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Understanding Defensive Equity

Executive Summary

The outperformance of simulated defensive equity portfolios during the global credit crisis and during the recent turmoil in European financial markets has highlighted the potential benefit of avoiding concentrating risks in securities with the highest sensitivity to market fluctuations.[1] By over-weighting safer securities and under-weighting risky ones, defensive equity strives to reduce sensitivity to market movements – seeking long-term benchmark-like returns with lower volatility.

This paper analyzes the intuition behind defensive equity. We review the empirical evidence, analyze construction and performance of defensive equity portfolios, and discuss the possible explanations for its outperformance. Finally, we discuss the role defensive equities can play in investors' overall portfolios.

1 This is based on simulated returns of a Global Defensive Equity portfolio versus the performance of the MSCI World Index from January 1990 to July 2012. Please see the important disclosures at the end of the paper for the backtest methodology.

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Part 1: The Low-Risk Anomaly

Defensive Equity, Low Beta, Minimum Variance, Low Volatility, these names all describe investment strategies that generally seek to over-weight safe securities and under-weight risky securities (relative to capitalization-weighted benchmarks).[1] These strategies have received increasing attention over the past few years for a variety of reasons. First, backtests of these strategies have empirically shown higher risk-adjusted performance than traditional benchmarks.[2] Second, after the severe global market decline in 2008 and the recent turmoil in European financial markets, many investors are concerned about avoiding severe losses during periods of financial distress. Third, as a result of the increased volatility in equity markets, investors have sought to reduce their concentration in equity risk as well as the risk of their overall portfolios.

Portfolio allocations to equities are typically 60% or higher (relative to fixed income and other asset classes), and within equities investors have traditionally relied on capitalization-weighted benchmarks.[3] Though this allocation may appear well diversified, it actually bears a large amount of concentration risk. Since equities have approximately three to four times the risk of bonds, this allocation leads to a portfolio that has roughly 90% of its risk budget dedicated to equities. Furthermore, since capitalization-weighted benchmarks have approximately 60% of their risk concentrated in more volatile, higher-beta stocks, the traditional 60/40 allocation has about 55% of its overall risk budget in the universe of individual stocks with the highest sensitivity to market fluctuations.[4] In other words, when viewed through the lens of risk, traditional asset allocations are highly concentrated in equity markets and, in particular, high-risk stocks.

This paper analyzes allocation choices within equities, specifically focusing on defensive equity portfolios. Defensive portfolios are designed to mitigate concentration in high-risk stocks that are symptomatic of traditional capitalization-weighted approaches. A related topic, beyond the scope of this paper, is the asset allocation analogue of defensive equity: risk parity portfolios, which are designed to mitigate concentration in high-risk asset classes.[5]

Figure 1 shows the allocation of the Russell 1000 Index to high- and low-beta stocks shown both in capital (dollar) allocations and in risk allocations.[6] Despite the fact that high-beta stocks comprise less than half the market capitalization of the index, they are responsible for the majority of portfolio risk. This observation is simply a mathematical fact. That a larger fraction of risk in a portfolio stems from riskier securities is in itself not problematic, provided that investors receive the appropriate compensation.

However, historically investors have not received extra compensation for holding risky securities relative to safe securities. In fact, the average return of high-beta stocks has been about the same as the average return of low-beta stocks.[7] This phenomenon is known as the "low-risk anomaly," and it is what enables defensive equity portfolios to deliver long-run returns similar to traditional benchmarks, at a significantly lower volatility.

Part 2: Ample Evidence

Historically, risky securities have not generated higher risk-adjusted returns than safe securities within the same asset class. In other words, investors holding safe securities have received much higher compensation relative to the risk they bared. While academics initially referred to this effect as the "low-beta anomaly," the evidence has been extended to include other risk measures beyond just beta: total volatility, idiosyncratic volatility as well as more fundamental measures of risk, generically referred to as "quality." In that vein we prefer to refer to it as the "low-risk anomaly."

The evidence for the low-risk anomaly is pervasive, supported by four decades of research, most of which is out of sample relative to the initial findings. Figure 2 shows the performance of individual US stocks broken into deciles based on their beta. The figure shows that safe stocks have delivered higher risk-adjusted returns (as measure by Sharpe Ratio) than risky stocks. [9]

1 A stock's "beta" is defined as its sensitivity to fluctuations of the overall stock market. By construction, the overall market has a beta of 1.0, and we define "high-beta" stocks as those with betas above 1.0 and "low-beta" stocks as those with betas below 1.0. While volatility, idiosyncratic volatility, and betas are related to risk, they are not the same as risk. However, they are an important input in determining the risk of an asset. In this paper we will use the term "safe" ("risky") to indicate either low (high) beta, low (high) volatility, low (high) idiosyncratic volatility, and high (low) "quality" stocks. Also we'll use the generic term "defensive" to indicate portfolios that over-weight safe securities and under-weight risky securities relative to capitalization-weighted benchmarks.

