many financial reporting, corporate disclosure, taxation, and trading advantages for U.S based investors.  For clients who prefer to trade ADR's, DRA Int'l flags any stock that has an ADR issue available.  About 1300 of the 1700 companies within MSCI ACWI Ex-USA have ADR's, though many are non-listed and illiquid (DRA tends to more favorably rank the more liquid ADR's).  The chart below shows that the ADR universe as a whole has tended to beat the full MSCI ACWI Ex-US membership (i.e., average excess returns are positive), and that DRA Intl's better-ranked ADR's tend to further outperform.



**DRAI Predicts Relative Returns for ADRs**
**(MSCI ACWI Ex-USA universe, 2003-2023)**

Avg Annual Buy&Hold %Excess Returns

DRAI Score Decile Rank (1 is 'lowest rank')

### 25. How do Downside Risk Alert and DRA Int'l work as overlays on existing stock selection strategies?

RIR is happy to provide historical DRA and DRA Int'l scores for testing, and clients have found these tools to be effective overlays to a wide variety of more sophisticated strategies. Many investors rank or screen stocks using "factors" that capture characteristics deemed to be desirable, so we can show the versatility of DRA and DRA Int'l by overlaying model ratings on an assortment of factor-based screens. To illustrate, we screened the MSCI U.S. IMI and ACWI Ex-U.S. stocks down to the 'best" 25% using individual factors that capture value, dividend yield, profitability, forecasted EPS growth, analyst recommendations, price momentum, low risk characteristics, large size, and small size. The charts show how DRA and DRA Int'l ratings are able to *further* discriminate subsequent winners and losers *within* each factor's best stocks.
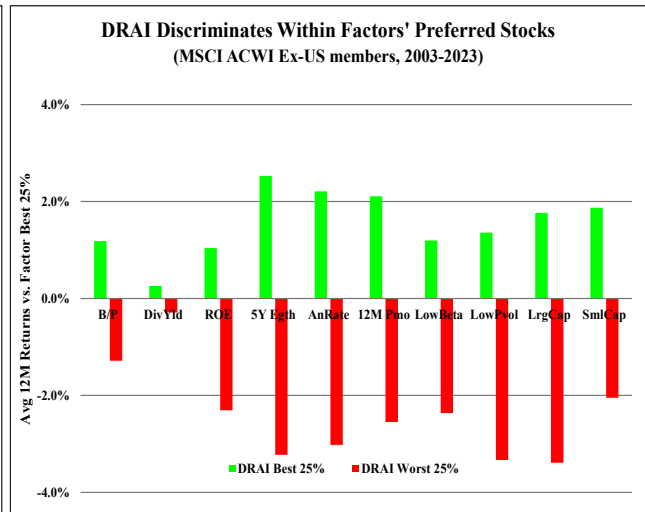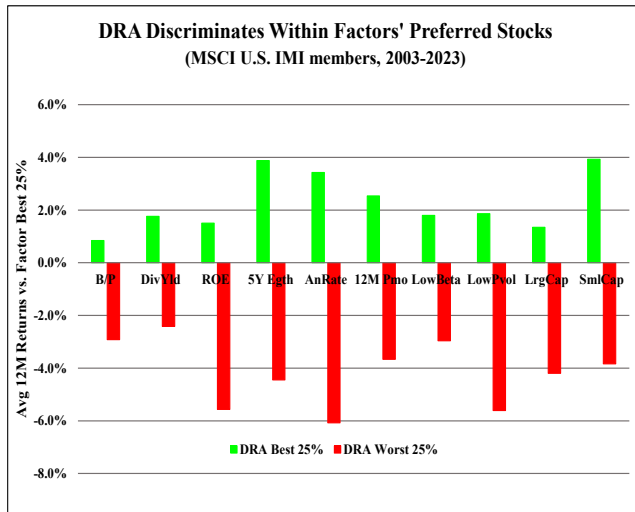
### 26. Can DRA and DRA International be effective as the sole 'buy/sell' drivers of portfolio strategies?

