The Size Factor Still Has Its Place in Multi-Factor Portfolios

Felix Goltz, PhD, Research Director, Scientific Beta
Ben Luyten, Quantitative Research Analyst, Scientific Beta

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Introduction

Asset managers who sell factor investing products are often opposed to the idea that there is a size factor. For example, Alquist, Israel and Moskowitz (2018) discussed the size effect and argued that there is neither strong empirical evidence nor robust theoretical support for a persistent size premium. Others have also questioned the robustness of the size factor (Beck *et al.*, 2016).

Recent comments emphasise this view. Most notably, AQR published a note on its website[1] entitled: "*There Is No Size Effect: Daily Edition"*. Our note questions the relevance of these conclusions.

In fact, there are two important results regarding the size factor. On the one hand, the standalone outperformance of small stocks over large stocks is weak and may even disappear when taking exposure to the market factor into account. This has led providers to claim that the size factor does not exist. On the other hand, further analysis consistently shows that a size effect is found when controlling for other factors, especially quality-related factors (see Asness *et al.*, 2018). This points to the usefulness of the size factor for investors who also have exposure to other factors.

In their recent note, AQR stress their previous view that the size factor does not exist. The note provides results showing that size does not have a premium when accounting for the market factor. In particular, they estimate the intercept in a time-series regression of size factor returns onto the market factor return. They find that augmenting the set of independent variables with the lagged market return in addition to the contemporaneous market return leads to an insignificant size premium.

We question whether this result has any practical relevance for investors. Instead, we focus on the question of practical relevance: does the size factor add value to an investor's portfolio?

[1] See https://www.aqr.com/Insights/Perspectives/There-is-No-Size-Effect-Daily-Edition

Factor performance should be assessed from a portfolio perspective

The simplest way to assess whether a factor adds value to a portfolio is to compare the risk/return characteristics with and without inclusion of the factor. An investor who is concerned about risk-adjusted returns will want to include a factor in their portfolio if it increases the Sharpe ratio of the overall portfolio. Looking at standalone factor premia will not answer this question, since this does not take the correlations between the factor of interest and the other factors in the portfolio into account. Hence, stand-alone performance does not capture how the risk characteristics of the portfolio are impacted. Similarly, only accounting for exposure to the market factor, as in the AQR note, does not give a complete picture of how the factor will impact the portfolio, because it ignores correlations with other factors. Adding the lagged values of the market factor in the regression does not resolve this problem.

Nowadays, multi-factor investors have access to a menu of factors, such as value, momentum or profitability. The practically relevant case is thus that investors decide on their allocation to a range of factors. Consequently, to answer the question of whether the size factor adds value and improves the Sharpe ratio of a portfolio, we need to take exposures to all these other factors into account. Only accounting for the market factor would assume that an investor's choice is limited to holding only the market or holding the market and size.

Esakia *et al.* (2019), our previously published work on the size factor, conducts several tests to show that the size factor does indeed improve the Sharpe ratio of a multi-factor investor. Exhibit 1 presents a key result from the paper that clearly illustrate this. The graph shows the factor weights[2] that maximise the Sharpe ratio of an investor who can choose from a factor menu consisting of the market, size, value, momentum, low risk, high profitability and low investment factors, which have been widely used in both academic and practitioner research. This is a straightforward way to assess the impact of including a factor on the risk/return characteristics of a portfolio. Any deviation from these weights would lower the Sharpe ratio.

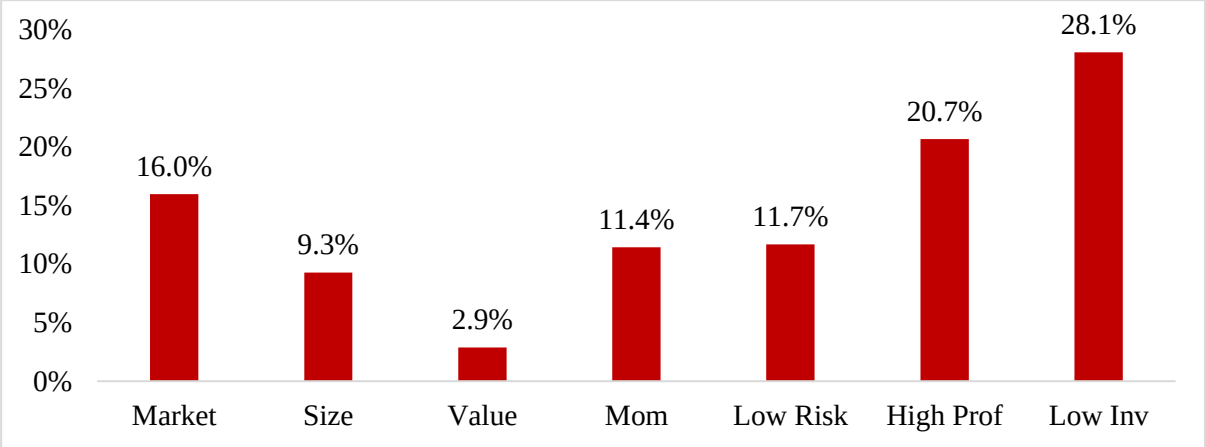
Size received a weight of more than 9% in the portfolio, which is greater than that of value (2.9%), and close to those of the momentum (11.4%) and low risk factors (11.7%). Esakia *et al.* (2019) also report that the standalone size factor had the lowest return among the factors in the menu over the period of the analysis. Momentum and low risk had average standalone premia that were about three times as high. However, the weights of the momentum and low risk factors in the optimal portfolio are not much higher than the weight of the size factor.

