



ALLIANCEBERNSTEIN®

July, 2021

# Are We Human or Are We Dancer?

---

15 Essays on the Nature  
of Investing

YOU ARE RECEIVING THIS PUBLICATION AS AN INSTITUTIONAL CLIENT OF ALLIANCEBERNSTEIN. THE PUBLICATION IS FOR YOUR EXCLUSIVE USE ONLY AND NO PERMISSION IS PROVIDED FOR YOU TO FORWARD THIS REPORT ON TO ANY THIRD PARTY.



# ARE WE HUMAN OR ARE WE DANCER?

15 essays on the nature of investing

A financial legacy of the pandemic will be a significant reallocation of assets that has barely begun. But we also think it leads to a more fundamental shift, in a questioning of the underlying assumptions used to form investment decisions.

We suggest the way goals are set and how they inform the interaction of asset managers and asset owners needs to shift. This includes an evolution of the proper measure of risk in a world where risk-as-volatility may clash with the risk of loss of purchasing power.

We make an extended appeal for the importance of process in investing as one area where there can indeed be progress. We also address foundational issues in the basis for financial models. This becomes even more relevant with increased adoption of AI.

The goals of investing and process of investment decisions need to be reconsidered for the post-pandemic world. Adjusting to the new equilibrium post the pandemic sets new types of challenges for the investment industry and for those of us working in it.





# PORTFOLIO MANAGER'S SUMMARY

Adjusting to the new post-pandemic equilibrium requires profound changes for investors. Specifically, there is a need to adjust to the post-pandemic investment environment in two ways: (1) in a change to actual positions in portfolios and (2) in investment praxis.

At one level, there are significant changes that we think should occur to many of the assumed norms of strategic asset allocation. We discussed this in our recent *Blackbook: [Inflation and the Shape of Portfolios](#)*. These imply a material reallocation of capital, a process that has barely begun. This *Blackbook* is about the deeper and more fundamental shifts that may need to occur in finance, i.e., the required adjustment of the rules-of-thumb and thought processes that drive investment decisions.

We consider the strategic context of investing. By this we don't mean the interest rate or growth environment, but instead the way investment goals are set and the context for how active and passive investment approaches may evolve.

We make an extended plea for more *process* in investing. This is an area where we think definitive progress can be made in finance, yet the idea can often be lost in the daily hunt for narratives in the market.

We cover more foundational issues in the basis of financial modeling. This is particularly relevant, given the methodological change to modeling implicit in the increased adoption of big data, machine learning and the path toward AI.

We also consider the nature of investment risk. We think there is an emerging confrontation between the idea of risk-as-volatility and risk of a failure to preserve purchasing power. If the great risk question of the Global Financial Crisis was the catastrophic consequences of model failure, then post-pandemic the equivalent question might be the risk of a mis-setting of investment goals.

Asset management companies may feel like they are under pressure, but we would argue that the outlook for asset owners is, in many cases, even harder. This demands a change in the way investment decisions are taken. On this topic, there is a lot of work to be done with different challenges that lie ahead both for the industry overall and those who work in it.

BERNSTEIN

# TABLE OF CONTENTS

<b>SIGNIFICANT RESEARCH CONCLUSIONS</b>	5
<b>THE STRATEGIC CONTEXT OF INVESTING</b>	
THE HIATUS OF INTIMACY AND RHYTHM: INVESTING AFTER THE PANDEMIC	17
THE EMPTINESS OF PRECISION	29
POST-CAPITALISM AND CHRONOPHOBIA	37
THE MAN WHO CREATED THE LAST INDEX	49
THE FUTURE OF INVESTING AND THE HEGELIAN DIALECTIC	65
WHAT IS THE POINT OF THE STOCK MARKET (IN A CAPITAL-LIGHT WORLD)?	79
<b>AN APPEAL FOR PROCESS IN FINANCE</b>	
FROM STOCK PICKING TO PORTFOLIOS: A LETTER TO FUNDAMENTAL PMS	97
PORTFOLIO MANAGEMENT AND NUCLEAR POWER STATIONS	107
SEVEN CARDINAL SINS (OF INVESTING)	115
A QUANT MANIFESTO	127
<b>FOUNDATIONAL ISSUES IN FINANCE</b>	
CAN THERE BE SCIENTIFIC METHOD IN FINANCE?	147
WHAT IS A MODEL?	155
ASYMMETRY OF TIME IN FINANCE	171
<b>FINAL THOUGHTS</b>	
WHY I AM NO LONGER A QUANT	185
WHY I DO THIS JOB	195
BIBLIOGRAPHY	203

BERNSTEIN

# SIGNIFICANT RESEARCH CONCLUSIONS

## ARE WE HUMAN OR ARE WE DANCER?

*Are we human*

*Or are we dancer?*

*My sign is vital*

*My hands are cold.<sup>1</sup>*

Investing over the last year has been a case of adapting to radically different circumstances. Now, the attention of investors is shifting from navigating the reopening to trying to discern where the post-pandemic equilibrium states for markets and policy lie. The pandemic is, we think, the most significant regime change for the policy environment and its impact on markets that we have seen in decades.

There is a need to adjust to the post-pandemic investment environment in two ways: (1) in a change to actual positions in portfolios and (2) in investment praxis. The first of these adjustments has only barely begun. We think there is a huge reallocation still to come in the composition of portfolios, in asset allocation, and in the types of funds and positions that investors seek to buy. We recently wrote at length about what this means in a practical sense for asset allocation in our *Blackbook*: [Inflation and the Shape of Portfolios](#). Despite the ubiquity of commentary on inflation in the reopening trade, it seems apparent that investors have not repositioned their portfolios for a new equilibrium in which inflation is a real possibility for the longer term. This is hard, given it upends so much of the learned experience of investors in recent decades and points to the possibility of huge reallocations of capital in the years to come.

But the potentially bigger shift is in the intellectual process that underpins the formation of investment decisions, i.e., the required adjustment of the rules-of-thumb and thought processes that drive investment decisions. We suggest this shift still lies ahead of us. In this *Blackbook*, we want to go one stage deeper than the usual commentary on macro forces and discuss how the pandemic may accelerate a change in the underlying basis of investment decisions, in investment methodology, and how goals are set. These are the kinds of topics that tend to receive relatively less attention in investment writing. We get it, there is always a more immediate task at hand to get the "day job" done. However, it has long been our view that these issues should be the core of investment strategy writing.

The claim that an evolution is needed in the underlying process of investment decision making really stems from the nexus of the way the pandemic has brought about a profound shift in the policy environment; the probability that the outlook for capital markets is very different from the last four decades; ongoing innovation within asset management in the

---

<sup>1</sup> *Human*, The Killers

passivization of investing and integration of an ESG dimension to decisions; and also in the changing needs of asset owners. The nature of financial models, the formation of goals, and indeed what the point of the stock market is, all require attention.

It will take time for more clarity to emerge about the post-pandemic policy environment, but at its heart it seems likely to involve more government, a swing of the pendulum from capital to labor, and more active use of fiscal policy. On a strategic time horizon, there is the likelihood that policies that look a lot like universal basic income (UBI) become more actively discussed — elements of Modern Monetary Theory (MMT) and, ultimately, elements that have emerged in post-capitalist literature in recent years. In short, we would expect a rolling-back of some of the default assumptions of recent decades.

For asset managers, margins seem likely to decline and revenue growth harder to sustain; but for asset owners, the challenge is ultimately greater still. The question for asset owners is how to preserve purchasing power for investors in a world where nominal returns may be lower, diversification harder, lower-risk assets harder to find, and arguably less predictability in policy. This is a very different kind of question to that underlying investment in recent decades, when financial assets have easily outperformed real assets, and low-risk assets and diversification have been plentiful. This leads to seeing investment as a series of return streams and determining how to source them and allocate to them.

Policymakers will also have a role to play in this. If the likely path is one of structurally higher debt levels, it becomes even more important to maintain the current system that has passed much of retirement risk to individuals. However, the implicit social contract that underlies that is only sustainable if people have things to buy that can meet those future real-world liabilities.

This Significant Research Conclusions chapter attempts to draw together the broad themes that we cover in more detail in the rest of this *Blackbook*.

**Social and political context and setting of strategic goals in investing:** The first essays in this *Blackbook* are concerned with the strategic context within which investment decisions are made. By strategic context we don't mean the interest rate environment, but the way investors need to adapt to the implications of there being more government role in the economy; the way that investment goals are set; and the way in which active and passive investment approaches may evolve.

**The importance of process:** Despite huge changes in the strategic context of investing, we think the nature of *process* in investing is a field where progress can be made. We consider the nature of markets and how investment and organizational set up can help.

**Foundational issues in basis of models and basis of finance theory:** A period of change in the investment landscape is as good an opportunity as any to address the basis for financial models. This is particularly relevant, given the methodological change to modeling implicit in the increased adoption of big data and machine learning.

We realize that the approach we take in this volume is not like opening a financial textbook that examines the methodological and theoretical basis for investing step by step and we certainly do not attempt to claim that this is meant to be comprehensive! However, we think

there are alternative ways to address these topics. This is not just a question of how to make the type of investment choices that immediately help the ultimate investor, it is also about helping set the goals and expectations of those end-investors while handling all the myriad agency problems that are an inevitable part of entrusting money to others to manage and, indeed, the whole place of the investment industry in society.

We suspect that a significant evolution in the industry will take place to answer the demands of preserving purchasing power for a given level of risk and also navigating the constantly moving frontier of what counts as active and passive, and the adjustment of allocations between public and private markets. Ultimately, all investing is an active act, but to really embrace that concept, more of investing needs to be seen in a more explicitly multi-asset light. It also needs to be open to an evolution in the most fundamental goals and how they should change, and also in the frailty and limitations of the basis of models, the structure of which has evolved over the last 30 years in a social and policy setting which may no longer apply.

*And I'm on my knees  
Looking for the answer  
Are we human  
Or are we dancer?<sup>2</sup>*

### **The strategic context of investing**

In a series of essays in the first part of this *Blackbook*, we address the macro context of post-pandemic investing. When people say "macro" context, it usually implies the context of interest rates and other aspects of the policy environment and the business cycle. Here we want to consider a bigger picture than that.

The chapter titled "The Hiatus of Intimacy and Rhythm: Investing After the Pandemic" considers how the pandemic has changed the temporal culture of society. Prior to the pandemic, the advanced state of a 24/7 culture saw a homogenization of rhythm. While this feels intensely modern, we argue it was prefigured by Marx. In *Grundrisse*, he asserts that, taken to its conclusion, capitalism demands a homogenization of rhythm. The pandemic caused a shocking break in that rhythm.

We make the claim that all investing comes down to the political backdrop. The pandemic is a source of social change and, hence, political change. This is most immediately evident in the scale of government debt and the apparent political acceptance of an activist fiscal policy which, we suspect, may prove not to be merely a temporary phenomenon of the pandemic. It has been evident for years that at some point traditional monetary policy would likely lose its potency as a force to cushion the economy; the pandemic accelerated that. The fiscal genie is out of the bottle. Come the next downturn, will governments really be able to resist the clamor to send checks to people?

Indeed, the possibility of a "K-shaped" recovery from the pandemic could profoundly shape policy. The ingredients of high unemployment (or reduced labor participation), profoundly wider gaps in inequality once the dust settles after the pandemic, and apparent political "air

---

<sup>2</sup> *Ibid.*

cover" for handing out cash to people directly sound like possible ingredients for UBI and raise profound questions of the future of work. We address this in the chapter, "Post-Capitalism and Chronophobia." This also leads to questions of inter-generational fairness and, frankly, what capitalism even means when real rates find an equilibrium at zero.

The investment industry has made hugely impressive strides. The discipline produces a mass of data every day that can be analyzed with ever more advanced analytical techniques. In parallel, there is a weekly torrent of academic papers covering theoretical and empirical aspects of finance. The industry has sucked in a large share of the most educated part of the population (20% of employed UK graduates were in banking and finance as of 2017<sup>3</sup>). This gives an aura of precision in the making of investment decisions and management of risk. However, we suggest this aura may be misplaced.

In the chapter, "The Emptiness of Precision," we question the goals of investment research. The mass of analysis, commentary, and trading around the release of quarterly numbers for a company, say, are all very well but they are far removed from the true investment horizons of most end-investors. It is sometimes argued that the long term is a sum of short terms, but for investing we are not sure that is really the case. There are investment techniques such as mean-reversion that take time and cannot be replicated by a series of short-term trades, especially when investment decisions are overlaid by agency problems that inevitably arise when capital is entrusted to someone else to manage.

The precision can also lead to a false sense of security. This touches on the bigger question of can there ever be progress in investment research, a topic that runs through many of the chapters in this *Blackbook*. We are somewhat doubtful on the case for progress in the sense that a given research idea today is probably going to be less effective than an equivalent idea 20 years ago, given the greater efficiency of markets, plus the very reflexivity of markets themselves, meaning that any new discovery of a particular way of investing is likely to be ephemeral. It is this self-referential nature of investing that leads to radical uncertainty in investment decisions, creates a need for process, and makes it clear that precision in investing has a different status to precision in science, a question we deal with explicitly later in this *Blackbook*. Does the seeking of greater precision of goals lead inevitably to a focus on absolute returns? In that sense, maybe a journey is always a return.

Part of the strategic context of investing is considering changes brought about within the industry itself. In addition to the exogenous social and policy forces at work that make a case for shifts in how people invest, there are endogenous changes too. Preeminent among those is the rise of indexation and passive investment.

Sometimes it is easier to explore the deeper implications of change outside the usual constraints of a sell-side research note format. So one chapter is a work of fiction: "The Man Who Created the Last Index." This chapter makes the point that the purpose of the index has changed. What started as a tool for journalism, i.e., to report on what had happened in the market, has become a driver of the market itself. However, the plethora of indices (more than three million equity indices alone) again raises the question of misplaced precision.

---

<sup>3</sup><https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/articles/graduatesintheuklabourmarket/2017>

The endless enumeration of ways to track groups of securities leads to a sort of passive singularity, i.e., the point when there are so many "passive" tools to choose from that the term "passive" loses its meaning. It is akin to the Library of Babel, the library that contains every possible permutation of text in books. Tantalizingly, the library necessarily contains all possible truths, but at the same time it contains all possible untruths too and, hence, is useless. Moreover, books don't respond to the act of reading them, whereas the behaviors of financial indices do respond to the act of investing in them; thus the profusion of indices is, in a sense, even more unhelpful than the profusion of printed matter in the Library of Babel.

Passive investing, however, has a crucial role to play in the future of investing, which we explore in the chapter, "The Future of Investing and the Hegelian Dialectic." This takes the starting position of active investing as thesis and passive investing as antithesis. If that is the case, what does the synthesis look like? People often ask us "at what point is there too much passive investing?" or "what limits do market efficiency place on the rise of passive?". We think these questions are mistaken, or at least miss the point. The limit to passive investing, if such a notion even makes sense, does not come from the market, it comes from investors and fund buyers. The most simple example of this would be the case of an investor who uses a framework akin to a 60:40 allocation and within that takes a passive long position in equities and fixed income. The prospect of such an allocation delivering a return that only barely beats inflation and at the same time carries markedly higher risk than it did before<sup>4</sup> forces that investor to do something different.

The synthesis recognizes that a significant portion of an investor's allocation should be passive. In the process, the definition of passive evolves to include many asset classes, long-short as well as long-only, and both listed and non-listed assets, but it also requires that, ultimately, there is no such thing as an entirely passive position. The act of investing is ultimately an active decision. The moving of the active-passive boundary (to include simple factor strategies as passive, for example) is a necessary condition to show which parts of active are genuinely valuable and worth an active fee. The moving of that boundary also reveals that one needs to have a flexible approach to what passive means; it is more helpful to refer to such positions as "beta" in a generalized sense of exposures to asset classes, markets, factors, and themes.

The chapter also discusses the role of the Efficient Market Hypothesis (EMH). Our view is that EMH doesn't hold, not because of residual inefficiencies in the pricing of securities with respect to relevant information (there is every sign the market will continue to become more efficient in that sense), but instead the bigger inefficiencies are in the way goals are set, in the mis-match of investment time horizons with liabilities, and in the mass of agency problems that inevitably beset the industry. That points to using a mix of passive and active vehicles together.

This chapter also touches on the future of ESG. The particular focus here is on the question of what might be meant by macro ESG investing. The focus of the ESG wave so far has overwhelmingly been at the single security level. However, we think it would be wrong to assume that macro ESG is simply an aggregation of security-specific issues. There are

---

<sup>4</sup> For a discussion on why we think this is indeed the outlook for such an approach, see [Inflation and the Shape of Portfolios](#).

other issues that emerge at a macro level but that are not necessarily an issue of stock-level concern from an ESG point of view. Examples of this would be the social desirability, or otherwise, of buybacks and the bargaining power of labor in the gig economy.

This leads to us asking the question in the next chapter ("What Is the Point of the Stock Market (in a Capital-Light World)?"). We argue that the point of the market for entrepreneurs raising money, for investors, and even for policy makers has changed. In a capital-light world, there is less need for upfront capital. This is evident in the pattern of companies listing later in their evolution or not at all. The primary incentive to list is more about being able to offer liquid incentives for workers than a need for investment per se. For investors, the stock market has gone from being the primary source of access to growth and as a way to deploy a risk budget, to merely being one of a host of options.

### **An appeal for *process* in finance**

The central part of this *Blackbook* is an extended appeal for process in finance.

A starting point for this is an appeal to fundamental managers to think more about the step from picking stocks to the forming of a portfolio. The industry pours huge resources into trying to forecast the outlook for individual securities, but then devotes so much less resource to how to put them together. A list of "buy" ideas does not make a portfolio. We make the point in the "From Stock Picking to Portfolios: A Letter to Fundamental PMs" chapter that there is much more "stickiness" in variance and covariance than there is in returns. This does not mean that one is inevitably led to a low-volatility approach. However, it does imply that once a set of investments has been chosen (be that single securities or more generalized return streams) a good *starting point* for how to combine them is at least somewhat tilted in favor of equal risk contribution.

This need for process within finance can be extended and placed within a broader context. In the next chapter, "Portfolio Management and Nuclear Power Stations," we take the work of Charles Perrow in the domain of organizational theory and apply it to investing. The original work of Perrow was focused on the organizational issues of flying aircraft and running nuclear power stations, especially when things go wrong. But we think there is an important lesson for the role of process in investing on this point too in Perrow's work.

Perrow describes certain kinds of systems as being prone to what he calls "normal accidents," which is a term that is used very specifically to describe accidents that are a function of the system itself rather than operator error. Such systems tend to share two characteristics — one, they are "tightly coupled," in the sense that processes happen in quick succession and cannot be detached from each other in a temporal sense, and two, they tend to be "complex" in the particular sense that any individual element performs many functions rather than just one. These two traits come together to create a third characteristic — the potential for total incomprehension of operators of the system when a malfunction appears.

We suggest that portfolios share these attributes. Events clearly cannot be decoupled in a temporal sense when news hits. Moreover, any individual element of a portfolio inevitably performs several functions at once, in that they bring in asset class exposure, factor exposure, thematic exposure, and some idiosyncratic element.

All this is not meant to get PMs off the hook when they underperform. However, the solution to such systems in other domains (airplanes and nuclear power stations) tends to be via process, i.e., checklists and organizational structure.

We further generalize the case for process in investing using the seven deadly sins as a handy guide in the chapter, "Seven Cardinal Sins (of Investing)." For instance, pride leads to overconfidence, e.g., in how much of return comes from idiosyncratic skill vs. the luck of having a set of factor exposures. Lust, in the sense used here, is the expression of investors falling in love with certain themes or narratives. The need for process extends to fund selectors as well as PMs; hence, the problem that underperforming funds are in general sold too soon.

For quant managers in particular there are questions of process that are critical as detailed in the chapter, "A Quant Manifesto."

Quant investing is emerging from probably the toughest four-year period ever, which is putting huge pressure on the ability to raise and defend assets. The irony is that the world of investing is more quant than it ever has been before, but people are not buying quant funds. We suggest some particular aspects of process that matter for quant managers within the framework of Marinetti's *Futurist Manifesto*.

### **Foundational issues in finance**

It has often been said that those engaged in financial research suffer from physics envy. There does seem to have been a concerted attempt to make finance and investing more scientific. Many people may even genuinely believe that is possible. However, we think it can only ever at best be a veneer. We address this in the chapter, "Can There Be Scientific Method in Finance?". We conclude that finance and investing necessarily fail most definitions of being "scientific." Nevertheless, we ask whether there are weaker definitions of scientific method that can apply to finance and, if so, whether we can learn from them in the organizational structure of investment teams.

We discuss the idea of science as a "research program undertaken by a community of experts which is continually willing to question every long-established certainty." On the one hand, this is yet another appeal for process, but it also points to a need to end the culture of story-telling in finance.

On the other hand, a foundational issue that has a direct bearing on the current development of research programs is the question asked in the next chapter, "What Is a Model?". This could perhaps be construed as an overly-philosophical question that may not impinge on quotidian issues in investment. We think, however, that would be a mistake.

The ongoing drive to greatly expand data used to form investment decisions often goes hand-in-hand with a desire or need to recraft financial models and, in some cases, to move into outright forms of machine learning. This prompts profound questions of what framework is necessary for a financial model and what financial models are for. A key question is whether financial models are "merely" trying to predict or whether they have to offer an explanation as well. The latter is a much higher bar. Even if we reject the idea that explanation requires truth, still the concept of explanation becomes hard in the case of a

model that uses a neural net, support vector machine, or random forest of binomial trees. Even in normal operation, there may be constraints on the ability of such models to be said to "explain" financial phenomena, but when they fail — as they inevitably will — then will the portfolio manager ever be able to sit across the table from the client and really explain in an adequate way why the model failed? We think this is very relevant for the crafting of a new generation of models.

The last chapter on foundational issues, "Asymmetry of Time in Finance," is on the question of the direction of time. Many financial models don't care which way time goes, yet financial markets have a very clear arrow of time. In this sense, they are like a thermodynamic system. We regard an interest rate as really being the price of time, but the directional arrow of time enters financial models via the risk premium. This leads to a discussion of the role of mean reversion, which is possibly the most powerful tool that investors have at their disposal.

### **What is the meaning of risk? From risk of "model failure" to risk of "goal failure"**

A topic not explicitly covered in the other chapters is the issue of how the nature of risk may need to change. The narrative outlined in this *Blackbook* points to a rethinking of the meaning of investment risk. This is traditionally thought of as being commensurate with volatility, or risk of a given loss or tail event. We suggest that if nominal returns are lower and inflation higher (or to put it another way, for the returns of financial assets to be lower relative to prices of real assets and services than what we have become used to), then more focus may need to be given to the risk of failing to preserve purchasing power. We suggest there may indeed be a direct conflict between the measures of risk-as-volatility and risk-as-preserving-purchasing-power. Our suggestion is that the latter is the more important consideration, so portfolios do indeed migrate to "higher risk" allocations (in the volatility sense). But this would require a shift in goals and possibly in regulation to allow more long-short, more factor exposure, less fixed income, etc.

As another strand of this, we suggest there may no longer be risk-free assets, especially in a world of structurally higher government debt (see: [Global Quantitative Strategy: The end of Pax Americana and what it means for the market](#)). This has the practical consequence of being yet another source of increased risk in portfolios. It also has the more theoretical consequence of questioning whether such a thing as absolute valuation is really possible.

In our recent work on inflation, we doubted that fixed income can continue to diversify equity risk if the levels and volatility of inflation rise. This becomes yet another source of risk at the portfolio level and means that one of the central tasks of multi-asset investing is to seek out new sources of diversification and address what amounts to a "duration problem" for investors. In recent years the perception that capital market returns may be lower and that diversification will be harder has been one of the driving forces in the shift to more illiquid assets. As the dust settles after the pandemic, there is likely to be a desire to shift even further toward such assets, especially in the context of a desire to allocate to real assets that may offer inflation protection and also increase yield. This trend suggests yet another reason why portfolio risk may need to be measured more in terms of outcomes rather than volatility.

After the global financial crisis, one of the preeminent questions asked in the context of risk was to what extent was there a "model failure." Huge strides have been made to address

this question over the last decade. We think after the pandemic, the equivalent question would likely be whether there is a risk of "goal failure" and, if so, how investment goals need to be rephrased and the way asset managers and asset owners interact needs to change.

### **Final thoughts**

If we draw together the elements of the need for process in investment with the potential for a profound change of the policy and social environment within which investment decisions are made, it calls into question many long-held assumptions on investing. To this end we reproduce a note we wrote last year as a chapter, "Why I Am No Longer a Quant." If the pandemic doesn't count as a regime change, then we cannot imagine what would count. How does one make investment decisions if the rules have changed? This means our ability to apply backtests as a basis to support future investment decisions is challenged. However, we do not want to advocate a "shoot from the hip" approach to merely taking a series of discretionary views on market narratives. History is, ultimately, all we have to go on when it comes to investing. But in the post-pandemic world, how that history is applied needs to be reconsidered, especially as we are in this indeterminate phase when the post-pandemic policy equilibrium is yet to be established. We are not saying quant investing is over, but equally we do want to move on from the canonical views of what quant investing means.

We end this *Blackbook* with some thoughts on what the point is of investment strategy research in the chapter, "Why I Do This Job." We first published this three years ago, but it seems a fitting way of tying up the strands of this *Blackbook*. It covers issues such as what a research program of this nature can hope to achieve, how the goals of PMs may need to evolve, and what the goals of the industry should be more broadly.

Asset management companies may feel like they are under pressure, but we would argue that the outlook for asset owners is, in many cases, even harder. On this topic there is a lot of work to be done with different challenges. This requires a rethinking of the foundations of *how* we invest. On the one hand this is commercially important, but also presents an intellectual challenge for all those in the industry. This is something to keep us all busy for at least the next decade.

*And sometimes I get nervous*

*When I see an open door*

*Close your eyes*

*Clear your heart*

*Cut the cord.<sup>5</sup>*

---

<sup>5</sup> *Human, The Killers*

BERNSTEIN

# **The Strategic Context of Investing**

BERNSTEIN

# THE HIATUS OF INTIMACY AND RHYTHM: INVESTING AFTER THE PANDEMIC

## OVERVIEW

This chapter is a provisional sketch of what economics (in the most general and loosely defined sense of the term) and investing might look like after the pandemic. We discuss what we think will be some of the more profound implications, and hence this chapter is about the intersection of the personal sphere (rhythm and loss of intimacy) with the public sphere (increase in inequality and unemployment).

All investing ultimately comes down to the political backdrop. Thus, the enormous social changes that will likely be a lasting feature of the pandemic will probably change the outlook and even the goals for investing. While the belief that a "science of investing" is possible was likely shaken by the GFC, we think the pandemic will be its death knell.

## DETAILS

In this chapter, we attempt a provisional sketch of what we think might be some of the more profound changes stemming from the pandemic for economics — in the most general sense of the term — and for investing. The social dislocation in response to the virus has been on a scale not seen in developed economies since WWII. We still await to see what this implies in terms of long-run implications for the economy and for investing. So, maybe the biggest questions are best dealt with in an essay rather than in a "sell-side strategy note" with its requisite charts, data, and projections. Such notes have to be quantified, but our topic here is necessarily qualitative in nature. This chapter is about the interplay of forces in the public sphere — social changes, the direction of the political narrative, etc. — with the private sphere — rhythm, intimacy, the learning or realization of what is personally important and, of course, death.

The Covid-19 pandemic has brought several huge changes with it. The direct social response to the virus is the lockdown, which temporarily forced an end to physical intimacy. It also put the prevailing 24/7 culture on hold, thereby breaking the social rhythm. Then, there is the economic impact of the social and political changes brought on by the virus. We think the most profound of these changes could be a long-term impact on the politics needed to respond to the social crisis. This may well involve a questioning and then a possible reframing of some of the core tenets of neoliberalism in the form of a shareholder-first corporate culture and technocratic stewardship of the economy via independent central banks with minimized government intervention. Methodologically, for finance this may lead to a realization that there cannot be a science of investing. Finance rests, ultimately, on the political economy and the personal subjective sphere cannot always be ignored in economics. This highlights the bounds of any model that assumes society is merely a sum of rational mean-variance optimizing participants. The GFC might have been the impetus to start that realization, and the pandemic likely amplifies it.

### Rhythm and intimacy

*Touch, I remember touch*

*Pictures came with touch*

*A painter in my mind*

*Tell me what you see.*<sup>6</sup>

The focus of the policy debate has so far been on the intersection of social restrictions and the economic support required to offset them. But the deeper changes are likely to be the more long-lasting ones.

For the first time ever, nearly all of humanity suffered a synchronized loss of the intimacy of physical contact. There has never before been a global loss of touch. If anyone had begun to doubt the importance of the physical embrace in a world where so many interactions could apparently occur via social media, then maybe the enforced removal of the possibility of such tangible contact was a large enough shock to recognize the limits of *faux* intimacy via media. The loss of intimacy transcends our attempt to overcome physical remoteness through contact via video. The viewer's gaze on their interlocutor is not the same when it is via a camera; it is passive and not actively engaged. A conversation via video necessarily focusses attention on the explicit and not the implicit, so speakers can neither threaten one another nor express love in the same way. It is no longer possible to directly look into the eyes of others, and eyes do not glint in the same way when intermediated by a screen. It will take a long time before the social and psychological effects of this hiatus of intimacy can be understood. No doubt the effects of this suspension of intimacy will be explored in art and literature for years to come.

Crary (2013) points out that a 24/7 culture had come to dominate advanced economies before the pandemic. The term 24/7 not only implies an incessant continuity of activity but also a mass *synchronization* of consciousness and memory. This has created a standardization of experience, which has led to a loss of subjective identity. Yet that 24/7 rhythm has abruptly, for the first time, been stopped by the lockdown. Everyone, by the nature of their forced isolation, has suddenly been left to find their own rhythm. Yes, for those who are lucky enough to be able to do their jobs remotely, there is a semblance of a continuation of the quotidian timetable with meetings performed via the screen, but even this timetable has been shaken up. No doubt it will be re-established in time, but it is hard to imagine that the cessation of the rhythm so suddenly will not have a lasting cultural effect.

24/7 culture may feel very contemporary, and indeed some aspects are. But actually its roots are as old as the Industrial Revolution. In this context, the suspension of a 24/7 culture is all the more shocking as it is embedded and assumed in so many aspects of contemporary society. Ever since Richard Arkwright's cotton mill in Derbyshire established back-to-back 12-hour shifts that ran right through the day and night, the rhythm of the individual has been progressively bound up by the needs of a capitalist society to regulate and impose a uniformity on personal temporal experience to improve the efficiency of production. Marx himself recognized that the internal logic of investment in capital required

---

<sup>6</sup> *Touch*, Daft Punk

a uniformity of rhythm to be imposed. "Hence the greater the scale on which fixed capital develops...the more does the continuity of the production process...become an externally compelling condition for the mode of production founded on capital."<sup>7</sup>

Indeed, not long after Arkwright, the building of railway networks required the measurement of time to be synchronized across whole countries for the first time in human history, thereby ending the local measurement of time in each town. Local time had often been marked very physically with a meridian laid out as a brass line across the floor of a cathedral, and these are now often long-forgotten and lying under pews or rugs. A hidden reminder of a very much unsynchronized past, a transitory stage in human development when the measurement of time was important but not globally synchronized.

Carry's work inspired an exhibition at Somerset House in London in 2020, also called *24/7*, that explored the ever-waking continuum of the modern world. In retrospect, the timing of that exhibition now seems remarkably prescient. It marked, artistically, the last hurrah of an uninterrupted 24/7 rhythm before that rhythm was obliterated. It included such works as Douglas Coupland's *Slogans for the 21<sup>st</sup> Century*, which consist of posters printed in bold capitals on bright backgrounds shouting at us about how we experience the modern world, such as "IT'S NOT AN ILLUSION TIME IS MOVING FASTER" printed on a bright red background. Also, the more subtle work of Tatsuo Miyajima who invites one to enter an enclosed dark space lit only by blue LED digital counters continually counting down all around one in an endless cycle, at once calming and unnerving.

Not included in the exhibition, but arguably the supreme embodiment of capturing the temporal dystopia of our temporarily lost 24/7 world, Christian Marclay's *Clock* installation won the Golden Lion at the Venice Biennale in 2011. It consists of looped video footage of thousands of short cuts from films where a clock or watch is captured, either intentionally or not, in the frame of the shot, arranged so as to show them in "real time" over the course of the day and night, and which runs continually on a 24-hour cycle. The effect is mesmerizing, but also disturbing. Lounging on a sofa in the vast space of the old rope-making halls of the Venetian *Arsenale*, now converted into an exhibition space, the viewer is left on edge and in a frenetic state of sensing the need to keep to a strict agenda, time moving on by the second. If that seems a fitting artwork for the last decade, for the temporal culture of the pre-pandemic world, it contrasts wildly with the current state in which we now find ourselves in lockdown with us all being left to find our own independent diurnal rhythms, no longer intermediated by a common time.

The disruption of rhythm and enforced immobility has led inevitably to more time for introspection and thinking. Such a development is antithetical to 24/7 culture, which does not value a pause or idle time. This leaves more time to think about what is actually important. What is novel about this is that it has never before been imposed on everyone in unison. Moreover, and I don't think there is any point being coy about this fact, this time for introspection is happening at a time of death. If introspection and death together cannot bring about change, then what can? Not least because in this context, the closest emotional counterpart to death is love.

---

<sup>7</sup> Marx, K., *Grundrisse*, p703

Solnit put this very well in a recent essay: "We often divide emotions into good and bad, happy and sad, but I think they can equally be divided into shallow and deep, and the pursuit of what is supposed to be happiness is often a flight from depth, from one's own interior life and the suffering around us — and not being happy is often framed as a failure. But there is meaning as well as pain in sadness, mourning and grief, the emotions born of empathy and solidarity. If you are sad and frightened, it is a sign that you care, that you are connected in spirit."<sup>8</sup>

No doubt there will be an attempt to rush back to the old normal, but it seems unlikely that we end up back at the status quo. For one, we still face a period during which at least some social distancing and/or travel rules persist, but also there can now be a questioning of the interaction of personal vs. common rhythm as we now realize that there is, actually, another way.

### **Scale of loss of employment**

Second to the scale of deaths that are going to be experienced, probably the next most savage social consequence of the pandemic is likely to be unemployment. The ILO suggests that working hours lost at the peak of lockdowns in 2020 to be equivalent to 305 million full-time jobs.

The headline unemployment rate in the US has rapidly fallen with reopening, but globally it seems likely that the pandemic leads to a shift in employment that has social implications. In many countries there is still the temporary fig leaf of furlough schemes or supplementary unemployment benefits. Moreover, the participation rate has not bounced back and the nature of lockdowns has likely brought forward automation that would have occurred over the next five years.

In the past, weak bargaining power on the part of labor was often compensated by rates of unionization above levels seen today. In the wake of World War I, 40% of the UK labor force was unionized. This fell during the 1920s, but it ranged from 40% to 50% in the 1950s-70s. Today it is 22%. Likewise, in the US, there has been a parallel slide in unionization, only with the overall level being lower than in the UK. In 1950, 32% of US employment was unionized; today it is 11%.

Let's be clear, the explosion in unemployment as a result of the pandemic is going to have massive social and, hence, political implications. These implications are likely to dominate politics for the next decade. There was already, before the pandemic, a debate about whether technology was going to destroy jobs at a rate that would be hard for society to cope with. In a sense, the loss of jobs to technological change is no different to what has been seen since the Industrial Revolution. However, the change may be more socially disruptive now than the one faced by the Luddites, as it is occurring on a time scale that is significantly shorter than people's career spans. This was all known and widely discussed before the pandemic, of course. But now we have an exogenous shock that lifts unemployment dramatically. It is possible that the unemployment rate simply never falls back to pre-crisis levels. As demand picks up after this crisis, investment will likely go much more strongly than ever before into automated ways to perform functions. This is also

---

<sup>8</sup> <https://www.theguardian.com/world/2020/apr/07/what-coronavirus-can-teach-us-about-hope-rebecca-solnit>

bound up with the unstitching of global supply chains and pressures for de-globalization. An on-shoring of production back to the US and Europe implies a rush to automation.

This will require a policy response and one that will probably take several election cycles to become clear. The base assumption has to be that this leads to an expansion of social welfare programs. Maybe this could be the shock that leads to UBI? Calls for such a policy have grown in recent years. It would seem plausible that the current crisis is the shock that finally brings it about. Larger and ongoing fiscal support may be socially *required* to stop unrest and, at the same time, economically it may indeed be more possible if all recent political limits to government indebtedness are thrown out the window. This will take years to play out, but perhaps we are not so very far from it in the initial, "temporary" government responses to the crisis, such as the UK government paying 80% of the salary of furloughed workers, various European governments picking up at least part of the wage bill for millions of idled workers, Canada's temporary basic income<sup>9</sup> and, of course, the adoption of "helicopter money" in the US, presumably the first instalment of which will not be the last. In the absence of mass re-unionization (which seems implausible both politically and practically, given the changed nature of the workforce), other long-term policy changes will be needed to balance the loss of jobs.

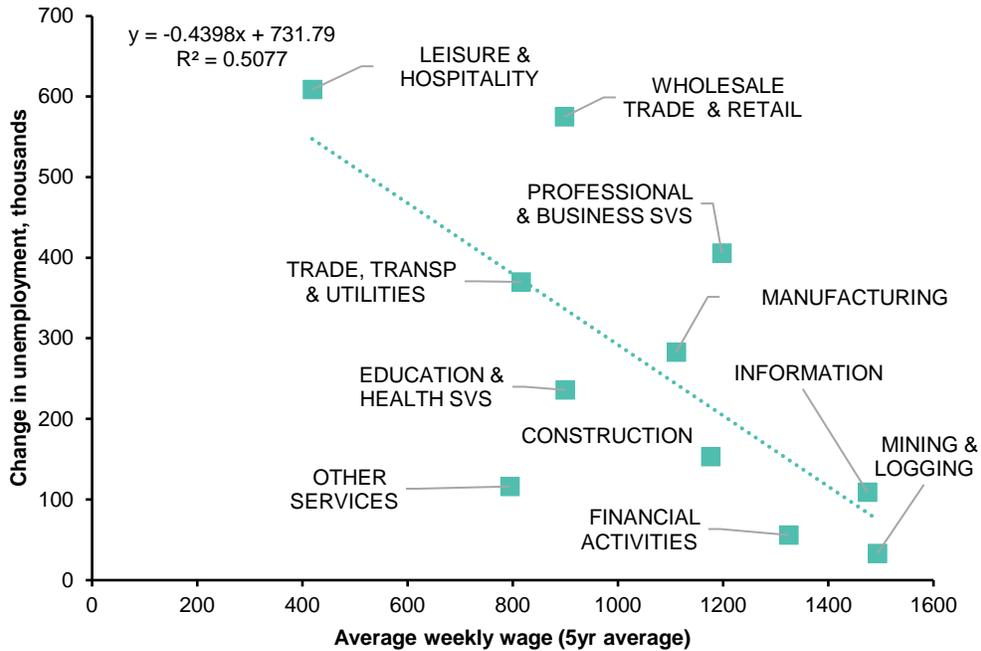
### **Inequality**

Unlike unemployment, which has not been a topic of much economic concern in recent years, the trend that has been hard to avoid discussing is inequality. We argue this is set to become significantly worse. A large increase in unemployment and loss of labor bargaining power is likely to fuel inequality anyway, as labor is the one wealth-producing asset that all workers have, even those with no capital. But we are dealing with — so far at least — a very uneven pattern of unemployment. White collar workers are able in many cases to work from home vs. many workers in leisure service industries and, to some extent, manufacturing simply losing their jobs or having to take personal health risks in performing them. We tend to like to keep charts out of our essays, but a picture makes this point clearer. Exhibit 1 shows the increase in unemployment in the US since the start of the pandemic, plotted against average hourly earnings by industry. The increase in unemployment has been fastest in the industries that pay the least, and vice versa.

---

<sup>9</sup> <https://www.bbc.co.uk/news/world-us-canada-52022506>

EXHIBIT 1: **Increase in unemployment over the course of the pandemic has been worse for lower paid jobs – change in unemployment rate and average hourly earnings (US\$) by industry**



Source: Datastream, Bureau of Labor Statistics (BLS), and Bernstein analysis

As discussed earlier, there is likely to be little labor bargaining power after an unemployment episode such as we are seeing. Piketty (2013) noted that there was already an unusual increase in the distribution of wealth stemming from an inequality in earning power, over and above that coming from the unequal ownership of capital. That inequality of earning power seems set to get worse in the near term.

The only really comparable shifts in employment patterns (apart from the Great Depression) have occurred during major conflicts. However, unlike in a major conflict, there is no direct destruction of physical infrastructure taking place as a result of the pandemic. As Scheidel (2017) showed, in a war such capital destruction can lead to a leveling of wealth, as capital is owned very unequally. Over the course of the pandemic, by contrast, financial asset prices have mainly risen; so, the owners of financial capital seem to have got off very lightly.

A combination of higher unemployment and greater inequality constitutes a "social virus" in tandem with the actual virus. Whatever the short-term economic effects of the lockdown, we think this social virus has a long-term effect both through changing social mores and also more directly via politics.

#### **All investing, ultimately, comes down to politics**

We have long held the view that all views on the market and investing ultimately come down to politics — at least to the political backdrop that sets the framework for investing. Textbooks on investing tend not to talk about this much. This is likely because most of the recent ones have been written in an environment where politics was benign, or at least

appeared to be, from the point of view of a public equity shareholder. A shareholder-first mentality anchored by a geopolitical climate defined by *Pax Americana* gave the appearance that an equilibrium was achievable in capital markets. The uncomfortable truth is that to recognize the role that politics and society has in investing would be to deny the attempt to put investing and finance on a scientific footing (see the chapter "Can There Be Scientific Method in Finance?" of this *Blackbook*).

It seemed we were already nearing the limits of the fiction that financial markets and investing could be free of politics before the pandemic. The rounds of quantitative easing (QE) since the financial crisis, the growing awareness of the inequality that was perceived — justified or otherwise — to stem from neoliberalism, the rise of populism, and the fraying of the post-war multilateral order all pointed in this direction. Although it is too early to say exactly what the political direction will be after the pandemic, it seems inevitable that there will be a change, potentially on a large scale, and the investment outlook will be inescapably bound up in it. Several parts of this picture are easy enough to spell out. After going through a medical emergency on a scale not seen in several generations, maybe, just maybe, it is something that could prompt governments to increase spending on universal access to healthcare in countries such as the US.

The political economy will likely see larger changes too. Former UK Prime Minister Theresa May famously said "there is no magic money tree," ironically enough in replying to a question from a nurse about funding for the NHS.<sup>10</sup> Well, events of the last year have taught that, in fact, there *is* a magic money tree. Central banks can create as much credit as needed and governments (well, those that have fiscal independence at least, we will come back to that) can issue as much debt as they please. This is in the short term at least. It then increases risks of inflation and devaluation. We will see this point debated *ad nauseam* in coming years, but to get it done just required a shift in the political frame of reference. In a sense there is nothing new about this. The leveraging of government balance sheets has been a steady process over the last 40 years and the ugly fact is that economic growth has become ever more dependent on it over that time. However, up until now that was in an environment when powerful forces (e.g., globalization) were lowering nominal interest rates. The level of government indebtedness in advanced economies now looks set to equal levels last seen at the end of the WWII and possibly even exceed those levels. Such a marker is in no way an upper limit. Indeed, it seems entirely probable that one of the lasting political consequences of the pandemic is that society signs up to permanently higher government debt and probably a series of further increases from these levels.

It is often pointed out that the burden of servicing this debt is not a problem if interest rates are so low. But there is a level of debt at which sovereign and currency risk may indeed matter, and not just for emerging markets. Moreover, politically this will constrain the fiscal space of future governments in a way that raises a question of inter-generational fairness. This will be made all the more difficult as in only 11 years the number of over 65-year-olds will outnumber workers aged 18-40 in OECD economies.<sup>11</sup> In democracies, where the older tend to participate in elections more anyway, this sets the stage for a potential inter-

---

<sup>10</sup> On June 2, 2017, during an election edition of BBC1's Question Time <https://atomic-temporary-113173672.wpcomstaging.com/2018/04/16/origin-watershed-television/>

<sup>11</sup> [Age of the aged: Demographics - destiny for the market, doom-mongering or a path to a better benchmark?](#)

generational clash and a potentially large disconnect between the vote-base and the tax-base of societies.

After WWII, servicing equally large debt burdens became easier over time, given the scale of the rebuilding of the capital stock that was needed, the demographic expansion and, in the First World at least, the emergence of a US-led international order. Such circumstances do not hold in the present case. Capital stock does not need to be built to anything near the same scale and the US-led order is in question. This presumably will lead to a long-running debate about the limits of fiscal policy and of the appropriate strategic allocation to gold. Zeihan<sup>12</sup> would counter this thesis. His claim of US exceptionalism would suggest the US does not actually need the international order that it created due to demographics, geography, and energy independence through shale. However, we suggest that maintaining the dollar as a global reserve currency does require engagement in a world order.

We don't subscribe to all of Zeihan's case for permanent US exceptionalism, but do find it relatively easy to spell out a path where the long-term political repercussions of this are more profound in Europe, especially for the holders of public equity in European companies. First, it seems entirely plausible that there is a more significant backlash against an Anglo-Saxon shareholder-first mindset. We have already seen the rapid emergence of a debate in society and even specifically from European pension funds about whether it is "ethical" for corporations to continue dividend distributions to shareholders in the region. Second, with the UK no longer part of EU decision-making, it becomes politically easier to take a path that is comfortable for public equity holders. Third, we note that the mega cap tech-based firms that have come even more to dominate communications, business functions, entertainment, and retail pay relatively little taxes to European treasuries and are not listed in Europe.

But there is a more existential problem in Europe too. Southern Europe has been hit hard by this crisis. This after a 15-year period when real growth in Italy, for example, has been zero. This is just extraordinary for a large, rich European society and will create some extreme social pressures. It is not clear how long such pressures can be contained, and is likely to have an outcome that few could have foreseen when the euro was set up. The failure of the Eurozone to establish a fiscal union alongside its monetary union looks like an unsustainable strategic error in an era when monetary policy has run its course and fiscal policy is the only game in town.

There is a huge level of political support behind keeping the Eurozone intact and the pain of dissolving it is almost unthinkable. At the very least, there will likely be a further testing of trust in the euro and its institutions. For what it is worth, we think the northern European countries will blink and agree to further steps toward common debt and fiscal union, the alternative being politically worse. Investing through such a period will be a matter of reading politics, not of looking for trends or mean-reversion on any charts.

But the big political economy question is what the pandemic means for the whole post-Thatcher and post-Reagan legacy of smaller government, primacy of shareholders, and the

---

<sup>12</sup> Zeihan (2014)

central role of the market. There was already rebellion growing to neoliberalism. Berardi<sup>13</sup> has suggested that the neoliberal climate of recent years has led to "empathy and universality having been torn away." Well, it is harder to imagine anything genuinely more universal than a pandemic and — at least temporarily — there would appear to be a welling up of empathy. On the spectrum from small to large government, a swing back to larger government seems inevitable — both in the blunt terms of the scale of public sector debt and also in the need for government to be directly involved in more parts of economic activity, e.g., in the way governments dictate social distancing rules and subsidize wages.

The political and economic consequences of the pandemic (aside from the largest recession in at least 100 years) would seem to be significantly higher unemployment, greater inequality, a retreat from globalization (though how far that goes is, at the moment, unclear), and a semi-permanently higher level of public sector debt.

It seems eminently likely that an eventual result of this is more populism, of the kind that has already emerged in the last five years. But what form that populism will take is, at the moment, unclear. Will the dominant tone be one of nationalism and anti-globalization, or one of higher taxation and greater redistribution?

### Investing

What does all this mean for investing? Methodologically, we think the consequences of this crisis will reveal, in case it wasn't clear already, that there is no such thing as a "science" of investing. A greater proportion of directional decisions about investment will likely depend on taking a view on policy decisions, which in turn respond from a social stimulus. Note that this does not mean that *process* doesn't matter. Far from it — areas such as portfolio construction become even more important to make sure that the exposure expressed in a portfolio are indeed those that are intended.

There was already a process of de-globalization in place before the crisis hit. We have seen this in the trade wars of recent years and in the narrative of politics in recent years, e.g., in the US and the UK. Either intentionally or unintentionally, this seems set to accelerate, particularly with regard to the open global supply chain model of recent decades. Indeed, the whole model of globally outsourced labor seems likely to have passed its zenith. Yes, there is the narrative that explains that a globalized world increases the size of the overall pie, but after a decade of stagnation of median incomes for many in developed economies and now with huge unemployment levels and large hits to national wealth, it would seem to be a very hard sell for politicians to stand on a podium espousing the benefits of globalized labor markets. Maybe someone can emerge to do it, but the odds seem stacked the other way. We think this leads to a cultural questioning about what the point is of publicly listed equities. We pose this question in the "What Is the Point of the Stock Market (in a Capital-Light World)?" chapter in this *Blackbook*.

But what now? Already, over the pandemic there was discussion about whether engaging in buybacks and distributing dividends is socially acceptable. Some companies stopped such activity out of economic necessity, but others did so because of non-economic pressure, either political or social, placed on them. The shock of the current recession will

---

<sup>13</sup> Berardi (2019)

likely lead to more companies having to raise capital again and buybacks will likely be muted for a long time. But can this lead to a more profound rethinking of the role of public equity markets? Maybe there will be a realization that governance structures were wrong. We don't mean in the (frankly wet) way that ESG metrics often screen for governance, but in a fundamental way, by which we mean the cultural norms that shaped approaches to governance structures *in aggregate*. Was it sensible, in hindsight, that US corporations could go on a 10-year frenzy of issuing low-grade debt to buy back their stock? For any individual company that made sense — and especially for management teams whose KPIs were all set on absurdly short time horizons of three years or less. But the result was a record decrease in the quality of outstanding debt and a massive de-equitization, which leaves the system overall much less able to absorb shocks.

It doesn't require a social or moral stance to form a view that this was not ideal. A huge proportion of capital invested in equity markets is done so for retirement or other long-term savings goals. The time horizon of such investments should definitionally be long term. In that context, setting the horizons of Management KPIs at three years and also the average time horizon for investment in active funds at about three years is absurd. It comes down to age-old behavioral frictions. There is the agency problem of working out how to trust a manager to invest one's capital (be that the manager of a fund or the manager of a corporate) vs. the need to meet a long-term liability. But that is better answered by more accurate metrics to unpick skill vs. luck rather than by shortening horizons.

Another artefact of the cultural norms determining aggregate governance of the corporate sector is the extraordinary divergence between manager pay and average pay of the last 30 years. It was perhaps easy for people to convince themselves that the pay was worth it when stock prices went up so much and people were taught that shareholder outcome was the only metric of value. Well, we would suggest a lot of that increase in share prices could have been the result of macroeconomic forces way beyond the control of management, such as the decline in macroeconomic volatility and falls in discount rates. The confluence of greater attention to governance needs that are optimal for longer-term retirement savings plus a social storm about inequality may change both the accepted structures of the level of management pay and extend the time horizon over which they are assessed.

### Conclusions

The pandemic seems likely to cause a break with some aspects of our recent past. In a narrow investment sense, the break appears in the likelihood that the policy response to the pandemic eventually ends up being inflationary (even beyond the reopening trade) and also shifts the correlation of stock and bond returns from negative to positive, hence increasing the risk in nearly all retirement portfolios.<sup>14</sup> In a more profound sense, the influence of the pandemic will likely be felt in the hiatus of the rhythm of our 24/7 culture and, with it, a realization of the importance of intimacy and introspection. Thus, a reassessment of goals, including those of investing, seems plausible.

On the other hand, the pandemic, despite changing so many things, may accelerate forces that were already in place over the last decade. Trends that could well be accelerated by

---

<sup>14</sup> [Portfolio Strategy: Tilting the balance from shareholders to governments? The strategic outlook post Covid-19](#)

the pandemic are the outperformance of mega cap stocks relative to the average stock,<sup>15</sup> rotation from active to passive management within equity portfolios, and the expansion of duration and, hence, interest rate risk in fixed income portfolios. On a more macroeconomic scale, trends that were already in place but look set to continue are the growth of government debt, the level of wealth inequality, and the role of populist forces in the sphere of political economy.

This sets the stage for the huge investment question for the post-pandemic age. How to save for retirement if inflation rises while returns from fixed income are lower, duration risk in multi asset portfolios is greater, and equities and bonds are no longer diversified? What does the build-up of public sector debt mean for sovereign and currency risk and the fiscal space of future governments?

But it is in the interaction of the private sphere and the public sphere that the more profound questions possibly arise. If unemployment never again falls to the low levels of recent years and if inequality becomes a dominant social trend, what does this mean? This implies an ugly build-up of social pressures within the largest economies. Is some form of UBI needed to ameliorate these effects? The hiatus of rhythm and intimacy in lockdown could well change what is socially acceptable and politically possible, and bring about changes in the goals of investing. What should governance structures look like in a world that desperately needs to extend the horizon of investment? Does an unravelling of some aspects of the neoliberal age along with a process of de-globalization mean an end to, and even a reversal of, the long-term downward path of yields? Moreover, what is the status of theoretical statements about finance and investing and the attempt to frame investment as a scientific enterprise? The financial crisis of 12 years ago showed the fallacy of such a view; the pandemic may be its death knell.

---

<sup>15</sup> [Portfolio Strategy: Entrenching an odd market structure - what it means for market direction, factors and active managers](#)

BERNSTEIN

# THE EMPTINESS OF PRECISION

## OVERVIEW

This chapter considers the goals of investment research. Can there ever be said to be progress in such an activity? We explore the ways in which changes in the environment for returns and endless commoditization of strategies change the aims of investment. An indexing Library of Babel is, at the same time, changing our relationship with the index. The result suggests a downgrading in the obsession with forecasting quarterly returns, or at least leaving it to the machines to do on our behalf, but at the same time hints at types of narratives that become important and, thus, may form a goal for research.

## WHAT ARE THE GOALS OF INVESTMENT RESEARCH?

Investment research, at its best, hopefully reflects the fascination of financial markets. In the same way that Claudio Magris once described the sea, we think for the market "its seduction lies in its infinite repetition and regeneration."<sup>16</sup> But the cause of that fascination also lays bare the problem at the heart of studying markets. Does investment research build on what went before, like science? In the famous phrase, does investment research "build on the shoulders of giants?". It doesn't seem as if it does. There don't seem to be any "giants," or at least if they are, they only stand for a short time before becoming irrelevant. Put another way, it would seem hard to claim that a given piece of research today can add more value (in the sense of giving rise to a larger direct benefit in the form of greater returns) than one 10 or 40 years ago. Having said that, this chapter is an attempt to lay out ways of studying the market that maintain their relevance.

Even Benjamin Graham, that doyen of fundamental investment research, wavered in his view later in life. When asked in a 1976 interview about the pros and cons of fundamental investing vs. a more simple passive approach, he replied:

*I am no longer an advocate of elaborate techniques of security analysis in order to find superior value opportunities. This was a rewarding activity, say, 40 years ago, when our textbook "Graham and Dodd" was first published; but the situation has changed a great deal since then. In the old days, any well-trained security analyst could do a good professional job of selecting undervalued issues through detailed studies; but in the light of the enormous amount of research now being carried on, I doubt whether in most cases such extensive efforts will generate sufficiently superior selections to justify their cost. To that very limited extent, I'm on the side of the "efficient market" school of thought now generally accepted by the professors.<sup>17</sup>*

If we are to believe this, then the effort of detailed study of individual securities might have been worth it in the 1930s, but by the 1970s, not so much. And that was the 1970s! To what extent can we say there has been a steady advance in the studying of markets? Over a dinner party in Marylebone in December 1817, John Keats accused Isaac Newton of

<sup>16</sup> Magris (1999)

<sup>17</sup> Graham (1976)

removing poetry from nature. "[He] has destroyed all the poetry of the rainbow by reducing it to the prismatic colors."<sup>18</sup> Personally, we would humbly disagree with the eminent poet on this point, but the essence here is that there is no risk of everything being intellectually reduced in this way in finance.