Yes. Though most clients use DRA and DRA Int'l as inputs to their stock selection decisions, the charts in Questions 15 & 16 strongly suggest that portfolio strategies that hold stocks with better DRA scores and avoid stocks with poor DRA scores should perform well. To illustrate, we simulated actively managed portfolios that held 60 U.S. or 100 international equal weighted (+ or – 0.25%) stocks at all times. For the U.S. portfolio, stocks in DRA's 1st decile were purchased and held as long as their DRA decile rank was 5 or better at each monthly rebalancing. If a stock's DRA score fell into the bottom half (deciles 6 to 10), it was replaced by the stock with the best DRA score that wasn't already owned. Transaction costs of 50bps were deducted for every stock bought or sold. We used similar rules for the international portfolio. The tables and charts below show that both portfolios easily outperformed their benchmarks. Portfolio risk was much lower than the benchmarks, an impressive result considering that no portfolio level risk constraints (e.g., benchmark relative sector or country weighting) were employed in these simple simulations. Annual portfolio turnover was also low.

| Year | DRA Portfolio Return | MSCI U.S. IMI EW Ret | Excess Return |
|---|---|---|---|
| 2002 | -8.3% | -18.8% | 10.5% |
| 2003 | 34.1% | 49.6% | -15.6% |
| 2004 | 24.8% | 19.4% | 5.4% |
| 2005 | 10.9% | 6.8% | 4.1% |
| 2006 | 19.0% | 17.2% | 1.7% |
| 2007 | 4.8% | -2.3% | 7.0% |
| 2008 | -35.6% | -39.6% | 4.0% |
| 2009 | 42.6% | 47.0% | -4.4% |
| 2010 | 22.5% | 28.4% | -5.9% |
| 2011 | 5.5% | -6.0% | 11.5% |
| 2012 | 19.3% | 17.8% | 1.4% |
| 2013 | 39.5% | 42.2% | -2.7% |
| 2014 | 13.2% | 6.2% | 7.0% |
| 2015 | 4.8% | -5.1% | 9.9% |
| 2016 | 17.3% | 21.3% | -4.0% |
| 2017 | 23.6% | 17.8% | 5.8% |
| 2018 | -9.3% | -10.4% | 1.1% |
| 2019 | 31.1% | 27.0% | 4.1% |
| 2020 | 18.7% | 21.0% | -2.3% |
| 2021 | 31.7% | 20.1% | 11.6% |
| 2022 | -9.6% | -19.6% | 10.0% |
| 2023 | 17.3% | 18.3% | -1.0% |
| **Annualized** | **12.8%** | **9.4%** | **3.4%** |
| **Annualized Alpha=4.57%, Beta=0.82** | | | |
| **Annualized Portfolio Turnover = 31%** | | | |



DRA Portfolio Outperforms With Less Risk
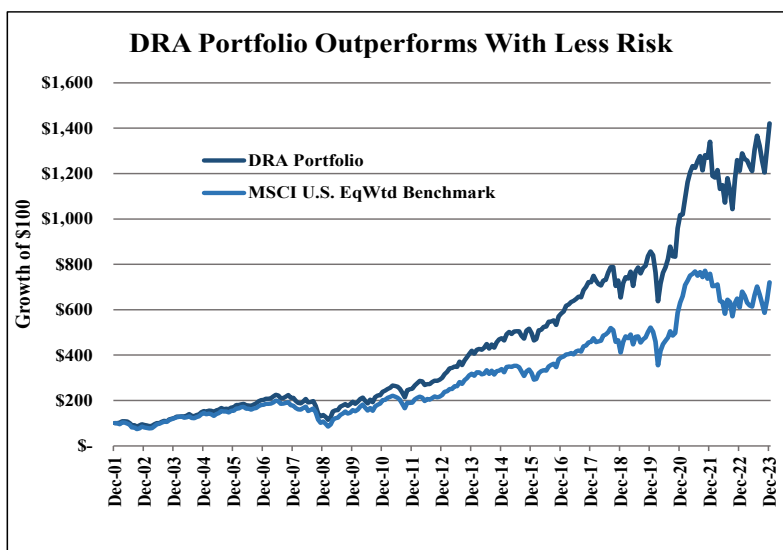
| Year | DRA Int'l Portfolio | MSCI ACWI Ex_US | Excess Return |
|---|---|---|---|
| 2007 | 19.9% | 17.5% | 2.4% |
| 2008 | -38.8% | -44.8% | 6.1% |
| 2009 | 38.5% | 41.8% | -3.3% |
| 2010 | 23.2% | 12.0% | 11.2% |
| 2011 | -1.3% | -13.6% | 12.4% |
| 2012 | 22.6% | 18.2% | 4.4% |
| 2013 | 22.8% | 15.8% | 7.0% |
| 2014 | 3.3% | -3.6% | 6.9% |
| 2015 | 0.5% | -4.2% | 4.7% |
| 2016 | 1.9% | 4.8% | -2.9% |
| 2017 | 23.7% | 27.3% | -3.6% |
| 2018 | -11.1% | -13.0% | 2.0% |
| 2019 | 24.5% | 21.4% | 3.1% |
| 2020 | 2.5% | 9.3% | -6.8% |
| 2021 | 17.6% | 9.4% | 8.2% |
| 2022 | -13.9% | -14.2% | 0.3% |
| 2023 | 19.2% | 11.9% | 7.3% |
| **Annualized** | **7.3%** | **3.6%** | **3.8%** |
| **Annualized Alpha=4.0%, Beta=0.87** | | | |
| **Annualized Portfolio Turnover = 29%** | | | |



