Paying for Defense

A deeper dive into defensive equity.

July 2020

Averie Thomas
Multi-Asset Solutions Analyst

Farris Shuggi
Portfolio Manager

Hailey Lynch
Quantitative Investment Analyst

Robert Panariello
Associate Director of Research

Som Priestley
Multi-Asset Solutions Strategist

KEY INSIGHTS

- Following the 2008–2009 global financial crisis, defensive equities—such as "low beta" and "high quality" stocks—became popular investments for many investors.
- Low-beta equities were not as defensive when valuations were high leading into sell-offs. Expensive high-quality equities showed more dispersion in sell-offs.
- We believe investors should not rely too heavily on defensive equity as a portfolio hedge, given how widely historical performance has varied based on valuations.

Traditionally, investors have expected defensive assets, including defensive equity, to provide some improvement in portfolio performance during market drawdowns. These equity styles have increased in popularity since the 2008–2009 global financial crisis, prompting us to take a closer look at the question: Are there underappreciated risks lurking in these investment approaches that investors tend to believe are relatively less volatile?

In this paper, we analyze defensive equities as an investment by focusing on two main types: low-beta equities and high-quality equities.

- In section one, we show how the universe of equity assets considered to be defensive has become more crowded over time.
- In section two, we analyze the relationship between relative valuations and performance during market drawdowns.
- Section three applies our framework to a recent case study (the COVID-19 pandemic).
- Finally, the fourth section offers our thoughts on the implications of our findings for investors.

For definitions of our low-beta and high-quality equity categories, our methodology in constructing relative composite valuation metrics, and the historical periods covered by our data sources, please see the appendix.

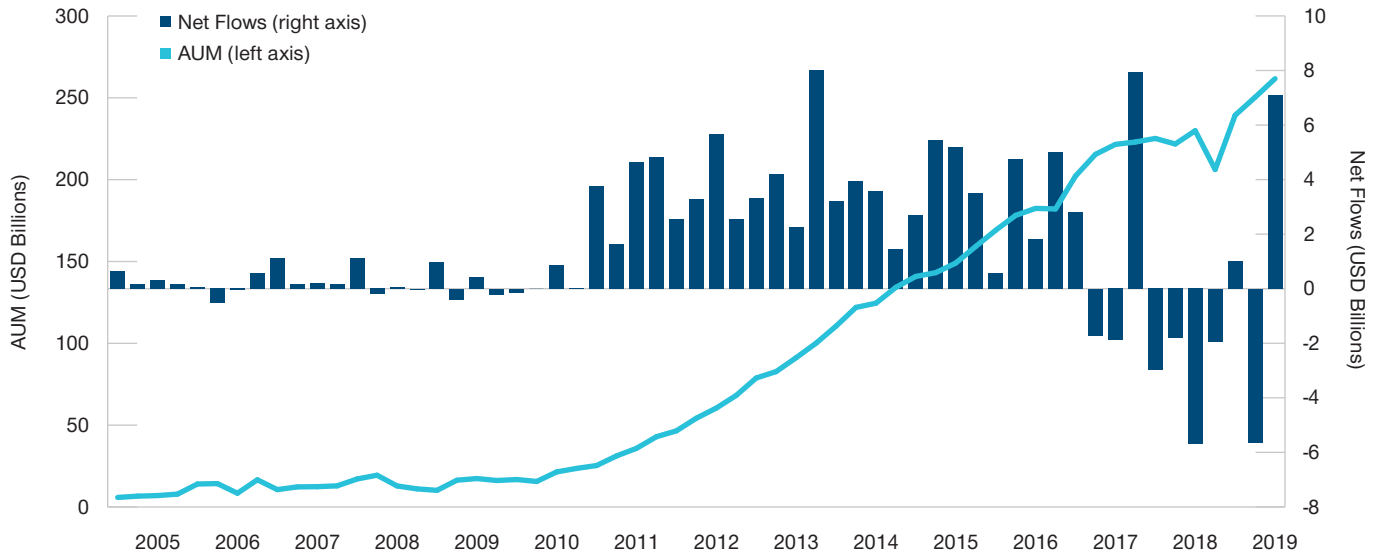
Crowdedness

The global financial crisis was one of the most significant market downturns in recent history. Unsurprisingly, the recession induced by that crisis led to a spike in defensive investing, including defensive equity investing. Figure 1 shows the rapid flow of assets into U.S.

> Are there underappreciated risks lurking in these investment approaches that investors tend to believe are relatively less volatile?

Defensive Equity Strategies Have Grown More Popular

(Fig. 1) Institutional net flows and assets under management (AUM)



June 1, 2005, through December 31, 2019.
Source: eVestment Alliance, LLC.

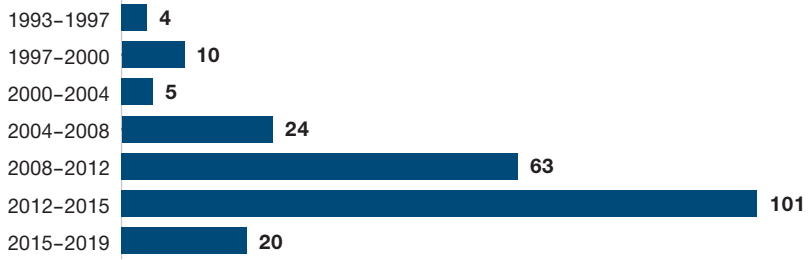
defensive equity strategies after the global financial crisis, while Figure 2 shows the number of defensive equity strategies launched during that same time period.[1]

Given the increased popularity of defensive equity strategies, we wanted to investigate their defensive characteristics to better understand their potential role in investment portfolios.