Part of the problem is that financial systems are human systems, and so have a self-referential nature that leads to radical uncertainty. Why would we even expect that theoretical progress could be made in such a system? Bookstaber eloquently laid this out as one of his four key problems with economics.<sup>19</sup> In his view, these are: (1) The presence of emergent phenomena, i.e., the tendency for characteristics to emerge at the macro level in financial systems that are not present in the underlying components. (2) Non-ergodicity, i.e., we cannot assume the system will have the same properties averaged over all time, and essentially we cannot assume the properties of the system are constant in the long run. (3) Computational irreducibility, essentially asserting that modeling society is far more complex than the famous "3 body problem." (4) Radical uncertainty. Others have made this case too — in particular, Soros in his work on reflexivity in financial systems<sup>20</sup> and Lo in his work explaining why financial systems are not the same as systems that are studied in physics.<sup>21</sup> Lo's recent book makes the case that biology might be a better guide for studying markets than physics.<sup>22</sup>

A student of the market might throw their hands up in despair at this point. But actually, it just means that the nature of studying markets is different from science and, therefore, requires a different response. It is not our aim in this chapter to consider the basis for making theoretical statements in finance. We have discussed that before in [Global Quantitative Strategy: Can there be scientific method in finance?](#) We have a more prosaic point in mind — what does it mean for financial research as it is actually conducted in commercial, as opposed to academic, settings? In this context, the constraints of inquiry are different, given they are weighed by the prose of reality. Anyway, Montaigne — ever happier pondering how things actually are than eyeing some metaphysical scheme — warns us to philosophize only by accident.<sup>23</sup> The constantly changing nature of finance means there is a continual need for a narrative of the market, but the problem with this is that it leads to too much "storytelling" in the bad sense of the word, i.e., vague descriptive commentary not anchored by some means of assessing efficacy. Yes, investors need to understand what state they are in, or understand how the dynamics of the system are evolving, but that can also lead to vague justifications. So, at the same time as a need for narrative, we also simultaneously require a methodology for investing. There may be more hope for progress in some form there than either in grand theorizing about economics or in the development of specific investment techniques. We discuss this in more detail in the section of this *Blackbook* devoted to process in finance.

---

<sup>18</sup> Said over a dinner hosted by Haydon and attended by William Wordsworth, Charles Lamb, and others. See Penrose: *The Autobiography and Memoirs of Benjamin Robert Haydon 1786–1846 Compiled from his "Autobiography and Journals."*

<sup>19</sup> Bookstaber (2017)

<sup>20</sup> Soros (1998)

<sup>21</sup> Lo (2010)

<sup>22</sup> Lo (2017)

<sup>23</sup> See the claim by Sarah Bakewell in her wonderful biography of Montaigne, *How to Live — or — A life of Montaigne in One Question and Twenty Attempts at an Answer*, Bakewell (2010).

## THE EMPTINESS OF PRECISION

It seems to us that at least part of the problem is to make sure the goals of researching and forecasting are correct. In office buildings around the world, thousands of people scurry away analyzing financial market data. We worry a lot of apparent precision is misplaced in the studying of markets.

A good example is the prediction of quarterly earnings. This chapter is not intended to be a rant about them, but quarterly earnings do serve as a useful example for discussion. A huge amount of time and energy across the investment profession is devoted to the prediction of earnings for the next quarter, and an equally huge amount of energy is devoted to trading stocks around the gap between the prediction and the outcome of such numbers. We are not saying no one should do it, but we claim a lot of this activity is misplaced. It encompasses several aspects of what we think is a misallocation of resources on the wrong sort of precision.

First, diving in and devoting resources to predicting quarterly earnings beats and misses presumes the end-investor has, first of all, decided what the precise goals of investing are. This might sound like an odd thing to say, but we suspect the goals and benchmarks used are often confused. Often a manager is hired to outperform a specific index. Well, how precise is that assessment of that particular index being the right one? As we have pointed out before,<sup>24</sup> there are 3.2 million equity indices in the world and only 45,000 stocks. We suspect this superabundance of indices means that wittingly or not many investors are lost in a sea of benchmarks. So what? That is not necessarily a reason for not wanting to be precise in the forecasting of near-term earnings. Maybe, but we suspect the mechanism by which asset owners decide on benchmarks to follow (often via consultants) needs more precision and investment of time and resources to make sure it does indeed reflect their goals.

Second, an obsession with quarterly earnings implies a time horizon for investment that is much shorter than the stated horizon of many investors. Many buyers of funds say they want to be long term; yet, in reality, they go on churning funds on average every three years despite the wealth of evidence on how bad this is for them.<sup>25</sup>

In a strictly temporal sense, the long term is made up of a series of short terms, but at the same time strategies have different time horizons, and managers need to run strategies that operate on the time horizon at which they have skill. Thus, when it comes to investing, it is not at all obvious that we can mimic the long term synthetically by concatenating a series of shorter periods. Even aside from the trading cost implications of changing views more frequently, there is a variation in the alpha decay time of factors and strategies. This variation in decay time for a given strategy tends to be fairly consistent over time. The lesson we learn from this is that managers need to consider what is the real return-generating process they claim to follow and, as best they can, make their horizon fit that. Asset owners have more power here. Ultimately, they set the time horizon for the industry, or at least they should. In reality, however, the same career risks apply there and they face agency risk in hiring managers. Still they could, in theory, move the horizon for assessing managers

---

<sup>24</sup> See [Trust in Asset Management?](#).

<sup>25</sup> Morningstar estimates that the cost of poor fund timing alone costs buyers of funds 40bps a year; see [Trust in Asset Management?](#).

somewhat closer to a horizon that has a more meaningful relationship with the horizons they care about, which are longer.

Third, and probably most controversially, it is the short-term forecasting of quarterly earnings that is probably most susceptible to being disrupted by AI, specifically, machine learning. There is a huge debate raging over the role of AI in the investment process. We have written about this at length in [Global Quantitative Strategy: Setting practical rules of the road for machine learning in finance](#), so we won't revisit all the arguments here. AI can excel in situations where the characteristics of the system are constant, e.g., facial recognition. The jury is out (and will remain out for a long time) on how successful that can be in systems such as financial markets, where not only can the dynamics of the system utterly change from one regime to the next, but where they are also explicitly self-referential. Moreover, at a foundational level, there is a legitimate argument about whether AI can ever play a role in explanation as opposed to prediction. Nevertheless, if the goal is to predict next quarter's EPS, then the recent trend of data from the company in question, the performance of similar companies, and a wealth of higher frequency data that can be related back to the health of individual end-markets constitute a *prima facie* case that machine learning can be profitably brought to bear. If that is correct, the prediction of one-quarter-ahead earnings, as an exercise, is very much in the zone of tasks that could be attacked by AI. Indeed, there is already evidence in the work of Zach Lipton and John Alberg<sup>26</sup> that this can be done.

Companies encourage this focus by often incentivizing management on a series of very specific metrics tied to very specific financial metrics for the company. It strikes us that this may often be another case of misplaced precision. Setting goals based on precise definitions of earnings including line items A, B, and C but excluding X, Y, and Z seems to open a risk that, at the margin at least, accounting or financial engineering is used to achieve those goals, when really all the investor probably cares about is whether the company is going to outperform the market or sector, say five years forward. But we will leave the question of the ills of management incentives for another note.

This raises questions beyond quarterly earnings, however. What *kind* of research is valuable and what type of views should one take? Just because a piece of research makes a good forecast and "pays off," it does not mean that was necessarily a view that had high value. Some return streams are cheaper to access, some are more liquid, and their correlation with other positions that investors have will vary. All these will affect the value of the view and how much research is warranted. It has always been true that some research ideas lead to actions with more capacity or greater liquidity than others, which affects (or should affect) the value of the research. But new trends are coming to bear on this as well. As the price of smart beta strategies falls to zero, we argue there is very little value in an active manager devoting time to generating a return that is part of a generic factor trade. As we have said many times before in our research, active return streams have to be idiosyncratic. Moreover, some possible views may have high correlation with other strategies an investor is running and, thus, may lower their value. In addition, the overall level of correlation

---

<sup>26</sup> Alberg and Lipton (2017)

between stocks and the split of total risk in the market between systematic and non-systematic risk is dynamic and will, in turn, affect the value of individual views.

This might cast a harsh light on some types of research and the return streams that result from implementing such ideas. Blanqué tells us it is possible that "what the investment community called 'alpha' over the last 20 years or so was simply fake alpha — capturing risk premia on hidden fat tails."<sup>27</sup> Likewise, Harvey memorably showed that through the research activities of academics over the last 40 years, 314 separate factors have been discovered in equity markets.<sup>28</sup> The point of the exercise was to highlight how absurd the cottage industry of factor data mining has become. Having said that, capital flows into semi-passive manifestations of factors have not degraded the returns of such instruments.<sup>29</sup>

A pertinent question for stock research is: what types of views tend to result in idiosyncratic returns? Presumably, anything that takes the form of a genuinely distinct form of research for each stock as opposed to applying the same approach to each one is a start. But also the formation of a strategic industry-specific view may be less prone to short-term factorizing.

Maybe these two trends (for research on single stocks) of investors only paying for idiosyncratic ideas and the replacement of the generic part of predicting next quarter's earnings being done by AI do the industry a favor. If short-term and generic research ends up being "passivized" in the same way that generic factors masquerading as active management have been "passivized" by smart beta, then what is left may be the part that is more valuable. Or so one can hope.

## A JOURNEY IS ALWAYS A RETURN

---

A journey is always a return. We think active investing is going back to (at least something akin to) absolute returns (or at least real return outcomes) and a focus on the long-term growth potential of the business itself. There has been a long detour, lasting decades, through an extended attempt to benchmark returns. This was a logical response to the agency problem that arises whenever a manager is hired to run assets. How does one know that the manager is delivering value for money? Could those returns have been achieved more cheaply through a passive implementation of a strategy? Several problems have been exposed with this approach. First, the utility of benchmarks, as they are currently understood, has declined in inverse proportion to their number. With more than 3 million indices now available vs. 45,000 stocks, we are approaching what we term the "passive singularity," when it becomes apparent that there is actually no such thing as passive investing. Of course, where cheap and mechanical implementation is available, it should be used wherever possible. But we struggle to think of any other area of human endeavor where there are far more buckets with which to classify things than there are things to be classified. The artist Gianfranco Baruchello created vitrines within which he painstakingly created an apparently uncountable number of tiny partitions for the classification of objects. There is something mesmerizing, satisfying, and indeed, almost hypnotic about the

---

<sup>27</sup> Blanqué (2014) p9

<sup>28</sup> Harvey (2013)

<sup>29</sup> [Global Quantitative Strategy: Are factor premia disappearing?](#)

ranks of tiny partitions; but for anyone of a practical disposition, as their number increases it is harder to conceive of their utility.<sup>30</sup>

This ratio of indices to stocks cannot really represent an equilibrium state. Yes, the number of theoretically possible indices is given by the mathematics of combinatorics. So the number of possible ways of arranging  $n$  stocks is  $2^n$ . However, the maximum number of possible indices is even more than this, as there are a plethora of choices of weighting scheme, rebalance frequency, ESG overlays, etc. Given such a mathematical upper limit, this superabundance of indices is not going to go away; instead, it is our relationship with "the index" that needs to change.

Another way to come to the same conclusion is to ask what a passive investment would look like. The only truly passive investment is one that exactly matches a liability, a fully liability-driven investment (LDI). One stage short of that would be a passive instrument that held all possible assets. A true representation of that will always remain only a theoretical construct, unrealizable in practical terms. It would be the investment personification of Borges' Library of Babel,<sup>31</sup> that library which held books containing all possible permutations of letters and, hence, must have all books that have ever been written or will ever be written. The fund version of this holds every possible asset with a weight that represented its current "market value," with the list of investments and their relative weights having to continually adapt. More tangibly, in the format of an investment fund, maybe parts of this at least can be approximated if one confined one's investment to just listed equity and debt assets, certain private assets, and cash. It would be as if the three giants of index investing only offered their clients one fund that had everything in it. Even that would not truly be passive, however, as it would presumably not naturally track a liability. It requires an act of asset allocation to buy such a fund, and the nature of that act is necessarily active.

A whole generation of investors has, therefore, been brought up striving for benchmark-relative returns rather than outcomes. This could only ever have been a way station. Aside from the contradictions of this as benchmarks multiply, the prospect of a low-return future, which we think is likely,<sup>32</sup> makes us think investors will come to realize it is outcomes that matter more. This is something akin to a search for absolute returns, which was a more normal mode of investing prior to the explosion of benchmarking. One option here is indeed to target an absolute outcome, e.g., 5% return. However, we suggest that for many investors, especially if the horizon is long, then setting this as a real return or as a spread over inflation would make more sense.

This is not entirely a return to an older approach to investing. We are not proposing that modern portfolio theory be abandoned in the process. For example, the diversifying properties of portfolios and the role of portfolio construction are hugely important today in a way that was not recognized 50 years ago. Indeed, if we wanted to look for areas where there is cumulative improvement in the industry, a methodical approach to portfolio construction might be one of the few we can point to. No one can afford to ignore a

---

<sup>30</sup> *Il Palazzo Enciclopedico* (2013)

<sup>31</sup> Borges (1941)

<sup>32</sup> For a discussion of the likelihood of a lower return and higher correlation future, see [Global Quantitative Strategy: The Strategic Investment Outlook - Blame it on the Boogie](#).

covariance matrix when building their fund, though admittedly the actual covariance that goes into that at the asset class level, at least, might be changing in a way that we have not seen in a generation (the movement to a positive correlation between stocks and bonds, which we think will happen at some point in the coming years).

Having said that, some consequences of modern portfolio theory are likely to become less prevalent. The slavish following of optimizers would be one example. Another would be the consequences of having to give up any notion that there is such a thing as a risk-free asset.

However, the core of the "return" has more to do with the way fundamental stock-focused investors interact with companies. Several commercial trends are converging on this. First, there is ESG investing. We think a lot of current approaches based on screening companies into "good" and "bad" will be passivized. But we think one of the most interesting consequences will be if this encourages engagement with corporates and bringing about corporate change. That is ESG, but in a different mode. The other force that converges in the same direction is the enormous growth of private equity in recent years. It seems natural that active managers of public equity should compete, in part by buying private assets themselves but also in their engagement with companies they own.

Is the point of investment research to predict stuff or to explain it? Well, we could say ideally both, but that is likely too high a hurdle in nearly all cases. Prediction often requires precision, though as we have argued in this chapter, we need to be careful we are directing our predictive attempts at the right goal. Explanation does not necessarily have the same requirements at all. Cartwright goes as far as to argue that there is ultimately a tension between accurate description and explanation, which renders these two goals incompatible.<sup>33</sup> She points out that to use a law of nature to make a factually precise statement about the world requires the overlaying of other relevant laws and lists of special cases that might be relevant for such-and-such a case. In manipulating it in this way, the law loses its explanatory character.

This is not an argument to be imprecise for the sake of it. But, equally we worry that being steeped in precision obfuscates the true goals, be that for investing or the research that underpins it. The goals are changing in part because of the external forces of lower returns (but unchanged liabilities), but also the internal forces of the need for idiosyncratic returns. Other forces of change lie in our changing understanding of what passive means, and also of the likely commoditization of prediction of near-term generic quantities, such as next quarter's EPS. As we have suggested, at the stock level, there will be an increased demand for research that can lead to an idiosyncratic return. At the macroeconomic level, the role of asset allocation — both strategic and tactical — becomes more important. When we combine these changes with the self-referential and dynamic nature of finance, it suggests an interesting intellectual challenge of crafting a narrative to describe markets and also an organizational challenge in generating return streams to meet these goals.

---

<sup>33</sup> Cartwright (1980)

BERNSTEIN

# POST-CAPITALISM AND CHRONOPHOBIA

## OVERVIEW

The legacy of the pandemic raises questions about the role of capital and the nature of work. The likelihood of low returns on capital presents a challenge to corporates and investors alike. Meanwhile, we think there will be a persistent jump in unemployment that will lend credence to the demands for UBI. This capital vs. labor dynamic has been hotly debated since Marx, and both these elements are undergoing profound change for very different reasons.

The prospects of low returns and higher unemployment meet in the challenge of saving for pensions, and raise the question of whether society can still afford this model of retirement, especially where individuals bear the risk of saving for it.

If an interest rate is the price of time, what does it mean if rates are at, or below, zero? We would describe this aspect of the current state of the world as one of chronophobia. There is no price placed on the passage of time, and this reverses the view of time for savers and creditors.

For the owners of capital, the path down to zero or negative rates is a very happy one. However, the future prognosis is less pleasant once one arrives at that state. In equilibrium, if the return on capital tends toward the cost of capital, it implies a return on capital that is essentially zero. What does it even mean to be a capitalist in such a regime?

Meanwhile, persistent higher unemployment post Covid-19 and an increase in inequality will, we think, increase demands for UBI. The socialist demand for UBI sees it as a response to automation and the higher unemployment that results. By contrast, the emerging post-capitalist argument for UBI inverts this argument by starting with a rejection of the coercion to work and then demanding automation and UBI in tandem as a response.

One possible implication of these dynamics is that the return from labor/work could begin to exceed the return from capital, a reversal of the long-term norm, but a process that would counteract growing inequality.

The categorization of zero or negative interest rates as chronophobia is not an arcane implication of the role of interest rates as the way time enters financial models. It goes to the heart of long-term savings problems and questions of inter-generational fairness. It also forces attention on the appropriate time horizon for investment and corporate management. An implication is that the time horizon over which key performance indicators (KPIs) are set for management should be extended.

## DETAILS

This chapter seeks to blend a narrative from the prospect of low or negative real rates and the post-Covid-19 debate on the nature of work, inequality, and unemployment. The problem of making long-term savings decisions when real rates are negative and the long-term social and political pressures in the wake of the pandemic come together, raise profound questions about how to save for retirement. The path downward in real rates has driven up the price of financial assets, and at the same time raised questions about whether returns can be sustained in future. In parallel, there is the prospect of permanently higher unemployment as Covid-19 has accelerated job losses that would perhaps have occurred due to automation<sup>34</sup>, and has had a larger impact on lower-paying jobs. This is in addition to the legacy of the last decade, which saw an erosion of workers' rights by the emergence of the gig economy and a decline in unionization. Taken together, these two dynamics have created a record disconnect between the concept of value defined in the capitalist sense as the price of an asset vs. Marxist value theory. We think this disconnect has social and political ramifications that will bear directly on the financial sector.

What is an interest rate? We suggest it can be thought of as the price of time. So when rates fall to zero, financial markets no longer place a value or a cost on the passage of time. While the path to such an outcome was set long before Covid-19, the pandemic has rapidly accelerated our arrival at such a state. If financial markets no longer put a price on time, or even place a negative price on it, then we can say we are living in a world typified by chronophobia. The term has been applied in an artistic setting to anxiety about time in contemporary society,<sup>35</sup> but we think the aversion to time's passage or the price of it can be applied to finance too. This has social implications in reversing the perspectives of time for savers and creditors. It also profoundly questions the core tenets of capitalism.

Investment praxis, on the one hand, adopts this language through an incessant obsession with the path of interest rates, and on the other hand rejects it as assumptions about the process of investment appear fundamentally unchanged. Claims that we have seen "late capitalism" and the urge to move to "post capitalism" are a common refrain from commentators on the left. Those employed in financial markets, it is fair to say, have probably largely dismissed this. However, a post-Covid-19 unemployment problem, the strong likelihood of a greater role of governments in economies, and a possible shift in the returns from capital vs. labor imply one at least needs to engage in the debate.

If the return on capital and the cost of capital are at zero and likely to stay there, while at the same time governments are increasingly involved in seeking to set the price of labor, at first through minimum wages and furlough schemes, but at some point probably with the adoption of UBI in at least one developed economy, where does this leave the role of investing, and indeed capitalism itself?

This chapter is about changes within capitalism due to the evolution of the return on capital and challenges from outside due to demands to alter the nature of work. These are two very different narratives, but they meet in the challenge of saving for retirement and also prompt deeper philosophical questions about investing.

---

<sup>34</sup> See [Portfolio Strategy: Wages, labour shortages and the outlook for inflation](#).

<sup>35</sup> La Biennale di Venezia, catalogue 2017 p50

### Chronophobia

The act of discounting future cash flows is probably the most basic tool of financial analysis. It is the foundation of the whole edifice of valuation. But what happens to a discounted cash flow model when the discount rate is  $r=0$  or  $r<0$ ? At that point, the whole attempt to arrive at the notion of "absolute value" seems to break down.

Indeed, we would argue that already, for very different reasons, the notion of absolute value was outmoded and under attack. If we unstitch the discount rate used to derive a present value for future cash flows on anything, it encompasses a real risk-free rate, inflation, and a series of risk premia (term premia, credit premia, asset class premia, etc.). However, in a world where government debt levels are reaching record levels and elements of Modern Monetary Theory (MMT) are being used as descriptions of the economy (although not as policy, as we discuss later), we do not think there is any such thing as a risk-free rate.

There is nothing radically new about this; it's just that collectively we had forgotten. We have shown in previous work ([Global Quantitative Strategy: The end of Pax Americana and what it means for the market](#)) that the existence of assets that deliver positive risk-free returns (if the return is not positive, how could it be considered risk free?) is not a permanent historical fact but is contingent on the political economic regime (essentially the long periods of *Pax Britannica* in the 19<sup>th</sup> and early 20<sup>th</sup> centuries and *Pax Americana* in the late 20<sup>th</sup>). It just happens that the whole structure of modern financial theory and practice has fixated on those periods. Therefore, all one is left with are the sets of risk premia without the underlying foundation of a risk-free rate. Valuation of financial assets is still possible, but only relative valuation, not absolute valuation. Thus, absence of a risk-free rate is not really new; what is new is prevailing discount rates being zero or negative.

In physics, Newtonian classical mechanics does not care whether the sign on the time variable is positive or negative. One can always replace  $t$  with  $-t$  in such a system and the laws still work equally well. It is effectively the same as playing a film backward. If the film is of idealized billiard balls ricocheting off each other, then no one could ever tell if the film was being played in reverse. However, films of colliding billiard balls are not terribly interesting. When a film of anything at a human scale is played in reverse, it becomes obvious pretty quickly that something is awry.

In thermodynamics, whether time has a positive or negative value clearly does matter. Heat flows from hot to cold, milk disperses in the coffee when poured, glass shards of a shattered window scatter on the ground, and never (in our observed world at least) do these processes run in the other direction, however indifferent the Newtonian mechanics that describe the movements of the individual constituent particles are to this temporal asymmetry. Simple financial models that specifically discount future cash flows act a bit like Newtonian mechanics. The model itself doesn't really care if the sign on the "price" of time is positive or negative; the model will still spit out an answer. But interpreting what that means at an economic and social level, and what an investor would do in response to that model requires a different model.

Any realistic economic model that seeks to explain at a *social* level how investors or any rational persons act clearly cares about whether the price of time is positive or negative. In physics terms, finance is more like thermodynamics than Newtonian mechanics (though

finance is a very poor comparison to either and does not have remotely the same status, nor will it ever).<sup>36</sup>

What does capitalism look like with zero or negative discount rates? For investors, the path downward of discount rates is dizzying, given the abundant returns that are possible from the price appreciation of financial assets. However, once the zero or negative rate is reached, investors who need to preserve, and ideally grow, purchasing power (and what other motivation can there ultimately be for investing?) face a problem. There can be little alternative for them but to increase risk.

What does this mean for corporates and entrepreneurs? In the real economy, an abundance of "free money" means the cost of starting a new marginal venture, which in normal times might have been questioned, is lowered. Likewise, there emerge zombie companies that only survive when the cost of capital is zero. In equilibrium, the return on capital in such an economy would tend lower.

Discount rates at this low level also lead to massive errors in attempts to calculate the fair value of assets or potential projects, even in relative terms. High discount rates usefully masked our embarrassing failure in making accurate long-term forecasts of cash flows for businesses. But when discount rates are low, the impact of such errors in calculating fair values explodes. This introduces problems for individuals of a capitalist disposition, whether they be investors or entrepreneurs.

Haskell and Westlake, in their work on the intangible economy,<sup>37</sup> suggest equity finance is better suited for intangible investments, loans tend to need to be secured against tangible assets, and equities can give workers who create intangible assets exposure to long-term growth benefits. This means firms may find it harder to raise capital via traditional routes of bank lending and debt issuance if seeking to buy intangible assets.<sup>38</sup> However, if a firm seeks to develop intangible assets organically, then it simply may not need as much upfront capital. Here, the main benefit of public equity capital, if it is needed at all, is to offer liquid long-term incentives for employees who create intangible assets.<sup>39</sup> If this is the case, then low discount rates may be less directly beneficial for entrepreneurs and companies now than was the case when most corporate investment was in tangible assets.

### Work

Keynes famously pondered whether technological advances would mean the working week would get shorter. In fact, there is another way to get to a similar end position from a very different perspective, and 100 years earlier. Moses Hess defined communism as a system in which work becomes equated identically with pleasure. This does not necessarily describe a world of leisure, but instead one where the coercive aspect of wage labor is removed.

There has long been speculation about the point at which automation or the organization of society might make the working week shorter. The working week for the average worker

---

<sup>36</sup> [Global Quantitative Strategy: Can there be scientific method in finance?](#)

<sup>37</sup> Haskell, J. and Westlake, S. (2018)

<sup>38</sup> See Caggese and Pérez-Orive (2016) on this point.

<sup>39</sup> See [Fund Management Strategy: What is the point of the stock market \(in a capital-light world\)?](#).

has indeed declined since the turn of the 20<sup>th</sup> century. But in recent decades, despite all our advances, the working week has not become any shorter; in fact, in many cases, it has become longer. The recent change in this trend has been associated with a strong bifurcation in wage levels and the view of work. The rights accorded to many workers have declined, e.g., through de-unionization and the emergence of the gig economy. At the same time, there has also been an enabling in work culture in some sectors of the economy, which has also contributed to the earnings of the top 1% to take off in a new way (in the past, wealth differences were more due to the unequal ownership of capital, not of wage earning power).

To the extent that automation may have taken away some work, it has pretty clearly not been in the way envisaged by Keynes or Moses Hess. Indeed, it has created a bigger problem of precarity and the risk for people of being locked out of the labor market, what Srnicek and Williams refer to as "the misery of not being exploited."<sup>40</sup>

This trend was firmly in place when the Covid-19 crisis accelerated it by bringing forward a wave of redundancies that would have happened over the next decade due to automation. The particular nature of the social distancing requirement has driven a shift to automation at a rate that would never have been imagined before. Our belief is we will never again see the low unemployment rates of 2019; well, not unless some future political consensus places unemployment above all other concerns. This means the question of the nature of work and the response to unemployment and inequality is going to become an urgent one once the immediate dust settles after the pandemic.

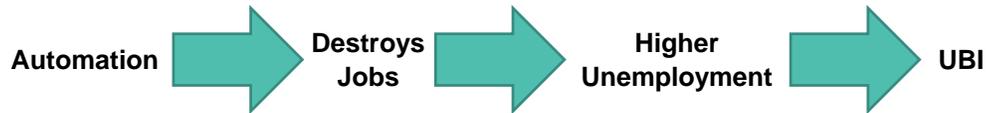
This seems likely to increase the possibility of a move toward a form of UBI being adopted in some major economies at some point in the next five to 10 years. If nothing else, such a move may be required to assuage the combined social pressures of unemployment, recession, and inequality.

The debate about UBI on the Left has been catalyzed by growing automation, but there are also other ways this could be realized. Indeed, as part of their critique of the contemporary Left, Srnicek and Williams urge a shift away from responding locally, practically, and reactively to societal problems, and instead call for a movement that is more systematic and theoretical. Probably a key example of this is to reject the logic whereby greater structural unemployment justifies UBI. Indeed, their framing of UBI within the context of post-capitalism upends this logic and suggests a different approach.

We write the socialist argument for UBI as shown in Exhibit 2.

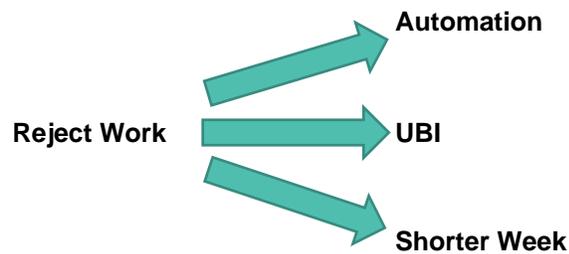
---

<sup>40</sup> Srnicek and Williams (2016)

EXHIBIT 2: **Socialist argument for UBI**

Source: Bernstein analysis

The post-capitalist justification is very different (see Exhibit 3).

EXHIBIT 3: **Post-capitalist argument for UBI**

Source: Bernstein analysis

Unlike older narratives of the Left that demand full employment, the post-capitalist route is to reject the coercion to work and thus to demand full *unemployment*. Automation then becomes the mechanism to allow that. For example, the *Accelerationist Manifesto* asserts that technological process is directed at the moment to a persistent cycle of upgrades of consumer electronics of questionable ultimate social utility, but which have huge implications for the growth factor in the equity market. Instead, this technological progress could be directed elsewhere:

*Capitalism has begun to constrain the productive forces of technology, or at least, direct them toward needlessly narrow ends. Patent wars and idea monopolization are contemporary phenomena that point to both capital's need to move beyond competition, and capital's increasingly retrograde approach to technology.*<sup>41</sup>

While the merits or otherwise of such a view will, no doubt, be debated for years, perhaps these two themes on the Left seem destined to meet. The economic response to the pandemic has made possible policies that were once heretical. Okay, we are very, very far from this post-capitalist narrative becoming the political reality in the US or in Europe. But Covid-19 makes all this relevant for several reasons. First, it speeds up the problem of

<sup>41</sup> Srnicek, N. and Williams, A. (2013): *Accelerationist Manifesto* available at <https://criticallegalthinking.com/2013/05/14/accelerate-manifesto-for-an-accelerationist-politics/>

automation, rapidly increasing unemployment, too rapid for people to be retrained and, thus, creating a need for public debate on how to respond. Second, it has already led to policy mechanisms such as furlough schemes being very quickly implemented, which look a lot like UBI in many ways — albeit supposedly temporary in nature. Third, lockdowns have changed the way that people work, leading to a questioning of what the nature of work is.

UBI is often tied with calls for MMT. While MMT seems very unlikely to be adopted anytime soon in a major economy as it requires a radically different fiscal policy structure, perhaps MMT doesn't have to be adopted as actual enacted policy to be influential.

When Copernicus published *De Revolutionibus*, Andreas Osiander added an introduction that said readers shouldn't take this heliocentrism too literally. It didn't have to be actually *true*; it could be thought of as just a way to *describe* the world. In a similar vein, Stephanie Kelton has been at pains to point out in her latest book<sup>42</sup> that MMT can be seen as a description and not necessarily a prescription (though she would favor the latter). In fact, she even uses the word "myth" to describe the system that had gone before — established economics seen as a Ptolemaic system, perhaps.

While full MMT seems unlikely to be adopted in the short term in a major economy, as we discussed recently in another note,<sup>43</sup> we think it likely to become more widely adopted as a *description* for how the economy and policy interact. Everyone has seen US\$3Tn be created in 2020 by the Fed without a meaningful impact on the dollar, and the genie is out of the bottle. The steps toward UBI in terms of (albeit, in theory, temporary) helicopter money, furlough schemes, and top ups to unemployment have all been enacted in at least one major economy over the course of the pandemic. That was in response to the assumed temporary spike in unemployment. While unemployment in 12 months' time may not be as high as it is today in the US (though it probably will be higher in Europe due to furlough schemes expiring), we think it will remain at an elevated level. Moreover, this is very much infused with the debate about inequality, given that more jobs were wiped out at the lower pay end of the spectrum. Therefore, we think the steps toward UBI will remain in place as part of the policy debate.

### **The Victorians invented childhood, the post-war era saw the invention of retirement**

Why is Inigo writing about this stuff? Well, the two strands in this chapter are the nature of investing when real rates are negative and the way attitudes to work may be permanently changed by the Covid-19 crisis. These two strands come together on the thorny issue of retirement.

The idea of retirement was invented in the mid-20<sup>th</sup> century, just as the idea of childhood was arguably invented by the Victorians.<sup>44</sup> It took the massive social upheaval of WWII to set up a broad-based retirement system and (well, in some countries at least!) universal healthcare as a pillar alongside that. It does not seem too outlandish to suggest Covid-19 has the potential to bring about social changes of the same order of magnitude as WWII.

---

<sup>42</sup> Kelton, S. (2020): *The Deficit Myth*, John Murray

<sup>43</sup> [Portfolio Strategy: Inflation, investing and the coming of MMT](#)

<sup>44</sup> Okay, this latter point can be argued — but it was under the Victorians that the idea of a minimum working age and maximum hours of work per week for children were introduced, along with broader access to education.

It is beyond the scope of this chapter to review why the pension promises made in the wake of the war were possible. The story is familiar enough. Demographics were favorable, the post-war rebuilding of the capital stock was a growth impetus, the establishment of a US-led post-war order — for some of the world at least — led to a favorable investment regime, and the political and social consensus had shifted. However, this generous model of pension promises was already becoming increasingly hard to sustain in recent decades, hence the great societal shift to devolve more of the financial risk of saving for retirement onto individuals and away from either corporates or governments. We have argued in recent research that post Covid-19 it seems no longer sustainable.<sup>45</sup> There are various options to deal with this issue.

If the returns on capital are likely to be low, and with a greater probability of higher inflation, then preserving purchasing power over long horizons becomes harder. In this context, it makes less sense (in narrow *financial* terms) to even try to save to fund pensions. If most asset markets (equities, credit, bonds, real estate, private equity, etc.) are at record valuations and inflation is going up, then the combination of believing in the late 20<sup>th</sup> century social norm of retirement and also asserting that funding this can be done by individuals over their working life becomes harder to sustain.

This kind of long-term retirement problem is at the heart of the issue of why the price of time being zero causes havoc with entrenched views about saving. Calling an interest rate the price of time is not merely an esoteric interpretation of what such a rate means; it has a real social consequence for the longest-horizon investment decisions. If one were starting from a blank slate (and again from a narrow financial perspective), in these circumstances it might be more intuitive not to bother to try to save for pensions and instead just fund them from future taxes. However, in practice, for most major advanced economies that seems politically impossible. The shift in demographics with increasing dependency ratios in most large economies puts a very high and increasing tax burden on a relatively smaller cohort of young workers. Moreover, this provokes questions of inter-generational fairness. The wealth profile of a society with younger cohorts being less well off (adjusted for age) means they are unlikely to accept paying higher taxes to fund better-off retirees. We discussed this recently in [Fund Management Strategy: Savings, velocity, inflation and pension investing](#). The other way out would be mass immigration to change the demographic profile, but in the current political climate that also seems unlikely, to say the least.

This leaves a few ways forward. If an attempt is to be made to continue to fund pensions (which is the most likely path), then the savings rate has to materially increase from pre-Covid-19 levels. Those lucky enough to still have jobs will have to divert more of their annual income to savings. Our models suggest that a downward shift in the return of pension assets from a nominal 7% per year to 4% per year implies an average worker would have to save an extra 6ppt p.a. of their salary.<sup>46</sup> Not only will higher unemployment depress consumption in the years after Covid-19, but those in employment will save more, thereby reducing consumption further. If one is a believer in the quantity theory of money, this

---

<sup>45</sup> See [Fund Management Strategy: Let's play Twister, let's play Risk](#) and [Pension funds cannot afford not to buy more stocks](#).

<sup>46</sup> It is actually worse than this, as this increase only accounts for the likely fall in returns. As diversification between bonds and equities worsens, more needs to be saved to avoid tail risk hardship outcomes ([The Next 10 Years of Investing](#)).

increased savings may also lower the velocity of money and, hence, require even more money printing.

Another piece of the puzzle is the need for the risk level of pension plans to rise.<sup>47</sup> In fact, what should really happen is that "risk" for a pension plan should be defined in terms of the risk of a hardship outcome for beneficiaries rather than whatever the trailing volatility happened to be for the asset portfolio. That could allow pension plans to lengthen the time horizon of investment, increase exposure to real assets such as equities, and take more long-short and factor positions, all of which are likely necessary to try to meet return targets.

In conjunction with this, another likely result is that everyone works longer. As a practical point, governments of European countries that tried to impose older retirement ages have faced massive resistance. To say the least, society seems ill prepared for the idea. Post Covid-19, with near-universal negative real rates, working ages need to increase dramatically. This need to work longer seems incompatible with the reaction against the nature of work in the contemporary thinking of the Left.

If this is the case, can there still be such a thing as retirement? Could it be that retirement was a late 20<sup>th</sup> century luxury? Maybe the massive health improvements over the last 120 years that led to such an extension in average human lifespans created the demand and ability for many people to have years of relative leisure (or at least freedom from "coercion to work" as a Marxist would have it). Was this possible due to a certain confluence of special and unusual demographic, financial, and social factors, but actually only a temporary phase? Such a conclusion would seem depressing, to say the least, and politically unimaginable today.

This is very much linked to the outlook for the future of work. Any shift of the retirement burden to taxpayers is akin to UBI-for-retirement. Meanwhile, the ability of individuals to save is linked to their ability to earn a lifetime income. If we join these dots, it leads us to ask the question: if there is UBI, then is there such a thing as a pension anyway? The need for a separate taxpayer-funded pension system would seem to evaporate and be subsumed within UBI payments.

So here is the conundrum:

- Earning sufficiently high returns over inflation will become harder. It will entail taking much more risk. This implies larger equity and real asset positions, and more leverage, e.g., long-short positions. And yes, we get the irony of asserting this while most financial asset classes are trading at all-time record high multiples.
- The economy is already very asset-price dependent, but this retirement problem makes it even harder for authorities to ever "let" asset prices meaningfully fall, though if they don't the rage against inequality will remain a consistent feature.

---

<sup>47</sup> [Fund Management Strategy: Savings, velocity, inflation and pension investing](#)

- Those fortunate enough to have well-paying jobs will have to save more each year and/or will need to work longer.
- But with high levels of inequality, and decades of reduced bargaining power of labor recently finding its expression in the gig economy, will working longer be a socially acceptable proposition?
- We have already seen helicopter money and furlough schemes adopted, which in a short span of time, have radically altered the acceptable fiscal tools available to governments. When combined with higher unemployment and inequality, we think it seems likely to at least open the possibility of a form of UBI in some developed economies over the next five years.
- Inequality of outcomes is going to be even more stark if pension outcomes are taken into account. Already, there is a massive skew in the distribution of retirement pots, which is even worse if they don't even share some growth in real terms.
- If individuals are not able to realistically save to fund a comfortable retirement, the risk for governments is that liability ends up on the public sector balance sheet. Although if some countries adopt some form of UBI, then is a separate taxpayer-funded pension system even needed?
- Governments will be desperate to keep retirement as a reality and also something that, as much as possible, stays off the government balance sheet. Thus, they will be incentivized to change the management and regulation of pension funds to allow them to take more risk and possibly even redefine what risk means.

#### **Where does this leave us?**

We have attempted to blend a narrative out of some very different aspects of the current state of the world — the prospect of very low returns persisting for a long time and what that does to capitalism from within, mixed with the changing pressures on the nature of work, and tackling questions of unemployment and inequality. Negative rates and the labor markets we have outlined create a record disconnect between capitalist and Marxist theories of what constitutes value, and these topics meet in the issue of retirement.

Real rates locked below zero for an extended time can be characterized as a state of chronophobia. Technically, this is because an interest rate is the way the notion of time enters financial models. But there are larger reasons why this seems to us to be an apt description, to do with the problems it presents for long-term savings in particular and questions of inter-generational fairness. Questions about the role of time in finance might sound like issues that only people who want to debate philosophical issues in finance might care about. But actually, we argue this lies at the heart of the interaction of social pressures, the political setting, the nature of investment, and the question of how to save for retirement.

Piketty<sup>48</sup> refers to the "central contradiction of capitalism" as the observation that the return on capital (i.e., wealth acquired in the past) tends to exceed  $g$ , the growth rate of the economy (and hence the growth rate at which labor income can generally be expected to grow by). This observation that  $r > g$  is one of the central forces that drives inequality. Piketty asserts it constitutes a contradiction in that were this process to continue unchecked, then the entrepreneur would eventually become a rentier, and productive innovation would be stifled.

The irony, however, is that the narratives we have laid out here — of persistent low returns on capital and more direct political concern and tools to steer the price of labor — could mean we face a near-term future where  $r > g$  no longer holds. This should act to reduce inequality. However, this process will be too slow to appease the momentum behind inequality reduction as a policy initiative. Also, it won't help reduce the other engine of inequality that has emerged under the aegis of "late capitalism," i.e., massive income inequality, which has been accelerated by Covid-19, given the gap between those who can work via Zoom and those who cannot.

All this has implications for the management of corporates. There has long been an odd misalignment between the very long horizons of the liability of pension investing and the short horizon over which KPIs are set for assessing corporate management teams. With real rates held low for longer, this discrepancy appears even more stark. An implication of low discount rates is that the time horizon for the management of corporates should be extended, given the implications of long-term low rates for the value of long-term projects. This will likely raise the bar on approving buybacks vs. other uses of cash.

This prompts questions as to the role of stewardship of corporates by their investors. We think stewardship becomes more important anyway as the savings rate increases post Covid-19, and as a greater proportion of those savings assets are allocated into equities. Greater savings imply lower consumption and hence a drag on overall growth. However, active stewardship of companies becomes a route to ensure that extra savings capital is put to use in a more active and growth-focused manner. This gives a macro role for ESG considerations.

---

<sup>48</sup> Piketty, T. (2014)

BERNSTEIN

# THE MAN WHO CREATED THE LAST INDEX

*This chapter is a work of fiction that addresses the role of indexation and passive management in investing today. It covers the origins of indexation and how the role an index is expected to perform has now changed. The rapid growth in the number of indices presents a problem for investors in that it becomes harder to articulate what is meant by passive investment. This leads to our discussion of the work of Borges and Balzac, and what it means for investing.*

He considered the plan of attack for the day. His task was clear, albeit perhaps apparently mundane to a casual observer. To create all possible stock market indices. Yes, there are all the major indices endlessly repeated on websites and newspapers and scrolling along the bottom of television screens. But those are just the indices for major markets. Maybe a financial daily would list up to a few hundred indices for markets and sectors. It had now been decided that there was a need — a demand, indeed — for something that went way beyond that. Indices were required for what the cheapest stocks had done, or the highest growth ones; indices where the weight of a company was not determined by its size, but by some other characteristics. And so it went on. In short, his task was to create far more indices than had been even thought of before.

He recognized many would regard such a task as tedious and utterly pointless. He didn't mind; there would always be non-believers who did not understand. Others would come to realize how important his task was. A few might even come to appreciate its beauty.

What currently occupied his time was creating all possible stock indices weighted toward a concept of "value." He had been at it for a month now. He had created lists of stocks on all the metrics that seemed sensible, or at least plausible. This started with the obvious ones, forming indices of stocks that were cheap on multiples of earnings or book value or cash flow. He then moved on to selecting stocks that had low multiples of every conceivable different definition of earnings. He reweighted stocks on the same metrics. He formed indices of stocks that had fallen the most in recent years. He produced indices that defined value as mispricing of stocks, and thus based on companies that were cheap, given their level of profitability or growth. He wondered about the need to group the definitions of value that relied on the balance sheet and those that relied on income, or should they all be kept separate? Yesterday, he had completed all the permutations of value when that was defined as things that are cheap compared to their history, as a counterpoint to value defined as things that are cheap compared to their peers. Today, he was going to embark on value taken from within sectors, from within industries, from within subindustries.

But how to arrange? How to go about the task? His hope each day was to find eloquent beauty in the task, and his daily fear was to descend into mindless enumeration of possibilities. He could start with a plan, a kind of grid with many dimensions, and work his way across it. But also the project must, in the end, have every index and therefore, logically,

every interpolation between every index. If the interpolations had to be there too, then maybe the plan did not matter? He realized he had leeway to decide what this meant. They had, after all, engaged him to undertake this task and he was expressly allowed to judge, to consider, to decide what was required. He was entrusted with the power to decide what the final set of indices would look like.

Some said the apparently useless indices should not be created, or if created but subsequently regarded as superfluous, they should be ruthlessly culled. He fought back against this idea. Who was to say which was a useful one and which was a useless one? Four decades ago, many of the ones in demand now were unimagined and no one could have conceived to what use they could be put to. An index that lowered volatility as its founding *raison d'être* would have been met with bafflement by a previous generation, had they been inclined to turn their attention to such a thought. Yet now, there was a whole family of such indices. This reminded him that he had not yet planned how he would make his way through all such indices that lowered volatility. Yes, he could weight by  $1/\text{volatility}$ , or he could screen by volatility and remove the most volatile members. He could make each stock contribute equal risk to the portfolio, and thus take covariances into account as well. He could optimize by volatility and, if so, he could perform that calculation alone in a multitude of ways. There was then the question of whether good corporate governance lowered volatility. If so, there were all the interpolations between indices based on measures of good governance and those based on volatility. And so it continued.

There was the great hope of discovering The Index, the ultimate one, the one that had always surpassed all others and always would. A great deal was said about the possibility of such an index. Logically it must exist, he thought, one of them must be it. Others said it could not exist, that the "best index" was always a contingent thing. Such nay-sayers claimed The Index could only be, at best, provisional, as the self-referential nature of markets would destroy it as soon as it was known. If indeed he could discover The Index, then with its discovery would come adulation from many quarters.

It had not always been thus. The idea of applying the word "index" to a thing that could be bought and sold is not that old. That is not to say an index has not always been tangible. The index itself as a list has a long heritage as something tangible long before someone applied it to the stock market. In *Troilus and Cressida*, the index is referred to as a guide when Nestor says:

*And in such indexes, although small pricks  
To their subsequent volumes, there is seen  
The baby figure of the giant mass*<sup>49</sup>

Our creator of indices liked the idea of the index as a guide. Indeed, the Latin usage of the word index referred to a discoverer, a catalog, or the index finger. In a sense, all these denote a thing that shows the way. Shows the way, yes that was apt, he thought, given the origins of the stock index lie firmly in financial journalism and most definitely not in financial theory. He considered the sense of meaning as very fitting to the zeitgeist. In a world of free information, free computing, and search boxes, the idea of an index as simply a list of words

---

<sup>49</sup> *Troilus and Cressida*, Act I, Shakespeare

on paper was outdated. But at the same time, endless computing power made the concept so much more powerful if it referred to that data-driven amalgam of experience that could show the way. Indeed, submitting to an all-encompassing data-led guide was exactly what people were increasingly willing to do, it seemed.

The index was that which showed us what has happened, or is happening. A convenient tool for concisely describing the activity in the market. Yet, the importance of his project was more than this. He was not restricted to describing what had happened; the goal of his task would necessarily lead to something that would influence the future. The index had become that which determines what investments are made. The index was now the channel by which capital flowed into the market. Thus, the index no longer represented an act of journalism — it had become the process of investment itself. But also, in the number of indices that he had to create, his task would no longer be a "small prick to [the] subsequent volume" as Shakespeare defined the index. With many more indices than stocks, the scale was inverted.

Was this inversion a process of temporal confusion? Was the index that directed investments and, thus, determined what will happen in future a different thing from the index that merely reported what has happened? Some said such a step was too farfetched and bound to fail in a circle of logical contradiction. He tended not to be moved by such sentiments, though he did recognize that his task was something the early founders of indexing would not have recognized.

Charles Dow arrived in Leadville, Colorado in 1879 on a train full of eminent bankers, investors, geologists, and Mr. Brayton Ives — the president of the New York Stock Exchange — amid a silver rush. The journey from New York took six days in a "hotel" car for most of the way, followed by stage coach. In Dow's regular letters for *The Providence Journal*, his outbound journey takes the form of a wonderful piece of descriptive journalism, but by the end of the short stay, his letters for publication in the *Journal* take an air decidedly more leaning toward financial journalism.<sup>50</sup> Apart from staring out of the windows and a brief breakfast at the Palmer House in Chicago, the playing of cards passed the time despite their initial misgivings that it might not be proper. A Mr. Dam kept launching into songs from *HMS Pinafore*, driving the party to despair, while Captain Crowell "has a passion for rising at unnaturally early hours, such as 7 AM, after which he promenades through the car and admonishes those who are enjoying their beauty sleep." We are told that dinner was served on the train at 5 o'clock while cigars were handed around "every hour or oftener." One of the party was a lawyer, traveling with the task of foreclosing on one of the railway companies that they were to pass over. At Abilene, cases of rifles were put on board as the Kansas Pacific Railroad was much subject to train robberies. Every few miles, they passed emigrant wagons toiling westward.

From Dow's letters for *The Providence Journal* when he got to Leadville, we learn the two great causes of death in the town were exposure and alcohol. Sleeping on the sidewalks after a night of gambling and drinking leads to pneumonia and death. In the evenings, gambling was the principal activity in the town. A great deal is said about the games of cards played and their rules. We are told the leading game in the West is the same as in the East,

---

<sup>50</sup> Letters from Leadville reproduced in Bishop, G. (1960)

namely, Faro. A little way from the Faro table, there is usually a table for "chuck-a-luck," where the dealers are "less aristocratic." Other games are Lansquinet, high ball poker, Short Faro ("for boys"), Rouge et Noir, and "the nut shell game" which, we learn, is played with three half walnut shells and a rubber ball the size of a pea. The trappings of civilization were arriving in fits and starts. Dow tells us that "if a man shoots another in cold blood, he is obliged to procure \$1,500 or \$2,000 bail, or he will be kept shut up." Dow opines "this is a great step. When a community gets to the place where murderers are arrested, it is approaching the time when murderers will be punished," though clearly that latter state of enlightened justice had yet to arrive at the time.

By the end of the sojourn in Leadville, Dow is increasingly inclined to furnish his readers with financial information that presumably has a bearing on the decisions of those in the East who may have felt the inclination to invest. One of the last letters from Leadville (which appeared in *The Providence Journal* on July 28, 1879) is titled "The extent of the carbonate field" and includes lists of mines and a consideration of the current thinking of eminent geologists. We are told in detail the process for assaying silver output and provided with some forecasts: "My opinion is that the silver production of Leadville for 1879 will not exceed \$10,000,000." While the last letter, published two days later, tells us that "A comparison of the stock list with that of a year ago shows a marked increase in the business in mining stocks." "Stock list". There it is. Not "index" or "average" — those terms were to come later. It is just a list, but it makes its appearance. The letter itself ends with a tabulation (the only table of numbers in the letters) of the "Eastern investment" in the mines of Leadville and a brief discussion of the dividends paid. The tabulation is important. It is, after all, the first step to forming an index as it is understood today, and indeed the stepping stone in the very meaning of the word index, allowing it to jump from index-as-a-list to index-as-a-measure-of-the-market.

Back from Leadville and editing his daily news sheets that eventually were transformed into *The Wall Street Journal*, Dow wanted a way to concisely describe the movement of the market. Thus, the Dow Jones Average appeared in the 1880s. He used the simple expedient of adding up the closing prices of the 12 companies he chose for the index and taking an average. This methodological choice may now cause much frustration, but is also revealing in a number of ways. First, it reflects the brute difficulty in creating anything else. Yes, a weighted average of returns for 12 stocks could be worked out on paper, but once the number grew, so did the complexity, not to mention the problem if such a calculation had to be quickly performed for different points in history to make a comparison.

But the "average" also signifies what the index was for. Dow was firm in his view that the compiling of a stock market average was merely a tool to aid the description of what was happening, not as a thing to invest in its own right. The stock market average in this sense is definitely in the camp of journalism and not in the camp of investing. This is why it is totally acceptable for the "index" to be an average of prices with none of the contemporary complications of weighting methodology. The first edition of *The Wall Street Journal* on July 8, 1889 included his average of "12 active stocks." Was this the best index to use though? In an editorial in *The Wall Street Journal* in September 1889, Dow noted "[the 12-stock average] has occasionally been attacked as not including stocks enough to fairly represent the market, and we often have inquiries as to what stocks are made the basis of the calculation. As a matter of fact, the 12 stocks taken represent the movement of the market

as well as a greater number. Twenty stocks reach in their averages the turning point on nearly or quite the same days as 12 stocks." Nevertheless, Dow added a 20-stock average and an average of 60 stocks.

The language had not fully adapted to its modern sense, however. In all the editorials by Charles Dow, he never once uses the word "index" to refer to the stock market. The word "index" is used solely to refer to the "commodity index" maintained by the newspaper *The Economist*. This usage is informative. Clearly, the word index existed; it even existed in a narrow financial context for tracking the price of something (in this case coal) in a way that was relevant to stocks. However, the stock market average and the index were not equated.

Indeed, the idea of buying the whole market seems utterly antithetical to his writings. His editorials for *The Wall Street Journal* are dense with methods that investors can use to go long or short individual companies. The whole market is never something that is meant to be bought. However, armed with a concise description of market movements in the form of his average, Dow tried to take this tool further by making it the centerpiece of a body of work that tried to be specific about general rules on how to go about the process of investing.

In an editorial of December 14, 1900, Dow asks whether there can be a scientific approach to investing. Dow correctly realized that, strictly speaking, a science of investing is not possible. But he did think that a greater use of methodology could be applied through the use of maxims. These maxims were based on looking at charts, observing swings in prices, and analyzing the history of dividend payments. There is no valuation in the modern sense, but this was still three decades before Benjamin Graham, and anyway modern valuation and accounting standards had to evolve in parallel. Without accepted accounting standards, a focus on the study of dividends would seem eminently sensible. To the modern reader, the feature of the maxims of "Dow Theory" that shocks is how many of them are still quoted frequently today.

But how could one actually perform the operations required to calculate an index? The Dow 12-stock average could be calculated on paper if need be, but he was also reporting on 20- and 60-stock averages. There were averages for Industrials overall and averages for Railroad companies. The calculations quickly become cumbersome, especially if one wants to calculate and compare indices at many points in time.

The genesis of one solution to this lay earlier in the 19<sup>th</sup> century on the French Iberian military campaigns under Marshal Sout, one of Napoleon's marshals. Charles-Xavier Thomas de Colmar, while on the staff of the eminent marshal, needed to perform a huge number of calculations for the correct angle at which to fire guns or the logistical problems of moving vast armies across Europe. This led him to consider the need for a mechanical solution to such operations. With conflict over, he was appointed General Manager of the Phoenix Insurance Company, where the need for a mechanical solution to large numbers of calculations again became more pressing.

He named his invention the Arithometer and was first granted a patent in 1820. Thomas worked on numerous improvements to it, but owing to the time he had to devote to running a large insurance business, the Arithometer was not widely accepted until the 1870s,

around the time of his death. However, at that time, it could claim to be the first multiplication machine made generally available for sale.<sup>51</sup>

It was, however, cumbersome to use. In order to perform a calculation, the operator first set numbers to be inputted on a series of sliders. The operator then turned a handle that mechanically transferred the numbers to a movable carriage which, in turn, was connected to dials that showed the results. In most versions, one had to keep track of the number of turns of the handle as the number of turns determined what the input number was multiplied by. Via the expedient of a reversing switch, the machine could be made to perform division as well. The Arithometer was usually constructed in a wooden box with a folding lid that could comfortably sit on a desk.<sup>52</sup> Larger presentation versions were also made with greater calculating ability, encased in elegant cabinet work, making them look similar to a fine upright piano or harpsichord and approximately of the same dimensions. Such versions were presented at international exhibitions such as the Great Exhibition of 1851 (it won the second prize for calculating machines, behind the Russian entry designed by Israel Abraham Staffel) and also, no doubt, featured in several gentlemen's "cabinet of curiosities."

Since the beginning, in 1820, Thomas envisaged that the primary commercial use of the invention would be by insurance companies and banks. Indeed, by 1877 the offices of Prudential in London had 24 Arithometers at work, and Henry Harben, the chairman of Prudential, noted at the time that "without them our work would have been impossible."<sup>53</sup>

The closest inheritor to the earliest indices are those for countries. Within the context of his current task, he regarded these as the most mundane and least interesting. Yet, he had to make sure all such indices were created. He had done this last month, and it was with a sense of quiet satisfaction that he could tick off that whole section of the project. It had been relatively easy. There was the obvious question of how many stocks needed to be included in each country. Then, which countries? At the moment, he was only concerned with assets that were listed. So, if a country did not have a public market, it would naturally be excluded. He realized that when he came back to consider private assets, some more countries might have to join the list.

There was then the question of how to group countries. The current fad was for the naming of regions with an endless enumeration of abbreviations, which he felt was ugly and so tried to avoid. Regions did actually have names, after all, and over the sweep of human history, regions had been thought of in so many different ways; he felt he did not need to stoop to ugly abbreviations.

The task of building indices for countries was not entirely without upset. He was worried by Denmark. It vexed him greatly. Actually, Israel too. At times, a single stock had dominated the weight of these indices. How dominated by one company could any index be allowed to be? If one stock was most of an index, would that even count as an index? If he stumbled across such an occurrence when creating a factor screened within a sector, he would

---

<sup>51</sup> Johnston, S. (1997)

<sup>52</sup> Russo (2001)

<sup>53</sup> Johnston (1997)

conclude he had gone too far and halt the process. But a country was a country, and that could not really be argued with.

He would face the same question more frequently when he got around to sector indices. He was putting this off, and he realized it. He thought of these as akin to country indices in offering little by way of intellectual challenges, but at the same time being a minefield of competing classifications. He had lost track of the number of times classifications had come and gone. To be true to his project, his response to this would be nothing but brazenly pragmatic. He would build all possible classifications. This would be the only sure way to capture the multiplication of taxonomies.

### **The index as a work of art**

He had finished his "value indices" the previous evening; today, he was starting a new chapter in the work. He was now creating indices not bound by any constraints of asset classes. For too long, he felt, people had assumed that indices had to be either for stocks, for bonds, or for other assets such as real estate or commodities. Why were there these constraints? He felt it could only be intellectual or institutional inertia that imposed such limits. He was going to show them how much more powerful his indices could be. This was the path to making everything passive, to being able to remove active investment decision-making, and was likely the path to The Index. He was convinced such a creation could be a thing of beauty as well.

