"Quants are Dead. Long Live the Quants"

Fourth Quarter Commentary and Review

2019 was a solid year for Vitruvian Capital Management, with all our strategies outperforming their respective benchmarks from almost 2% to over 3%. The same cannot be said for many of our rivals and competitors.

The last two years have been particularly difficult for quantitative investors in equity markets. Returns to a wide swath of quantitatively managed funds have almost universally disappointed. Figure 1 shows data from Joseph Mezrich at Nomura (via the Financial Times) demonstrating the performance challenges over the past two years among quant strategies

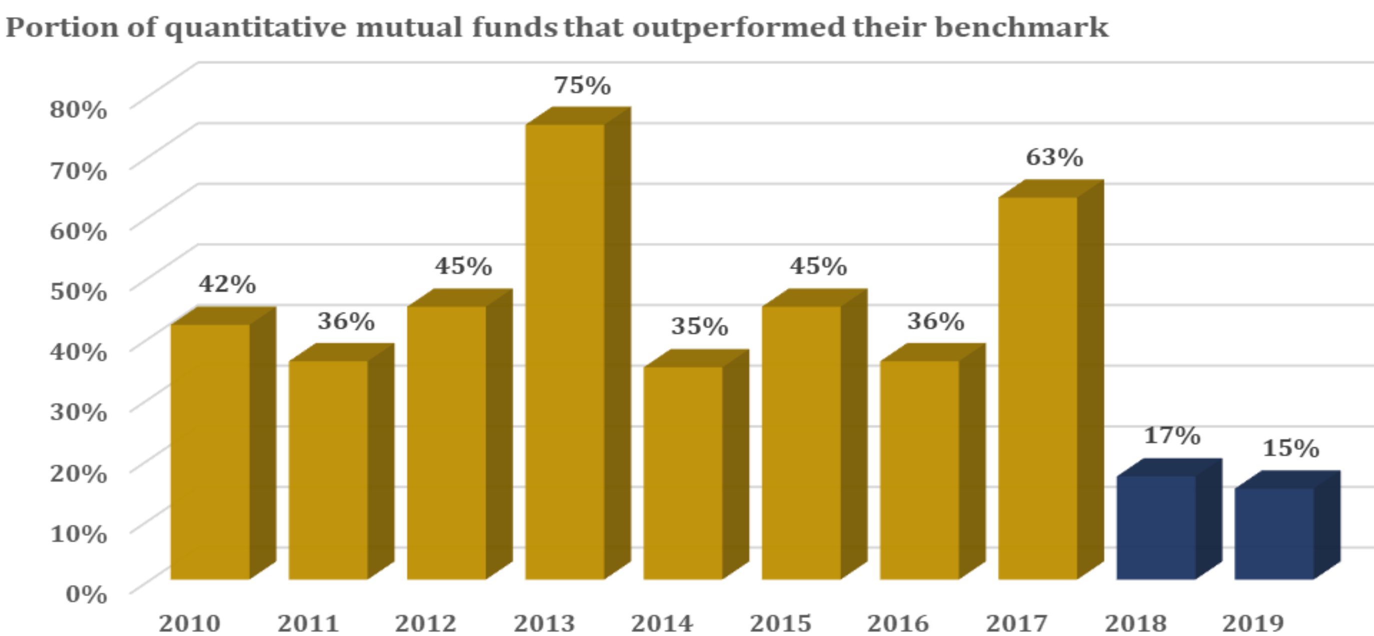
For the last decade through the end of 2017, 47% of quant funds had beat their benchmark (compared to 37% of fundamental funds).[i] Since then less than 20% have. Cliff Asness, CEO of AQR, a $180 billion quantitative investment manager, wrote several exasperated investor letters in 2018 discussing the challenges factor-based strategies experienced and his conviction to stay the course with them. After further underperformance in 2019, Cliff's public expressions of exasperation were less frequent, but a 20% drop in AUM at AQR catalyzed a 10% reduction in staff.

Rob Arnott and Campbell Harvey discuss many of the issues facing factor investors in a paper entitled "Alice in Factorland".[ii] In the article, Rob and Campbell point out many reasons that factors may disappoint investors, including crowding, implementation costs, and periods of extreme underperformance. Notably they point out that the performance of factors degrades by an average of 50% after research on the factor is published. They also review a set of 15 common investment factors, showing that while their long-term effectiveness is statistically significant, performance since 2004 has become indistinguishable from noise.

A loss of effectiveness is one thing, but what we are seeing in the last two years has been an extended bout of negative performance. The AQR Market Neutral Fund (QMNIX) returned -11.27% in 2019, after returning -11.73% in 2018! These two years of subpar performance gave back the solid returns delivered by this fund the previous 3 years. To discuss what is behind these large negative numbers, we have to dig deeper into the nature of what makes factors work.

Most factors owe their effectiveness to behavioral biases and risk premiums. A behavioral bias is the

Figure 1



tendency for investors to under (or over) price certain types of companies consistently, such as high quality or momentum stocks, allowing more astute investors willing to take the opposite position to benefit. Risk premiums are compensation for investors for bearing certain types of market risk such as illiquidity, small size, or value. These characteristics broadly identify stocks where there is more uncertainty, and if you are willing to assume that risk, the market will reward you over time.

