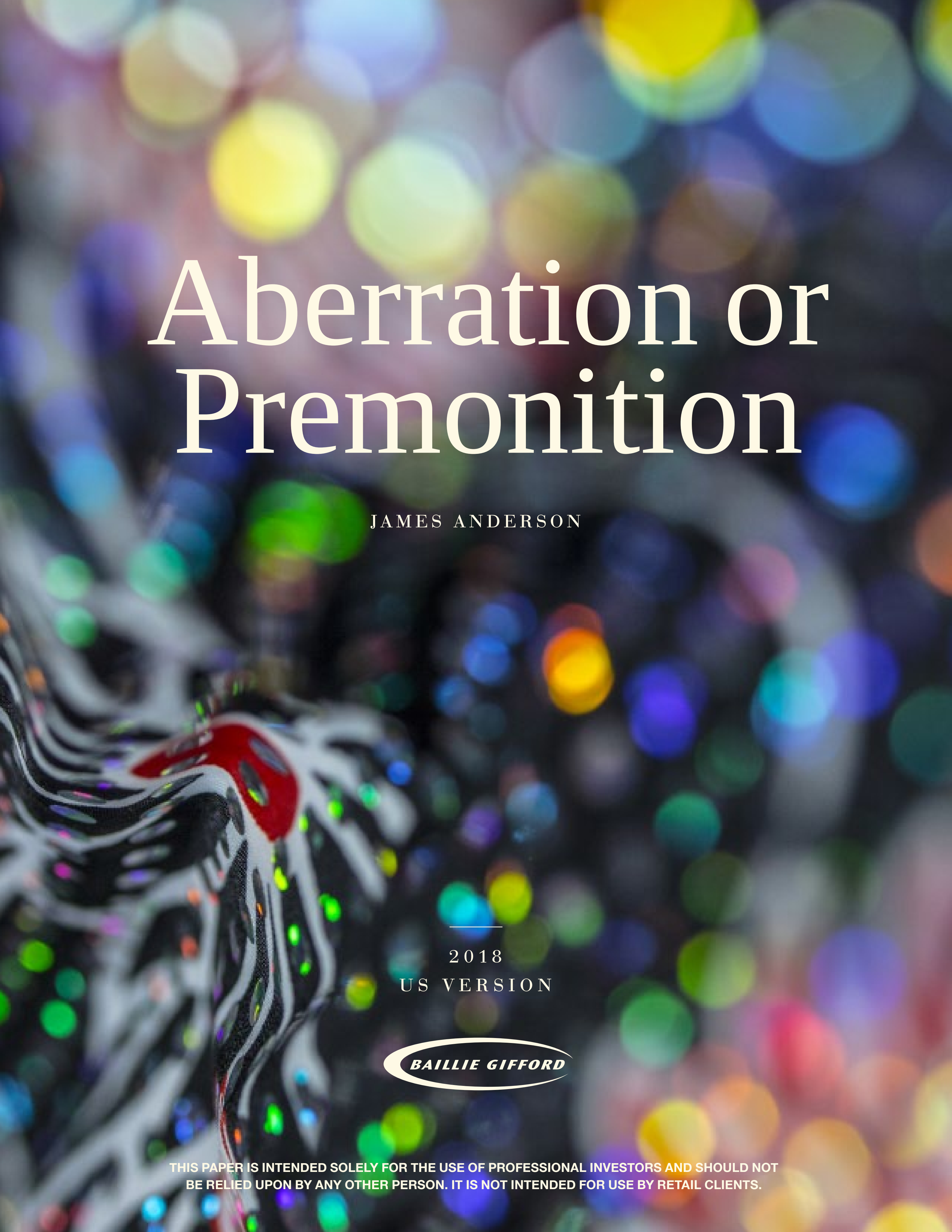


Aberration or Premonition

JAMES ANDERSON

2018
US VERSION

BAILLIE GIFFORD

IMPORTANT INFORMATION AND RISK FACTORS

RISK FACTORS

The views expressed in this article are those of James Anderson and should not be considered as advice or a recommendation to buy, sell or hold a particular investment. They reflect personal opinion and should not be taken as statements of fact nor should any reliance be placed on them when making investment decisions.

POTENTIAL FOR PROFIT AND LOSS

All investment strategies have the potential for profit and loss, your or your clients' capital may be at risk. Past performance is not a guide to future returns.

STOCK EXAMPLES

Any stock examples and images used in this article are not intended to represent recommendations to buy or sell, neither is it implied that they will prove profitable in the future. It is not known whether they will feature in any future portfolio produced by us. Any individual examples will represent only a small part of the overall portfolio and are inserted purely to help illustrate our investment style.

This article contains information on investments which does not constitute independent research. Accordingly, it is not subject to the protections afforded to independent research and Baillie Gifford and its staff may have dealt in the investments concerned.

All information is sourced from Baillie Gifford & Co and is current unless otherwise stated.

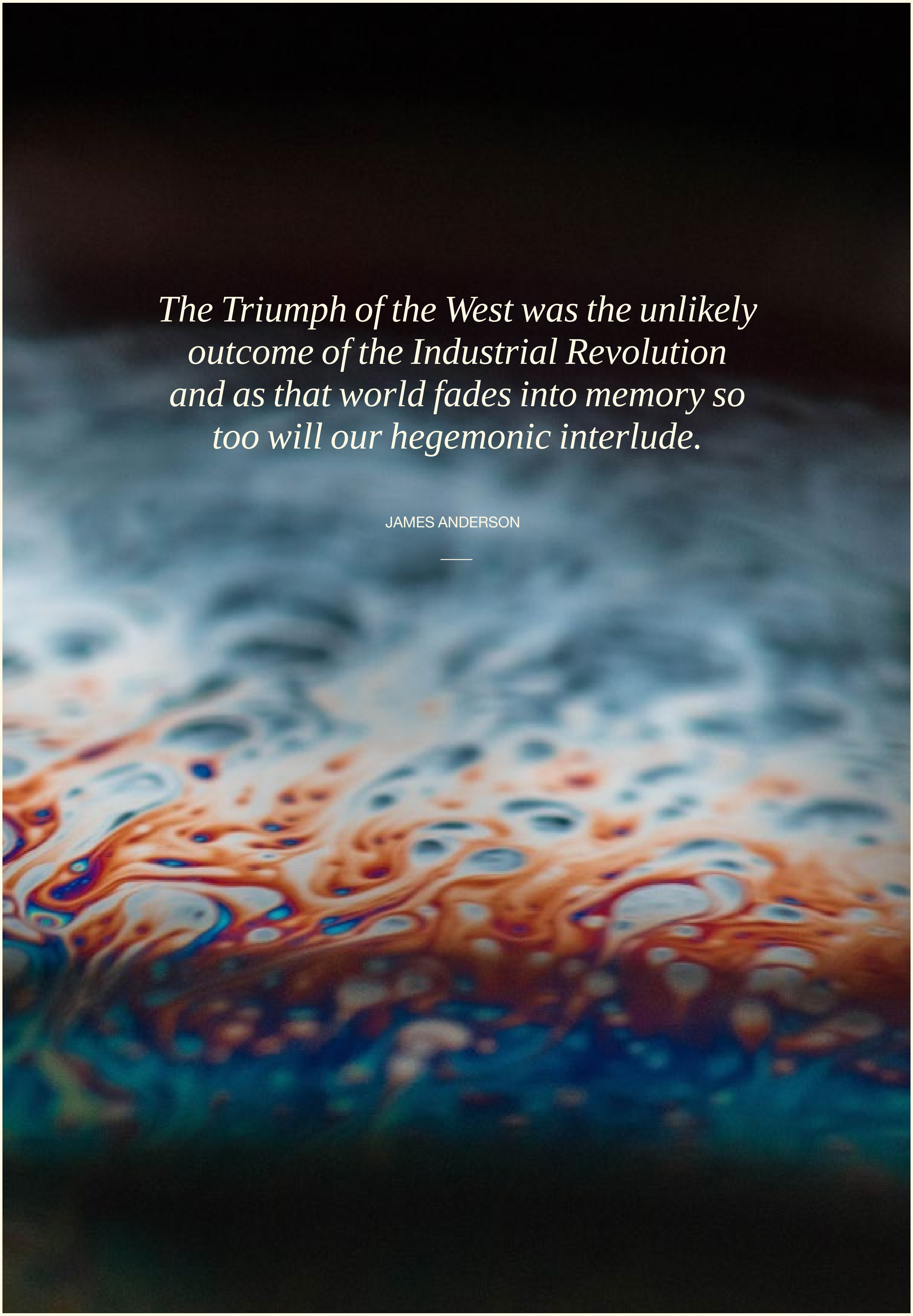
The images used in this article are for illustrative purposes only.

Annual Past Performance to 31 December Each Year

	2013	2014	2015	2016	2017
Long Term Global Growth Composite Net (%)	32.8	6.1	13.6	-4.0	54.4

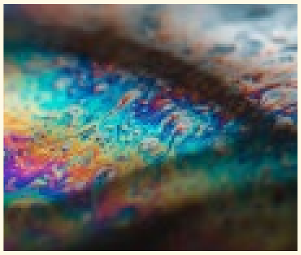
Source: Baillie Gifford & Co. US Dollars.

Changes in the investment strategies, contributions or withdrawals may materially alter the performance and results of the portfolio.


The Triumph of the West was the unlikely
outcome of the Industrial Revolution
and as that world fades into memory so
too will our hegemonic interlude.
JAMES ANDERSON

JAMES ANDERSON
Partner

James graduated BA in History from Oxford University and after postgraduate study in Italy and Canada he gained an MA in International Affairs in 1982. He is a Trustee of the Johns Hopkins University. He joined Baillie Gifford in 1983 and became a Partner in 1987. He headed our European Equity team until 2003 when he co-founded our Long Term Global Growth strategy. He has Chaired the EAFE Alpha Portfolio Group since its inception in 2003 and has been the Manager and then Joint Manager of Scottish Mortgage Investment Trust since 2000. He has also served as a member of the Advisory Board of the government sponsored Kay Review and as Chair of the subsequent industry working group that set up the UK Investor Forum. James is a member of the Firm’s Strategic Leadership Group.



