



The Case for Quantitative Management

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Where does the investor believe he has an informational advantage? Does the investor believe that he is better able to assess the current fair market price of assets given known and existing conditions, or does the investor believe that his advantage lies in being better able to predict future market conditions? Both views assume that market prices are at least partially inefficient. In the first case, it is assumed that currently available information about the state of the world isn't fully priced, while in the second case, the assumption is that some investors are somehow able to see into the future to see what other investors can't see. How one thinks about this has a bearing on the case for quantitative management.

The Basis of Active Management

Having recently witnessed one of the largest financial bubbles ever seen, it should be easier to accept today the notion that there is some degree of inefficiency in market prices. What kind of inefficiencies exist should probably depend, in part, on what you believe about how stable the state of the world actually is.

If you believe the world is very stable, then it becomes increasingly difficult to believe that market prices will fail to reflect known market conditions. In a very stable world, investors would presumably have had ample time to assimilate all available information related to the state of the world, determine what it means for market prices, and adjust their holdings (and thus asset prices) in accordance with this

knowledge. The more time that investors have to absorb and respond to information regarding the known state of the world, the less likely it should seem that market prices would be inefficient.

Alternatively, if one's belief takes the opposite extreme and assumes that the world is always in flux, that the state of the world changes frequently and significantly, then it becomes increasingly difficult to believe that investors could be successful in forecasting how the world will change. The less stable the world is, the less predictable it must be, or so we would assume.

There is a central point in between these two extremes where, we believe, one can make a stronger case for active management than at either of the two extremes. If the world is neither in a steady state, nor in a state of extreme flux, then it is a world with somewhat stable characteristics undergoing modest change through time. Change then occurs at the margin, and some active investors may believe that their informational advantage lies in the speed at which they are able to accumulate, interpret and react to information related to marginal changes in the state of the world.

Realize that it would be difficult in today's world to establish a large advantage in the aspects of accumulation (data gathering) and reaction (trading)¹. There are many who gather information effortlessly on a real time basis, and there are similarly many who stand ready to transact on a near-real time basis. The place to establish an advantage is in the interpretation of the information, which itself imbues accumulation and reaction with value.

Such an investor would not rely upon the markets being so inefficient as to leave long-established market conditions unpriced, nor would

¹ *There will, of course, be some investment strategies that do depend upon either execution speed or the speed of information accumulation. For example, earnings revision and earnings surprise strategies rely principally on the ability to execute quickly.*



she rely upon a skill in telling the future. Instead, she would be reliant upon the world being complicated enough that investors could differentiate themselves based upon their ability to evaluate the consequences of newly observed changes in the state of the world. The fact that there are usually many changes occurring simultaneously throughout the world lends credence to this assumption of complexity, as does the fact that there are so many interconnected elements and dependencies throughout the markets and the economic system.

The strongest basis for active management, is, we believe, the fact that changes at the margin are, first of all, just that, "at the margin," and secondly, are sufficiently numerous that skill is required to interpret the large amount of information available. The fact that the world is largely stable with changes occurring only at the margin implies that we can learn from the past how the world works today, and adjust for what changes do occur. This would not be possible were the world in a constantly in extreme flux, and our personal bias is to believe that predicting future states of the world in such an environment would be next to impossible. The fact that skill is required in interpreting the large amount of information regarding change is what, we believe, gives quantitative approaches an edge.

Can You Spot the Inefficiencies?

Most changes in the state of the world are changes that have been seen before. Interest rates have risen and interest rates have fallen. We've seen earnings improve and we've seen earnings decline. GDP growth, rate of return on equity, trade balance, money supply, and debt to equity ratios, growth in capital expenditures, inventory levels, exchange rates, probabilities of default - all of these vary through time, rising and falling and rising again.

It never occurs that all of these aspects of the world are configured in exactly the same way twice, so we never experience the same state of the world twice. Heraclitus, an early Greek philosopher, once

explained that one can never set one's foot into the same river twice, as the river is always changing. Yet much about it remains the same, or at least similar, from moment to moment. As investors, we can learn how attributes of the markets interact, and how change transpires.

As *active* investors, however, we need to know more than that. Active investing depends for its success upon the existence of market inefficiencies. Active investing depends upon some changes not being efficiently reflected in market prices. It is imperative that we know which changes are persistently associated with market inefficiencies and which are not if we are to succeed in exploiting market inefficiencies.

This implies that not only must we study the past and learn what will lead to changes in the state of the world, but that we also extract from our study of the past a measure of how efficiently investors respond to different kinds of change. "Correctly" responding to new information is of no value to an active manager if the markets have already fully priced the new information. We know of no other way to identify where the market inefficiencies persistently exist than to measure them through time. That's where quants strike their first advantage. Quants don't merely become good at understanding the effects that changes have on market prices, they also become good at knowing which changes are dealt with efficiently by the markets and which are not.

