Overview

The signal used for the construction of the primary strategy is the "Quality Minus Junk: Growth" which is the Growth component of "Quality Minus Junk Factor (QMJ)" as defined by Asness et al. (2019)[1]. Regarding the Growth factor, theory proposes that it should come from "the increase in sustainable profits in relation to book values", Asness et al. (2019). The intuition for this indicator, as well as for the QMJ factor, is that the quality of a company is somehow positively embedded into their price, therefore investors should be willing to pay a premium to access it. That is, higher-quality firms should, all else equal, sport higher prices. In the case of Growth, "Investors should also pay higher price for stocks with growing profits", Asness et al. (2019). All QMJ factors are price agnostic given they are solely based on non-price-related measures and history has shown that price floats somewhat freely even with high-quality stocks[2]. The reason, as suggested by Asness et al. (2019), is that this mispricing is linked to behavioral finance and other constraints.

As a standalone investment, this strategy has an interesting performance over the full sample period, with significant abnormal returns over the beginning to middle of the period (2000 to 2010) but performing in line with the market for the remaining years. As part of a broadly diversified portfolio, the mean-variance analysis tells us that it was possible to achieve a Sharpe Ratio over 1 over the full sample period. In addition, going Long on the Top tercile of the Growth signal yields a significant alpha over the bottom period, favorable to Value investing, therefore it is an interesting addition to a portfolio with the possibility for abnormal returns.

Regarding the indicator, Asness et al. (2019) constructs the "QMJ: Growth" from standard measures of profitability and growth and computes them "as the five-year growth in residual per-share profitability measures (excluding accruals), averaged across five measures.", Asness et al. (2019). The five-year window is used to reduce noise and focus on sustainable growth.

$$Growth = z(z_{\Delta gpoa} + z_{\Delta roe} + z_{\Delta roa} + z_{\Delta cfoa} + z_{\Delta gmar})$$

1.1 Strategy Analysis

To analyze this indicator, we will evaluate how much the risk factors of the CAPM and the Fama French 3 Factor model explain the returns of the indicator's portfolio. Then we regress the indicator's portfolio on these risk factors to obtain the exposure of the portfolio to that specific risk factor, represented by the coefficients. The intercept of this regression is the (alpha), the risk-adjusted return,

[1] Asness, C.S., Frazzini, A. & Pedersen, L.H. Quality minus junk. Rev Account Stud 24, 34–112 (2019). https://doi.org/10.1007/s11142-018-9470-2

[2] Johnson, Ben. "The What, Why, and How of Quality." Morningstar, Inc., 30 Mar. 2016, www.morningstar.com/articles/746828/the-what-why-and-how-of-quality.

that is, the average portfolio return that is not explained by the portfolio's betas on the risk factors. Intuitively, alpha, if positive, investors are getting a higher return than required by holding that risk.

For this, we sorted stocks into terciles based on the signal and formed a value-weighted portfolio for each of the terciles, in excess returns, and constructed *a Long Portfolio* using the *Top-tercile* and a *Long Short portfolio*, long on the *Top tercile* and short on the *Bottom tercile*. On **Figure 1.** below we find the Cumulative Return over the full period of the sample. Intuitively, if we had invested 1 euro at the start of 2000, the highest performance would come from holding the *Long Portfolio* with more than 4.5 euros in 2020. However, there are two clear patterns, from 2000 to 2010 the *Long-Short portfolio* outperforms both the *Long* and the *Market Portfolio* while from 2010 to 2020, the *Long portfolio* outperforms both the *Long Short* and the *Market*.