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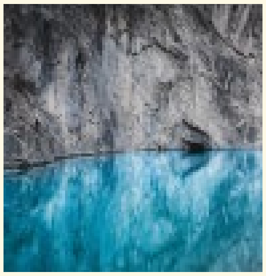
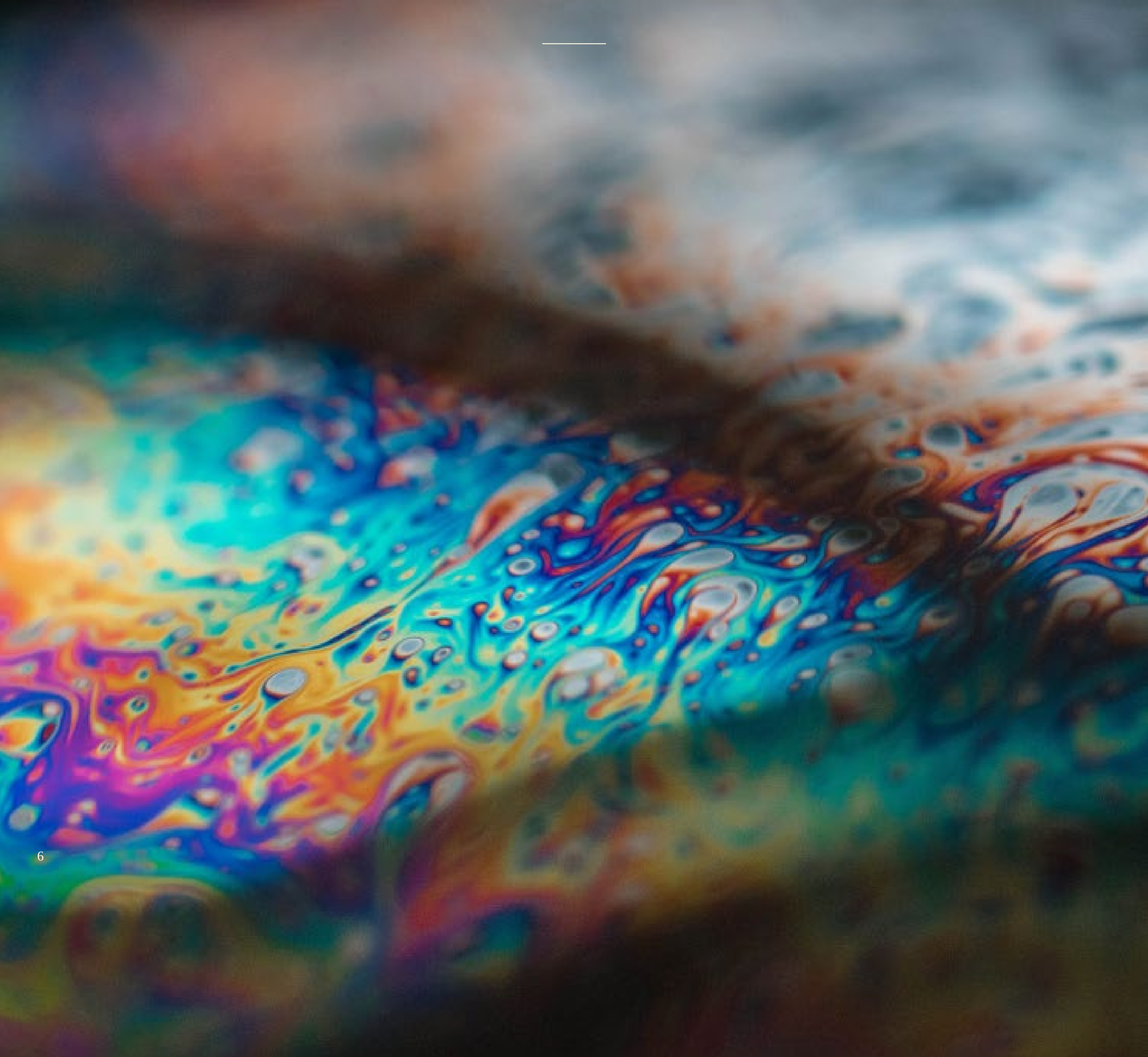


RECENT TRENDS AND FUTURE PROSPECTS



Back in the mists of time, otherwise known as the 20th century, it was believed that markets provided a useful indication as to the future. Their genius lay in revealing needs and opportunities that individuals could not glean for themselves in isolation. Now we believe in no such lead indication. Mean reversion is all that matters. This applies to both markets and fund managers. If stocks rise it must be a bubble. If managers outperform it must be the time to remove assets. Corporate success is suspect. Fund manager alpha is inconceivable.

This mentality is flawed. It's just as flawed as the prior assumptions that markets are infallible and that successful fund managers always remain worthy of celebration and inflows. Sometimes markets contain useful information, sometimes investment managers even possess skill. We can't comment on whether we fall into such a category. But we can explain why we think that markets are being rational in rewarding the Great Growth companies of today – and more importantly why we think this is likely to be closer to the beginning than the end of pleasing returns for investors.

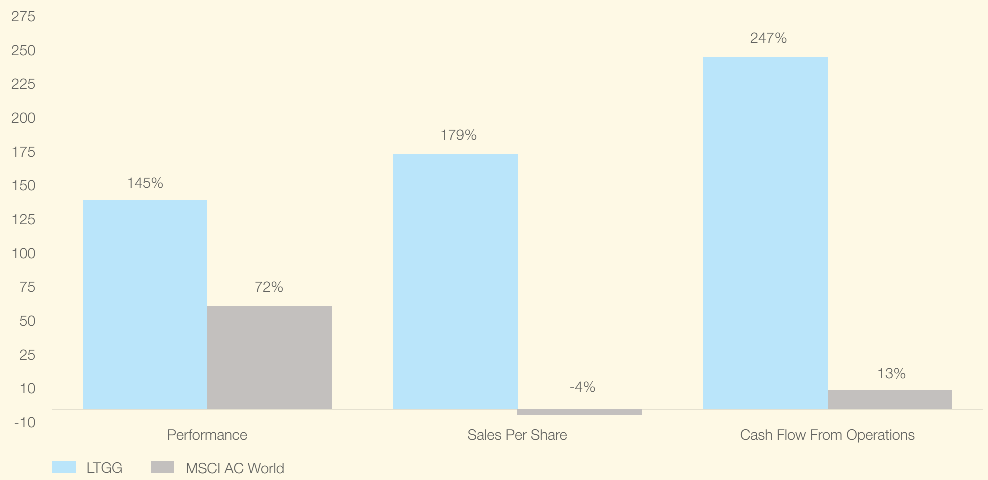
It may seem as if we're just replicating previous appeals for optimism or that we're simply repeating our consistent bets on red at a gambling table. But this doesn't feel right to me. I think we've learnt a good deal about the underlying trends and potential transitions in the global economy in recent years. At one level we hope this has made us better investors.

At another level we think the paths that lead to tectonic shifts in outcomes have become much clearer in recent years. I don't believe that we've become unduly confident or complacent. Instead I want to explore the possibility that our contentions about the future have moved from being plausible hypotheses to being the most likely course of events.

It's conceivable that we need to consider the possibility of being approximately right. That's actually quite mentally demanding. But if it is a fair representation of reality then we'd also suggest that the wholesale rush by clients to reduce exposure to 'winners', to 'Growth', or to weird categorisations such as 'FANG' or 'BAT' may be misguided – or even disastrous. Just because stock prices have risen it does not follow that valuations have become more demanding. This extends beyond immediate sales and earnings. But as shown below these have been distinctly supportive. Meanwhile the ultimate size and returns on offer may have become still greater. The odds of success may have been transformed. The moat may have been dug much deeper. The potential longevity may be far more extended than previously feared. We actually believe that all these are probable amongst our major holdings.

Operational progress and opportunity

5 year comparison of LTGG versus MSCI AC World



Composite performance is 5 years delivered total return to 29 December 2017 in US dollars.
SPS and CFO based on a representative LTGG portfolio, weighted average.
Last fully reported year compared to 5 years ago.
Source: Bloomberg, StatPro and relevant underlying index provider(s).

EVOLUTION IN OUR INVESTMENT PERSPECTIVES

Beneath the output of stock decisions and performance numbers that provide the perennial conversation pieces of fund management life lurks the less visible but more important bedrock of investment philosophy. There has to be a framework of interpretation. This needs to be anchored on first principles not common presumptions. The more basic of first principles is coming to a conception of what drives returns in markets. Our thoughts about this have moved on substantially in recent years.

There is no equity risk premium. Most stocks will add no value to a portfolio. In most cases it is possible to identify in advance those stocks that fall into this large and dismal category. Exclusion is not that demanding a task in most cases.