Can the "index as a list" be a thing of beauty in its own right? The artist Richard Long revealed a list to be a work of art by annotating long walks either with found objects in the landscape that he passed, a series of interactions, or events of the walk. The walks themselves tend to take several days and nights, and are often across remote and rugged ground. In this way, the work of art is an index of the walk. A typical example would be a list of different time intervals encountered on a continuous walk of 24 hours on Dartmoor, titled *Dartmoor Time*. The viewer encounters the work as simply a list in large-format black text in an unadorned font:

1 1/2 HOURS OF EARLY MORNING MIST

THE SPLIT SECOND CHIRrup OF A SKYLARK

FORDING THE WEST DART RIVER IN TWO MINUTES

PASSING A PILE OF STONES PLACED SIXTEEN YEARS AGO

HOLDING A BUTTERFLY WITH A LIFESPAN OF ONE MONTH

CLIMBING OVER GRANITE 350 MILLION YEARS OLD ON GREAT MIS TOR

THINKING OF A FUTURE WALK

In another work called *Dustlines*, Long directly addresses the line traced by the walk. The viewer sees bold red text that proclaims:

KICKING UP A LINE OF DUST EACH DAY ALONG THE WALKING LINE

## A 7 DAY WALK ON THE EAST BANK OF THE RIO GRANDE

## EL CAMINO REAL NEW MEXICO

There is something mesmerizing about reading these descriptions of the landscape. One can quickly adopt the Long style in one's own interaction with the world each day, and in so doing radically alter an assessment of what the key elements of the landscape, in fact, are.

Another interpretation of this activity is that Long's lists are actually landscape paintings themselves rather than a list that describes a landscape. And why not? In that case, the index of stones picked up and put down, or the list of birds heard, or rivers crossed itself becomes the image of the landscape from which they were drawn. In so doing, it replaces the conventional scene of river in the foreground with mountains rising behind. There are different elements of the index that coexist within such "landscapes" in parallel. There is the line of the walk. The act of walking necessarily forms a line, an imaginary line, or at least a line that only exists in the memory of the space that the walker has inhabited. There is also a real line, one that is left in the temporary depression in the grass or of the displaced gravel, and yet another real line where a line of ink could describe the path across a map.

There is another artistic approach relevant to the act of indexing, and is particularly relevant for the task of creating all possible indices. A work by Gianfranco Barucello<sup>54</sup> consists of large vitrines installed in the gallery within which are created endless partitions. Unlike Long, here it is not the listing that arouses the aesthetic interest, but instead the act of endless partitioning. Whereas the work of Long could be seen as the artistic embodiment of the time series aspect of an index, the work of Barucello represents all the possibilities of classification and subdivision that the formation of an index requires. The viewer is first struck by the number of apparently uniform, neat partitions stretching across the field of view. They are constructed from card or wood and built on a minute scale. One is then drawn to the slight differences between them. Some may have minute representations of books or cylinders of printed paper or other found objects. Suddenly, the eye of the viewer is moving across the partitions in search of the differences between them. There is something deeply satisfying about the enumeration of endless partitions. Lyotard maintained that these works "formulate a provisional picture of the postmodern sublime."

What would The Index look like? Surely, that would be a thing of beauty and, hence, in a sense be an art work as well? Some said it would represent the optimal allocation to all possible assets. He was increasingly sure it should not and could not be confined to just the stock market. Thus, it would be the amalgam of all stocks, bonds, commodities, and other financial assets held with weights such that they represented human societies' needs for these different types of capital. By fulfilling this need, The Index at once performed a social good and also guaranteed its own success. Others doubted this could exist; was society so self-aware that it knew what its optimal allocation to all assets should be?

Others said it would be narrower in scope. In their view, it was not all possible assets that were the important thing to hold; after all, financial assets were always being created and destroyed. No, the more important thing was to take all possible risks. If The Index took all

---

<sup>54</sup> *La Grande Biblioteca, see Il Palazzo Enciclopedico* (2013)

possible risks then it must, logically, be paid all possible rewards for taking those risks. Moreover, if it took all possible risks, then it would naturally be diversified in a kind of holistic netting off. This type of index was different; it was not so much an index as an enumeration of all possible assets, but instead an enumeration of all possible strategies. It would represent not the passivization of asset ownership but the passivization of the act of investment itself.

Such an index should not be constrained to merely taking an investment in every asset; it would have to also be able to include long-short indices as subcomponents. Only an overly timid interpreter of his task would conclude that the list of all possible indices would be constrained to be long-only. The early creators of indices had surely missed this point?

---

## LISTS OF LISTS

As a child, he made lists. Lists of beetles found on a hot summer's day in the garden, lists of shells picked up at the beach. When older, this became lists of kings and queens, lists of emperors, lists of electors of the Holy Roman Empire. He kept his enumeration of lists private, on endless handwritten sheets of squared paper in a folder that grew evermore inadequate to its task of keeping his multiplying sheets of paper in order. It wasn't that he was ashamed of his lists per se, but for him, the set of lists was intensely personal at some level he found hard to explain, even as the list of items being enumerated themselves was evidently innocuous. When older, this evolved to lists of songs and lists of books, by which route he learned, to his great surprise, that some lists actually could be public and even play a social role. There were others who wanted to intensely argue the pros and cons of why a given entry might be on one of these lists.

He thought about his task as the making of indices. What that word has represented has changed over time. For most of the time, the word has meant a list of various forms. The primal "index as a list" has to be the *Index Librorum Prohibitorum*, that great list of censored works the Catholic Church forbade Catholics from reading as they were deemed inimical to the moral or theological health of believers. This was really a series of distinct indices undergoing perpetual revision, The Pauline Index, The Tridentine Index, etc. Although there are examples of very early versions of such an index, the need for such an index suddenly grew with the invention of printing in the 15<sup>th</sup> century and the resulting greater availability of books. This led to the index of prohibited books becoming a major cultural influence.

There is yet another great list that has the aim of "showing us the way," and that is the exhaustive-seeming list of questions that Thomas Aquinas poses and then answers in the *Summa Theologiae*, which he wrote from 1265 until his death in 1274 (he left the work unfinished). The work was intended to be the amalgam of all known learning. It is divided into a list of 614 questions, and the list of questions and subquestions could be thought of as a categorization of all thought, at least in terms of man's relation to God. Picking it up and opening a page, one is immediately struck by the rigorous structure so loved by scholastics. Each question is dealt with in a methodical way. For example, in the book pleasingly called "the first part of the second part," Aquinas poses the question "what is happiness?". This is then dealt with by a prologue followed by subarticles: Article 1: Whether happiness is something uncreated? Article 2: If it be something created, whether it is an operation? Article 3: Whether it is an operation of the sensitive, or only of the intellectual part? Article 4: If it be an operation of the intellectual part, whether it is an operation of the

intellect, or of the will? And so on. Within each article, he lists objections to the argument, mirroring the style of scholastic debate, and then we hear his opinion. The scope and structure of the great work could be a guide in this ultimate task of indexing. Posing questions that might span all possible knowledge and then methodically breaking them down and answering them is like the intellectual equivalent of the enumeration and implementation of all possible divisions of assets and strategies upon them.

Any discussion of lists inevitably leads to lists of lists. For example, the 1881 edition of the *Encyclopædia Britannica* has an entry on Indices that supplies a useful list of concordances, those wonderful alphabetical lists of instances of words within certain works that have now been rendered definitively obsolete by computers. There is something doubly redundant about a list of lists that no longer have any use, but each was the product of years of work. The entry on Indices tells us that the first concordance of the Bible was compiled by Hugo of St. Cher in 1247; the first English concordance of the New Testament was published in 1536, and to the whole Bible in 1550, compiled by John Marbeck. Other Biblical concordances are those of R. F. Hervey, 1579; C. Cotton, 1622 (frequently reprinted); J. Downname, 1632; R. Wickens, 1655; S. Newman, 1650, 3rd edition 1682; A. Cruden, 1737, and so on. It also furnishes us with lists of other concordances: to *The Iliad*, by G. L. Prendergast, 1875; to Shakespeare, by S. Ayscough, 1790, by F. Twiss 1805, and by Mrs. Cowden Clarke 1845. There are concordances listed to Milton's *Paradise Lost*, to Pope's works, to Tennyson, etc.<sup>55</sup>

Jack Lynch in his fascinating history of reference books<sup>56</sup> even has a list of lists of lists. We learn that the General Catalogue of the British Library lists 38,904 titles that contain the word dictionary, the Catalogue Général of the Bibliothèque Nationale de France contains 42,162 works with *dictionnaire* in their title, the Deutsche Nationalbibliothek in Leipzig features 41,892 titles with the word *Wörterbuch*, and so on.

Some lists are so captivatingly universal in their titles that they demand attention. The *Gazetteer or Newsman's Interpreter* of Lawrence Eachard (1692) described itself as being a "GEOGRAPHICAL INDEX of all the considerable cities, patriarchs, Bishopricks, Universities, Dukedoms, Earldoms, and such like; Imperial and Hance Towns, Ports, Forts, Castles &c in Europe : shewing in what kingdoms, provinces, and counties they are in, to what Prince they are now subject, upon or nigh what rivers, bays, seas, mountains &c. they stand, their distances (in English miles) from several other places of note, with their longitude and latitude according to the best and approved maps : of special use for the true understanding of all modern histories of Europe as well as the present affairs."

Such lists do not have to be historical. In fact, the explosion of some forms of lists recently is a nice parallel to the evolution of the role and prevalence of the index in investing. These are the lists of things to do, consume, watch, or experience. 100 films to watch before you die, 100 albums to listen to, 100 holidays to take, 100 pictures to see, 1,000 churches to admire. These are lists that try to point the way and, hence, are exactly indices in the original Latin sense of the word. One suspects that (however inadvertently) they are also attempts to passivize daily life outside investing. No need to make an active decision on the next song

---

<sup>55</sup> *Encyclopædia Britannica* (1881)

<sup>56</sup> Lynch, L. (2016)

to listen to or holiday to take or book to read: "I am working though all 100." Indeed, this is the enunciation of a language of passive culture.

THE INDEX AS NATURAL  
HISTORY

---

Dow may be credited with the creation of the first stock market average, but the genesis of what he was trying to achieve can be traced back further. If the index is not a thing to be bought but instead a tool for recounting a financial history, then there are earlier precedents. Henry Varnum Poor (as in "Standard and") published "History of the Railroads and Canals of the United States" in 1860. This is "history" in the sense of a vast enumeration of numerical facts. There are pages upon pages of tables printed across the whole page listing by year, earnings from freight, from passengers, and from mail, with columns for share capital and floating debt, and normally culminating in dividends paid. If one thinks of the usual meaning of the word "history," it may seem far removed from the task of indexing. However, reading the work, although it would be anachronistic to claim that is what Poor intended, the underlying sense is exactly that of following an index, albeit an index articulated in semi-prose form and presented as a book. To the modern reader, it may seem too prose-like to be an index and too dense with lists of numbers to be read. But a work of indexing it is, nonetheless.

The introduction to the chapter on each state is a string of paragraphs, one for each year, detailing how many miles of railway were constructed, with occasional observations on the success, or otherwise, of the enterprises in question. So a typical extract of the introduction for the chapter on Massachusetts reads:

*In 1840, 34.33 miles were opened; the Western Railroad, 15.01 miles; the Eastern, 2.82 miles, and that part of the Norwich and Worcester, 16.50 miles...*

*In 1841, The Western Railroad was extended to the western boundary of the state, 40.20 miles.*

*In 1842, only 6 miles were opened – The Charlestown Railroad having been extended this distance*

*In 1843, 26.17 miles were opened, Viz: the Berkshire, 21.14 miles and the Fitchburg, 5.03 miles... The Fitchburg Railroad has been a successful work, having paid dividends amounting annually to 5.8 per cent.*

*In 1844, 44.71 miles were opened... The Worcester Branch, designed to connect the railroads entering the city of Worcester, was opened, 0.55 miles...*

*In 1845, 98.33 miles were opened...<sup>57</sup>*

And so a financial index, of sorts, is born.

In this sense, the work is more like the sense of "history" in "natural history" rather than the more modern sense of the term that suggests an overarching narrative of events. It is as if

---

<sup>57</sup> Poor (1860)

Linnaeus or Cuvier had applied their patient classification and recording of the natural world to the modern railroad; indeed, the eminent French naturalist had died only 30 years before. This seems appropriate; after all, an index cannot provide a narrative. In a sense, that is the real difference between an active and a passive mode of investing — one has a narrative and the other does not.

Poor tells the reader in the introduction that he is not going to speculate on reasons for success or failure as to the prospects of the companies he studies. However, that does not prevent him from sometimes allowing himself to be forthright in brief phrases interjected between the endless tables of data. In the chapter on Vermont, for example, we learn that The Vermont Central railroad (chartered in 1843) has "proved to be one of the most disastrous enterprises ever taken in this country, having for the past six years failed to pay anything to its stockholders or bondholders." Poor tells us, for example, that the Vermont Central railroad in 1859 earned \$178,732 from carrying passengers and \$494,607 from carrying freight. However, maintenance costs were running at \$585,595 per year. It had defaulted on a rent to The Vermont and Canada railroad in 1854, and also in the same year stopped paying interest to the company's bond holders.

By contrast, there are success stories recounted in the same dry prose with two or three numerical facts per sentence. An example was the Boston and Lowell Railroad which, we are told, had returned dividends of 6.75% p.a. over the 20 years since its completion. We learn that the Horse Railroads within New York City are a remarkable example of adaptation to the needs of cities and that their construction has been "exercised of the entire impunity with which the grossest outrages on the public are perpetrated by the city of New York."

Poor slipped on ice in Boston in 1905 and died, but by the early 20<sup>th</sup> century, Standard Statistics started maintaining a weekly index (struck at the close of each Wednesday) of 223 stocks across different sectors of the market. It subsequently calculated a daily index, but this had to be limited to 90 because of the difficulties of calculating that for a larger number of companies daily. Indeed, the sheer mass of numbers prompts the question, how was the data collected, stored, and manipulated?

The Arithometer of Thomas de Colmar was useful, but was expensive and slow to operate. The comptometer of Felt and Tarrant represented a big improvement in ease of use. Its great step was that the machine was activated by depressing the keys as opposed to setting keys and then cranking a handle.

The operator enters numbers by pressing as many keys as required simultaneously, and this number is added or subtracted. It was the first commercially successful mechanical calculator operated in this way. Felt had started his initial prototype during the Thanksgiving holiday of 1884 using a Macaroni box, skewers, and rubber bands. He was awarded the patent in 1887. Early comptometers were constructed in wooden boxes, with the numbered keys arranged horizontally across the top. Later versions were a metal construction with the keys arranged across a slanting panel, giving them a look that would later become more familiar as the style of a cash register in shops. The comptometer was widely sold to banks and accounting departments of corporations. Photographs show scores of operators employed in accounting departments performing endless calculations with these new machines. The pictures show women (in photographs of the comptometer

in use in offices, they appear to be universally staffed by women) sitting at rows of individual wooden desks, each desk equipped with a comptometer and a neat sheaf of papers. The scene looks very much like an earlier version of what we would now call an open-plan office. Indeed, there is a familiarity in their desk-bound role alongside their peers that would be recognized by many office workers today.

---

THE UNKNOWN MASTERPIECE

What then was the nature of this task that he had been set? He was not a latter-day Dow or Poor, because although he was engaged in the task of making indices, the purpose of the task was utterly different. Why did Dow create his index? He wanted to report on what "the market" had done in a precise and concise way that could be described on a news sheet. With the index established, it could then lead him to use it for other purposes as he did in his set of editorials that came to be thought of as the Dow theory. But the index reported on the market — this is the use of "index" in the sense of a catalog of events. The creation of the index was an act of journalism. The direction of causality was clear.

Now, it was different. The direction of causation was being inverted. That inversion was implicit in the grand project. The mass of indices he was now creating were for things to buy, not reporting on prices that resulted from the activity of others. They spanned all possible investments. This was not a task of journalism, but instead a task of replacing all other forms of investment. In this aspect, his task was beguilingly picturesque. For this reason, he preferred the other sense of the word "index," as "showing the way." Yet, this inversion gave a certain ambiguity to his work. What was it, exactly, that he was doing? Reporting? No, clearly not that. Investing? Well not that either. In a sense, he was replacing the need for such an act with something that was all-encompassing.

He could just create all indices and present them to the world. But he felt that the impact of that might fall flat. He wanted to go beyond that, hence the hunt for The Index. The ultimate one that surpassed all others would have imitators. It was said to exist, but so far not to have been discovered. There was always a danger with this hunt that what, in fact, he would arrive at would be another index very alike The Index in every way but so formed that it would cease to work on the day after it was discovered, and another that would be discovered to be flawed only in coming years. In fact, given the need to find all interpolations between all indices, there must be incalculable numbers of ones that would be like the True Index but in fact be false in some way. Would he be able to recognize the one true ultimate index when he saw it? Indeed, would the discovery of it immediately break it?

He felt the answer had to be to make his indices more comprehensive. If they could incorporate more assets and more strategies on more assets, then they would become more robust. They would need to have private assets that are not listed on any exchange. They would not have prices that updated every day, but that did not matter. This could extend across the range of real assets. He would have to include all successful long-short strategies as well. Indeed, he would need an index for every "strategy" that used to be thought of as active investing.

He would then set to work to include all these indices too as elements of The Index. In that way, The Index would include every asset and every strategy that used those assets. But what of assets that had not yet been invented? If The Index was really the ultimate index,

then wouldn't it have to include those as well? The definitions of how it evolved and rebalanced would have to be sufficiently broad to allow future assets to be included too.

Borges tells the story of the Library of Babel.<sup>58</sup> This was the library that held all possible books. Specifically, all possible books of a given number of pages with a set number of symbols per line and lines per page that are achievable with the Latin alphabet and simple symbols of punctuation. This library necessarily contains all knowledge in all languages. It also contains among its works those that give a truthful account of all future events. However, it also contains volumes that contain nothing but apparent random assortments of letters, or perhaps these volumes could be elegant prose but written in a forgotten language. Some works are meaningless jumbles of letters, but with just one meaningful phrase on a single page. For librarians at work, the Library is their whole world. Many of them have tried to seek out those works that would tell what the future held. Yet, the confidence that this library held all truth could only be based on the fact that it held all possible untruths as well.

Hunting the Library of Babel for the volume that held the key to the future is a task that, in many ways, is like the hunt for The Index that answers all future needs of investment. However, the tasks differ in an important way. The books in the Library do not respond in any way to their discovery. Markets, unlike the physical manifestation of a book, are self-referential. Thus, The Index, by its nature, has to be comprehensive enough to include all possible strategies that have not been discovered yet. In this way, The Index is not equivalent to a volume in the Library of Babel; instead, it is equivalent to the entirety of the Library itself.

A flicker of worry assailed him. The comprehensive nature of the Library of Babel was what guaranteed that it contained the truth. But that very same comprehensive nature was what rendered the Library ultimately useless, a futile enumeration of truths and untruths. Was it possible that by creating all possible indices he was not replacing the act of investment but simply rephrasing the problem? If that was the case, maybe The Index was always unknowable and unreachable. Indeed, would the existence of all possible indices render the idea of a stock market index utterly useless, and so destroy its utility? Maybe his attempt to make indices that were truly comprehensive was, in fact, going to be the final act that destroyed the inventions of Poor and Dow?

And so one is led, with a certain inevitability, to Balzac who recounts a story about an artist, Frenhofer.<sup>59</sup> He was so skilled as to be able, in a mere few strokes of a brush, to transform another artist's work from an accomplished but lifeless form to something that left the viewer speechless with admiration. However, Frenhofer was much more circumspect in allowing artists to view his own work. The reason was that for years he had been working on his ultimate painting. This was a painting of a woman he had painted in a way that he insisted was so lifelike it had become his companion. But he worried that others would steal her from him if they beheld her. He would be jealous even of the gaze of others if they saw this work. So confident was he that it was so perfect that he declared it was not possible to

---

<sup>58</sup> Borges (1941)

<sup>59</sup> Balzac (1831)

determine where art began and life started. Indeed, he declared that the art had vanished; it was invisible, so that it was the form of a living girl that was in front of the viewer.

He was tricked into showing his masterwork to two artists. They were very impatient to see the work, and when they were finally allowed into the studio they approached the easel with eager curiosity. But were then left uneasy by what they saw. The work appeared to them as a "confused mass of color and multitude of fantastical lines that go to make a dead wall of paint." The only thing to show that this was, in fact, a painting of a woman was that in one corner there was the image of a bare foot emerging from the chaos of the rest of the canvas. Frenhofer had undoubted skill, but the realism of the work was something that only he could see. He had carried on adding improvement after improvement to make the work more comprehensive and had been utterly incapable of stopping. The result was merely a freakish mess of color, not a woman.

Our nameless creator of indices stopped. He looked with growing horror at his plan for creating the ultimate index. Was he destined to follow the fate of Balzac's Frenhofer? Was the only result of his work to be a crazed superimpositioned upon superimpositioned morass of financial series? He was not ready to believe such a thing. The path to this point had been one of logical incremental steps. None of them by themselves a step too far, after all, from Poor enumerating miles of railway track to Dow averaging stock prices to indices for all markets and then indices for all strategies. All these were logical steps, surely, along a path of progress.

Yet, Balzac's hero followed a similar path. His unquestioned skill produced what was probably at one stage a masterpiece. But there always seemed to be a way to improve it. An extra brush stroke to embellish an arm, another way to add depth, or enhance a shape. Each step on each of these extra paths may have been a step that seemed correct. Yet each one of these steps toward the masterpiece had, in fact, been a process that was incomprehensible to others and was a slow and gradual process of destruction. So bound up was he in the details that he was unable to step back and consider.

Was his life's task really destined to be pointless? No, he could not accept that. He would be different. All he had to do was to add one extra index...

BERNSTEIN

# THE FUTURE OF INVESTING AND THE HEGELIAN DIALECTIC

## OVERVIEW

This chapter discusses how a synthesis might be formed from active and passive investing. We argue that it requires a theoretical shift and a change in the framework of investing; it is not just a question of investment praxis. The emergence of a synthesis can, we think, play a role in the great socio-political debate of our age — the future of neoliberalism. This role is particularly evident in addressing the inequality of pension outcomes and the likely need for more people to work longer. If ESG investing is to leave any intellectual mark, we think it needs to respond to the claim of there being a "parthenogenesis of value" due to the dominance of markets over society. This leads to a macroeconomic interpretation of ESG and a reinterpretation of the role of economic and financial theory in society.

## DETAILS

If active management was the original "thesis" of investing and passive the antithesis, we discuss in this chapter what an appropriate synthesis might be. The original crisis of active investing was caused by charging too much for hugging or underperforming benchmarks. The crisis of passive investing will be investment outcomes that fail to meet liabilities, particularly the cost of retirement.

We do not think there is a bubble in passive investing per se, but there is a bubble in 60:40, or its latest incarnation of 60:40+"alternatives." A synthesis has to involve rejecting such heuristics that have outlived their usefulness.

The synthesis also requires a theoretical framework: we question the assumption of rational expectations and its spin-off in the Efficient Markets Hypothesis (EMH). It is not clear if anyone really believes in the EMH, but still it has, at the very least, a pedagogical role and theoretically underpins simple definitions of passive. We reject it because it is too narrow. If it is to have any use underpinning a new definition of passive, it has to span asset classes and public/private markets.

Over the last 20 years, we have socialized retirement risk while access to public equity investments has been democratized via ETFs. For a time this seemed like a mutually supporting combination. However, the utility of these democratized savings vehicles is declining. This immerses the process of investment in the key socio-political debate of our age.

We live in a period when there is an unprecedented questioning of the neoliberal victory of the last 30 years. A synthesis of investment cannot dodge this question. Indeed — from the narrow window of the world of investing at least — it should offer a way to help mitigate some of these issues and also, hopefully, make an intellectual contribution to the aims of investment for society.

If the current rage for "ESG" investing is to leave any intellectual mark, we think it needs to respond to the claim of there having been a "parthenogenesis of value" due to the dominance of markets over society and policies of recent decades, e.g., QE. Such a response requires a framework for abstracting beyond the implications of any single investment to consider the overall system.

The synthesis requires a rethinking of the point of investment, which can lead to a relinking of value with social structures. As such, it can be part of the debate on how to reform neoliberal economics. In investment praxis, this leads to paying for outcomes and idiosyncratic returns, not simply beating benchmarks. It puts an active approach to asset allocation at the center of the investment decision.

In this chapter, we suggest that the great forces of change at work in the investment industry can be understood within the context of the Hegelian dialectic. We suggest such a process is useful in analyzing what needs to happen next, both for the investment industry and for the theoretical framework investors use. At the same time, we live in an age that is seeing the neoliberal victory of recent decades come under unprecedented attack. We don't think the investment industry can dodge this debate. Indeed, we hope the intellectual underpinnings that drive change in the industry can explicitly be part of that debate — one of the most important socio-political arguments of our age. Economics and finance are, ultimately, always political. The idea that they can be morally value-neutral doesn't seem supportable anymore. Also, political reality always dominates economic models in determining investment outcomes. Thus, it is natural that the topic is analyzed from this wider viewpoint.

We think the dialectic is a valid approach to analyze the industry, as active and passive really are opposing modes of investment. Sometimes we hear people referring to a "paradigm" having changed in the move from active to passive investing in recent years. However, the language of the Kuhnian paradigm shift does not seem to be quite appropriate. Active and passive investing are in opposition to each other; so we argue that a synthesis is really required.

### **Thesis**

The initial thesis was active investment. The crisis that this original thesis faced has been charted in the US\$5Tn net flow from active to passive over the last decade. Although this rotation has been plain for all to see, in order to predict how the active-passive allocation evolves from here, it is important to understand why this occurred. We think there are two empirical/practical forces at work and one theoretical. All, however, need to be called into question.

Too many managers were charging active fees for running portfolios that delivered returns too close to (or less than) the benchmark. The failure of active management has been its (in aggregate) inability to beat the benchmark over multiple decades. We argue that the obsession with benchmarks as they are currently understood is a mistake, but they have been viewed as the easiest way to address the agency problem of deciding which funds are worth the fees.

The second practical question has nothing to do with what active managers did; it just happened to be the case that equities and bonds both beat inflation for 30 years and managed to do so while having a negative correlation between them; with *hindsight* there was less need to pay for active investing in such an environment.

There has also been a theoretical force at work in the form of an intellectual framework grounded in the assumption of rational expectations manifested in the form of the EMH. Following this reasoning, there is no point in paying for active investing as the market already incorporates all relevant information and, thus, is impossible to beat.

### **Antithesis**

Passive investing emerged as the antithesis to active, but the starting point of this chapter is the presumption that passive faces a crisis. We worry that the current approach to passive investing will lock in underperformance. Let's be clear: we are not going to make the facile suggestion that an investor should try replacing a given passive fund with a given active fund as it "might outperform." The last 30 years have taught us how unlikely that is and we see no reason why that should be any different now. Instead, we think the framework for investing will need to change.

The locking in of underperformance comes from the linking of passive strategies with investment heuristics such as 60:40, and the very different outlook for returns of asset classes and correlations between them now. In addition, there are other reasons that passive may face a crisis. Investors will likely make the discovery that, actually, there is no such thing as passive. If the real benchmark for measuring investment outcomes is inflation over long horizons, then many of the things we call passive are not really passive. Passive would either literally be buying everything (really everything) or else just buying a return stream that matched the required liability. We also note that there are 3.7 million equity indices. This means that there are 70-fold more stock market indices than there are stocks. We have made the point before that this leads to an indexing Library of Babel.

People ask us if we think there is a "bubble in passive investing." One can understand why people might answer this in the affirmative. With US\$5Tn having been reallocated from active to passive funds in the last decade, that might *sound* like a bubble. Moreover, the growth of passively managed assets has been monotonic with no link to any economic cycle, so the charts might *look* like a bubble. But, on balance, we think there is no bubble in passive *per se*. Much of the flow from active to passive has been investors selling funds that were closely tracking an index and simply choosing to buy the index directly instead. If the "active" fund in this case had a low tracking error, then at the company level the change in capital allocation in making the active-to-passive transition is likely only a minor one.

The bubble is not in passive but in the belief in the set of heuristics that underlie the large allocation to it — most notably in 60:40 and in its latest manifestation of 60:40+alts. This is possibly one of the largest bubbles in investment of all time, plain for everyone to see. Yet it is not considered a bubble, as it is seen as a default or even "passive" asset allocation decision. Because it is accepted as a default option, it is potentially especially dangerous.

The problems are deeper than just the heuristics that underlie current approaches to asset allocation, however. The theoretical underpinning of passive has been the rational

expectations theory and its offshoot, the EMH. It is unclear whether anyone actually believes in EMH in any of its forms, but despite that it still seems to inform allocation decisions and financial modeling.

Since the global financial crisis, the concept of rational expectations has been under sustained attack.<sup>60</sup> With regard to the more specific issue of the EMH, there have been attacks on it ever since it was proposed in its current form 50 years ago. However, much of the discussion on EMH has been in a narrow empirical track of whether securities are efficiently priced in a cross-sectional sense. The behavioral finance literature of the last 30 years has proudly pointed out the myriad ways that markets are inefficient and come up with a plethora of (ex post) rationalizations for this. However, we think this misses the big point.

If we approach the question "from the other end," so to speak, it seems extraordinarily unlikely that investment decisions in aggregate map onto a set of rational expectations of asset prices. The whole process of asset allocation, fund allocation, and decisions around time horizons for investment are riven with outdated heuristics, agency problems, and the desire to minimize career risk for all the middlemen along the way. An example of the inefficiency this creates is the time horizons of investment decisions. Both DC and DB pension assets usually seek to pay out a return stream with a horizon that is measured in decades. Yet, most individual fund allocation decisions have a three-year cycle.

So yes, markets could well be very efficient in a narrow sense of the relative price of a group of related securities (e.g., those in the same sector or within similar financial attributes) rapidly adjusting to new information. In fact, it seems likely that defined that way, markets are now more efficient. But that does not mean markets are efficient in a more general sense. Most of all, EMH gives no guarantee at all that an asset class in aggregate is priced efficiently (as we came to realize in 2008).

The emerging model for many asset owners is to passivize exposure to public markets and use private markets as the primary expression of active management. A problem is the allocation between the two is often set *ex ante* and the investments then undertaken by very different groups. This makes it very hard to ensure that assets are efficiently priced between these two parts of portfolios. If they were treated as one portfolio (as they should be), that would be a different matter.

The 60:40+alternatives heuristic is, we think, wrong on a number of levels. First, it assumes that there is such a thing as "alternatives" vs. "non-alternatives"; second, it assumes that asset class decisions are the correct primary building block of asset allocation; and third, it assumes that traditional fixed-income assets can still form the "stable income" backbone of a portfolio. These decisions have been hard-wired at the beginning of the investment process in an attempt to overcome the inevitable agency problem that always arises if one is going to pay someone to make investment decisions on one's behalf.

In practical terms, this builds up to the likelihood that investment outcomes fail to achieve their required level to meet retirement costs. We think the current set of investment

---

<sup>60</sup> Bookstaber (2017) and Skidelsky (2018) are good examples within the fields of finance and economics, respectively.

heuristics is going to lock in a shortfall. This will be the crisis that prompts the search for a synthesis. We also think it will prompt a rejection of the theoretical basis for passive management at the same time.

### **The attack on neoliberalism**

We think bringing together elements of active and passive modes of investing is not only critical for the industry but also has a social role. Part of that social role is practical, in meeting some real funding needs, but we also hope it can have an intellectual component. We think the emergence of a new approach to investing and capital allocation can influence broader contemporary debates.

We live in a period that is seeing an unprecedented questioning of the neoliberal victory of the last 30 years. This includes a questioning of the power of markets within society, questioning the growth of inequality, a debate on the role of work and whether the working week should be reduced, and on the power accorded to technocrats, e.g., over monetary policy and trade.

Why are we talking about this here? Because we think the process of coming up with a synthesis of modes of investment, different from traditional interpretations of active and passive, is — from the narrow window of investing at least — a possible way to help both find practical solutions to what could otherwise become a crisis for neoliberalism. We also hope it will provide a more philosophical contribution via a reconsideration of the aims of investment, the time horizon of investment decisions, and the appropriate methodology to determine capital allocation in society.

A case in point is the outlook for pension savings. The switch from defined benefit to defined contribution pensions in recent decades has socialized much of the risk of retirement. Ever since retirement was essentially invented as an idea in the middle decades of the 20th century, the cost of paying for it has mainly fallen on corporates or governments. It came to be thought of as a right and as a core part of the social contract in an era when corporates were still happy to take that risk. However, through policy changes and decisions taken by corporate management teams in recent years, at least in theory, a greater share of the risk in many countries falls on individuals. We say "in theory" because it only requires a single election for that risk to be dumped on to government balance sheets. If income and wealth inequality is the basis for the current attack on neoliberalism, we think that retirement inequality — or frankly even the ability to retire at all — may be the basis of the attack in future.

In parallel to this shift in risk over recent decades, the *social* impact of the active-to-passive rotation has been to democratize access to savings in a way that has never been seen before. For the first time, we are at a point when the cost of investing has, in principle, declined to nearly zero. Unfortunately, it has done so at the time when the usefulness of being able to buy passive long-only exposure to the public equity and bond markets may be at its lowest in 30 years. Yields have declined for decades, making sustained high returns less likely.

The current path is one in which not only is there under-saving for pensions (already the subject of much public hand wringing), but the problem is way worse because too many

people are assuming future returns on stock and bond investments which are in line with historical returns. However, we think there is a significant risk that the equity part of that disappoints, and the bond part seems almost mechanically destined to. Thus, the current path implies either a cut in retirement income for many or the need to work longer (both of which we suggest will be socially unacceptable) or a need to dump the responsibility back on governments, which presumably would have to issue more debt to fund this. These options all speak directly to some of the key debates in contemporary politics. The socio-political aspect of the socializing of retirement risk and further inequality seems set to get more, not less, intense.

A movement in contemporary literature across the Left is focused on the nature of work and the desire to reduce the working week and change the distribution of benefits of returns. However, this conflicts directly with the need to work longer, implied by insufficient saving and a lower-return environment. What happened to Keynes' speculation that the working week would eventually shrink to 15 hours?

Instead, we argue that as a society we currently face three mutually incompatible facts or beliefs:

- Workers should be able to retire at close to the currently accepted retirement age.
- Workers should take the bulk of responsibility of saving for their retirement.
- The main forms of mass-market saving are some version of the 60:40 asset class-based heuristic with cheap building blocks in the form of passive broad asset class indices.

We argue that these three statements can no longer hold at the same time. This is the investment community's role in the current political discourse.

The current set-up is heading for an ugly clash between these three beliefs. The debate on the Left is currently focused on how the median worker will need to put in more hours per week to maintain living standards in real terms, but this is nothing compared to the argument that will ensue when most workers find themselves having to work decades longer. There is a great deal said about how workers no longer want to retire at 65 and that with longer life expectancy it seems odd that the retirement age hasn't moved. This is a totally fair point, but it has not been explained to society at large, and shifting those expectations will likely take decades.

Another trend in the literature is a questioning of whether capitalism is still even efficiently allocating capital in a way that is consistent with maximizing growth. The suggestion is that capitalism may be beginning to constrain the productive forces of technology or direct them to needlessly narrow ends, i.e., toward more idle consumer gadgetry rather than reducing the need for more people to work. Likewise, capital allocation could be too narrowly focused on aggregate growth metrics regardless of climate impact or other factors. An example of this would be the *Accelerate Manifesto*,<sup>61</sup> which suggests that the combination of climate change and the social effects of austerity and automation have led

---

<sup>61</sup> Williams and Srnicek (2013)

to a secular crisis of capitalism. The authors call for a post-capitalistic system that improves the social benefits of technology for ends such as work-life balance and limiting climate change. Unlike traditional Marxist literature, this explicitly seeks to co-opt modern data analytics and economic modeling. In fact, the idea that modern data techniques can change the attractiveness of planned economies is beguiling and a more common theme in recent literature. As a case in point, the recent essay in *The Economist*, "Beware the Borg,"<sup>62</sup> ponders the question of whether all the Soviet Union's economy lacked was a computer big enough to optimize the planning, and with that maybe the social outcome would have been a happier one than in the West.

We ourselves have argued that one of the key selling points for active management is its ability to drive the allocation of capital. We fully recognize that does not need people to take active views on single securities — it can also be via ETFs and non-listed assets, but active views, nonetheless. But what if that capital allocation process is actually not functioning well? It would be easy to imagine that the growth-maximizing mechanism of capital allocation could lead to suboptimal decisions if, for example, climate impact or adverse implications for inequality were not properly priced in. Thus, to fix the capital allocation process, such an outcome needs to become an explicit part of the goals of investment (and perhaps they are not directly financial ones); it also impacts the investment time horizon. We turn to this next when we consider ESG.

Very interesting recent works on the more philosophical aspect of this are Berardi's books *Uprising* and *Breathing*.<sup>63</sup> He is concerned by what he calls the "defenestration of language," the separation of words from their referent which, he claims, underpins the neoliberal project to put markets at the heart of the organization of society. The question is: what is the basis on which value is assigned, be it to labor or assets? Is this social or market-based?

While neoliberalism may have been effective in increasing aggregate wealth, that might be of little utility if the language of value has become detached from a social connection. He suggests the basis of ethics has to be social, yet that is destroyed if social beings are brought down to the level of being competitors. This has led to an "ethical apocalypse."

The claim that "value" has been delinked from social structures seems plausible. Certainly, large sections of the voting population of the West seem to implicitly take that view. There is no reason, in principle, why an investment process could not take this into account. It prompts some deep questions about the point of an investment, and certainly requires a hard look at secondary impacts. One of Berardi's recurring themes is rhythm and how the rhythm in society is endangered. This argument also prompts a shift to much longer time horizons.

Contemporary Marxist literature suggests that the way to fix this is to break the market's stranglehold over society. We suggest that a synthesis of the framework of investing could possibly help find a middle path that mitigates the delinking of language from its referents. There is no reason why climate change and the precarity of labor cannot become part of

---

<sup>62</sup> *The Economist*, December 2019

<sup>63</sup> Berardi (2012), *The Uprising — on Poetry and Finance* and Berardi (2019), *Breathing — Chaos and Poetry*.

the theoretical framework of investing. Forcing time horizons of investment to be closer to ones set by the rhythms of society rather than the agency problems and career risk of intermediaries would also help.

Seen this way, we think Berardi is too dismissive of the possibilities of markets when they are tamed under some form of social structure. However, we think he might be right in claiming that making markets a basis for social structure has created a disequilibrium in society that needs to be resolved somehow. He calls for an act of language to resolve this. While that may be correct, we believe a fundamental rethinking of the mode and point of investing could also help.

### **Can ESG make an intellectual contribution?**

We sense that most people in finance will probably never read this kind of literature or, if they do, will dismiss it. But we think it is important for practical and theoretical reasons. For example, if the current rage for "ESG" investing is to leave any intellectual mark, we think it should respond to Berardi's claim of there having been a "parthenogenesis of value" caused by the neoliberal victory of recent decades. We think what this means in practical terms is that markets have been allowed to determine the price of things in an unprecedented way. This is so, even though we also know that such markets clearly were not efficiently pricing assets in the run up to the financial crisis and we know that they do a terrible job of pricing geopolitical, social, and climate risks, to name but a few. We think that Berardi's phrase also beautifully describes the pricing of financial assets in the world of QE. Expansion of central bank balance sheets is exactly parthenogenesis.

Without comprehensively answering this issue, ESG seems set to be merely a passing commercial fad that leaves no intellectual trace and would be at risk of being forgotten in the face of a 20% drop in the market.

In practice, what this means is a change in goals. At the micro level, this can be easy to define, e.g., pressuring a corporate to improve its environmental impact. That is all well and good, but it is not enough. It has to be applied across the whole system. In the same way that we all know that the total risk in a portfolio is not just the sum of the risk of the individual securities, the ESG impact of a portfolio is more than the sum of the ESG issues of its constituents. There are emergent properties in a portfolio of many assets. This is what we have referred to as "macro ESG."<sup>64</sup> This implies a need to drive change in individual companies based not on anything bad they are doing themselves, but because of a problem that results from corporates operating in a certain way *en masse*.

The obvious contemporary example would be buybacks. For an individual company, they can make sense and the owner of a portfolio might be happy that a given individual company has bought back its stock. But for a large pension fund (especially national ones), there is a very different interpretation. In aggregate, it has led to mass issuance of lower-grade debt and, hence, the overall quality of corporate debt is the worst in 20 years. It also contributes to the process of de-equitization and makes the overall system less stable. It might also be a sign that long-term investment opportunities are being spurned in exchange for meeting short-term management incentives. Finally, it is also open to a social

---

<sup>64</sup> [Fund Management Strategy: Management incentives, buybacks and the failure of ESG](#)

charge of further increasing inequality. A macro ESG policy would likely take a dim view of many buyback programs. This is probably at odds with the current "cult of the buyback" on Wall Street, and doesn't even usually feature as an ESG issue.

Another such issue would be precarity of labor. This is a topic that dominates discussion on the Left and, in particular, the attacks on neoliberalism. If one wants to be able to defend any part of liberal politics, it is probably necessary to answer this. This is best dealt with as an emergent phenomena that applies to a portfolio or a whole market rather than at the individual corporate level.

But that is not all. To stop there would still not really be giving any intellectual depth to ESG. So, we think it has to be taken further. As an example, one particularly tricky area to fix is the setting of time horizons. It is tricky as it goes to the heart of the agency and career risk problems that lie at the core of why it is so hard to change the asset/fund allocation process, and yet this is one of the most important problems to solve. Indeed, it is intimately bound up with the very concept of what it means to make an active investment decision. At the moment, there is an absurd mismatch between multi-decade time horizons attached to many liabilities or savings goals vs. two separate short horizons in terms of how assets are allocated. The first short horizon is the three-year average holding period of funds and the second is the three-year maximum horizon used for KPIs that determine what management of corporates are paid. Both these horizons are absurdly short, yet the gap is mainly due to agency risks. However, we know that it is not impossible to overcome, as the one thing private equity has got right is that it routinely involves decade-long investments. If the investment industry could make progress on this point, it could have genuine social implications.

There are parallels in emerging debates in economic and monetary policy-making. The consideration of more social concerns into financial decisions, financial structures, and even (eventually) in financial theory is probably the inevitable, delayed consequence of the financial crisis and the wave of populism that followed. In practical terms, we see this in the unwillingness across the political spectrum to go along with the neoliberal norms of recent decades and leave areas of policy to technocrats. This is most obvious in the areas of global trade policy and monetary policy. But we also see elements of this in the Trump administration, and in both sides of the political spectrum in the UK, in response to pronouncements from specialists in areas from climate science to economic policy.

Some of this is an ugly mistrust of "experts."<sup>65</sup> This is by no means limited to the field of finance. We have shown in previous reports that the use of the words "fact" and "evidence" have seen a precipitous decline in recent decades ([Global Quantitative Strategy: The rejection of facts - Twitter, the Enlightenment and the fallacy of operating earnings](#)). This decline has, in fact, been the largest decrease in the frequency of use of these words in the English language since the start of the Industrial Revolution.<sup>66</sup> At a deeper level, there also seems to be a depressing mistrust and antipathy to science, seen in the number of climate change doubters and the growth of the anti-vaccination movement. Ultimately, this

---

<sup>65</sup> See Nichols (2017).

<sup>66</sup> [Global Quantitative Strategy: The rejection of facts - Twitter, the Enlightenment and the fallacy of operating earnings](#)

represents a real challenge to the legacy of the Enlightenment. While we think it seems right to defend the role of experts, we have to be careful of what exactly we are defending.

Bringing the issue of science into the picture changes the debate. Economics and finance are not, and can never be, science. There can never be universal laws in economics, experiments are not possible in the same way in finance as in physics, and there are feedback mechanisms at work that make it unlike natural science. We wrote at length on why there cannot be a scientific method in finance in [Global Quantitative Strategy: Can there be scientific method in finance?](#) More importantly, economics — and by extension finance — can never ultimately be detached from politics, policy-making, and society. This gets to the core of how a synthesis of investment styles can take into account the attacks on neoliberal free markets.

Maybe too many "believers" somehow forgot that finance and economics are not sciences and rushed too far in making them the basis of social structures. As finance is not a science, there is a need to temper any faith that people have in the theoretical framework used. Moreover, the idea that investment decisions and the structure of financial theory can be morally value-neutral (which was common before the financial crisis) now seems laughable. This holds at the micro level of investment decisions in individual companies, and also at the most macro level.

So, in order to rebuild the trust in "experts" when it comes to the fields of finance and economics, there needs perhaps to be a little more humility and a recognition that the subject is not a purely scientific one. There is a two-way flow between financial decisions or models and the socio-political environment.

This works both ways. It means the societal impact of an investment decision cannot be neatly detached from the financial impact — it may be that the societal and financial impact may not be felt or experienced by the same people. This connection also flows the other way, from the socio-political domain to the financial one. Take the simple example that equities have looked expensive and household allocation to equity has been high for at least five years. This would usually have meant that one would have expected returns to have been low. Instead, we have had one of the strongest bull markets in history. More pressingly, this applies to looking forward into the future. A simple reading of valuations and equity allocations tells us to expect low returns. But forecasts formed on this basis have been so wrong for so long; how are they to be trusted? This was the basis of our chapter setting out two very different forecasts for the S&P500 index level 10 years hence: one target at 4000 and the other at 8000 (see the chapter "S&P 4000 or S&P 8000? Our Strategists Disagree" of [A New Paradigm for Investing Blackbook](#)); the bottom line is that policy and politics trump financial models based on mean-reversion any day. Financial models have to recognize that.

Delinking of value from social structures and remembering that finance and economics are not sciences suggest that society needs to be inserted into the framework used for investing and also the praxis of forming investment decisions. This mirrors contemporary calls to insert society into macroeconomics. For example, Skidelsky recently urged that the starting point for a macroeconomic framework has to be the social structures through which decision-making takes place. A specific proposition that follows is that "the trade-off

between inflation and unemployment...over several years, should be a matter of political judgement. It cannot be outsourced to technicians."<sup>67</sup>

It is within this framework that a synthesis of investing has to be formed.

### Synthesis

So, how can the investment industry help here? In practical terms, the answer would be: providing democratized return streams and a framework for capital allocation that meets the expanded goals of investment now demanded (climate, society, etc.). But hopefully, we can go deeper than that and make progress on a more theoretical level as well.

A synthesis of active and passive modes of investing involves a rejection of simple assumptions of rational expectations and, with it, the EMH. We are not talking about a failure of EMH in the traditional simple sense of securities not being priced in the cross-section within the equity market. This has been the bedrock of most tests of EMH. If anything, it seems likely that securities become more efficiently priced in that sense. Two innovations make this more likely. First is the plethora of indices that are now available for different markets, sectors, factors, baskets of stocks, with and without ESG overlays, etc. If investors want to express a position on any "cut" of the market, they never had it easier. We are often asked if the rise of passive makes the market less efficient and, hence, whether at some point active stock-level investors would enjoy a renaissance with super-normal profits. We think this unlikely. Empirically, there is no evidence that active stock-level investment has become easier, as the passive share of AUM has risen toward 50% in the US. Moreover, in Japan where the passive share of AUM stands at 73%, there is no evidence that active managers enjoy an advantage over their peers elsewhere. If there is some empirical threshold at which active stock selection becomes easier, it is at a higher level of passive penetration than that which we currently see. Moreover, to our knowledge, no one has established a theoretical level of passive penetration at which active stock selection becomes easier.

The other reason that seems likely to make the market more efficient is the explosion of the use of Big Data. While we suspect that from a commercial perspective it may not be as effective as some asset managers hope, it does seem likely to embed more information within the pricing of securities. If the market is just one big information processing machine as Hayek proposed, then this seems likely to be another level of information within its purview. The deployment of algorithms employing Big Data seems likely to make the active/passive divide a moving boundary as more strategies that used to be thought of as active become passive, followed by better algorithms.

However, these changes can at the moment only go so far. Take the use of Big Data as an example. Even where its use penetrates the furthest, i.e., with quant hedge funds and CTAs, it is not that transformational for the end-investor. After all, it may enhance a fund in which they invest but, at this stage at least, it seems unlikely that such a technique would or could be used to address bigger questions about their investment decisions such as overall asset

---

<sup>67</sup> Skidelsky p360

allocation, the process by which external managers are selected, optimal tolerance for risk and, above all, the time horizon of investment.

Overall, it seems likely that within an asset class such as equities, assets become much more efficiently priced as a result of the adoption of Big Data techniques. But the issue is the overall structure of the investment process. As we mentioned earlier in this chapter, this is beset with agency problems and layers of intermediaries, which in turn bring about suboptimal time horizons and dependence on incorrect heuristics. These are the harder problems to solve in investment.

These huge issues haven't had to be addressed as a matter of urgency as equity, bond, and credit markets have all gone up in recent decades, and equities and bonds have had negative correlations. In the past, it might have made sense to pigeonhole the investment decision and use benchmarks defined as broad market indices that could be bought cheaply and deliver positive returns. However, in a world in which the returns from broad asset class indices are not enough, these assumptions need to be addressed. In a sense, this could be good news for asset managers who are attuned to this change and less good news for asset owners who have a responsibility for delivering the end outcome.

In this chapter, we are more interested by what it means for the process of investing and the role of theory. What approach to investing is needed to deliver above-inflation returns at a given level of risk in a low-return world with less diversification on offer?

Sometimes, hearing people talk about the world of investing, we are struck by how they sound similar to those who proposed that we had reached "the end of physics" in the late 19<sup>th</sup> century. There was a school of thought then that all that remained was a "dotting of i's and crossing of t's," in the sense that what was needed was merely filling in a few equations here and there, but the metaphysical structure was all there with Newton's classical mechanics and Maxwell's equations. The equivalent today would be the assumption that many investors seem to be adopting, which is that investing in public equity markets should all go passive and that the main active decisions should be in private markets. We think that people will look back on this assumption as a historical error. It is not an error because allocations to active managers should have been slightly higher or because the asset allocation was out. We think it is an error because the investment "metaphysics" is wrong. We think the current assumption of the meaning of active and passive, and the distinction between asset classes and public-private, is unhelpful. All that matters is the aggregate net-of-fee outcome, with the "outcome" possibly including some not purely financial aspects too. Instead, a clear focus on the output has been obscured by an obsession over the nature of the inputs. While that is explainable because inputs are easier to manage and control, it does not mean it is sufficient. This is bound up by theoretical beliefs in constructs such as the EMH and heuristics such as 60:40 that are too blinkered. They may have been useful for an earlier age, but we think they now get in the way.

We also hear people say "60:40 is dead" in a trivial way — i.e., people claim that the mix is wrong and that it should really be 80:20 or some other ratio of equity-bond investment. We think this totally misses the point and is typical of overly narrow thinking on this topic. It is not as if some other allocation is better: the whole asset class-based approach to the selection is wrong. We set out our thoughts on this in the chapter "The Active Future of

Asset Allocation" of [A New Paradigm for Investing](#) *Blackbook*, so we won't repeat the argument here. But we suggest the alternative has to be dividing the allocation by the nature of the returns. We suggest the partitions are not equities, bonds, and "alternatives," but beta, IA, income, and cash/gold. The assumption is that betas are cheap and IA is hard but has higher (possibly performance-based) fees. Income replaces the fixed-income category; it includes some traditional fixed-income assets but also has significant allocations to real estate, infrastructure, and high-yielding liquid equities. Gold allocations are also higher than they were traditionally.

So how would a program to achieve a synthesis proceed? There are theoretical/philosophical aspects of a synthesis and also practical aspects.

The first step toward a synthesis is theoretical rather than practical, and has to include a redefinition of what we mean by active and passive investing. Passive investing can no longer be equated with buying a broad-market ETF and the buying of single securities equated with active. Instead, what passive needs to mean is passive *implementation*, where the goal is a "beta" and the fee is relatively low. The actual fee could range from zero in the case of simple public equity market exposure (a market or a factor) to a higher number for a passive strategy that was harder to implement, e.g., to private or illiquid assets.

Active would be any investment that delivers a return different from simple betas, i.e., idiosyncratic returns. Some of this can be at the single security level and probably a growing share of it takes place at a more macro level. The rule of thumb for allocation of investment assets would be to leave to passive implementation what should be passive, and then active returns are truly idiosyncratic active returns.

If any theory related to rational expectations or EMH is to be used, it needs to be abstract beyond an overly narrow focus within a given market. It has to reflect that an investment decision is usually ultimately relative to a non-capital market benchmark (i.e., inflation is a more likely benchmark). In that context, an investor will seem to make investments across asset classes and across public and private markets. These in turn have different agency problems, and while a synthesis should work to find a way to set common time horizons, realistically in the short term, the time horizons for different parts of the investment book will vary.

One of the big challenges for the investment industry is to come up with new forms of democratized savings products. Such products should emulate what passive index investing did in the last 20 years, but this time, applied across asset classes and across public and private assets. There are attempts at this already, with semi-passive vehicles giving exposure to a large part of aggregate hedge funds returns at a much lower price point; such products are starting for private equity too. But they are in their infancy and will grow over time. They will not come into their maturity until they are seen as being part of a truly cross-asset offering.

The emergence of the antithesis showed the importance of fees. In a lower nominal-return world, the pressure on fees will (rightly) never go away. However, we think that a synthesis has to focus on maximizing the net-of-fee outcome and, therefore, embed fee allocation with asset and fund allocation. This seems most likely to be felt first in so-called

"alternative" investments, which now account for over 40% of all fees paid for asset management services. Many of these allocations — especially private equity — are made with long time horizons, so it may take a while to realize that returns are disappointing. But the point when alternatives account for half the fee pool, we suspect, might be a wake-up call.

We write about how the framework for asset allocation needs to change in the chapter "The Active Future of Asset Allocation" of [A New Paradigm for Investing](#) *Blackbook*. We won't repeat that content here, but it implies giving primacy to a (redefined) alpha, beta, and income return stream where asset classes and "alternatives" do not have a set allocation. More outcome/cross-asset investing means retasking analysts and PMs to think across assets and across the public/private divide.

The growth in ESG investing might sound like it answers some of the socio-political points raised in this chapter, but we doubt it does. In fact, we are depressed by most of the financial activity we see taking place under an ESG banner. Maybe it is a start at least. First, if ESG is about screening companies into lists of being "good" or "bad," that will be done by passive investors far more effectively than active ones. There is no need to pay much of a fee for such activity. Even when such activity rightly looks beyond that and tries to change what companies do, there are problems with the current approach. We suspect that such activity will stumble into some big arguments about what exactly these non-financial goals will be. People should not be surprised if this debate quickly becomes political. In fact, we do not see that it can be anything but political. This is further magnified when the issues being addressed are society-wide ones, such as climate change, labor precarity, and the pros and cons of mass corporate buybacks.

If the investment industry responds well to this, it might be able to take part in the debate of how to ease the tensions over the role of neoliberalism and markets within society. We suggest it would be better to be part of that debate, showing how improvements can be made. If not, the investment industry will just find itself at the receiving end of a political diktat.

# WHAT IS THE POINT OF THE STOCK MARKET (IN A CAPITAL-LIGHT WORLD)?

## OVERVIEW

We argue the purpose of the public equity market has changed both for investors and for entrepreneurs. Less need for large upfront capital investment, shrinking equity markets, a higher proportion of intangible vs. tangible assets, and the growth of dual share class equities that deny control to many investors combine to alter what the market is *for*.

For portfolio managers, one of the key conclusions is liquidity becomes the attribute where investors and entrepreneurs have a shared interest; hence, the resilience of liquidity should be a prime concern. The views outlined here also support our thesis of a lower-return outlook for the equity market as access to early-stage corporate growth becomes harder.

We show the pace of new IPOs has decreased to its lowest proportion of the total number of listed companies since 1980. At the same time, the median age of firms seeking an IPO has risen. This suggests entrepreneurs are less in need of capital from an IPO, but it also means it is harder for public equity investors to access the early growth stage of companies. This has implications for return expectations.

The proportion of IPOs by US companies that are loss-making has reached 80%, a level only briefly seen once before in the tech bubble. Part of the reason for this could be the high proportion of intangible assets of new businesses and the accounting for intangibles, which requires that more of the investment cost is expensed rather than amortized.

We think the purpose of the market for various participants has now changed.

**For entrepreneurs**, we argue the purpose of a listing is more about liquidity, allowing them to motivate employees by awarding shares and enabling founders to exit should they wish. But we suspect a listing is less about capital raising *per se*.

**For investors**, liquidity is also one of the key attributes of public equity as is the sheer scale of the public equity market, at \$70Tn vs. \$5Tn for private equity. There are just not enough private assets, bridges, renewable power projects, or other infrastructure assets to absorb the required savings pool. Finally, another key attribute for investors is cheapness of access in a world of zero-fee mutual funds. Note that in our world view, the attractions of the public equity market are no longer the prospect of high returns from simply earning the equity risk premium, nor diversification between equity and bond markets.

**For policymakers**, the attraction of the public equity market is its offer of democratized access to savings and an equality of opportunities for investors that does not exist in private assets, infrastructure, real estate, etc.

