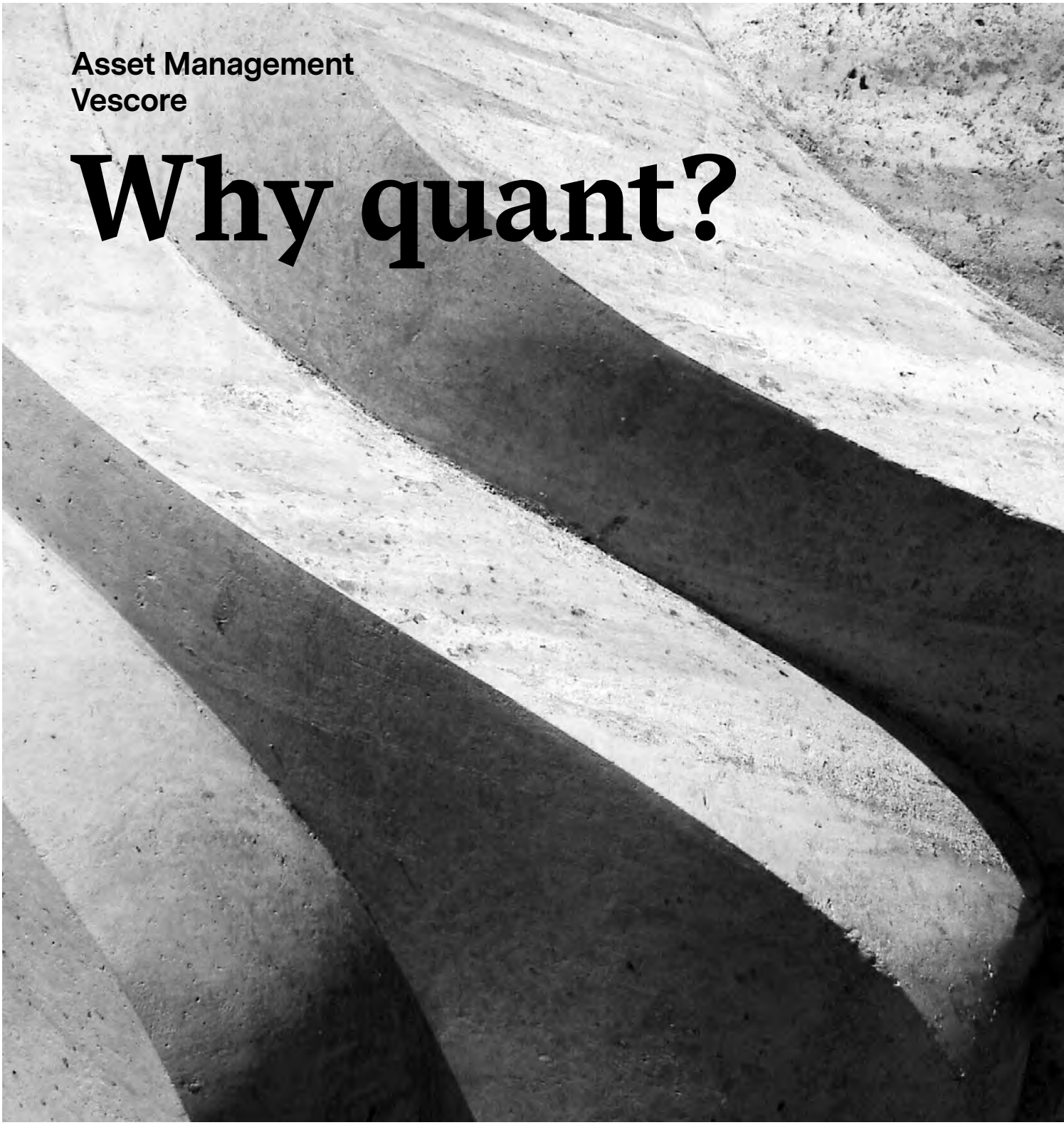
vescore
by Vontobel Asset Management

Asset Management
Vescore

Why quant?



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About the author

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Daniel is Head of Vescore, the quantitative investing boutique of Vontobel Asset Management. His daily focus is on running Vescore's investment process, driving innovation in product development and research as well as managing the investment team. Since 2009, when Daniel joined Vescore Solutions AG as Chief Investment Officer, he has been instrumental in operating the company's portfolio and investment management division. Prior to this, he ran the hedge fund platform of Swiss Capital Investment AG where he oversaw the investment activities of various funds of hedge funds, allocating 1.5 billion U.S. dollars to a broad range of hedge funds. Daniel started his career as an analyst in the field of sustainable investments.

