Fix the odds

Beating the market with data-driven strategies





Fix the odds: Beating the market with datadriven strategies



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British investors often bemoan the lack of exciting opportunities on the domestic market. It's not an unfair criticism. Look at the performance of the FTSE and Aim All Share indices compared to their peers across the pond and the returns are pretty bland. Even the European indices have started to overtake those in Britain. And in the wake of the Brexit referendum, fewer and fewer companies are looking to list on these shores - an issue that private investors are no doubt hoping the Chancellor will address in his upcoming annual budget.

Hunting for stocks which 'shoot the lights out' is fun and investors who manage to find one of these companies can claim substantial bragging rights (as well as some healthy profits). But identifying those stocks which generate portfolio-defining returns is not easy (especially in a market like Britain). Before embarking on the quest, investors should consider the strategies to employ to improve their odds of finding winners.

This study set out to demonstrate the importance of picking an appropriate investment strategy. By setting up screens and testing portfolios built based on clear sets of rules, we expected to be able to show that some rules-based investment strategies have a higher chance of success, while others require more detailed discretionary analysis.

In order to do this effectively we ran a Monte Carlo Simulation (MCS) to back-test the performance of thousands of portfolios built by randomly selecting stocks which align with these clearly defined screening rules. The randomised selection might seem counterintuitive at first - in the real world investors don't select stocks without careful consideration. But this method is designed to assess the effectiveness of screening rules, rather than measuring an individual investor's skill in stock selection. As such we are testing the screens against a wide range of decision outcomes.

Consider the game of Lucky Dip as an analogy. An unknown mixture of red and green balls are placed into a bag, and you pick one at random. Selecting a green ball signifies a win, whereas picking a red ball results in a loss. If the bag contains more green balls than red, we can expect to win more than we lose. Conversely, if there are more red than green balls, the likelihood of losing increases.

Playing the game once provides limited insight. It doesn't reveal if the outcome was typical or an outlier, nor does it indicate the overall probability of success. Similarly, a single investment decision may not accurately reflect the effectiveness of your stock screening process. If we were to play the game 10,000 times and plot the number of wins and losses, the resultant chart would reveal the ratio of wins to losses. With such a large sample size, this ratio becomes a reliable indicator of the overall probability of winning or losing and thus an approximate for the proportion of red and green balls in the bag.

While the stock market's complexity far exceeds that of the Lucky Dip, the fundamental principles remain the same. By using a Monte Carlo Simulation to screen and randomly select stocks, we can effectively model a range of outcomes.

And so our study has helped us gauge the efficacy of a range of screening strategies in filtering out less favourable investments - much like deducing the mix of balls in the Lucky Dip bag - and we have found that some strategies raise the odds of building winning portfolios compared to others. But this is not the end of the story. Using the numbers alone can increase your chances of picking winners and avoiding losers, but identifying those winners is really down to you. We hope that this study can help skew the odds in your favour.

Methodology

Step One: Defining Screening Rules

Initially, we established a set of criteria to screen stocks based on various financial metrics such as P/E ratio or historical growth rates. The purpose was to filter stocks that meet specific investment strategies or risk profiles.

Name	Aim	Risk Profile	Rules
Quality	Portfolio only bought stocks which had exhibited high quality metrics over the last five years	Lowest	5yr Average Operating Profit Margin >10% 5yr Average ROCE >10%
Value	Portfolio only bought value stocks which were trading at a discount to historic levels	Medium	TTM PE < 5yr Average PE Current PE < 15
Growth	Portfolio only bought stocks where revenue was growing	Highest	PEG Ratio <1 Revenue Chg TTM >0

The rules used for the various screening strategies can be seen in the table below:

To add more depth to our analysis, we also created a set of screens which purposefully sought to decrease the risk profile of the strategy by only identifying profitable companies. These can be found in the following table:

Name	Aim	Rules
Quality Value	Portfolio only bought value stocks which exhibited quality metrics over the last five years	TTM PE < 5yr Average PE 5yr Average Operating Profit Margin >10% 5yr Average ROCE >10%
Quality Growth	Portfolio only bought growth stocks which were profitable and which exhibited high quality metrics	Operating Income Chg TTM >5% 5yr Average Operating Profit Margin >10% 5yr Average ROCE >10%
Value Growth	Portfolio only bought growth stocks that were both profitable and decent value	PEG Ratio <1 Revenue Chg TTM >0% Net Income TTM >0

Step 2: Portfolio Construction

After establishing the screening rules for each strategy we set up the simulations to identify stocks which had met that criteria. We chose to simulate a £500,000 portfolio of 20 stocks as follows:

- 1. Random Stock Selection: From the screened pool, 20 stocks are randomly selected. This randomness emulates the diverse decision-making process of investors.
- 2. Equal Weighting: Each stock is allocated an equal proportion of the total investment.
- 3. Annual Rebalancing: In December of each year (2015-2023), the entire portfolio is liquidated, the screening rules re-applied and a new set of 20 stocks selected from the qualifying pool. These new stocks are purchased in equal proportions, maintaining the investment strategy's consistency. (Securities which were delisted in the holding period were sold at delist price).
- 4. Nine-Year Duration: This process is repeated annually for a duration of nine years. At the end of this period, we record the final returns and valuation of the portfolio.

Step 3: Repeat 10,000 times (per screen)

Monte Carlo Simulation represents a statistical approach that simulates a system's behaviours by repeating a process to observe a range of possible outcomes. This helps ensure robustness in the methodology. We replicated the portfolio construction simulation 10,000 times to help us understand the range of potential outcomes and the effectiveness of the screening strategies under different market conditions.

Step 4: Results Interpretation

Each run of the Monte Carlo Simulation contributed a data point to our analysis, reflecting the returns of that specific portfolio simulation. The mathematical nature of the simulations means they encompass a wide range of outcomes, from portfolios with strong investment cases to those which are little more than speculative gambles. These purely speculative outcomes lie at the tail ends of the distribution.

Aiming for returns in this tail end is not advisable, as Benjamin Graham said: "An investment operation is one which, upon thorough analysis, promises safety of principal and an adequate return. Operations not meeting these requirements are speculative." And so, to align with Graham's definition of an investment operation, we have excluded these speculative outliers from our analysis of the results.

Having defined this normal range, we have been able to compare the results of six strategies tested. We've defined the portfolio at the bottom of the normal range for each strategy as a 'poor' outcome, the median (or most expected) portfolio as a 'good' outcome and the portfolio at the top end of the expected range as an 'excellent' outcome.

Descriptive statistics

We used the following key statistical metrics to interpret the results:

- **Median:** The midpoint of the result set which is used a proxy for the typical return of the simulation. The median is chosen over the mean to provide a consistent measure that is less influenced by extreme values and skewness, especially useful when comparing datasets with differing symmetries and when including or excluding outliers.
- **Outlier Analysis:** Outlier Analysis involves identifying data points that are significantly different from the majority of the data. In our case, we identify outliers as those results that lie beyond 1.5 times the interquartile range (IQR). This method helps in differentiating between typical investment cases and extreme cases, which may be unrealistically speculative.
- **Probability of loss:** We have calculated the number of portfolios in each simulation which lost money over the nine year period to determine higher risk strategies.
- **Standard Deviation:** This metric illustrates the consistency or variability of a strategy's performance. A small standard deviation indicates consistent performance, while a wider spread suggests greater variability.
- **Skewness:** This metric assesses the asymmetry of the distribution of returns. It helps in understanding how the returns deviate from a normal distribution. If the skewness is positive, it indicates that the distribution has a longer tail on the right, suggesting a tendency towards higher returns. Conversely, a negative skewness means a longer tail on the left, indicating a tendency for lower returns. Essentially, it gives us insight into the direction and extent of potential outliers in the returns, enhancing our understanding of the risk profile.

Limitations

Historical Data Limitations: The study is based on historical market data from the UK. The data we've analysed is specific to the market conditions prevalent during 2015-2023. Whilst this period includes a diverse range of market conditions such as the Brexit pullback, the period of historically low interest, and the post covid reversal, they should not be seen as a guarantee of future performance. Financial markets are inherently unpredictable, and past performance is not a reliable indicator of future results.