While crowdedness does not explicitly cause overvaluation, highly popular asset classes historically have tended to trade at a premium to the overall market. In the context of defensive equities, this suggests that the asset class could exhibit a different risk/return profile relative to periods when it featured more moderate valuations. To investigate this, we examined the performance of defensive equities during periods of market weakness, conditional on valuation.

Asset Managers Responded to Increased Investor Demand

(Fig. 2) Number of defensive equity strategy inceptions

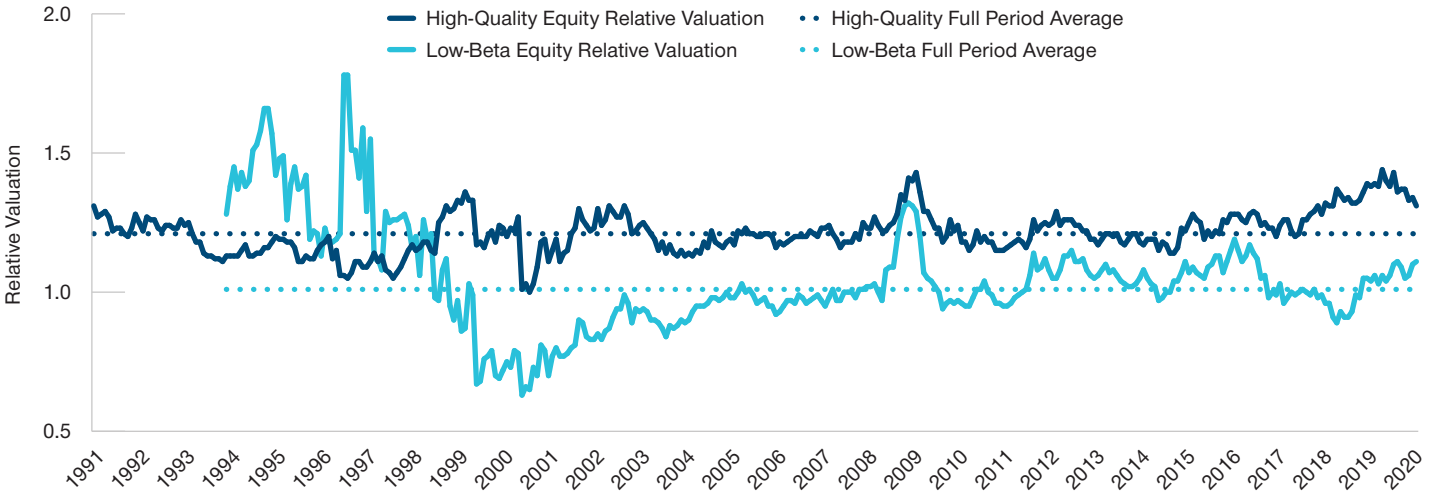


June 1, 1993, through March 21, 2019.
Source: eVestment Alliance, LLC.

[1] We compiled a list of U.S. defensive equity strategies in the eVestment Alliance database by combining the strategies categorized in the following eVestment universes: U.S. Low Volatility Equity, Smart Beta Equity: Low Volatility, and Smart Beta Equity: Quality.

Defensive Equity Valuations Have Varied Significantly Over Time

(Fig. 3) Composite valuations relative to the Russell 1000 Index



January 31, 1991, through February 29, 2020. See appendix for the methodology.
Source: Russell (see Additional Disclosures). All data analysis by T. Rowe Price.

> ...we wanted to see if expensive valuations, on average, have correlated with less defensive short-term performance.

Valuations and Performance

The purpose of our analysis was to discover whether defensive equity assets have not been as protective in periods when they were valued relatively expensively. Recognizing that relative valuations can and have varied significantly over time (Figure 3), we also wondered if these varying valuations have had an effect on relative performance.

First, we wanted to see if expensive valuations, on average, have correlated with less defensive short-term performance. Here, we defined the short term as the one-month period in which a sell-off occurred. In Figures 4 and 6, and again in Figures 5 and 7, the data are grouped into buckets that define the assets as being cheap, expensive, or normally valued at the time of the sell-off.