DRAI Portfolio Outperforms With Less Risk
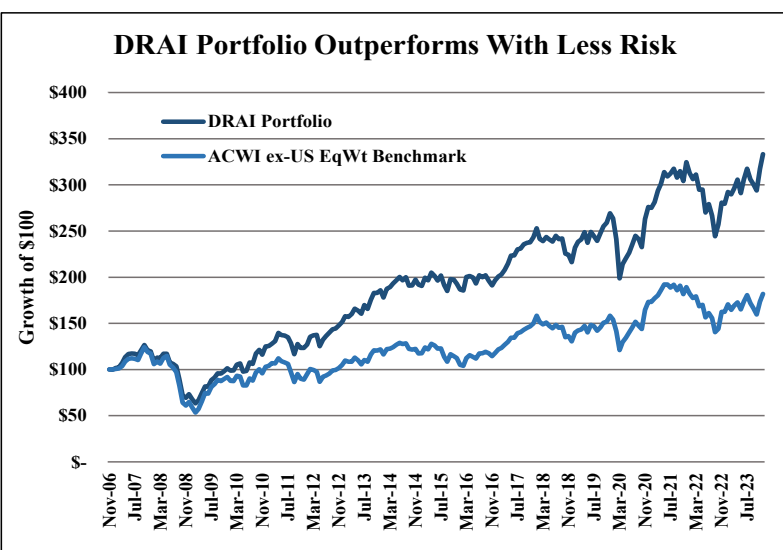
For clients interested in developing new equity management products, RIR believes that using DRA (and DRA Int'l) can be a great starting point and perhaps even the primary 'alpha input' of a variety of equity portfolio strategies (RIR principals use DRA and DRA Int'l to manage their personal portfolios). For example:

- DRA's strong performance within market segments (see Question 21) suggests that DRA could be used for large cap, small cap, growth, value, or sector portfolios.
- DRA's below-market risk characteristics and low portfolio turnover are ideal for equity managers running portfolios for risk averse, non-tax exempt investors.
- DRA's ability to identify strong and weak performing stocks make DRA attractive for long/short hedged equity portfolios.
- DRA's high capacity, risk characteristics, and low portfolio turnover are suitable for equity managers running low volatility portfolios or even as the basis for an ETF.

RIR is happy to provide guidance to clients wishing to develop equity strategies using DRA or DRA Int'l. On a consulting basis, RIR can develop equity portfolio strategies to meet client product design specifications.

## 27. How do Downside Risk Alert and DRA International differ from other research tools aimed at identifying risky stocks?

DRA and DRA Int'l have distinctive features stemming from their focus, breadth, and ease-of-use.