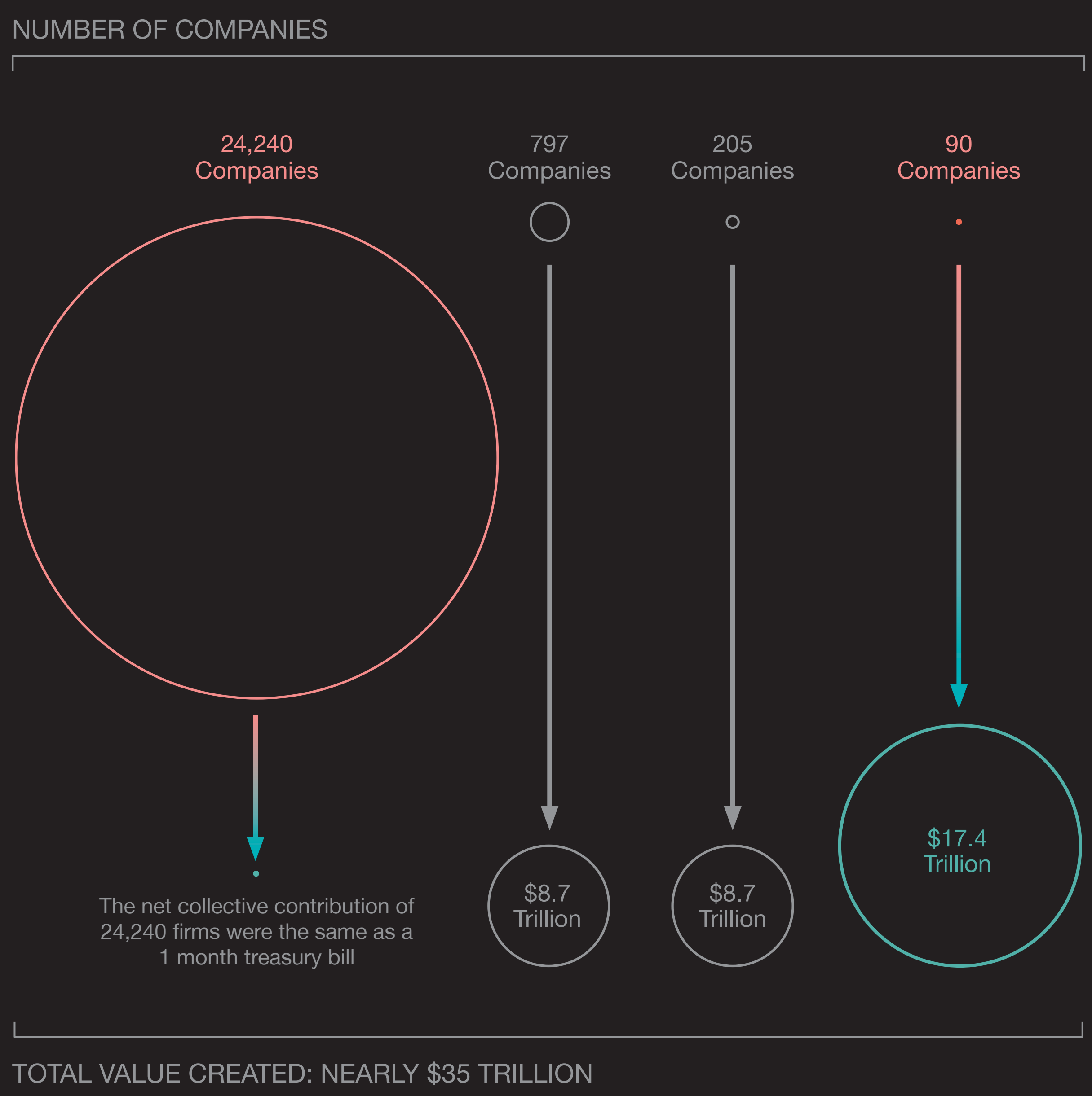
We have long suspected that performance lies in the extremes. But we've underplayed the extent of this phenomenon and the radical implications for research that ought to follow. Our own experience certainly endorses this interpretation. For our Long Term Global Growth mandates the data appears to show that approximately 5% annual out-performance of the World index (MSCI ACWI) over 10 years has been generated by just **2 stocks**. This pattern is unlikely to change.

Behind our experience lies a much bigger data set. In the most important research paper published for many a year entitled 'Do Stocks Outperform Treasury Bills?' Hendrik Bessembinder concludes that in general they do not. The entire wealth creation of the US stock market since 1926 is attributable to a mere 4% of the companies. Although this research has attracted much attention its full ramifications seem to have been almost entirely ignored. If the data is right, internationally replicable and has any future relevance, then the common shibboleths of investment fall apart. The Capital Asset Pricing Model (CAPM) makes no sense. There is no systemic relationship between risk and reward. The CFA[1] is teaching fallacies.

But the lessons for an active fund manager are just as sharp. Our job must be to give ourselves the best possible chance of owning the outliers. The traditional notion that to do our jobs properly, starting with the largest companies and then working our way through everything on offer under-weighting and overweighting as we go is clearly misguided. Secondly, we should give up any angst about a small group of stocks dominating returns: it was ever thus. It's the natural order of markets.

1. The CFA Institute is a global association of investment professionals.

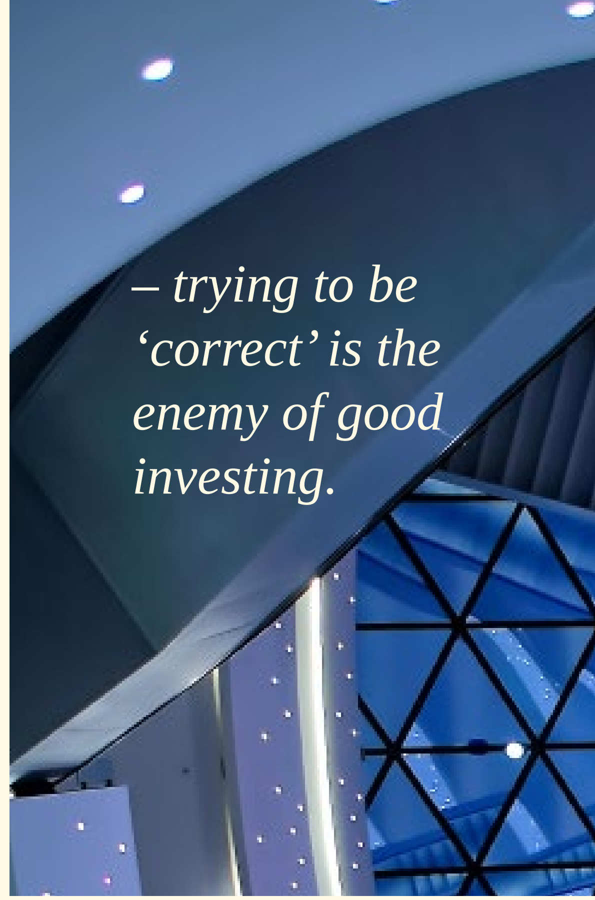
Total net wealth created by all listed US common stocks 1926–2016



Stock market wealth creation is defined as an accumulation of value (inclusive of reinvested dividends) in excess of the value that would have been obtained had the invested capital earned one-month treasury bill interest rates.

Reading the data: The data includes all 25,967 CRSP common stocks (25,332 companies) from 1926 to 2016. Beyond the best-performing 1,092 companies, an additional 9,579 (37.8%) created positive wealth over their lifetimes, just offset by the wealth destruction of the remaining 14,661 (57.9% of total) firms. The implication is that just 4.3% of firms collectively account for all of the net wealth creation in the US stock market since 1926.

Source: Hendrik Bessembinder, Do Stocks Outperform Treasury Bills? (August 2017).



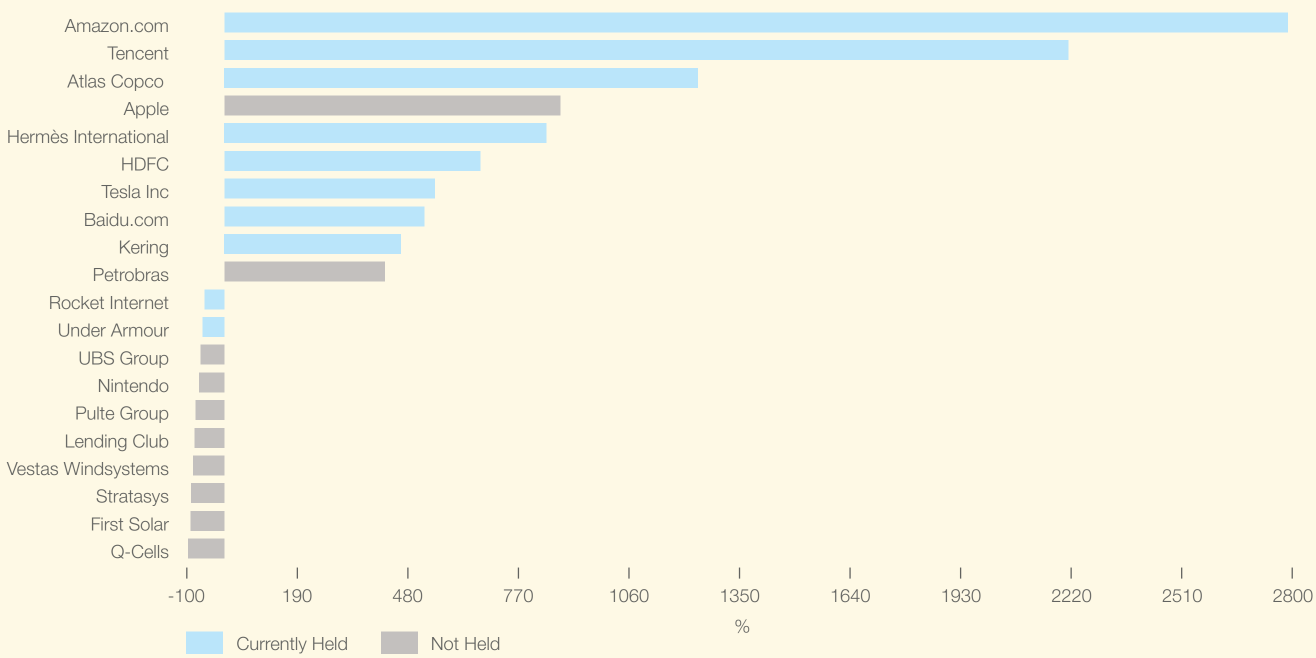
THE GREATEST CHALLENGE

By far the most rewarding and meaningful opportunity we have is to understand just how large, how great and how supra-competitive a merely promising company can become in our era. Imagining success is vital. Continuing to re-imagine it is essential.

To be even blunter: clients should interrogate us far more about the skills needed to capture great opportunities than about stocks that have failed to scale the heights. The associated upside far outweighs the potential losses. Intense loss aversion and the constricted time frames of our industry mean that the potential advantages over our peers is correspondingly expanding.

Embracing Asymmetric Returns

Cumulative Absolute Returns of Long Term Global Growth holdings during their tenure



Source: StatPro, Datastream, Advance/Factset. US dollars.
29 February 2004 to 31 December 2017. LTGG composite. Some stocks were only held for part of the period.