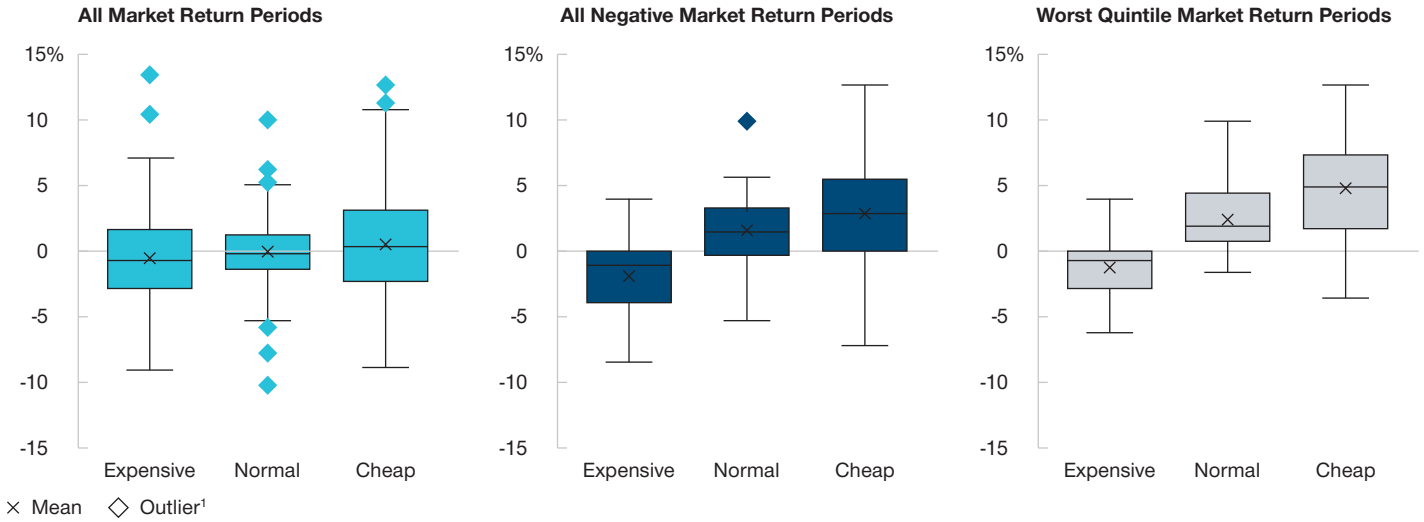
We also bucketed historical data points into three categories: all historical periods, all periods when the U.S. large-cap equity market (as measured by the Russell 1000 Index) experienced negative returns, and all periods that were in the lowest-returning quintile of returns over the full time period studied. The purpose of this bucketing was to visualize how the relationship between valuation and forward relative performance has varied in different market environments.

For low-beta equities, we see that this asset class was less defensive when it was expensive leading into a market sell-off:

- Figures 4 and 5 show that the differences in average excess performance between relatively cheap valuation periods and relatively expensive valuation periods were larger in equity market drawdowns (the center and right-hand panels in Figure 4).
- During periods when composite valuations for low-beta equities were normal or cheap, their excess returns were highest when market returns were in their lowest quintile. However, this relationship broke down when composite valuations were expensive.
- The effect of high valuation on relative performance was effectively "hidden" until a market drawdown occurred. In other words, expensive low-beta equities provided less portfolio defense and diversification exactly when those portfolios needed them most.

Low-Beta Equities Were Less Defensive When Valuations Were High Before a Market Drawdown

(Fig. 4) Short-term excess performance relative to the Russell 1000 Index



January 31, 1994, through February 29, 2020. See appendix for the methodology and important information for back-tested results.

[1] Outliers represent individual stocks that were at the extreme ends of the range of excess returns for their valuation categories in the periods shown. Statistically, outliers are defined as values that are more than 1.5 times the interquartile range above or below the quartiles marked by the boxes shown in the charts.

Source: Russell (see Additional Disclosures). All data analysis by T. Rowe Price.

For Illustrative Purposes Only. Not representative of an actual investment or T. Rowe Price product. Past performance is not a reliable indicator of future performance.

Low-Beta Equities Were Less Defensive When Portfolios Needed It the Most

(Fig. 5) Average short-term excess performance relative to the Russell 1000 Index

	All Market Return Periods			All Negative Market Return Periods			Worst Quintile Market Return Periods		
	Expensive	Normal	Cheap	Expensive	Normal	Cheap	Expensive	Normal	Cheap
Average Excess Performance	-0.5%	0.0%	0.5%	-1.9%	1.6%	2.9%	-1.3%	2.4%	4.8%
CVaR (75%)	-2.6%	-1.4%	-2.2%	-3.8%	-0.3%	0.2%	-2.2%	0.8%	3.2%
Hit Rate	37%	47%	56%	22%	71%	79%	23%	84%	88%
Number of Observations	63	189	62	18	58	28	13	32	17

January 31, 1994, through February 29, 2020. See appendix for the methodology and important information for back-tested results.

Source: Russell (see Additional Disclosures). All data analysis by T. Rowe Price.

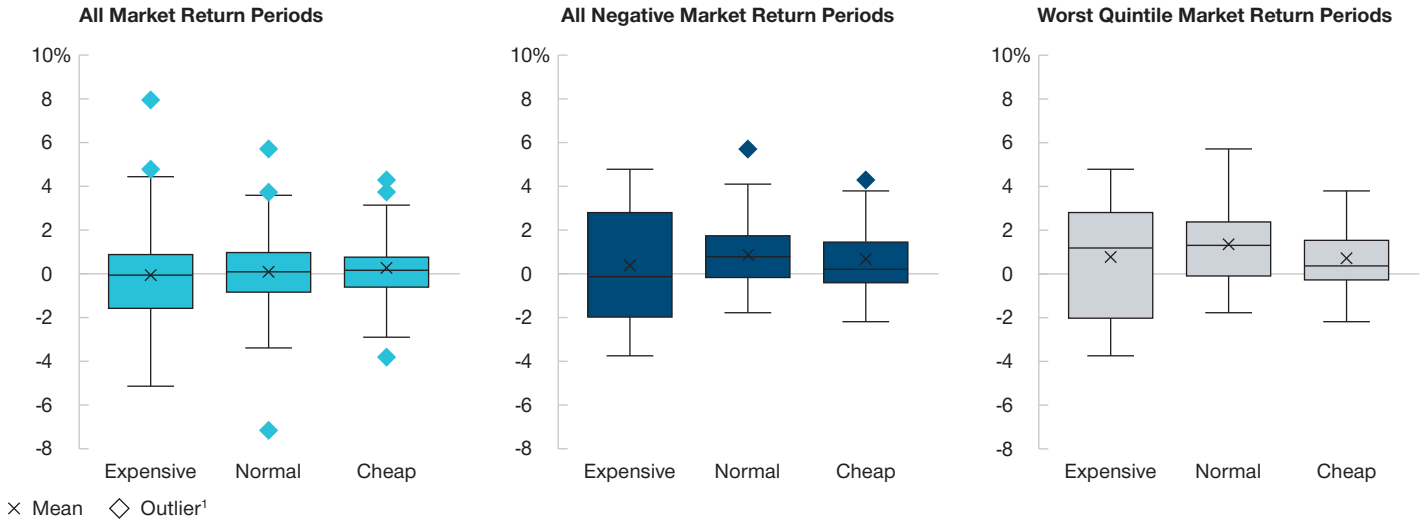
For Illustrative Purposes Only. Not representative of an actual investment or T. Rowe Price product. Past performance is not a reliable indicator of future performance.