2 This is based on simulated returns of a US Defensive Equity portfolio versus the performance of the Russell 1000 Index from January 1984 to March 2012. For brevity we use US portfolios to illustrate results. However, all the conclusions in this paper generalize to Global, International and Emerging Markets portfolios. Please read hypothetical performance disclosures at the end of this paper.

3 We use the term "benchmark" or "traditional benchmarks" to indicate capitalization-weighted (or float-weighted) indices.

4 A portfolio's "risk budget" is defined as the amount of risk that a portfolio manager is willing to take on, in order to pursue her target return.

5 See Hurst, Johnson and Ooi (2012).

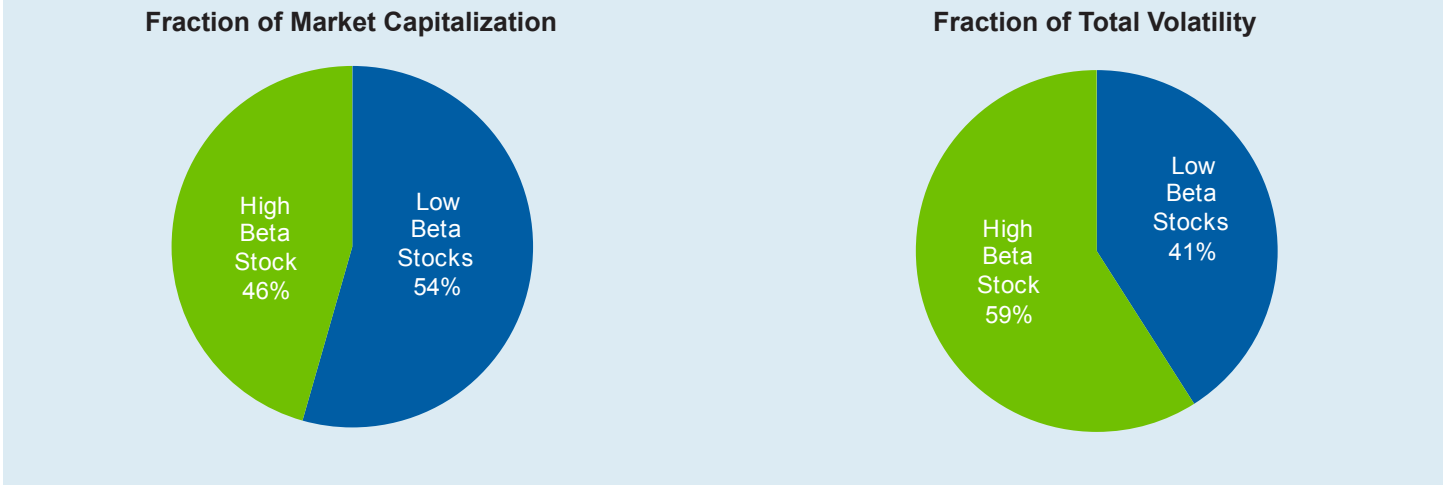
6 Russell 1000 Index as of March 31, 2012.

7 This is based on comparing the simulated return of US low-beta and high-beta stocks from January 1926 to March 2012. See Figure 2. Moreover, these are arithmetic averages. Compounded returns would be lower for high-beta stocks.

8 At the beginning of each calendar month stocks are ranked in ascending order on the basis of their estimated beta at the end of the previous month. The ranked stocks are assigned to one of ten deciles portfolios. All stocks are equally weighted within a given portfolio, and the portfolios are rebalanced every month to maintain equal weights.