Daniel's educational background includes a PhD (Dr. oec. HSG) and a Master's degree in Financial and Capital Markets Theory from the University of St. Gallen (lic. oec. HSG). In his doctoral thesis, he focused on asset pricing and asset allocation. In addition, he holds a Master's degree in Environmental Sciences from ETH Zurich (dipl. natw. ETH).

Content

Why quant?

Society's welfare is imperiled by large pension savings gaps that push retiring generations across the globe to the brink of poverty. Profound demographic changes have appeared on the horizon that testify to the obsolescence of a static retirement system that has failed to adapt over time. The system's main building block, a growing labor force, is disintegrating. As a result, the system runs the risk of crumbling under the crushing weight of an aging population in financial need. Managing assets efficiently has become essential in sustaining and growing the available capital stock which has moved the asset management industry center stage. Asset managers have the means and skills to fill this gaping gap while other institutions, such as corporate and sovereign pension plans, fall short of providing the required support. However, taking on a task of large socioeconomic significance comes at a price: tightened regulation and heightened investor scrutiny with a focus on risk, transparency and costs. When striving to meet the new requirements of regulators and investors, successful asset managers will achieve operational excellence and embrace technological change as the key to innovation. The type of asset manager that has a strong competitive advantage in this environment is the quantitative manager of the 21st century. Quantitative managers have evolved in lockstep with technological and scientific advances which has equipped them with the tools to provide attractive risk-adjusted returns at reasonable cost. Drawing on the strengths of active and passive investing, quantitative managers have a strong edge in the areas of return, risk and liquidity. Not only are they a master of the fundamental law of active management which enables them to achieve high returns but they also excel in tight risk management. Finally, by operating exclusively in very liquid markets, they maximize strategy capacity. Therefore, quantitative managers are unrivaled in their position to manage, preserve and grow the asset base of today's society in a changing demographic landscape in order to serve current and future generations.

Mind the gap

The global retirement crisis has been quietly ballooning in the background over the past decades as the scales have been tilting towards an ever growing number of retirees supported by an increasingly smaller work force. In 2015, the global retirement savings shortfall stood at a staggering 70 trillion U.S. dollars (see chart 1) – a gap that seems hard to fill, especially since it represents about 1.5 times the annual GDP across the countries studied. This number is rising by 5 percent each year as the world population is aging, living longer while being less inclined to having children. In addition, policymakers of the developed world have failed to put the brakes on the issue by shying away from making drastic changes to the current system which revolves around a static retirement age. As a result, the retirement savings gap is projected to reach 400 trillion U.S. dollars in 2050. This is equivalent to an additional 28 billion U.S. dollar deficit every day.[1]

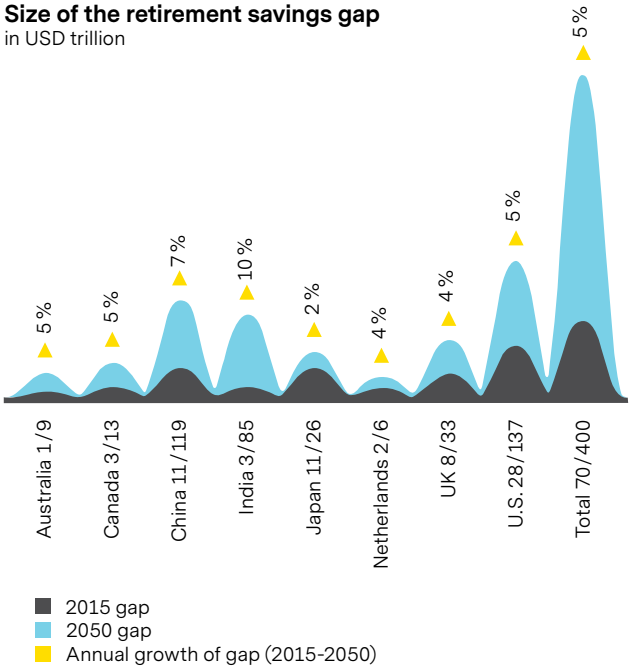
Retirement, conventionally hailed as a person's "golden age", has become deeply tarnished as poverty looms. Today's society is likely to be hit by a demographic paradigm shift brought about by a large elderly generation in need of financial support. This support cannot be provided by the working population as the number of workers funding each retiree is falling. In the euro area, this number is estimated to shrink from 3.7 to 1.9 between 2005 and 2050.[2] In addition, today's pensioners do not have enough savings to carry themselves through retirement. Across Europe the savings shortfall amounts to 2 trillion euros each year which people need to fill to adequately cover their spending needs. Retirees look to financial institutions that help them manage their savings to generate a steady stream of income. Investing for capital growth has become paramount as retirement savings must be put to work by prudent asset managers who will act as the new safeguards of the pools of capital that serve the purpose of sustaining current as well as future generations. Asset management as an industry is set to increase its weight in society to unseen levels.