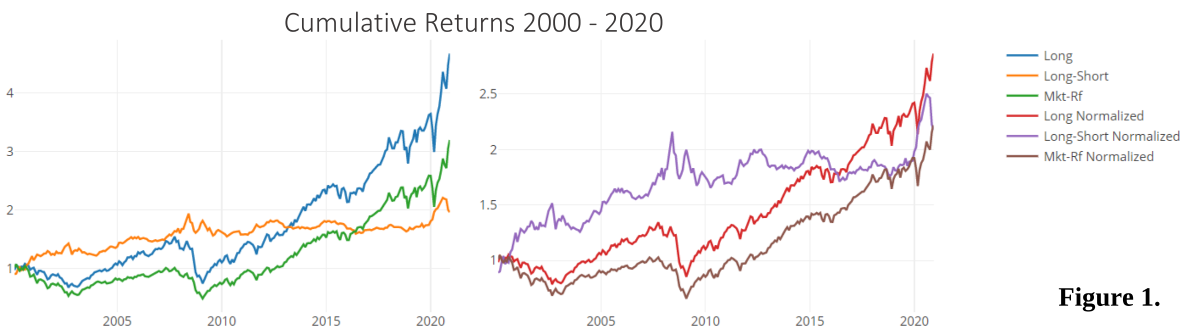

Figure 1.

Looking at the performance indicators in **table 1.** below we confirm the graphical observations above, where the *Top Half* of the sample period (2010 to 2020) has no significant alphas for both portf olios when controlling for the CAPM and the FF3 model risk factors, while the *Bottom Half*, has an alpha of 5,9% significant at the 5% level for the *Long-Short Portfolio* when controlling for the FF3 model and the *Long Portfolio* possesses a significant alpha of around 4% controlling for both the CAPM and the FF3 models. A possible explanation is that this signal has also been affected by this past decade's worse performance for value investing strategies.[3]

Looking at the information ratios we have a measure of portfolio returns beyond a given benchmark, this provides a measure of consistency where a higher information ratio implies that the portfolio is "consistently" beating the benchmark over time. For reference, a number between 0.4 and 0.6 is considered a good IR[4]. Having this, for the *Bottom Half* period the *Long Portfolio* has a very high information ratio with 0.7 for the CAPM and 0.84 for the FF3 alpha. This means that not only the alpha is significant, but these abnormal returns are also consistent over the *Bottom Half* period.

[3] Long, Mark. "Value Investing Is Struggling to Remain Relevant." The Economist, The Economist Newspaper, 14 Nov. 2020, www.economist.com/briefing/2020/11/14/value-investing-is-struggling-to-remain-relevant.

[4] "Information Ratio: Zephyr Associates, Inc." Zephry Associates, Inc, www.styleadvisor.com/resources/statfacts/information-ratio.

Similarly, for the *Long-Short Portfolio,* we have an IR of 0.5 for the CAPM alpha, although not statistically significant at the 5% level, and 0.65 for the, now significant, FF3 alpha, suggesting again that the abnormal returns of 5.9% are consistent over the *Bottom Half* period. Looking at the average annualized return and annualized Sharpe Ratio, the *Long Short* has the highest return in the *Bottom Half* period, of 5.1% with a Sharpe Ratio of 0.14 while the *Long Portfolio* sports a 14.5% annualized return in the *Top Half* of the sample, and a Sharpe ratio of 0.286. However, as explained above, given the alpha is approximately 0 in the Top half of the sample, we could effectively replicate the same returns using the market portfolio with this strategy not adding any value in this top part of the sample.

Looking at the *Full Sample* period, controlling the CAPM and FF3 risk factors, there is a significant alpha for both *Long* and *Long Short* portfolios, implying that high-quality growth stocks capture abnormal returns over the market. From these, the highest abnormal return at 5%, between CAPM and FF3, is achieved by the *Long Short* portfolio, long on higher-quality growth stocks, and short on lower-quality growth. Furthermore, a high information ratio of 0.6 and 0.66 for CAPM and FF3 alphas respectively, suggests that this strategy is also consistently outperforming their benchmark.