How many fund managers are really spending time and effort on framing the returns to extraordinary success? I say ‘extraordinary’ deliberately. It encapsulates both the extreme outcome and the necessity to imagine. The latter is very difficult if you are trained to see yourself as a hard-nosed and hard-bitten analyst scornful of optimistic naivety. Instead we need to acknowledge the importance of stretching towards the apparently improbable. Creativity not accountancy is the essential tool. The bravery to accept failure and to endure sneers along the way matters. None of this is particularly easy but all of it is more reliant on curiosity and independence of mind in the pursuit of first investment principles than on IQ, academic qualifications or the amount of detail on a spreadsheet.

In our view the necessary investment creativity can only flourish in the presence of a long time horizon. Or, to put it another way, our favourite Jeff Bezos quote of 2017 is that “A CEO should always live in the future, never in the present”. That’s even truer for investors. I think it’s unarguable that the single most important change Baillie Gifford as a whole ever made was abolishing quarterly performance reviews. It now seems incomprehensible that we would ever have subjected investors to mass review and criticism for being underweight the Royal Bank of Scotland in the last three months. But it happened.

We now need a dogged refusal to make forecasts of earnings, cash flows or share prices. If you are merely forecasting the most likely outcome over the next year or two you will be most unlikely to hang your spreadsheet on predicting a discontinuity. It’s much more sensible to predict a continuation of current business or to follow guidance. It’s rare for us to know when a dramatic change will occur but frequent for it to be close to inevitable at some point. Certainty is an abject temptation. The world is too complex, too erratic and too full of surprises to make spot forecasts of anything of significance. I’d push this further: trying to be ‘correct’ is the enemy of good investing. It’s much more valuable to have doubt and to make portfolios the beneficiaries of potential Black Swans.

Therefore the best we can do is to come up with a set of possibilities and probabilities, endeavour to make them extreme, blend them with each other and then think about the potential returns. Then we watch. It’s better than acting. Or as Charlie Munger urges “this habit of committing far more time to learning and thinking than to doing is no accident”. Occasionally we adjust our sights as time, learning and our thoughts progress. We need to give up the excessive arrogance implicit in forecasts if we are to maximise returns. After all the most likely forecast a dozen years ago was clearly that Amazon would fail. That was rational analysis. But it wasn’t a very good assessment of the probability adjusted pay-offs.

Perhaps the most important moment in pushing us in this direction came some years ago although it may still be worth recording. When Roche tried to buy Illumina in 2012–13 we asked how they had come up with the price offered ($44.50). The young, eager and highly financially trained Roche CFO answered that he simply looked at analyst forecasts for up to five years and plugged that into his Discounted Cash Flow Model. At that very time we were discussing with Illumina how you should value a business that has the possibility of extraordinary growth and growth that would only fully blossom well after five years had elapsed. Success would only be apparent in the decades ahead. We agreed that this was full of uncertainties.

Once we acknowledge doubt and extend the time frame sufficiently it becomes plausible to outline the potential upside. For sure it still requires fortitude. Perhaps the best investment analogy is that of a medieval fortress. In trying to preserve valuable assets, investors are constantly under attack from those intent on destruction of value. Instead of assault by fire, brimstone and rats bearing plague we are thrown quarterly earnings, market tantrums and broker reports. Frequently the case in days of yore was that, under these pressures, the castle was undermined from within by those who thought surrender to escape immediate pain was the best policy. Naturally no investment management executive would ever be so foolish in the 21st century.

In retrospect enduring the siege looks easy. In each great investment what looks like a straight and exponential line of bottom-left to top-right compounding is in reality jagged and painful. There was a very good article written last year describing God's portfolio. It pointed out that even if God knew in advance which stocks would do the best over the next five years his (her?) portfolio would still suffer severe relative and absolute downdrafts as impatience took its toll.

– The advantages of loyalty usually trump the disadvantages of stubbornness.

It’s important to learn how to suffer. We’re now trained to know that Amazon ‘misses’ earnings a couple of times a year. We cope with the numerous downward lurches in share price that result from this and from colleagues and clients kindly pointing out that “it doesn’t have any profits.” Or that Alibaba is apparently the reincarnation of Enron. Barron’s was as sure of this as it was that Facebook was doomed to decline. Or the daily barrage of hedge funds attacking Tesla – one day for the astounding revelation that building a car factory requires capital, the next claiming that Tesla makes dangerous machines (as if the death toll of the car industry in the past should be ignored). We mustn’t defend investments that have lost their purpose but interrupting compounding is the very worst that we can do.

IMPROVING THE CHANCES OF INVESTING WELL

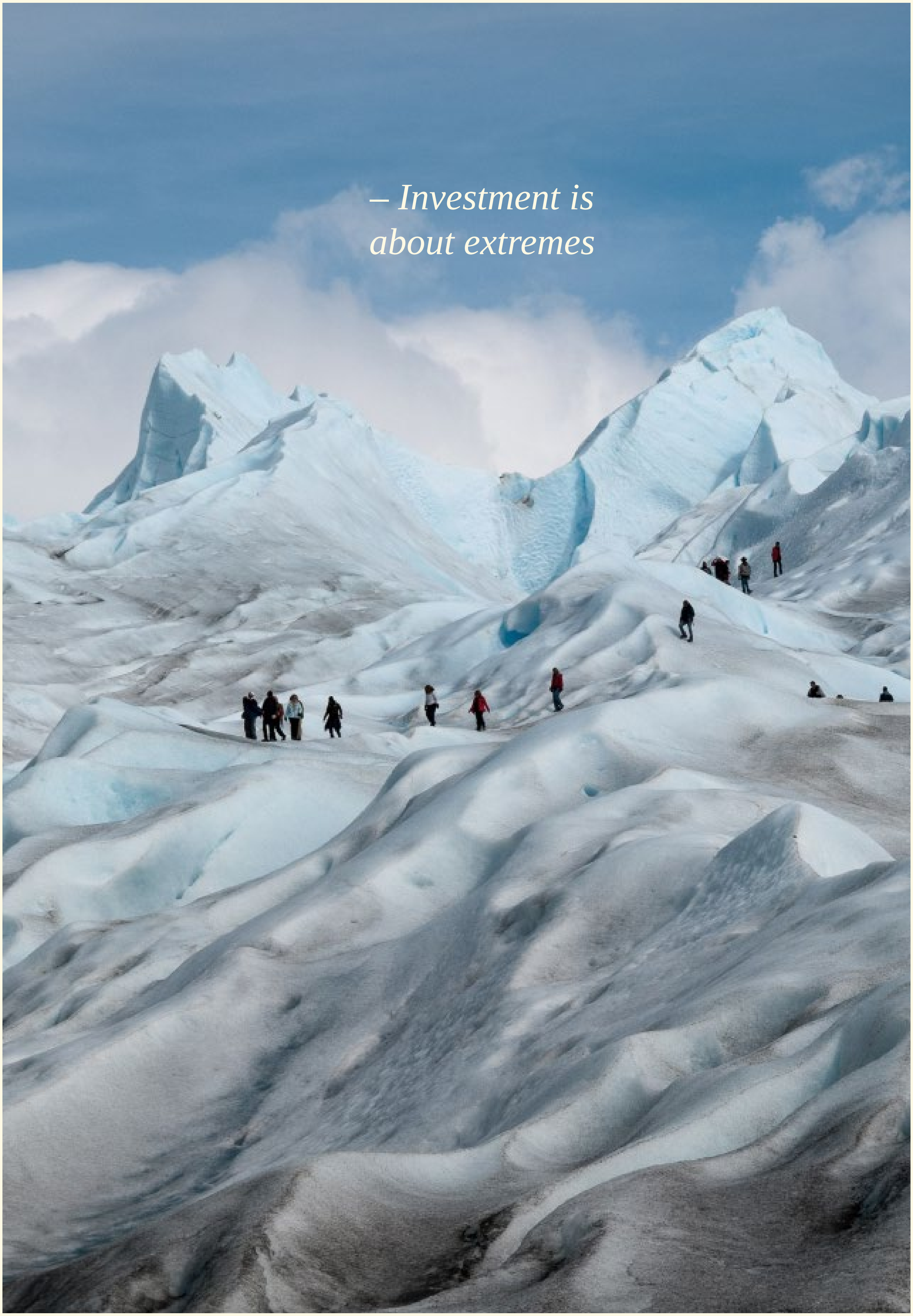
If capturing extremes is the key then our investment process has to change still more. We can't afford to sit back in contentment. Indeed if it's creativity not analytical expertise that's central then we may need to abandon the very notion of 'process' or the very idea of an investment firm as current conventions dictate. This is a hard topic to address. Where do potentially great ideas come from? I fear not from the conventional rounds and daily rituals of fund management. This is not a popular thought.

My guess is that promising ideas primarily come from the intersection of shocks, brilliance and sufficient space as to resemble leisure. I hasten to add that the brilliance is rarely, if ever, our own. The more we can talk to brilliant people the dumber we can be. That's useful. The more we spend time with brilliant people the more we listen and learn. That's much better than us talking.

The task is therefore to persuade brilliant people to talk to us. In the business world we do this by endeavouring to build a reputation as patient, constructive and large shareholders. We want companies to like to have us as shareholders. Ultimately we want Baillie Gifford being shareholders to be beneficial in itself. But we have a fair distance to go to achieve this aim.

But we need more than this too. We need to shock ourselves by exploring other worlds. I was recently asked by a long-standing client how I'd go about the practicalities of building an investment manager from scratch. My first step would be to incentivise the avoidance of the office. It's vital to get away from the contamination inherent in financial group think – be that the self-referential circularity of the finance bubble or the temptation to inward looking complacency that all too often characterises investment management firms grown accustomed to some success.

We need to reject the whole inherited notion from the industrial era that production can be increased by scheduled employment between 9am and 5pm and then sitting (ever more) people at a desk in front of a screen or in meetings and then demanding output to a plan. Although this is an industrial era process it's been extended well beyond rationality by the homage paid to it by the bizarre cults inculcated by such as GE under Jack Welch, Harvard Business School and the self-interested managerial power structures that have brought their monumentally unhealthy practices, methods and incentives into finance. Great ideas don't come from staring at a screen. They don't come from adding extra analysts. They don't come from confusing trading with investment. Nor from mimicking hedge funds. They don't come from coverage lists or targeting research output. Great ideas are all that matter. Investment is about extremes. It relies on openness to odd but brilliant ideas. This requires quirky individuals more often than the team work beloved of sporting analogies or management homilies. For sure there are moments when group input and especially support at times of difficulty can help but mostly investing is an individual task. Loneliness mostly trumps sociability. Here too Charlie Munger is right.