- **Focus** – Revelation Investment Research's sole research mission is discovering ways to anticipate weak market performance for individual stocks. DRA and DRA Int'l explicitly define stock-specific risk as the probability of underperforming the broad market over the next 1-year period.
- **Breadth** – DRA and DRA Int'l cover the largest 2300 U.S. and 6000 international stocks using an extremely diverse set of Valuation, Financial, and Sentiment criteria. Every research concept input was explicitly chosen and formulated to be an independent predictor of downside risk and to be complementary to the other research concept inputs.
- **Ease-of-use** – DRA and DRA Int'l have long-term time horizons and transparent inputs that make them easy-to-use tools for portfolio managers, equity analysts, and quantitative analysts.

At the risk of overgeneralization, we suggest that other available research tools for assessing the riskiness or negative return potential of individual equities tend to have one or more of the following shortcomings:

- Limited risk definition – often a stock's risk is defined from a single perspective such as return volatility, contribution to a portfolio's benchmark tracking error, or default likelihood.
- Limited perspective – often stocks are evaluated using a one-dimensional viewpoint (e.g., corporate governance, earnings quality, cash return on capital, bankruptcy prediction), use a particular type of analysis (e.g., forensic accounting, distance to default), or employ a single type of analytical/modeling technique (e.g., Probit, CART, Value-At-Risk).
- Limited universe – often research coverage is restricted to stocks followed by an analyst or stocks with a particular trait (e.g., those with bonds outstanding or large market capitalization), and sometimes we see entire sectors excluded from quantitative model coverage (e.g., Finance).
- Limited horizon – often stocks are evaluated using short-term periods such as 1 – 3 months which may conflict with lower turnover strategies favored by most investors.
- Limited focus – occasionally a research provider may tout selected screening criteria or factors as useful risk indicators, but comprehensive downside risk forecasting is not the research focus of those firms.

**28. Why can't I develop my own downside risk model?**

You could develop your own downside risk tool, but that effort would consume lots of research time and dollars that might be best allocated elsewhere. RIR certainly doesn't claim to have all the answers or all the good underperformance forecasting ideas, but we do believe that specializing in this research area has yielded many valuable insights so far and will continue to do so in the future.

For the rare firm that already has some type of downside risk estimation built into their equity research process, RIR's downside risk expertise can still be value-added. For example, RIR has clients that use selected individual DRA research concepts to enhance their decision making rather than relying on the DRA composite score.

**29. Why can't I simply use the "sell side" of a good cross-sectional multifactor model for sell signals?**

You could, since cross-sectional models often identify underperformers as well as they identify outperformers. This symmetry stems directly from commonly used factor selection processes. For example, cross-sectional performance statistics such as Information Coefficients, return spreads, and T-stats are generally maximized for models by including factors that are correlated with returns across their entire value distributions.

But RIR contends that linear cross-sectional analytics are sub-optimal for underperformance forecasting applications. Why?
- First, we believe that underperformance forecasting should focus primarily on predicting *negative outcomes*. If the dependent variable is defined this way, the downside risk model development process will select independent variables best suited for predicting underperformance, many of which will differ from those chosen for their cross-sectional predictive power.
- Second, measuring effectiveness using cross-sectional metrics such as IC's may disqualify variables with non-linear return distributions or limited data availability that could be useful for predicting downside risk:
  - Asymmetric return variables – such as factors that are better able to identify underperforming stocks than outperformers
  - Idiosyncratic event variables – such as flagging stocks with recently restated earnings
  - Boolean variables – such as classifying stocks as positive or negative according to their most recent EPS surprise
  - Incomplete coverage variables – such as flagging stocks with low pension funding from among the 1/3 of companies with defined benefit plans

**30. When did Downside Risk Alert and DRA International go into real-time production?**

DRA was launched in August 2014 and DRA Int'l in September 2017. Consequently, RIR has no choice but to include some backtest results in this document to explain and illustrate their design principles and performance characteristics.

RIR principals have been building and running quantitative models for 30 years. We are well aware of the potential pitfalls in developing strategies using backtest results. We assert that we were conservative in utilizing historical data in creating DRA and DRA Int'l. We further note that DRA's focus on larger market

cap stocks and predicting long-term downside risk helps us avoid the misleading performance figures sometimes seen from backtests involving microcap stocks or high frequency indicators.