The reason for these results is that optimal factor weights are not only based on returns or market-adjusted returns. They also depend on risk properties, notably the volatility and the correlation with other factors apart from the market factor. Taking these risk properties into account is particularly useful as we are able to measure them with a fair degree of

[2] Note that these results are based on over 50 years of data to avoid drawing conclusions on a short-term analysis, such as in Horowitz *et al.* (2000).

reliability, while expected returns are notoriously hard to estimate (see Merton (1980)). The positive weight of the size factor in the optimal portfolio reflects the fact that including exposure to size improves the risk/return properties of a multi-factor portfolio, even though the factor may not have stellar returns. The size factor contributes to the Sharpe ratio because it has a particularly low correlation with other traditional factors, which makes it an effective diversifier in the portfolio.

Exhibit 1: Weights in mean-variance optimal portfolio, taken from Esakia *et al.* (2019).



The period is July 1963 to December 2018. Monthly returns come from Kenneth R. French's website and the AQR data set (for low risk). Due to rounding errors, the weights do not add up to 100%. Mom = momentum; Prof = profitability; Inv = investment.

Esakia *et al.* (2019) further show that the diversification benefits of the size factor are so strong that it would still be a valuable addition to a multi-factor portfolio with close to no premium.

When the AQR note stresses that there is no size premium after taking only the market factor into account, it merely points to a finding that does not have much practical relevance. By ignoring the low correlation of the size factor with other traditional factors and the accompanying diversification benefits, one also ignores its added value in a multi-factor portfolio.

AQR researchers provided a more relevant analysis in an earlier publication (Asness *et al.* 2018), where the size premium is analysed while accounting for multiple factors. This earlier study concludes forcefully that "*A significant size premium emerges, which is stable through time, robust to specification, not concentrated in microcaps, more consistent across seasons, and evident for non-price-based measures of size, and these results hold in 30 different industries and 24 international equity markets*." This finding implies that the size factor is a useful addition to multi-factor portfolios. Knowing that the size factor adds value when combined with a standard set of factors is much more relevant for investors than knowing that it does not add value when combined only with market returns and lagged market returns.

Academic research offers support for the inclusion of the size factor

Our conclusion that the size factor has an important role in multi-factor portfolios is not at all surprising. Instead, it aligns with what the academic literature has to say about the size factor.

Factors find their origins in academic asset pricing models. The objective of these models is to explain differences in expected returns in the cross-section of assets. To achieve this objective, it is assumed that variation in exposures to some common risk factors are the drivers of these differences. Exposure to the factors represents systematic risk that the average investor dislikes. Higher expected returns reflect compensation for bearing such risks. Translated into an investment context, factor tilts allow an investor to tilt a portfolio towards stocks which tend to earn higher risk premia.

The big challenge is to define which factors are relevant in explaining variations in expected returns. The first attempt was the Capital Asset Pricing Model (CAPM) developed by Sharpe (1964) and Lintner (1965), which only included one factor – the market factor. However, subsequent research has shown that exposure to the market factor does a poor job of explaining differences in average stock returns. Additional factors are necessary to capture the cross-sectional variation in returns. Fama and French (1993) proposed a three-factor model that extended the CAPM with two additional factors – the size and value factors. Throughout the years, other factors such as momentum (Carhart, 1997) and low risk (Frazzini and Pedersen, 2014) have also been proposed.

In the search for additional factors that explain the variation in expected returns across assets, the academic literature clearly recognises the importance of accounting for other factors. Fama and French (2015b), for example, argue that the incremental contribution of a variable in asset pricing tests is a more relevant measure than the return spread generated by sorted portfolios on the given variable. In other words, it is important to take the presence of other factors into account and assess a factor based on its ability to add value when combined with the other factors.

Academics do disagree on the precise set of factors that are best able to explain variations in returns across stocks. Exhibit 2 illustrates the set of factors used in several studies. While this makes clear that views on the most useful set of factors differ, we also note that the size factor is included in all these recent models. In fact, except for the market factor, the size factor is the only factor that is included in all the models. Consequently, there seems to be a consensus that the size factor explains differences in returns that remain unexplained by other factors. From an investment perspective, this suggests that considering a size tilt along with other tilts provides benefits to investors in terms of risk and return.

It is useful to consider consensus-based empirical evidence. The relevance of the size factor for asset pricing is shown in the consistent use of this factor in the academic literature's asset pricing models.

Exhibit 2: Overview of asset-pricing models, taken from Esakia *et al.* (2019).

Authors	Model	Factors
Hou, Xue and Zhang (2015)	Q-Factor-Model	Market, **size**, low investment, high profitability
Hou, Mo, Xue and Zhang (2018)	Q^5-Factor-Model	Market, **size**, low investment, high profitability, expected growth Factor
Fama and French (2015a)	Five-Factor-Model	Market, value, **size**, high profitability, low investment
Fama and French (2018)	Six-Factor-Model	Market, value, **size**, high profitability, low investment, momentum
Barillas and Shanken (2018)	Six-Factor-Model	Market, **size**, low investment, high profitability, value, momentum

The size factor does not have stellar returns but is a valuable addition to a portfolio

When taking into account other potential factor exposures in a portfolio, apart from only considering the market factor, it becomes clear that adding the size factor improves the risk/return characteristics of the portfolio. Size is a strong diversifier of other traditional factors and consequently adds value to a multi-factor portfolio. Analysis that fails to take exposures to factors such as momentum or profitability into account is of little practical relevance to investors.

Furthermore, claiming that there is no size effect is contrary to the various academic asset pricing models that conclude that the size factor adds explanatory power in the cross-section of returns. These models, by including factors other than the market, provide meaningful conclusions for investors.

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