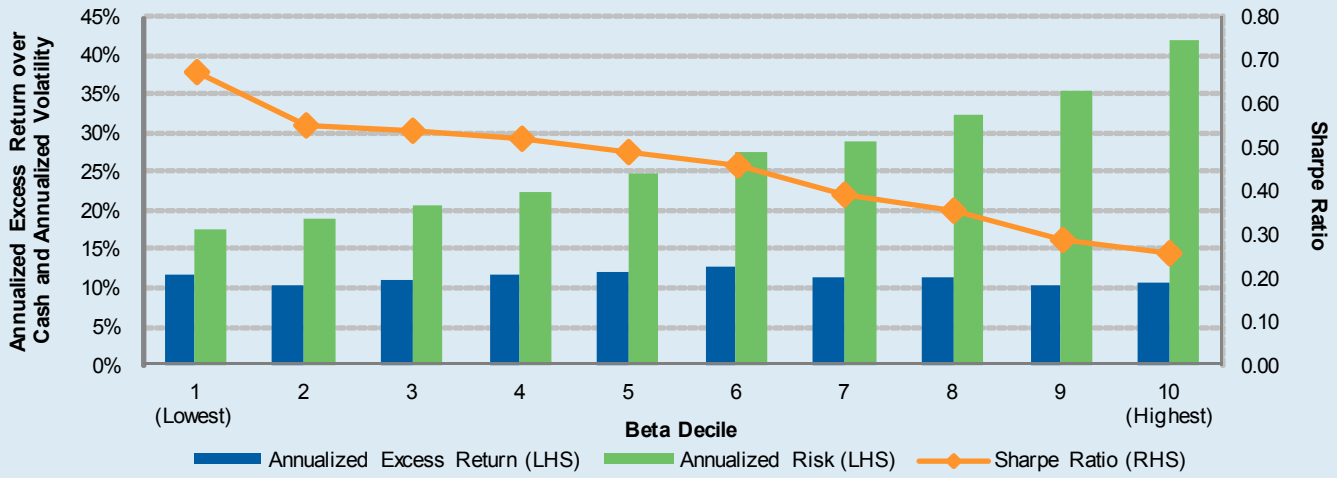
9 The Sharpe Ratio of a portfolio is defined as its average return (in excess of the risk free rate) divided by its volatility.

Figure 1: Traditional Benchmarks Are Concentrated in Risky Securities



Source: AQR. Figures above are not based on an actual portfolio and are for illustrative purposes only.

Figure 2: Low Beta Stocks Offer Higher Risk-Adjusted Returns (US Equities, 1926-2011)



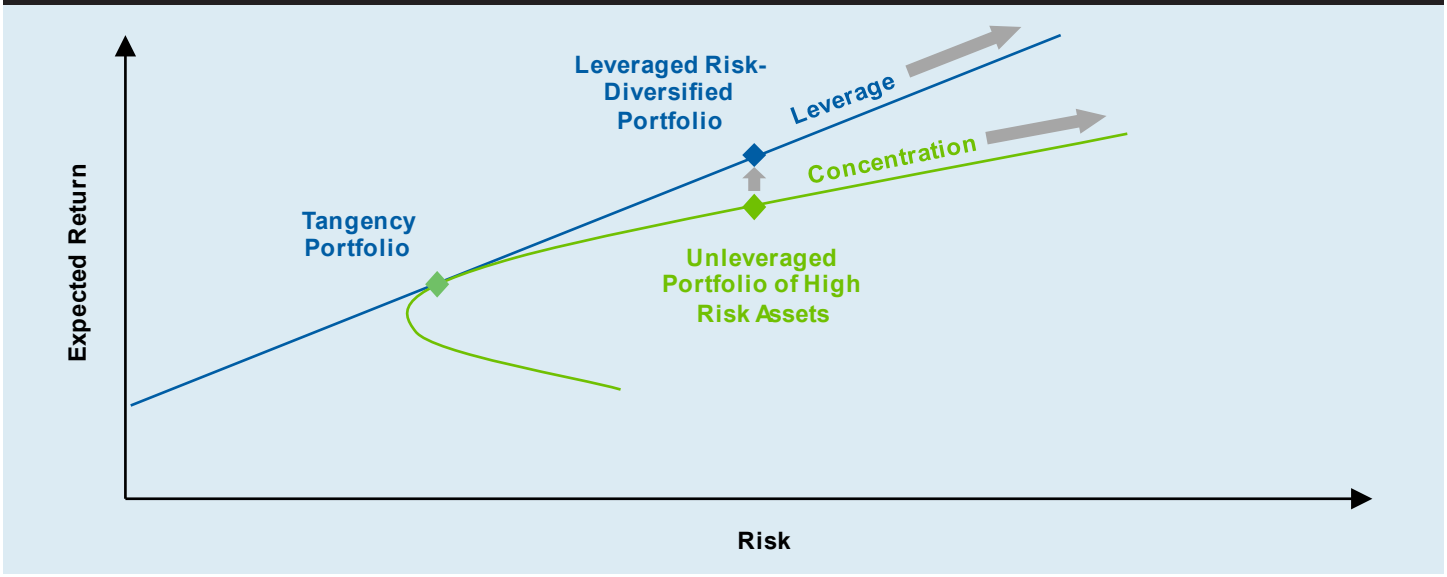
Source: AQR. Performance/Correlation results based on AQR models of hypothetical portfolios.[8] These are not the returns of an actual portfolio and are for illustrative purposes only. Please see important disclosures in the Appendix relating to hypothetical performance and risks.