If liquidity is the common attraction of a public listing for both entrepreneurs and investors, it is also a double-edged sword as in the presence of career risk and agency problems, it encourages short-termism. In this chapter, we discuss ways to encourage investors to apply a common time horizon to public and private investments.

---

## DETAILS

We feel we need to explain upfront why we would write a chapter on what is apparently such an absurd topic as the title suggests. However, we think a number of themes converge to make the question relevant. The preponderance of high-growth stocks that eschew a market listing or do so only late in their evolution, the capital-light nature of many new companies, and the significant switch by asset owners to make much of their active investment decisions in private markets all beg the question of what the stock market is for. We think the purpose of the market both for entrepreneurs and investors is changing.

For traditional asset managers (both passive and active), this change raises an existential question about their role. More practically, it has specific implications for their business strategy. For portfolio managers, one of the key conclusions is that liquidity becomes the attribute where investors and entrepreneurs have a shared interest; hence, the resilience of liquidity should be a prime concern. We showed recently<sup>68</sup> that while the liquidity of the equity market has generally improved in normal trading conditions, there are reasons to worry that that liquidity has become more fragile. The views outlined here also support our thesis of a lower-return outlook for the equity market due to the reduced opportunity to access relatively early growth stages of companies. The other issue pertinent to the business strategy of asset managers is the need to address the time horizon of investment decisions, which often ends up being adversely affected by the very liquidity which is the positive attribute of the market. This is magnified by the move by asset owners to significantly increase their exposure to illiquid assets in recent years. Ultimately, this chapter is part of a series of research pieces from us that suggest the future for investing is one where the alternative/non-alternative and public/private split investing is something that goes away, and in the process, the investment industry changes.

Given the growth in allocation to illiquid alternative investments and the prognosis for returns, we think the equity market has to be seen much more in conjunction with allocations to those other markets, and the return, diversification, and liquidity properties have to be tied more closely to them. Maybe, in the last 30 years, it became more normal for a broader range of investors to think of the equity market in isolation and for benchmarks to be very equity market-centric, but we think it makes less sense to have such a mindset now. The narrative for entrepreneurs had been consistent for a long time. Since the 1600s, when a third of ships sailing to the East Indies were lost, there has been a need for fractional ownership of risk capital for funding projects with high upfront capital needs. But does that model make sense anymore in a world where many of the highest-growth opportunities are via the development of intangible assets, where the main cost is often the price of motivating a relatively small number of employees?

---

<sup>68</sup> [Global Quantitative Strategy: Liquidity poses a strategic challenge to investors](#)

There is a series of interconnected challenges for proponents of public equity markets. Specifically:

- There is less need to fund large start-up capital requirements in many fast-growing knowledge companies.
- The stock of public equities is shrinking in developed markets, particularly the US, due to decreased issuance and increased buybacks over the last decade.
- Increasingly, high-growth companies don't let mainstream equity owners exert control, reserving it for the founders via dual shares structures.
- Active public equity investors are increasingly regarded as short term (and bizarrely, passive investors are often regarded as "long term"). The short-term charge might be fair enough in many cases, but how can this be resolved? Related to this, management incentives of public companies tend to be set over short horizons.
- If the majority of high-growth assets are now intangible rather than tangible, is the accounting treatment for public companies the right one? Unless they are bought in via an acquisition, much of the cost of developing these intangible assets has to be expensed as a short-term cost. This might contribute to the exceptionally high proportion of IPOs that are now from loss-making companies, and also appears as an odd mismatch with the payback period of many of these assets.
- Regulation: The disclosure requirements of a public listing are expensive.

We have written about how we are rapidly moving toward a world where most investment in public assets is being done passively, and soon the main expression of active investing will likely be in private assets ([Fund Management Strategy: Passive public markets vs active private markets?](#)). The result is that at the current rate, public equity markets are likely to continue to become a smaller share of the pool of financial assets. Maybe that is fine. There are other vehicles for investment and for raising capital after all, and those of us in the industry whose job it is to analyze or manage public equities can find other jobs to do. But we think the existence of a healthy functioning stock market is useful for the economy; it is also very useful for investors as it offers a very democratized access to investment vehicles; and it also likely performs a broader social function in holding management to account. This chapter explores the function of a stock market in today's world and tries to make the case that it does still perform a useful function, albeit an altered one. We would outline this as follows:

- Even though fast-growing companies may not need capital in the traditional sense of building fixed assets, they do need to pay (expensive) employees, and so public equity can be useful for that purpose. Yes, companies can award private stock to employees, but then there is no liquidity and is, hence, less attractive.
- Liquidity: A liquid public listing means investors can get out and employees can sell options they have been awarded, in a transparent way. However, this liquidity is double-edged if it fosters short termism, as we discuss later.

- Information/price discovery: A public market focuses price formation in one place. This in turn can be critical for accessing other forms of short-term/operational funding (e.g., loans) and for attracting employees.
- Although there are direct costs of listing, it can also lower the cost of capital. We won't discuss this point at length in this chapter, but recent literature on this point includes the paper by FCLTGlobal: *Public markets for the long term*.<sup>69</sup>
- Democratizing access: Okay, this is not a concern for any individual company, but it is a social good and, hence, a topic for policy makers and the more socially aware asset owners (e.g., enlightened public sector pension plans needed). This comes down to the cost of accessing much cheaper return streams via a combination of active and passive funds, allocating within public equity markets rather than for private assets. Thus, an interesting question arises: given current pension and savings arrangements that push more responsibility onto individuals, does a reduction in the size of the public equity market – and, hence, the amount of savings assets that can be stashed in it – contribute to savings inequality and constitute a social ill?
- Keeping assets in a private structure is fair enough, but a certain proportion of such assets needs a route for owners to exit; indeed, private equity often relies on that. Thus, there is an interdependence between private and public markets.
- There is also some literature on the benefits to the broader economy from the existence of a healthy public equity market. We will not cover this point in detail in this chapter, but notable examples are Caporale et al. (2004): *Stock market development and economic growth: the causal linkage*, *Journal of Economic Development*, Vol 29 No 1; Levine, R. (1998): *Stock markets, banks and economic growth*, *The American Economic Review*, Vol 88 No 3; and Wurgler, J. (1999): *Financial markets and the allocation of capital*, *Journal of Financial Economics* 58.

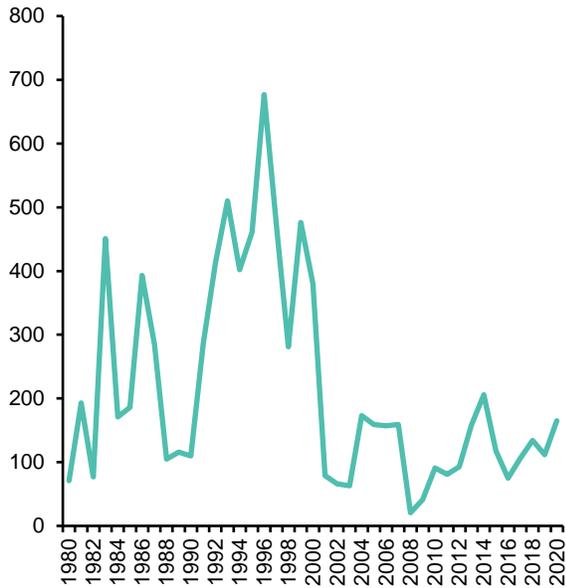
The stock of public equity in developed markets is shrinking. It might not feel like that, but that is just because the market index happens to have gone up. We can show<sup>70</sup> the number of listed firms is declining slightly, and also because of increased buybacks and decreased issuance, the quantity of listed equities (market cap divided by index price) is shrinking in the US, Europe, and Japan.

This is perhaps most stark if we look at the number of US IPOs. Over the last decade, there have been on average 112 IPOs per year, significantly down from on average 447 IPOs per year in the 1990s. Likewise, the number of IPOs per year now only accounts for a mere 0.17% of the number of listed companies, down from around 1.5% in the 1990s (see Exhibit 4 and Exhibit 5).

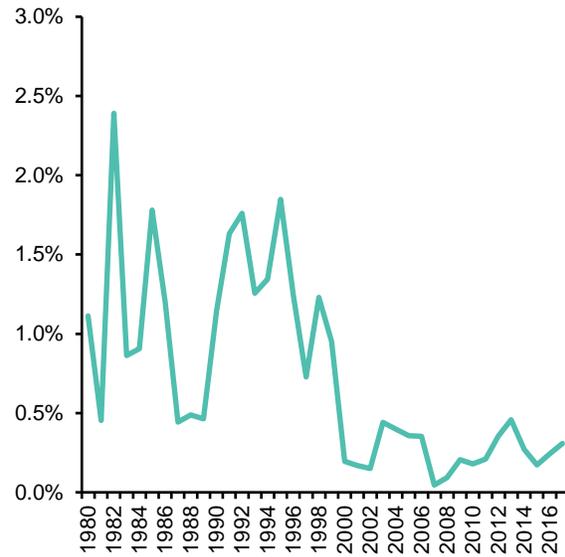
---

<sup>69</sup> [https://www.fcltglobal.org/docs/default-source/publications/public-markets-for-the-long-term.pdf?sfvrsn=267b218c\\_3](https://www.fcltglobal.org/docs/default-source/publications/public-markets-for-the-long-term.pdf?sfvrsn=267b218c_3)

<sup>70</sup> [Fund Management Strategy: Passive public markets vs active private markets?](#)

EXHIBIT 4: **Number of IPOs**

Source: Initial Public Offerings: Updated Statistics, Jay R. Ritter, Cordell Professor of Finance, University of Florida, June 2021 and Bernstein analysis

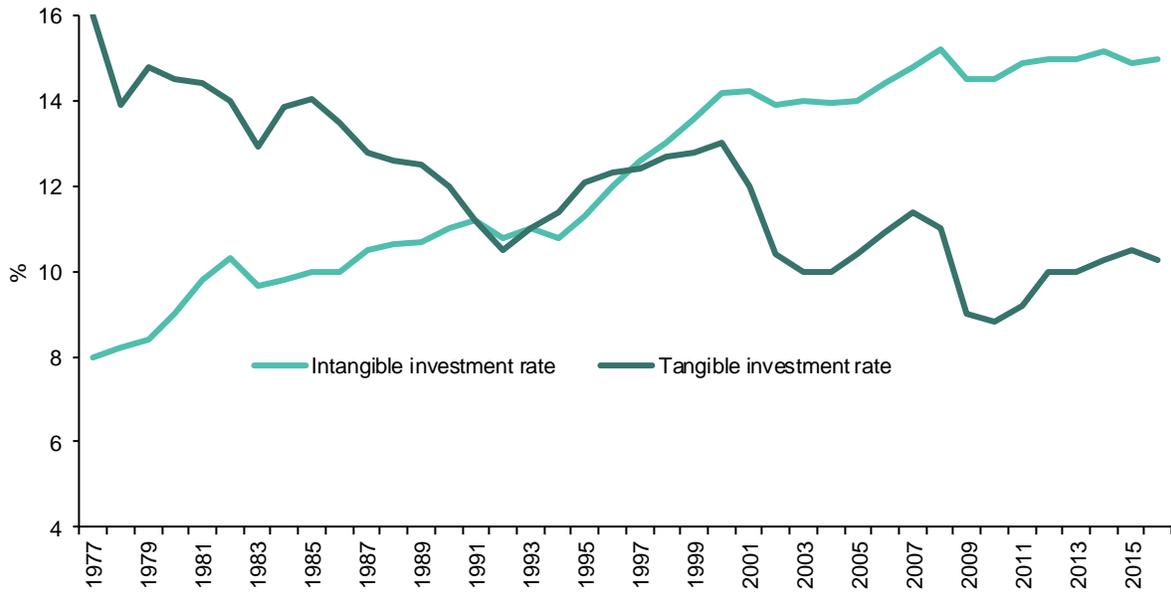
EXHIBIT 5: **Number of IPOs as a percentage of listed firms**

Source: Initial Public Offerings: Updated Statistics, Jay R. Ritter, Cordell Professor of Finance, University of Florida, June 2021, World Bank, and Bernstein analysis

### Capital needs in a capital-light society

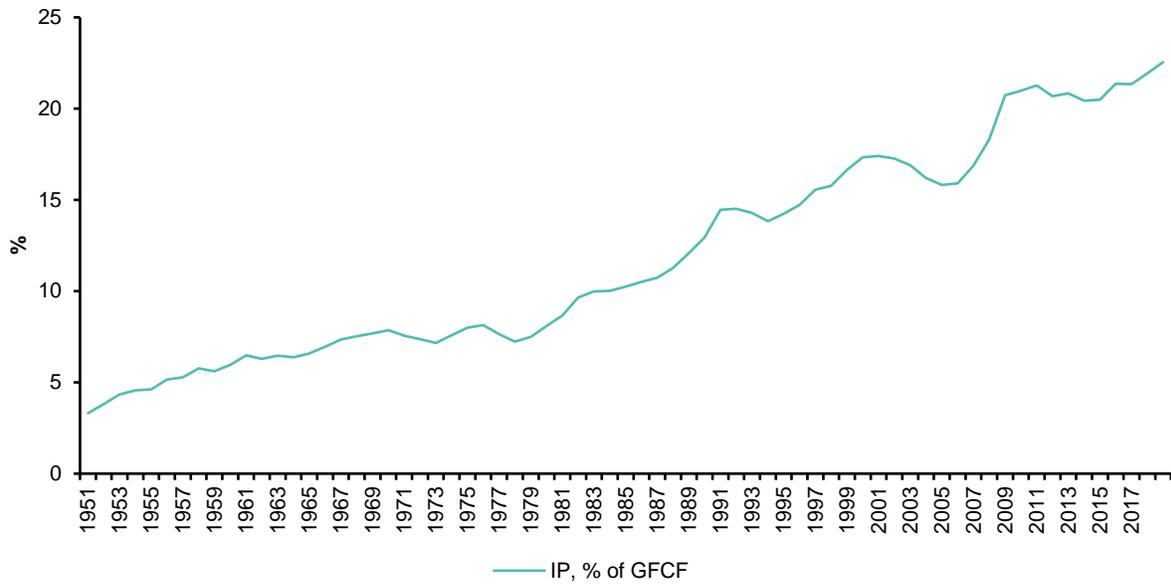
We suspect one reason for this shift in the prevalence of IPOs is the type of investment that new companies require. Exhibit 4 and Exhibit 5 show that post 2000, the number of IPOs fell dramatically. No doubt the short-term reasons for this were the unwinding of the tech bubble, but the rate of IPOs did not recover with the market. The nature of investment by corporates has pretty clearly shifted to be significantly directed toward intangible assets (see Exhibit 6 and Exhibit 7). It was in the early 2000s that the rate of investment in intangibles surpassed that of tangible assets, and the overall rate of investment in intellectual property products in the US passed 15% of gross fixed capital formation (capex).

**EXHIBIT 6: Investment rates in intangible (rising) and tangible (falling) assets, private industries, 1977-2016 (investment relative to private industry gross value added)**



Source: Carol Corrado and Charles Hulten and Bernstein analysis

**EXHIBIT 7: Intellectual property products, percentage of total gross fixed capital formation**



Source: Bureau of Economic Analysis (BEA) and Bernstein analysis

Exhibit 8 shows the median age of US firms at the point of IPO. In the 1980s and 1990s, the average age was eight years, but this has averaged 11 years since 2000. This implies that capital from the IPO was not needed for a longer time of the early-growth phase of the company; the *quid pro quo* of this is it is harder for investors in public equity to buy into early-growth phases of companies now compared to the 1980s and 1990s, with implications for return expectations.

A worry from an investor's point of view is whether the public equity market is just becoming a vehicle for founders to exit. If that were the case, it would imply a very different growth exposure for buyers of newly issued public equity. Of course, no company will say the purpose of its IPO is for founders to exit, but the longer wait before seeking a listing would not be incompatible with that view.

EXHIBIT 8: **Median age of firms that IPO**



Source: Initial Public Offerings: Updated Statistics, Jay R. Ritter, Cordell Professor of Finance, University of Florida, June 2021 and Bernstein analysis

Aside from firms choosing to list much later than previously, another notable shift is in the proportion of firms that are loss-making at the point of listing (see Exhibit 9). At the height of the tech bubble in 2000, fully 80% of new IPOs were of loss-making firms. In recent years, we have steadily reached the same proportion. However, a big difference from 2000 is that it coincided with several years of a massively increased rate of IPOs, so presumably companies were listing that should not really have sought a listing — this time it is against a falling number of IPOs.

EXHIBIT 9: **Percentage of IPOs with EPS<0**

Source: Initial Public Offerings: Updated Statistics, Jay R. Ritter, Cordell Professor of Finance, University of Florida, June 2021 and Bernstein analysis

One read on this is that the high proportion of loss-making IPOs is simply another example of the frothiness of the market. With US equity markets close to all-time highs and a US Shiller PE in the top decile of its 130-year range, surely this reflects a perfectly rational decision of entrepreneurs to seek a listing to tap into the demand for equities? That may well be the case. However, there is possibly another force at work here too. The accounting treatment for tangibles and intangibles is often quite different if they are built "organically" rather than bought in via an acquisition. Much of the cost of developing intangible assets, e.g., in the form of paying employees, has to be expensed rather than being amortized. As intangibles have made up a much larger part of the asset base of companies since the 2000s, it seems plausible this high proportion of loss-making companies is a shift that will be permanent, or at least until accounting rules are changed.

This asymmetry in treatment of assets could be a contributing factor in the change in the nature of exits by private equity buyers. Exits via sales to strategic buyers have increased, while exits via IPOs have declined, suggesting it might be more attractive for pre-built intangible assets to be bought via an acquisition (see Exhibit 10).

EXHIBIT 10: **Private equity exits to strategic buyers have increased, while the proportion of exits via IPO has declined**



Note: Bankruptcies excluded; IPO value represents offer amount and not market value of company.

Source: Dealogic

Policy makers might want to question whether the requirement to expense much of the development cost of intangibles contributes to the declining number of IPOs by making it more likely that the firms will be loss-making for a protracted period. At the moment, this might not matter. As we showed recently,<sup>71</sup> the vast majority of KPIs that determine how management is paid are defined on a non-GAAP basis. Companies and their remuneration committees seem to have enormous latitude to define earnings that determine what management is paid. As discussed in our ESG research, we think this should change, but perhaps it will be hard to make this switch unless there is a change in the accounting treatment of intangibles. This is linked to one of the themes we keep coming back to, i.e., time horizon. We can ask a counterfactual question as to whether capitalization and subsequent testing for impairment of intangibles might lengthen the time horizon management takes when making investment decisions.<sup>72</sup>

Founders are not the only owners who may try to use an IPO to exit a position and, hence, indirectly rely on the public equity market for setting a price. As we pointed out, although exits to strategic buyers have become more significant, since 2009 10-20% of PE exits have been via IPO.<sup>73</sup> This has not increased recently. In fact, if anything, private equity owners seem more inclined to sell to other private equity owners. This likely reflects the very large capital raising of private equity firms in recent years and the desperation to put

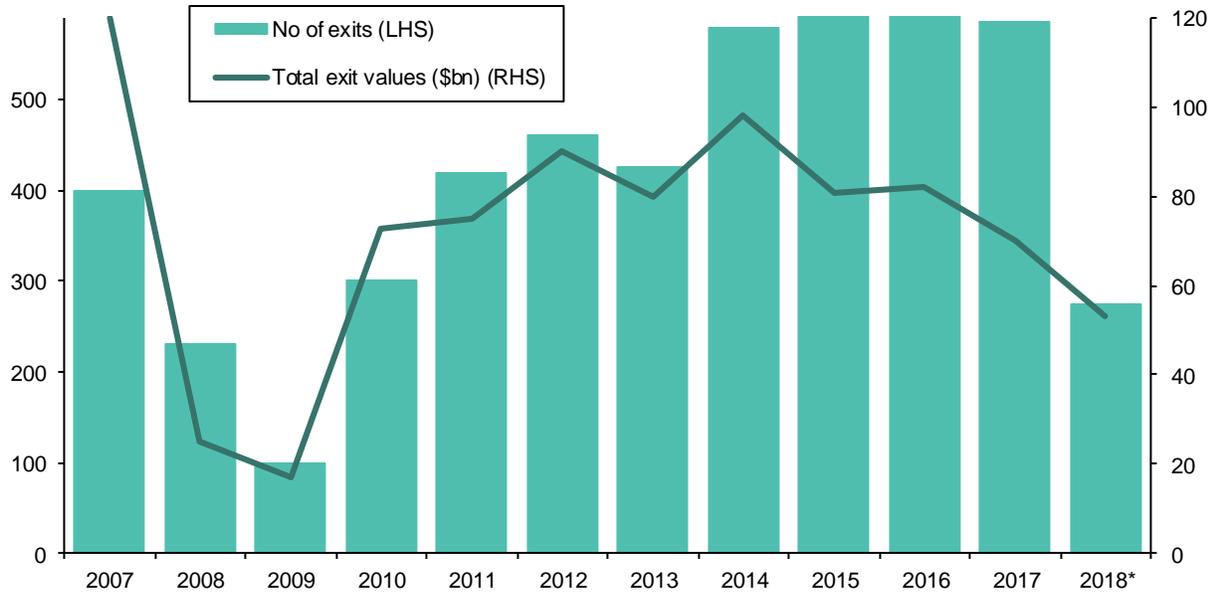
<sup>71</sup> [Fund Management Strategy: Management incentives, buybacks and the failure of ESG](#)

<sup>72</sup> See a very good discussion on this point in Lev, B. (2018), *Intangibles*. Available at [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3218586](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3218586).

<sup>73</sup> <http://docs.preqin.com/quarterly/pe/Preqin-PE-Quarterly-Q2-16-Buyout-Deals.pdf>

this to work, while there have been outflows from many key public equity markets (see Exhibit 11).

EXHIBIT 11: **Private equity firms are increasingly selling to other private equity firms**



\*Year to date

Source: Preqin and Bernstein analysis

### The "time horizon problem" and liquidity

A topic that we keep coming back to in different aspects of our research is time horizon. Differences in time horizon give rise to an inefficiency in markets that cannot be "arbitraged away," as it comes down to existential issues such as the career risk of individuals and the difficulty of solving agency problems.

One of the huge advantages of public equity markets is that they provide liquidity to investors and to owners of the business (or employees who are paid with awards of stock). But this liquidity is a double-edged sword. The two drawbacks in the context of this chapter are: (1) it leads to investors in the market being tempted to churn positions in a way that might not be optimal for their investment goals, and (2) given a greater share of investment by asset owners going into illiquid investments, it increases the pressure on liquid equity investments if there is a need to sell.

Having the ability to sell is highly advantageous, but there is an agency problem in hiring others to manage assets and career risk for those involved in any allocation process. If one wanted to be cynical, one could see at least part of the motivation for the high allocation to private equity assets by pension funds as a way to solve an internal agency problem that asset owners seem to have imposed upon themselves, i.e., an allocation to a public equity manager tends to be assessed on an annual basis, and probably much more frequently. However, if an allocation to a manager is in the part of the portfolio classified as private assets, then the time horizon for assessment can be extended significantly. The long

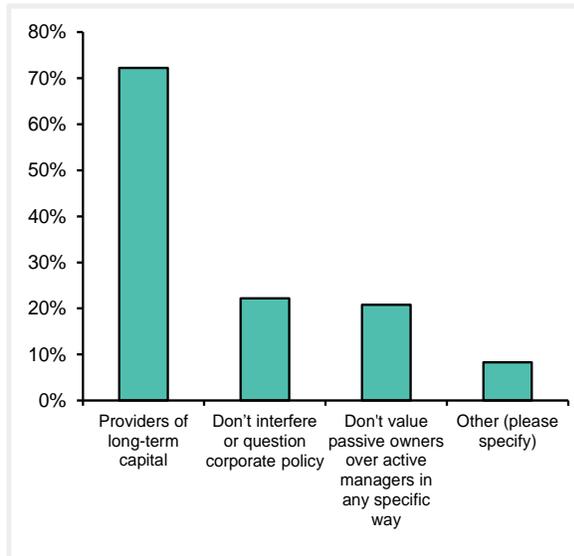
horizon is probably much more appropriate for an investment that is intended to meet a retirement goal, so that long horizon itself is attractive. But it is inefficient to treat different parts of the book differently, and also highly inefficient from a fee allocation perspective to have such different fee structures on these public and private elements.

Does the liquidity of the public market inherently lead to short-termism? That certainly is the perception of many. Our survey of corporates (or at least their IR teams) highlights how many of them see passive investors as longer-term investors than active managers (see Exhibit 12). We think this illustrates a misunderstanding of the nature of passive investing, which is a truly zero-horizon activity by definition (it mimics an index). But to counteract this view, active managers have to make a virtue out of their ability to have a long time horizon. This probably requires an alignment of the governance structures of the fund manager and the fund buyer.

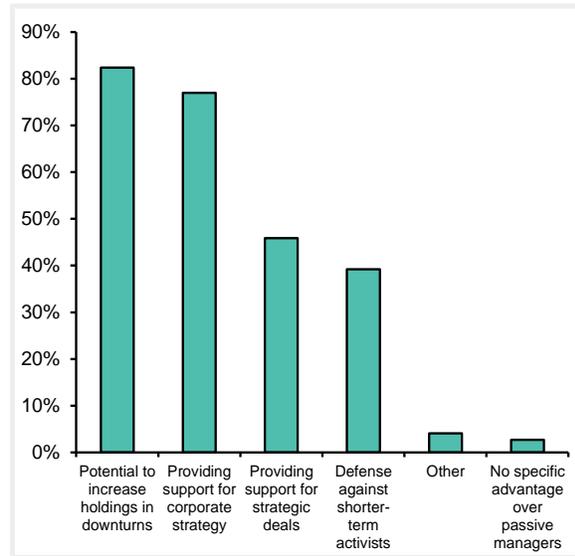
Corporates have a role to play here too. Rather than assume that active asset managers are short term, they can foster relationships with asset managers who have a long-term mindset — we think they will increasingly find a ready pool of such capital as asset managers assess their commitment to stewardship goals as part of an increased drive for ESG-friendly investing.

**EXHIBIT 12: Views of corporates on the relative advantages of active and passive ownership**

**What, if anything, do you value in passive managers vs active on your share register?**



**What do you specifically value in active managers vs passive on your share register?**

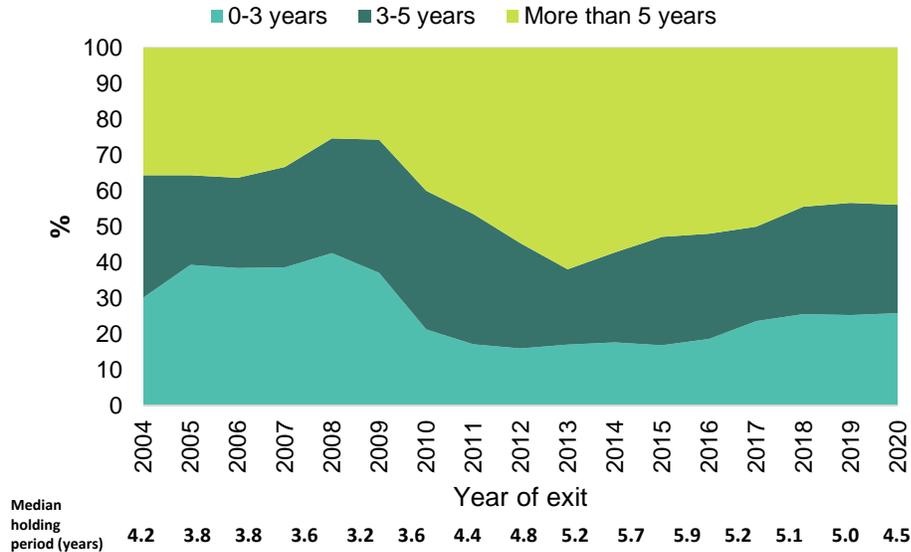


Source: Bernstein survey of IRs and analysis

The good news for believers in public equity markets is solving the time horizon problem is key for asset owners anyway. Solving this problem is complicated, as anything that involves career risk is hard to diversify. However, we believe it is fixable; it is after all a question of goal setting, incentives, organizational structure and, dare one say it, culture.

The long holding period of private equity managers might be something of a myth anyway. Exhibit 13 shows that the proportion of private equity positions held for more than five years has shrunk from 60% in 2013 to under half more recently.

EXHIBIT 13: **Holding periods of private equity are falling**



Note: Distribution of global buyout-backed investments exited, by length of time held in fund portfolio.

Source: Preqin and Bernstein analysis

Liquidity is double edged. We showed in a recent note ([Fund Management Strategy: Passive public markets vs active private markets?](#)) that asset owners have made a material increase in their exposure to illiquid assets in recent years. Therefore, if there was a reason that forced a sale, it could materially increase pressure on the liquid part of an allocation. Moreover, we have also shown<sup>74</sup> that the resilience of liquidity in equity markets may have decreased, potentially magnifying this problem.

#### Public equity in danger of becoming irrelevant – the change in nature of control

Exhibit 14 shows the composition by market cap weight of the global market by region and sector in terms of where there are unequal voting rights. Globally, just ~6% of developed market cap is accounted for by companies that give unequal voting rights to different share classes. However, this is very concentrated and, unsurprisingly, has become much more prevalent in the US and in the tech sector.

<sup>74</sup> [Global Quantitative Strategy: Liquidity poses a strategic challenge to investors](#)

EXHIBIT 14: **Share of equities with restricted voting rights**

<b>REGIONS</b>	<b>ALL MKT CAP</b>	<b>UNEQUAL RIGHTS</b>	<b>% UNEQUAL</b>
ASIA	2814638	0	0.0
EUROPE	14585884	0	0.0
US	41377728	5170792	12.5
JAPAN	5903816	0	0.0
CANADA	2101324	65249	3.1
GLOBAL	66783390	5236040	7.8
Communication Services	5378675	2142900	39.8
Consumer Discretionary	9094354	304394	3.3
Consumer Staples	5064657	256360	5.1
Energy	2170832	0	0.0
Financials	9028192	607494	6.7
Health Care	7860328	159533	2.0
Industrials	7638969	240285	3.1
Information Technology	13443758	1494059	11.1
Materials	3084814	12253	0.4
Real Estate	2030814	12999	0.6
Utilities	1987996	5762	0.3

Source: FactSet and Bernstein analysis

This is further evidence that investors in arguably the highest-growth area of public equities are experiencing a change in the nature of that investment. This makes the split between private and public equity assets all the more stark. One can have full or partial control with the former, but potentially no control with the latter. Why have investors let this happen? With equity markets mainly rising for 35 years, it might not have appeared important, but with a low-return outlook and huge pressure to show ESG credentials, there is now a belated realization that there might be a need for public equity investors to exert control.

#### **And so, what is the point of the stock market?**

For perhaps the majority of investors, the stock market has come to be seen over the last 60 years as a way to buy fractional ownership of individual corporations, which in the US, Europe, and Japan at least, mostly chose to list publicly. For most investors, it became the main way to make such investments. It paid off very well, better than over the previous century.<sup>75</sup> However, now we think this view of fractional ownership of individual companies as a principal mode of saving is changing. This is because of the conjunction of: (a) a greater share of companies choosing to remain unlisted, (b) a plethora of very cheap indices allowing access to "return streams" rather than necessarily individual companies, and (c) a realization that the market might yield real returns only slightly above zero for the next decade.

<sup>75</sup> [Global Quantitative Strategy: The end of Pax Americana and what it means for the market](#)

A progression from thinking about single companies to instead investing in "return streams" probably makes sense in a world where returns and diversification become harder to achieve, and the cost of access to investing in indices is zero. Of course, equity investment has only been a part of institutional portfolios, and it is still probably one of the best long-run sources of an inflation-hedging asset. However, given the growth of "alternative" investments over the last decade, it seems likely that for many more investors, equities are only an element of the investment process — one that is more integrated with other assets, especially private ones.

So, what is the point of the stock market today? We have to presume the main reason for listing historically was to fund upfront capital investment. For entrepreneurs building growth assets, upfront capital needs are now somewhat diminished. New companies still need cash, but if it is to pay employees to develop intangible assets, then it may be easier to link that to future returns of the company via options.

For investors, meanwhile, the expectations of returns are changing too. The decision to list later or not at all means the potential for large returns in public equity from the relatively early high-growth stage of companies is diminished. That this is happening at the same time as the asset price inflation of the last 35 years means aggregate market returns are likely to be lower as well.

We suggest, therefore, that the purpose of a public equity market in today's world is different:

**For entrepreneurs**, the purpose of a listing is more about liquidity, allowing them to motivate employees and for founders to exit should they wish. A listing also facilitates price discovery, which can be useful for other tasks such as accessing loans if needed and attracting staff. But we suspect a listing is less about capital raising *per se*.

**For investors**, liquidity is also one of the key attributes of public equity, maybe *the* key attribute. In a world where investment in private assets and infrastructure plays a permanently larger role, it is the liquidity of public equities that sets them apart from most other assets. Another key attribute for investors is the sheer scale of the public equity market, at \$70Tn vs. \$5Tn for private equity (including private equity, VC, real estate, and private debt). There are just not enough private assets, let alone bridges, renewable power projects, or other infrastructure assets to absorb the required savings pool. Finally, another key attribute for investors is cheapness of access. There is no other asset class that has a hope of delivering long-run positive real returns that has such a low cost of access with such a variety of return streams (market beta and factor beta). Note that in our world view, the attractions of the public equity market are no longer the prospect of high returns from simply earning the equity risk premium, nor diversification.

**For lawmakers**, the attraction of the public equity market is its offer of democratized access to savings and an equality of opportunities for investors that does not exist in private assets, infrastructure, real estate, etc. The disadvantage of it for lawmakers is that the liquidity that is so attractive for entrepreneurs and investors will also always encourage short-termism. This question of time horizon is, we think, critical. Large asset owners, such as pension funds, should find it easier to extend the time horizon of the industry, and we should

probably look to them to lead this process. However, this is easier said than done. The question of career risk for individuals making investment decisions is very hard, perhaps impossible to diversify away. Having said that, we suspect there is a good case to increase the centralization of asset ownership, which would reduce the power of intermediaries such as consultants and also improve buying power for asset owners who want to mix public and private assets on a level playing field.

Regulators might, therefore, want to think about ways to counteract that — be it through changing the way funds are selected to extend the horizon over which they are assessed, or trying to influence the way management of corporates are compensated (we recently wrote about this: [Fund Management Strategy: Management incentives, buybacks and the failure of ESG](#)), and possibly changing the way accounting treats intangible assets.

If this view is correct, it implies a radical change in view about what the public equity market is for and, in turn, changes the role of asset managers whose job it is to sell return streams based on it.

BERNSTEIN

# **An Appeal for Process in Finance**

BERNSTEIN

# FROM STOCK PICKING TO PORTFOLIOS: A LETTER TO FUNDAMENTAL PMS

## OVERVIEW

This chapter takes the form of a letter to clients rather than a normal research note format. It concerns us that too many fundamental investors think that somehow portfolio construction is not relevant to them. We outline five reasons we hope will convince portfolio managers that they need to care about the topic, that it is commercially relevant, and is not just a topic of idle intellectual curiosity. There are several steps they can take to address this

Carrie Bradshaw advised us to "accessorize the outfit we've got." This applies equally well financially as it does sartorially. The asset management industry expends an enormous amount of resources on forecasting the returns on single stocks. But too often, that effort is seriously undermined by not considering how those stocks should be combined.

Selecting a list of stocks is emphatically not the same as building a portfolio. The whole is more than the sum of the parts, and the step in between matters. We outline five reasons why:

(1) A fund is not driven by "stock selection" just because the manager asserts that it is so or because the fund spends all its time thinking about individual stocks. The fund is *ONLY* driven by stock selection if idiosyncratic stock returns are indeed the main driver of return.

(2) Idiosyncrasy will also sell funds. This becomes a necessary (although not sufficient) condition to market funds in a world where smart beta ETFs are available at close to zero fee.

(3) The performance of active funds *on average* has lagged over the last decade. More attention on how portfolios are weighted can help extract every last drop of performance.

(4) Some smart beta funds do nothing other than portfolio construction, and they are gaining assets and taking market share.

(5) Portfolio construction is a way to integrate ESG into funds.

We show risk is stickier than returns. This means it should have a greater role in how stocks are weighted than return expectations. This is emphatically not suggesting a low-volatility approach to investing, but instead a disciplined approach to how to weight a group of stocks that one thinks will outperform.

When adding a stock to a portfolio, in addition to how good an investment it is, investors should also care about how much idiosyncratic vs. systematic factor risk it brings.

What we are suggesting is not hard. It should improve portfolios. The question really is why wouldn't one do it? It does not have to be complicated. The central message is the importance of paying attention to the *process* of investment. This applies equally to assessing the merits of individual stocks as it does to how they are put together.

---

THE LETTER

Dear Clients,

This chapter comes in the form of a letter. We are addressing you in the unconventional form of a letter as opposed to the more distant language of a research note because we want to emphasize how important we think the topic is for you personally.

We want to address fundamental fund managers, and in particular those who regard themselves as "stock pickers." Portfolio construction might seem distant from what you do every day, it might even be handled by a different team, but it is to you that this is, in fact, most relevant.

**Carrie Bradshaw on portfolio construction**

You can always hope that the stocks you have chosen are the ones that are really going to outperform, but one always has to be realistic that they are likely to be far from perfect. One of our favorite thinkers on many issues that we face in life, Carrie Bradshaw, put this more eloquently than we ever could:

*I admit it's tempting to wish for the perfect boss, or the perfect parent, or the perfect outfit, but the best anyone of us can do is not quit. Play the hand we've been given, **and accessorize the outfit we've got.*** (emphasis added).<sup>76</sup>

Portfolio construction is accessorizing the outfit that we have. Some fundamental fund managers we speak to labor under the mistaken belief that portfolio construction is too "quarty" for them. They seem to regard things such as the covariance matrix as somehow "not what we do." If you are in this group, we say with the greatest respect that we profoundly disagree with this view. The whole point is it is only through proper regard for how a portfolio is built that one allows a fund to be driven by the things one says one has skill in.

So, if "stock picking" is what you say you do, you can only claim that is indeed what drives the portfolio if the portfolio is constructed in a certain way, as we will explain in more detail. Ignoring the topic and somehow thinking it is irrelevant could well mean that despite what you think, you may not in fact be a stock picker at all.

**Why this is urgent and not just idle intellectual curiosity**

We realize this might seem like nothing other than a point of intellectual curiosity to you. However, we argue there are a number of reasons why this is of practical and immediate concern.

---

<sup>76</sup> *Sex and the City*, Season 4 Episode 17

**(1) If you say you are a stock picker, make sure you really are a stock picker**

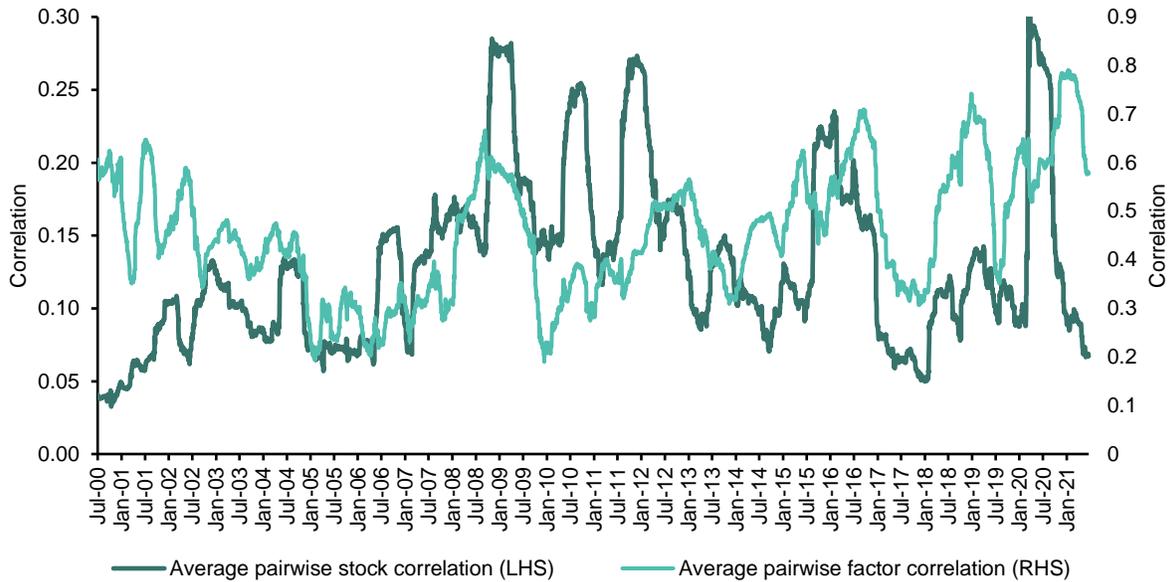
This might sound like a tautology. It isn't. In fact, it is the central reason for this letter. Just because you spend all your time thinking about the pros and cons of one stock or another and focus on selecting a list of companies that you think will outperform, does not mean you really are a stock picker. The crucial missing piece is whether the performance of the resulting portfolio is driven by the performance of individual stocks, or in fact whether other elements dominate.

**(2) Factor risk**

The last five years have seen multiple episodes of rapid reversal in factor leadership. These turning points have often been harmful as they quickly change the source of risk in portfolios. This is one of the key reasons that our Alphalytics research has shown idiosyncratic alpha is more persistent than alpha as simple excess returns. Portfolios that demonstrate idiosyncratic alpha skill are less likely to be smashed by a rapid switch in factors at macro turning points.

A related point is that tactically, recent years have seen average correlation of stocks and factors fluctuate significantly (see Exhibit 15). When stock correlation falls, that is usually good news for investors who aim to outperform through making decisions on individual stocks. This means it is easier to outperform (as long as their views are right!). However, that is an incomplete picture of the market at the moment. Factors are moving more closely together than they ever have before. The practical consequence of this is that on any given day at present, stocks are moving within factor cohorts. This means average stock correlation is low, but factors have become the vehicle by which macroeconomic influences are driving the market.

Again, the point is factors are probably driving more of your portfolio right now than they normally do.

EXHIBIT 15: **Stock correlation has fallen, but factor correlation is still elevated**

Note: Global, daily data, six-month window. Global L/S Factors: Comp Value, 12-month Price Momentum, Quality, Composite Growth. We use rolling correlation of absolute returns of long-short factors and correlations of (signed) returns of stocks.

Source: MSCI, FactSet, Institutional Brokers' Estimate System (IBES), and Bernstein analysis

### (3) Idiosyncrasy will sell funds

If we consider the distribution and marketing of funds as opposed to just the "manufacturing" element, we think demonstrating that funds have idiosyncratic returns is going to be crucial and will become more important than considerations such as active share. This is driven by the rapid lowering of fees on smart beta factor products (current going rate is 4bps for ETFs) and also the evidence of greater persistence of idiosyncratic alpha. We cover this in more detail in the Alphalytics research: [Alphalytics: Tearing up the rules on active management](#).

### (4) Active fundamental performance has been poor; need to extract every last drop of performance

There are several reasons for the persistent flow from active to passive over the last decade. First, in the past there were too many funds charging active fees but delivering returns close to the index. Second, in a world where equities and bonds both beat inflation and had a negative correlation between them, it encouraged a passive 60:40 model (we think that comes to an end). But a third reason has been the poor returns from the average active fund (see Exhibit 16) (see [Alphalytics: Does Active beat Passive?](#)).

EXHIBIT 16: **Active-passive return spread – monthly cumulative index (since January 2010), US samples**

Note: IA quartiles based on 5-year trailing IA, with an annual rebalance.

Source: eVestment, Morningstar, MSCI, S&P, FactSet, and Bernstein analysis

We reject the idea that this is all structural. We explained recently that we think part of this is cyclical and poised for an improvement over the next 12 months.<sup>77</sup> But in such an environment, active managers should be looking to extract every last drop of information ratio out of their portfolios. Moreover, we suspect there are some relatively easy steps that can be taken to do this. It is not necessarily difficult!

**(5) Some smart beta does nothing other than portfolio construction and avoids the messy business of trying to predict the returns of any individual stocks**

Smart beta gets a lot of attention for dragging the price of factors down to zero. There is another aspect of smart beta we want to draw attention to. There are some forms of smart beta that do nothing other than portfolio construction, i.e., they can make a virtue out of not getting involved in the messy and unreliable business of trying to actually forecast the returns of individual stocks; instead, they only aim to build portfolios more efficiently.

Examples of this include some specific types of minimum variance where the objective is to build a portfolio that sits at the left-hand extremity of the efficient frontier. Another example would be the so-called "maximum diversification" portfolios that seek to maximize idiosyncratic risk per unit of total portfolio risk. It could be argued that the so-called "Fundamental Indexation" technique that weights all stocks in an index by variables other than market cap is also, in essence, a portfolio construction technique.

<sup>77</sup> See [Fund Management Strategy: Ending the active performance drought](#) for more details.

These approaches are gaining significant assets and, if nothing else, illustrate the commercial attractiveness of thinking about portfolio construction.

### **(6) ESG as portfolio construction**

One growth area in active portfolio management is ESG. It is becoming increasingly necessary for managers to build this into institutional fund offerings as more asset owners are demanding it. In addition, we think asset managers will choose to add this into retail funds as well as a way to increase demand.

We recently discussed that the way to bring ESG into the financial mainstream is to make it part of the portfolio construction process. We won't repeat the arguments here,<sup>78</sup> but it is a consequence of the observation that within ESG, the goals of investors will always differ and there will not be a common agreed-upon target that will suit all investors.

### **A collection of stocks does not a portfolio make**

At the heart of this letter is the observation that a collection of stocks is not a portfolio. Or to put it another way, a portfolio has other features over and above that of the sum of all the individual stocks. Maybe this is an obvious point, but we worry that not all investors fully appreciate this.

### **What are we suggesting in practical terms?**

First, there should be a framework for thinking about how to weight stocks in a portfolio. Our aim here is not to be prescriptive about a particular technique, but instead to bring it back to what skills you think you have and where your confidence lies.

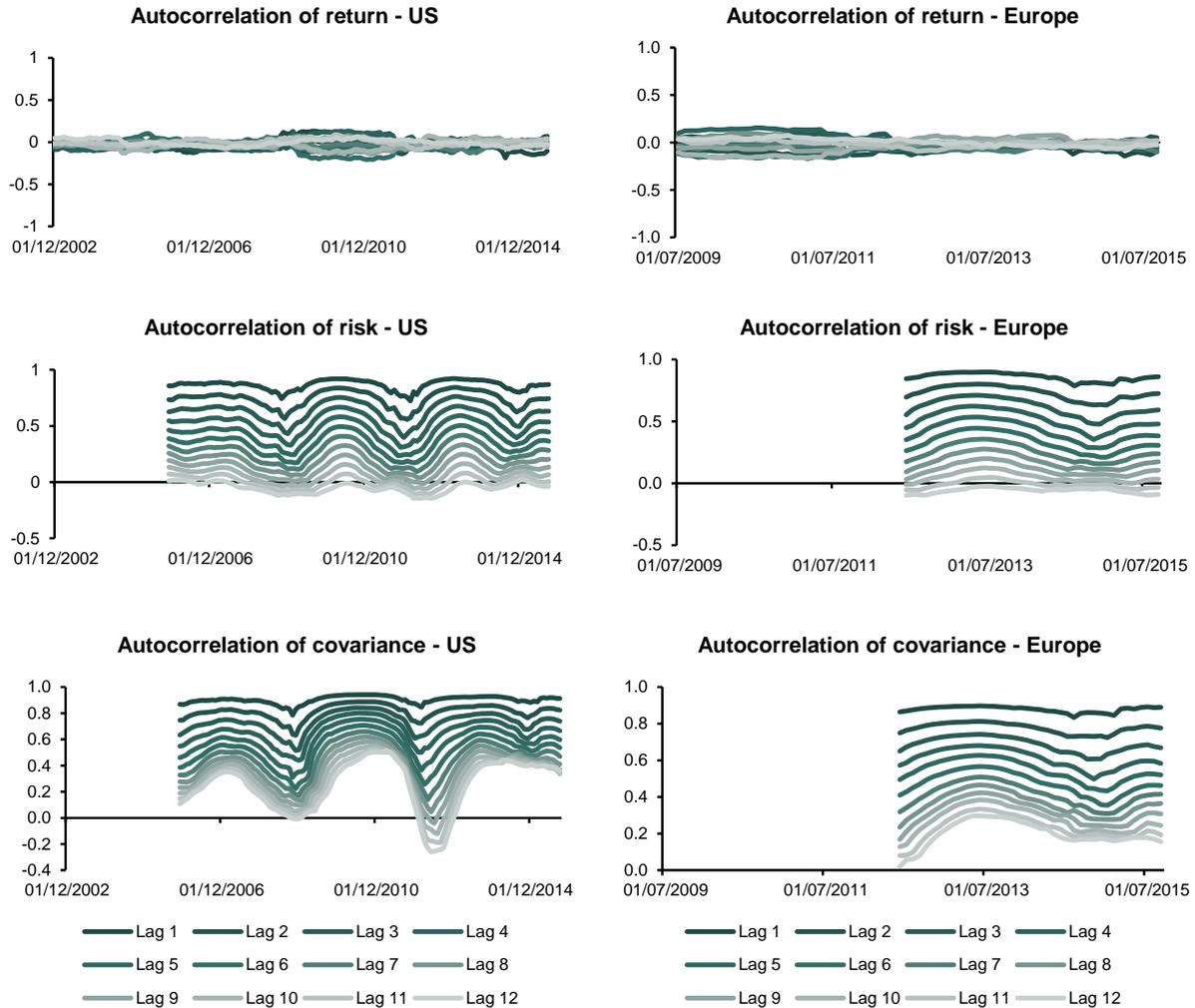
We start from the observation that risk is much "stickier" than returns. What do we mean by this? Forecasting returns is really, really hard. That is why so many people are employed to try to do it. But one also needs to be realistic about how much returns vary as opposed to risk for individual securities (or whole strategies, for that matter). To illustrate this, we show in Exhibit 17 the persistence of returns, variance, and covariance for a large number of companies in the US and Europe.

Specifically, we calculate the autocorrelation of returns, variances, and covariances for companies. The lines in the top panel show there is very little correlation between returns at time  $t$  with returns at time  $t-1$  month,  $t-2$  months,  $t-3$  months, etc. The middle and lower panels show, by contrast, there is a high degree of correlation in variance and covariance. That means if we want to calculate the variance or covariance of a stock in the next period, then observation from the last period is a good starting point. That is not the case with returns.

---

<sup>78</sup> For full details, see [Fund Management Strategy: ESG Mandates - how to win them and how to set them](#).

EXHIBIT 17: Importance of portfolio construction – risk is more "sticky" than return



Note: The autocorrelation is calculated with a 36-month rolling window. We represent the risk by the volatility and a 36-month window is used for the calculation of the risk and the covariance. The universe is 150 stocks for the US and 200 for Europe. We constrain the universe from the MSCI World to only keep the stocks present over the entire sample period.

Source: FactSet, MSCI, and Bernstein analysis

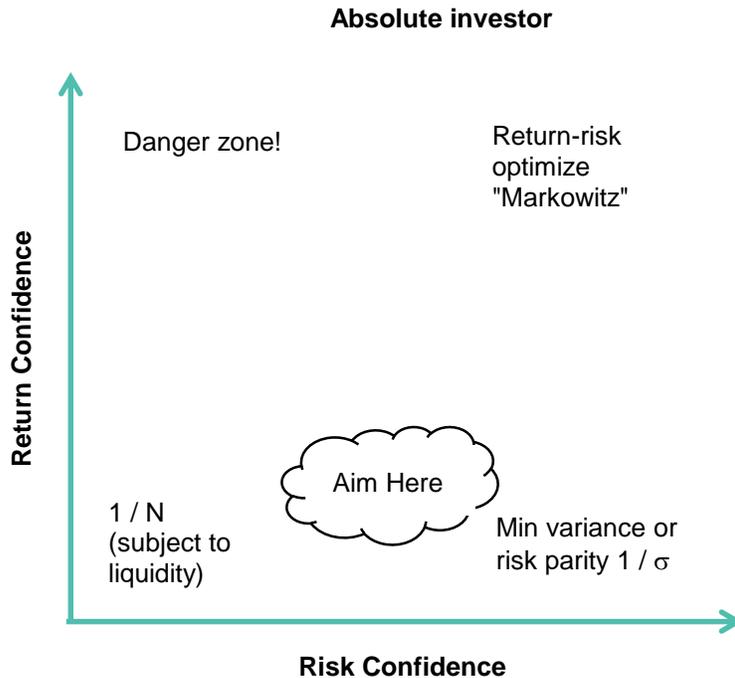
"Ah ha!" you might say, "but in order to calculate the variance and covariance, one needs a block of time that will overlap with the observation from the last period." In order to show that this does not defeat the argument, let's consider two stocks. Let's take Glencore and Glaxo. Suppose one was asked to form a portfolio consisting only of these two stocks starting in one year's time but with weights decided today, what would one do? One has no idea what the relative return prospects of those two stocks is going to be starting in one year's time, as they may take unexpected paths between now and then. However, we would be highly confident that Glencore would be more volatile than Glaxo in one year's time; hence, we would give Glaxo a bigger weight. But, you might say, "starting in one year's time seems like an artificial exercise." Not really. We just want to illustrate a case where the outlook for the stocks is uncertain (as it is in reality were we to form the portfolio today).

So, what do we do with this information? We suggest it can be used to guide one toward at least a default starting position for building a portfolio. We like to think about approaches to portfolio construction as a function of confidence in predicting returns and confidence in predicting risk (see Exhibit 18). We can imagine a number of situations. If one is highly confident in the future returns and risks of a set of assets, then that is the easiest case. In that case, one is living in a Markowitz world. One should reach for the nearest optimizer available on the market; plug in the expected returns, variance, and covariances; and it will tell you what weights to put on those assets. However, decades of psychological literature have told us it is more likely that we know nothing about the future of these assets than knowing everything about them. If we know nothing, then one should equally weight the assets. This is the most "humble" approach to weighting assets as it assumes no information about future returns and risk (here, we are assuming an absolute return portfolio; if it was benchmark relative, then the "zero information" portfolio is the benchmark; we are also ignoring liquidity constraints).

But we do know something, at least. The work on the persistence of variance and covariance says we should have some confidence in future risk. That is not to say we optimize on risk, because the covariance matrix does evolve, but at least have some weighting on it. Note we are not advocating a low-volatility portfolio here! We are applying this over a hypothetical small group of securities that have already been selected through fundamental research. So, a default position should probably be in between equal weighting (subject to liquidity) and  $1/\text{volatility}$  weighting.

This is intended to be seen as a default position. Then, of course, if there is a good reason to have conviction on a return forecast, by all means, use it. The key thing is to avoid weighting by confidence in the return forecast. We think that is a dangerous course.

**EXHIBIT 18: Importance of portfolio construction – approach to construction could be a function of confidence in return and risk forecasts**



Note: Possible approaches to portfolio construction, given investors' confidence in their ability to predict risk and return.

Source: Bernstein analysis

There is a second practical implication. When adding a stock to a portfolio, there should be a number of considerations. The obvious one is what it does to the total portfolio's expected return and risk. However, if a fund is marketed as a "stock picking" fund, then there should be another point of interest too. That is, one should think about what the addition of that stock does to idiosyncratic vs. systematic factor risk. If the stock that is to be added increases aggregate systematic factor risk and decreases idiosyncratic risk, then maybe one should consider the next best stock on the list of candidates instead.

A way of thinking about the relative scale of the inputs and their relationship is to decompose active risk or tracking error. We can write this as:

$$TE = \sqrt{\text{systematic risk}^2 + \text{idiosyncratic risk}^2}$$

Sapra and Hunjan (2013)<sup>79</sup> show that through this approach we can separate the expected value of the tracking error into a term dependent on a sum of systematic risk factors and a term dependent on active share and the idiosyncratic risk of stocks. So, expected value of tracking error becomes:

<sup>79</sup> Sapra and Hunjan (2013), Active Share, Tracking Error and Manager Style, available at <http://www.pimco.co.uk/EN/Insights/Pages/Active-Share-Tracking-Error-and-Manager-Style.aspx>.

$$TE = \sqrt{b'Wb + AS^2 \frac{2\pi}{N} \overline{\sigma_e^2}}$$

Where  $b$  is the portfolio exposure to systematic risk factors,  $W$  their mutual covariance,  $AS$  the portfolio's active share, and  $\overline{\sigma_e}$  the average idiosyncratic stock risk. Note this only works if the latter term is the idiosyncratic risk of stocks, as the total risk of each stock would include both a systematic and an idiosyncratic element. We note in passing that equations of the form  $z^2=x^2+y^2$  map out a curved cone shape, but the terms are constrained to one quadrant of a cone because of the range of values that factor exposures and active share can take. Thus, we can think about the tracking error of a fund as lying somewhere on such a surface with its position defined by a systematic factor term and an active share\*idiosyncratic risk term.