These factors are easily identifiable, and simplistic. They apply to broad ranges of stocks, and when they are effective, provide performance for a large share of these stocks. A rising tide lifts all boats. But when the foundation of an investing method is based on well-known and duplicable methods, then others are likely to imitate them or worse, interfere with them.

Enter Simons

In November of 2019. Greg Zuckerman released his much-anticipated book "The Man Who Solved the Market" about Jim Simons and his secretive quantitative hedge fund, Renaissance Technology. Greg provides a well-researched description of the story of the firm, and how they built a process that has generated 60%+ annual returns over the last few decades.[iii]

When it came to equities, Renaissance (and their competitors at D.E. Shaw, Two Sigma as well as some parts of Citadel, SAC, Millennium, etc.) ruthlessly hashed through reams of market data to discover the smallest of patterns in bulk, and exploited them, often with the help of leverage. Encompassed in these processes was an ongoing anticipation of the moves of other market participants, such as factor investors.

While it is not explicitly mentioned in the book, it is easy to imply that firms like these are becoming more and more efficient at anticipating market movements driven by traditional quantitative factors, and systematically arbitraging them away, perhaps even to the point where they provide negative returns. Given the size of factor-based investing in the recent years, this is very likely.

The Modern Paradigm

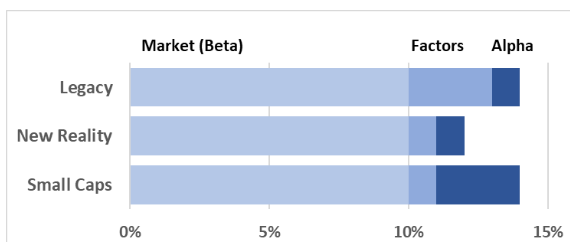
Does this spell the end for factor investing? Not completely. Returns to factor investing will recover if for nothing more than everything reverts to the mean at some point. Going forward, factor investing stands to change in the following ways:

The behavioral components of factor returns will be greatly reduced. Campbell and Arnott's work, along with many others has shown that while human behavior is not changing, other humans are adjusting their behavior to anticipate most of the mispricing.

The rewards from risk premiums will be reduced as well. While there is always a price for taking on risk, the proliferation of products based on these premiums have whittled away their rewards.

Given these two evolutions in the marketplace, prices have fallen. Smart beta ETFs can be had for only a slight premium to market-based ETFs. One investor's alpha becomes another investor's beta. Investors more and more are only willing to pay for _**true alpha**_. As they should. True alpha comes from deeper analysis into individual companies or industries. It is harder. It requires greater innovation and effort. And it is difficult to scale.

Figure 2: Components of Equity Performance



Fundamental managers have always focused on finding true alpha by digging deeply into individual firms looking for an information edge. For an investment firm with an army of well-paid analysts, it is an achievable goal. But along the way, a complication has developed.

It is well-appreciated that more alpha is available among smaller, neglected stocks. The explosion of passive products has primarily been a large cap issue, and alpha continues to be abundant among smaller stocks. The liquidity constraints of smaller stocks bring with them limitations to how large such funds can be. Given the fee pressure of recent years, the economics of the such products struggle to support the level of resources necessary to effectively apply fundamental analysis across thousands of small stocks.

This is where systematic investors step in. Prudent quants have taken a page from their fundamental-focused brethren and focused on the analysis of individual companies. Instead of seeing what behavioral theme or risk exposure a stock fits in to, progressive quants methodically dig into each firm using modern methods of data acquisition and statistical analysis. Behavioral biases and risk premiums are replaced by:

- Analysis of the competence and confidence of management.
- The use of capital.
- Valuation based on the specific qualities important to that firm.
- The nature of their shareholder base.
- Analysis of activity upstream and downstream of the firm's supply chain.

Using the tools of modern data science and machine learning, a modest sized team of analysts can construct portfolios of small cap stocks selected based on their own, unique investment merits instead of membership in some overlying investment theme.

The namesake of Vitruvian Capital Management is Vitruvius, an architect and polymath from Roman times. Vitruvius' design embraced balance and symmetry in the buildings he designed. In the same way, Vitruvian's investment strategy emphasizes symmetry in the portfolios we construct, ensuring balance between the many market forces, including factors, that may affect our portfolios, while focusing on the systematic analysis of stock specific criteria for security selection. In this way, we address the most in efficient and alpha-rich segment of the equity market, small caps, with the scale and capability that other firms cannot achieve economically.

It comes with great rewards. A portfolio built around true alpha is the combination of many small risks instead of a few large risks. The broad source of independent returns unleashes the power of diversification to produce more consistent and reliable results.