The original low-beta premium findings focused on the period from 1926 to 1965.[10] Subsequent studies have found evidence of the low-beta anomaly in the out-of-sample period after the original research was published.[11] Furthermore, evidence supports the presence of the low-beta anomaly in a wide variety of asset classes not included in the original studies: international equity markets, Treasury bonds, corporate bonds, credit, futures, options, and levered ETFs, as well across asset classes.[12]

More recently, researchers have also uncovered consistent evidence on more fundamental measures of risk, where "safe" companies can be thought of as those that are less exposed to macro-economic fluctuations, and bear lower operational and business risk. These fundamental measures of low risk, generally referred to as "quality" indicators, include (among others): high profit margins, low financial and operating leverage, and lower earnings volatility. Consistent with the earlier evidence, safe, profitable, and stable companies have historically earned higher risk-adjusted returns than risky, unprofitable, and unstable firms.[13]

10 Black, Jensen and Scholes (1972).
11 Gibbons (1982), Kandel (1984), Shanken (1985), Bhandari (1988), Fama and French (1992), Falkenstein (1994), Polk, Thompson, and Vuolteenaho (2006), Ang, Hodrick, Xing, and Zhang (2006, 2009) and others.
12 Frazzini and Pedersen (2010, 2011) and Asness, Frazzini and Pedersen (2011).
13 Piotroski (2002), Novy-Marx (2012), Asness, Frazzini and Pedersen (2012).

Figure 3: The Efficient Frontier, Leverage versus Concentration



Source: AQR. For illustrative purposes only.

Part 3: Leverage Aversion, and Other Explanations

There are several possible explanations for the low-risk anomaly. Perhaps most prominent is the theory of leverage aversion first suggested by Fischer Black in 1972. Simply stated, all investors seek high returns but many are unable or unwilling to borrow. These investors overweight risky securities, which lowers their rates of return (compared to a world where investors can leverage) and underweight safe securities, which increases rates of return.[14]

Figure 3 plots a standard, hypothetical efficient frontier, which gives all the possible risk-return combinations of a portfolio of risky assets and the risk-free rate. According to traditional portfolio analysis, pioneered by Harry Markowitz and James Tobin, all investors should hold some combination of a diversified portfolio (the portfolio that lies where the blue line meets the green efficient frontier line, or the "tangency portfolio") and cash.[15] Leverage then allows investors to move up the blue capital market line to seek higher risk and returns. This enables an investor seeking high rates of return to maintain the same Sharpe ratio as a lower-risk portfolio. However, there are large pools of capital controlled by investors, such as mutual funds, pension funds, or long-only institutional managers that are precluded from or averse to using leverage. These investors can take higher risk only by concentrating their portfolios in risky stocks (i.e., by moving along the green line).

Since all investors in aggregate must by definition hold the capitalization-weighted benchmark, these constrained investors must induce someone to take the other side of their overweights and underweights. On average, investors who buy more high-risk securities must compensate those who sell those securities by paying a higher price for the risky securities and receiving a low price for safe securities. Thus, according to this theory, the returns of the low-risk anomaly are equivalent to a fee that leverage-constrained investors pay to leverage-unconstrained investors who are willing to use leverage and therefore can increase portfolio risk without concentrating in high-risk securities.

There is a large amount of evidence consistent with this theory, including the fact that the returns of low-beta portfolios tend to be related to conditions in the credit markets (a measure of the availability and cost of leverage). In addition, looking at portfolio holdings from regulatory filings, leverage-constrained investors do in fact hold riskier assets than investors who are able to lever.[16] Naturally, there are other hypotheses that support the higher risk-adjusted returns of safer assets. The alternatives include models of delegated portfolio management with benchmarked institutional investors,[17] mutual fund managers' incentives to overweight high-beta stocks due to option-like payoffs,[18] preference for lotteries,[19] or money illusion.[20] All of these explanations are not mutually exclusive and can all help to explain the low-risk anomaly.

14 Black (1972, 1992).
15 Markowitz (1952), and Tobin (1958).
16 See Frazzini and Pedersen (2010, 2011), Asness, Frazzini and Pedersen (2011) and Frazzini, Kabiller and Pedersen (2012).
17 Brennan (1993), Baker, Bradley, and Wurgler (2010).
18 Falkenstein (1994), Karceski (2002).
19 Barberis and Huang (2008), Mitton and Vorkink (2007).
20 Cohen, Polk, and Vuolteenaho (2005).

Part 4: Constructing a Defensive Equity Portfolio

AQR has developed defensive equity portfolios that capture the low-risk anomaly in a robust and efficient way. Our goal is to construct long-only, unlevered portfolios that overweight safe stocks and underweight risky stocks, where risk is broadly defined as both a firm's stock price sensitivity to market fluctuations (beta) and its sensitivity to the economic environment (fundamental quality indicators).