Reflecting our RIR belief in transparency and accountability, we provide quarterly summaries of DRA and DRA Int'l real-time performance to our clients.

### 31. Does the formulation of Downside Risk Alert (and DRA International) ever change?

The formulation of DRA will certainly evolve to incorporate RIR's research findings, but inputs are fixed for a given model "version". If DRA's formulation needs to be changed in any meaningful way, a new version of DRA is created. The current DRA version is #3, while DRAI is still using version #1.

To minimize disruption, new DRA versions are launched only after clients have been adequately prepared. Preparation includes providing the rationale for the changes, performance comparisons, change documentation, making historical data availability for backtesting, and parallel delivery of the current and new versions for a period of time.

### 32. How are Downside Risk Alert and DRA International delivered to clients?

DRA scores are updated weekly for all stocks in the MSCI USA IMI except REITs (~2300 companies). Data is delivered in Excel file format via email or FTP to clients on Sundays. Information provided for each stock includes:
- Downside Risk Alert composite score (typically ranging from about 50 to -60), recent changes in the DRA score, probability of underperformance, and decile rankings over the full universe, within sector groups, and within four market capitalization groups (i.e., large cap, large & midcap, mid & small cap, and small cap.
- Scores on a +5 to -5 scale for each of DRA's 12 research concept inputs
- Selected data items to facilitate screening and sorting, including stock price, market cap, beta, price volatility, trailing P/E, dividend yield, 5-year EPS growth forecast, ROE, debt/equity, 6-month stock price change, average daily trading volume, short interest ratio, number of analysts providing FY1 forecasts, most recently reported quarterly EPS surprise, next expected EPS report date, sector group, and industry group

DRA Int'l scores are updated weekly for all non-REIT stocks in the MSCI All Country World Index IMI (~6000 companies). Client mays choose to receive DRA Int'l scores on the full MSCI ACWI Ex-USA IMI universe or just on the 1750 large and mid-cap ACWI Ex-USA members. Data is delivered in Excel file format via email or FTP to clients on Sundays. Information provided for each stock includes:
- DRA Int'l composite score (typically ranging from about 60 to -70), recent changes in the DRA score, and decile rankings over the full universe, within sector groups (sector neutral), and within countries (country neutral).
- Company identifiers such as SEDOL, CUSIP, ADR CUSIP, and home country
- Two sets of DRA Int'l research concept scores:
  - +5 to -5 ranked relative to the DRA Int'l universe
  - +5 to -5 ranked relative stocks in the same country (country neutral)
- Selected data items to facilitate screening and sorting, including stock price, market cap, beta vs. country, beta vs. ACWI Ex-USA, price volatility, trailing P/E, dividend yield, 5-year EPS growth
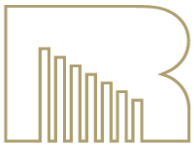
forecast, ROE, debt/equity, 6-month stock price change, average daily trading volume, number of analysts providing FY1 forecasts, most recently reported quarterly EPS surprise, next expected EPS report date, sector group, industry group, geographic region, ACWI member flag, and EAFE member flag.

All clients receive RIR's bi-monthly Research Brief and Product Usage Brief studies, as well as quarterly model performance summaries. Research Briefs present original research on stock selection and portfolio management topics of interest. Product Usage Briefs are directed toward answering specific client questions about how RIR's models can and/or should be used. Research Brief and Product Usage samples can be found at www.RevelationIR.com.

### 33. How does Revelation Investment Research minimize potential operational risk issues that might impact clients?

Successful business relationships hinge on trust. At Revelation Investment Research, we know we must earn your trust before you will be comfortable depending on us as a research partner.

To help insure reliability in product delivery, all RIR systems and data used for research and product production are regularly backed up and fully accessible off-site. RIR also adheres to best practices outlined in the CQA's "Sound Practice Guidelines for Quantitative Investment Managers" in areas such as:
- Model development and lifecycle management
- Data governance and integrity
- Model and process documentation
- Error management policies
- Disaster recovery