Non-Inclusion of Trading Costs and Expenses: The simulation results presented are based on gross returns and do not factor in trading costs, taxes, and other related expenses. These costs can significantly impact the net returns of an investment strategy. In the real world, every trade incurs some cost, be it brokerage fees, bid-ask spreads, or slippage. Additionally, taxes on capital gains and dividends can also affect the actual returns an investor receives.

Results: Statistical Analysis

The tables below show the results of the poor, good and excellent portfolios simulated for each strategy. They also show how these portfolios performed compared to the benchmark (the FTSE All Share).

Simulated returns as a %

	Poor	Good	Excellent	Chance of loss	Chance of market outperfor -mance	Volatil- ity	Poor Alpha	Good Alpha	Excellent Alpha
Quality	-31.17%	40.79%	115.01%	3.99%	79.48%	28.53%	-51.17%	20.79%	95.01%
Value	-40.03%	19.40%	80.85%	16.72%	48.41%	22.63%	-60.03%	-0.60%	60.85%
Growth	-61.15%	-2.57%	65.25%	54.95%	18.83%	25.43%	-81.15%	-22.57%	45.25%

Simulated final value from the original £500k portfolio

	Poor	Good	Excellent	Poor Alpha	Good Alpha	Excellent Alpha
Quality	£344,138	£703,967	£1,075,049	-£255,861	£103,967	£475,049
Value	£299,863	£597,015	£904,262	-£300,136	-£2,984	£304,262
Growth	£194,259	£487,157	£826,255	-£405,740	-£112,842	£226,255

Of the three core strategies tested, Quality performed the best with a median portfolio return of 41% (£704k closing value from an initial £500k investment) and the 'excellent' case returning 115% (£1.08m).

As expected, the strategy was also the lowest risk of the three core strategies (quality, value and growth), with only 4% of portfolios losing money. For those that did lose money, the extent of the loss was less painful than other strategies. The average return of loss-making portfolios was -7%. Compare that to the Value strategy where the probability of loss in all 10,000 simulated portfolios was 17%, rising to 54% for the Growth strategy.

The distribution of these three core strategies are shown in the following three histograms. These histograms have been produced by tallying each of the data points by categorising them according to their returns and the frequency of portfolios achieving these returns. These histograms therefore show us not only the observed range of returns, but also how likely they are to occur.





These histograms also help us visualise the distribution of each of the core strategies. For example, the Quality strategy has a high skewness (shown by a longer right tail) than either the Value or Growth strategies, meaning there are more instances of higher-than-average returns compared to lower-than-average ones.

Looking at the results from these three core strategies (quality, value and growth), we have found that the odds of building winning portfolios (and avoiding losing ones) is higher if you screen for some element of quality. With this in mind, we've dug a little deeper into the use of quality screening ratios to improve the odds of better returns.

	Poor	Good	Excellent	Chance of loss	Chance of market outperfor -mance	Volatil- ity	Poor Alpha	Good Alpha	Excellent Alpha
Quality Growth	-26.51%	52.31%	134.30%	1.20%	89.79%	30.68%	-46.51%	32.31%	114.30%
Value Growth	-40.51%	11.87%	65.50%	26.50%	33.86%	20.34%	-60.51%	-8.13%	45.50%
Quality Value	-32.78%	25.46%	85.30%	9.64%	59.90%	22.02%	-52.78%	5.46%	65.30%

Simulated returns as a %

Simulated final value from the original £500k portfolio

	Poor	Good	Excellent	Poor Alpha	Good Alpha	Excellent Alpha
Quality Growth	£367,466	£761,571	£1,171,521	-£232,533	£161,571	£571,521
Value Growth	£297,443	£559,326	£827,522	-£302,556	-£40,673	£227,522
Quality Value	£336,078	£627,285	£926,519	-£263,921	£27,285	£326,519



Of the strategies tested, the Quality Growth strategy demonstrates the highest median performance (52%) and the lowest probability of loss (1%). The skewness of this strategy (0.75) also shows that the screen leans towards positive outcomes, suggesting that they tend to produce some very high returns. The same is true of the Value Growth strategy (skewness of 0.5). The screen used here only picked profitable stocks, which seems to have helped improve the likelihood of winning returns (compared to the pure Value and Growth strategies, which omitted any quality criteria).