The portfolio construction process is agnostic to traditional benchmarks. We begin by estimating each stock's risk characteristics and use a proprietary robust optimization technology to build a portfolio that tilts towards stocks with low beta/volatility and high-quality stocks (which are less sensitive to macroeconomic fluctuations). The quality tilt seeks to provide exposure to companies with low overall macroeconomic risk, stable profitability, and healthy balance sheets, and it has been introduced to limit the potential for errors in estimating betas and volatility.

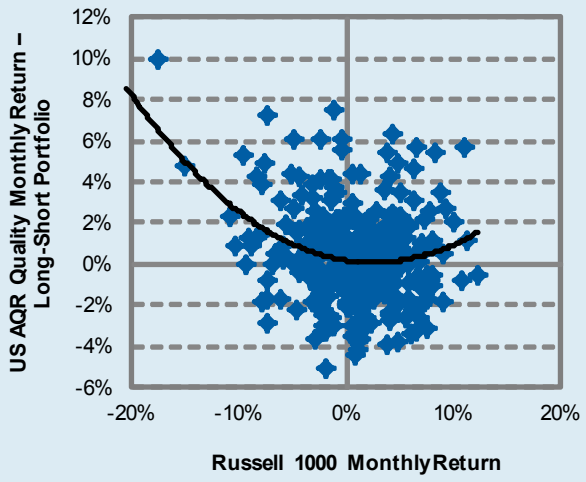
We seek to systematically reduce risk along multiple dimensions, while avoiding some of the pitfalls of other "low-risk" approaches, such as concentrating the portfolio in certain industries, sectors, and regions. We set diversification criteria to avoid heavily weighting certain markets and sectors (US utilities for example), which we believe to be sub-optimal based on first principles.

Figure 4 illustrates the potential advantage of AQR's approach of combining different measures of risk. It compares simulated monthly returns of a market-neutral, long-short portfolio that buys high-quality and sells low-quality firms, to the return of the benchmark. The left quadrant of the graph shows that during periods of market declines, high-quality stocks have outperformed low-quality stocks, thus providing a valuable hedging tool to mitigate severe losses.

Figures 5 shows performance of the hypothetical AQR US defensive equity portfolio compared to the Russell 1000 Index. The figure shows that a defensive equity portfolio delivers similar total returns to the traditional benchmark, but at significantly lower volatility. Consistent with the academic evidence, defensive equity portfolios have higher risk-adjusted returns (Sharpe ratios) than traditional benchmarks.[21]

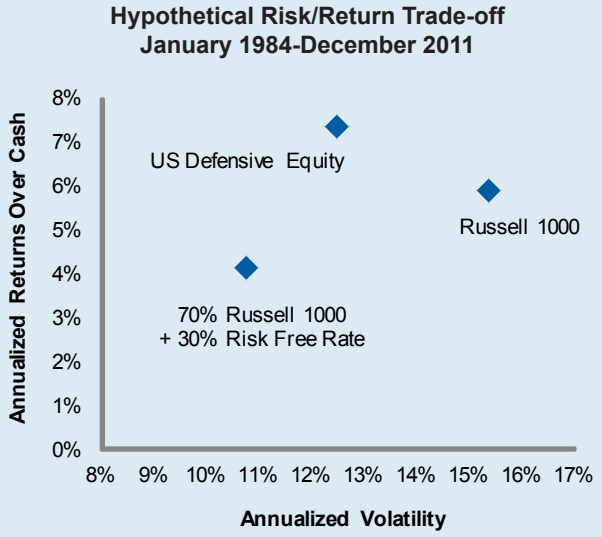
21 Figure 5 shows that over this sample period, this defensive equity portfolio has actually delivered both higher risk-adjusted and total return than the traditional benchmark. However, as we stress more in detail below, we prefer to use a more conservative approach and we expect defensive equity portfolios to deliver similar (not higher) long run return than traditional benchmarks, at lower volatility.

Figure 4: High-Quality Companies Display Tail Hedging Characteristics



Source: AQR. These are not the returns to an actual portfolio and are for illustrative purposes only. Please see important disclosures relating to hypothetical performance and risks as well as further details on backtesting methodology at the end of this paper.

Figure 5: Seeking Market-like Returns with Lower Risk



Hypothetical Gross Returns	Russell 1000	US Defensive	70% Russell 1000 30% Risk Free Rate
Annualized Excess Returns Over Cash	5.8%	7.3%	4.1%
Annualized Volatility	15.4%	12.5%	10.8%
Sharpe Ratio	0.38	0.58	0.38
Beta vs. Russell 1000		0.76	0.70
Max Drawdown	-51.0%	-35.8%	-38.0%

Source: AQR. US Defensive Equity backtest based on AQR models of hypothetical portfolios; net of transaction and financing costs but gross of management or advisory fees. These are not the returns to an actual portfolio and are for illustrative purposes only. Please see important disclosures relating to hypothetical performance and risks as well as further details on backtesting methodology at the end of this paper.