	Performance Indicators									
	Portfolio	Average Annualized Return	Annualized Sharpe Ratio	CAPM Alpha	CAPM t-stat	CAPM Information Ratio	FF3 Alpha	FF3 t-stat	FF3 Information Ratio
Full Period	Long	0,086	0,160	**0,022**	**2,328**	0,514	**0,023**	**2,538**	0,563
	Long-Short	0,036	0,122	**0,048**	**2,736**	0,604	**0,051**	**2,972**	0,660
Top Half	Long	0,145	0,286	-0,002	-0,253	-0,082	-0,010	-1,292	-0,436
	Long-Short	0,021	0,102	0,032	1,698	0,551	0,012	0,673	0,227
Bottom Half	Long	0,027	0,049	**0,037**	**2,286**	0,708	**0,040**	**2,603**	0,839
	Long-Short	0,051	0,140	0,048	1,632	0,506	**0,059**	**2,014**	0,649

1. Top Half: Middle to end of sample period Significance at 5% level - t-stat 1,96 **(BOLD)**
2. Bottom Half: Beginning to middle of sample period

Table 1.

Prior work, from Asness et al. (2019) considers a similar sample period, from 1998 to 2016, where the authors found significantly larger alphas for both CAPM and FF3 at 0.16 and 0.24 respectively. The excess returns over the full period are at 15% with an annualized Sharpe ratio of 0.37 and a very high information ratio of 1.22. Therefore, although both findings suggest the significant presence of abnormal returns for high-quality growth stocks, there are major differences in magnitude for such a small difference in the considered sample.

1.2 Strategy as part of Diversified Portfolio

To explore the possibilities of diversification, we will use the Mean-variance portfolio optimization which weights risk, expressed as variance, against expected return and optimizes it to find the best risk-return trade-off. From this, we want to find the tangency portfolio, the most efficient in generating the most return for every unit of risk taken, and find the optimal combination between the tangency and a risk-free asset. For this purpose, two MVE portfolios will be generated. The first, a combination of the Long with the Vanguard Total Stock Market ETF (VTI), and the second, the Long Short with the VTI. For the risk-free asset, we will use the Vanguard Total Bond Market ETF (BND). To compare performance, we create a relatively balanced portfolio with 60% on equities and 40% on bonds. This *60/40 portfolio* is a combination of the VTI and BND respectively. Plotting the cumulative returns for the 3 portfolios, **Figure 2.** we have the *60/40* outperforming both *MVE portfolios*, however, the latter are more robust to drawdowns, most noticeable the 2008 drawdown from the financial crisis when the *60/40 portfolio* falls sharply with the market and the pandemic shock in March 2020.

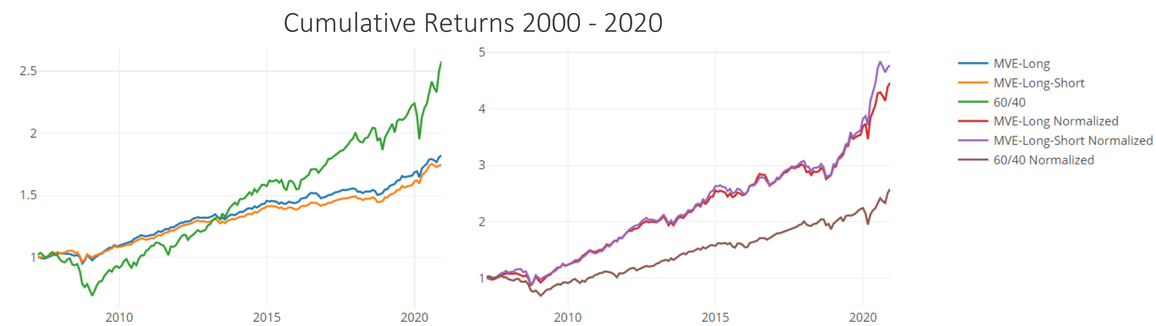

Figure 2.