And like the pure Quality strategy, the strategy that screens for stocks that exhibit both quality and value metrics delivered reliable returns with a relatively low likelihood of loss (9%).



And so, incorporating quality metrics into our value screen has positively altered the performance profile. The median return has risen from 19.4% in the pure Value strategy to 25.5% in the Quality Value approach. This 6.1 percentage point increase is indicative of a more consistent performance for the majority of our portfolios, reflecting a strategic benefit in adopting a quality overlay.

The introduction of the quality dimension also brings about a slight improvement in the risk profile. The standard deviation shows a small decrease, moving from 23% in the pure Value strategy to 22% in the Quality Value approach. This marginal reduction in volatility suggests a more stable performance pattern.



Results: Case Studies

Only 393 of the 10,000 portfolios simulated using a quality screen lost money over the nine year period and, of those loss making portfolios, the average return was -7% - far less terrifying than the portfolios built using value or growth screens where loss-making portfolios averaged -10% and -18% respectively.

On the upside, the average return of the Quality portfolios which rose in the period was 46%, a figure that was surprisingly higher than the equivalent for the Value and Growth simulations (28% and 22%, respectively).

What's perhaps less surprising is the performance profile of the median performing portfolio for all three core strategies tested.

The median Quality portfolio suffered two years of underperformance where more than 10 of the 20 stocks selected lost money. The Value and Growth portfolios had four of these each years (with the latter having to stomach a year when 16 of the 20 stocks selected lost money). The average decline of stocks that lost money was also sharper for both the Value and Growth portfolios than for the Quality. But the maximum upside was higher, as the case studies below highlight.

Quality Strategy: Renishaw

Renishaw, a global engineering technology group, distinguished itself as stand-out performer within the Quality investment portfolio due to its outstanding all round quality characteristics. The company, which is renowned for its precision solutions in metrology, healthcare, and additive manufacturing (metal 3D printing), went far beyond meeting the rules of the initial screening criteria.

High quality businesses can often be found operating in specialist niche industries. In his book "Hidden Champions of the 21st Century," business consultant Hermann Simon explored the notion that small to mid-sized companies, that are market leaders operating within specialised niche industries, tend to achieve significant success.

Renishaw exemplifies this concept very well. Its comprehensive range of products and services are able cater to a diverse range of industries including aerospace, automotive, healthcare, electronics, and scientific research. Its specialisation and relentless innovation in its niche market have consistently yielded financial rewards over the years.

At the close of 2016, Renishaw's return on capital employed (ROCE) and operating margins both met the 5-year average threshold above 10%, but the annual figures stood at 15.2% and 18.2% respectively. This demonstrated profitability well in excess of the 5-year averages, and importantly, that the fundamentals of the business had been on an upward trajectory. Indeed, this strong trading was confirmed in trading updates in 2017, where the company raised its own revenue and profit forecasts.

Renishaw's prudent management of its capital structure further solidified its position as a company with excellent all round quality characteristics. The company's ability to maintain a net cash position and comfortable liquidity metrics, like the current ratio, or its net gearing, underscored its financial resilience.

While Renishaw initially met the screening criteria for the portfolio that year, some further quantitative and qualitative analysis would have highlighted the extent of the company's qualities. This could have helped guide investors towards picking a company that would have generated a 107% return for the portfolio and perhaps avoided a -23.4% return for the bottom performer (Celebrus Technologies) in the same period.



Value Strategy: Kier Group

The old adage "Don't catch a falling knife" is quite well known within investment circles, cautioning against impulsively pursuing stocks experiencing significant price declines. Despite the allure of perceived bargains amidst steep drops, not every steep decline signals a ripe buying opportunity. Prudent assessment is always crucial, or investors may end up buying what is known as a 'Value Trap'.