Part 5: Investing in Defensive Equity

In this section we explore how defensive equity portfolios can fit into investors' overall portfolios. We argue that investors should allocate part of their risk budget to overweighting safe assets and underweighting risky assets. How much is ultimately allocated depends on investors' preference for risk control and preservation of capital versus outperforming a cap-weighted benchmark.

Defensive equity supports long-term wealth preservation

Investors with a long time horizon and a low tolerance for large capital losses would benefit from exposure to defensive equity portfolios. Typically these investors are more focused on long-term wealth preservation than short-term wealth maximization. These investors seek to:

- Reduce the overall risk of their portfolio while remaining fully invested
- Reduce risk concentration in their equity portfolio
- Mitigate large loss of capital during periods of financial distress
- Take advantage of relatively higher compensation offered by safer assets

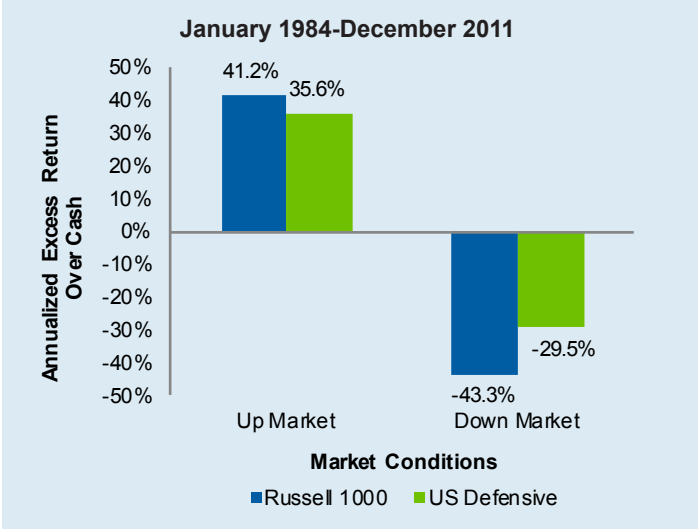
Defensive equity portfolios are designed to increase risk-adjusted returns, lower overall risk, and outperform in bear markets. However, they should not be expected to necessarily have higher total returns than traditional benchmarks, and certainly not during strong bull markets. Rather, they should be expected to deliver long-term returns similar to traditional benchmarks but at a significant reduction in portfolio volatility. This is shown in Figure 6: the US defensive equity portfolio lagged the traditional benchmark in bull markets while mitigating capital losses in bear markets.

Figure 7 shows the cumulative total drawdown of a hypothetical US defensive portfolio versus the Russell 1000 Index. The figure illustrates a key attribute of defensive portfolios: smaller drawdowns and a faster recovery from drawdowns.

Defensive equity does <u>not</u> track traditional benchmarks

Defensive equity strategies are less suited for investors who desire portfolios with tracking errors tightly managed to capitalization-weighted benchmarks. By construction, defensive equity portfolios have large tracking errors relative to the traditional benchmark, and a low overall beta. They are designed to deliver superior performance per unit of risk, i.e., to achieve similar long-term returns of traditional benchmark with significantly lower volatility.

Figure 6: US Defensive Equity - Hypothetical US Portfolio Performance in Up/Down Markets



Source: AQR. US Defensive Equity backtests based on AQR models of hypothetical portfolios; net of transaction and financing costs but gross of management or advisory fees. These are not the returns to an actual portfolio and are for illustrative purposes only. Please see important disclosures relating to hypothetical performance and risks as well as further details on backtesting methodology in the Appendix.

How much of my equity portfolio should I allocate to defensive equity strategies?

Defensive equity portfolios can be used as a substitute for either 1) passive capitalization-weighted indices or 2) active long-only portfolios benchmarked to a capitalization-weighted index. Since defensive strategies mainly focus on long-term capital preservation, the amount allocated should be a function of the losses investors are willing to tolerate, as well as their investment horizon.