– Investment is
about extremes

BETTER AND LESS TAPPED INFORMATION

Our current obsession is to encourage engagement with other worlds and minimise unthinking contact with the financial world and especially its dominant centres and institutions. Our focus should be in building a very large, very long-term research budget devoted to academia, science and a sprinkling of access to geniuses. This type of insight is rarely efficiently incorporated in markets. It can provide a substantive informational advantage. This is an alluring possibility in an industry that has generally given up on differentiated information gathering.

The more such viewpoints are sourced from outside the Anglo-American canon so much the better and cheaper this would all be. All that remains is to turn the vision and first steps into fully fledged reality. In 2018 this will require further steps in China. It probably requires not just academic links but also a renewed physical presence ('office' is a very bad word). It's simply not possible to shift our mentalities away from the 'America first' narrative that is now so questionable without wholesale and deliberate re-education.

A major proportion of the hunt for outside insight is composed of either moving towards detailed understanding of specific developments in, say, gene therapies in healthcare or battery technologies in renewable energy. Just as often simply watching and listening without pre-determined purpose turns out to be the most beneficial of all indulgences.

But in 2018 it may be that the most valuable external research for us will be more conceptual. We think that we are now reaching a phase in which a general road map is both feasible and potentially useful. The investment world has become consumed by senseless political dramas and meaningless financial data just at a time when broader matters are already reshaping our world.

Beyond the tyranny of noise there is a serious danger that what we take to be eternal verities or mathematical truth in finance are merely the temporary insights and justifications of very different eras. The beliefs surrounding the workings of the stock market founded on decades of US hegemony, middle class affluence and the dominance of professional US investing institutions may prove just as flawed, or rather the output of a mere moment in time, as the then frontier principles of the Dutch East India Company in 1602 or the equally self-confident Victorian dynasties featured in Trollope's novels. They are all but the Way We Live Now. Before eventually ending this piece I'll try to outline a few interpretations that might be more relevant to the future. They do exist.

Dutch East India Company – The most valuble company ever?

Dutch East India Company 1637 – $7.9 Trillion (inflation adjusted)

Dutch East India Company

Current LTGG Portfolio, by market capitalisation – $3.9 Trillion

Alphabet | Amazon.com | Facebook | Tencent | Alibaba | L'Oréal | NVIDIA | Inditex | Aia Group | Netflix | Balance of the Portfolio

Based on a representative portfolio as at 31 December 2017.

FROM HERE TO 2030

Exponential, exploitable long-term trends.

As we’ve noted, information hailing from outside the financial world is rarely captured by market traders. But its principal value to us lies in two even more compelling characteristics that we have not yet commented upon.

At its best this information offers both high probability and long-term significance. This puts it into a very different category from most data fawned over by markets. Not for nothing did Kevin Kelly title his fine recent book on future exponential changes in technology and thus society 'The Inevitable'. He talks in decades too, not quarters.

With most pieces of macroeconomic or political news it's most improbable that such structural advantages exist. The odds of consistently and correctly forecasting Federal Reserve decisions, GDP figures, Brexit, Trump or quarterly earnings are vanishingly small, evanescent and deeply competitive. In many cases even knowing the outcomes in advance wouldn't give a useful and actionable market cue. This seems to be becoming ever clearer even as (should that be because?) more and more attention is lavished on predicting earnings to less and less purpose.

But if we know what the underlying improvement rate of a technology is likely to be then the room for debate is minor, the impact is long-lasting and the opportunities are potentially dramatic. It's much more valuable and reliable than mere events. If I wished to know when the Federal Reserve would next move interest rates I could pay a great deal of money to many very self-confident experts and still not get a clearer perspective than that baked into the current market consensus. And I still would have no idea what to do with our verdict to make money for our clients. In contrast if I'm lucky enough to know that Moore's Law ought to continue until 2030 or that solar panels should continue to fall in price by 15–20% per annum then opportunities open up on many fronts.

But we do come close to knowing that Moore's Law will continue to 2030. It's highly probable that solar costs will continue to fall exponentially. I could, and will, go on into other such predictions. Instead of focusing our attention on a Tetlock style of analysis of how to marginally improve decision making on the unknowable (and usually unprofitable) topics of daily headlines[2] we're far better shifting our minds and research to the predictable and exponentially profitable categories.

2. Superforecasting, Tetlock and Gardner, 2016.

What's so exciting for us as Growth investors is that there are now several exponential technologies that meet the requirements for profound and long-lasting investment significance. In each case the trend lines of progress are firmly in place. In each example the stage of development is such that this matters beyond mere scientific excitement. Moreover, the impact of each of the technologies is potentially transforming of our economies and societies without fear of exaggeration.

It should be added that, in all these instances, there are already companies that appear to have competitive leadership so there is no need for blind investment in undifferentiated technologies.

– the trend lines of progress are firmly in place.

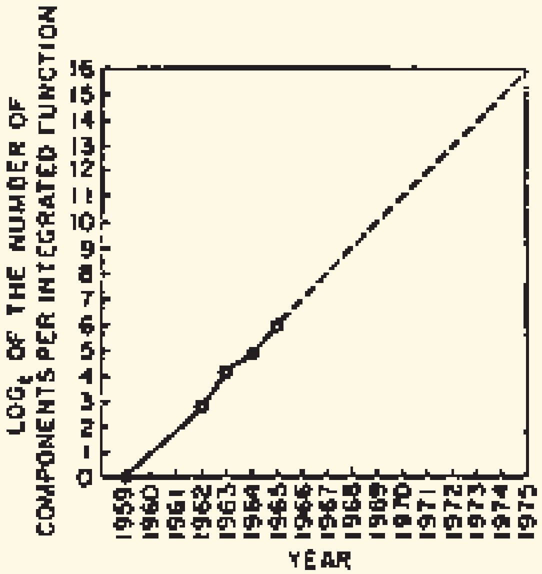
THE PREDICTABLE AND THE UNPREDICTABLE

To sum up the previous themes: although it is often argued that prediction is very hard, that's not always the case. For sure there are many areas where predicting is fraught, from guessing market movements to political forecasts it's far from clear that it is true of categories of knowledge that are the foundations of change. Naturally it's not always simple or quick to translate this type of information into explicit stock purchases, but at least we can identify where opportunity might lie. We can thereby narrow the field by both inclusion and exclusion. These are not minor victories. For instance if we took a decade from Gordon Moore's initial 1965 paper to come to believe that he was onto something, a something that was subject to some revisions in search of precision but a something of great power that would continue for a worthwhile period then the next 50 years became, well, predictable. Past has been prologue.

The specific implications might have been obscure but just keeping the pattern of exponential improvement in mind would have opened investor eyes to personal computers, electronic games, mobile phones, the internet and e-commerce. For all their initial failings we'd have known that judging the outcome by their initial capabilities was unintelligent. At each stage the victims of these changes would have been far clearer. From traditional retailers to newspapers the path of the old to purgatory was quite visible.

So where are we now? I'd suggest that there are more areas with even greater transformative potential that are at the point of looming revolution than has been the case in the past era. From that point of view we should be very excited. From that point of view the gloomy prognoses of a Robert Gordon[3] or of the gods of secular stagnation look quaint. The problem is liable to be too much rather than too little excitement.

The Original Moore's Law, 1965



Source: Cramming more components into integrated circuits, Gordon E. Moore, Electronics, Volume 38, Number 8, April 19, 1965.

3. Robert Gordon, The Rise and Fall of American Growth, 2016.

THE NEXT PHASE OF MOORE'S LAW

There's no need to start elsewhere. What's given such dramatic gifts to investors over the last 50 years isn't likely to disappear as a source of wonder. We're at the second half of doubling the grains of salt on this chessboard so the ramifications of further progress are potentially hard to comprehend in their scale.