A prime example of this can be found in the pure value portfolio, where Kier's shares nosedived from £9.17 in early 2018 to £3.52 by year-end. However, amid this downward trend, the question remained: Did this substantial decline present a distinctive value proposition worth considering, or was this indeed a value trap to be ignored?

Kier comfortably met the pure value screening criteria of a trailing twelve month price to earnings (PE) ratio below the 5 year average and a current PE ratio below 15. At the end of 2018, the forward price to earnings ratio had fallen to a figure just below 4, a remarkable figure enticing to value-oriented investors.



Moreover, the price-to-book (P/B) value, standing at 1.11, would have equally appealed to bargain hunters, while the even more impressive price-to-sales ratio of 0.11 underscored the stock's attractive valuation. Sales figures are less susceptible to manipulation than earnings or book value, so this figure would have particularly stood out as a reliable metric for devout value investors due to the reliance on actual transactions and revenue generation.

In 2019, Kier Group encountered yet another tumultuous year characterised by a string of profit warnings, write-downs, and a pronounced downturn in shareholder value, including scrapping the dividend payments. Once regarded as a cornerstone in the construction and services sector, the company faced a barrage of challenges that directly undermined its financial health, including dwindling operating margins and an escalating debt load.

One of the primary reasons for Kier Group's struggles in 2019 was its failure to accurately forecast and address underlying operational challenges. The company experienced volume pressures within its highways, utilities, and housing maintenance businesses, resulting in lower-than-expected revenue growth and a profit warning that led to the share price falling 40% on the day.

Investors could have heeded warning signs indicating Kier Group's impending struggles by more closely monitoring its financial metrics and wider market conditions. The collapse of its competitor, Carillion, in 2018, should have triggered initial concerns. Furthermore, the company's mounting debt levels, multiple profit warnings, and executive departures should have served as red flags, prompting investors to reevaluate the investment despite its valuation credentials.

Growth Strategy: Gulf Marine Services

By the end of 2022, it became clear that Gulf Marine Services (GMS) was starting to emerge as a compelling growth opportunity within the offshore oil, gas, and renewables sectors. A number of indicators suggested that GMS was poised for continued expansion as it has demonstrated consistent revenue growth, aligning with the positive revenue change over the last trailing twelve month criterion. Moreover, the company's price to earnings growth ratio below 1 highlighted a favourable valuation relative to its earnings growth rate.

Specialising in the provision of self-propelled and self-elevating support vessels for the offshore oil, gas, and renewables sectors, the company was benefitting from green energy tailwinds, whilst carefully optimising its existing portfolio.

The company, which operates a modern fleet of highly versatile vessels across international markets services major clients such as Saudi Aramco, Shell and Total.

Based in the UAE, GMS announced a series of notable contract awards and extensions throughout 2023 and significantly bolstered its order backlog, resulting in increased revenue visibility. These contracts, coupled with improved day rates for its vessels, showcased GMS's ability to capitalise on burgeoning demand within its target markets.

Another key factor contributing to GMS's attractiveness as a growth play was its financial discipline and commitment to deleveraging. The upward revision of its EBITDA guidance for 2023 and 2024 signaled positive momentum and underscored management's confidence in the company's future prospects. Additionally, GMS's proactive approach to debt reduction, evidenced by significant prepayments towards its debt obligations, showcased prudent financial management and a viable route to more sustainable growth rather than overburdening the company.

But it wasn't just the company's value and growth metrics that were commendable. A look at the company's Piotroski F-Score, one of the primary indicators of the financial strength of a company, would highlight a perfect score of 9/9. Developed by accounting professor Joseph Piotroski, the F-Score evaluates nine accountancy-based questions to assess a company's financial health and trend. GMS's high F-Score reflects improving fundamentals across profitability, capital structure, and operating efficiency metrics.

Overall, GMS's strategic positioning within the offshore energy sector provided a solid foundation for sustained growth. The company's leading market position, coupled with its diversified geographical footprint, ensured exposure to a wide range of opportunities in both traditional oil and gas markets as well as the rapidly expanding renewables sector.