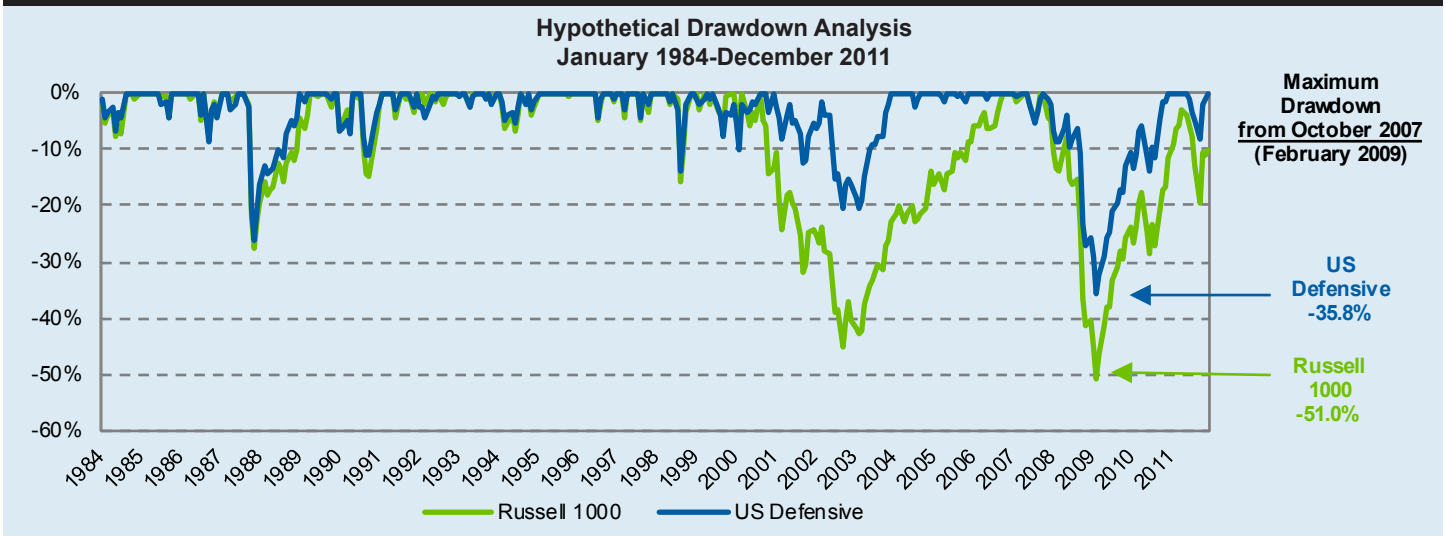
Figure 8 plots drawdowns and Sharpe ratios of portfolios allocating capital between the hypothetical AQR US defensive equity and the traditional benchmark. The figure shows that investors with a low tolerance for large capital losses should allocate a larger fraction of their equity holdings to a portfolio overweighting safer stocks and underweighting risky stocks. For example, given the benefit of hindsight, a long-term investor unwilling to tolerate 1-year losses exceeding 30% would have allocated over 60% of his equity holdings to a defensive strategy.

Conclusions

There is a vast amount of evidence across a variety of asset classes that safer assets outperform riskier assets on a risk-adjusted basis. This effect can be captured in a defensive equity portfolio that overweights safe/high-quality stocks and underweights risky/low-quality stocks.

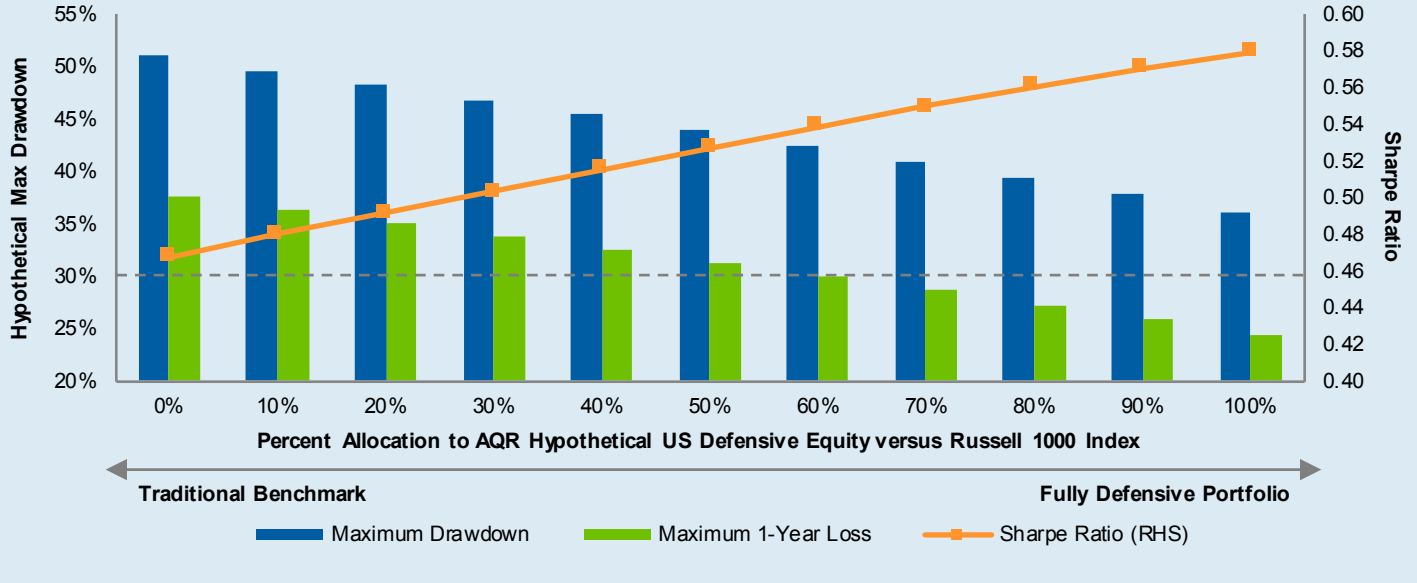
These portfolios have increasingly gained popularity with investors seeking to mitigate severe losses during periods of financial distress, increase risk-adjusted returns, and deliver long-term returns similar to traditional benchmarks. AQR defensive equity portfolios are designed to achieve these goals in a robust and efficient way.