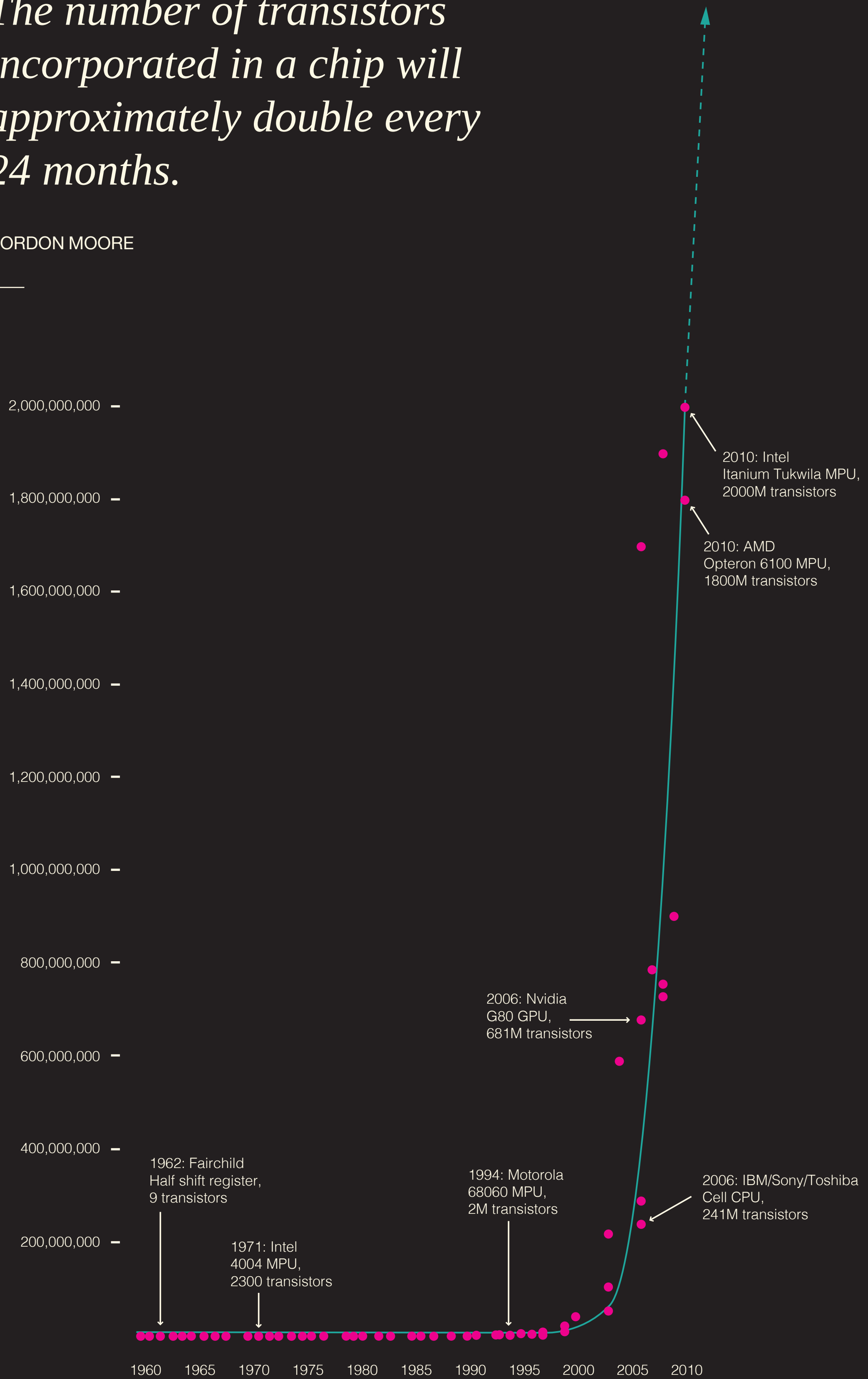
That this is so is primarily to the credit of that most unusual of triumphs – that of a European technological leader. To me ASML may be the most important company in the world. That is not the same as being the most attractive investment. It might be worth adding that according to ASML's CTO, the brilliant Martin Van den Brink, Moore's Law actually dates back in all but name to 1900 so it's coming up for 117 years old. But unless ASML had fought its way through the challenges of extreme ultra violet (EUV) lithography then it's quite possible that it would finally have ground to a halt. Certainly no one else has come close to solving the problems. But now, as they say, it's a clear path to around 2030. In return ASML has become a monopolist. This seems fair.

So if we know we have at least a decade more then what follows? What gets better and cheaper? What becomes possible? The first comment would be that it's most improbable that another decade of Moore's Law is a good omen for those waiting and praying for a reversion to the mean and a reversion to value. The traditional will be swimming against very strong currents. That becomes still more challenging considering that the most obvious targets for Moore's Law enabled change are in big data, machine learning, the Internet of Things and artificial intelligence. Given that it is the major technology companies that have the most data then their leadership – dominance if you prefer – is reinforced. Their fields of action seem broadened and their longevity expanded. This seems almost inescapable. At this stage we do not wish to be dogmatic as to where this will take our world for good and ill. Again we would rather just watch intently.

In specific investment terms what this near 'inevitable' progression translates to is an extraordinary and persistent demand for silicon. For once it's fair to quote a broker, Bernstein's Pierre Ferragu, with his conceptualisation of the trends as actually being to 'Artificial Stupidity'. What he's capturing so persuasively is that what we're actually going to be doing is throwing vast quantities of silicon at the problems. It's not that subtle. But it may outrun Moore's Law as the demand for chips or power improvements may well increase at a rate well in excess of a doubling every two years. Therefore cutting edge capacity will be in constant demand. Perhaps ASML does become about the best investment as well as the most important company if this is right.

The number of transistors incorporated in a chip will approximately double every 24 months.

GORDON MOORE



Source: Courtesy of the Computer History Museum.

MOORE'S LAW COMES TO NEW FIELDS AND INTERACTS WITH EQUALLY POWERFUL AND PREDICTABLE TRENDS

Artificial intelligence (AI) is a direct consequence of Moore's Law. The imminent revolutions in healthcare and transportation require its unholy power but also rely on additional, but almost equally predictable, processes of exponential change. Together with AI they add up to the prospect of some of the most dramatic, wondrous but disorientating ructions that our societies have ever confronted. They are close to inevitable.

HEALTHCARE

This is not an industry brimming over with recent success. Costs are out of control, new drugs are vastly more expensive but substantially unchanged versions of often questionable mass prescriptions and life expectancy is now falling in several supposedly advanced societies. On current trends everybody will work in healthcare, all inflation will come from healthcare but we won't be healthier. But these are the trends of the past. Beneath the decline the potential for transformation is prophecy no more.

To be precise: 2017 stands an excellent chance of being seen as the year marking the start of a new era of healthcare. The combination of genomics, immunotherapy and associated gene therapies and editing techniques has now produced clinical data and licensing approvals that make it possible to talk of cures in several rare diseases and an increasing number of cancers. 2017 saw the FDA licence gene therapies for the first time. This has happened for both cancers – starting with Kymriah, as the first authorised CAR-T immunotherapy – and for inherited conditions, with Luxturna for blindness. This isn't to say that progress will now occur in a straight line. It never has. The first gene therapy to be licensed was Glybera in Europe. It was the world's most expensive drug on its introduction in 2012. It's quietly been abandoned. There was a tiny market and doubtful efficacy. The previous dreams of gene therapy ended in the death of Jesse Gelsinger in 1999 as science over-confidence proved well ahead of clinical reality. But it's clear that even if there are serious specific setbacks to come that the overall situation is far in advance of that of the end of the 20th century or even five years ago.

This could be illustrated in the number of treatments in trial (in the hundreds) or the range of indications that are covered, but it may be better to focus elsewhere. As Nick Leschly of bluebird bio puts it "the key advance is that we can now understand what we are doing in biotechnology and how it works". That's the gift of super-exponential progress in genomics. This doesn't just bring exponential progress. It also introduces healthcare to the world of deflation.

The leaps in potential progress that this combination implies are worthy of reflection. Bluebird hopefully represents a case in point. After even a modest period of learning and experimentation via sequencing its multiple myeloma treatment bb2121 shows 56% of patients in complete remission and 89% had a very good partial response or better.

We are no longer in the world of recent decades of marginal improvement in return for much higher prices. For sure this requires serious re-thinking of pricing and supply mechanisms but let's not be scared by the side-effects of dramatic change for the better. It's very exciting.

ENERGY

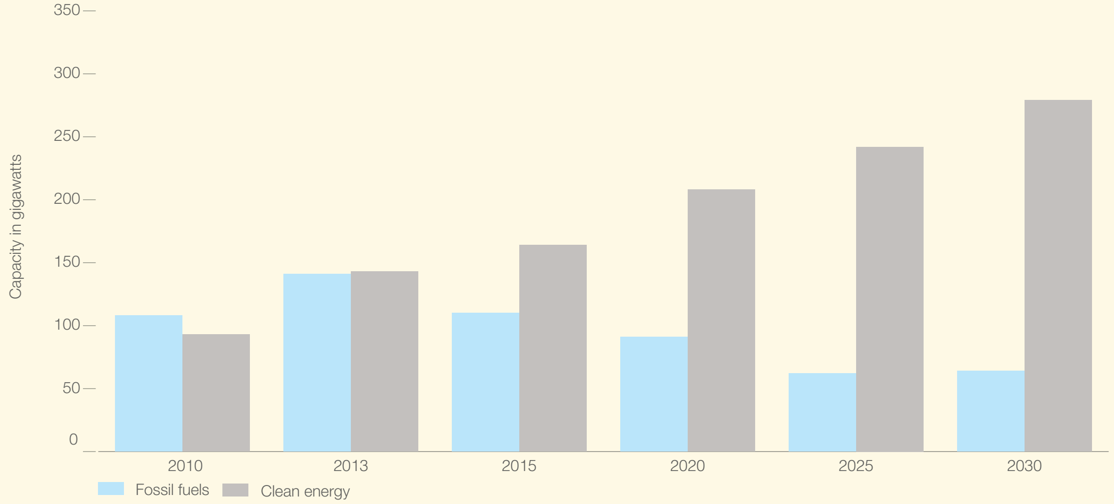
Each great phase of economic and social advance requires a new era in energy availability. Some go far further than this. The great Ian Morris concludes that "energy capture determines values"[4] and that our whole world view is predicated on fossil fuels or expanded slightly that "the sources of energy available to a society set the limits on what kind of values can flourish". Energy capture not culture, religion or moral philosophy explains our mentalities and values.

Whatever we may make of such a fundamentalist version of our society what seems to us to fall into the category of the well-nigh inevitable is that the age of fossil fuels is drawing to an end. No, we cannot tell anyone precisely when this will happen and no, of course it doesn't mean that events, political or economic will not permit a last hurrah in hydrocarbon pricing. Surely we've all learnt that predicting the Middle East is imprudent.

But in anything other than the shortest of horizons this matters not a jot. The pricing of renewables is continuing to fall so convincingly and the increase in the installed base is rising so sharply that this is becoming acutely embarrassing for traditional forecasters such as the International Energy Agency (IEA).

These developments are now structurally encouraging for reasons that we have previously touched on and have seen as critical for investment cogency. As The Santa Fe Institute hypothesises the best prediction about future prices is contained in past price progress[5]... So if nuclear costs rise rather than fall most years then it's better not to bet on trend inversion. The opposite applies for solar and wind power. The trend of price declines and performance gains has been sufficiently persistent and exponential, so that what once seemed forlorn green posturing is now emergent economic reality. Further progress will make this clear even to the most jaundiced oil obsessive. This is backed by the Kurzweil Law of exponential doubling: seven doublings from 0.01% take us to 1% and seven more to 100%. We are at one percent now.