Market inefficiencies disappear because investors see the advantage of changing their behavior and do so accordingly. Earnings revision and earnings surprise were sources of profit for active investors in the early 1990's because investors generally took too much time to respond to revisions and surprises in earnings. A smaller set of investors were able to take advantage of this by responding faster, i.e., before other investors. That all makes sense. Should you employ such a strategy today? How would you know whether to do so or not?



Only by measuring the magnitude of the market inefficiency through time would an investor know whether there is profit left in it today. Because more and more active investors employed more and more capital through time in seeking to exploit earnings revisions and earning surprises, the inefficiency largely disappeared. You'd know this either by employing the strategy and finding it to be unprofitable today, or, you could know this by carefully studying the past, and the profit trajectory of this strategy through time.

The Balancing Act

On the average day, we will observe *many* changes in our economy and our markets. Interest rates may rise while the value of the local currency is falling, consumer confidence is rising, and the price of oil is in decline. What does that mean for each stock in the automobile industry? Well, the rise in interest rates is bad news for future consumer spending on automobiles, and worse news for those firms that depend more heavily upon the issuance of debt. The falling currency, on the other hand, makes foreign autos less competitive, and the rise in consumer confidence in conjunction with a decline in the price of oil - which leaves consumers with a larger budget for discretionary spending - leaves prospective auto sales looking stronger.

Is it obvious what impact these different changes in the state of the world will have on auto stocks? No, of course not. It's very hard to know, in fact. Knowing how to respond requires that we can balance the relative importance of these changes. Quants have often explained their edge as being related to their ability to systematically deal with large amounts of information quickly. Embedded in this claim is the notion that the significance of each piece of information can be counterbalanced against the significance of every other piece of information.

This is one of the more difficult tasks that quants face. As we have already said, the same state of the world never exists in exactly the same way twice. Were that to happen, we might be able to know with

precision how asset prices would behave when change causes us to move back toward a state of the world we've seen previously before. Because that doesn't happen, we must use quantitative techniques to assess which changes to which attributes of the world tend to be the most important through time, and to assess which changes lead to the most consistent responses in asset prices. To the extent to which quants extrapolate the past into the future, it is this that they extrapolate.

It is by a study of the past that we learn how sensitive different stocks have been over time to changes in the exchange rate. It is by a study of the past that we learn which stocks are most sensitive to a change in the long-term bond yield, or consumer confidence, or the employment rate. And very importantly, it is by studying the past that we can learn how *much* influence each of these changes will have on an individual asset so that when they change, we can balance the list of positive influences against the list of negative influences to see whether, on balance, the aggregate of all these changes is good news or bad.

For example, the market has been punishing stocks for a high level of discretionary accruals for many more years than just the last three years. Stocks with high levels of discretionary accruals have been underperforming stocks with less evidence of "earnings management" for a decade or more. At the same time, stocks with sensible growth in capital expenditures have been favored by the markets over the last decade or more relative to those where capital expenditure were significantly outpacing underlying sales or revenue growth. If a firm has shown modestly high discretionary accruals, but has been showing at the same time a strong, and well-supported growth in its capital stock, how will its price be treated by the market?

To answer this, we must look to the past to see how these attributes are weighed by the market on a *relative* basis. As it turns out, the market punishes stocks with high discretionary accruals more than it



rewards firms for sensible growth in their capital base. The only way we'd know this is through a rigorous measurement of past price reaction to changes in these attributes.

That's how the balancing act is managed by quants. We'd be hard-pressed to explain how other investors balance these countervailing forces against each other.

Apples and Oranges

Active investing is all about making comparisons. We're principally interested in the relative opportunities that different assets may provide. Above we described the complexities involved in evaluating the relative importance of information that may cause changes in asset prices. The fact that some information will tend to matter more than other bits of information is not the end of the story, however. Some of that information that tends to matter more, may tend to matter less to certain kinds of stocks. Stocks are not all alike, so we must struggle everywhere to avoid comparing apples with oranges.

Quantitative methods can help a great deal in minimizing this error. Take valuation, for example. Comparisons based on differences in valuation are always vulnerable to being an apples to oranges comparison. One can't simply compare the valuation of General Motors with that of Ford Motor Company. There is a long array of reasons to expect these two firms to trade at different valuations.

To start with, they have different industry exposures. While they are both involved in auto production and finance, they each have different degrees to which their revenues are derived from these two activities. Furthermore, Ford's revenues depend meaningfully on auto leasing, while GM derives revenues from its activities in the communications and insurance industries. Their financial structures are different as well

as evidenced by their different debt/equity ratios. From the investor's perspective, they have different risk characteristics as evidenced by their different levels of stock price volatility.