Figure 7: Less-Severe Drawdowns



Source: AQR. Please see the disclosures for important risk information. A drawdown control policy may not always be successful at controlling a fund's risk or limiting portfolio losses.

Figure 8: Allocating Between Hypothetical US Defensive Equity and Traditional Benchmarks



Source: AQR. Please see disclosures for important risk information.

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Hypothetical performance results (e.g., quantitative backtests) have many inherent limitations, some of which, but not all, are described herein. No representation is being made that any fund or account will or is likely to achieve profits or losses similar to those shown herein. In fact, there are frequently sharp differences between hypothetical performance results and the actual results subsequently realized by any particular trading program. One of the limitations of hypothetical performance results is that they are generally prepared with the benefit of hindsight. In addition, hypothetical trading does not involve financial risk, and no hypothetical trading record can completely account for the impact of financial risk in actual trading. For example, the ability to withstand losses or adhere to a particular trading program in spite of trading losses are material points which can adversely affect actual trading results. The hypothetical performance results contained herein represent the application of the quantitative models as currently in effect on the date first written above and there can be no assurance that the models will remain the same in the future or that an application of the current models in the future will produce similar results because the relevant market and economic conditions that prevailed during the hypothetical performance period will not necessarily recur. There are numerous other factors related to the markets in general or to the implementation of any specific trading program which cannot be fully accounted for in the preparation of hypothetical performance results, all of which can adversely affect actual trading results. Hypothetical performance results are presented for illustrative purposes only.

Gross performance results do not reflect the deduction of investment advisory fees, which would reduce an investor's actual return. For example, assume that $1 million is invested in an account with the Firm, and this account achieves a 10% compounded annualized return, gross of fees, for five years. At the end of five years that account would grow to $1,610,510 before the deduction of management fees. Assuming management fees of 1.00% per year are deducted monthly from the account, the value of the account at the end of five years would be $1,532,886 and the annualized rate of return would be 8.92%. For a ten-year period, the ending dollar values before and after fees would be $2,593,742 and $2,349,739, respectively. AQR's asset based fees may range up to 2.85% of assets under management, and are generally billed monthly or quarterly at the commencement of the calendar month or quarter during which AQR will perform the services to which the fees relate. Performance fees are generally equal to 20% of net realized and unrealized profits each year, after restoration of any losses carried forward from prior years. In addition, AQR funds incur expenses (including start-up, legal, accounting, audit, administrative and regulatory expenses) and may have redemption or withdrawal charges up to 2% based on gross redemption or withdrawal proceeds. Please refer to the Fund's Private Offering Memoranda and AQR's ADV Part 2A for more information on fees. Consultants supplied with gross results are to use this data in accordance with SEC, CFTC, NFA or the applicable jurisdiction's guidelines.

There is a risk of substantial loss associated with trading commodities, futures, options, derivatives and other financial instruments. Before trading, investors should carefully consider their financial position and risk tolerance to determine if the proposed trading style is appropriate. Investors should realize that when trading futures, commodities, options, derivatives and other financial instruments one could lose the full balance of their account. It is also possible to lose more than the initial deposit when trading derivatives or using leverage. All funds committed to such a trading strategy should be purely risk capital.

Diversification does not eliminate the risk of experiencing investment losses.

Backtesting Methodology:

US Defensive Equity

- Universe: Liquid tradable universe for US stocks of approximately 1100 names
- Quarterly rebalancing frequency with the following backtesting period: January 1984 to December 2011
- Risk model: Barra US Equity Model (USE3L)
- Performance is measured after AQR's proprietary t-cost estimates.

Global Defensive Equity

- Universe: Universe: Liquid tradable universe for Global stocks of approximately 1500 names
- Quarterly rebalancing frequency with the following backtesting period: January 1990 to December 2011
- Risk model: Barra Global Equity Model (GEM) from 1999 to 1996; Barra Global Equity Model 2 Long-term (GEM2L) from 1997 to 2011
- Performance is measured after AQR's proprietary t-cost estimates.