Our point here is that not all tracking error is equal. Yes, we have known this in theory for ages, but it is product pricing that is making this more important. Mapping out funds in this way is no longer just an issue of risk management; it now also becomes an issue of fund pricing. Paying attention to this would ensure that a fund really was driven by stock picks and not by some other unintended source. A spin-off benefit of this is, as we have said in recent research,<sup>80</sup> we think it is increasingly idiosyncratic returns that will be the basis for marketing and selling of active funds in a multifactor benchmark world.

### Commercial implications

In our view, the cheapening of smart beta to outright passive rates makes a significant impact on how funds are measured and what the terms of success are. If this is correct, it has implications for organizational structure and pay. A logical consequence is fund manager compensation should reflect, at least in part, an ability to generate idiosyncratic returns. Yes, returns have to be good as well, but that becomes a necessary rather than a sufficient criterion to pay a manager well. This does not mean pay comes down, but it does change the balance of who gets paid. Asset management groups will need to move in this direction in order to ensure that the funds they offer are those that asset owners need.

We hope this letter convinces you that the topic of portfolio construction is not arcane and, in fact, is of commercial importance in the near term. In the final analysis, the question really is: why wouldn't one do this? It does not have to be that complicated. It does not have to involve handing over one's portfolio to an optimizer and blindly following the results. Instead, it is more about adopting a disciplined framework. The central message is the importance of paying attention to the *process* of investment. This applies equally to assessing the merits of individual stocks as it does to how they are put together.

---

<sup>80</sup> See [What is worth paying for in an asset manager?](#).

# PORTFOLIO MANAGEMENT AND NUCLEAR POWER STATIONS

## OVERVIEW

This chapter continues the theme of the need for process in fund management in the form of a second essay on the topic. We take the study of high-risk systems such as nuclear power plants and planes as the basis for a discussion on investment. In particular, we want to take the thesis of "normal accidents" of Charles Perrow<sup>81</sup> and apply it to investing. This has been done before in the specific context of financial crises<sup>82</sup> but, as far as we are aware, it hasn't been done to the everyday process of investing. Essentially, the idea is that when systems acquire a certain level of complexity, interactivity, and rapid response then there is a category of accident that we should think of as normal. An "accident" in investing could either refer to a major loss of wealth such as occurred during the financial crisis but also, and more our focus here, everyday investment decisions that don't work out and lead to the underperformance of a fund or an outcome that is not what the end-client requires. These mistakes are often described as "operator error," but the thesis under consideration here suggests that, in fact, they may sometimes be the fault of the system itself. In the daily process of fund management, the fund manager may be blamed for underperformance, but we suggest that, in fact, sometimes the system of investment may be the real cause of error. We should explicitly note upfront, however, that this is not intended as a general get-out for the avoidance of blame. Sometimes the fund manager (or indeed the sell-side strategist who suggested the trade) is just plain wrong! Moreover, before fund managers start using this to justify any underperformance, we note that the potential remedies may not be all to their taste either.

To illustrate what we mean by all this, we start with two examples. Both are far removed from finance, but that is exactly the point — we want to bring to bear situations that are outside the narrow frame of investing. One example that Perrow himself spends some time on is nuclear power and, in particular, the Three Mile Island accident of 1979.<sup>83</sup>

At the Three Mile Island nuclear plant, a leak in the coolant system caused pumps to automatically stop (even though nothing was, in fact, amiss); in turn, this shut down the steam turbine automatically. To remove heat from the reactor core, emergency feed water pumps came on. What the operators did not know was that the valves on this system had been left in a closed position, so although the operators verified that these pumps came on they did not know they were not pumping water. There were in fact two indicators for the valves, but they were lost among the 1,600 lights on the control panel and one of them was obscured by a repair tag; anyway, the operators had no reason to suspect a problem there, it did not fit into their mental map of what was happening.

---

<sup>81</sup> Perrow (1999)

<sup>82</sup> Bookstaber (2007) and Lo (2008)

<sup>83</sup> Our discussion of the accident here is based on Perrow (1999).

As pressure rose in the reactor core, another emergency system called "high pressure injection" came on to force water into the core at a rapid rate. But there were risks with letting this run for too long, so operators shut it down after two minutes. The operators were looking at two pressure dials that were meant to move together but one was showing pressure falling while the other showed it was rising. Which one to believe? In deciding upon their course of action they had no way of knowing that water in the earlier emergency system was not flowing. All this was just a couple of minutes into the accident.

The subsequent investigation spent a long time looking into faults of the operators, but Perrow's conclusion is that this is the essence of a "normal accident," there was an interaction between multiple failures that were not in operational sequence. This was mixed with incomprehensibility on the part of the operators who could not attain a clear picture, given this interaction between failures and the rapid sequence of events.

We take our second example from a very different area, that of plane crashes.<sup>84</sup> A DC-9 operated by ValuJet crashed en route from Miami to Atlanta in 1996. The "proximate" cause of the accident was a cargo of oxygen generators which exploded in the hold. They should not have been on board and were insecurely stored. But Langewiesche sets out the case that this is another example of a "normal accident," i.e., one where the major cause is likely to have been the "system" itself. The reason why the oxygen generators were on board ends with a confused tangle about how complex work orders and technical manuals were interpreted. The oxygen generators themselves were from three ValuJet MD-80s that were being refurbished in Miami. Overall, 72 workers had logged 910 hours against the job of replacing the oxygen generators. Each step was mechanically followed on worksheets where workers duly signed off against steps they had taken in removing them from the planes and storing them in a hangar at Miami. Despite worksheets specifying steps that needed to be taken, some of them were unclear or the reports of steps taken by some workers were open to misinterpretation by others. There were daily demands of getting the work done and unclear distinctions on the work cards between the meaning of terms such as "expired" and "expended." In the course of these many steps, the question of where the oxygen generators should be stored and how they should be transported became convoluted and lost. They ended up in the cargo hold of the plane and then brought it down mid-flight.

In our investing context here, we find this example interesting as the "system failure" in the process leading up to the accident was a relatively slow-moving set of decisions that were taken by many people, something which we think has parallels to the way plan boards, consultants, and portfolio managers may interact at times in setting up an approach to investment.

### **A theory of "normal accidents"**

The claim is that there are characteristics of high-risk technologies that make a certain type of accident inevitable. This is to do with the way failures interact and also the difficulty that users face in comprehending those interactions in real time. The central point is that

---

<sup>84</sup> For this example, we rely heavily on Langewiesche (2010). We encourage those interested to read Langewiesche's compelling account of this and other related events.

accidents can become a function of systems themselves, rather than necessarily a mistake by the operators of those systems.

There are three attributes that define a system that is prone to this sort of accident:

- The system is said to be "tightly coupled." This means processes happen quickly one after another and there is no way to separate the different parts of the system (this should sound familiar to anyone running a portfolio). A tightly coupled system is one in which there is a close linkage in time from one step to another, so there is less likely to be an opportunity to "freeze" the process and take time for considered reflection between steps.
- The other attribute of systems is whether they are linear or complex. A linear system in this case is one where each element serves a distinct function and its impact on other elements in the system is easy to comprehend. A complex system is one where individual elements can serve many functions, so if they malfunction they can impact different parts of the system at the same time.
- These come together for the third element, the potential incomprehension of operators when a malfunction appears. It may simply not be possible to fully grasp the interactions in a complex and tightly coupled system in real time. In the case of failures in factories, spaceflight, flying aircraft, and air traffic control, the interactions in the system can be things that the designers never dreamed of. In some cases, better technology can help the operators of such systems understand what is happening, but in some cases it cannot and, instead, it requires a more organizational response.

The term "normal accident" might sound odd, blasé, or even dismissive (especially when applied to nuclear power stations or air traffic control systems), but it is not meant to. As Perrow says at the outset of his initial work on this topic:

*The odd term normal accident is meant to signal that, given the system characteristic, multiple and unexpected interactions and failures are inevitable. This is an expression of an integral characteristic of the system, not a statement of frequency.<sup>85</sup>*

The operator is often blamed for a catastrophe (or in our more humdrum world, the PM is blamed for underperformance), but maybe the system of investing makes it inevitable.

#### **How does this apply to investing?**

Of course, the big difference between the systems that Perrow seeks to analyze and the world of investing is in their catastrophic potential. We are "only" dealing with a loss of wealth when there is a failure in the systems that we are interested in, not a loss of life or many lives. So, the problems in investing are not remotely on the same level. Nevertheless, our claim in this chapter is that we can draw some interesting analogies that have implications for the process of investment. Moreover, as regular readers of our research will know, we are very much believers in the concept of there being a social function of investment. In fact, there are two such functions: the immediate one is to fund the

---

<sup>85</sup> Perrow (1999) p5

retirement and other savings needs of society and the indirect one is to aid the process of capital allocation in an economy and, thereby, influence aggregate growth. In that sense, a loss of wealth or a misallocation of capital can indeed have profound long-term negative social consequences, so the cost of mistakes go well beyond a simple desire to avoid losses.

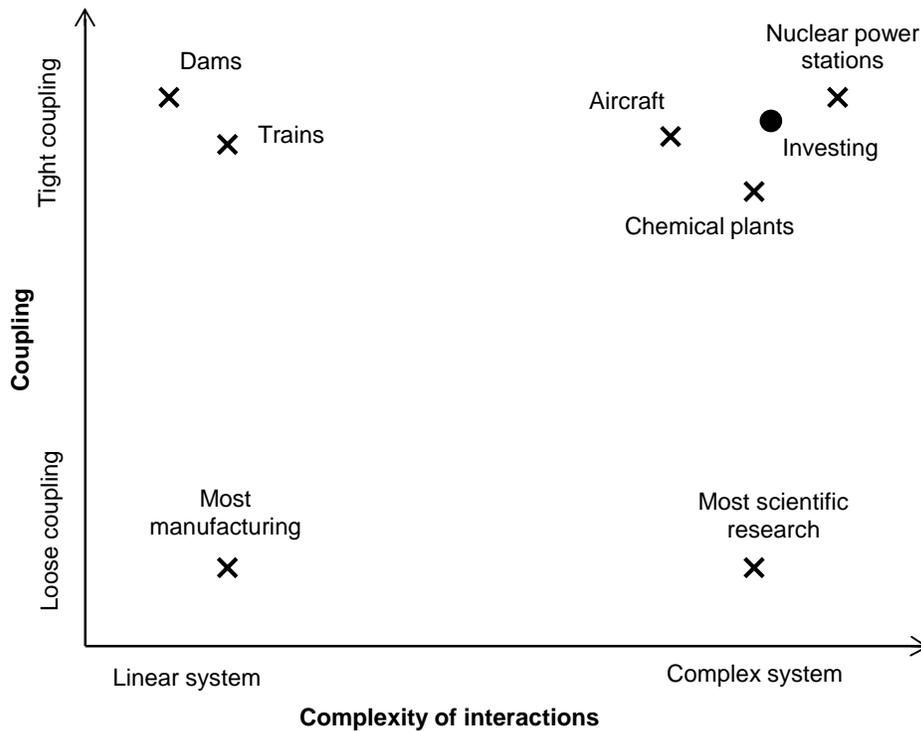
Can we make the case that investing shares the crucial properties that identify the systems we have considered? We think active investment in capital markets does indeed meet the criteria we described previously.

Financial markets are "tightly coupled." There is no opportunity to unhitch one asset from another and observe in a leisurely way the action of one security in response to news before it impacts another. This is evident on a micro scale in the process of intraday price formation with high-speed trading. It is also very evident on a macro scale when crises gradually unfold, such as in the GFC. But it doesn't only have to be in those circumstances where tight coupling applies. It is an inherent function of many aspects of capital markets.

Financial systems and portfolios of securities are also complex in the very specific definition of individual components performing multiple roles. Any asset plays several roles in a portfolio. For example, in a portfolio of single stocks, an individual name can be there to give exposure to an idiosyncratic return driven by the individual prospects of the issuer; to a macro theme on which that issuer depends, or to an overall factor exposure that has nothing to do with the issuer of the security. It can also be there for risk purposes as opposed to return; in that case, the asset serves a purpose which is a function of other assets held by the investor owning the portfolio and is not a function of the economics of the issuer. Generally speaking, all assets continually possess all these properties concurrently and it is not possible to disentangle them.

That leads to the third criterion, which is the potential for incomprehensibility on the part of the portfolio manager when things are going wrong. Sometimes, the interactions and the reason for the underperformance can be baffling and it can be far from obvious how to respond.

We show where various industries or activities lie on these axes of complexity and coupling in Exhibit 19. Most manufacturing is linear in that each machine does one task and loose coupled in the sense that a pause could be inserted in between the separate stages in a production process. Trains and dams display tight coupling in that when a failure occurs it is not possible to detach one part of the process and consider it at leisure. However, each component still tends to perform one task, making the system easier to comprehend in real time. Aircraft, chemical plants, nuclear power stations and, we claim, the daily process of investing are all complex and tightly coupled.

EXHIBIT 19: **Coupling and complexity of different systems**

Note: The figure shows the extent of tight coupling and complexity in different systems. Complexity refers to whether components in the system perform one function or multiple ones; tight coupling refers to how close-linked in time the various stages of a process are. Activities in the top right are both tightly coupled and complex and are claimed to be at greater risk of "normal accidents."

Source: Partly adapted from Perrow (1999) and Bernstein analysis

There have been some attempts to apply Perrow's work to economics and finance, but only in the very specific and macro case of crises. As far as we are aware, it has not previously been applied to the normal daily functioning of portfolios and the making of everyday investment decisions. Two examples of applying it to crises in particular are:

- Bookstaber (2007) examines, using the language of "system accidents," how the make-up of the financial system may make it prone to crashes. This is from the point of view of risk management, where he makes the very valid point that in a crisis normal economic linkages may no longer apply and instead what may matter more is "who owns what and who needs to liquidate."
- Andrew Lo in his testimony to the US House of Representatives in a November 2008 hearing on hedge funds,<sup>86</sup> makes the case that the financial system satisfies the complexity criterion and that the credit relationships between counter parties, in particular, has created tight coupling. He concludes that "Financial crises are normal accidents."

<sup>86</sup> Lo (2008)

In this chapter, we want to go beyond the analysis of crises and apply the concept of "normal accidents" to underperformance or investment errors that can occur to any of the normal investment strategies applied to financial markets. It can also apply in a much more strategic sense to how the investment world approaches the question of allocating to assets in a low-return world as demographics become more challenging, and how to deal with underperformance compared to target retirement outcomes.

### **What can we do about this?**

If this is indeed the case, what can one do about it? Can better technology, organization, or process help? Technology can be helpful, but probably only in limited ways. If portfolio managers are equipped with software that can inform them of the risk exposures of their portfolio along multiple dimensions (e.g., macro risk, factor risk, and the sum of total to idiosyncratic vs. systematic risk), it can help both in understanding how shocks might cause harm to the portfolio and in trying to determine the weight to put on securities in a more rigorous manner. This is not groundbreaking, but we suspect that there is still a lot that can be done to equip managers with such tools. They should be mandatory. It is also conceivable that developments in AI could at some point help with parts of the "incomprehensibility" part of the problem. However, we suspect that in the main, the proper response to this problem is primarily one of organization and process.

One element of the role of organization and process is in the use of checklists. These have been perfected over decades in other high-risk systems, notably in the examples that we have already alluded to for aircraft and nuclear power, but also in a plethora of other high-risk and engineering systems. The same can apply for investing too. The checklists do not have to be dogmatic, as one has to recognize some fluidity in thought processes. However, they may as well be explicit as opposed to implicit, as if they are explicit they can be held up to scrutiny and adjusted, where needed, over time. Such checklists could include basic items such as the return-risk ratio of the proposed trade, its correlation with the rest of the portfolio, the time horizon of the trade, and a stop-loss that might indicate the thesis was not working. It could also include other considerations such as the extent to which the trade relies on mean-reversion versus making a forecast (humans are not very good at the latter, though the former requires patience, which humans tend to lack as well); whether we can say anything about the hit rate of such trades in the past, and the macro environment in which they did or did not work; the extent to which the trade is dependent on macro or micro forces; the factor exposure of the trade; etc.

As another example, we can think what the role of organization and process is when it comes to the running of long-only portfolios comprised of individual stocks. In this case, what this chapter comes down to is an analysis of the steps from selecting stocks to constructing and then managing a portfolio. The step from selecting stocks to constructing a portfolio is a very substantial one, yet we sense that, at least historically, there were some corners of the industry that thought portfolio management was co-terminal with stock selection. We saw earlier that each asset in a portfolio performs numerous functions simultaneously — an idiosyncratic role, macro and factor exposure, and risk control. Such a system is also tightly coupled (we cannot detach one asset from another and, instead, the impact of news will ripple through the system rapidly). Thus, the portfolio management role goes far beyond the process of selecting individual assets.

An organizational consequence of this is that we reject the idea that there is a linear step from the act of stock selection to the process of portfolio construction, for example. Instead, these roles have to be circular and iterative. An example will demonstrate this. Suppose a manager wants to add a new stock into a portfolio. Presumably, research has shown that it is likely that the addition of this stock will increase the information ratio of the portfolio, otherwise why would the stock be added? But that by itself is not sufficient to justify buying the stock, nor does it address the question of what weight to give to it. The portfolio construction problem is often thought of as a constrained optimization, where the constraints are various factors, sectors, and macro risks that have been identified. However, it needs to go beyond that to consider total idiosyncratic risk. Most stocks will come with a portion of idiosyncratic risk and systematic risk, but if adding the stock decreases idiosyncratic risk, then we suggest it should probably in most cases be rejected as it will likely bring the overall portfolio closer to passive competitors (we are assuming for the sake of argument that the fund sells itself as being a "stock picking" fund). If that occurs, then there has to be a loop back to the research and stock selection process in order to find the next best stock that still carries with it enough idiosyncratic risk.

There are other organizational responses in investing that may be required too, but some of them might be harder to pull off as they cover processes that span different corporations. One such area is the whole question of asset/factor allocation, fund selection, and the question of matching investment allocations with needed client outcomes. Here we see a "normal accident" unfolding in slow motion that could lead to a significant underperformance of pension funds compared to their long-run needs, in an analogous way to the slow-motion web of organizational failures that led to the crash of the ValuJet DC-9. We worry that the system of pension plan boards, pension consultants, and asset management firms, with the host of other parties who are in on the act of fund allocation is ill-suited to the emerging world that has three new characteristics that were not a significant feature of the process of fund allocation over the last three decades, to wit: (1) low returns across asset classes, with an associated increased importance of asset allocation; (2) a complete passivization of simple factor strategies, meaning the goal of active stock selection has to be idiosyncratic return not "simply" outperformance relative to a benchmark; and (3) a growing demand for the social function of asset management to be recognized, especially through engagement with corporates and other ESG criteria.

In this case, we suggest the appropriate organizational response is likely to be in making sure that the plan board and the advisors they hire set incentives that genuinely align fund managers with their goals, perhaps rewarding the generation of a return stream in proportion to what it contributes to end-client outcome. Part of this would demand that time horizons on fund assessments are set in a way that is more aligned to the liabilities of the client, which probably means an extension of the three-year norm and a more general matching of governance structures between asset owner and asset manager, particularly when it comes to measuring and recognizing ESG considerations. This should include a debate about fee structure as opposed to just fee level and also one that recognizes "fee allocation" alongside asset allocation and puts alternatives and traditional investments alongside each other and considers their contribution to the asset owners' return alongside their draw on the asset owners' wallet. The fees demanded by pension consultants and their efficacy in asset and fund allocation should also be a part of this.

This chapter is ultimately a plea for more focus on process in investment. The process of selecting stocks, constructing portfolios, and then selecting funds might sound less exciting than making the case for the next big tactical idea, but in the end it is more important. Nuclear power stations and flying aircraft may seem far removed from investment, but we have shown that they share similar features of complexity and tight coupling. The lesson from those other areas is that an organizational response is needed and that is what we propose here to make sure that an improved process of investing is possible.

# SEVEN CARDINAL SINS (OF INVESTING)

## OVERVIEW

In this chapter, we make a plea for a greater role of process in fund management by only half-jokingly asking the question: Can an active manager be without sin?

Okay, we know that is an unusual premise for an essay. But we think the seven cardinal sins are a useful guide to things that investors often get wrong. There is an explicit purpose to this chapter, which is to suggest specific steps to improve active management.

For example, there were failures of process over the last two years when abrupt rotation in leadership hurt many managers. Our suggestions here also seek to offer strategic advice for managers being attacked by passive competition.

**Pride:** Overconfidence leads to some quite specific implications. Investors tend to be too confident in their ability to predict returns, and also in predicting what proportion of returns come from stock picking vs. other drivers. We suggest approaches to portfolio construction that overcome that.

**Envy:** The desire to keep up with peers can distort behavior, leading to either insufficient or excessive risk taking and hurting returns. Asset managers should focus on the real-world liabilities faced by their clients. Envy can also lead to chasing Momentum and to crowding.

**Wrath:** Wrath leads to underperforming positions being sold too soon, and also leads to managers being fired too soon. Asset owners would benefit if the fund measurement period was longer, as it also creates an opportunity in "deep-value" stocks.

**Sloth:** The industry is not working hard enough on portfolio construction, risk management, and asset allocation. Sloth can also lead to failure to understand costs and paying too much for the wrong products.

**Greed:** In a competitive world, there is pressure on analysts to have strong research conclusions. The problem is it leads to selective analysis and data fitting. In practical terms, the assumed required level of statistical significance is often just wrong.

**Gluttony:** Excessive concentration, excessive trading, and crowding are examples of "gluttonous" behaviors in investing, with the current exuberance toward Value stocks one striking illustration of this. Better portfolio construction and risk management can help mitigate this.

**Lust:** It's ok, it's not carnal. But investors do fall in love with stocks, themes, and recent runs of success. This leads to overvalued "glamor" stocks. The good news is this creates opportunities.

**Peccavi:** We have to end a discussion like this with an acknowledgement of our own "sins," which are numerous. Just to be crystal clear, we are not above any of these faults ourselves.

We should make it clear at the outset of this chapter that we are not throwing stones. "Let he who is without sin cast the first stone." Well, the sell-side research community is hardly without sin. Nevertheless, we think the seven cardinal sins provide a useful guide to many things that are wrong with the world of investment. We intend to use this as a guide for what can be done to improve the process of investment decision-making. Rather than just making a list of things we think are wrong, we aim to turn it around to address how these various problems can be alleviated. This chapter focuses on how active managers can improve the core offering which should, in principle, help lead to the goal of generating idiosyncratic returns in particular.

More tactically too, this matters. There were explicit failures in recent years when an abrupt rotation hurt managers, and we think, tactically, another such turn could await. Examples include periods when crowded stocks did well and rapid shifts in factor leadership, e.g., in H2 2016. Given we are using the cardinal sins to provide the template for this chapter, we will use Dante as our guide – who better?

---

## PRIDE

Pride is traditionally thought of as the worst of the seven. Dante placed it at the start of the mountain of Purgatory, and finance is awash with it. The most obvious manifestation of this is overconfidence. There has been much academic literature on the impact of so-called "confirmation bias." This is the tendency of people to assume their thesis was correct or their skill was verified when something they invested in worked, whereas this could have been because of a different reason. We can focus on some specific aspects of this.

A consequence of overconfidence is people's amazing optimism in their ability to predict returns, be it of single stocks or the market overall. In a sense, this is maybe inevitable. If you hire an entire industry's worth of analysts and portfolio managers, and they need to tell stories about why they are adding value, it almost has to be the case that they will think their ability to predict returns is why they are doing their job. But how good are people at actually doing this? We can show that the persistence of returns in the market is low. Instead, forecasting risk is actually much easier – both variance and covariance tend to be "stickier" than returns.

In an earlier chapter "From Stock Picking to Portfolios: A Letter to Fundamental PMs" we showed returns are less sticky than risk. The "Pride" in the ability to predict returns, in too many cases, precludes fully exploiting the persistence of risk. The good news is these things need not contradict each other, and there are clear steps that portfolio managers can take.

The virtue that traditionally offsets the sin of Pride is humility. We think humility has an obvious analog in the choices that PMs make in their approach to portfolio construction. If one assumes one knows everything about future returns and risk, then those numbers can be put into an optimizer to determine portfolio weights. Such an approach may indeed be the only way to proceed if there is a tight tracking-error constraint. What is worse, in our view, would be to focus on the forecast returns alone and not the risk. We do, indeed, see this being done in practice, where the main determinant of weight is the expected upside, with less focus on variance/covariance. To us, that is the worst embodiment of Pride when it comes to portfolio construction.

What is the alternative? If we seek humility, then we suggest the most humble approach to building a portfolio is the equally weighted, or 1/N, portfolio (subject to liquidity constraints). This is humble because it assumes the investor/manager has no view on future returns, variance, or covariance. That is probably a lot closer to the truth than assuming the opposite, which is complete knowledge.

In practice, the assumption of no knowledge is probably too harsh as the stickiness of variance and covariance is enough to at least be desirable for use in building a portfolio. There are smart beta portfolios that are "humble" in that they either equal weight (or "step-weight" to overcome capacity and liquidity issues in comparing very large and small stocks) or at least do not try to forecast return at all (minimum variance and maximum diversification). While we don't necessarily want to endorse these smart beta approaches, the fact that they exist and are attracting assets provides a useful prod to the investment industry. In our chapter "From Stock Picking to Portfolios: A Letter to Fundamental PMs," we suggested a sensible starting default assumption for weighting assets was somewhere between risk weighting and equal weighting. — at least as a starting assumption.

Another area of potential Pride is, perhaps, controversial. Many portfolio managers describe themselves as "stock pickers." A stereotypical example would be a manager who ascribes all his outperformance as coming from his skill in picking stocks. This could be the case. However, our empirical investigation<sup>87</sup> of the drivers of performance of 220 global "fundamental" fund managers over the last five years suggests more than half of their returns could be ascribed to simple factors such as Value, Momentum, and Quality. How do we interpret this? It is perfectly possible that a manager could spend all day thinking about nothing other than single stocks and genuinely believe they are, therefore, building a portfolio driven by skill in stock selection. However, a portfolio is not a stock-picking portfolio just because the portfolio manager asserts it is so; that is not a sufficient condition. Indeed, it is arguable whether it is even a necessary condition. No, a portfolio is a stock-picking portfolio only if an analysis of the drivers of return shows that the portfolio is not driven by regions, sectors, factors, or the timing of the allocations to any of them.

Luckily, there is a solution to this. When adding a stock into a portfolio, aside from the normal question of "does this increase the IR of the portfolio?" a second question should also be asked, "does the addition of this stock increase or decrease the proportion of portfolio returns coming from systematic factor returns?" If it increases that component, then maybe that stock should not be added, however attractive its individual characteristics may be, and instead a different stock selected.

On the first cornice of Purgatory, Dante encounters the proud, who are destined to walk around carrying great rocks on their back to purge them of their sin:

*Those shades imploring, went beneath a weight  
Like unto that of which we sometimes dream*<sup>88</sup>

---

<sup>87</sup> See [The Future of Asset Management](#).

<sup>88</sup> *Purgatorio*, Canto XI

## ENVY

The desire to have what others possess has many expressions in the world of investing. As elsewhere, it has blurred boundaries with Lust and Greed, but there is a very specific sentiment of being envious of peers' investment portfolios and, particularly, of their returns — all of which can lead to very poor decision-making. The pressure — both external and self-generated — to keep up with or beat the benchmark or the peer group can lead to not enough risk taking ("hugging the index," or over-diversifying the portfolio for fear of making the wrong bets and being left behind) or too much risk taking (making large active bets in a bid to ramp up tracking error, active share, and — questionable though the link is — performance), neither of which is good for the end-investor.

The so-called "herd mentality" could also be thought of as driven by Envy. Another hugely popular area of behavioral finance, this refers to "following the crowd" and investing in what is doing well and is popular without due consideration to valuation, risks attached to the trade, and/or how it fits with the end-investors' time horizons and objectives. Chasing High-Momentum stocks and investing in or holding onto crowded assets are behaviors whose perils we hardly need to spell out. Beyond the all-too-obvious example of the tech bubble, one can track the valuation paid for factor attributes in the market and their crowding levels. These are important as they can be a guide to future sentiment-driven weakness.

Dante sees the envious paying a heavy price by having their eyes stitched up:

*For all their eyelids with an iron wire  
Are stitched and sealed, as to a wild young hawk  
That won't be still, men do to quiet her*<sup>89</sup>

## WRATH

Wrath brings about a whole different set of investment problems. One of the historical reasons for it being on the list of sins was it leading to the desire for vengeance. This is evident, we think, in "Deep Value" as a factor and the excessive churning that exists in the industry. This exists in asset owners (or their consultants, at any rate) over-churning fund managers and also in fund managers over-churning stocks.

We address various other aspects in this chapter of why valuation matters, but one specific angle is that "Deep Value" works as long as one is prepared to hold the positions for long enough. This fits nicely within the idea of wrath directed at stocks that have badly underperformed and are seen as "uninvestible" by a number of investors. Definitions of "Deep Value" vary, but as good a starting point as any is stocks that trade on the cheapest decile of price-to-book in the market. We remember showing such a stock list to a client once who said the stock list "made him want to puke" (please forgive the directness). There is, pretty clearly, a risk premium in owning such stocks. There is the risk premium as classically defined, i.e., the forward volatility of such stocks is high and a non-trivial number of them may go bankrupt. There is also the more immediate risk premium in the form of the job security of the manager who bought them. Nevertheless, as long as one holds those stocks for a long time, the returns are high on average. Of course, the definition of a "long time" is critical — it has to be in the five-to-10-year range, which is simply not possible for many asset managers. Fund managers who work directly for asset owners may wish to

---

<sup>89</sup> *Purgatorio*, Canto XIII

place more emphasis on such strategies. Under the Wrath title, we would also worry about the over-churning that exists in the industry. Academic evidence has shown that the three-to-five-year investment horizon so prevalent in the industry is especially injurious, which we cover in detail in the chapter of this *Blackbook* devoted to time horizon of investment.

Dante, as ever, gets to the point directly. Those who have sinned with Wrath have to walk around in smoke that hides their ability to see, as their Wrath did.

*Darkness of hell, and of a night deprived...  
Ne'er made unto my sight so thick a veil,  
As did that smoke which there enveloped us,*<sup>90</sup>

## SLOTH

For Dante, Sloth is about "half way" on the scale of deadliness. Yet, less deadly than Pride or Wrath though it may seem, in the world of investing, Sloth has much to answer for. Indeed, if we start by thinking of all the things that we are aware of commonly doing "wrong" as investment professionals, most of them, at least in part, have Sloth at their root. In this, investing is hardly different from other activities and parts of life.

Broadly speaking, all the mental shortcuts that investors routinely make — from how they assess a "buy" case for a stock, an index, or a fund to deciding when to sell a position, to fire a manager, or how they execute those various decisions — make one liable to the charge.

One important example of Sloth in investing is the perpetual lack of attention given to portfolio construction — in a broad sense, that also includes risk management, execution, and asset allocation.

We have written at length about the fact that there are too many instances — especially among fundamental managers — where a thoughtful approach to how to put a portfolio together is still lacking.<sup>91</sup> That is, beyond deciding what one wants to buy — to which a large amount of resources is dedicated to by the industry — not enough time is being spent thinking about how to weight holdings in view of their individual risk properties, of how they interact with each other, of what the overall portfolio ends up looking like in terms of its risk composition and exposures, and how that fits the mandate and objectives of the end investor. Once the portfolio is built, "tending" to it — monitoring how individual weights and overall risk exposures drift, rebalancing with due care and discipline, checking how each trade affects portfolio risk and its composition (e.g., into common factor versus stock-specific risk) — is also often not given enough attention, or certainly not while things are "working," i.e., while the performance is good.

Yet, portfolio construction is more important than ever today as a means to improve the risk-return profile in a world where returns on equities and bonds can be expected to be low for years to come, which makes every incremental bit of "alpha" even more valuable. Further, it is becoming inextricably linked to the very ability of active managers to sell funds. In a world where active managers face multiple benchmarks in the form of commoditized

<sup>90</sup> *Purgatorio*, Canto XVI

<sup>91</sup> See [Fund Management Strategy: From stock picking to a portfolio - A letter to fundamental portfolio managers](#).

factor exposures or smart beta vehicles, the concept of idiosyncratic alpha becomes key. This, in turn, almost tautologically requires a greater focus on portfolio construction and risk management than when one only had to worry about the market index as a benchmark.

In a similar vein, and linked to this, various layers of asset allocation — from the broadest asset class decisions (including the choice of active versus passive) to intra asset-class allocation to sectors, regions, or various risk premia — are crucial for delivering desired outcomes to end-investors in a low-return world where diversification may be getting harder to achieve.<sup>92</sup> Yet, the industry overall does not work hard enough on these tasks.

Asset allocation is something we want to emphasize separately, as it is arguably one of the most important, if not the single most important, investment decision an investor gets to make. Yet, too much of it is still done in the traditional "60:40" way, or by way of rigidly allocating to the standard "buckets" of equity/credit/sovereign debt/commodities/alternatives, etc. As mental shortcuts go, this is a major and very pervasive one, and we want it gone, as we discuss in [Fund Management Strategy: A short proposal for the future of asset managers](#). The focus should be on the outcome for the end-investor, not on the slothful following of a process just because this is how it has been done in the past and how one is used to thinking about it.

Allocating to smart betas — one of the fastest areas of growth in the industry — has even more of an Achilles heel in this regard as, with some exceptions, typically there is very little formalized process to allocating. The little that is done, certainly in the case of smaller asset owners, tends to be done by consultants, and we worry that this could be done a lot better.<sup>93</sup> It is this area that we think presents a genuine opportunity for active managers to step in, bridge the gap in the offering, and generate active fees.

Yet another example of Sloth has to do with understanding and paying due attention to costs, and to what exactly one is paying for in an asset manager. While the charge of Sloth here may seem to be most directly applicable to asset owners, one could perhaps blame Greed among asset managers for making fee structures opaque and difficult to understand, as well as charging too much for products that underperform.

Costs are just one part of the overall investment outcome for the end-investor — but it is, arguably, the most predictable and controllable one, given how much harder it is to predict both market and individual manager returns. And the fact that costs have an enormous impact on returns over time hardly needs spelling out. Yet, overall, the willingness in both the retail and institutional space to pay for expensive and poorly performing funds simply because of a strong brand, a manager name, recent performance, or inertia remains high.

One can, of course, also attempt to improve net-of-fee returns by finding a winning manager or a winning investment strategy, i.e., focus on the alpha or skill rather than just costs. Unfortunately, we know, and numerous research studies confirm, that this is easier said than done. This is, emphatically, not to say that one should give up on the skill or alpha and focus exclusively on costs. Indeed, at the heart of our work on active management<sup>94</sup> is

---

<sup>92</sup> See [Global Quantitative Strategy: Declining returns and diminished diversification: The great challenge for investors](#).

<sup>93</sup> See [In Defence of Active Management](#).

<sup>94</sup> Ibid

our belief in a low-return world and, hence, the need for active management to generate the returns needed to cover asset owners' liabilities. The key here is to understand what one is paying for in an asset manager and control costs as a way of maximizing the return per unit of fee and achieving the optimal outcome for the end-client. One key concept here is idiosyncratic return as the genuinely active return stream that can justify an active fee.<sup>95</sup>

The task of understanding costs and achieving cost efficiency is not made any easier by what are often hugely opaque and complicated fee structures set by asset managers. One of a plethora of recent studies on this found that pension savers face more than 100 charges, many of them hidden from both pension fund trustees and consumers, which potentially consume more than a third of the value of funds over their lifetime, prompting Andy Haldane — the Bank of England's Chief Economist — to concede even he was "not able to make the remotest sense of pensions."<sup>96</sup> Clearly, this is the issue that the industry, government, and regulators are very aware of and are addressing — whether or not the response is always correct is another matter. We have previously argued the seemingly exclusive focus on fees and costs from some of the legislation is just as dangerous, as it can divert the focus from the overarching importance of the overall quality of the outcome for the end-investor.

The bottom line here is, with regard to costs, a more thoughtful and diligent approach is needed from all parties. It is not only paying more than what is justified that is an example of slothful behavior on behalf of investors. Buying products — e.g., passive or smart beta products — just because they are cheap is just as "slothful." Equally, regulators need to be aware of the "bigger picture," and of the crucial social functions played by active management, rather than focusing on fees above all else. Finally, asset managers can work harder at structuring fees in a way that provides transparency, encourages loyalty to avoid excessive churning, and, ultimately, helps them achieve the best outcome for their clients.

On the fourth cornice, Dante encounters the slothful having to continually run, shouting out examples of zeal and Sloth:

*When at all once, and close behind our backs  
Startling me up, a throng came roundabout,  
Wheeling towards us in their circling tracks...  
Soon they were on us, for the whole great crowd  
Were running at top speed;<sup>97</sup>*

---

<sup>95</sup> See [What is worth paying for in an asset manager?](#).

<sup>96</sup> FTfm: Asset Managers under Fire over hidden pension fees, May 20, 2016

<sup>97</sup> *Purgatorio*, Canto XVIII

## GREED

Greed takes various forms. One is that in a competitive industry, there is a need to show good results. This is not just a question of the performance of funds, however. It takes a more fundamental role in the creation of underlying research on stocks or strategies. Individual researchers, be they on the buy side, sell side, or in academia, all face pressure to come up with views that are high profile. This presumably is strong enough to bias results. Rather than focus on the faults of investment professionals, for this one, we can turn to academics. One of the cleanest examples of the pressure to come up with good results was highlighted in the recent address by Professor Campbell Harvey to the AFA.<sup>98</sup> He undertook an analysis of all papers published on factor effects in top finance journals since 1963. Hardly any papers were published with a t-stat on the factor effect that was less than 2. In order to be accepted for publication, the results had to be perceived as being strong. Also, the number of papers published with a reported t-stat in the range 2-2.6 and 2.6-3.1 was nearly the same. That does not make a lot of sense unless results were being carefully selected to get them into these categories. We have no reason to presume that research undertaken by investment practitioners has any higher standards than this.

Interestingly, Harvey's paper suggests some improvements that can be made to the research process to avoid this problem. Part of this is in setting the right level of t-stat that has to be targeted. In a multiple-testing scenario, the required t-stat for an effect may be over 3. There are also other suggestions such as the desirability of taking "risks" in research, i.e., putting time into projects that may be less likely to pay off, but would lead to genuinely novel conclusions if they did. We like this approach. We wrote on this at length in [Global Quantitative Strategy: Can there be scientific method in finance?](#) Imre Lakatos in his paper "Science and Pseudoscience"<sup>99</sup> suggests for an undertaking to be "scientific," it needs to make genuinely novel and surprising predictions, which are often sadly lacking in finance.

There is a more prosaic problem caused by Greed. The desire for quick profits means investment time horizons are, in general, too short. Yes, there are some strategies that work over short horizons, but the more reliable results from, say, investing in Value or Quality stocks tend to accrue over years, not quarters. If managers are fired for underperforming for a couple of quarters, they cannot afford to take advantage of such long-term effects.

In Dante, for their Greed, the covetous are chained face down so they cannot see the objects they were tempted by:

*On the fifth Cornice, people stretched out here  
Weeping, their faces turned towards the ground.<sup>100</sup>*

---

<sup>98</sup> Harvey, C. (2017), The Scientific Outlook in Financial Economics, available at [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2893930](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2893930).

<sup>99</sup> Reproduced in Curd and Cover, "Philosophy of Science: The Central Issues" (1998), with the paper originally published in 1973.

<sup>100</sup> *Purgatorio*, Canto XIX

## GLUTTONY

Gluttony may refer to prandial excesses, but "over-indulging" is rarely good in any sphere of life — in the world of investing, putting too much weight into one investment is, more often than not, a recipe for disaster. This is hardly rocket science; the benefits of diversification are one of the most basic and fundamental tenets of finance and risk management that exist. Nonetheless, history is replete with tales of bubbles and crashes where investors, individually and collectively, put too much of their money into too few or excessively correlated assets, and had phenomenal runs followed by disastrous endings. There are some investors who can make large concentrated bets and get them right on a sustained and repeated basis. But this requires superior skill in idiosyncratic stock picking and/or in timing (of factors, sectors, themes, markets, etc.) — and the managers who have this ability to generate idiosyncratic alpha through large, highly concentrated bets are, we would argue, a small subset of those who think they do.

The consultant-led (as well as regulator-led) focus on active share as a measure of activity and value added has not helped matters, and contributed to the frantic launching of and flow of AUM into highly concentrated fundamental products, as asset managers have sought to differentiate themselves from passive and defend themselves against the charge of being "closet indexers." We have written at length about the limitations of active share (and tracking error) as a measure of activity, and have advocated the use of idiosyncratic alpha as a crucial measure of how active a fund manager is. "Gorging" on one or two stocks where one loves the story, or on a particular exposure such as Value or Momentum is all very well while it works. But in a world where smart beta makes factor exposures accessible free of charge, such managers can be "passivized" away. Furthermore, without superior allocation and timing skills, taking these large bets is likely to go very wrong when they stop working.

"Gluttonous" behavior is also exemplified by excessive risk taking which, in turn, is often a direct consequence of overconfidence. Research suggests heightened risk appetite often results in excessive trading, which detracts from returns both through poor timing and higher transaction costs.<sup>101</sup>

Dante is overtaken on the sixth terrace by those repenting for Gluttony in perpetual hunger:

*Hollow and dark of eye was every one,  
With pallid face so wasted that the skin  
Had all its contours moulded on the bone;*<sup>102</sup>

## LUST

Well, in the dry world of investment, this is not exactly carnal. But there are equivalents. The most evident is in the overvaluation of stocks that happen to have had a good run, say in terms of earnings growth, in recent years. Often, they are referred to as "glamor" stocks. Investors fall in love with such stocks and inevitably project that growth too far into the future. We can be quite specific about this. Lakonishok, Shleifer and Vishny (1994)<sup>103</sup> show

<sup>101</sup> See Ricciardi and Baker, *Investor Behavior: The Psychology of Financial Planning and Investing*.

<sup>102</sup> *Purgatorio*, Canto XXIII

<sup>103</sup> Lakonishok, Shleifer and Vishny (1994): *Contrarian Investment, Extrapolation and Risk*. As reproduced in Thaler: *Advances in Behavioral Finance Vol II*.

that on average investors project such recent good performance 10 years into the future, whereas in practice firms usually only manage to sustain that growth for one to two years. The result of this is that there is a group of "non-Value" companies on expensive multiples where this cannot be sustained by future growth. Of course, there can be exceptions to this, but the overvaluation of glamor stocks is a function of the Lust of investors rather than an attribute of companies that is likely to change.

There is another kind of Lust in investment too, and that is in emotional attachment to ideas. We wrote recently<sup>104</sup> about how hypotheses in finance are accepted and rejected. The process is rarely as clear cut as Popper would like. While simple tactical hypotheses and predictions can be cleanly rejected when they are wrong, e.g., the prediction of the value of a given data release, it is rare in finance for more generalized theories to be proposed and then cleanly rejected. So it is difficult to precisely say when it becomes illogical to hold on to a thesis in the light of new evidence. One common form this takes is "thesis creep," whereby the reason for a trade is no longer valid but a new one is invented to maintain a justification for the trade.

Dante is startled when he comes upon the lustful:

*Here the bank belches forth great sheets of flame...  
And now from that great heat and heart of fire  
I saw spirits amongst the flames<sup>105</sup>*

## CONCLUSION

So, can an active manager be without sin? Probably not! However, we can do things to improve the process of investment. There is a real need to do this, given the growth of passive and the pressure for active managers to prove their worth. There is also a practical need to address these topics, simply for the purposes of maximizing returns for clients. The good news is that for all these issues highlighted in this chapter, there are potential solutions.

This chapter is an example of what happens if you leave analysts to take long-haul flights with an iPad, a keyboard, and a copy of Dante, and no other distractions (other than the coasts of Iceland and Greenland covered in snow, glowing in the russet-hued evening light). Yet, we hope it is useful in offering ideas for how to improve the process of investment. With this productive flight coming to an end, we can look up and now see the stars.

<sup>104</sup> See [Global Quantitative Strategy: Can there be scientific method in finance?](#).

<sup>105</sup> *Purgatorio*, Canto XXV

## ANTE-DISCLOSURE: PECCAVI

If we didn't address our own "sins" in such a chapter as this, it would give the appearance that we feel we are above all this and do not suffer from these problems. Of course, that is not the case. So, purely in the interests of fair disclosure, we thought we would include a prefix to the usual disclosures with which we end our reports with a few of our own sins.

When we form quant portfolios, it is often hard to calculate the idiosyncratic vs. systematic contribution of the marginal new stock and then iteratively adjust the stock choice or the weight placed on that stock. So we are often guilty of lazy portfolio construction (Sloth).

The time horizon is always shorter than one wants it to be (Greed). We talk at length about the benefits of lengthening the investment horizon, but the unavoidable fact is we operate in a world where quarter-to-quarter and certainly year-to-year performance matters. While there is constantly a fear in investment that certain effects or factors might be "arbitraged away," one thing that cannot be arbitrated away is the differences in investment horizon that end-clients will have.

Although we generally would describe ourselves as contrarian investors and, indeed, we explicitly use the crowding data from our US quant team to avoid overheld positions, there is always the risk of a different kind of crowding. That is, the risk that other macro investors are using the same contrarian approaches (Gluttony).

Then, there is Pride and the prediction of returns. We try to be clear about what things we think we can forecast and those we cannot, but we need to take a view. There are many other sins too, but we include these for illustrative purposes!

BERNSTEIN

# A QUANT MANIFESTO

## OVERVIEW

Quant techniques are growing in investment management and are now more influential than ever, although quant funds *per se* are less popular, having recently suffered several years of poor performance. The term "quant" now encompasses an incredibly broad array of approaches. So, in this chapter, we try to seek out a common thread. We attempt to set out a series of goals for quant investment as we understand it now, think about the business model for practitioners in the field, and also try to identify areas where quant can expand as well as what it needs to do to achieve that.

**Smart beta** is the Uber of fund management. Asset share will continue to grow not because these products are so great, but because this is a disruptive format that is lowering costs and increasing the availability of factor exposure. Let's be clear about what we need and don't need here.

- We don't need any more new indices — enough! There are now more smart beta indices than there are investible stocks. This cannot be sensible.
- We also don't need any more academic papers justifying index  $N$  with behavioral process  $A$ .
- We don't need hand-wringing about whether such strategies are active or passive. Who cares? The distinction is moot anyway.

What we *do* need is a better way of allocating to such strategies and guidance in how to think about them. Smart beta also needs a better name.

**Quant techniques may be the only way to incorporate, on a meaningful scale, the new sources of inputs into a decision-making process that is now becoming available.** The vast amounts of data being thrown up by the litter we leave in social media and the like will require the power to manipulate, use, and deploy large amounts of data. Equally, quant techniques will be important in deciding which types of "Big Data" are *not* relevant to an investment decision. Quant can also be important for incorporating other new inputs into the fund management process, such as ESG signals.

**Portfolio construction is beginning to matter more.** We were always perplexed at why investors put so much effort into trying to predict returns and so little effort in how to turn those predictions into a portfolio. Risk is a lot stickier than returns. Moreover, some smart beta strategies are nothing other than portfolio construction approaches, and they are taking market share. This might be the final prod to make more investors take notice of portfolio construction.

For non-quants, the use of screening to decide what to focus on becomes more important as investment universes become broader. And, at its most minimal, quant can be thought of as a series of checklists. Even the most discretionary investor will surely find it hard to

argue against that as an idea. But let's make the reasons to use screens explicit so they can be held up to scrutiny.

**By stealth, the world has changed in the last decade. We now live in a world where the benchmark has become multivariate.** This is a subtle shift from asset management over the last 30 years. It doesn't matter if the fund prospectus only names one benchmark. It doesn't matter if regulation requires a single benchmark. It doesn't even matter if one dislikes smart beta and commoditized factors, and is dismissive of their utility. The reason for this change is the rapid cheapening of the cost of buying factors. This means measures of activity and skill should be phrased in terms of how idiosyncratic returns are. On this basis, quant is changing the rules for all of fund management.

Bringing this together and attempting to answer some questions about the role of quant investing leads us to declare a **Quant Manifesto**, which we lay out at the end of this chapter.

## DETAILS

---

Quant techniques are growing in investment management and are now more influential than ever before, although quant funds *per se* are less popular, having recently suffered several years of poor performance. There is the rise of smart beta, risk premia investing, approaches using the new datasets of "Big Data" and, much more broadly, in setting the rules of success for all investors in new ways.

The purpose of this chapter is to hopefully shed some light on some big questions about the process and business of investing today. What impact will the rise of quant (or systematic) investments have on "fundamental" or non-quant asset management? What does the current growth of quant approaches mean for legacy quant approaches? Why is there a rise in quant management now? What do we even mean by "quant" investment? And by way of our attempts at answers to these questions, we arrive at a Quant Manifesto — a statement of belief in why quant should continue to grow and why it is a force for positive change. As a manifesto, it is inherently a document that will assert to have normative force. We think that is right as the ideas outlined here will, we think, map out at least part of the approach to investment that will have to be followed by participants in the markets.

We think quant is likely to become yet more influential in a number of ways:

**More influence of smart beta:** As we have said before, we don't like the name, but we use it as that is the common expression for cheap, commoditized, and simple factor exposure. It won't grow because it is so great, but because it is so cheap and increasing the availability of factors. We should think about this as the Uber of fund management. It is disruptive and will likely become much more so. It also needs more work in terms of its offering, especially in the process of allocating to such factors.

**More risk premia:** We use this term to refer to the long-short and often cross-asset exposure to factors. In a low-return world, it could be more desirable; also, investors need the diversification that it can potentially provide in a world where diversification is hard to come by. Under the "risk premia" umbrella, we think there will also emerge a disrupting product for hedge funds that have yet to face cheap commoditized competition. This is also part of the boom in multi-asset products.

**Growth of active quant:** This has been troubled by three to four years of poor performance. However, there is scope for traditional quant approaches to claw back some lost ground and also for new approaches to emerge, e.g., machine learning, text-based algorithms, and massive data manipulation. We argue quant processes are the only way to access the only genuinely new source of input into the investment decision that we have had in decades. Moreover, quant may be the natural way to incorporate changes in investment style that are being needed; by this, we particularly mean the growth of ESG investments.

**Portfolio construction:** Not enough people care about portfolio construction. Risk is easier to predict than returns; yet much more focus is placed on future returns than on future risk. We think this is changing, in part because as returns are lower, managers and investors need to eke out all the benefits they can and also because some investment processes being sold now are pure portfolio construction and nothing else. And they are gaining assets.

**Screening:** One could also set the bar at what constitutes quant at a lower level of sophistication, and on that basis the case for growth becomes even stronger. Fundamental stock pickers have to decide what to invest in. As more assets are run globally and as more EM countries are brought into the potential investment universe fold, the question of how to decide what to focus on becomes ever more pressing. If a manager is running a portfolio of 50 stocks and the universe is 2,000 or 4,000 names, then there HAS to be an initial screen. This could be either explicit or implicit. But if it exists, it may as well be explicit. In fact it SHOULD be explicit, as then it can be challenged.

On a par with screening, the other very broad approach to quant would be to view it in terms of **checklists**. Should any investment decision ever be purely discretionary, or should the approach require an implicit or explicit checklist? As with the screening approach to reducing a large potential starting universe, we suggest making the checklist explicit will help as then it is open to being challenged.

**Robo advisors**, and also potential changes to asset management distribution that at some point could include partnerships with tech companies, as Alibaba has done already.

And the final way quant becomes more influential is in **changing the rules of the game** for all investment processes. By this, in particular, we mean the need for idiosyncratic returns and the new emergence of a multifactor benchmark, which we explain further.

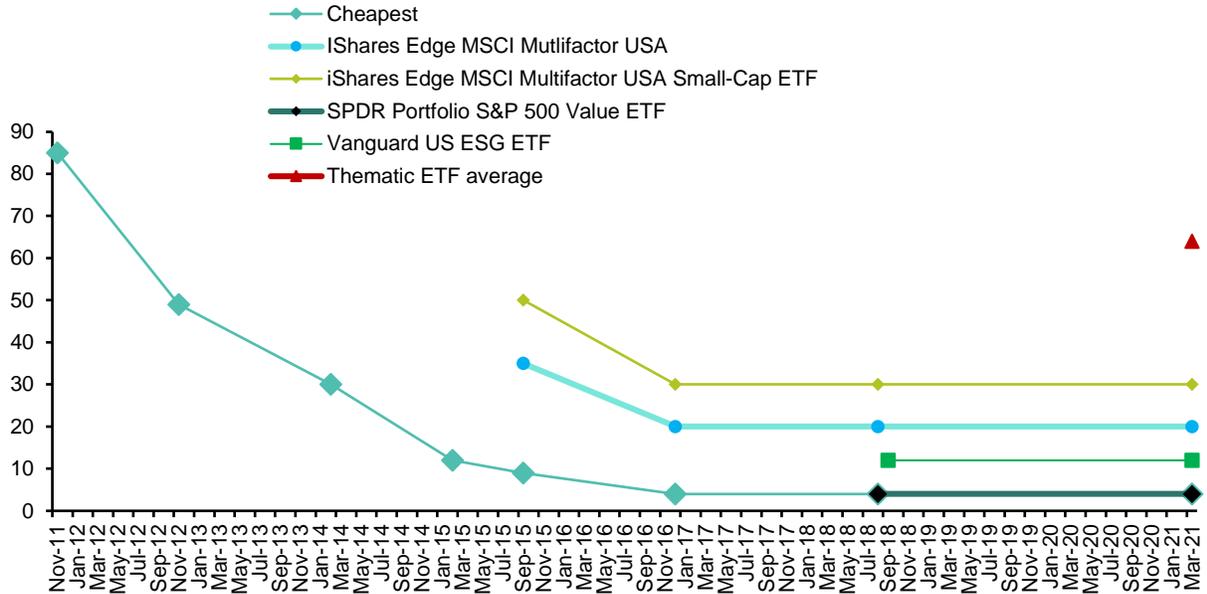
## SMART BETA: THE UBER OF ASSET MANAGEMENT

---

At its simplest, quant in the form of smart beta allows for cheap replication of some of the style factors that have been used by active fund managers to drive outperformance over the last 20 years. The passive replication of these factors by, for example, smart beta ETFs provides a service for asset owners in lowering a cost for something they no longer need to pay a full active fee for. We think the best way to think about smart beta is as the Uber of fund management. It is potentially one of the main disruptive forces in equity investment, and its effects are likely to be soon felt in other asset classes too. It lowers costs for investors and democratizes access to a range of investment returns.

As we have said before,<sup>106</sup> we have a lot of sympathy with Montier's pithy equality of *smart beta=dumb alpha + smart marketing*.<sup>107</sup> We do not want to be mistaken for evangelists for a smart beta approach (or alternative beta, strategic beta, exotic beta, or whatever one wants to call it). Smart beta is not going to grow because it is so good. The strategies used in smart beta are akin to active quant circa 1995. Smart beta is going to grow because it is so cheap. And it is becoming cheaper. In Exhibit 20, we show fees have fallen to now be at around 4bp. We think these can fall further still.

EXHIBIT 20: **Smart beta fees – zero might not be a lower bound (fee level of select smart beta products)**



Note: Data sourced as follows: (1) Powershares RAFI pre 2012 fee referenced in <http://www.ft.com/cms/s/0/5133d548-3a3a-11e2-a32f-00144feabdc0.html#axzz3mdRjfaGM>; (2) Powershares RAFI fee cuts of 21-36bps referenced in <http://www.ft.com/cms/s/0/5133d548-3a3a-11e2-a32f-00144feabdc0.html#axzz3mdRjfaGM>; (3) Pre-2015 average fee level of State Street smart beta products as reported in <http://www.ft.com/cms/s/0/cc2c12da-b04c-11e4-a2cc-00144feab7de.html#axzz3pEk5uFHY>; (4) February 2015 price reductions for State Street smart beta products as reported in <http://www.ft.com/cms/s/0/cc2c12da-b04c-11e4-a2cc-00144feab7de.html#axzz3pEk5uFHY>; (5) GSAM active beta (multivariate smart beta) fee as reported in <http://www.ft.com/cms/s/0/21831abe-61f3-11e5-9846-de406ccb37f2.html#axzz3pEk5uFHY>; (6) Vanguard factor ETF as offered by <http://www.nutmeg.com>; (7) Schwab US large-cap Value ETF from December 2016 prospectus.

Source: *Financial Times* and Bernstein analysis

Here, we are taking a particular strand of smart beta, which is long-only, equity, US, ETF-format smart beta. But that is a large strand, and anyway the pattern holds elsewhere. This particularly strikes a chord in markets such as the UK and Australia, where fees have become the key issue above all others.

<sup>106</sup> See [Global Quantitative Strategy: Is Quant a State of Mind?](#)

<sup>107</sup> Montier (2013), No Silver Bullets in Investing (just old snake oil in new bottles), GMO December 2013

EXHIBIT 21: **Smart beta: what we need and what we don't**

What we need	What we dont need
A process for strategic allocation to smart beta	Yet another new smart beta product launch with a new strategy or new weighting scheme. PLEASE NO MORE INDICES.
A classification of smart betas	Another academic paper on why smart beta approach N will work because of behavioural bias X
A measure of success of a given strategy	Please deliver us from consultants determining the allocation to these products
A better name	Agonising about whether they are active or passive. Who cares? the distinction is dead anyway.