A quantitative model can take all of these differences into account simultaneously and adjust for these differences to allow for a more apples to apples comparison of their valuations. The technical term for this is "orthogonalization," which simply means that you first account for those differences in valuation that can be explained by the different attributes of stocks, strip out these explainable differences, and what's left are the differences that are unique to each individual stock. That's where the pricing inefficiency is located. This is necessarily a quantitative exercise.

Establishing a proper base for comparison, then, is very important to not only the use of valuation, but to other sources of market and economic information as well. One of the weaknesses of the traditional Wall Street approach to fundamental stock valuation, it would seem to us, derives from the way analysts are organized into industry or sector "buckets." By dividing analysts' attention in this manner, it's hard to see how one can compare stocks *across* sectors. What's the basis for an apples to apples comparison?

If one analyst is very hot on his sector, while another is only modestly bullish on her sector, can we assume that they share a common basis for comparison? Might one tend to be more optimistically biased than the other? It would seem to us that we have apples and oranges here. If disciplined and systematic about their approach to stocks *within* their industry or sector, one can imagine that fundamental analysts may be making more of an apples to apples comparison of stocks within their industry or sector, but what should lead us to believe that we can compare the information set of one analyst with the information set delivered by another working in another industry or sector?



The Quant's Competitive Advantage

There are then several specific ways in which the quantitative manager has an advantage. The two advantages associated with the quant approach that are most commonly cited are that quantitative models strip human emotion from the decision making, and that quant models don't suffer from the array of biases in judgment and perception that cognitive psychologists have attributed to humans. These are important advantages, but they are fairly abstract. There are advantages for quant that are more concrete than those, and we've sought to highlight some of them here.

Most important is quant's use of history. Some will criticize quant for using history because they perceive it as causing a quant to drive while focused on the rearview mirror. That's an accurate depiction of the problem that a certain kind of quant has, but it does not accurately reflect upon all quantitative approaches. The quant that has her eyes focused on the rearview mirror is the quant that is doing nothing more than extrapolating past *returns* into the future. There are those (both quant and non-quant, fundamental and technical) who do precisely this, and the analogy strikes accurately at the heart of the problem with such extrapolation.

Other quants look to the past to learn "how things work," rather than "what things return(ed)." The past confirms for us that rising interest rates raise the cost of doing business, just as theory would expect. Similarly, the past confirms that falling productivity growth is related to slower real earnings growth. There is a long array of such statements, and it should never be the case that these relationships will begin to behave in the future in opposition to the way they have behaved in the past. We are, therefore, quite happy to extrapolate such relationships into the future. Future returns may not turn out to look much at all like past returns even if markets and investors continue to function in the same way. That's a subtle, but very important point.

But history tells us more than that. Quants are better able to subdivide the large set of ideas about what moves stock prices into those ideas that can be exploited to earn an excess return from those that the market fully and immediately prices before anyone can seek to utilize the information to their advantage. With thousands of analysts all looking at pretty much the same data, differentiating between indicators in this way is supremely important. It's not just *how* one should set expectations that's important, but whether one should trade or not in an effort to profit from those expectations.

Furthermore, it's not just differentiating between indicators that matter. It's also important to measure the relative risk/reward of pursuing different market inefficiencies (i.e., which ones provide the best risk-adjusted reward), and to measure the relative importance of such inefficiencies on market returns (i.e., which ones should receive more weight the others when balancing different indicators). This is the balancing act that we've described.

And finally, there is the need to compare apples with apples that gives quants another advantage. Stocks are highly varied in their attributes, and simple comparisons between them risk ignoring these differences. A systematic, quantitative approach is necessary, we find, to account simultaneously for the long array of attributes, which differentiate stocks and the prices at which they should trade.

This is not the end of the list of advantages that a quantitative approach may offer, but this is where we will stop. Our discussion has ignored, for example, the advantages that a quantitative approach to risk management may offer, and it has ignored the strengths that a quantitative approach may have in evaluating systematically the cost of transacting against the risk-adjusted returns that may be captured by transacting.



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PARTNER'S MESSAGE

We have also put aside a discussion of the possible pitfalls associated with the quantitative approach. Like all endeavors, this one too can be done badly. Quantitative approaches to investing must be thoughtful, grounded in theory, and tightly controlled. Because quants don't read footnotes in financial statements, nor look CEO's in the eyes to judge their honesty, competence and confidence, they need to diversify their holdings to insure against getting individual stock picks wrong. Quants exploit general tendencies, not specific instances, so diversification and risk control are of more importance to the quant.

Just as we've seen with so many other walks of life, from navigation to education to running businesses, quantitative tools have become central to how we work and live. Investors have increasingly taken up the use of quantitative tools, although many still rely on them only as a marginal tool. One day it will be difficult to imagine how investors worked without the use of these tools.