Two important implications flow from the asset management industry moving into the limelight. On the one hand, asset managers will be put under the magnifying glass by regulators who are likely to step up the pace of imposing new regulatory requirements on an industry that has taken on a task of systemic magnitude. On the other hand, steady capital growth requires sophisticated and efficient capital management – a process that will face increased scrutiny by investors.

CHART 1

Size of the retirement savings gap

in USD trillion



Source: We'll Live To 100 - How Can We Afford It? (Geneva, 2017) <http://www3.weforum.org/docs/WEF_White_Paper_We_Will_Live_to_100.pdf> [accessed 23 March 2017].

Twisting the regulatory thumbscrews

In the wake of the financial crisis of 2008, investor protection, next to the financial system's health, has become of the utmost importance to regulators. Increased requirements for heightened transparency and rigorous risk management are likely to be applied to the entire investment apparatus of asset managers to address the structural vulnerabilities of the industry that potentially put investor interests at risk. Especially core risk management processes will be examined for robustness such as the ones addressing operational, counterparty, credit, market and liquidity risk. In addition, regulators will increasingly question how well connected the risk management function of a company is with the day-to-day business since proximity to investment processes is essential to efficiently tackling risks. Furthermore, product transparency will become more prominent than it is today with increased demands for clearly outlining investment processes. New disclosure requirements will force asset managers to put in place reporting systems that are able to store, process and retrieve large amounts of client as well as portfolio-related data.

[1] We'll Live To 100 – How Can We Afford It? (Geneva, 2017) <http://www3.weforum.org/docs/WEF_White_Paper_We_Will_Live_to_100.pdf> [accessed 23 March 2017].

[2] Reimund Mink, General Government Pension Obligations In Europe, 28th edn (2008) <http://www.bis.org/ifc/publ/ifcb28.htm> [accessed 18 August 2017].

Investors chime in with regulators

In the aftermath of the global financial crisis, investors have become more investment-savvy, risk-averse and skeptical.[3] Promising double-digit absolute returns wrapped in obscure investment funds administered by wizard-like managers is no longer good enough. Instead, investors' focus has turned to performance net of all risks incurred. Therefore, answering risk-related investor concerns has become more demanding than just pointing out the variation of returns. As a result, the industry must withstand the critical scrutiny of investors who have initiated a strategic shift towards transparent and truly sustainable investment strategies.

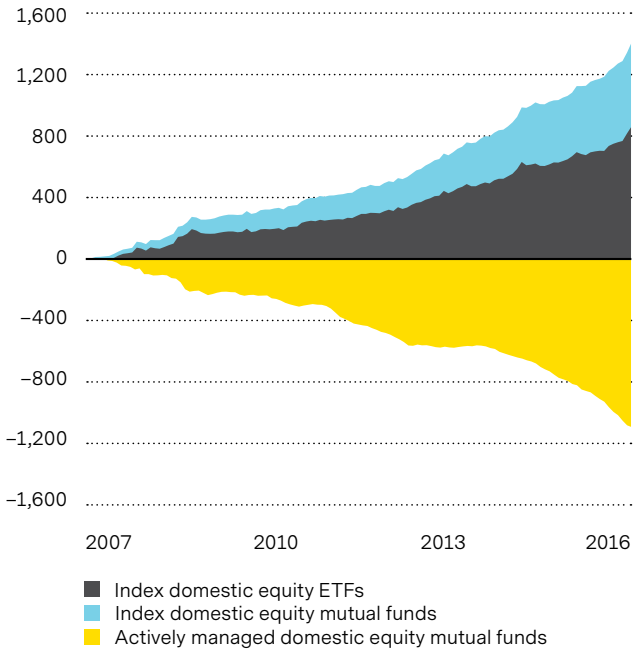
Efficient asset management: Less sweet talk, more talking turkey