Source: Bernstein analysis

Where perhaps the most work needs to be done is in the allocation process toward smart beta. We don't mean dynamic or tactical switching; yes, we do see a growing appetite for that, but such tactical approaches will always be in the minority. What is of more urgent need is a way of making a strategic or structural allocation to smart betas. At the moment, this is a mess, and one of the areas we think most likely to give smart beta — and quant in general — a bad name. We see many cases where the investment in an often univariate smart beta strategy is being pitched as a replacement to an active mandate with the aim of a significant lowering of the fee. It may well be the right thing for an investor to replace a more traditional active mandate with a collection of smart beta funds, but moving to one smart beta probably makes a very significant change in factor allocation. We worry end-investors at smaller institutions may not fully realize this. We worry more when this process is intermediated entirely by consultants, as the evidence from academia implies they may not be best suited to making active allocations such as these.<sup>108</sup>

Please, asset management businesses, take this out of the hands of consultants and help clients with a better understanding of the benefits of taking multiple factor allocations rather than one.

What we don't need are more indices. Adding on top the other indices available from other index providers and from ETF platforms means there are now more smart beta indices than there are large cap stocks that can be meaningfully invested in by investors. So, our hearts sink when we hear someone has launched a new smart beta index using some new screen or some new weighting approach. What use is that meant to be? We can all produce indices. We can line up as many screening factors as one likes, we can array as many weighting schemes as can be imagined, and hey presto! We will have a superabundance of indices. Many of these may well outperform the cap weighted index. So what? What conceivable value would that add to an investor? There seems to be some woefully mistaken belief that

<sup>108</sup> Jenkinson, T., Jones, H. and Martinez J., Picking Winners? Investment Consultants' Recommendations of Fund Managers, September 26, 2014, forthcoming in the *Journal of Finance* and available at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2327042](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2327042)

the next smart beta index will somehow add something the others have not. One may as well search for the philosopher's stone.

Equally, we have become bored and dejected by the stream of academic or semi-academic articles explaining why smart beta index N will outperform because of behavioral bias Y. Or that someone has discovered a new "anomaly." What anomalies? "Anomaly" only makes sense if there is a prevailing paradigm in a Kuhnian sense, and we don't think the efficient markets hypothesis retains enough credibility to be regarded as such.

The final thing we do not need is more agonizing about whether smart beta is active or passive. Our answer is, so what? The active versus passive distinction was good for the last 40 years of investment management, but the dichotomy has had its day and is no longer relevant. When more end-asset-owners are adopting real return benchmarks such as inflation, then any capital markets investment is active. Moreover, we now think there is a continuum of activity levels within equities, and the distinction between whether strategy A is active or passive is a subjective one in the eye of the beholder.

In summary, there has been a lot of hype about smart beta. This is right in the sense that it is a growing area, but it is growing because costs are falling so fast and it is "disrupting" some areas of traditional asset management. The growth of the last five years has been linked to the launching of new strategies, but the next spurt of growth needs more structure for allocating to such strategies and guidance for a way of thinking about such strategies.

What are the business implications of smart beta? These vary depending on a manager's area of expertise. The provision of commoditized factors is now firmly in the same camp as more traditional forms of passive, and is normally run by the same individuals. With headline fees on many of the products below 10bps, this is a bulk-volume, low-margin effort.

There is still scope to charge a higher fee with more tailored or specialized versions of these strategies, but we think a larger opportunity may exist for the solutions businesses of asset management companies in putting together a strategic allocation to such factors. The other business opportunity for managers is to take market share back from index providers. For index providers, the growth of smart beta has been a fantastic opportunity to expand their business lines that had been based on traditional passive before. Nearly half of the new MSCI-based ETFs launched in 2014 were linked to MSCI factor indexes. Moreover, for 2014, MSCI disclosed that assets either benchmarked to or passively tracking its factor indexes totaled \$122Bn. This was up 69% from the equivalent \$72Bn number for 2013.<sup>109</sup>

Asset managers have effectively ceded market share to index providers in this space for the last three years. There has been a tendency for asset managers to be happy to create smart beta product that bears the brand name not of the asset manager, but of an index provider. There have been several reasons for this. For one, as these products have been sold as semi passive, just having an index provider brand name has been important for gaining the trust of the investment committees of some investors such as small pension funds. Another reason is that it has often been the passive teams within asset management companies that are launching such indices, as opposed to traditional active teams.

---

<sup>109</sup> MSCI annual report available at [http://files.shareholder.com/downloads/MSCI/1406858044x0x816421/CB97F084-029B-4EB8-8330-ACAC47F44904/2014AR\\_832959\\_019\\_MSCI\\_BMK.PDF](http://files.shareholder.com/downloads/MSCI/1406858044x0x816421/CB97F084-029B-4EB8-8330-ACAC47F44904/2014AR_832959_019_MSCI_BMK.PDF)

However, we think investors are starting to look beyond this simple labeling. A bigger reason for managers to fight back against this model is the fee level. When the fees on these products were above 20bps, paying 3bps to an index provider to use their name on the passive replication of a factor index might have been acceptable. But with fees now below 10bps and falling, this no longer makes business sense. The other business opportunity is for the long-short version of smart betas, which we turn to next.

---

## RISK PREMIA

We tend to distinguish risk premia from smart beta by defining the former as long-short and cross-asset, while the latter tend to be long-only and often an intra-asset class. We fully recognize that this nomenclature is still fluid and may (and perhaps should) change in time. However, we think the distinction is important, as there are different clienteles for the two approaches. We discussed cross-asset risk premia in some detail in our initiation report and so will not repeat the material here.<sup>110</sup> But examples would be the long-short versions of strategies such as equity value, equity momentum, rates, carry, commodities momentum, and credit value. We see two distinct markets:

- (1) Sophisticated asset owners who wish to reduce their exposure to traditional asset allocation and instead move to an approach where they are "harvesting" risk premia; and
- (2) Replacing hedge fund positions.

Note the latter is not another "hedge fund replication" strategy where an attempt is made to replicate the performance of an aggregate of hedge funds. Why would one want to bother? Instead, this stems from the observation that some hedge funds suffer from the same issue as a number of long-only funds in that a proportion of returns comes from a linear combination of systematic factor exposures. It is just that in this case, the factor exposure in question happens to be constructed in a long-short way. Clearly, this will not be an issue for all hedge funds — far from it. But, where there is a subgroup living off factor premia dressed up as stock alpha, then there will be a significant fee spread between the current fully active fee and a commoditized factor fee that can be exploited. We think this second use of risk premia can be used as a market that is potentially easier to access and allow for a build-up of investor trust, while ultimately it is the first use that presents more of a profound structural change in fund management, making it possible to set factors as the primary investment building block rather than asset classes.

Risk premia strategies could also be fertile ground for quants, as they are a way to offer products in the area of multi-asset fund management, which is one of the most rapidly growing areas of the industry. As with the other areas of quant we cover in this chapter, we suggest in Exhibit 22 the topics within the development of risk premia where we need more development and also what would be unhelpful.

---

<sup>110</sup> See [The State of Fund Management: Quants Have Destroyed the Active-Passive Distinction](#).

EXHIBIT 22: **Risk premia – what we need and what we don't**

What we need	What we don't need
This is the one area where we actually DO need new indices	Risk premia with opaque construction of their performance indices
More cross-asset application of such strategies	Risk premia with opaque pricing structures that might give the topic a bad name
We desperately need more asset management fund format products	
We need evidence of their stability and liquidity in practice	
A broader group of asset owners to think more strategically about their ultimate benchmark and how they achieve diversification to generate more demand	
Academic work supporting the case for risk premia as an alternative or compliment to traditional asset allocation	
Educate consultants on the advantages of such an approach	

Source: Bernstein analysis

## TRADITIONAL ACTIVE QUANT

So far, we have been talking about forms of "quant" at which many practitioners who have the word "quant" on their business card would turn up their noses. The distinction between active quant and smart beta is bleary, but probably the easiest way to distinguish is that the active quants call themselves quants, whereas peddlers of smart beta do not. One could say the quants follow in the steps of Cecily Cardew when she says "when I see a spade I call it a spade."<sup>111</sup> A more exact distinction would be that active quants are likely to take a more thoughtful approach to factor construction and to factor combination, and probably a much more thoughtful approach to portfolio construction.

This is the group that has come under the most pressure over the last decade. We think there is, in part at least, a sense of the inevitability of the growth of quant in general, given the incessant increase in computing power and desire to lower costs. Some of this was brought upon quants by themselves. There was undoubtedly too much hubris in a quant investment community that had overly relied on backtests in a certain market environment. Some of it was due to a misguided view that somehow anything with the word "quant" was bad, as if the quantitative process of pricing tranches of securitized products somehow meant that Value + Momentum was going to be doomed. Also, quants suffered because they could be identified as a group and held up for examination.<sup>112</sup> People didn't do that for non-quants.

The arguments brought out against what we would call "core multifactor active quant strategies" today are somewhat different.

Has the macro environment killed quant? NO! There is a worry the equity market is now moving entirely in response to common macro forces. There are a few responses to this.

<sup>111</sup> Wilde, *The Importance of Being Ernest*

<sup>112</sup> For example, see Chincarini (2012), *The Crisis of Crowding: Quant Copycats, Ugly Models and the New Crash Normal*, Wiley.

Yes, in an environment where average pairwise correlation between stocks spikes upward, life will be more difficult for well-diversified quant-relative stock-picking strategies. But, that is not an issue peculiar to quant; it will apply to most stock selection strategies, whether systematic or discretionary. (Though we note very concentrated idiosyncratic strategies might be spared.) But also, quant strategies — whether they use dynamic factor allocation or a static approach — should, if well constructed, be predicated on a history of data that includes similar historical periods and learns from them. The current environment is no worse than events the market has suffered before (we are happy to argue with the doomsayers on this point).

---

Within active quant approaches, we think strategies based on traditional multifactor models with simple accounting factors, linear factor combination, and one-off rebalances have probably had their day. Existing ones will probably stand managers in good stead for a few years yet, but we doubt such models can be a source of much new growth. The business case for traditional active quant from here does, in part at least, rely on being able to distinguish from smart beta, including the new multifactor smart beta products. The good news is that is not a problem as quants can differentiate themselves in a variety of ways:

- Better portfolio construction,
- Better factor construction,
- Better factor combination,
- Better trading implementation (i.e., not rebalancing the whole portfolio in one go),
- Allowance for more complexity where justified in choosing factors differently for certain subsets of stocks, and
- The possibility of systematically timing factors.

As your author reeled off this list of benefits in a meeting once the client stopped him and said "*But DUDE [we were in California], you are missing the most important one: alpha*". So, yes, we will allow the possibility that:

- Some quants might be able to generate better alpha through exposure to new data sources, which we turn to next.

We can summarize this with a table of what we think is helpful and what would not be helpful for the further growth in what we would describe as traditional quant (i.e., non smart beta and non risk premia) fund management (see Exhibit 23)

EXHIBIT 23: **Traditional quant fund management – what we need and what we don't**

What we need	What we don't need
Make fund buyers understand the value of lower tracking error, lower active share strategies as long as they are systematic	No new classic multifactor models. Frankly we are bored with these.
New approaches to factor combination	No more “new” accounting factors. There aren't any so don't bother looking.
A new attempt at dynamic factor allocation, the door has opened to more of these	
New inputs (big data, etc)	
Quant as a way to integrate ESG factors (there is an opening to take advantage of here)	

Source: Bernstein analysis

## NEW FORMS OF QUANT

We think the core of traditional active quant also needs to move on. Multifactor models that allow for an efficient combination of traditional factors have been the bedrock of this approach to investing. These models are still very relevant and, we would argue, superior to either single-factor approaches used in many smart beta mandates and also to a less systematic combination of factors. However, it is important to continue innovating. Smart beta is, we think, more of a challenge to fundamental or discretionary investors as the fee spread between their funds and commoditized factors is greater. But multifactor smart beta is a challenge for some traditional quant approaches too.

The increase in interest in factor investing has sparked new interest in dynamic approaches to factor allocation. Moreover, there are many more ways to bring factor combination to bear than in cross-sectional regression models, for example, considering their different alpha decay times.

Another whole field has opened up in the manipulation of vast datasets. We think there are no new factors when it comes to standard reported accounting data, but one of the biggest changes happening now is the multiplicity of other sources of previously unstructured or unobtainable data. Nearly all this requires a large data manipulation ability, and the rapid response to it may require machine learning. In many cases, a pure data mining approach may well not be appropriate, but the lessons from guiding model construction using more traditional data to select stocks can be used.

In fact, the integration of data previously not used in finance into the asset management process is broader. One growing area of demand is for funds that incorporate an ESG score or process. In one sense, this had historically been seen as a problem area for quant as the list of long data histories made the traditional backtesting approach harder to use. But actually, in some areas, quant is being seen as the most efficient way to mix this new input into creating a portfolio that also uses more traditional financial factors. This point was recently well made by the *Financial Times*.<sup>113</sup>

<sup>113</sup> Quants are the new ethical investors, FT January 24, 2016 <http://www.ft.com/cms/s/0/35798046-a33c-11e5-8d70-42b68cfae6e4.html#axzz3yuV0aOWY>

## CHECKLISTS AND SCREENING

There are two other ways that quant could be defined that set the bar much lower in terms of what constitutes a quant process: these are the use of checklists and also screening, and are essentially quant inputs that non-quant investors could (we argue "should") use. If we define quant in this way, then it encompasses many, many strategies — in fact, maybe all strategies. So we would not want to describe people who use such approaches as quants, but the input is systematic in nature. In both the case of screening and checklists, we suspect many managers may implicitly use such an approach. But the point that both have in common is there could be advantages in making such a process explicit as then it can be challenged and tested.

In the most general case, a checklist for making an investment could be a series of decisions to test if an investment is a good fit for a given strategy. Why wouldn't one do this?

The use of screening is a more obviously quant process. Even though pension fund consultants have, in general, been very disparaging of active quant for much of the past seven years, they have been actively encouraging fundamental investors to make more use of screens to underpin their process. This is made more urgent by the increasingly global nature of mandates and the inclusion of EM markets into benchmarks. This means the potential investment universe is huge. In such a case, there will probably be, at the very least, a need for an implicit filtering process as a precursor to more fundamental stock analysis. But if the screen exists, then why not make it explicit?

We can summarize our views on the use of quant processes by non-quant investors by thinking about what would improve such non-quant funds and what would be unhelpful (see Exhibit 24).

EXHIBIT 24: **Use of quant by non-quant investors – what we need and what we don't**

What we need	What we dont need
More attention to portfolio construction by fundamental managers	Another person saying that "I like this stock the most so I will give it the biggest weight"
More checklists for assessing fundamental/discretionary positions	Emotional factor selection disguised as stock selection "alpha"
Explicit recognition of factor risk and idiosyncratic return	
Use of explicit screens to reduce the universe of possible investments	

Source: Bernstein analysis

## WHAT IS QUANT ANYWAY?

A distinction is often made between quant and fundamental. This is embedded as a distinction in the industry. We don't really like the distinction at all, as a quant strategy can equally well use a "fundamental" input as well as a technical-type input. A much better distinction would be between systematic and discretionary. Given the name "quant" on a fund has generally become less popular, this evolution may take place in time anyway.

As should hopefully be clear by now, we think "quant" is now a very broad term covering a multitude of different investment approaches. This is different from how quant investing was perceived (both by its practitioners and by external observers) before the financial crisis, when there was more of a canonical approach.

What status do quant strategies have? Underlying the use of a quant investment process is, at the very least, the assumption that an observed regularity will persist into the future. This is true even for dynamic factor allocation processes, where the persistence is one of the processes of factor rotation rather than a given factor itself. But, as with any system based on an assumption of the persistence of regularities, what reason does one have to believe that an observed regularity in financial markets might continue in future? In recent years, proponents of quant finance have increasingly turned to psychology and the field of behavioral finance to "explain" observed phenomena. Such a line of reasoning can be helpful in suggesting why Value or Momentum effects often exist. For example, Value is usually explained as participants in the market projecting the recent past too far forward into the future. It has been suggested that for a company that has recently managed to outgrow the market, investors on average assume this superior growth 10 years into the future and value it accordingly. However, in reality, superior growth at the company level usually only can be maintained for two years. When this is realized, the premium valuation is unwound. The opposite state of affairs holds for companies that have recently undergrown the market, and hence, the Value effect follows.<sup>114</sup> The behavioral approach seems promising as markets are, after all, the result of many thousands of human interactions. Even as more capital is allocated by machines, it is plausible that some behavioral effects could persist. However, a major problem we have with relying only on behavioral explanations is that all of them (to our knowledge) are used for post hoc explanations of behavior. Here, we use behavioral explanations as an example. We suspect for nearly all factors or strategies in quant finance, they were observed first and "explained" (if at all) after the fact. There is nothing wrong with this as far as it goes, but for at least several hundred years one of the main supports for believing that scientific theories have latched on to something in the world that really exists at the theoretical level is their ability to make novel predictions.

This is one of the core arguments made by so-called "realists" in the philosophy of science who believe there really is a theoretical structure of the world "out there" to be discovered, and that possibly some laws of nature might have latched on in some way to this structure. Examples of novel or surprising predictions abound, but one striking example is the prediction of the existence of Neptune. It was noted that the observed orbit of Uranus did not exactly comply with the one predicted by Newton's laws, but Adams and Le Verrier in

---

<sup>114</sup> See Richard Thaler, *Advances in Behavioral Finance* Vol III (2005) for a comprehensive collection of key papers on this. Especially the 1994 paper by Lakonishok, Schleifer and Vishny, "Contrarian Investment, Extrapolation and Risk," which forms chapter 8.

1846 demonstrated it could be made to fit if an as yet unobserved planet was postulated to exist. When astronomers trained their telescopes on the area of the sky in question, sure enough, they observed the never-before-seen planet, subsequently named Neptune. This was rightly seen as a major support for the theoretical structure being used.<sup>115</sup>

At stake is the status of financial theories — how much should we believe in them and to what extent can they be used to make predictions? It is part of a wider debate as to whether there are indeed any theories in the social sciences or whether they constitute "pseudoscience." We turn to this in a separate chapter.

What conclusion can we draw from all this for quant finance? Most importantly, please note we are not at all intending to sound negative on the whole project of using quantitative models as the basis for investment. We emphatically do not support the idea that because some quant models have fared poorly at various points over the last seven years, the whole approach should be abandoned. Instead, we want to draw attention to the importance of understanding their limits and trying to understand what information is needed to encourage support for such approaches. Finally, we again stress that recognition of such limits should put quant investing at a marked advantage over "fundamental" investing, where the limits and status of the investment process are much harder to ascertain.

**Idiosyncratic returns: Why quant is changing the rules for everyone and the emergence of a multivariate benchmark, whether you like it or not**

As the active-passive distinction evaporates, a more relevant question is: what kind of activity does a manager offer? First, our basis for saying the active-passive distinction no longer exists is the growth of products that lie in between the two, and also the increased adoption of real benchmarks by asset owners, which mean the decision to buy any capital markets product is an active one. However, if a given benchmark is specified then, within equities, broadly three categories of activity are possible:

- Strategic factor exposure (i.e., a persistent factor bias that is not timed);
- Timing (e.g., of market risk, factor risk, themes); and
- Stock picking.

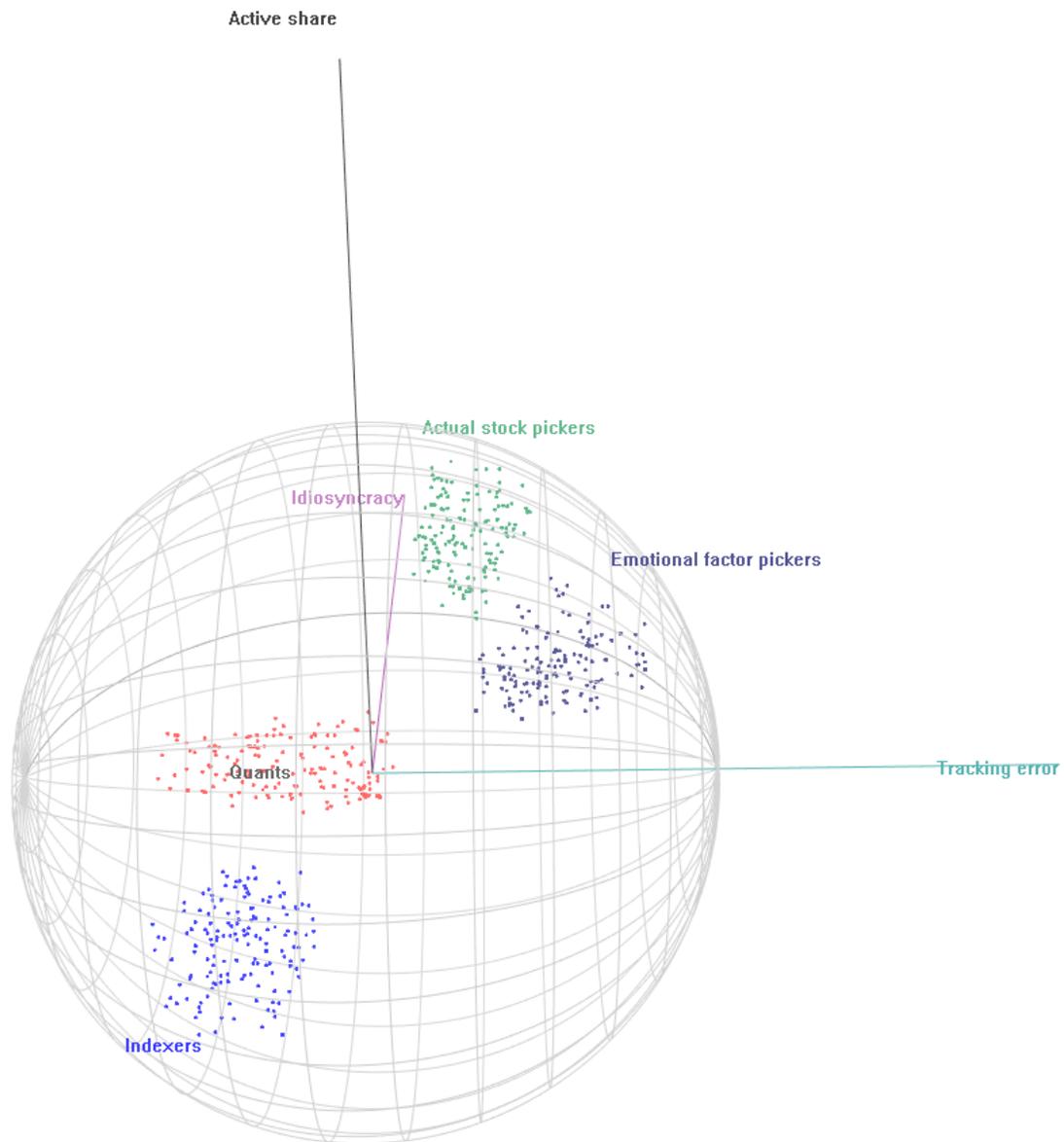
We think three axes of fund activity are needed to map out managers and distinguish their sources of activity and, ultimately, their type of skill: tracking error, active share, and idiosyncratic risk. The latter is the share of a fund's activity that comes from sources of return not captured by strategic exposure to systematic risk factors, as has been explained extensively in our Alphalytics research.

We show these three axes of activity in Exhibit 25, along with suggestions of where manager groups might lie. Quants are usually low active share and have a tracking error that is likely to vary from low to middling, but can achieve idiosyncratic returns. Therefore,

---

<sup>115</sup> Although we note Le Verrier tried to repeat his success by postulating a new planet named Vulcan to account for the orbit of Mercury, which also did not comply with that predicted by Newton. However, no such planet was observed, and we had to wait until Einstein threw out the whole of Newtonian theory before the orbit could be explained. We learn there is no hard and fast rule as to when a theory needs to have extra assumptions tacked onto it or when it has to be abandoned.

they can aim to be in the back half of the sphere. The real distinction comes within the universe of fundamental (non-quant) funds, where we distinguish between actual stock pickers who have high active share and tracking error, high idiosyncratic returns, and what we call "emotional stock pickers." The latter group look like they are active because they have high active share and high tracking error, and they might even *think* they are active as they select individual securities, but really they are just inefficiently reproducing factors. While the former group have, we think, a stable outlook and no need to reduce their active fees, it is the latter group that are going to come under pressure — both on pricing and in terms of reputation in an environment where market participants are quick to point out so-called closet indexers.

EXHIBIT 25: **Spherical classification of active managers**

Note: Figure shows where different groups of asset managers are likely to lie on three axes of investor activity: tracking error, active share, and idiosyncratic returns. Tracking error is defined as the time series standard deviation of deviations in return from benchmark, active share is one half of the sum of absolute weight differences between the portfolio and its benchmark, while idiosyncratic returns captures the proportion of returns that are not due to common style factor exposures. The clusters of points indicate where we believe different managers lie. For example, indexers have a low level of activity on all three measures, and actual stock pickers have a high level on all three measures. The group of investors who have high active share and high tracking error but only exhibit low idiosyncratic returns we call "emotional factor pickers." For active quants, we suggest the goal is likely to be high idiosyncratic returns, low active share, and a range of tracking errors from low to medium, dependent on risk budget.

Source: Bernstein analysis

The broader point here is that quant is changing the rules of the game for all fund management. There has been a subtle shift in the last couple of years from a univariate to a multivariate benchmark. Not everyone realizes this yet. Importantly, it doesn't matter what the fund prospectus says the benchmark is, or that regulation specifies that a single benchmark is identified, or that the manager may dismiss smart beta and disagree with the notion of commoditized factors. The multivariate benchmark of cheap factors is now a fact of life because these factors have a cost close to that of the traditional cap weighted benchmark.

---

## A QUANT MANIFESTO

In setting out this view of what quant asset management can offer, we are also led to a more normative approach to methodology. The natural culmination of this view would be a Quant Manifesto.

Many in finance may automatically think of Marx and Engels and their 1848 *Communist Manifesto* when we speak of a manifesto. Our favored model would more be Marinetti and the *Manifesto of Futurism* of 1909:

*"We had stayed up all night, my friends and I, under hanging mosque lamps with domes of filigreed brass, domes starred like our spirits, shining like them with the prisoned radiance of electric hearts. For hours we had trampled our atavistic ennui into rich oriental rugs, arguing up to the last confines of logic and blackening many reams of paper with our frenzied scribbling,"*<sup>116</sup> wrote Marinetti. Well, this chapter was mainly written staying up on a plane instead (we think Marinetti would approve). Marinetti set out a prescriptive new path, so we attempt to do the same for quant. In following the form of the Manifesto as an expression of ideas, it also allows us to break out from the more dull, normal bullet point-based language of financial analysis.

---

## ARTICLES OF A QUANT MANIFESTO

(1) The world of stock picking has lazily wallowed in taking factor exposures and hidden behind their benefit. We reject the simple exposure to these as a form of active management. To those who are in a factor-hugging closet, "come out!" we say. There is a more noble cause. The future is an idiosyncratic one. Rejoice in this!

(2) Cheap factors cannot be uninvented. Their influence will grow from the remorseless logic of lower costs. Seek not to question this, such is progress. Quant, in fact, can be nothing but violence and destruction. Weep not and move on.

(3) There is no room for more smart beta indices. What drudgery it is to create more of these and what lack of ambition does it show? No, we reject the need for more of these and we cry "enough!"

(4) The debate on whether new factor approaches are active or passive amounts to so many scholastics debating angels on pinheads. Who cares? The active-passive distinction has had its day and is relevant no longer.

---

<sup>116</sup> <http://www.italianfuturism.org/manifestos/foundingmanifesto/>

(5) Let us demolish all those supposed new accounting factors that academics and practitioners all too often announce. We should burn the pronouncements of such new factors. There are no more! We need to search elsewhere for new forces to underpin our models.

(6) Take up your pickaxes and hack away at the old quant multifactor models. Let your hearts be warmed when you see these models die and sink away into a primordial morass of decay and putrefaction. They are old and their time is past, and we should not shed a single tear as the last of them is ripped out and spat upon. No, we need them no longer. Look up and not back at these poor beginnings.

(7) Let us look up and seek inspiration in new tools that have been given to us. New datasets arise from the litter trail left in social media from the mass of people. What other way can there be than a quant one to tame these and use them on a scale to change the investment world?

(8) Let us further take heart in new ways to combine the factors we have. We look to nature, for what other true guide can there be? The TREE that starts from its single trunk, and by twists and turns, leads on up to myriad leaves is our template for knowing in which state of the world we find ourselves.

(9) Oh the non-believers who ridicule portfolio construction as beneath their dignity, the world has changed and DEMANDS that they take note. Taking a crowded and common factor risk will end with them being burned in the purgatory of factor rotation.

(10) For those who say Value has stopped working, we hurl back the suggestion as it is the only true tool we, as humble students of investing, can bring to bear.

(11) Here, at the rebirth of quant influence, we challenge those who stand in the way. The rise must be violent. All change that is good is born this way. Enough, enough, of the overly emotional story-led approach to investment.

BERNSTEIN

# **Foundational Issues in Finance**

BERNSTEIN

# CAN THERE BE SCIENTIFIC METHOD IN FINANCE?

## OVERVIEW

No.

But rather than give such a monosyllabic response, the next 4,000 words are an attempt to see why there cannot be, but yet at the same time explore whether there is a weaker description of scientific process that can be applied. What does this mean for the way we arrive at investment decisions? Investment is plagued by a reliance on story-telling, a low hit rate of success, and an opaque link between the decision-making process and the quality of the outcome. How can this be improved?

Finance can never be a science. It can never have theories with a claim to universal explanatory power. It also generally does not allow for experiments, at least not as they are generally understood in science. Having said that, we argue there are elements of scientific methodology that can be applied in finance.

If Popper is our guide, then an endeavor is only scientific if its theories make statements that are refutable by experiment, and once refuted a new theory must be developed. Finance fails at this. Either its statements that are attempts at theory (e.g., the CAPM) do indeed make predictions but then fail in tests, or else hypotheses are often too vague or in need of too many auxiliary hypotheses to be tested in a pure form.

However, luckily for defenders of financial research, most of science fails Popper's test too. This chapter explores whether there can be a weaker definition of what constitutes a scientific method that finance can aspire to. If the measures of scientific method in fact lie in the existence of a community of practitioners that debate evidence and are genuinely willing to question accepted beliefs, then finance may have something to learn of direct relevance.

For this to work it does, however, require a bridging of the gap between merely "experiencing" phenomena to testing via experiment. Financial research has to get as close to the latter as is possible.

We do not wish to deride those in finance who suffer from physics envy. Finance can never attain the theoretical universality nor the experimental purity of physics. However, it is far, far worse not to try at all. Without an attempt at rigorous methodology, finance reduces to storytelling. There is far too much of that in the profession. Luckily, there are lots of ways in which financial research at least can learn from the methodology of science.

## DETAILS

It has often been said that those engaged in financial research suffer from physics envy.<sup>117</sup> There have been many attempts to describe "laws" or "principles" of finance; there are those who even use the phrase "investment science"; and others who mistake mathematical description of markets (which is a good thing and, indeed, necessary) with the mathematical expression of physical theory. Just because the math used may be the same does not mean the two fields have equivalent status. Finance is not science and never will be for a host of reasons. Much of the difference comes down to the absence of an equivalent theoretical structure in finance (financial theories can never be universal) and the fact that financial systems are self-referential (participants in markets change their behavior in response to evidence about behavioral effects in markets).

Rather than address the question of what status theories in finance can have, we want to ask a more pragmatic question here. Are there aspects of scientific *method* that can be applied to the process of investment? We scorn physics envy for being mistaken, but what is worse in our view would be no attempt to learn from the process of the sciences. Investment is plagued by a reliance on story-telling, a low hit rate of success, and an opaque link between the decision-making process and the quality of the outcome.

We have written<sup>118</sup> about how the quality of the (net-of-fee) investment outcome has to be the core measure of success in fund management. It strikes us that a good way to achieve this would be to link the success of the outcome to the process of investment and to make the process iterative in some way. Maybe that is obvious, but it strikes us as being very far from the reality of what we see when investment decisions are being weighed up.

In science one often says a theory replaces one that has gone before when it subsumes the explanatory power of the theory that went before it and expands its explanatory reach (ok, there is more to that debate, but that is beyond the scope of the current topic), but in finance the explanatory regime often seems more contingent and temporary, and anyway cannot have the same theoretical ambitions.

Finance is more empirical, and will always remain so. If finance lacks robust theory, the way to proceed to gain explanatory relevance for financial phenomena is likely to be inductive and not deductive, as a deductive route has no generalized theoretical base on which to start. So we can rule out the pure deductive approach of Descartes as a guide at the first hurdle. Francis Bacon seems a more appropriate starting point. In the *Novum Organum* published in 1620, Bacon rejects deduction from a priori statements and instead sets out the classic argument for inductive reasoning. One should lay out all the relevant examples of the phenomena under investigation and draw conclusions from them.<sup>119</sup>

If the inductive process is relevant in finance then maybe, from a methodological standpoint at least, finance and science have a common starting point. We work from particular empirical observations to generalizations (PMLs have increased, labor markets have

---

<sup>117</sup> See, e.g., Lo (2010), "WARNING: *Physics envy may be hazardous to your wealth!*," available at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1563882](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1563882).

<sup>118</sup> See [Fund Management Strategy: A short proposal for the future of asset managers](#).

<sup>119</sup> Sometimes when faced with researching a topic on which he has no priors, your author adopts a consciously Baconian approach and arranges all the relevant charts on some given investment theme side by side and starts by just looking at them (often arranged around one's seat on a long-haul flight).

become tighter, 5y5y inflation swaps have moved up, we observe a wide spread of valuation multiples across the market, and conclude that we are in a cyclical upswing and pro-Value phase of investing). However, merely enumerating observations is not enough and it is a point where the methodological practice of finance and science probably necessarily diverge. Science has been rooted in the primacy of the experiment for providing the empirical input that anchors science. It is hard for finance to conduct experiments in the same way; in finance, it is probably fairer to say that we experience events but that is not the same as running an experiment.<sup>120</sup>

A crucial difference lies in the repeatability of experiments. In chemistry or physics, if the same experiment is repeated multiple times it is assumed to give the same answer. This is not quite as pure as it sounds, as a decision has to be made about what are the relevant things that have to be kept constant and, in fact, this decision is laden with theory. As an example, if the experiment involves boiling a liquid, then if it is conducted at a different altitude, the answer may be different. So, an assumption has to be that altitude is kept constant.

We can imagine a typical quant research process taking the form of backtesting a combination of factors over a two-decade time frame. In a sense, it might feel like an "experiment" if one tests five different permutations of factors over that two-decade period. The researcher might conclude that Value and Quality together are an attractive combination of attributes for companies to have that are followed by outperformance on average; at the same time they may reject other measures. It seems problematic to us to conclude that this is genuinely an "experiment" though. It is all "in sample" and conducted within a confined block of time. Some of this can be mitigated. The best practice that we know of in such cases is where researchers are denied access to the full dataset and forced to run tests constrained to just portions of the dataset (say only on European stocks 1990-2010). When hypotheses have been tested on such a subsection, they can then be run "out of sample" e.g., on European data post 2010, or applying the same technique to the US data. The point of such an approach is that it gets one at least closer to the idea of a scientific experiment. If we allow that there may be a spectrum of what counts as an experiment, then methodological steps can be taken to move the process of financial research at least closer to science.

But in questioning whether or not such a process can strictly have the same status as an experiment in physics or chemistry, we do not want to in any way belittle such an approach. Whether this counts as an experiment or merely an experience, it is still far more valuable that it is done than not tested at all. Can we formalize this process and understand the sense in which the best of financial research can approach the methodology, at least, of science?

Popper pointed out<sup>121</sup> that if we collect empirical evidence and look for confirmation of a hypothesis it is always easy to find. He suggested that confirmation should only count if it is the result of a risky prediction. By "risky" he means a prediction of an observation that would have been genuinely surprising had we not advanced the hypothesis in question. For

---

<sup>120</sup> Wootton (2015) has an excellent discussion of the evolution of the word experiment in its modern sense in English in the mid-17<sup>th</sup> century, and how experiment came to be distinguished from a mere experience of events.

<sup>121</sup> See "Conjectures and Refutations," as reproduced in Curd and Cover, *Philosophy of Science: The Central Issues* (1998) p7.

Popper a process is scientific if the hypothesis being advanced makes predictions that are refutable by evidence. Any theory that is not refutable by any conceivable event is non-scientific (Popper used this as the basis to declare astrology, Marxism, and psychoanalysis non-scientific. Astrology's predictions are too vague to be refuted; Marxism did indeed make testable predictions but they were falsified, and psychoanalysis was, he concluded, simply not testable).

How would this work in practice in finance? We could take a widely used model such as the Capital Asset Pricing Model (CAPM) that links forward expected return of assets to their systematic risk. The problem is that it falls at the first hurdle. There is no evidence that greater systematic risk is rewarded by higher return; if anything the converse is true, and yet that is a widely taught model. Thus, some of the most developed theories in finance fail in the same way that Popper concluded Marxism failed. The theories lead to testable predictions, but then are rejected by those tests. We would argue that the situation is much worse for the day-to-day investment decisions that are the bread and butter of finance. Many of them are too vague or else include so many auxiliary hypotheses as not to be testable in their pure form in practice. So, much of financial research is either too vague to be scientifically tested or else make predictions, elements of which are then falsified.

Luckily, for those depressed by the comparison with astrology, it turns out that it is very rare for science itself to pass Popper's test. This led to a series of attempts by philosophers of science to see if they could save the idea of a clear line of demarcation between what counts as a scientific method and what does not.

Thomas Kuhn is famous for his suggestion that the corpus of scientific knowledge moves by way of more abrupt changes. Since he wrote *The Structure of Scientific Revolutions*<sup>122</sup> the term "paradigm" has been woefully overused as to almost lose its meaning. But it is important in extracting elements of scientific practice that may be relevant in finance. Kuhn's suggestion is that the overwhelming majority of science is conducted within a prevailing paradigm that defines the theory, metaphysical structure, and even the language within which a community of scientists conduct themselves. In that phase of "normal science," the practitioners are not trying to overthrow or challenge the accepted theory or paradigm, that process occurs only at discrete points when "revolutions" occur. That progression of "normal science" within a paradigm could in part be applied to much of financial research.

Imre Lakatos in his paper "Science and Pseudoscience"<sup>123</sup> offers an alternative view and claimed that what really counted as support for a theory was to make a "dramatic, unexpected and stunning prediction" and that "when theory lags behind facts, we are dealing with miserable degenerating research programmes,"<sup>124</sup> a poignant comment indeed for those of us in finance. He came to this conclusion because when it comes down to it, all theories fail to fit all the observed facts. There are always anomalies where extra "auxiliary hypotheses" have to be postulated, but making a prediction that was genuinely unexpected before and to see it empirically verified provides strong support that the theory

---

<sup>122</sup> Kuhn (1970)

<sup>123</sup> Reproduced in Curd and Cover, *Philosophy of Science: The Central Issues* (1998), with the paper originally published in 1973.

<sup>124</sup> *Ibid* p25

is useful. In quantitative finance, bold predictions drawn from a wide-ranging theory are rare and maybe never occur. Having said that, we can think of parallels in finance, at least on a micro level. If an analyst examines an industry or a market and concludes that it will take a path that no one expected, and that indeed comes about, then we could plausibly say that they stuck their neck out, made a risky prediction, and were right. The problem is that if this is the result of "fundamental" analysis, it may not be directly repeatable, though presumably there is a parallel that could be used to assess an individual. How many genuinely stunning predictions would an individual need to make for them to gain a following? Three? Five? Ten? The problems for using this as an approach in finance probably are more to do with deciding what actually constitutes a genuinely novel or stunning prediction, and also keeping track of all the failed attempts at prediction. In addition, individuals are often accorded high praise when they have made just one stunning prediction that happened to be right. Moreover, this is only of relevance for future predictions if it uses exactly the same process by which the earlier predictions were made. In fundamental financial research, this is rarely, if ever, the case.

It is hard to find theories that can really stand up to this test of refutability and/or make stunning predictions. As a result, an alternative line that can be taken is to turn more to the social aspect of a discipline be it finance or science. As an example, the philosopher Paul Thagard<sup>125</sup> suggests that a theory or discipline is pseudoscientific if it has been less progressive than competing approaches, but its practitioners fail to properly evaluate their theory in relation to others and are selective in considering confirmations and disconfirmations. By this definition, what makes a methodology or research program scientific is whether there is a community of practitioners who agree on what the research program is, care about measuring their success in explaining the phenomena under discussion, and actively try to find evidence that confirms or refutes their hypotheses. Taking the field of quantitative finance as an example, it seems plausible that a claim can be made that it would meet this looser definition of being scientific in its methodology.

In his magisterial recent history of science, Wootton (2015) claims the birth of modern science can be located to 1572, when Tycho Brahe observed a new star. What made an observation<sup>126</sup> of a new celestial object the starting point for science? Wootton asserts this was because astronomy from that point "had a research programme, a community of experts, and it was prepared to question every long-established certainty."<sup>127</sup> (In this case the long-established certainty was that there was never any change in the heavens and that all movement in the heavens is circular. Brahe demonstrated that the new object he observed had no parallax against the fixed stars, and so had to be much further away than the moon.)

The early development of science as a profession was marked by the formation of such communities. In Gilbert's historic publication on magnetism in 1600, he acknowledges the existence of a small community of experts engaged in the study of the topic. This approach eventually led to the foundation of the Royal Institution on Albermarle Street, London in

---

<sup>125</sup> Paul Thagard, "Why Astrology Is A Pseudoscience" in *Philosophy of Science Association*, 1978 Vol 1, edited by P.D. Asquith and I. Hacking (East Lansing: Philosophy of Science Association, 1978).

<sup>126</sup> Note this is just before the invention of the telescope.

<sup>127</sup> Wootton (2015) p1

1799, which was held up as an archetypal scientific community, differentiating itself from the "unscientific." If this is the guide, then it gives us the basis for more hope and, maybe can be relevant to our field, as these criteria could in principle apply to financial research.

Note, that in stressing the importance of a community of experts and, more specifically, of a research program as the defining features that are of importance in the context of finance, we are in no way espousing a relativist interpretation of science and, by extension, of finance. It has become popular in some circles to assert that scientific knowledge is a construct of the social setting within which it originates. Wootton (2015) gives an extended rebuttal of this, but the most eloquent expression of the difference in a scientific exercise undertaken by a research community rather than a pseudoscientific one has to be Sokal's hoax of 1994.<sup>128</sup> The physicist Alan Sokal submitted a sham article to the cultural studies journal called *Social Text*, which was a fake essay filled with jargon that had no meaning whatsoever. The article was accepted for publication and Sokal immediately went public with the news that the article was fake, much to the embarrassment of the academics in cultural studies departments and the glee of physicists. The moral is that there has to be a climate of challenging accepted views within such intellectual circles and, in particular, challenging with empirical evidence.

#### **An end to storytelling in finance**

So, what can be drawn from this to improve the process by which investment ideas are formed? There is probably no way to make the formation of investment ideas "scientific" in any strict sense. But much of this comes down to the end-goal of finance as not being generalized theories but instead much more contingent and locally-relevant observations of regularities. However, that does not mean finance has not got a lot to learn from science. For the purposes of our discussion here we can leave aside the big questions of whether or not there are theories in finance and what the goal of the study of finance should be. Instead, we can be humbler and focus on methodology.

The critical point is that we need to call an end to storytelling. The finance profession is beset by it. Yes, this is a people business just as much as (maybe more than) a numbers business, so relationships need to be intermediated by an explanation in plain language (at least so far in any case; robo advisers are an interesting example of taking humans out of the selling loop to a large degree). Linked to an over-reliance on story-telling, there is a bias in favor of using confirmation as a guide for believing in hypotheses or following individuals as apparent luminaries.

This is a poor way to proceed. If the most engaging story is the basis of investment decisions, then we may as well be making predictions from astrology. Especially in the case of deciding what fund manager to invest in, it would be very hard to have confidence in predicting ex ante who would make a good investment. If that is the core of active decision making, then investors may as well all go passive. Fees are known ex ante, but the linkage of stories to future returns is not.

This is where a philosophical discussion about scientific method becomes directly relevant for the process of forming investment ideas. Within finance, there is a very lively testing of

---

<sup>128</sup> See Weinberg (1996).

theories and specifically within the subarea of quantitative equity strategies, competing attempts come and go. If techniques are used, such as the ones we have described here to make the process of testing financial hypotheses at least a little closer to the idea of a scientific experiment, then the practice of financial research becomes stronger. While we would not go so far as to claim that anything in quant equity investment is deserving of the label "science," it can at least learn from science in its practice. Such an approach could be used to distinguish between differing individual investment ideas (should we buy stocks with characteristics X or Y when such-and-such macro event occurs?); different hypotheses (is what matters most for investment at the moment the direction of Fed policy or the outcome of elections?); different strategies (should we define the FCF Yield factor this way or that way?); and even whole research programs within finance, whereby some could be regarded as more "scientific" than others, i.e., how much confidence should one put in technical analysis (probably not much) versus quant or fundamental research.

In order to achieve this, what is needed is process. We don't need to be overly dogmatic about what this process actually is. Luckily, it does not in any way force a similar investment approach on everyone, but it can be adapted to many different types of investment. For example, this could take the form of looking for specific combinations of financial metrics to make an investment attractive. Another approach would be to use checklists before deciding upon an investment. Yet another would be to insist on rigorous attention to portfolio construction.<sup>129</sup> One can imagine many such examples either applied to single securities or to index-level macro trades. The key thing is that there is a feedback loop that allows an assessment of the process to be made. With a willingness to reject it, this would involve at least a semi-quantification of the investment process. Ideally, this would also involve a testing process for hypotheses that tried to get as close as possible to the idea of an experiment. The history of science since Brahe's observatory has also relied on the existence of communities of participants who were able to debate and argue about the interpretation of the evidence. On that point at least finance is not lacking. Let's just stop the storytelling.

---

## READING LIST

One of the best and most original recent books we have read on the history of the scientific revolution is Wootton's 2015 book, *The Invention of Science*. It gives a very comprehensive account of the development of what we now think of as the scientific revolution, but in the process includes new data that has been carefully collected on such things as the rate at which the circulation of text books of the Ptolemaic system declined after Galileo published his observations. He also includes an exhaustive analysis of when the words "facts," "experiments," and "laws" came to be first used in English in their modern form (the answer is around the 1660s). All this allows for a much more detailed analysis of exactly *how* the process by which science was done evolved. It ends with a robust and elegant broadside aimed at the tendency over the last 30 years to interpret science in a relativist way and wants to push back on the suggestion that choice of scientific theories is purely a product of the social circumstances under which they are developed.

---

<sup>129</sup> We write at length on the importance of portfolio construction as part of the process of investment in the chapter "From Stock Picking to Portfolios: A Letter to Fundamental PMs."

The writings of Popper are often the starting point for a discussion of scientific method, as he gives a very clear and stark account of what constitutes science and, therefore, what distinguishes it from pseudoscience. See his short essay "Conjectures and Refutations" as reproduced in Curd and Cover (1998). The other giant in the field is Kuhn with *The Structure of Scientific Revolutions* (1970) that sets out the view that radical change in science occurs in discrete steps when paradigms are overturned.

For those who want an overview of important essays in the field, there are several good anthologies of the key works. We would recommend Curd and Cover (1998), *Philosophy of Science: The Central Issues* and Lange (2007), *Philosophy of Science: An Anthology*.

# WHAT IS A MODEL?

## OVERVIEW

The adoption of Big Data and AI is bringing about a profound change to the content of financial research. Is this change just a matter of degree or are the models that use these new approaches utterly different in nature? In order to answer this, we need to explore foundational issues in modeling. A key question is whether financial models are "merely" trying to predict or whether they have to offer explanation as well. We highlight challenges that new techniques will have to answer in order to meet the higher bar of explanation.

**What is a model?** We start with this most basic of questions. Are models created to explain or to predict? For a model to be useful, does it have to be true? We consider these issues in the context of fundamental analyst models for companies, quant multifactor models, contemporary macro models for inflation, and the CAPM.

**What constitutes explanation?** We review the possible role of a model in explanation and ask can a false model still offer explanation? For a model to explain, does it have to offer a causal mechanism?

**Big Data** is starting to radically change the types of models used. This immediately raises concerns of data mining. To what extent are they the same as the data mining charge that has been levelled against quants for decades? Such models can offer a new challenge though if there is no theory or even commonly accepted methodological form on which to base them.

**Machine learning and AI** are only in their infancy in their adoption in finance and we think are set to have enormous influence. At one level, such models also have to answer a data mining charge. It is one thing to use a larger dataset, but quite another if non-linear approaches are used to hunt for patterns in that. They also offer more profound challenges that go to the heart of the question of "what is a model?". For example, can such models be said to explain if they offer rule-like results without actually having any encoded economic rules.

The pursuit of a more data-led approach may be the near-term consequence of the adoption of Big Data and AI in finance. We argue that this happens to coincide with a post-GFC zeitgeist that is suspicious of financial theory. Thus, in the near term, prediction may be a good enough goal for models. However, we suspect that in time the higher hurdle of explanation will also be required. AI and Big Data are poised to revolutionize modeling in finance, and in the process are likely to change the profession. The difficult challenge will be in how the act of explanation is carried over into a new form of model.

## DETAILS

---

There is no greater change happening to the *content* of financial research (as opposed to the mechanism for paying for it or the macro context in which it operates) than the adoption of Big Data and machine learning/AI. This is a large claim, but we think that it is as profound

a change to the way financial research is conducted as the switch from modeling on paper sheets with pencil to computer spreadsheets that took place in the 1990s. But is the AI and Big Data approach to financial modeling merely "an extension of modeling by other means" to paraphrase von Clausewitz, or is this a wholly new approach?

Our aim in this chapter is to address the philosophical issues raised by the application of Big Data and AI to financial modeling. In order to do this, we need to address foundational questions in financial modeling. The use of Big Data (or at least bigger data) is becoming more widespread, but the adoption of AI to investment is still in its early phase. As these trends become more established, we think it will make the topics that we address here progressively more urgent.

We start by asking the question "what is a model?". Foundational issues such as these are important, as we suspect we are seeing a profound change in the way models in finance are developed and used. The application of Big Data to financial modeling often takes the inputs to a model away from those suggested by theory, posing questions of data mining. The further application of AI to those datasets poses an even more fundamental question of how models are derived and of how we should think about the status of such models.

### **What is a model?**

This may seem like an odd question. In finance, we immerse ourselves in creating, using, or adapting models every day. But what are the required characteristics of such creations? We might say that models are needed to explain phenomena, or that they are used to make a prediction. What are they required to achieve in order to make a plausible claim to explanation or prediction, and do they need to be grounded in a theory or financial "law" to have any significance?

It seems to us that models are often used to explain phenomena, or at least some aspect of them. Frequently, in practice, they are also held to a lower standard which is "merely" to perform a prediction. There is nothing wrong with a model that only seeks to make a prediction with no ambition to be a description of how things really are. Some of the most important developments in the history of science have been presented that way. For example, Andreas Osiander added a preface to Copernicus' great work *On the Revolution of Celestial Spheres* in 1543, without the author's permission, suggesting the book should not be regarded as being true or even probable, but that it would just make the math easier.<sup>130</sup> That might have been an attempt to ease the reception of a heliocentric universe, but also may have been how many of the work's early readers viewed it. In the end, however, explanations do matter, and the best models seem to provide these. One clear case where prediction is not enough and explanation is required is when it comes to models that underpin policy changes. But investors like to have explanations too. Explanations are especially valued when things go wrong (i.e., when people lose money). At least a part of

---

<sup>130</sup> As an aside, see the wonderful discussion in Wootton (2015) on the marginalia in the surviving copies of the first and second editions of Copernicus that casts a light on what the first readers actually thought about the work. The conclusion is that they did indeed follow the suggestion of Osiander and see the new theory as merely a device to make calculations easier and not as being "true" in any sense.

the problem of many quant investment approaches in 2007-08 was their inability to offer an explanation.

If a model aims to explain, what does it have to do to achieve that aim? The traditional approach taken in the philosophy of science is the deductive-nomological model. The idea is that an explanation works by being grounded in a theory or law that is established or accepted. This over-arching theory perhaps offers a sense of unification by being used in many different settings. With that as an anchor, the explanation offers a link between that accepted base and the thing that is to be explained. This is often expressed in the form of a syllogism:

*Law or theory*

*Initial conditions*

*Therefore: Observed phenomenon*

There is a debate about whether this is indeed the way science works in practice. In the social sciences such as finance, this seems especially problematic. We can legitimately ask whether there are in fact any laws in the social sciences, an issue we discussed in the previous chapter. A problem with this structure is that there are no universal generalizations in financial theory.<sup>131</sup> Instead, it seems more likely that any law or theory in social science is "merely" a *ceteris paribus* condition. That is to say that all theories in finance are merely a statement about a regularity that can occur if A happens, but as long as conditions X, Y, and Z are held constant, and even then the self-referential nature of financial systems means that such statements only apply for a certain period of time. This is very different from, say, Newton's Second Law of Motion that simply asserts that force = mass x acceleration, with no other conditions required. We note that some philosophers would say the same restrictions really apply for all science.<sup>132</sup> Another way that some philosophers have thought about theories in finance and economics is that maybe they describe a tendency. For the tendency to be plausible though, it probably requires some view of a causal mechanism being at work. In that way, the theory may seek to reflect an underlying process even if in practice that process is continually interrupted by disturbing factors. Thus, the deductive-nomological form may face challenges in its application to finance because of the nature or status of the starting theory.

Can we use models to explain outside of this context? Does it matter if a model is not embedded in a theory? After all, many models that are used on a day-to-day basis to value companies do not necessarily directly appeal to theory but instead resort to commonly-accepted practice or rules of thumb. There have been various attempts in the philosophy of science to pin down what the status of a model is, in contrast to a more over-arching theory. One such attempt is to drop the idea that a model has to be true in order to explain. A

---

<sup>131</sup> No statements in the social sciences can be universally true. An example cited by the philosopher John T. Roberts is the example of the "law" of supply and demand. We posit that if supply of X increases while demand remains the same, then the price of X will decrease. But this can never hold universally. What would happen if the government imposed price controls or (as Roberts points out) if a comet was due to collide with earth within a few hours? Then the statement would presumably not apply. Such a statement cannot be truly universal.

<sup>132</sup> See, e.g., Cartwright (1983) and Cartwright, "Causality, Invariance and Policy" in Kincaid and Ross (2009). Cartwright also rejects that truth is required for explanation.

possible path here is to describe a model as a "credible world."<sup>133</sup> On this account, models do not attempt to describe the world as it actually is, but how it could be. Specifically, such a model describes an imaginary world in which causal relationships are known by construction; the model is then viewed as "credible" if it agrees with our sense of how the world works.

If the idea of explanation without truth seems hard, then an alternative is to say that models are heuristic and are not explanatory in the traditional sense. For example, Alexandrova<sup>134</sup> suggests that models have the status of an "open formula." That is to say they take the form:

In situation x, with some characteristics that may or may not include {C1, C2...}, a certain feature F causes a certain behavior B.

This is very different from the claim:

There exists a situation S with characteristics {C1, C2...}, where certain feature F causes a certain behavior B.

In the latter case, we are saying that a given situation with a certain causal structure does exist. In the former case, we are only outlining a template for a causal situation that may exist. This structure can then go on to help in the formulation of a hypothesis about causal explanation if we fill in exact examples of x. However, that comes at a later stage in the process, so the model itself serves a heuristic function.

The problem is that most models are unrealistic in a number of ways. Is it possible to distinguish between the unrealistic-ness of economic models versus realism about the models. Maki<sup>135</sup> suggests that models might not be true *per se*, but can reflect a truth about the key or relevant aspects of the causal process of a system, and in that way could be said to explain. In this way false idealizations can still serve an important purpose. He suggests that "economists build and use unrealistic models with unrealistic assumptions aiming at isolating possible mechanisms that also unify."<sup>136</sup> This results in what he calls "local realism." What is meant by this, is to contrast it with physics. To espouse realism with respect to theories in physics is to hold that the theories are predictively successful and that they are approximately true and, crucially, that this is the case in an all-encompassing universal way. By contrast, and as the name implies, a local realism view holds that such claims only apply locally.

In summary, models perform many roles in finance. Sometimes they are used to explain and sometimes to predict, ideally they should do both. If they seek to explain, they might have to be true, they may also have to suggest a causal mechanism. But that seems like a high hurdle, given the simplicity of many models and the complexity of financial systems. One possibility is to take the view that models do not need to be true in order to explain. Another

---

<sup>133</sup> Sugden (2000)

<sup>134</sup> See Alexandrova and Northcott, "Progress in Economics: Lessons from the Spectrum Auctions" in Kincaid and Ross (2009).

<sup>135</sup> Maki, "Realistic Realism about Unrealistic Models" in Kincaid and Ross (2009)

<sup>136</sup> *Ibid*

possibility is to deny that models actually explain and instead hold that they perform a more heuristic function.