The takeaways for high-quality equities were less clear-cut but also offer valuable insights, in our view. We see that there was a greater dispersion in outcomes when the asset class was more expensive leading into a market contraction over the short term (Figures 6 and 7).

- By comparing the length of the boxes (signifying the middle 50% of outcomes) in the expensive groups versus the "cheap" groups, we can

Dispersion Was Widest When High-Quality Stocks Were More Expensive

(Fig. 6) Short-term excess performance relative to the Russell 1000 Index



February 28, 1991, through February 29, 2020. See appendix for the methodology and important information for back-tested results.

[1] Outliers represent individual stocks that were at the extreme ends of the range of excess returns for their valuation categories in the periods shown. Statistically, outliers are defined as values that are more than 1.5 times the interquartile range above or below the quartiles marked by the boxes shown in the charts.

Source: Russell (see Additional Disclosures). All data analysis by T. Rowe Price.

For Illustrative Purposes Only. Not representative of an actual investment or T. Rowe Price product. Past performance is not a reliable indicator of future performance.

Impact of Valuations on High-Quality Equities Was Primarily Felt in Broad Market Declines

(Fig. 7) Short-term excess performance relative to the Russell 1000 Index

	All Market Return Periods			All Negative Market Return Periods			Worst Quintile Market Return Periods		
	Expensive	Normal	Cheap	Expensive	Normal	Cheap	Expensive	Normal	Cheap
Average Excess Performance	0.2%	0.1%	0.3%	0.7%	0.9%	0.7%	1.1%	1.3%	0.7%
CVaR (75%)	-1.1%	-0.8%	-0.6%	-1.1%	-0.1%	-0.4%	-0.7%	0.0%	-0.2%
Hit Rate	55%	53%	54%	58%	70%	56%	71%	70%	64%
Number of Observations	69	211	69	19	69	27	14	37	14

February 28, 1991, through February 29, 2020. See appendix for the methodology and important information for back-tested results.

Source: Russell (see Additional Disclosures). All data analysis by T. Rowe Price.

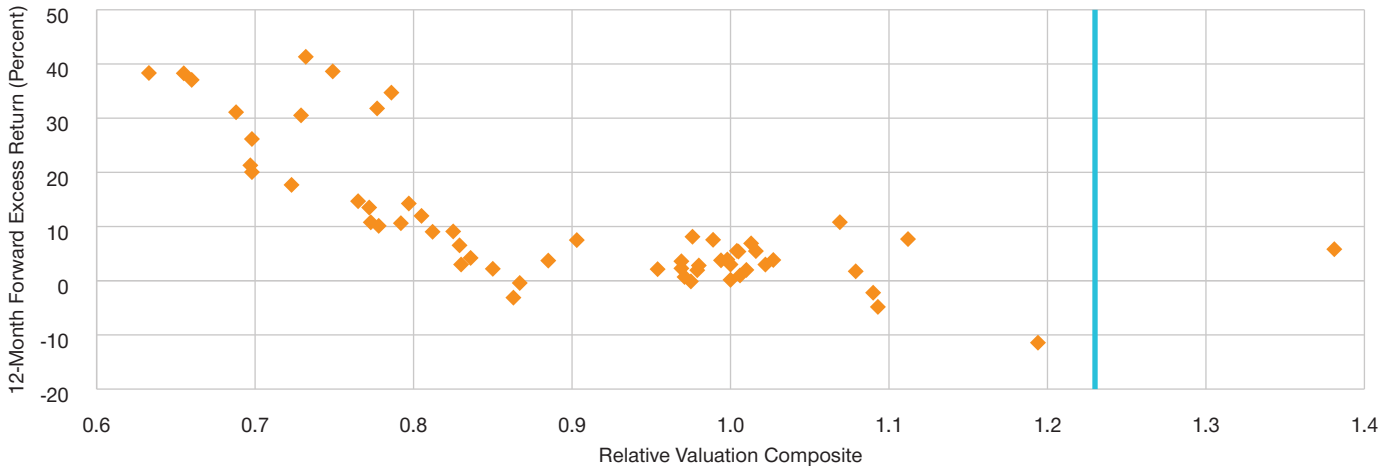
For Illustrative Purposes Only. Not representative of an actual investment or T. Rowe Price product. Past performance is not a reliable indicator of future performance.

see that the dispersion in relative performance was widest when high-quality equities were valued relatively expensively.