Steady capital appreciation demands an efficient management of client assets. At the center of efficiency is cost which has become a core concern to investors who have started questioning the industry's value proposition to asset owners. Stripping performance down to returns after all fees and other expenses has at times revealed a sobering picture of the asset management industry. Increasingly, investors want to know what they are charged for and how this affects their return which has greatly increased global competition among asset managers. Especially so-called closet index funds find themselves in the firing line. These funds, who claim to be actively managed, yet, whose returns hover around that of the benchmark, are likely to be weeded out by the competition. This is because, ultimately, beta can be obtained cheaply from passive funds as well as exchange traded funds (ETFs). This reality is reflected in the most recent evaluation of fund flows that have mainly benefitted passive strategies (see chart 2).[4] According to Moody's, passive investments will exceed 50 percent of the total assets under management in the U.S. by 2024 at the latest.[5]

CHART 2

Outflows from actively managed U.S. equity mutual funds have benefitted passive strategies

(in USD bn)



Cumulative flows to and net share issuance of domestic equity mutual funds and index ETFs, billions of dollars; monthly, January 2007–December 2016

Source: A Review Of Trends And Activities In The Investment Company Industry, 57th edn (2017) <https://www.ici.org/pdf/2017_factbook.pdf> [accessed 18 August 2017].

[3] Gary Shub and others, Global Asset Management 2016: Doubling Down On Data (Boston, 2016) <https://www.bcgperspectives.com/content/articles/financial-institutions-global-asset-management-2016-doubling-down-on-data/> [accessed 18 August 2017].

[4] Andrew Haldane, "The Age Of Asset Management?", 2014. Global Wealth And Asset Management Industry Outlook (2014) <http://ey.com/wealthassetmgmt> [accessed 18 August 2017], Gary Shub and others, Global Asset Management 2016: Doubling Down On Data (Boston, 2016) <https://www.bcgperspectives.com/content/articles/financial-institutions-global-asset-management-2016-doubling-down-on-data/> [accessed 18 August 2017].

[5] Stephen Tu and others, Asset Managers - Global: Passive Market Share To Overtake Active In The US No Later Than 2024 (2017) <http://www.n3d.eu/_medias/n3d/files/PBC_1057026.pdf> [accessed 24 March 2017].

Product innovation is the imperative for keeping abreast of change

With the compelling proposition of low-cost passives, the bar has been raised for justifying fees for future alpha. Asset managers have to work harder to demonstrate how they add value to investors. Investors' push for cost-efficiency has been driving product development in the industry over the most recent decades. Product development is an area that goes hand in hand with scientific advancement in financial markets research, a combination that historically has been responsible for fostering innovation in the financial industry. Before the advent of Markowitz's Modern Portfolio Theory in the 1950s, investing was a rather unscientific practice driven by human impulses. Investment professionals selected companies based on personal perceptions of a good story, the pedigree of a company's management and a cursory glance at the company's balance sheet. Then, Markowitz demonstrated that investing is not just about picking the right stocks but also about the combination of stocks chosen bearing in mind that diversification acts as a powerful tool with significant benefits. Asset pricing models, such as Sharpe's Capital Pricing Model, Merton's Intertemporal Capital Pricing Model and Ross's Arbitrage Pricing Theory Model, went a step further by suggesting that investors do not get rewarded by taking on unsystematic security-specific risk. Rather, the overall exposure to systematic risks is the only determinant of expected return. In addition, the Efficient Market Hypothesis made clear that trying to beat the market is a futile undertaking. This radical hypothesis unleashed a rush towards passive investment vehicles that popped up with the creation of market cap indices in the 1970s and the first offering of an index mutual fund in 1976. The Vanguard 500 Index Fund, designed to track the performance of the S&P500 Index, was open to anyone who wanted to invest. At first mocked by market participants, the invention of the index fund kick-started the ETF phenomenon in the early 1990s which has seen massive inflows over the past. This popularity put active managers into an uncomfortable position as they were forced to generate returns well beyond that of the benchmark in order to prove they still provided added value to the investor. Security selection based on fundamental data became the mantra of asset management with the ultimate goal of beating the index initiating the era of traditional active management that we know today.