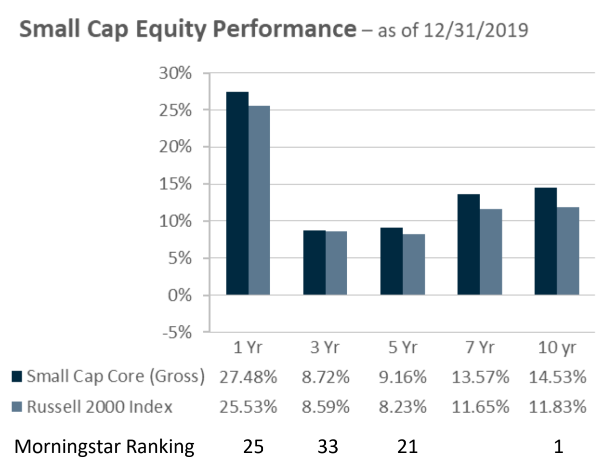
Strategy Review

2019 saw solid returns across all of our strategies. Earlier in the year, we introduced Natural Language Processing analysis of management communication. Though this system, we can interpret signals from executive disclosures, as well as their exchange with analysts to more accurately anticipate which companies stand to see expectations improve of fall.

The analysis fits as a complement to our exist analyses of capital decisions and stock transactions to provide a unique perspective on the firm's future.

Vitruvian Small Cap Equity

The VCM Small Cap Equity Strategy returned 9.57% in the fourth quarter, trailing the Russell 2000 Index by 0.37%. For the year, the strategy returned 27.48%, exceeding the Russell 2000 return of 25.52% by 1.96%. Over the ten calendar years we have managed the strategy, we have outperformed the Russell 2000 for nine of those years, and our ten year performance record ranks at the very top of the Morningstar Small Cap Blend universe.



For the quarter, pharmaceuticals and biotech had the largest influence on performance. Stock selection was solid, with positions in Kodiak Sciences (KOD) and Ra Pharmaceuticals (RARX) adding value. Both firms are clinical-stage biotechnology or pharmaceutical companies. With little financial data to go on, we rely on analysis of management commentary using language processing, sentiment among informed investors, and an assessment of the potential upside in the firms based on evaluation of intangible assets and research analyst target prices. In these cases, the best you can do is determine a range of possibilities of what is likely a binary event. Either their products prove effective or they do not. Within that range is the possibility that an outside investor may step in if they see an opportunity. For Kodiak, their shares jumped when they sold some of their future royalty stream to an investor for financing, and Ra Pharmaceuticals was bought by the Belgian drug company UCB.

Ironically, our underweight in the overall pharmaceutical industry eroded some of the gains from these firms. We experienced a similar pattern throughout 2019, but superior stock selection far outweighed any drift in our industry selections. Our performance from industry under and overweights was well within reason, and usually either washes out over time, or shifts to the positive.

Vitruvian Small Cap Market Neutral

Small Cap Market Neutral returned -0.22% for the fourth quarter, and finished 2019 with a return of 2.39%. While stocks selection was effective during the last three months of the year, it was not quite enough to overcome the drag from implementation costs.

During the quarter the largest positive position was a short position in Shake Shack (SHAK). This position had haunted us for several months. We saw little upside, investor support or positive qualities to make us believe in the rapidly appreciating burger chain. Perhaps it was our West Coast bias for In-N-Out? Finally, a disappointing third quarter result brought the stock back to earth.

Exterran (EXTN) was our largest negative position. The producer of equipment and services for the oil and gas exploration industry did not expand their order book in the fourth quarter as the market expected, and the stock sold off substantially.

We have gained considerable confidence in the market neutral strategy, both from the execution of the short side of our process, to the advantages that the mandate affords in portfolio construction and risk management. We have scaled up the gross exposure of the portfolio as the year has gone on to enhance returns in 2020.

Vitruvian Large Cap Long/Short

The Large Cap Long Short strategy utilizes the abundance of alpha available in small cap stocks and applies it into the large cap space by attaching a balanced, small cap long-short 'extension' to a large cap portfolio using our portfolio construction techniques. In this manner it allows clients to realize above market returns for a portfolio that behaves and can fulfill the role of large cap stocks in an allocation plan. It provides a viable alternative to either passive strategies, or active large cap strategies, which have proved unsuccessful for some time.

Our Large Cap Long-Short strategy returned 9.96% in the fourth quarter, outperforming the Russell 1000 index return of 9.04% by 0.92%. The strategy returned 34.66% in 2019 outperforming the Russell 1000 return of 31.42% by 3.24%.

The fourth quarter saw several of the stocks that had led performance for 2019 finish strong. Cloudera (CLDR) continued its strong comeback as their integration with Hortonworks continues to progress well. On the short side, Sunpower (SPWR) raised capital through a share issuance earlier than expected, confirming our fears about their financial health. The stock fell nearly 30% during the quarter. Our largest detractor continues to be the underweight position in Apple Inc. (AAPL). While we do not have a negative perspective on Apple, the underweight fits into the larger risk profile of the portfolio and should not be judged in isolation.

[i] "'Quant Winter' raises tricky questions about a hot industry", Robin Wigglesworth, Financial Times, January 16, 2020

[ii] Arnott, Campbell, Kalesnik and Linnainmaa, "Alice in Factorland", Journal of Portfolio Management, April 2019, p18-36

[iii] The Man Who Solved The Market, Greg Zuckerman, 2019