If models are required to predict but not explain, that may make the situation less complex. As we pointed out, there is a long and illustrious history of models being used to predict without an attempt to explain. However, in that case the model presumably has to have a limited domain in which it holds (if it was not limited, then it presumably would actually offer explanation) and those limits have to be understood. Also, models that are used for prediction have to be plausible. The process by which models in finance are adopted has a far, far lower threshold than in science, but models can be dropped quickly if they are perceived to have failed to predict and do not offer explanation.

### How does this apply to actual models?

Consider:

- An analyst model for a company based on discounted future cash flows,
- A quant model that selects stocks to buy based on a set of accounting and technical factors,
- A contemporary inflation forecasting model, and
- The Capital Asset Pricing Model (CAPM)

The analyst stock model typically has the form:

$$P = \sum_{k=1}^n \frac{D_0(1+g_1)^k}{(1+r)^k} + \frac{D_0}{(1+r)^n(r-g_2)}$$

Where P is the price of the asset, D the initial dividend cash flow, r the (constant) discount rate, and two growth rates assumed in an initial phase and a terminal phase. Such a model normally leads to a forecast price that is not the same as the price in the market. In what way could we say this forecast is the "true" fundamental price of the stock? It is not true if that is not the price observed in the market today. Instead, we say that *if* the future stream of cash flows was such and such and *if* the discount rate was X then this would be the price of the stock. But leaving aside the point that the discount rate can never be observed, this would be incomplete; stock prices fluctuate on intra-second time scales and such a model structure is not intended to account for that. At such time scales, very different models are required that do not reference future cash flows at all. Given such restrictions, such a model cannot claim to be true; instead it seems we are to interpret it more as a *ceteris paribus* prediction. Given this restriction, it is not clear to what extent such a model can be said to explain the subsequent movement of a stock price.

One intriguing possibility is that because company valuation models such as this are so ubiquitous and taught on every finance MSc or MBA program, that maybe they could indeed offer some notion of a causal mechanism. This could be the case if the management team of the company were themselves using such a model and changing the course of company policy as a result.

A classic multifactor quant model would often take the form:

$$r_i = \beta_1 x_{1,i} + \beta_2 x_{2,i} + \dots + \beta_n x_{n,i}$$

Where  $r$  is the forecast return of asset (e.g., a stock)  $i$ ,  $\beta$  is a coefficient on a factor (e.g., Value, Momentum, etc.), and  $x$  is the exposure of the  $i^{\text{th}}$  stock to the  $n^{\text{th}}$  factor. Here the claim is that the future return on a stock is the sum of the products of factor coefficients and exposures to those factors. Typically, the exposures are determined either by a regression or from the intersection of current prices and accounting data. The coefficients are either derived from a different regression or set in accordance with some *a priori* view (we suspect that this is normally derived from the quant analyst's personal experience rather than any theory). To what extent can we say that this model explains the future performance of a stock? Such a model is pretty clearly not causal as the "explanatory mechanism" at work would be of the form: "Stock A rallied because it had a 40% exposure to a Cheap PE factor, a 40% exposure to a High Quality factor, and a 20% exposure to High Momentum." We do not think that such a sentence meets the standards required of what one would demand from an explanation. Such a model is, we think, a good example of a purely "local model" that is merely trying to make a prediction for a certain group of stocks at a certain time. To be fair, such models are not normally trying to claim more than that (though they are often frustratingly unclear about what the exact bounds of applicability are).

Currently, one of the most critical issues for both policymakers and investors is the path of inflation and the key question of whether there is evidence for continued reflation. Understandably, this is consuming a considerable amount of analytical resources. A respected example of the type of model used for those trying to analyze inflation is the St. Louis Fed inflation model known as the price pressures measure.<sup>137</sup> The model has 104 input datasets arranged into nine factor groups and takes the form of an ordered probit model. Such a model yields an output which is the probability that inflation will exceed a given level over the next 12 months. The inputs are a very wide set of pricing and activity indicators such as consumer prices, commodity prices, labor market indicators, and business and consumer survey data. All these seem plausible metrics to give a handle on inflation, and the probit structure appropriate for answering questions of the type "will A be greater than B?"

However, it seems hard to claim that such a model can "explain" a given level of inflation. To be fair, the model is probably not intended to serve such a purpose either; so, to expect it to explain is taking it outside the domain for which it was intended. But let us ask the question of whether it can explain anyway, as an example. The model by itself could not serve as the starting line for a deductive-nomological explanation as discussed earlier, as it does not have the status of an accepted theory or law, it does not offer any ability to unify diverse phenomena and ground them in a common point for explanation. Nor does it indicate any causal mechanism. It offers a link between data series that all seem to be plausible indicators of inflation. It is silent on the underlying economic or social processes underlying those data series which are the result of the aggregate actions of millions of people. Instead, the aim of such a model is to produce a forecast. The forecast is also "local"

---

<sup>137</sup> <https://research.stlouisfed.org/publications/economic-synopses/2015/11/06/introducing-the-st-louis-fed-price-pressures-measure/>

in the sense that it is clearly predicated on conditions that have held since the mid-1990s, which happens to be the period over which the data series have been chosen and the coefficients fitted. It would presumably not be expected to hold in a different regime. Standing back from these points of detail, we would also suggest that any model that had 104 input data feeds grouped into nine factors would probably not be able to explain even if it did offer a causal mechanism. We seem to require theoretical parsimony for a satisfactory explanation, though for prediction that host of variables might possibly be quite acceptable.

To be clear, we are not criticizing this model in any way. We are very respectful of it. It achieves what it sets out to do, which is to act as a predictor of inflation. We just wish to point out that it does not attempt to explain.

The CAPM has been a starting point for a massive amount of financial analysis since it was first proposed in the late 1960s. Its basic form is familiar. For the purposes of screening individual companies on the basis of expected return it is often stated as:

$$r_i = r_f + \beta_i(ERP)$$

Where ERP is the equity risk premium. It would be very useful indeed if one could simply link the return demanded on an asset to its systematic risk. But to what extent does the CAPM explain? Is the CAPM true? Does it predict? Can we even say it meets the low bar of describing a "regularity"?

In a sense the CAPM does seem to potentially have explanatory power. It sits within a theoretical structure set by Modern Portfolio Theory. If investors operate within a Modern Portfolio Theory paradigm, because that is what they have been taught at business school say, and care only about systematic risk that they cannot otherwise diversify away and if they seek to be mean-variance efficient, then the CAPM would, in theory, tell us the return that they demand from a stock. In that sense, it would explain the observed behavior of stocks and offer a form of causal mechanism via the demands and actions of investors. The structure of the explanation would be in the simple syllogism of the deductive-nomological model:

*CAPM*

*Stock A has a  $\beta$  of  $x$*

*Therefore: expected return of stock A is  $y$*

However, that explanation crucially rests on the assumption that the CAPM is true. If it is not true, then it may not be able to explain the observed return of stocks, nor can it offer a causal mechanism via the demands of investors. So, is it true? There is a wealth of empirical evidence that suggests that in fact it is not a true description of stock returns. The empirical evidence against suggests that it cannot even claim to meet a weaker hurdle of offering some true likeness or verisimilitude. Finally, can it predict? Well not really. Were a sell-side strategist to offer a screening of stocks basing their future returns only from their beta, they would be given short shrift.

So, what role exactly does the CAPM play? Despite all this it seems to still have a use, is still widely taught, and referred to in practice. This mainly comes from serving a heuristic role. We could say that, *ceteris paribus*, it describes a required return that investors *should* tend toward. This is very different from, say, the multifactor quant model of stock performance that may be locally more accurate in prediction, but, we would suggest, does not have a heuristic role at all.

### Big Data

Possibly the biggest change that is currently happening in the content of financial research is the adoption of Big Data. It is not necessary for this chapter to describe the scope of new datasets, but most readers will be aware of the near-ubiquitous commentary on datasets, such as sentiment from news reports, satellite imagery, feeds from logistics operations, information from payment companies, etc. There are two characteristics common to most of these datasets that are germane to our discussion. First, as the name implies, the datasets are usually of a large size and, second, in many cases the nature of the data is not at face value directly linked to the traditional staple of financial accounts, pricing data, and analyst earnings forecasts.

The size of such data immediately prompts data mining concerns, which we consider. While these are considerable, they are not necessarily different in nature to the historical issues associated with quant modeling over the last 20 years. One area where there can be more of a divergence, however, is that in the application of Big Data to investment, there is often an absence of any guiding theory in how to use datasets that lie outside the usual cannon of accounting, pricing, and estimates data. Thus, the types of models developed are not necessarily embedded in an established theoretical world view.

Quants have often had a gung-ho approach to data mining and have happily run mass regressions on data in a trawl approach to find patterns. Campbell Harvey showed<sup>138</sup> that finance academics claim to have "discovered" 314 factors over the last 40 years. That is just the academics. The buy- and sell-side quant community will have claimed to have uncovered many more.

Is Big Data any different? The positive difference is this allows for much more specific data that might be suspected to be linked to some underlying causal process at work for the pricing of companies. For example, tracking actual underlying demand for a given good. However, the more negative difference is that there may be no overarching theory guiding the choice of variables or the structure of the model. This leads to a situation where the same dataset is used to both form the structure of the model and to fit the model, in a sense the very definition of data mining. We would argue that the most *plausible* quant models historically have been constructed to use a combination of some guiding theory (or at least a common sense guide to their structure if not actual theory) with an empirical over-ride.

When new "big" datasets are used, there is a danger that analysts tasked with using them start running blanket analyses looking for relationships with target variables of interest, e.g., future returns or earnings. Financial models could in theory either be arrived at deductively, working down from a theory, or inductively starting with the data. Big Data

---

<sup>138</sup> Harvey (2015)

tends to imply an inductive approach. The philosophical problems with such an approach go back to the problem of induction, which asks how a mode of reasoning which is in essence amplifying in its approach can guarantee that the next case fits the previously observed ones. The classic case being the fact that all swans observed in Europe were white until Willem de Vlamingh made the first recorded sighting of a black swan by a European in 1697. Until that point, the inductive process would lead to the statement that "all swans are white," but then that reasoning was shattered.

If we go beyond models for prediction, then the potential problems become even harder, e.g., if the aim of the model is not "merely" to predict but also to try to explain. Our earlier discussion asked whether explanation requires truth and/or causal mechanisms. In attempting to infer a generalized statement from a series of specific observations one faces what is known as "underdetermination of theory by the evidence." The issue is that there are likely to be many possible theoretical statements that could fit the observed data. Imagine we observe a series of data points and wish to set out a functional form for an equation that fits them. It is likely that we would have a choice of progressively more non-linear forms that could fit the observed data. We may say that we wish to be parsimonious and select the one with the lowest power function, but we have no way of knowing if that represents the true pattern, or indeed whether any true pattern in fact exists.

If we consider that explanation requires a causal mechanism, then the data-led approach is even more problematic. Determining causal relationships from data is very difficult, and some would argue impossible. Since David Hume, many philosophers have argued that one can never observe a causal relationship.

Having said that we probably need Big Data to move to a next step in financial modeling, it gives an opportunity to potentially change financial modeling in a radical way. The availability of data and computing capacity now is a chance to evolve financial modeling. Our goal here is not to suggest that this should be curtailed in any way but to improve the robustness of such models. Also, the adoption of Big Data is going to happen anyway, whether or not people have theoretical concerns. Attempts to improve the use of Big Data could either focus on the methodology associated with the extraction of information from such datasets or else a selective view on what the aim of such modeling should be.

One way to head off concerns and to keep models based on Big Data within the realm of historically established models is to use models that are underpinned by established theory. If theory *per se* is not readily available, then at least one could aim for models underpinned by prevailing practice and rules of thumb. This latter approach is clearly a much lower bar but still would provide more robust models. As an example, one could cite that there is a widely accepted set of investment models that aim to find candidates for stocks that will outperform by hunting for characteristics such as "Value plus a catalyst," where the catalyst could be a Momentum measure, an earnings announcement effect, etc. A Big Data approach could fit in such a framework, most obviously to fulfil the role of the catalyst, but also conceivably as the Value measure as well. The advantage of such an approach would be not only that it fits an accepted template, but also that one could hold up such a new model against an accepted "benchmark" model that used the same template and test if the Big Data approach offered a quantitative improvement. This is an approach suggested by White (2000), albeit not applied to Big Data.

While such an approach may have attractions in limiting the risk of being led down a path of false inferences, it clearly forgoes the ability to extract the full power of Big Data. It assumes we have a theory in which to ground a model or a template model from a small data world that can be applied. Some of the most exciting data sources are ones where it may not be obvious what predictive power they have. If no such structure is available, then it may be possible to adopt methodological criteria to temper the risk of unwarranted inferences.

Consider a dataset that includes the variable that we wish to forecast (the price of an asset, say). We can say there is some (unobservable) data generating process (DGP) that gave rise to this data. We can then ask how close an actual model could come to the DGP. Phillips and Ploberger (1996) derive a "proximity bound" for how close a model can approach the DGP. This is a function of the number of parameters and the type of data. They suggest that even with infinite data, a model cannot cross this bound. This leads to a way of assessing rival models within a Bayesian structure. They introduce a Posterior Information Criterion which suggests which of various possible models is best supported by data with a penalty attached to the number of parameters.

If methodological frameworks cannot help, then the other possibility is to adjust the goal of what the point of a model actually is. One could choose to be more modest about the goal and take a purely empiricist approach. On that account, one gives up any ambition of uncovering the actual DGP. Or another possibility is to assume that there are local DGPs. A local DGP would be one which had a reduced number of parameters, cut down to only those relevant to the task at hand. This could suffice for models that aim for local prediction.

### **AI and machine learning**

While the adoption of Big Data in financial research is well under way, for the most part the application of AI and machine learning is in its infancy. We see this as the next big change that will occur to the nature of financial research. For more details on the adoption of such strategies in practice see [Global Quantitative Strategy: AI, the data flood and the future of investment research?](#) We can rightly question how much of this activity genuinely counts as AI. Including the term "AI" in the marketing literature for a fund probably does wonders for its asset gathering ability. There is understandably a high degree of secrecy surrounding such systems in practice, so it can be hard to know what is in place. We suspect the bulk of such approaches use machine learning with a spectrum of sophistication.

Although it does not have to be the case, in many instances we see machine learning and Big Data being used together, with machine learning being viewed as a more efficient way to hunt for patterns in large datasets where there is no theory to act as a guide. Here the potential data mining problems become much worse. It is bad enough to hunt for patterns in a free-form way across a dataset using linear techniques such as OLS regressions, but the problems are magnified many times if the algorithms for extracting patterns are allowed to use non-linear functional forms. Some of the same methodological constraints that apply to traditional models will apply to AI as well. The timeframes for many of the tests of AI+Big Data structures are short, so there is the inevitable question of how they may fare if the macro environment changes. Likewise, the high cost and rapid development of the area naturally gives rise to a certain amount of secrecy. The problem with this is that it makes it hard to independently verify models.

Having said that, for many this is a natural extension of taking financial modeling on to the next step. In a world where market beta and factor beta have been commoditized, the opportunity to exploit new sources of idiosyncratic alpha may be too good to miss and a key part of the future of active management.

The various possible forms that AI can take, when applied to financial modeling, can lead to a range of philosophical problems that reflect the issues that we raised earlier in this chapter when we posed our question "what is a model?." We would contrast so-called classical AI, that sees the brain as a computer embodied in the computational theory of mind, versus distributed systems such as neural networks. In the former, the system manipulates data in accordance with a logical structure that is encoded in some way. The latter uses the interaction between all the nodes in the system to manipulate data. Both these approaches face questions over the degree to which they can be said to explain a system under examination. In classical AI, the computer that uses rules to manipulate data may have an ability to exactly reproduce a system under examination, but there is no guarantee that the rules it uses happen to be the same rules the system itself obeys. This is a parallel to the underdetermination of theory by the evidence that occurs in inductive reasoning. With a neural net, the system can produce rule-like results without actually having any encoded rules.<sup>139</sup>

If either of these routes are followed, they may lead to a description of systems without explanation. However, for most financial market settings in practice that may be adequate. There is a major distinction between describing a system and explaining a system. Earlier in this chapter, we touched on what constitutes an explanation. If AI let loose on finance is given the task of describing, then it merely has to accurately sketch out the characteristics of an observed regularity in the data. If the task is to explain, then presumably this requires an attempt to mimic a representation of the causal process at work in the production of the regularity in question. The question of what would constitute evidence of a step from one of these levels to the other is very much open. What would a computer system need to have as attributes to constitute understanding? There is an epistemological problem of what step is needed to demonstrate a level of psychological reality.

If we use AI to extract patterns from Big Data, does this obviate the need for financial theory? One could view an AI system sitting on top of a Big Data set as merely being like a traditional financial model but just with vastly more data and an ability to combine that data in non-linear ways. If framed in that way, there is no reason to suspect that the rules governing such models are any different in substance from traditional financial models. However, it is possible that at some level of complexity the "theory" that is needed could plausibly not be financial theory as such, but instead theory related to information and a robust methodology for its use.

What kind of financial models does this leave us with? We can take the examples of the models that we used earlier as a guide.

---

<sup>139</sup> See discussion in Robinson, *Philosophical Challenges*, in Frankish and Ramsey (2014).

**(1) An analyst model for a company based on discounted future cash flows.** We can imagine this kind of model being transformed in ways to make it unrecognizable. The modeling of future cash flows could become a function of a vast dataset that seeks to respond in a much more agile way for cues as to how a company is doing and even the accounting inputs themselves at some point may be challenged if accounting standard setters responded to the new types of data that are available. What one would end up with is still a model where the target variable was the price of a stock and the structure of discounting future cash flows would still be present, but everything else would change. Presumably such a model would no longer exist in a spreadsheet but instead reside in some coding language.

**(2) A quant model that selects stocks to buy based on a set of accounting and technical factors.** Although these have been the mainstay of systematic investment for at least 20 years, quant managers have always been tinkering with their structure and inputs. As it is these same quant managers who tend to be leading the AI and Big Data charge into finance, we should expect these models to change first and such models may be completely replaced.

**(3) St. Louis Fed inflation model with 104 input datasets.** We would see this as a macro analog to the multifactor quant model. Presumably, no one has any particular love for this kind of model and there would be a rapid switch to a Big Data equivalent if one were shown to be better at forecasting.

In the cases of both (1) and (2) above, the models only seek to predict and not explain. As such, they are perfect for being overturned by a model that has a higher degree of complexity as long as it can be built in a way that is shown to have some degree of robustness and avoid the worst perils of data mining.

**(4) The Capital Asset Pricing Model (CAPM).** It seems harder to imagine that in the foreseeable future that a model such as this is overturned by some generality uncovered by Big Data and AI. Indeed, the CAPM assumes some degree of efficiency of markets. To the extent that the adoption of new types of models in finance allows vastly more information to be rapidly incorporated into stock prices, presumably markets might become more efficient and, thus, the CAPM becomes more important.

### Conclusion

We opened with a misquoting of von Clausewitz. Personally, we have always disagreed with the redoubtable Prussian's famous dictum. War is not merely an extension of politics by other means, because the moral consequences of war cannot be regarded as being co-terminus with those of politics. In the more humble domain of financial modeling, this same question arises. In one sense, the application of Big Data and AI to financial modeling is indeed merely an extension of existing modeling by other means. The issues, particularly in the case of handling the information contained in Big Data sets and the choice between different types of non-linear machine learning algorithm, in a sense just sound like the same type of problem that quants have been grappling with for decades, albeit taken to a different degree.

Having said that, there are ways in which this future is utterly unlike quant models of the past, and at that point we are not merely dealing with an extension of financial modeling by other means but with a different beast entirely.

The first way in which it is different is perhaps trivial but may be the most immediate. In the delineation of financial modeling over the last 20 years, there has been a clear distinction between "fundamental" models that deal with specifics, usually the outlook for one asset, and try to arrive at that outlook with high conviction, and "quant" models that deal in broader regularities, i.e., the cross-sectional distribution of stock returns and where the conviction is at the factor level, not at the single-asset level. Thus, for single securities, such models work on average rather than through conviction. We think this distinction is set to be upended and we think it will quickly go away altogether. Is a model for the outlook of a single security that uses vast trawls of data from payment systems, news feeds, etc., brought together with a machine learning process a "quant" model or a "fundamental" model? We think that the distinction ceases to have any meaning. However, this does not have any philosophical importance at all. Its consequences are sociological and organizational. In practical terms, we see this in a changing intake to the finance profession with more focus on computer science and less on economics.

A more serious shift is the potential to move away from models being embedded in financial theory, or at least accepted "common sense" practice and to be more data led. The immediate concern has to be one of data mining. There is nothing wrong with such an approach *per se*, but steps have to be taken to ensure that such an approach is robust. We would argue that the most robust financial models have been those embedded in an overarching theory. We recognize that such models are rare, however; so, a less stringent approach is to use a commonly accepted template or structure for a model. Such an approach makes it easier to establish a benchmark for the model. Big Data, even without any machine learning overlay, quickly leads to models that are outside that structure and become very much data led.

Going beyond this, if theory is invoked to support a model, then as AI is applied to finance it is increasingly likely that the theory in question is one related to the use of information rather than economics. This may well prove to be very successful at predication and explanation, but the nature of the explanation in that case would likely be very different.

Maybe the adoption of models that are more data led, where theory takes a backseat, would suit the theoretical zeitgeist? In the wake of the financial crisis, there is a strong sense that economic and financial theories have failed and, at the very least, need to be a lot more humble. If we accept that there is a "social" element in the adoption of theories and accepted methodological practice,<sup>140</sup> then arguably the criteria of what constitute an acceptable model have changed. Development of Big Data and AI was happening for many years prior to the financial crisis, but the financial crisis might have tilted the balance in favor of more data-led approaches, where theory is downplayed, and at the same time forced practitioners and academics to actively seek out a richer variety of datasets.

---

<sup>140</sup> See in [Global Quantitative Strategy: Can there be scientific method in finance?](#) for further discussion on this point.

Recent work on the nature of financial theory and the finance industry has also suggested a tilt in the role of theory in model formation. The recent work by Andrew Lo<sup>141</sup> is a great example of one such approach seeking to re-ground financial models. As he states in the introduction "The short answer is that financial markets don't follow economic laws. Financial markets are a product of human evolution, and follow biological laws instead."<sup>142</sup> He then goes on to develop a compelling argument for what financial modeling needs to break away from physics as a template.

Another recent approach to the changing (and need to be humbler) role of theories in finance is Bookstaber (2017), who is concerned with why economic and financial theory as we currently understand it is no good at predicting crises, with an examination of the process by which we arrive at economic and financial models. Bookstaber identifies four key problems with economic systems that make it difficult to deploy deductive reasoning. These are:

- Emergent phenomena, i.e., the properties of economic systems that "emerge" at the level of a group of actors but are not present in any one agent, which in some ways is similar to the difference between what a single car does and the properties that the flow of many cars can exhibit en masse on a motorway.
- Non-ergodicity, i.e., the idea that the rules are not always the same over time; history or the path matters in social systems in a way that is not true in physical systems.
- Radical uncertainty, which is driven by the self-referential nature of social interactions. Here he engages in a good discussion of the notions of uncertainty developed by Godel and Turing, and how Soros has discussed the impact of this in finance through the idea of "reflexivity." Bookstaber clearly has a lot of respect for Soros.
- Computational irreducibility, where he makes the point that modeling social interactions is way harder than the notorious three-body problem in physics.

Ultimately, he argues for an approach that is above all pragmatic for developing explanations of economic and financial phenomena, but at the same time one which takes the "no-realism" interpretation of Kuhnian paradigm change (we note, however, that Kuhn himself said that his ideas for paradigm change were not necessarily opposed to the concept of realism in theory formation). What this ends up with is a call for process and a rejection of the hunt for equilibrium solutions, in exchange for continually-evolving explanation instead. Buried toward the back of the book he makes what is probably his strongest claim, which is that this approach should be the basis for all the social sciences and sets them apart from the natural sciences.

Prior to 2007, systematic investment strategies enjoyed a 10-year stretch of phenomenal success both in performance and asset raising, reaching approximately 20-25% of equity AUM.<sup>143</sup> The reputation of such approaches was shattered by the financial crisis and a canonical form of quant strategies in the form of multifactor linear regressions underlying

---

<sup>141</sup> Lo (2017)

<sup>142</sup> *Ibid*

<sup>143</sup> [The State of Fund Management: Quants Have Destroyed the Active-Passive Distinction](#)

a highly diversified enhanced index fund went out of favor. With the emergence of AI and Big Data, many quant managers see the pendulum coming back in their direction. From a commercial perspective, they see it as a way to distinguish themselves from fundamental active investors who are under extreme pressure from passive funds. Quants may also be forced to move in this direction as some simple traditional quant strategies become commoditized by smart beta.

A theme that has echoed through this chapter is the question of whether the goal of a model is prediction or explanation. Explanation is harder as it may involve claims of truth and causation. When the ultimate goal is the formation of a new financial theory, then we suggest that explanation is indeed required. Thankfully, perhaps, it is not usually incumbent on financial market practitioners to develop theory. A more common demand for explanation, however, will come from policymakers. The formation of public policy does ideally require explanation and causal language. This will likely remain the case whether or not the basis for such models is traditional or includes Big Data and/or AI components.

On an everyday basis for financial market practitioners, and especially analysts whose job it is to produce the models that we discuss in this chapter, if explanation is too hard to attain then maybe prediction is good enough. After all, that is a large part of what the active management industry has been trying to sell for 40 years. We suspect that in the initial phase of the adoption of new modeling approaches, prediction may indeed be enough. If this happens to coincide with a post-crisis environment that is humbler about the role of financial theory or even rejects that such theory is necessary or possible, it will amplify this tendency. However, we suspect that at some point models will once again need to try to explain in order to be plausible. Confidence in systematic models was shattered in the financial crisis because they could neither predict nor explain. If they had at least been able to explain, then investors may have been more tolerant. We think eventually sophisticated investors will again require their models to explain. AI and Big Data are poised to revolutionize modeling in finance and in the process are likely to change the profession. The difficult challenge will be in how the act of explanation is carried over into a new form of model.

BERNSTEIN

# ASYMMETRY OF TIME IN FINANCE

## OVERVIEW

This chapter is about a philosophical problem relating to the direction of time in financial systems. We freely recognize that most people may not think they have a "problem" with the direction of time and might not want to grapple with issues of a philosophical nature in their day jobs. However, we argue that this has several important practical consequences about how models in finance work.

Many models in finance don't actually care which direction time goes, and yet we observe a clear arrow of time in financial markets. Running financial time series in reverse does not always look the same. This is similar to what is known as the problem of the direction of time in the philosophy of physics, whereby theories describing dynamics at a micro scale can be agnostic to time direction, but macro systems exhibit an arrow of time.

The purpose of a discount rate is that it serves as a "price of time." However, the risk-free rate that purely prices time applies if time runs in either direction. If we take the source of the asymmetry in finance as our ability to remember the past and uncertainty about the future, then it is the risk premium that accounts for uncertainty which introduces an arrow of time into finance.

The way the arrow of time is introduced via the risk premium has several practical consequences in financial modeling.

Although ultimately it is knowledge of cash flows that is of most importance in determining the value of an asset, in the short term it is changes in the risk premium reflecting uncertainty about the future that drive changes in price.

Finance can be thought of as a special case of thermodynamics. The tendency of systems to move toward the higher entropy states and toward equilibrium is a powerful explanatory tool. We regard this mean-reversion as being the basis that makes the concept of valuation useful in finance.

## DETAILS

---

THOMASINA: When you stir your rice pudding, Septimus, the spoonful of jam spreads itself around... but if you stir backwards the jam will not come together again. Do you think this is odd?

SEPTIMUS: No

THOMASINA: Well I do. You cannot stir things apart.

SEPTIMUS: No more you can, time must needs run backwards...disorder out of disorder into disorder. This is known as free will.

THOMASINA: Septimus, Do you think God is a Newtonian?

SEPTIMUS: An Etonian? Almost certainly, I'm afraid.

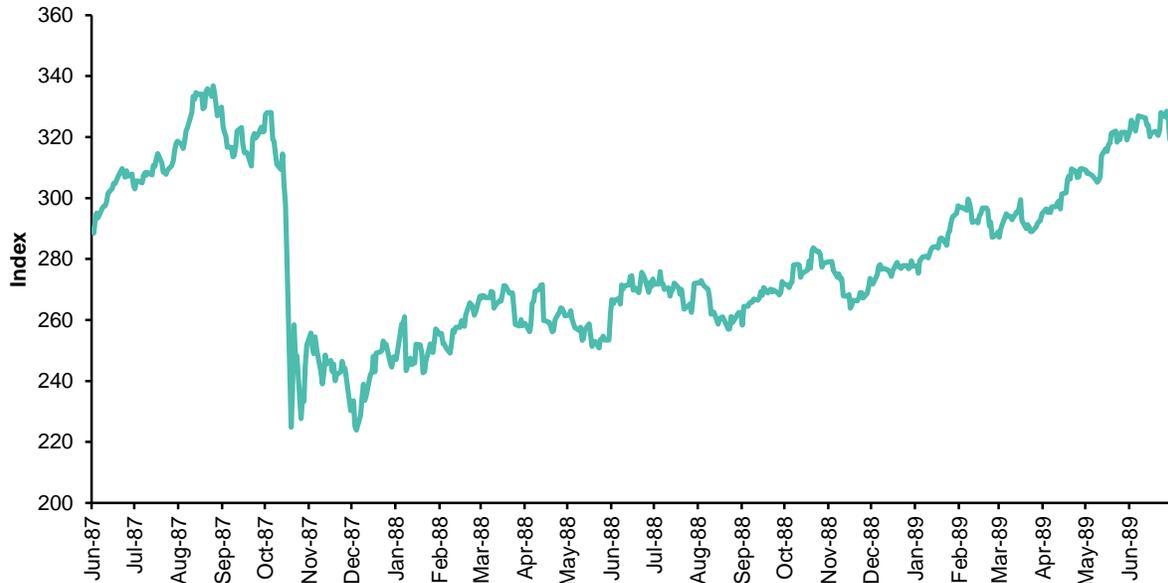
THOMASINA: No Septimus, a Newtonian...Newton's machine which would knock our atoms from cradle to grave by the laws of motion is incomplete! Determinism leaves the road at every corner...Newton's equations go forward and backwards, they do not care which way. But the heat equation cares very much, it goes only one way.<sup>144</sup>

—Tom Stoppard, *Arcadia*

We freely recognize that most people may not feel they have a "problem" with the direction of time. But there are subtle differences between the way time enters some financial theory and the way time is experienced in financial markets. We think this also happens to be linked to several important modeling issues in finance, such as the way prices move in the short term vs. the long term.

There is a time asymmetry in financial systems that plays a central role in all financial modeling. It could be argued that in some sense this asymmetry is odd, as often when we think about models in finance, the direction of the time arrow appears reversible. However, financial systems are not time reverse invariant (TRI); playing back a time series of a stock price or an index, it doesn't look the same in reverse. This can be shown in a host of large-scale and small-scale effects. One large-scale effect is the evolution of the S&P500 during and after the 1987 stock market crash (see Exhibit 26).

EXHIBIT 26: **The 1987 crash as an example of time asymmetry in financial series (S&P 500)**



Source: Datastream and Bernstein analysis

We also see this more generally in financial time series. The last 50 years of returns of the S&P500 show that on average bull markets have lasted three-and-a-half years, whereas

<sup>144</sup> Thomasina Coverly speaking to her tutor Septimus Hodge in Tom Stoppard's magnificent play *Arcadia*.

bear markets have lasted one-and-a-half years. Likewise, over the last 90 years, the performance of cheap versus expensive stocks has been highly time-asymmetric. Periods of Value outperformance have lasted four-and-a-half years on average, punctuated by two-year periods of underperformance (see Exhibit 27).

**EXHIBIT 27: Uneven length of upward and downward movements in equity markets and the Value factor (time in years)**

		Value	S&P 500
Since 1926	Down	2.2	
	Up	4.5	
Since 1963	Down	2.2	1.4
	Up	5.7	3.6

Note: Number of years of upward versus downward movements. Value refers to relative return of Cheap and Expensive stocks.

Source: Ken French Factor data, Datastream, and Bernstein analysis

There is a small academic literature on this point. Jiang, X, Chen, T and Zheng, B (2013) claim that while there is indeed time asymmetry on long time scales (greater than 1 day), large return fluctuations at shorter horizons are time reverse-invariant. Borland, L, Bouchard, J-P, Muzy, J-F, Zumbach, G (2008) review aspects of financial time series that seem to be time-asymmetric. Notable among such asymmetries is the observation that a negative price change is on average followed by a volatility increase. They also note that there is a more general asymmetry in the evolution of volatility. Zumbach (2007) investigates the ability of models of returns such as ARCH and GARCH to capture the observed time asymmetries of financial series.

All this matters as, if a model is proposed for how prices evolve in finance (e.g., random walk and ARCH models) it should adhere to the observed time asymmetry of financial systems. If it does not, then it is an incomplete model of that system. There is a deeper point here, which is that the equations that govern financial systems do not, in general, care about which way time goes. One can often replace  $t$  with  $-t$  and nothing changes.

Probably the most important equation in all of finance is the discounting equation that tells us what a stream of cash flows in the future is worth today. It is worth thinking about how this doesn't care which way time goes. We start with the usual expression value for the price today  $P$  that one would pay for a stream of dividends  $D$  that grow at rate  $g$  and are discounted at rate  $r$ . We have:

$$P = D \int_0^{\infty} e^{-(r-g)t} dt$$

It is then normal to make the assumption that the growth and discount rates are constant, which massively simplifies the maths, so it reduces to the Gordon Growth model. Rather than just jump to the final step let's think about the steps. Integrating the above we have:

$$P = D \left[ -\frac{1}{(r-g)} e^{-(r-g)t} \right]_0^{\infty}$$

Substituting in for  $t=\infty$  and  $t=0$  we achieve the usual Gordon Growth model result.

$$\frac{P}{D} = \frac{1}{r-g}$$

But what happens if we run time backwards? We replace  $t$  with  $-t$  and consider the block of time from  $-\infty$  to 0 so our starting point becomes:

$$P = D \int_{-\infty}^0 e^{-(r-g)(-t)} dt$$

Integrating we get:

$$P = D \left[ +\frac{1}{(r-g)} e^{-(r-g)(-t)} \right]_{-\infty}^0$$

Therefore,

$$P = D \left[ \left( \frac{1}{(r-g)} e^{(0)} \right) - \left( \frac{1}{(r-g)} e^{(r-g)(-\infty)} \right) \right]$$

$$P = D \left[ \left( \frac{1}{(r-g)} \right) - 0 \right]$$

Hence,

$$\frac{P}{D} = \frac{1}{r-g}$$

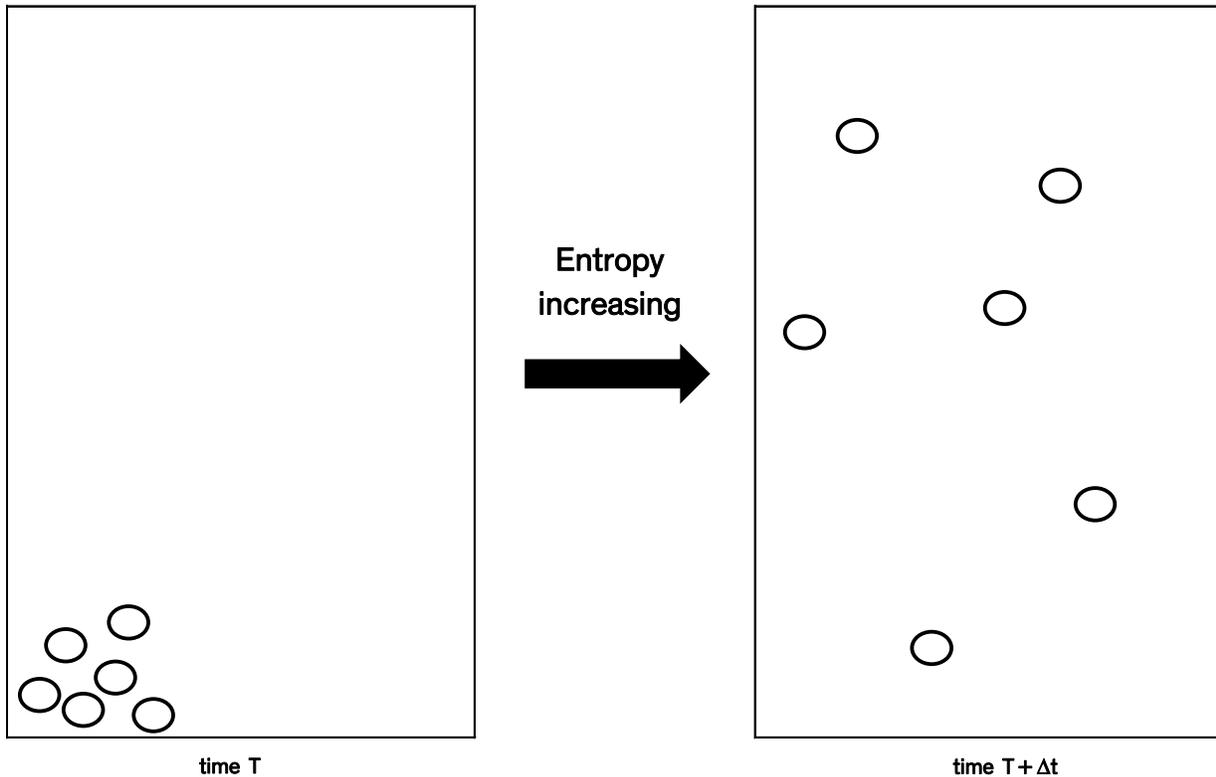
So we have the same result. This is really just a special case of a much bigger question known as the problem of the direction of time in philosophy of science. Simply stated it says that macro systems (i.e., systems at a human scale) have a clear arrow of time, but the individual particles that the macro systems are composed of might not have any such arrow.

Specifically what this relates to in physics is that the "classical" equations describing the dynamics of the universe do not care which way time is run. In an archetypical system we can think of matter in the universe as filled with matter made of "billiard balls" that collide and bounce off each other. Such interactions are described by Newton's laws where  $t$  can be replaced by  $-t$ . A way to visualize this is that a film of the interaction of these idealistic billiard balls played in reverse would not look odd in any way and in fact it would not be possible to spot that such a film was being played backward. But at the macro scale the behavior of matter is very different. What happens to a mug of coffee when the milk is poured in is clearly time-asymmetric. All the individual molecules in the coffee and the milk may be obeying laws of motion that know no direction of time, but we know that we are never going to see the milk and coffee unmix however long we wait.

This asymmetry in macro processes is often phrased as the Second Law of Thermodynamics, which states that the entropy (disorder) of a system always increases. This can be broadly understood as saying that any system (mugs of coffee, financial markets, the solar system) always moves from a state of order toward a state of disorder. But where does this arrow come from?

The crucial concept here (at least in the thermodynamical explanation of phenomena) is the notion of equilibrium. As the concept is also crucial in finance, we will return to it later when we consider practical implications. Rather than think about mugs of coffee and milk, which are complicated systems with billions of particles involved, let's consider gas particles in a container. The equivalent of the milk not mixing would be for all the gas particles to be in one corner of the container and to stay there. However, there are only a relatively small number of ways for the gas particles to be arranged in one corner of the container, but a massively larger number of ways for them to be evenly distributed throughout the container. If the particles were to start in one corner of the container, when we come back and observe them later (a temporally-biased term but we will come back to that) then through the random interaction of the particles, it is massively more likely that we find them evenly distributed than still confined in their initial corner of the box (see Exhibit 28).

We say that entropy has increased, i.e., the system has moved from a highly ordered state to a less ordered state, from an improbable state to a more probable one. Even though the individual gas particles can be described by Newtonian laws that can run forward or backward in time, their random interaction is massively more likely to distribute them across the container. That is to say, a film of the motion of an individual gas particle colliding with other gas particles or the walls of the container would not look odd played backward, but a film of the whole box played backward showing all the gas particles arranging themselves neatly in one corner would look very odd indeed.

EXHIBIT 28: **Gas particles attaining equilibrium and entropy increasing**

Note: A collection of gas particles finding themselves confined to one corner of a container at time  $T$  will most likely move toward a state at a "later" time where they are uniformly distributed across the whole container.

Source: Bernstein analysis

In this way of thinking, we can consider entropy as akin to probability, and if this is the explanation, then our perceived arrow of time is not a fundamental attribute of the world but merely an artefact of systems moving to more probable states. If it is the tendency of systems to move to states of higher entropy that gives an arrow to time, then the direction of time is not some ontological brute fact about the fabric of the universe (i.e., there is no law that says the milk cannot unmix from the coffee, it is just unlikely to happen). Some people may be uncomfortable with time, which seems so fundamental, being relegated to such a derivative role.

Astute readers may note that it does not answer the question of how the particles came to be in one corner in the first place and indeed that if one waits long enough (which could be a really long time) then eventually by random happenstance the particles probably would find themselves back in the corner of the box, so this really only provides a "local" explanation for the direction of time.

It was Boltzmann who in the late 19<sup>th</sup> century suggested that this might be because starting conditions just happen to be more ordered than we perceive an arrow of time. To get around the problem of if one waits long enough then improbable states might appear (and time might appear to run backward), he proposed to apply the argument to the universe more broadly. Suppose we just happen "by chance" to be in a universe that started in a highly

ordered state and is steadily becoming more disordered, or "heading toward equilibrium." Then, that happenstance of the initial starting condition is what gives rise to our perceived direction of time. It would not need to be the whole universe that was structured this way, maybe only our "local" part of the universe, though we have so far failed to observe parts of the universe where this was not the case. Note that this is independent of theories suggesting a "big bang," and merely relates to special starting conditions giving rise to a direction of time. In fact Boltzmann suggested that our apparent arrow of time might be the result simply of a large fluctuation away from equilibrium in our part of the universe.

Some thinkers have always been uncomfortable with the idea that the direction of time is due to this. They suggest that it is very "unlikely" that a universe selected by chance happens to start in such a special way, leaving aside the problems of imposing a probability metric on the set of all possible starting universes, the common response to this objection is the anthropic principle. As Boltzmann suggested, it is plausible that intelligent life depends on the "special case" of a low entropy initial condition for its existence and that life is not possible in a universe that just consists of gas particles in equilibrium. If that is the case, then the conditional probabilities change. *Given* we are sentient beings that rely on a direction of time in order to function, there is no mystery as *conditional* on our existence, the fact that we live in such a universe is, in fact, highly probable.

In recent decades there has been an attempt to pin the direction of time on quantum mechanics. This would have a possible intellectual attraction of making the dynamics of micro systems inherently time-asymmetric and, thus, the time asymmetry of macro systems could be derived from that rather than from special universal starting conditions. One way of interpreting the dynamics of a system that obeys quantum mechanics as opposed to Classical Newtonian mechanics is that all possible paths co-exist and are equally present in superposition until an observation is made. At that point, one of those states becomes a reality (the wave function "collapses" in the language of physics). The popular interpretation of this is the case of Schrodinger's poor cat who exists in a state of life and death simultaneously until the box is opened. For our purposes here, the important point is that this process of observation and collapse of the superposition of states into one state is time-asymmetric. It does lead to a bigger question of what constitutes an observation and does this require a self-aware being. If so what counts as self-aware? Could, for the sake of example, a cat count as being self-aware for these purposes?

### **The discount rate as the price of time**

Let us bring this back to finance. We started this chapter with the observation that financial systems seem to have an arrow of time in an empirical sense as financial time series tend not to look the same played backward. In a sense, all finance is just a special case of thermodynamics — i.e., it is a "macro" system (in the physics sense of the word, not the economics sense) with underlying "micro" components. Also, for the purpose of forming theories to explain financial phenomena it is very helpful to assume that we are heading toward equilibrium — but that is not an especially helpful statement in itself. The assumption that any financial system moves toward equilibrium (whatever that might mean) is a powerful one for modeling purposes. We discuss this in the section on practical consequences later in this chapter.

Aside from the time-reverse-invariant price of time as expressed by a risk-free discount rate, there is also an arrow that enters from uncertainty about the future versus memory of the past. Thus, we could say the arrow of time in finance comes from our memories. We remember the past but not the future, so the uncertainty about the future and certainty about the past is the key variable in setting an arrow of time in finance. It is how we account for this uncertainty that links the arrow of time in finance to decisions about how we build models and value assets.<sup>145</sup>

This brings us to two elements of the "price of time" that is then necessary for discounting. First is the direct time value of money that sets the degree of preference for immediate versus deferred consumption; this is commonly known as the risk-free rate. The second is the risk premium that needs to be applied on top of this to account for uncertainty. The first part applies in a time reverse invariant way, whereas it is the uncertainty measured by the risk premium that brings in the time asymmetry. Thus, the asymmetry could be said to enter via the risk premium rather than via the risk-free rate.

We regard discounting as a foundational issue in finance and would go as far to say that the very purpose of a discount rate is acting as the "price of time." That is what the discount rate is there for. We wrote about the modeling issue of when the "price of time" falls to zero (see [Global Quantitative Strategy: Death of the DCF model?](#)) and touched on the topic in a more generalized sense in the earlier chapter in this *Blackbook* on Chronophobia. Much has been written on the asset allocation implications of a world in which interest rates are zero or below zero. However, we think that the methodological problems are potentially even greater. Discounting of future cash flows become very unreliable as a guide to value if the discount rate no longer "washes out" uncertainties in forecasts of cash flows many years in the future. We argue that a zero interest rate world is intellectually painful because putting no value on time at all is so utterly at odds with the human experience. What, by the way, happens if discount rates go negative? In a sense, this places a negative value on time. It would not seem to change the asymmetry however, as that is due to the risk premium in its role of measuring uncertainty.

#### **What are the consequences of all this?**

Well, we think there are significant consequences for finance arising either from time asymmetry and the unique direction of memory itself or from the role of uncertainty in models that respond to this

**(1) The pricing of assets (be it a market index, a single stock, or a real asset) will, as a consequence, have its price driven more in the short term by adjustments to the discount rate (reflecting uncertainty) and over a longer time driven by cash flows.**

We already saw that the discount rate for cash flows in the future has two components. One part reflects the time value of money; we usually think of this as the risk-free rate, but it can equally well be thought of as the "price of time." The other part of it has to do with the

---

<sup>145</sup> There is an open question as to whether the thermodynamic arrow by which systems move to states of higher entropy is one and the same with the psychological arrow by which we remember the past but not the future. Stephen Hawking has proposed that memory is linked to entropy in that the act of reconfiguring neurons to form a memory could expend energy, dissipate heat and, hence, lead to a slight increase in entropy.

uncertainty about those payments (the risk premium). Standing today and running the clock backward, there is still a time value of money, but not uncertainty (a risk premium) so the total discount rate would have to be different.

How does this help us on a day-to-day basis? Observing financial assets "in real time," it is their cash flows that, as they become known, are the most important force in determining the value of the asset that gives rise to those cash flows. But in the near term, assuming a positive risk-free rate (a price of time), distant cash flows will be worth less, and this applies in either direction of time. But cash flows in the future also have a risk premium associated with them. It is important to bear in mind that these two aspects are distinct, but together they mean that it is much more likely to be changes to the discount rate that affect the present value of the asset than views on cash flows themselves.

So, one can consider a process of price discovery as one where prices are initially set as a function of the discount rate but then over time become a function of views on cash flows.

## **(2) The nature of mean reversion and the basis of value measures**

The concept of equilibrium is central to both economics and finance, and its importance is hard to overstate. This concept is reliant on the language and paradigm of thermodynamics. It is pedagogically attractive to think of financial assets and time series as behaving as if they are gas particles that through all their random interactions always end up as a uniform equilibrium. It is mean-reversion that makes the concept of valuation useful. In fact, it is central to it. We would go as far as to make mean-reversion the basis on which Value measures are constructed. Thus, we can say the very definition of a good valuation measure is that it mean-reverts. If a metric does not measure a mean-reverting process, but rather a process that moves further away from the mean, then it should be, in financial language, a Momentum or Growth measure.

In this case, the valuation of financial assets is somewhat like the statistical mechanics that describe the behavior of gas particles. It is different though in a number of ways from the Boltzman world view. First, a given financial time series tends to suffer a series of shocks that send it away from equilibrium and then mean reversion acts to bring the system back to equilibrium again and again. All these mini mean-reversions are very different from the global tendency to higher entropy states that bring about the thermodynamic arrow.<sup>146</sup>

Finance also differs from thermodynamics in that fluctuations away from the mean are often not time-reverse-invariant. Over long time scales, price fluctuations seem to be very time asymmetric; there are fast draw-downs and slow recoveries. This presumably relates to the time-asymmetric way that uncertainty is represented in a financial system via shocks to the discount rate. A rapid price decline is often followed by a temporary increase in volatility and an increase in the risk premium, but a temporary spike in volatility is rarely followed by a rapid price increase.

---

<sup>146</sup> Note that these mini fluctuations in financial time series are not incompatible with the thermodynamic arrow, as a single financial series is not a closed system. It is possible that if one described all possible financial systems, maybe entropy for that entire system might increase. To our knowledge no one has tried to demonstrate whether this is the case or not.

We argue that we need mean-reverting series in order to make forecasts. Of course, this is not the only kind of forecast that can be made. Instead, one can make statements of the form that a financial system (a market, an industry, a single corporate issuer) is going to enter a new state that has not been seen before. But finding mean-reverting series has a special place because if one can demonstrate that mean-reversion has occurred many times in the past, then those episodes of mean-reversion can be studied. One can analyze the probability of reversion and what has been necessary for it to occur. However, the importance of mean-reversion goes beyond that; it has a special place, we think, because it mimics the tendency to equilibrium that we observe in thermodynamics and so brings financial systems back to the daily human experience by which we experience time's arrow.

As Valentine Coverly said, again from Stoppard's *Arcadia*: "We are all ending up at room temperature."

---

## READING LIST

We end this chapter with a reading list for those who want to explore topics in more detail. There is a huge literature on the philosophy of time and the problem of the direction of time in physics. We would recommend the recent *A Brief History of the Philosophy of Time* by Bardon as a very accessible, short, and yet broad overview of the topic.

For those who want more detail, Savitt's *Time's Arrows Today* gives a survey of the most important recent papers in the philosophy of time, while *The Oxford Handbook of Philosophy of Time* edited by Callender has a very comprehensive selection of papers from the foremost academics today working on the topic. For a discussion of the direction of time that arises from thermodynamics and statistical mechanics, we would recommend Sklar's *Physics and Chance: Philosophical Issues in the Foundations of Statistical Mechanics*. Huw Price has also written about the advantages of allowing for retro-causation and the issue of time-reverse-invariance in *Time's Arrows and Archimedes' Point*.

The literature on the direction of time in finance is much more limited. One book that stands out is Pascal Blanqué's *Money, Memory and Asset Prices*. This takes a fascinating though very different approach to the role of time in finance to the one we take here. Blanqué's is a more psychological time, intimately linked to how humans remember and forget. The forces of forgetfulness and memory are crucial in how the experience of the market historically is used to price assets today based on forecasts about the future. The temporal reference frame, in this world view, becomes one based on the subject (the investor), not an exogenous clock time and, thus, can dilate: "Clock time has no reality in the economic and financial sphere. The only reality is the perception (projection) of the consciousness."<sup>147</sup>

Readers will guess that the author is a fan of Tom Stoppard. Many commentators have written about the play *Arcadia* and "what it is about." At face value, it is about the history of English landscape gardening, the history of ideas, Lord Byron, and the hubris inherent in a certain kind of modern academic pursuit. What makes it particularly germane to our topic here is the way it links the history of English landscape gardening to the discovery of the Second Law of Thermodynamics. The transition from the "Beautiful" (in the Burke sense<sup>148</sup>)

---

<sup>147</sup> Blanqué 2010, p208

<sup>148</sup> Burke (1757)

and ordered landscape as represented in a painting by Claude Lorrain to the "Sublime" and (apparently) disordered landscape, so beloved by the Romantic movement, as represented by a painting of Salvator Rosa can be seen as a parallel to the movement from order to disorder captured by the Second Law of Thermodynamics and the science of heat, which was being developed at the same time. Thus, the emergence of the Romantic movement is seen as an allegory for the transition from classical Newtonian mechanics to thermodynamics, and it is exactly this tension inherent between Newtonian mechanics and thermodynamics that is the source of the "problem of direction of time" that we address in this chapter.

BERNSTEIN

# Final Thoughts

BERNSTEIN

# WHY I AM NO LONGER A QUANT

## OVERVIEW

Quant funds have been undergoing something of an existential crisis. In aggregate they have badly underperformed in 2020. That might be excusable as high stock and factor correlations, a market led by mega caps, and the implosion of the Value factor are all inimical to most systematic approaches. However, as my colleague Alla Harmsworth has shown recently that what is more troubling is that this is now the third year of underperformance for quant funds (see [An existential crisis for quants?](#)).

There are steps that can be taken to address this. However, the core of this chapter is about a deeper issue. At their core, quant funds try to apply backtests to future investment decisions. But what does it mean to do quant research and run backtests if the rules have changed? There is a challenge to quant beyond a recent patch of poor returns.

If Covid-19 doesn't count as a regime change, I don't know what does. The nature of the policy response is a clear break from the past and directionally points to the possibility of higher inflation, but without a commensurate increase in real rates. This is unlike recent decades, with profound implications for factors and asset allocation.

But more important than that, a legacy of Covid-19 will likely be permanently greater government involvement in the economy and in investing. This points to an inherently more political and less technocratic steering of the economy. In a domain such as finance that has no theoretical "laws" to fall back on, this constitutes a problem.

The other challenge is that quants have relied on a highly diversified approach, both in terms of factor exposures and how that translates into stock portfolios. Yet, maybe there is such a thing as too much diversification, to a degree that it precludes outperformance. The explosion of "Big Data" and machine learning appears not to have helped in this regard either.

Before my quant clients and colleagues disown me — this chapter is not saying that quant investing is over. I am definitively not saying it's ok to just "shoot from the hip" and invest merely on the basis of a series of views, stories, and speculations. We live in a world that is more quant than it ever has been. But what that means has changed.

There are practical things that quant-informed investors can do in terms of addressing demand for cross-asset investments, improving growing areas such as ESG, extending time horizons, and possibly becoming more concentrated.

So, there is a future in using systematic inputs into an investment strategy. At the same time, traditional quant approaches face a high hurdle. The bottom line is that if one believes that the rules of investment are undergoing a change, this implies a step away from relying on a backtest as the primary rationale or support. If quant investing has to rely on such backtests and a diversified framework, then I am no longer a quant.

### A new regime

In Antonioni's magisterial film *Beyond the Clouds*, the Malkovich character has this line "Rather than thinking through my problems I want to feel my way through them." The phrase has been running around, in a way at the edge of my consciousness for a few decades. I think it finds its moment. A systematic approach to investing is, in one sense, the antithesis of applying feeling to investing. Often, quant investing has explicitly prided itself at being counter to "behavioral biases" and indeed trading against them. However, we suggest that sometimes "feeling" has to be the way, or at least be allowed to influence it. This is not the "decline from thinking to feeling"<sup>149</sup> but a response to the way the world of investing looks today.

The policy response to the crisis is not, in our view, a temporary stop gap to tide us over just another recession. Instead, it represents a permanent change of regime. Regime changes don't happen very often; one can argue *ad nauseam* about what data is required to show that the regime has changed, but if this doesn't count as a regime change then I frankly can't imagine what would. The particular aspects of the current crisis that are most relevant here are the rapid shift from independent monetary policy to a blurred combination of fiscal and monetary policy as the key cushion for the economy over the business cycle, and the social impact on unemployment and inequality that seem highly likely to change the level of political involvement in the economy and markets in many countries. A permanently much larger role for governments in economies and financial markets, and a process of economic policy formation that is distinctly more *political* than technocratic is a break from the last few decades. We think this also implies a particular set of macro outcomes that raise the possibility that inflation rises but that the yield curve may not steepen in the way that it usually does when inflation rises.

Nearly all models that look back and learn from the past (after all what else have we to go on?) will find themselves wanting. Add to that another long-running bugbear, that there will never be anything like the laws of nature when it comes to finance<sup>150</sup> and the basis for forming investment views faces a challenge in navigating this change.

Don't get me wrong. I am not suggesting that a "shoot from the hip" approach in terms of forming investment views is better, far from it. Such approaches to investing are slowly dying out anyway. Markets are more systematic than they have ever been before and will only become more so. This is especially true over short horizons and also within asset classes. The dividing line between "alpha" and "beta" is a constantly moving gray dividing line, but it only moves one way, with more approaches previously thought of as active becoming commoditized and passivized. When we came to Bernstein six years ago, one of our opening pieces was [The State of Fund Management: Quants Have Destroyed the Active-Passive Distinction](#). The process of destroying this distinction has advanced further since then. There is very little scope, we think, in coming up with a new active fund that seeks to outperform a broad index with mid-to-low tracking error and to do so by following some simple investment rules of thumb. An active approach now has to offer more than

---

<sup>149</sup> Tom Stoppard, *Arcadia*. Said in reference to the supposed intellectual decline from the Enlightenment to Romanticism.