Such robustness was expected as the *MVE portfolio* optimization leads to the best combination of the tangency portfolio with the risk-free asset which in effect, yields the optimal allocation of weights for the given sample period, in this case, the period where all 3 portfolios have all the assets. Therefore, even though the highest average annualized return belongs to the *60/40 portfolio* at 7.4%, its standard deviation of 10% is much larger than the 3.5% to 4% of the MVE portfolios. This is due to the heavyweight of the mean-variance portfolios on the risk-free asset with 88% and 69% respectively, which assures a safeguard in times of high volatility.

	Overlapping Periods			Full Period	Weights Overlapping		
Portfolio	Average Annualized Return	Annualized Sharpe Ratio	Annualized Standard Deviation	Optimal Annualized Sharpe Ratio	BND	Portfolio	VTI
MVE Long	0,044	1,142	0,039	1,025	88%	10%	3%
Full Period MVE Long-Short	0,041	**1,192**	0,035	**1,158**	69%	19%	12%
60/40 Portfolio	**0,074**	0,742	0,100				

Larger values in **(BOLD)**

Table 2.

Looking at the Sharpe Ratio **Table 3**. we have a measure of the return per unit of risk and both MVE portfolios outperform the *60/40* with the highest Sharpe Ratio of 1.192 belonging to the *MVE Long Short* portfolio. Similarly, when considering the full period, from 2000 to 2020, the highest optimal Sharpe Ratio of 1.158 also belongs to the *MVE Long Short*, being slightly lower than on the overlapping period. A reason for this is that the full period starts in 2000 instead of 2007 for the overlapping, therefore the years where this strategy has shown to have higher returns are not present and, when considering the full period, there are likely larger weights on the Long or Long Short assets than when considering the sample from 2007 where their performance is generally worse.

Looking at the left panel, in **Figure 2.** the annual volatility is normalized to 10% and both *MVE portfolios* considerably outperform the *60/40 portfolio*. This happens because the mean-variance optimization does not consider utility functions, these depend on the investor's risk aversion, and, at a 4% volatility, it is constructing a considerably risk-averse portfolio. Therefore, by normalizing for annual volatility of 10%, we effectively validate the conservative approach which then implies that the MVE optimization yields the best portfolio performance.

Conclusions

As seen in topic "*3.2. Strategy Analysis*" the difference between considered samples, 1998 to 2016 and 2000 to 2020, drastically changed the magnitude of the alphas. Furthermore, this specific period of 20 years was punctuated by several global crises and a technological development incomparable to anything the markets had seen before. Therefore, with such a short period we do not know if we are in the presence of an abnormal period, for example in the last 10 years, Value Investing has been underperforming the market.

In addition, the MVE Portfolio by looking for the best in-sample set of weights that maximizes the trade-off between risk and Sharpe ratio used suffers from a major pitfall when the in-sample is the full sample period, as it is the case, this results in overfitting of the data and yields a too optimistic prediction for future performance. A more appropriate way of conducting this analysis would be to estimate the tangency weight over a portion of the sample period, say 10 out of 20 years, and then test the resulting weights on the "unseen", out-of-sample portion of the dataset. However, for the reasons above, 20 years is a relatively short time, even shorter if decide to reserve a portion of it as an out-of-sample test set. Therefore, a second pitfall of the MVE is that it requires a large and significant training dataset so that the obtained weights for the tangency are generalizable for the out-of-sample dataset.

In summary, this strategy has an interesting performance over the full period, however, when considering slightly different sample periods it shows a big difference in magnitude. Furthermore, using the MVE analysis we can only estimate the ideal combination for the last 20 years, in hindsight we could all probably be rich. Nonetheless, going Long on the Top tercile of the signal yields a significant alpha over the bottom period. Therefore, if we have confidence that in the next decade or more the basis of fundamental investing will again become relevant this would likely be an interesting addition to a portfolio given the possibility for abnormal returns.