Global additional power generation capacity by energy type 2010-2030

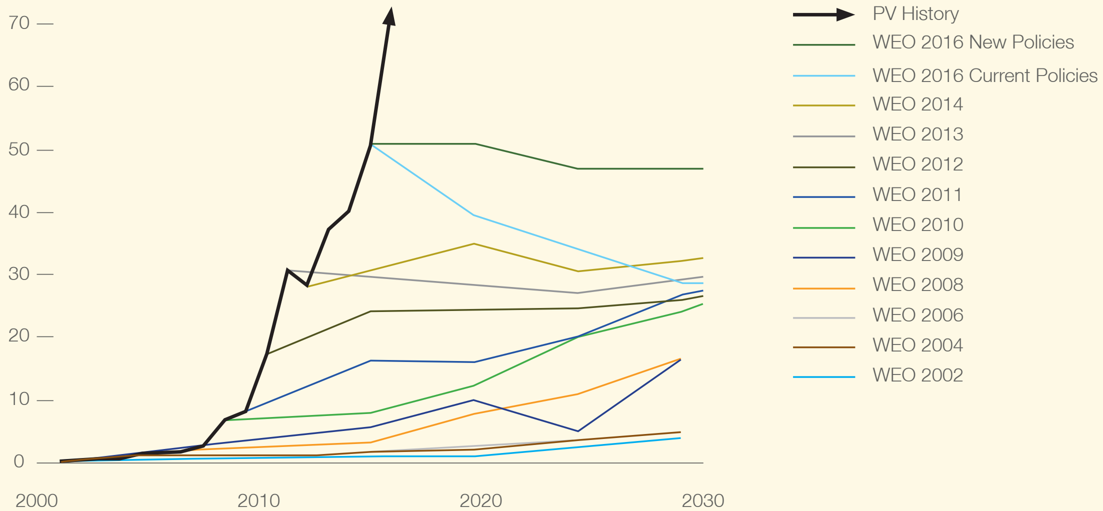


Source: Bloomberg New Energy Finance; New Climate Economy.

4. Foragers, Farmers and Fossil Fuels: How Human Values Evolve, Ian Morris, 2015.

5. Santa Fe papers, Determinants of the Pace of Global Innovation in Energy Technologies, Bettencourt, Trancik, Kaur, 2013 and How Predictable is Technological Progress?, Farmers and Lafond, 2015.

In GW of added capacity per year – Sources World Energy Outlook and PVMA



Source: @AukeHoekstra/Twitter.

CHINA – AT THE HEART OF THE GLOBE

Asset allocation by geography is usually questionable. Decades of economic prosperity frequently fail to translate into local corporate earnings or stock market enthusiasm. We are similarly sceptical as to most claims surrounding structural shifts in global economic leadership. Bookshops still stock dusty texts from the 1990s promoting Japan's coming dominance.

But a decade after the rise of China became an influence on our portfolios we are at a turning point. China, not America, is likely to determine probable investment narrative for the next 50 years. Currently the IMF and World Bank peg Chinese GDP per capita at market values at just 15% of US levels. By the end of that time frame China should be as rich as the US on that same per capita basis. The comparative human and physical capital trends make this apparently extreme contention seem almost conservative. Such a state of affairs would, after all, be no more than a return to the state of affairs so surprisingly interrupted by the Industrial Revolution and subsequent western dominance.

A decade ago the corporate beneficiaries of Chinese resurgence were as likely to be found in Brazilian or Australian commodity producers as in domestic Chinese stocks. But this is no longer the case. The current and future corporate monarchs are, and will be, Chinese. 2017 saw this move considerably closer. The market capitalisations of Tencent and Alibaba are now similar to their American peers. This is but early days. It's hard to overestimate the historic rarity and potential value of companies already valued at around $500 billion that are still growing at 40–50% per annum.

– China should be as rich as the US on that same per capita basis.

FROM-LOW COST MANUFACTURER TO TECHNOLOGICAL SUPERPOWER

When I was in China in November (2017) our last meeting was with Jack Ma, the founder of Alibaba, just a few hours before he hosted the extraordinary internet shopping extravaganza that is Singles Day. It attracts a TV audience larger than the US Super Bowl. Mr Ma projected transaction volumes to peak at 360,000 per second. Alibaba failed him. It only reached 357,000. To give a comparison, in the entire 24 hours of Singles Day Alibaba recorded sales of $25.4 billion. Total US online sales on Cyber Monday were $6.6 billion.

Yet the most intimidating feature of Singles Day doesn't lie in either raw numbers or comparisons. It resides in the rationale. This invented holiday isn't really aimed at marketing or pumping up sales. Instead it functions as a test of what will be needed every ordinary day in five to 10 years time.

Such anecdotes are illustrative of the coming Chinese era. The levels of corporate and national scale, of consumer demand and technological prowess are beyond numerical compare although reminiscent of the restless ambitions that bred Dutch, British and American global leadership in their historic turn. It's part of a functioning and integrated system. We may not like all aspects of that system but denial is not an adequate investment response. That Alibaba works with millions of small and far-flung companies to provide them with the resources and intelligence to discover and penetrate burgeoning markets is evidence of the system working to create wealth for the many. Alibaba suggested recently that its network has created 31 million jobs. This in turn is assisted by the extraordinary infrastructure encouraged and built by governments, both local and national. This may not be democracy as we perceive it but it's currently a mutually reinforcing process that assists companies, the bulk of the population and – for sure – the continued acceptance of rule by the Party.

What Alibaba has driven in internet commerce is paralleled by other champions in almost all digital technologies. Tencent's WeChat social media platform is a prime example. Facebook is honest enough to acknowledge that the broad uses and

– Singles Day functions as a test of what will be needed every ordinary day in five to 10 years' time.

A screen shows Alibaba's GMV exceeding RMB 168.2 billion in the 2017 Single's Day Global Shopping Festival.

© Visual China Group/Getty Images.

ubiquity of its Chinese counterpart is inimitable. WeChat is a major part of the all-embracing but deeply practical nature of digital China. Instead of the sound and fury of the western version, mobile phones and applications provide a method to navigate through a society of nearly 1.4 billion people and cities of a pace and scale foreign to Westerners. From travel, to food, to transport and on to finance China leads.

The consequences for the future are now emerging into the light. The digital achievements described above are impressive in their own right but are more critical as building blocks for future dominance in a data driven economy. As machine learning and artificial intelligence become the keystones of the global economy China will have data at an unrivalled scale. At some moments in economic history the flexibility of small units and the flexibility of city states is a virtue but at others size matters. As a leading digital entrepreneur said to us "Scale is as much – no more – of an advantage in a data driven world than in manufacturing."

MENTAL ADJUSTMENT

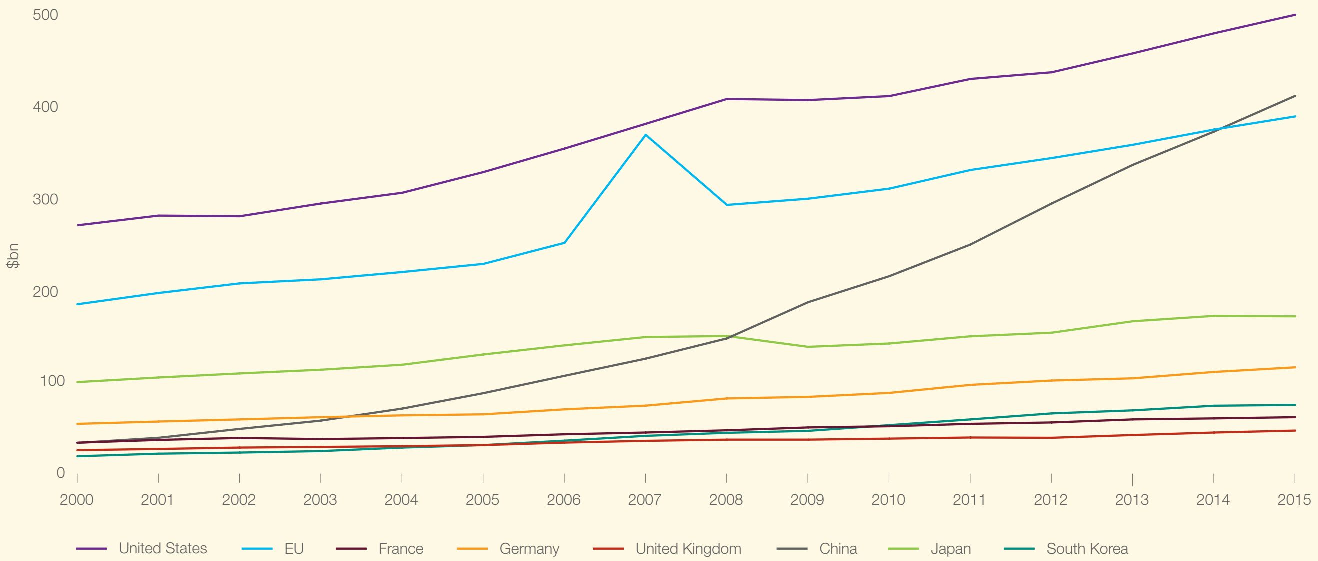
It's normal in life and still more in investment to be deeply suspicious of optimism. That's even more so as regards China. The next superpower is rarely popular. A century ago Scottish Mortgage[6] was suspicious about America. Now most American investors are both ignorant and scathing in their attitude to China (usually the more ignorant then the more scathing). Even those less consumed by negativity prefer to hide Chinese exposure within a closely watched and tightly constrained 'Emerging Markets' allocation. To us this appears problematic relative to the size and uniqueness of the opportunity.

We do not believe that China can be easily dismissed. Its debt levels seem to us to be more than balanced by assets, savings and the sovereign ability to print money. The demographic challenges seem to underplay productivity gains driven by the remarkable and continuing investment in education. In the next decade China will likely generate four to five times the number of science and technology graduates each year than the US. China is on course to overtake the US in expenditure on science research and development. It may have done so already having increased by 18% per annum since 2000. I'd be still more upbeat about the prospects of China confronting its environmental demons. Government and people know that change is needed. As the founder of our unquoted electric vehicle manufacturer, NIO, put it "it's easier to work with the grain of society than against it." In December 2017 186,000 electric vehicles were sold in China. That's 6% of registrations or more than total UK monthly sales. China installed 1GW of solar power per week in 2017. This is 60% more than predicted and is capable of replacing two coal fired plants per week.

For the first time in my investing life Silicon Valley is not the cutting edge of the global narrative. It's not possible to confine the excitement of China to one city or valley but as a symbol Hangzhou will do well. It was once described as "without a doubt the finest and most splendid city in the world." That was by the marvelling Marco Polo. Perhaps it's just restoration of the rightful economic order that Hangzhou is now the home of Alibaba.