<sup>150</sup> [Global Quantitative Strategy: Can there be scientific method in finance?](#)

this. In this sense markets and the process of investing is more quant, or more driven by systematic processes than it ever has been before.

### **Perhaps life is too short to wait for mean reversion?**

Mean reversion is like the holy grail in finance. If one can identify processes or systems that mean-revert then one is freed from having to make forecasts, and humans are terrible at those and too confident in them as well. This makes mean-reverting processes ideal to form as the long-time horizon leg of systematic strategies and to act as a complement for mainly trend-following short-term strategies. In a sense, the confluence of these two has formed the bedrock of quant investing for decades.

As Keynes famously noted, in the long run we are all dead. The problem is that there is every reason to suppose that we may be in a new world. Observations that count as a regime change could stem from the observation that the recession of 2020 seems likely to be bigger than any that has occurred while modern investing as we know it has existed. It could also come from the business model changes that occur as a result of the lockdown and the accelerating destruction of "moats" around certain industries. But we think the principal reason to declare a new regime is the fiscal and monetary policy environment within which economic activity takes place. The world of monetary policy being independent (of politics and of markets) seems likely to be over. Trying to second guess central bank reaction functions can no longer form the mainstay of what counts for forming a macro input into investment decisions. Instead, fiscal policy (or a sort of fiscal-monetary policy hybrid) is the cushion for the economy in future recessions. This is inherently more politically driven and not something that technocrats can have exclusive power over. Okay, it could in theory be handed to technocrats, but that seems so far removed from the current political and institutional structure of advanced economies as to be discounted. This means that "rules" gleaned from how investments have behaved as cycles have evolved in recent decades need to be viewed with new suspicion.

Both the current episode of liquidity driving the market rather than fundamentals, and the prospect of a more political steering of the macroeconomy imply there may be a tempering of the power of mean reversion. Moreover, we cannot go back. Policy rates have been driven down to zero, or below. Growth has been ever more dependent on debt and the multiplier effect of that debt has declined year by year. A permanently elevated level of unemployment and an explosion of inequality seem to define the future, once the dust has settled post Covid-19. That will keep the need for political intervention higher, and also likely give extra impetus for a swing away from the shareholder-first capitalism of recent decades.

We all need to get used to more government in the economy and in financial markets. The scale of the debt build up, the need for life support for businesses and households, the long-run social tension implied by the virus, and the inevitable (eventual) increase in taxation, all point to a profoundly unsystematic and non-mean-reverting world.

### **Quant funds have hit a bump in the road**

Aside from the theoretical case that the world has changed, there is also compelling empirical evidence that quant investing as traditionally understood is under severe pressure. Our sample of quant funds that we track has underperformed during the

pandemic. Part of the problem in 2020 has admittedly been very specific. It doesn't really matter what one's alpha "engine" has been — if the mode of implementation was via diversified portfolios then performance will have been heavy-going in 2020 when leadership has been so narrow. Having skill alone has not been enough in 2020, one had to be skilled and concentrated to outperform.<sup>151</sup> An environment like that will always be horrible for quant.

For quants, a confluence of high stock correlation, high factor correlation, and narrow leadership by mega caps amounts to a "perfect storm." Our prior work on what drives performance of quant managers has pointed to these conditions being highly unfavorable.<sup>152</sup> So underperformance in 2020 might be excusable. If it was just that, then the advice could be to simply ride it out. Every investment strategy encounters market conditions that temporarily make it hard to effectively function.

However, the brute fact is that traditional quant funds have had a performance problem for three years that pre-dates the current pandemic. This longer-run underperformance cannot be blamed on high correlations. It seems more likely due to narrow leadership, several factors "failing," and in particular continued failure of the Value factor, which is hard to avoid as an input in most systematic funds, apart from those with very short holding periods. A more scary prospect is that it could reflect the apparent failure of a broad set of factors, not just the Value factor. Some investors have asked whether these have been arbitrated out?

My colleague Alla Harmsworth has shown in a report published under the Alphalytics brand that quant funds in aggregate run portfolios that offer positive exposures to a broad range of factors (see [An existential crisis for quants?](#)). Indeed, the whole ethos of the canonical approach to quant investing in recent decades has been explicitly to offer a diversified approach to factor strategies, so such funds have been practicing what they have preached. But maybe we are in a world where a diversified approach to factors doesn't apply for a long period of time?

The good news is that I have not seen evidence that these factors have been arbitrated out by flows into smart beta. 90% of smart beta AUM is benchmarked to US factors, yet the failure of risk premia to keep up with their long-run performance is broader than the US. However, that does not preclude the possibility that quant funds (as opposed to simple smart beta ETFs) might have put too much capital to work in such factors, or that for cyclical reasons, several key factors have seen a period where they fail to perform.

This might have nothing to do with the alpha generation process per se. It could also represent a failure of an approach that relies on very broad diversification. Basically, if growth and leadership has become much more narrowly concentrated in the market (as it has been), then there can be such a thing as too much diversification.

---

<sup>151</sup> [Alphalytics: Concentrate and hold 'em](#)

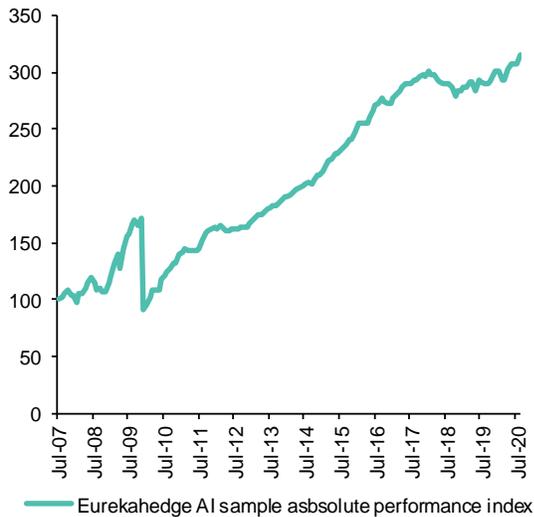
<sup>152</sup> [Fund Management Strategy: Ending the active performance drought](#)

### But dude, you forgot the alpha

It seems highly plausible that a number of "factors" that have been "discovered" over the last decade were nothing of the sort. They were either never there in the first place and were merely artefacts of the profusion of over-sampling of data that Campbell Harvey told us about,<sup>153</sup> or they were there in a sense but have simply been exploited by too much capacity that stops them from working. There is always the possibility of constantly attempting to discover new systematic data in new datasets, and indeed that is a potential business model for some investors, under the guise of a constant IT and data arms race.

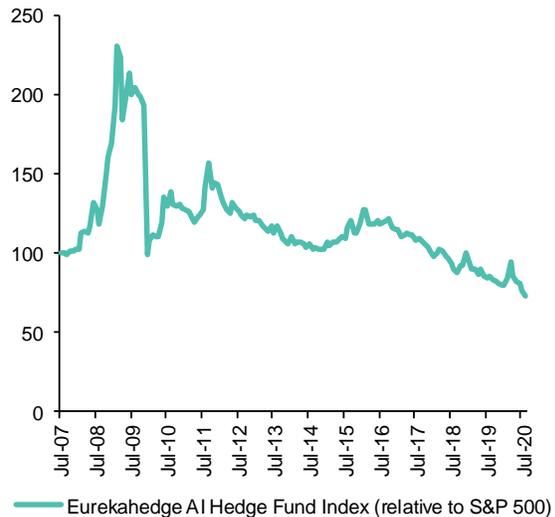
The performance of a group of quant hedge funds that identify themselves as AI-led has been positive in absolute terms, but even for them the recent performance has been below their historical norm (over an admittedly short look-back period), and that performance has not been enough to keep up with the overall equity market (see Exhibit 29 and Exhibit 30). The performance of equity quant hedge funds overall tells a similar story (see Exhibit 31). The evidence seems to be that, so far at least, such approaches might help but still not be enough to make a strong case of outperformance of such strategies in aggregate. That is not to say they cannot work, but they may also face headwinds in periods when diversified approaches struggle. There is also an issue that they might lead to a quant "arms race" approach and, hence, rely on factors that have short half-lives.

EXHIBIT 29: AI Hedge Fund Index (absolute)



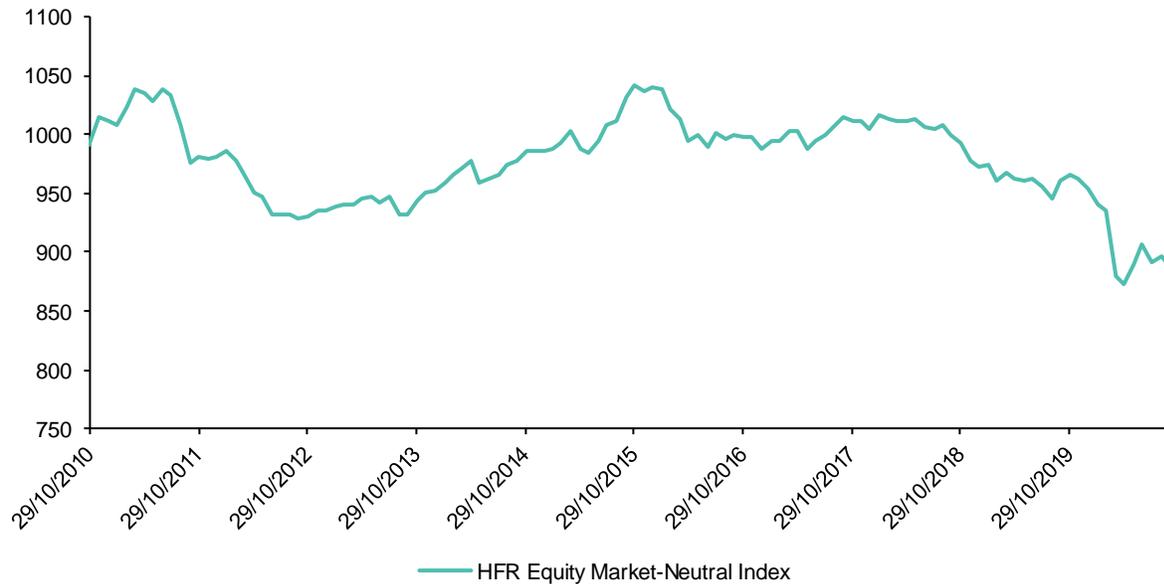
Source: Eurekahedge, Bloomberg, and Bernstein analysis

EXHIBIT 30: AI Hedge Fund Index (relative to S&P 500)



Source: Eurekahedge, Bloomberg, and Bernstein analysis

<sup>153</sup> Harvey, C (2013) *...and the Cross-Section of Expected Returns*, available at [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2249314](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2249314)

EXHIBIT 31: **Equity Market-Neutral Index**

Source: HFR, Bloomberg, and Bernstein analysis

### Conclusion

This chapter is not meant to be seen as in any way being anti quant funds; far from it, I strongly believe there are very good reasons to put a systematic process in the heart of an investment strategy. Markets today are more systematic than at any point before.

However, the process of forming investment views is undergoing a profound change. The rules have changed from those that held for the last 40 years. Moreover, if it was just a question of adapting to a new regime, then a good algorithm should be able to do that. But things are not as simple as that. There is the distinct possibility the future is one that involves a greater role of politics in economics and investing, and so suggests an environment that is more inimical to pure rules-driven views of the world.

In addition, the *structure* of the market has been such that a diversified approach to factor investing has simply not been helpful. Maybe parts of Value can rebound, as we have discussed in a recent *Blackbook* [Inflation and the Shape of Portfolios](#), but can we afford to rely on a constant set of exposures to a broad set of factors? Maybe that approach that offers diversification is actually offering too much diversification to be of use?

It is often hard for quant investors to incorporate explicit macro calls into their investment process. Indeed, one could argue that they should not attempt to do so; it is not something that can be backtested and it is very hard to have an edge. We would certainly not want to advocate a switch to "quantamental" investing. That was tried after the GFC; it implies a regular use of discretionary overlays and anyway is a depressingly ugly neologism. However, occasionally changes in the macro status quo come along that investors do need to adapt to. The possibility of higher inflation but without higher rates, or the role of ongoing greater government involvement in the economy are such changes, we think.

One thing quants have succeeded in doing is destroying the active-passive distinction. So making a statement such as "I buy cheap stocks in a sector that has growing margins, or secure free cash flow" sounds to us increasingly like an intent to invest passively, with consequent fee implications. Instead, the reason for each individual investment at the stock level may need non-replicable idiosyncratic reasons for it — if stock alpha is the main source of alpha for the fund.

I was hired by my current employer with a job title that involved the phrase "quantitative strategy." I have come to the conclusion that I have no idea what that label really means. Yes, all investing needs to be aware of systematic signals, either as a basis for forming views, or at the very least to know what kinds of views can be taken in a commoditized way. But at the same time, the rules are changing for investors to a degree we have not seen in decades. It leads to the more interesting question of what KINDS of views are the key ones, the label being less important.

Yes, the march of passive to encroach on areas that used to be thought of as active will be relentless. As we have said many times before, if the metric of opportunity set of the active management industry is the percentage share of AUM run on active versus passive approaches, then look away now. We see no (and we mean no) realistic near-term upper limit on how far passive share of equity and fixed income AUM can go, and that will penetrate the alts space too. But if active management is considered the delivery of an overall return stream that necessarily spans asset classes, then the outlook is more rosy. Add onto that the need to link investment and tax decisions in a closer way and again there will be plenty of work for active managers to do.

So, where does this leave one?

In the short term, correlations may be held higher by central banks; that is likely not great for traditional quant approaches, but ultimately is a temporary issue. We don't believe correlations are permanently higher, they are ultimately a function of the cycle.

One massive advantage that quants have in theory is generally a more disciplined approach to portfolio construction, an ability to process mass data, an awareness of which simple factors are available for free, and above all an awareness of the importance of investment process. These attributes could be used to stand them in good stead.

One area where this could be brought to bear is ESG. It is an area of investing that seems set to grow fast, especially in the US. 2020 has seen an affirmation of ESG in terms of asset share growth. However, the area is beset by problems relating to poor data quality (no one agrees on definitions, lack of agreement of scores, and chronically low frequency of data). ESG may be an area which is ripe for greater quant involvement, both to "disrupt" it and to passivize some of what passes for active ESG investing, but also on the active side too in helping to achieve a higher quality approach.

Quants can also choose to align themselves with the passivization trend. Fee pressure is never going to go away, so continually shifting the barrier between what counts as active and what counts as passive is another route to go. In a sense, this has been implicitly a path that has been trodden since the financial crisis. While active quant AUM share has suffered,

so-called smart beta has grown hugely. However, we recognize this is not the preferred path of defenders of quant investing, there has to be a higher goal.

One option is to overlay a policy view. We may not be able to apply backtests now in the same way as one could historically. Having said that, one can try to unstitch different elements of the historical efficacy of factors and apply it to a view of where macro forces will move. A specific example would be trying to unstitch the roles of inflation expectations and forecasts of real rates in the functioning of a Value factor and investing today in that part of Value that can respond to inflation in the absence of rising rates. Such impositions of a macro view might be uncomfortable, but the exceptional circumstances might warrant it.

A more radical approach would be to recognize that the diversified approach to factors and to stock positioning might be flawed. Thus, a more concentrated portfolio both in terms of factor exposures and especially when it comes to the number of securities could be desirable. Quants have traditionally been diversified, but there are other possibilities.

Likewise, quant funds tend to have short holding periods. Yet, our Alphalytics research suggests that longer holding periods might help ([Alphalytics: Concentrate and hold 'em](#)). There is a deeper issue here in that asset owners who face a harder task of preserving purchasing power may well be forced to adopt longer horizons. Addressing the agency issues inherent in such an approach would be key.

There is also a cross-asset angle. We think some of the major portfolio flows in coming years could be from investors who are taking a cross-asset view. We recently showed ([Fund Management Strategy: Let's play Twister, let's play Risk](#)) that pension plans might have little choice but to put factors alongside asset classes in their approach to asset allocation. Thus, developing factors that fit into a cross-asset view and might even be explicitly cross-asset in construction is an approach that could meet a growing investor need. This also would be supported by an investment environment where a greater share of the active investment view is taken at a more macro level and further removed from single securities, given the explosion in the number of indices and ETF products that allow investment in a segment of the market rather than a single security. After all, there are 70 times as many equity indices today as there are equity securities.

Active management in general may also need to think more broadly about how they add value to their clients. This goes beyond the narrow question of selecting individual assets that may do well, and applies equally to those of a systematic investing disposition. For example, one of the most important areas of investing over the next few years is going to be figuring out how the goals of asset owners need to change, and with that their governance structure and what this means for how they employ asset managers. This implies that the type of funds which are attractive, how they are selected, and how they are assessed will go through a process of revision. Another example might be the tax burden of investors, not usually a topic for quant investors. But if "betas" are set to deliver lower real returns in upcoming years (which we think is likely) and taxes are set to rise (also likely), then it implies that tax decisions might be a relatively larger determinant of the post-fee, post-tax return than an investor faces.

There is a future in using systematic inputs in an investment strategy. At the same time, traditional quant approaches face a high hurdle. If one believes the rules of investment are undergoing a change and don't resume a mean-reverting path, then this implies a step away from relying on a backtest as the primary rationale or support for an investment strategy. Process is important in investing, but also occasionally the system changes in a way that means process has to adapt in a profound way. I believe there is a case to be made that we are seeing such a change now. This applies both directionally in terms of factor views but also in the way these are implemented in a highly diversified portfolio. All of this points to a more uncertain and more intellectually murky future. If quant investing has to rely on such backtests and a diversified framework, then I am no longer a quant. However, systematic inputs into an investment process are more important than others.

BERNSTEIN

# WHY I DO THIS JOB

## OVERVIEW

This final chapter was first published a few years ago upon returning to the office after six months' absence for medical leave. It is a natural place to end this series of essays. This chapter is an attempt to answer this question with a focus on the content of the job in a way that is hopefully applicable to many in the investment industry.

---

## DETAILS

Coming back into the office after six months' absence for medical leave is a good opportunity to assess why one does one's job. There will always be a range of reasons why people gravitate to one job rather than another: the people one works with, the people one gets to meet, the environment, freedom of action, etc. But to write about such things would be needlessly self-obsessed for an essay that is published in the format of a sell-side research note. So, instead for these purposes, I wanted to write about the content of the job. Given the nature of the subject matter, in a break from the norm, this is a chapter written in the first person singular.

People will have different goals in the content of their jobs, but hopefully there is a core to the job that is intellectually interesting. There is not meant to be anything pretentious about that statement, but what it amounts to is the aspiration that the subject matter one is faced with each day is (mainly) interesting. It is that content which will be the main focus of this chapter. But more and more, I can't help feeling that is not enough. There is also ideally an element to a job that is socially useful too. Of course, anything that any one of us does is unlikely to have a measurable effect on society as a whole, but we can aspire to outline a faint link to a social function, nonetheless.

Maybe the yearning for a social function is personal and merely the result of being older, or having been ill. But I suspect there is also a reason of more general applicability to the readers of this chapter. That is the finance industry has vastly expanded its share of the economy, of listed market cap, and of the share of total wages paid over the last 40 years, and now this appears to sit very uneasily with a *zeitgeist* of harder times and changed social and political reality. We find ourselves in the Piketty world where there is a realization (albeit a belated and still hotly debated one) that there has been yawning inequality growing in society. I think there are two practical points to take from this for those who work in finance. First, if the financial industry does not recognize this, then it is at risk of simply being shut down and turned into a utility by an act of fiat of politicians. Second, and more positively, the finance industry has an enormous amount to contribute. Maybe finance has more to contribute to addressing problems that face society than any other sector, pharma and tech included. That is a bold claim, but I would argue, one worth exploring.

If the job cannot fulfil the goals of interesting content and some semblance of social utility — however faintly remote — then there will likely be some lingering question about it. In this industry, we all spend an awful lot of time staring at spreadsheets scrolled across screens or endure wasted evenings sitting exhausted in departure lounges at random airports. One

can do that for years of course and even though it is a cliché to say it, a profoundly personal shock is often needed to make one assess whether one on balance actually enjoys doing it.

I have always found that writing an essay is by far the best way to get one's thoughts in order on a topic. This chapter could have ended with a public statement of resignation,<sup>154</sup> but it does not. This chapter is about why I think that, in fact, the investment industry is exciting and we are fortunate to be part of it. The daily content of the job is (normally) fascinating and there is actually a social point to boot.

One has to work to create the interesting content (and social utility). My own job title is meant to reflect a blend of being a quant analyst and being a strategist. On a very personal level I find that, in fact, I want to reject what both of those titles usually mean.

The job of a strategist used to revolve around setting targets for indices and talking about whether sector x would outperform sector y over the next z months, or maybe a call on country A versus country B. Of course, such tactical statements are rightly part of the job, and not to make them at all would risk having a product that was not grounded in things that clients could actually act on. Moreover, without any such views, it would be impossible to track efficacy and hold the product to account. Nevertheless, to make index targets and tactical sector calls the *raison d'être* of the product is, we think, to lose sight of the wood for the trees. There are big topics, for example, to do with the structure of the market, the way that people invest, and issues that span asset classes that do not fit into an approach predicated on "the FTSE100 year-end target is x."

Similarly, the job of a sell-side quant research analyst used to be mainly about backtesting stuff. The commoditization of data and of backtesting engines was the first nail in the coffin of that approach, the second was the realization that too many traditional factors had been "discovered" to be plausible (and frankly too many new ones to be interesting anyway). There was also a very canonical view of what a quant equity model "ought" to be, grounded in a largely static multifactor framework. With hindsight, it was perhaps helpful that this model was shattered by the financial crisis. But to limit the role of a quant analyst to this anyway is missing the larger and more interesting point that there is a plethora of systematic techniques and data that can be thrown at investment problems. A quant analyst will always, ultimately, deep down be suspicious of "fundamental" colleagues making discretionary calls and will wonder how many of those calls would be better and more reliably handled by a machine. This sentiment has recently become commonplace as people debate the role of AI, but this question in the context of investing has underpinned all quant research for 30 years. The trick is to work out how to temper that suspicion of fundamental discretionary calls with an ability to humbly appreciate the discretionary calls that do work and which no automated model could capture, and also the need to transparently explain what one is doing.

Personally, I think that there is an alternative to these traditional roles anyway. Standing back and thinking about some of the most interesting engagements with clients over the past two decades, it seems that there is a lot more to be done under the general heading of

---

<sup>154</sup> Indeed, when leaving a previous franchise I had toyed with doing exactly this with the final note ending with the Sister Sledge quote "I quit my 9 to 5" (I chickened out of the idea at the last minute and erased the reference before I hit "submit").

the "process of investing." What is the methodology by which people come up with views? How do they judge the likelihood that they are correct? How do they come back and change those views when events turn out differently? How do they bring different types of views together into a portfolio? These then morph with more commercially-motivated questions of which parts of the investment process can and should be done more cheaply by a passive vehicle, and also with larger questions of what are the proper goals of investing and how does the overall framework of selecting and buying and selling of funds function? What emerges are several core subjects where one can maybe try to make a difference and which matter in part because they seem to be omitted by some investors in their rush to form a daily narrative of the market. Questions such as these ultimately frame the entire investment process.

I believe that one can actually achieve a small but tangible improvement by writing about these issues. Maybe that is in part why we occasionally end up with notes in the form of manifestos, as it can be a useful format! Having said that, it is very important that such work is grounded in something tangible. Merely pontificating may feel fleetingly satisfying but it is not good enough. Anyone can do that, but why should others listen? So, along the way one has to form the tactical views, tracking them and being open about when and why they don't work is important.

What techniques can investors try to use to achieve whatever goals they have (the goals themselves should also be up for analysis, of which more later in this chapter) to avoid a "shooting from the hip" approach or regression into pure storytelling? Along the way though, we have to admit that stories are important. Starting out doing quant analysis as one's first foray into finance, it was perhaps natural to initially think that finance was, at heart, a numbers business. That naïve starting position leads to the lingering suspicion that the whole edifice could be eventually reduced to a series of algorithms. However, I have changed my view on this. I think that ultimately finance is actually a people business at its core, but one where significant parts of the work happen to be reducible to algorithms most of the time. If it is ultimately a people business, then the stories will always be important (the humiliating failure of the quants to articulate their failure post 2007 determined a large part of their loss of assets). So there is a role for stories, but still I think that there is far too much reliance on purely telling stories and the industry can move up a gear. Indeed, it is doing that with the commoditization of factor strategies, the adoption of Big Data and AI, and the emergence of a better understanding of the drivers of return.

Forecasting is one of the central tasks of a financial analyst. But what kind of statement about the future can we have more or less confidence in and how do we assess the evidence for it? Ideally, we should seek some evidence of how a metric has worked before we apply it to making forecasts of the future. I am amazed at the number of times portfolio managers or analysts assert that they use a given metric for picking stocks, say, without evidence for whether it works (not to mention that anyway now such a simple approach if used in isolation is rendered obsolete by smart beta). It goes without saying that there are plenty of problems with backtesting or long-run historical analysis, but the only thing worse is not doing it at all. It at least gives a starting point for debate. One can then consider whether the current macro environment makes the testing invalid, or whether it may not apply in a certain micro case because of such and such a reason.

Standing in contrast to that, there used to be a school of thought among the hard-core quant believers that all one had to do was backtesting and nothing else. Indeed, finding new factors and backtesting them for a while seemed to be the main preoccupation of many quants. "See my backtest and buy my fund" has been doomed as a marketing strategy since the quant collapse of August 2007. However, I think that we can see the glimmer of this sentiment returning in some of the marketing hype around AI. It may well indeed work until those funds lose a lot of money. At that point, stories might become important again. The very best stories just might offer something more, which is explanation. We will touch on that later in the chapter.

We cannot avoid forecasting and nor indeed would we want to; after all, it is a large part of what financial analysts are paid to do. But we think there can be an improvement in the confidence bands that are applied to different types of forecast. As one example, we have made the point in our research that in general one can probably be more confident in predicting the future variance and covariance for an asset as these tend to be more "sticky" as opposed to predicting return, which is generally harder.

The holy grail in many cases is to find some process that mean-reverts. Mean-reversion is one of the most powerful forces in investing and so finding such relationships can be a powerful tool which can inspire more confidence than statements of the form "analyst X thinks that Y will happen." The caveat is that mean reversion often takes a long time. While we think the role of patience is poorly understood in the industry (not least because at so many stages in the investment process intermediaries are paid commission for churning, be it in the buying and selling of funds or in the trading of stocks in those funds), it is also no good to only rely on mean-reverting processes that may or may not come good after many years. People are unlikely to pay attention to advice that comes only in that form. There has to be an attempt to harness the power of mean reversion and other such tools and guide investors in their use.

Another area where it strikes me that there is a lot of work to be done is in helping investors think about the composition of returns. Part of this comes down to factors and part is more general questions of portfolio construction. Yes, many more investors today are happy to talk in a factor language than was the case 10 years ago, but there is still a lot of work to be done. In debates with clients, the juxtaposition of the factor perspective of the world plus the question of how to construct portfolios with macro and micro views that investors have leads to a very interesting and rich debate. In a sense, that is the core of the day job and the formation of tactical views.

Questioning the philosophical underpinnings of financial modeling has always been a niche interest to say the least. Alluding to it in a note probably causes most readers to skip on. However, I think there will be more interest in this topic. The rapid growth of AI applied to Big Data seems likely to bring about the largest change in the nature of financial research since the move from paper spreadsheets to computer ones. In the process, this begs a fundamental question of what we want from our financial models and what form do they take. Financial analysts have an exciting moment when maybe for the first time in a few decades there seems likely to be a real demand for an open discussion about the philosophical basis for financial models (whether or not people call it that). I think this comes down to the key distinction between whether models are used to "merely" predict

or whether they are also required to offer explanation as well. Initial attempts at AI with Big Data seem to be firmly in the former camp. That is fine for most purposes, but we suspect that eventually explanation may be demanded as an aim. This happens to coincide with a post financial crisis questioning of the role and need for financial theory. So the nature and purpose of financial modeling appears to be in flux and we all have an opportunity to be part of that debate.

At a much more practical and mundane level, this transition also raises the question of what financial models need to look like. At the moment, I suspect that more than 95% of analyst models for companies physically manifest themselves in Excel. In an AI and Big Data world, do we need a larger proportion of them to exist in code instead? How are we to manage this transition, with its implications for the skillsets of individuals and accessibility of data? We covered this in our "What Is a Model?" chapter in this *Blackbook*, so I won't go over that material again here. But this seems to be an exciting transition with a lot of work needed.

And then there is the question of social function and the future of our industry. I almost wish I hadn't written that Marxism note.<sup>155</sup> Yes of course, it was nice that it gained attention. But too many people read the headline and assumed that I am in some way anti passive and in favor of active at any cost, and that seems to have been a filter through which people have seen our subsequent research. For the record, let's be clear: passive investing has done more to democratize access to capital markets than any other innovation in investing that I can think of. With hindsight, I think it should not be controversial that in the past there were too many active managers charging active fees for delivering returns that were indistinguishable from the market. Who would want to defend that? Undoing that is one half of a revolution in investing. The other part still remains to be done, which is the process of choosing funds and linking the fund/asset/factor allocation process to client outcomes.

I believe that the whole framework of fund selection, incentivization of managers, and setting of goals by asset managers needs to change. This will be a huge task and a large part of the job in future is likely to be trying to steer the industry to a better place on this point. It has been relatively easy to set up passive competitors and take business away from active funds. That has been the story of the last decade. It is going to be harder to complete this revolution because it requires a system change across different corporates and how they interact with each other. Asset owners need help in setting what their goal should really be, the process of asset allocation/fund selection then needs a radical overhaul, and then asset managers need to work out how to best fit into this framework.

What should portfolio managers really be targeting and, more importantly, what targets should asset owners set when hiring fund managers? It seems the industry has got stuck in a rut on this point. There appears to be an accepted view in many institutional investment contexts where someone (a consultant?) decides an asset allocation, which is often some derivative of 60:40, but modified to include a chunky allocation (and even chunkier fee allocation) to so-called alternatives. Within the equity bucket again, someone has decided that one needs to manage active allocations within various categories such as "US large cap growth" or "international value." This approach seeks to solve an agency problem but at the expense of the outcome of the client and that needs to be radically transformed. I

---

<sup>155</sup> [The Silent Road to Serfdom: Why Passive Investing is Worse Than Marxism](#)

think this approach will not work for the end asset-owners in a low-return, higher-correlation world.

Andrew Haldane wrote a wonderful essay on patience in finance.<sup>156</sup> I think that a certain form of patience needs to be cultivated in investing. The empirical evidence seems very plain to me that investors churn funds too much and thereby impose a significant cost upon themselves. Of course, it is very easy to say this but harder to say what framework should replace it, not least as feeling a need to change something when things appear to be going awry is a very basic human impulse. But trying to improve this process should be a major concern for anyone who cares about the future of the industry (not to mention the return of investors).

Yes, passive took market share in part because there were too many active managers hugging the benchmark in the past. But it also took market share because nearly all asset classes went up and did so with low correlation. That second support of passive is going to come to an end and I think many investors need help understanding the implications of this. We wrote about why this is happening in [Global Quantitative Strategy: The Strategic Investment Outlook - Blame it on the Boogie](#), so I won't repeat the argument here. I think that this will end the whole active-passive distinction as it is currently understood and leave us with an investment industry much more targeted toward the end outcomes of clients.

This will be a daunting task for the industry, not least because it also implies significant organizational change. But it promises to throw up many intellectual and organizational problems that will need to be addressed. Moreover, with this change, the industry will likely be much more useful for society at large and so comes back to the point we made earlier about fulfilling a role of social utility.

Coming back to that Marxism note, I believe that there is a system-wide problem with passive which is the breakdown of the allocation of capital. But it is up to the investment industry to demonstrate that it can indeed add value to society in its role as an allocator of capital. Through a research product, one can try to develop empirical evidence for this role and also hopefully make the case that asset managers need to care about this.

The nexus of the strategic outlook for returns (notionally a topic for strategists), the correlation and factor composition of the market (notionally a topic for quant analysts), and the outlook for the fund management industry (not normally a topic for the sell-side at all) seems to me to be a fascinating area for analysis. I am only surprised that there don't appear to be more people turning their analysis to this confluence of topics. These will manifest themselves in a number of specific issues. A few examples would be the outlook for the global equity and bond markets and how we can bring to bear historical experience of valuations and the impact of the macro outlook to form a view. We have alluded to the upheaval that AI and Big Data will likely cause in financial research. There are some immediate questions that can be addressed in relation to that, e.g., where it is appropriate to use these techniques and where they are better or less good than current approaches. Other important questions include how to incorporate these techniques into a broader

---

<sup>156</sup> Andrew Haldane: *Patience and Finance*, available at <https://www.bankofengland.co.uk/-/media/boe/files/news/2010/september/patience-and-finance-paper-by-andy-haldane>

investment program and how to recognize where they may fail. Ultimately, the demand for return streams and how these fit into a broader social role for asset management are huge challenges that lie ahead for the industry and those who work in it. These might offer commercial opportunities, but also seem to also require a different intellectual basis for the forming of investment decisions.

BERNSTEIN

## BIBLIOGRAPHY

- Alberg and Lipton (2017): *Improving Factor-Based Quantitative Investing by Forecasting Company Fundamentals*, available at: <https://arxiv.org/pdf/1711.04837v1.pdf>
- Bakewell (2010): *How to Live: A life of Montaigne in one question and twenty attempts at an answer*, Vintage Books
- Bardon, A (2013) *A brief history of the philosophy of time book*, Oxford University Press
- Balzac (1831): *The Unknown Masterpiece*
- Beech, D (2019): *Art and Postcapitalism: Aesthetic, Labour, Automation and Value Production*, Pluto press
- Berardi (2019): *Breathing – Chaos and Poetry*. Semiotext(e)
- Berardi (2012): *The Uprising – on Poetry and Finance*. Semiotext(e)
- Bishop, G (1960): *Charles H. Dow and the Dow Theory*, Appleton-Century-Crofts
- Blanqué (2014): *Essays in Positive Investment Management*, Economica
- Blanqué, P (2010): *Money, Memory and Asset Prices*, Economica
- Boden, M (1990): *The Philosophy of Artificial Intelligence*, Oxford University Press
- Bookstaber, R (2017): *The End of Theory: Financial Crises, The Failure of Economics, and the Sweep of Human Interaction*, Princeton University Press
- Bookstaber, R (2007): *A Demon of Our Own Design: Markets, Hedge Funds and the Perils of Financial Innovation*, Wiley
- Borges (1941): *Library of Babel*
- Borland, L Bouchard, J-P, Muzy, J-F, Zumbach G (2008): *The dynamics of financial markets – Mandelbrot's multifractal cascades and beyond*. Available at <https://arxiv.org/abs/cond-mat/0501292>
- Burke (1757): *A Philosophical Enquiry into the Origin of Our Ideas of the Sublime and Beautiful*
- Caggese and Perez-Orive (2016): *Reallocation of Intangible Capital and Secular Stagnation*. Available at <https://cepr.org/sites/default/files/Perez-Orive.pdf>

- Callender, C (2011): *The Oxford Handbook of Philosophy of Time*, Oxford University Press
- Cartwright (1980): *Do the Laws of Physics State the Facts?* Pacific Philosophical Quarterly 61 (1980)
- Cartwright, N (1983): *How The Laws of Physics Lie*, Oxford University Press
- Crary, J (2013) 24/7, Verso
- Curd and Cover (1998): *Philosophy of Science: The Central Issues*, Norton
- *Encyclopædia Britannica* (1881), 9th edition
- Frankish, K and Ramsey, W (2014): *The Cambridge Handbook of Artificial Intelligence*, Cambridge University Press
- Graeber (2019): *Against Economics*. New York Review of Books December 2019
- Graham (1976): *A conversation with Benjamin Graham*. available at <http://www.grahamanddoddsville.net/wordpress/Files/Gurus/Benjamin%20Graham/A%20Conversation%20with%20Ben%20Graham%20-%20Financial%20Analysts%20Journal%20-%201976.pdf>
- Harvey, C (2015): *. . . and the Cross-Section of Expected Returns*, available at [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2249314](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2249314)
- Haskel, J and Westlake, S (2018): *Capitalism without Capital: The rise of the intangible economy*, Princeton University Press
- Hitchcock (2004): *Contemporary Debates in Philosophy of Science*, Blackwell
- *Il Palazzo Enciclopedico* (2013), catalogue of the 55th Venice Biennale
- Jiang, X Chen T and Zheng B (2013): *Time reversal asymmetry in financial systems*, *Physica A*, Volume 392, Issue 21, 1 November 2013, Pages 5369-5375
- Kelton, S (2020): *The Deficit Myth*, John Murray
- Kincaid, H and Ross, D (2009): *The Oxford Handbook of Philosophy of Economics*, Oxford University Press
- Kuhn (1970): *The Structure of Scientific Revolutions*, Chicago University Press
- *La Biennale di Venezia*, catalogue 2017
- Lange (2007): *Philosophy of Science: An Anthology*, Blackwell
- Langewiesche, W (2010): *Aloft*, Penguin

- Lo (2017): *Adaptive Markets*, Princeton University Press
- Lo, A (2008): *Hedge Funds, Systematic Risk, and the Financial Crisis of 2007-2008*, available at [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1301217](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1301217)
- Lo (2010): WARNING: *Physics envy may be hazardous to your wealth!* available at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1563882](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1563882)
- Long, R (2009): *Heaven and Earth*, Tate Publishing
- Lynch, L (2016): *You Could Look it Up*, Bloomsbury Press
- Magris (1999): *Microcosms*, Harvill Press
- Marx, K, *Grundrisse*
- Nichols (2017): *The Death of Expertise*. Oxford
- Papineau (1996): *The Philosophy of Science, Oxford Readings in Philosophy*
- Perrow (1984): *Normal Accidents: Living with High-Risk Technologies*, Basic Books
- Perrow, C (1999): *Normal Accidents: Living with High Risk Technologies*, 2nd edition, Princeton University Press
- Phillips, P and Ploberger, W (1996): *An Asymptotic Theory of Bayesian Inference for Time Series. Econometrica* 64
- Piketty, T (2014): *Capital*, Harvard University Press
- Piketty, T (2013) *Capital in the Twenty-First Century*
- Price, H (1996): *Time's Arrow and Archimedes' Point* , Oxford University Press
- Reiss, J (2013): *Philosophy of Economics*, Routledge
- Savitt, S (1995): *Time's Arrows Today – Recent physical and philosophical work on the direction of time*. Cambridge University Press
- Scheidel, W (2017) *The Great Leveller*, Princeton University Press
- Skidelsky (2018): *Money and Government: A Challenge to Mainstream Economics*, Penguin
- Sklar, L (1993): *Physics and Chance: Philosophical issues in the foundations of statistical mechanics*, Cambridge University Press
- Solnit, R (2020) 'The impossible has already happened': what coronavirus can teach us about hope. Available at <https://www.theguardian.com/world/2020/apr/07/what-coronavirus-can-teach-us-about-hope-rebecca-solnit>

- Soros (1998): *The Crisis of Global Capitalism*, Public Affairs
- Srnicek, N and Williams, A(2013): *Accelerationist Manifesto* available at <https://criticallegalthinking.com/2013/05/14/accelerate-manifesto-for-an-accelerationist-politics/>
- Srnicek, N and Williams, A(2016): *Inventing the Future: Postcapitalism and a World Without Work*, Verso
- Stoppard, T (1993): *Arcadia*, Faber and Faber.
- Sugden, R (2000): *Credible Worlds: The Status of Theoretical Models in Economics*, Journal of Economic Methodology 7(1)
- Thagard (1978): *Why Astrology Is A Pseudoscience*, In Philosophy of Science Association 1978 Volume 1, edited by P.D. Asquith and I. Hacking (East Lansing: Philosophy of Science Association, 1978)
- Varoufakis (2017): *Talking to my daughter about the Economy: A Brief History of Capitalism*, Penguin
- Weinberg (1996) *Sokal's Hoax*, The New York Review of Books, August 8, 1996
- White, H (2000): *A Reality Check for Data Snooping*, Econometrica 68 (5)
- Williams and Srnicek (2013): *#ACCELERATE MANIFESTO for an Accelerationist Politics* available at <http://criticallegalthinking.com/2013/05/14/accelerate-manifesto-for-an-accelerationist-politics/>.
- Wootton, D (2015): *The Invention of Science*, Allen Lane
- Zeihan, P (2014) *The Accidental Superpower*, Twelve
- Zumbach (2007): *Time reversal invariance in finance*, available at <https://arxiv.org/pdf/0708.4022.pdf>

## Disclosure Appendix

### REQUIRED REGULATORY DISCLOSURES

- Separate branding is maintained for “Bernstein” and “Autonomous” research products. Each brand operates as a separate business unit within the regulated entities referenced herein namely: Sanford C. Bernstein & Co., LLC, Sanford C. Bernstein (Hong Kong) Limited 盛博香港有限公司 and Bernstein Autonomous LLP. For information relating to “Autonomous” branded products (including certain Sales materials) please visit: [www.autonomous.com](http://www.autonomous.com). For information relating to Bernstein branded products please visit: [www.bernsteinresearch.com](http://www.bernsteinresearch.com). Recommendations contained within one type of research product may differ from recommendations contained within other types of research products, whether as a result of differing time horizons, methodologies or otherwise. Furthermore, views or recommendations within a research product issued under any particular brand may differ from views or recommendations under the same type of research product issued under another brand. The Research Ratings System for the Autonomous brand and the Bernstein brand and other information related to those Rating Systems are below.
- On and as of April 1, 2019, AllianceBernstein L.P. acquired Autonomous Research. As a result of the acquisition, the research activities formerly conducted by Autonomous Research US LP were assumed by Sanford C. Bernstein & Co., LLC, which continues to publish research under the Autonomous Research US brand and the research activities formerly conducted by Autonomous Research Asia Limited were assumed by Sanford C. Bernstein (Hong Kong) Limited 盛博香港有限公司, which continues to publish research under the Autonomous Research Asia brand.
- On and after close of business on December 31, 2020, as part of an internal reorganisation of the corporate group, Sanford C. Bernstein Limited transferred its business to its affiliate Autonomous Research LLP. Subsequent to this transfer, Autonomous Research LLP changed its name to Bernstein Autonomous LLP. As a result of the reorganisation, the research activities formerly conducted by Sanford C. Bernstein Limited were assumed by Bernstein Autonomous LLP, which is authorised and regulated by the Financial Conduct Authority (FRN 500498) and now publishes research under the Bernstein Research Brand.
- Please note that all price targets, recommendations and historical price charts are unaffected by the transfer of the business from Sanford C. Bernstein Limited and have been carried forward unchanged to Bernstein Autonomous LLP. You can continue to find this information on the Bernstein website at [www.bernsteinresearch.com](http://www.bernsteinresearch.com).
- References to “Bernstein” or the “Firm” in these disclosures relate to the following entities: Sanford C. Bernstein & Co., LLC, Bernstein Autonomous LLP, Sanford C. Bernstein Limited (for dates prior to January, 1, 2021), Autonomous Research LLP (for dates between April 1, 2019 and December 31, 2020), Sanford C. Bernstein (Hong Kong) Limited 盛博香港有限公司, Sanford C. Bernstein (Canada) Limited, Sanford C. Bernstein (India) Private Limited (SEBI registration no. INH000006378) and Sanford C. Bernstein (business registration number 53193989L), a unit of AllianceBernstein (Singapore) Ltd. which is a licensed entity under the Securities and Futures Act and registered with Company Registration No. 199703364C.
- Analysts are compensated based on aggregate contributions to the research franchise as measured by account penetration, productivity and proactivity of investment ideas. No analysts are compensated based on performance in, or contributions to, generating investment banking revenues.

### OTHER IMPORTANT DISCLOSURES

The Firm produces a number of different types of research products including, among others, fundamental analysis, quantitative analysis and analytics. Sanford C. Bernstein & Co., LLC, Sanford C. Bernstein (Hong Kong) Limited 盛博香港有限公司, and Bernstein Autonomous LLP, each issue research products under the “Autonomous” publishing brand independently of the “Bernstein” and “Alphalytics” publishing brands. Recommendations contained within one type of research product may differ from recommendations contained within other types of research products, whether as a result of differing time horizons, methodologies or otherwise. Furthermore, views or recommendations within a research product issued under any particular brand may differ from views or recommendations under the same type of research product issued under another brand.

Where this material contains an analysis of debt product(s), such material is intended only for institutional investors and is not subject to the independence and disclosure standards applicable to debt research prepared for retail investors.

This document may not be passed on to any person in the United Kingdom (i) who is a retail client (ii) unless that person or entity qualifies as an authorised person or exempt person within the meaning of section 19 of the UK Financial Services and Markets Act 2000 (the “Act”), or qualifies as a person to whom the financial promotion restriction imposed by the Act does not apply by virtue of the Financial Services and Markets Act 2000 (Financial Promotion) Order 2005, or is a person classified as an “professional client” for the purposes of the Conduct of Business Rules of the Financial Conduct Authority.

This document may not be passed onto any person in Canada unless that person qualifies as “permitted client” as defined in Section 1.1 of NI 31-103.

**To our readers in the United States:** Sanford C. Bernstein & Co., LLC, a broker-dealer registered with the U.S. Securities and Exchange Commission ("SEC") and a member of the U.S. Financial Industry Regulatory Authority, Inc. ("FINRA") is distributing this publication in the United States and accepts responsibility for its contents. Any U.S. person receiving this publication and wishing to effect securities transactions in any security discussed herein should do so only through Sanford C. Bernstein & Co., LLC. Where this report has been prepared by research analyst(s) employed by a non-US affiliate (such analyst(s), "Non-US Analyst(s)") of Sanford C. Bernstein & Co., LLC, such Non-US Analyst(s) is/are (unless otherwise expressly noted) not registered as associated persons of Sanford C. Bernstein & Co., LLC or any other SEC-registered broker-dealer and are not licensed or qualified as research analysts with FINRA or any other US regulatory authority. Accordingly, reports prepared by Non-US Analyst(s) are not prepared in compliance with FINRA's restrictions regarding (among other things) communications by research analysts with a subject company, interactions between research analysts and investment banking personnel, participation by research analysts in solicitation and marketing activities relating to investment banking transactions, public appearances by research analysts, and trading securities held by a research analyst account.

**To our readers in the United Kingdom:** This publication has been issued or approved for issue in the United Kingdom by Bernstein Autonomous LLP, authorised and regulated by the Financial Conduct Authority and located at 50 Berkeley Street, London W1J 8SB, +44 (0)20-7170-5000.

**To our readers in Ireland and the member states of the EEA:** This publication is being distributed by Sanford C. Bernstein Ireland Limited, which is authorised and regulated by the Central Bank of Ireland.

**To our readers in Hong Kong:** This publication is being distributed in Hong Kong by Sanford C. Bernstein (Hong Kong) Limited 盛博香港有限公司, which is licensed and regulated by the Hong Kong Securities and Futures Commission (Central Entity No. AXC846). This publication is solely for professional investors only, as defined in the Securities and Futures Ordinance (Cap. 571).

**To our readers in Singapore:** This publication is being distributed in Singapore by Sanford C. Bernstein, a unit of AllianceBernstein (Singapore) Ltd., only to accredited investors or institutional investors, as defined in the Securities and Futures Act (Chapter 289). Recipients in Singapore should contact AllianceBernstein (Singapore) Ltd. in respect of matters arising from, or in connection with, this publication. AllianceBernstein (Singapore) Ltd. is a licensed entity under the Securities and Futures Act and registered with Company Registration No. 199703364C. It is regulated by the Monetary Authority of Singapore and located at One Raffles Quay, #27-11 South Tower, Singapore 048583, +65-62304600. The business name "Bernstein" is registered under business registration number 53193989L.

**To our readers in the People's Republic of China:** The securities referred to in this document are not being offered or sold and may not be offered or sold, directly or indirectly, in the People's Republic of China (for such purposes, not including the Hong Kong and Macau Special Administrative Regions or Taiwan), except as permitted by the securities laws of the People's Republic of China.

**To our readers in Japan:** This document is not delivered to you for marketing purposes, and any information provided herein should not be construed as a recommendation, solicitation or offer to buy or sell any securities or related financial products.

For the institutional client readers in Japan who have been granted access to the Bernstein website by Daiwa Securities Group Inc. ("Daiwa"), your access to this document should not be construed as meaning that Bernstein is providing you with investment advice for any purposes. Whilst Bernstein has prepared this document, your relationship is, and will remain with, Daiwa, and Bernstein has neither any contractual relationship with you nor any obligations towards you

**To our readers in Australia:** Sanford C. Bernstein & Co., LLC, Bernstein Autonomous LLP and Sanford C. Bernstein (Hong Kong) Limited 盛博香港有限公司 are exempt from the requirement to hold an Australian financial services licence under the Corporations Act 2001 in respect of the provision of the following financial services to wholesale clients:

- providing financial product advice;
- dealing in a financial product;
- making a market for a financial product; and
- providing a custodial or depository service.

**To our readers in Canada:** If this publication is pertaining to a Canadian domiciled company, it is being distributed in Canada by Sanford C. Bernstein (Canada) Limited, which is licensed and regulated by the Investment Industry Regulatory Organization of Canada ("IIROC"). If the publication is pertaining to a non-Canadian domiciled company, it is being distributed by Sanford C. Bernstein & Co., LLC, which is licensed and regulated by both the SEC and FINRA into Canada under the International Dealers Exemption. This publication may not be passed onto any person in Canada unless that person qualifies as a "Permitted Client" as defined in Section 1.1 of NI 31-103.

**To our readers in India:** This publication is being distributed in India by Sanford C. Bernstein (India) Private Limited (SCB India) which is licensed and regulated by Securities and Exchange Board of India ("SEBI") as a research analyst entity under the SEBI (Research Analyst) Regulations, 2014, having registration no. INH000006378 and as a stock broker having registration no. INZ000213537. SCB India is currently engaged in the business of providing research and stock broking services.

SCB India is a private limited company incorporated under the Companies Act, 2013, on April 12, 2017 bearing corporate identification number U65999MH2017FTC293762, and registered office at Level 6, 4 North Avenue, Maker Maxity, Bandra Kurla Complex, Bandra (East), Mumbai 400051, Maharashtra, India (Phone No: +91-22-68421401).

SCB India does not have any disciplinary history as on the date of this report.

The associates of SCB India or their relatives may have financial interest(s) in the subject company.

SCB India or its associates do not have actual/beneficial ownership of one percent or more securities of the subject company. SCB India is not engaged in any investment banking activities, as such, SCB India has not managed or co-managed a public offering in the past twelve months. In addition, neither SCB India nor any of its associates have received any compensation for investment banking services or merchant banking services from the subject company in the past 12 months.

SCB India or its associates may have received compensation for brokerage services from the subject company in the past twelve months.

SCB India or its associates may have received compensation for products or services other than investment banking or merchant banking or brokerage services from the subject company in the past twelve months.

SCB India and its associates have not received any compensation or other benefits from the subject company or third party in connection with the research report.

The principal research analysts who prepared this report, a member of his or her team, are not (nor are any members of their household) an officer, director, employee or advisory board member of the companies covered in the report.

SCB India and its associate company(ies) may act as a market maker in the financial instruments of the companies covered in the report.

Sanford C. Bernstein & Co., LLC., Bernstein Autonomous LLP, Sanford C. Bernstein (Hong Kong) Limited 盛博香港有限公司, Sanford C. Bernstein (Canada) Limited and AllianceBernstein (Singapore) Ltd., Sanford C. Bernstein (India) Private Limited are regulated, respectively, by the Securities and Exchange Commission under U.S. laws, by the Financial Conduct Authority under U.K. laws, by the Hong Kong Securities and Futures Commission under Hong Kong laws, by the Investment Industry Regulatory Organization of Canada, by the Monetary Authority of Singapore under Singapore laws, and Securities and Exchange Board of India, all of which differ from Australian laws.

One or more of the officers, directors, or employees of Sanford C. Bernstein & Co., LLC, Bernstein Autonomous LLP, Sanford C. Bernstein (Hong Kong) Limited 盛博香港有限公司, Sanford C. Bernstein (India) Private Limited, Sanford C. Bernstein (Canada) Limited, Sanford C. Bernstein (business registration number 53193989L), a unit of AllianceBernstein (Singapore) Ltd. which is a licensed entity under the Securities and Futures Act and registered with Company Registration No. 199703364C, and/or their affiliates may at any time hold, increase or decrease positions in securities of any company mentioned herein.

The Firm or its affiliates may provide investment management or other services to the pension or profit sharing plans, or employees of any company mentioned herein, and may give advice to others as to investments in such companies. These entities may effect transactions that are similar to or different from those recommended herein.

All Bernstein branded research publications are disseminated to our clients through posting on the firm's password protected website, [www.bernsteinresearch.com](http://www.bernsteinresearch.com). Certain, but not all, Bernstein branded research publications are also made available to clients through third-party vendors or redistributed to clients through alternate electronic means as a convenience. For access to all available Bernstein branded research publications, please contact your sales representative or go to <http://www.bernsteinresearch.com>

The Firm and/or its affiliates do and seek to do business with companies covered in its research publications. As a result, investors should be aware that the Firm and/or its affiliates may have a conflict of interest that could affect the objectivity of this publication. Investors should consider this publication as only a single factor in making their investment decisions.

This publication has been published and distributed in accordance with the Firm's policy for management of conflicts of interest in investment research, a copy of which is available from Sanford C. Bernstein & Co., LLC, Director of Compliance, 1345 Avenue of the Americas, New York, N.Y. 10105, Bernstein Autonomous LLP, Director of Compliance, 50 Berkeley Street, London W1J 8SB, United Kingdom, or Sanford C. Bernstein (Hong Kong) Limited 盛博香港有限公司, Director of Compliance, 39th Floor, One Island East, Taikoo Place, 18 Westlands Road, Quarry Bay, Hong Kong, or Sanford C. Bernstein (business registration number 53193989L), a unit of AllianceBernstein (Singapore) Ltd. which is a licensed entity under the Securities and Futures Act and registered with Company Registration No. 199703364C, Director of Compliance, One Raffles Quay, #27-11 South Tower, Singapore 048583, or Sanford C. Bernstein (India) Private Limited, Chief Compliance Officer, Level 6, 4 North Avenue, Maker Maxity, Bandra Kurla Complex, Bandra (East), Mumbai 400051. Additional disclosures and information regarding Bernstein's business are available on our website [www.bernsteinresearch.com](http://www.bernsteinresearch.com).

This report has been produced by an independent analyst as defined in Article 3 (1)(34)(i) of EU 296/2014 Market Abuse Regulation ("MAR").

This publication is not directed to, or intended for distribution to or use by, any person or entity who is a citizen or resident of, or located in any locality, state, country or other jurisdiction where such distribution, publication, availability or use would be contrary to law or regulation or which would subject Bernstein or any of their subsidiaries or affiliates to any registration or licensing requirement within such jurisdiction. This publication is based upon public sources we believe to be reliable, but no representation is made by us that the publication is accurate or complete. We do not undertake to advise you of any change in the reported information or in the opinions herein. This publication was prepared and issued by Bernstein for distribution to eligible counterparties or professional clients. This publication is not an offer to buy or sell any security, and it does not constitute investment, legal or tax advice. The investments referred to herein may not be suitable for you. Investors must make their own investment decisions in consultation with their professional advisors in light of their specific circumstances.

The value of investments may fluctuate, and investments that are denominated in foreign currencies may fluctuate in value as a result of exposure to exchange rate movements. Information about past performance of an investment is not necessarily a guide to, indicator of, or assurance of, future performance.

## CERTIFICATIONS

- Each research analyst named on the front page of this research report certifies that all of the views expressed in this publication accurately reflect his/her personal views about any and all of the subject securities or issuers and that no part of his/her compensation was, is, or will be, directly or indirectly, related to the specific recommendations or views in this publication.



## BERNSTEIN GLOBAL SALES OFFICES

### AMSTERDAM

WTC Schiphol Airport, A-Tower  
+31-20-201-4982

### BOSTON

53 State Street  
+1-617-788-3705

### CHICAGO

227 West Monroe Street  
+1-312-696-7800

### DUBLIN

4 Earlsfort Terrace  
+353-1-246-3100

### FRANKFURT

Bockenheimer Landstrasse 51  
+49-69-5050-77-181

### HONG KONG

One Island East, Taikoo Place  
+852-2918-5762

### LONDON

50 Berkeley Street  
+44-207-170-5000

### LOS ANGELES

1999 Avenue of the Stars  
+1-310-407-0027

### MILAN

Via Monte di Pietà 21  
+39-02-30304-400

### MUMBAI

Maker Maxity, BKC  
+91-22-6842-1401

### NEW YORK

1345 Avenue of the Americas  
+1-212-969-2204

### SINGAPORE

One Raffles Quay, South Tower  
+65-6230-4600

### STOCKHOLM

Hamngatan 11  
+46-8-535-274-80

### TORONTO

161 Bay Street  
+1-416-572-2466

### ZURICH

Talstrasse 83  
+41-44-227-7910



BERNSTEIN