Gulf Marine Services share price growth vs FTSE All Share (2023)



Quality Growth Strategy: Plus500

In 2017, Plus500 entered the quality profitable growth portfolio, delivering formidable returns with a 136.4% surge in its share price over the holding period. As a prominent online platform, Plus500 facilitates retail customers globally in trading Contracts for Difference (CFDs). Despite regulatory hurdles and its fair share of controversies, the company persistently profits from the trading activities available on its platform, allowing clients to speculate on the price movements of various financial instruments without owning the underlying asset.

Building upon its robust performance in 2016, Plus500 sustained its momentum into 2017, showcasing remarkable financial metrics. The company boasted some of the best quality metrics available to investors in the UK market at the time, including industry-leading Return on Capital Employed (ROCE) and Return on Equity (ROE) figures, standing at 150% and 114%, respectively. Additionally, its operating margins outstripped those of its peers, registering an impressive 44.3%.

One of the most notable facets of Plus500's performance in 2017 was its impressive revenue and earnings growth. Throughout the year, the company consistently reported record revenues and profits, marked by substantial year-over-year increases in both quarterly and annual figures. Notably, Plus500 repeatedly highlighted instances where its trading activity 'exceeded market expectations'.

The screen criteria sought for operating income to grow by over 5% over the last trailing twelve months. However, Plus500 exhibited growth well beyond this level, with its earnings per share growing at a compound annual growth rate of 78% over the prior three-year period, and sales escalating by 70%. Plus500's ability to attract and retain customers, capitalise on market opportunities, and effectively manage its operations across diverse jurisdictions worldwide was clearly feeding through to the financials.

Operationally, Plus500 exhibited a relentless pursuit of obtaining operating licenses in new jurisdictions, such as in Singapore, thereby expanding its global footprint and diversifying its revenue streams. In terms of growth, Plus500 experienced significant expansion in its customer base, with record numbers of new and active customers reported throughout the year. Its confidence in its business meant that it began a share buyback programme in June 2017, to further enhance shareholder value.

Investing in high-quality, profitable, growing companies that are consistently beating expectations significantly increases the likelihood of finding companies that can provide you with market-beating returns.



Conclusion

Plotting the returns of all the strategies on a Box and Whisker diagram helps us draw some overarching conclusions.



Box Chart: Each box represents the 25th and 75th percentile, with the green line being the median. The whiskers extend to 1.5x IQR, outside of which are considered outliers. The blue dashed line indicates the performance of the FTSE All Share baseline.

- Including some kind of quality measure improved screening performance.
- All of these screens have the potential to build portfolios which outperform the baseline, however the probability of doing so decreases as the simulated result gets further away from the median. Therefore, the poorer the screen, the better the investor must be.
- A lacklustre performance of the Quality Growth screen would tend to outperform a strong performance of the Value Growth screen. In fact, when we exclude outliers, only the top 2% performers in the Value Growth screen managed to beat the median (most likely) return of the Quality Profitable Growth simulation.
- The range of outcomes goes some way to explaining why several investors could use the same screening rules but have completely different outcomes.

It would tempting to take away the notion that investors should search for the Holy Grail of investment strategies; the one which does away with the need for decision making. A fool proof system to beat the stock market. Unfortunately, such systems do not exist. As investors, we will always face a discretionary decision in one form or another. Instead, the analysis from our simulations suggests that a robust strategy will provide the best chances of success.

"Risk comes from not knowing what you're doing." Warren Buffett

Our conclusion is that investors should first choose an investment strategy which is built on proven investment principles, but also one which is well suited to their personal investment style and knowledge. By doing so, they enhance their capacity to make informed, discretionary decisions from a robust foundation, and maximising the chance of success in the stock market.

Once an investor has chosen a well suited strategy, they should commit to continuously honing their knowledge to complement their strategy. Strategy selection and knowledge acquisition should be in service of each other.

Get in touch

If you have any questions about our research, contact the authors at editorial@stockopedia.com

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- Important questions to ask yourself before building your portfolio
- Five simple portfolio building strategies
- How many stocks should I own?

Using screens

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- Lessons from the world's most successful investors

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- Factor investing for stock pickers
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