6. Scottish Mortgage Investment Trust PLC, Baillie Gifford's flagship investment trust.

Gross domestic spending on R&D – In billions of current PPP dollars, 2000–2015



Source: The amount on science research and development, using purchasing power parity (ppp) exchange rates for international comparison. Reproduced from National Science Board & Engineering Indicators – 2018; Chart: Axios Visuals.

THE GREAT TRANSITION AND THE GREAT EXTINCTION

Where does all this take us? As mentioned much earlier in this paper we fear that our industry is too lost in the combination of the inward looking world of finance and in Anglo-American political angst to be in any way capable of stepping back and considering where we might be structurally and systemically in economic and market development. Is the vocabulary of bubbles, crashes, crushed mean reversion, Trump and Brexit remotely capable of providing a guiding narrative? Of course they aren't as they are crutches propping up the old world rather than adequate attempts to observe the new.

This critique is expressly designed to be harsh. Practitioners, strategists and mainstream financial economists are lost. Their tools do not function as they once did. But this needs us not just to identify the absence of clothes but to try to provide some new garb to dress our world view. We think that Bessembinder's practical demolition of the CAPM can also provide such an investing framework.

But this leaves us requiring an economic and political narrative to judge our world by in a similar revolution. The point isn't that this can be expected to be a full and accurate model in all its details but that it might provide an interpretation that sheds some light in place of complete darkness. A limited road map of the future is better than mental mean-reversion to the world as perceived in the 1950s in Chicago, New York or Washington.

For some time we have thought that the single most useful interpretation of the trends underpinning the global economy are those of Carlota Perez and her school at Sussex University. In her seminal 'Technological Revolutions and Financial Capital' Perez investigated the structural similarities between major waves of innovation and the relationship of finance to underlying progress. This seemed to us to explain why the bubble of the 1990s was a precursor to much stronger technology companies rather than their death-knell. We have been very grateful for this guidance.

– The point isn’t that this can be expected to be a full and accurate model in all its details but that it might provide an interpretation that sheds some light in place of complete darkness.

More recently we have felt the need for still more help. It seemed to us that there were greater puzzles to be explained. For all the extraordinary power of technological change there was precious little evidence that either our societies were building these out in time honoured ways for the good of most and for productive growth. At the same time within finance the refusal to move on from exhausted business and industrial models to invest fresh capital into ambitious new projects and transformative technologies seemed almost entirely absent. Indeed investors appear preoccupied by the opposite: companies apparently exist to provide cash back not investment promise. Sadly the British stock market for once seems at the cutting-edge. It is hard to identify a single company in the FTSE 100 that actually believes in deploying new capital to create future returns.

So we asked Sussex University for help. We have funded a programme of research into the blocked transitions of our time. The preliminary lines of investigation are coalescing around the hypothesis that what we are seeing is both confusing and critical as it represents not just one more great surge in innovation but potentially a complete re-making of the same significance as a turning point such as the Industrial Revolution. What may be occurring will require us to forge a new set of mental models. For the moment we can just term it a ‘Deep Transition’ that upsets our paradigms.

What is certainly the case is that such a conceptualisation already helps to explain major conundrums of our age. The first is that the struggle to move into a new golden age becomes much more explicable if we acknowledge that what is churning away underneath our economies is the need for a complete re-thinking of our societies and philosophies. The vitriol associated with our current politics and the dysfunction of our financial system both make more sense if the traditional lights are really dying.

This struggle is parallelled by the refusal of the mean to revert or the extreme self-confidence of Value investors (as they modestly term themselves) to find market validation.

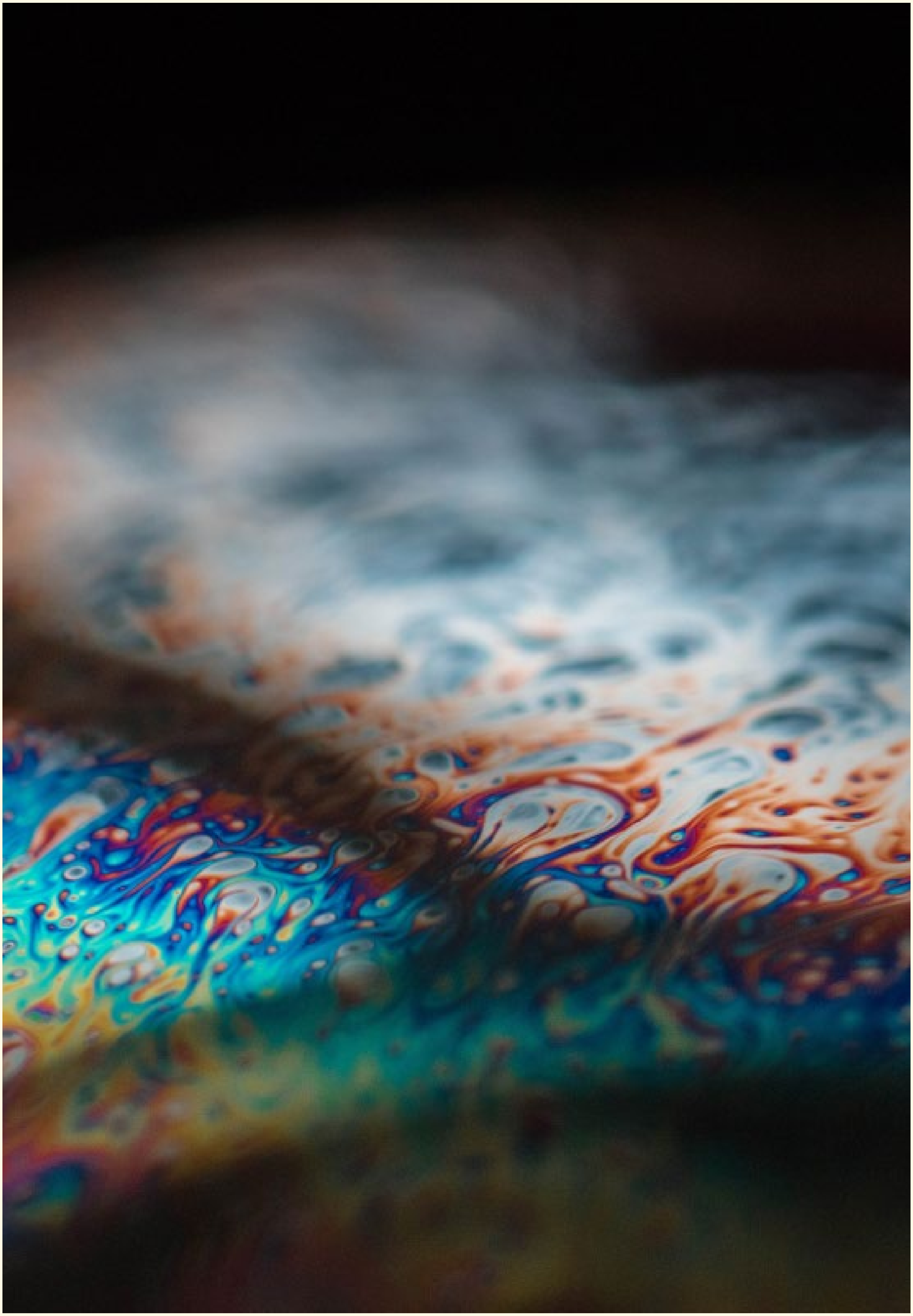
If what the world is just entering is a wholesale transition to a new order then it's likely that an era of comfortable mean reversion will be replaced by a quite different but equally credible output of capitalism: the death of the old. After all this has been the logical and visible fate of those businesses in the eye of the early internet storm. Do you remember all those articles preaching how ridiculous the valuation of Amazon was relative to established players such as Borders and Barnes & Noble? Well, they underestimated Amazon but they just as clearly overestimated its supposed peers. These companies with hundreds of other retailers haven't become 'cheap' or 'value investments'. They have instead declined towards and often into bankruptcy. Deep transitions lead to permanent and catastrophic dislocation not to gentle cyclical ups and downs. Why would this not expand from retail crisis to more general bonfires of the old?

This will only become more central to markets as the Deep Transition moves into more and bigger territories. From retailers and newspapers collapsing to the end of big oil, traditional healthcare and lumbering banks and insurance is but a decade or two in forthcoming disruption. But apparently it's prudent and risk-free to continually rotate into dying companies and industries because they are 'cheap' on current earnings. We shall see although to our eyes this looks like pernicious short-termism. Ironically we think our portfolios and methodology are now providers of diversity and risk limitation. If the old world implodes then we will be useful. We suspect that implosion will occur rather than mean reversion. A corporate 'Great Extinction' is probable. Or as Schumpeter wrote it illustrates "the process of industrial mutation that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one". This process of Creative Destruction is the essential fact about capitalism.[7]

Lastly, the Deep Transition is highly likely to be associated with major geographical shifts. The Triumph of the West was the unlikely outcome of the Industrial Revolution and as that world fades into memory so too will our hegemonic interlude. As discussed earlier, the future is already being born in China. The coming age will almost certainly rely on mass adoption by the many of new energy sources and on machine learning that morphs into artificial intelligence. Both will be much more easily accomplished with governmental support and widespread popular goodwill. They won't be driven by re-opening coal mines, by ever greater inequality, rising depths of despair or contempt for international co-operation. If the next Deep Transition is to come into being then our narrative needs to begin in China and be focused on China. For all the complexities and frequently unappealing facets of the current order we need to embrace this emergent reality. As Martin Jacques presciently wrote in 2012 "The emergence of China as a global power relativizes everything. The West is habituated to the idea that the world is *its* world; that the international community is *its* community, that international institutions are *its* institutions…that universal values are *its* values…That will no longer be the case." China isn't just one of four BRIC countries, it's not to be confined in the condescension of Emerging Market limits. It's the hope for the global economy, for investors and for the much needed Deep Transition.

7. Schumpeter 'Capitalism, Socialism and Democracy' 1942.


– the Deep Transition is highly likely to be
associated with major geographical shifts.



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