- By comparing the length of the boxes between the "All Market Return Periods" panel on the left and "All Negative Market Return Periods" and "Worst Quintile Market Return Periods" panels (center and right), we see that this disparity in consistency of performance between expensive assets and other assets only really was present when market returns were negative.

Longer-Term Performance of Low-Beta Equities Was Higher When Valuations Were Lower

(Fig. 8) 12-month forward excess returns relative to the Russell 1000 Index



February 28, 1994, through February 29, 2020. See appendix for the methodology and important information for back-tested results.
Source: Russell (see Additional Disclosures). All data analysis by T. Rowe Price.
For Illustrative Purposes Only. Not representative of an actual investment or T. Rowe Price product. Past performance is not a reliable indicator of future performance.

> In the longer-term analysis, low-beta equities also delivered higher excess performance in periods when they were more cheaply valued.

- As with low-beta equities, we can conclude that the impact of expensive valuations on high-quality equity returns was primarily felt when the broad market also was declining, and that this trend could have resulted in investors being surprised by an asset class that was supposed to be dependable.

In the second part of our analysis, we wanted to see if this relationship persisted over longer holding periods. Figures 8 and 9 show the historical relationship between relative valuations and forward 12-month excess returns for defensive equities during the worst quintile of 12-month market returns (as measured by the Russell 1000 Index). The vertical blue lines mark composite valuations as of March 31, 2020.

In the longer-term analysis, low-beta equities also delivered higher excess performance in periods when they were more cheaply valued. This negative relationship between relative valuation and 12-month forward excess returns is made clear in Figure 8 by the downward trend of the scatter plot points.

Further, the scatter plot trend indicates that someone investing in an environment with relatively high valuations (as marked by the vertical blue line) could have expected to receive a below-average level of defensiveness from this asset class during a market drawdown.

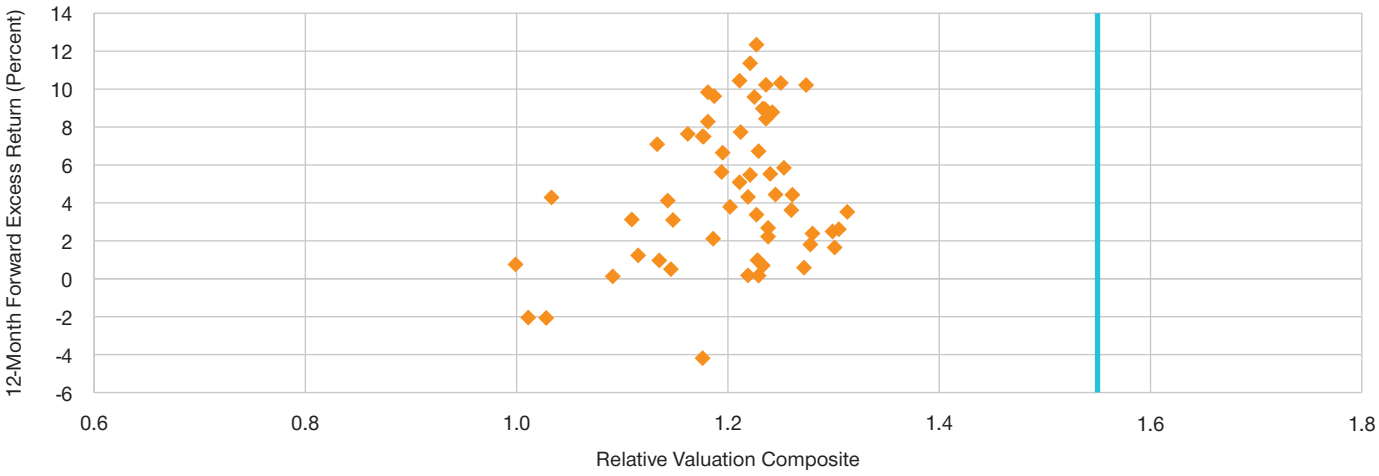
For high-quality equity, the longer-term analysis in Figure 9 shows that the relative valuation composite was at an all-time high as of March 31, 2020. Further, there is a wide dispersion of scatter plot points at this higher end of the valuation axis. This combination of high valuations and inconsistent relative performance suggests that, given an equity market drawdown, investors would not have been able to fully depend on this asset class to deliver a consistent level of portfolio defensiveness.

Case Study

At the beginning of 2020, the world experienced a historic market sell-off caused by the coronavirus pandemic and its economic implications. While equity markets since have rebounded, at this point we do not know how—or

Performance Dispersion for High-Quality Equities Was Wider at Higher Valuation Levels

(Fig. 9) 12-month forward excess returns relative to the Russell 1000 Index



February 28, 1994, through February 29, 2020. See appendix for the methodology and important information for back-tested results.
Source: Russell (see Additional Disclosures). All data analysis by T. Rowe Price.
For Illustrative Purposes Only. Not representative of an actual investment or T. Rowe Price product. Past performance is not a reliable indicator of future performance.

when—the pandemic crisis will end. However, the last few months of data provide some interesting insights.

As of February 29, 2020, betas for defensive equity assets were trending below their long-term averages, as seen in Figure 10. Historically, lower betas typically have correlated with more defensive performance.

However, at the same time, defensive equities also were valued relatively expensively compared with historical averages (see Figure 3). In particular, composite valuations for high-quality equities were in the top quintile of observations over the last 30 or so years, while composite valuations for low-beta equities were in the top 30% of observations over that same time period.

Given the backdrop of low betas and high valuations for defensive equities, we were curious to see how defensively these assets performed during the COVID-19 market sell-off. We looked at the peak-to-trough drawdowns

Before the Coronavirus Sell-Off, Defensive Equity Betas Were Trending Below Long-Term Averages

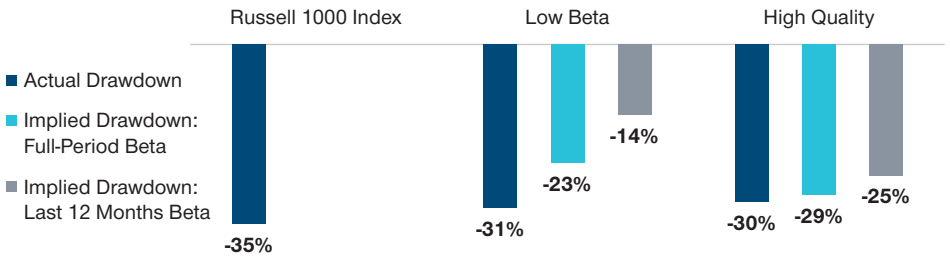
(Fig. 10) Betas for low-beta and high-quality stocks relative to the Russell 1000 Index

	Low Beta	High Quality
Full Period Beta	0.66	0.84
Last 12 Months Beta	0.39	0.73

January 1, 2020, through May 14, 2020.
Source: Russell (see Additional Disclosures). All data analysis by T. Rowe Price.
Full-period historical betas were calculated from February 28, 1994, through February 29, 2020, for low-beta equities, and from February 28, 1991, through February 29, 2020, for high-quality equities. Last 12 months betas were calculated over the 12 months ended January 1, 2020. See appendix for the methodology and important information for back-tested results.

Valuations May Have Played a Role in Relative Performance During Coronavirus Sell-Off

(Fig. 11) Actual and implied maximum drawdowns



January 1, 2020, through May 14, 2020. See appendix for the methodology and important information for back-tested results.
Source: Russell (see Additional Disclosures). All data analysis by T. Rowe Price.
For Illustrative Purposes Only. Not representative of an actual investment or T. Rowe Price product. Past performance is not a reliable indicator of future performance.

> ...expensive valuations may have played a role in relative performance during the early 2020 market drawdown.

experienced by low-beta equity, high-quality equity, and the benchmark (the Russell 1000 Index) from January 1, 2020, through May 14, 2020. For low-beta equity and high-quality equities, we also calculated what the implied drawdown would have been if those asset classes had matched their historical betas.

Focusing solely on actual drawdowns, it initially appears that both low-beta and high-quality equities offered some degree of defensiveness during the period. Their maximum drawdowns were a few percentage points short of the benchmark's. However, defensive equities did not offer the level of defense implied by their short- and long-term historical betas.[2]

For low-beta equity, the long-term beta would have implied an additional eight percentage points of defensiveness, while the short-term beta would have implied 17 additional percentage points. For high-quality equity, the differences were less stark, but the long-term beta would have implied an additional one percentage point of defensive performance, and the short-term beta an additional five percentage points of defensiveness.

At this point, we do not know how the market's reaction to the coronavirus pandemic ultimately will play out. However, the observed historical mismatches in beta-implied drawdown levels and actual drawdown levels for expensively valued defensive equities lead us to believe that expensive valuations may have played a role in relative performance during the early 2020 market drawdown.

Conclusions and Investor Implications

Generally, investors assume that traditionally defensive asset classes will help them mitigate drawdown risk in their portfolios. However, in our historical examination of two defensive equity asset classes, we have demonstrated that the degree of defensiveness of these assets can vary significantly and that this variation historically has been linked to valuation levels.

In particular, our analysis shows that highly valued low-beta equities historically have experienced worse

[2] We calculated implied drawdowns by multiplying the benchmark return by the asset class's short-term and long-term historical betas to the benchmark. Long-term historical betas were calculated over the period February 28, 1994, through February 29, 2020, for low-beta equities, and February 28, 1991, through February 29, 2020, for high-quality equities. Short-term betas were calculated over the 12 months ended January 1, 2020.

excess performance during market sell-offs (over both short-term and longer-term periods) compared with cheaply valued low-beta equities. We also found that highly valued high-quality equities had a wider dispersion of outcomes during market sell-offs than cheaply valued high-quality equities.

While we cannot predict the long-term performance of these asset classes, we would encourage investors to be thoughtful when investing in defensive equity assets and to consider factors like crowdedness and relative valuations when constructing and monitoring their portfolios. We believe investors should:

- use caution when interpreting historical back tests of low-beta and high-quality equities, given how significantly their performances historically have varied when conditioned on valuations;
- not rely too heavily on defensive equities as portfolio hedges as the degree of defensiveness they provide can be fickle when valuations are stretched;
- think about their portfolios holistically—carefully defining the objective for each asset class both individually and in terms of how it relates to the whole, then using a range of analyses to stress test the portfolio under a variety of potential market conditions.

Appendix

When researching hidden risks in defensive equities, we focused our efforts on two specific categories: low-beta equities and high-quality equities:

- Low-beta equity is synonymous with low-volatility equity: This category contains the stocks in the Russell 1000 Index that have had historical betas in the lowest quintile of that universe based on 60 months of trailing returns. Traditionally defensive sectors and industries, such as consumer staples and utilities, typically have been well represented in this group.
- We employed a proprietary composite measure to define quality. We defined high-quality companies as those stocks within the Russell 1000 Index that had relatively high profitability, lower leverage, stronger ability to generate cash flow, lower earnings variability, and lower stock price volatility (including both market beta and absolute volatility). Stocks ranked in the highest quintile by our composite measure were defined as "high quality."

High-quality companies were those that ranked in the highest quintile of the Russell 1000 Index based on the characteristics outlined above. Such groupings typically contain companies from traditionally defensive sectors but may also include high-quality businesses from industries with slightly more cyclicality (such as the industrials or consumer discretionary sectors). Reflecting that fact, our definition of high quality can be expected to produce a more heterogenous cohort of stocks relative to our low-volatility group.

Valuation Metrics

We also created our own custom composite valuation metrics to capture relative valuations compared with the Russell 1000 Index:

- We created a relative composite valuation for each defensive equity category (low-beta equities and high-quality equities).
- The underlying metrics used to create the composite were enterprise value (EV)/sales, price/book, forward price/earnings, and EV/earnings before interest, taxes, depreciation, and amortization (EBITDA).
- The first step in creating the composite was to make each metric relative to the benchmark. We did this by dividing each of the four valuations metrics for low-beta equities and high-quality equities by the respective valuation metrics for the benchmark for each time period.
- Once we had converted the four valuation metrics to "relative" values, we calculated a simple average of the four metrics to capture our overall relative composite valuation time series.
- In this analysis, we defined "cheap" as the least expensive (lowest) 20% of relative composite valuations over the time series. Accordingly, we defined "expensive" as the most expensive (highest) 20% of relative composite valuations over the time series. "Normal" referred to values in the middle 60% over the time series.

Historical Data

We used monthly data in our analysis, except in the coronavirus pandemic case study. Our back-testing window was based on the availability of data for low-beta and high-quality equities:

- Our first full month of low-beta equity data is December 1993.
- Our first full month of high-quality equity data is January 1991.

The use of different defensive equity definitions and other methodology could yield different results from those shown, perhaps significantly.

INVEST WITH CONFIDENCE℠

T. Rowe Price focuses on delivering investment management excellence that investors can rely on—now and over the long term.

T.RowePrice®

Important Information

This material is being furnished for general informational and/or marketing purposes only. The material does not constitute or undertake to give advice of any nature, including fiduciary investment advice, nor is it intended to serve as the primary basis for an investment decision. Prospective investors are recommended to seek independent legal, financial and tax advice before making any investment decision. T. Rowe Price group of companies including T. Rowe Price Associates, Inc. and/or its affiliates receive revenue from T. Rowe Price investment products and services. **Past performance is not a reliable indicator of future performance.** The value of an investment and any income from it can go down as well as up. Investors may get back less than the amount invested.

The material does not constitute a distribution, an offer, an invitation, a personal or general recommendation or solicitation to sell or buy any securities in any jurisdiction or to conduct any particular investment activity. The material has not been reviewed by any regulatory authority in any jurisdiction.

Information and opinions presented have been obtained or derived from sources believed to be reliable and current; however, we cannot guarantee the sources' accuracy or completeness. There is no guarantee that any forecasts made will come to pass. The views contained herein are as of the date written and are subject to change without notice; these views may differ from those of other T. Rowe Price group companies and/or associates. Under no circumstances should the material, in whole or in part, be copied or redistributed without consent from T. Rowe Price.

The material is not intended for use by persons in jurisdictions which prohibit or restrict the distribution of the material and in certain countries the material is provided upon specific request. It is not intended for distribution to retail investors in any jurisdiction.

Australia—Issued in Australia by T. Rowe Price Australia Limited (ABN: 13 620 668 895 and AFSL: 503741), Level 50, Governor Phillip Tower, 1 Farrer Place, Suite 50B, Sydney, NSW 2000, Australia. For Wholesale Clients only.

Brunei—This material can only be delivered to certain specific institutional investors for informational purpose upon request only. The strategy and/or any products associated with the strategy has not been authorised for distribution in Brunei. No distribution of this material to any member of the public in Brunei is permitted.

Canada—Issued in Canada by T. Rowe Price (Canada), Inc. T. Rowe Price (Canada), Inc.'s investment management services are only available to Accredited Investors as defined under National Instrument 45-106. T. Rowe Price (Canada), Inc. enters into written delegation agreements with affiliates to provide investment management services.

China—This material is provided to specific qualified domestic institutional investor or sovereign wealth fund on a one-on-one basis. No invitation to offer, or offer for, or sale of, the shares will be made in the People's Republic of China ("PRC") (which, for such purpose, does not include the Hong Kong or Macau Special Administrative Regions or Taiwan) or by any means that would be deemed public under the laws of the PRC. The information relating to the strategy contained in this material has not been submitted to or approved by the China Securities Regulatory Commission or any other relevant governmental authority in the PRC. The strategy and/or any product associated with the strategy may only be offered or sold to investors in the PRC that are expressly authorized under the laws and regulations of the PRC to buy and sell securities denominated in a currency other than the Renminbi (or RMB), which is the official currency of the PRC. Potential investors who are resident in the PRC are responsible for obtaining the required approvals from all relevant government authorities in the PRC, including, but not limited to, the State Administration of Foreign Exchange, before purchasing the shares. This document further does not constitute any securities or investment advice to citizens of the PRC, or nationals with permanent residence in the PRC, or to any corporation, partnership, or other entity incorporated or established in the PRC.

DIFC—Issued in the Dubai International Financial Centre by T. Rowe Price International Ltd. This material is communicated on behalf of T. Rowe Price International Ltd. by its representative office which is regulated by the Dubai Financial Services Authority. For Professional Clients only.

EEA ex-UK—Unless indicated otherwise this material is issued and approved by T. Rowe Price (Luxembourg) Management S.à r.l. 35 Boulevard du Prince Henri L-1724 Luxembourg which is authorised and regulated by the Luxembourg Commission de Surveillance du Secteur Financier. For Professional Clients only.

Hong Kong—Issued in Hong Kong by T. Rowe Price Hong Kong Limited, 6/F, Chater House, 8 Connaught Road Central, Hong Kong. T. Rowe Price Hong Kong Limited is licensed and regulated by the Securities & Futures Commission. For Professional Investors only.

Indonesia—This material is intended to be used only by the designated recipient to whom T. Rowe Price delivered; it is for institutional use only. Under no circumstances should the material, in whole or in part, be copied, redistributed or shared, in any medium, without prior written consent from T. Rowe Price. No distribution of this material to members of the public in any jurisdiction is permitted.

Korea—This material is intended only to Qualified Professional Investors upon specific and unsolicited request and may not be reproduced in whole or in part nor can they be transmitted to any other person in the Republic of Korea.

Malaysia—This material can only be delivered to specific institutional investor upon specific and unsolicited request. The strategy and/or any products associated with the strategy has not been authorised for distribution in Malaysia. This material is solely for institutional use and for informational purposes only. This material does not provide investment advice or an offering to make, or an inducement or attempted inducement of any person to enter into or to offer to enter into, an agreement for or with a view to acquiring, disposing of, subscribing for or underwriting securities. Nothing in this material shall be considered a making available of, solicitation to buy, an offering for subscription or purchase or an invitation to subscribe for or purchase any securities, or any other product or service, to any person in any jurisdiction where such offer, solicitation, purchase or sale would be unlawful under the laws of Malaysia.

New Zealand—Issued in New Zealand by T. Rowe Price Australia Limited (ABN: 13 620 668 895 and AFSL: 503741), Level 50, Governor Phillip Tower, 1 Farrer Place, Suite 50B, Sydney, NSW 2000, Australia. No Interests are offered to the public. Accordingly, the Interests may not, directly or indirectly, be offered, sold or delivered in New Zealand, nor may any offering document or advertisement in relation to any offer of the Interests be distributed in New Zealand, other than in circumstances where there is no contravention of the Financial Markets Conduct Act 2013.

Philippines—THE STRATEGY AND/ OR ANY SECURITIES ASSOCIATED WITH THE STRATEGY BEING OFFERED OR SOLD HEREIN HAVE NOT BEEN REGISTERED WITH THE SECURITIES AND EXCHANGE COMMISSION UNDER THE SECURITIES REGULATION CODE. ANY FUTURE OFFER OR SALE OF THE STRATEGY AND/ OR ANY SECURITIES IS SUBJECT TO REGISTRATION REQUIREMENTS UNDER THE CODE, UNLESS SUCH OFFER OR SALE QUALIFIES AS AN EXEMPT TRANSACTION.

Singapore—Issued in Singapore by T. Rowe Price Singapore Private Ltd., No. 501 Orchard Rd, #10-02 Wheelock Place, Singapore 238880. T. Rowe Price Singapore Private Ltd. is licensed and regulated by the Monetary Authority of Singapore. For Institutional and Accredited Investors only.

South Africa—T. Rowe Price International Ltd ("TRPIL") is an authorised financial services provider under the Financial Advisory and Intermediary Services Act, 2002 (FSP Licence Number 31935), authorised to provide "intermediary services" to South African investors.

Switzerland—Issued in Switzerland by T. Rowe Price (Switzerland) GmbH, Talstrasse 65, 6th Floor, 8001 Zurich, Switzerland. For Qualified Investors only.

Taiwan—This does not provide investment advice or recommendations. Nothing in this material shall be considered a solicitation to buy, or an offer to sell, a security, or any other product or service, to any person in the Republic of China.

Thailand—This material has not been and will not be filed with or approved by the Securities Exchange Commission of Thailand or any other regulatory authority in Thailand. The material is provided solely to "institutional investors" as defined under relevant Thai laws and regulations. No distribution of this material to any member of the public in Thailand is permitted. Nothing in this material shall be considered a provision of service, or a solicitation to buy, or an offer to sell, a security, or any other product or service, to any person where such provision, offer, solicitation, purchase or sale would be unlawful under relevant Thai laws and regulations.

UK—This material is issued and approved by T. Rowe Price International Ltd, 60 Queen Victoria Street, London, EC4N 4TZ which is authorised and regulated by the UK Financial Conduct Authority. For Professional Clients only.

USA—Issued in the USA by T. Rowe Price Associates, Inc., 100 East Pratt Street, Baltimore, MD, 21202, which is regulated by the U.S. Securities and Exchange Commission. For Institutional Investors only.

ID0003423 (07/2020)
202007-1237148