Technology as the game changer

Advancements in academic research on financial markets theory has seen the rise of a powerful ally, technology, that has acted as an accelerator of the rate of change in the asset management industry by driving much of the contest for investor fund flows. This competition has become more intense over recent decades. This is due to progress in the information technology sector and modern computing which has made it much easier to process large amounts of data and trade big sets of assets in order to construct baskets that track the performance of an index. Ultimately, the index funds' rise to power would not have been possible without advances in IT. Technology makes trading and monitoring portfolios highly efficient while eliminating frictional costs associated with intermediaries, such as brokers, that are a firm component of the active management process. Due to these characteristics, passive investment instruments have been able to offer attractive low-cost investment solutions that have been capturing significant amounts of market share.

As if it had not already caused enough of a stir within the industry, technology paved the way for new rivals to join the stage. In the 1980s the first members of a new generation of asset managers came into existence who borrowed from financial market theorists to apply their insights to rules-based investment processes and mathematical trading algorithms. The so called "quants" proposed a refreshingly sober approach to active management based on mathematical rigor which was closely intertwined with the highly coveted ability to accurately quantify risk and generate attractive risk-adjusted returns. As a result, quant managers rose to prominence over the past decades by capitalizing on the vast realm of computing power that has seen an exponential rise in processing capacity over the most recent past.

That's why quant

Hitched to the fast-paced developments in the information technology sector, the early quantitative managers have given way to an entirely different kind of animal: the quant manager of the 21st century. They have a unique value proposition to investors by having a clear competitive edge in the areas of return, risk as well as liquidity. They are able to fully cater to the modern investor's transformed set of needs against the background of today's profound demographic changes; and this is done in a particularly transparent way. At the heart of modern quantitative investing lies rigorous analytical discipline which subjects large financial data sets to the objective approach of mathematical analysis. The goal is to develop scientifically sound computer-based models that produce risk and return forecasts based on which portfolios are constructed that optimize the trade-off between risk, return and cost (for a more detailed definition of quantitative investing see page 8).

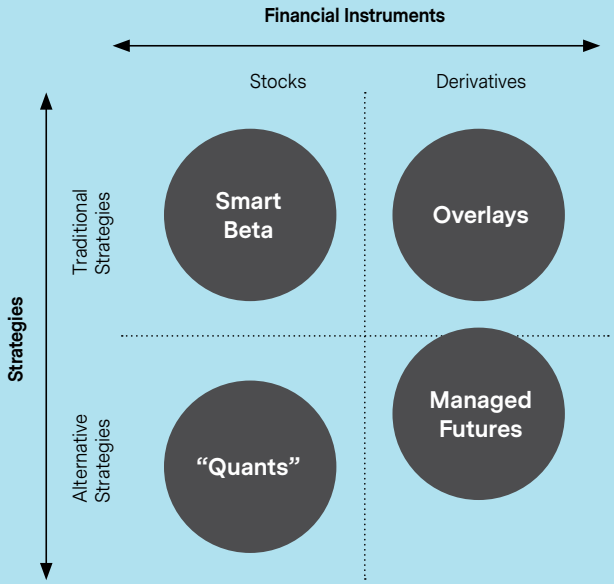
— continued on page 12

Navigating through the quant jungle

Quantitative investing is a systematic and computer-based approach to implementing a variety of investment strategies. Investment decisions are made based on quantitative analysis by a computer-run model construed by human engineering. Quantitative investing is highly adept at processing large data sets as well as refining these into actionable pieces of information of high explanatory power. These insights are deployed as trades in the marketplace by the means of computer-powered technology. Since every quant investor is looking for an edge, the current landscape of quantitative investment strategies is highly diverse. This is even more so because many investment managers are keen on claiming the quant label for themselves since it has become a buzzword synonymous with technological progress and avantgardism. As a result, the field of quant investing has become opaque.

Looking at the financial instruments used and the type of strategies employed brings some light into the crowded quant space which uses its own particular jargon. Splitting it into alternative versus traditional strategies and differentiating further by whether mainly equities or derivatives are used, quant approaches can be put into four distinctive categories which cover the most significant chunks of assets currently under management in the quant segment.

The early so called “quants” have their roots in the alternative space and have, since their inception in the 1980s, applied quantitative equity strategies by trading single stocks. These funds mainly pursue(d) statistical arbitrage and fundamental strategies isolating specific risk premia. In their early days, quantitative equity strategies exclusively relied on fundamental bottom-up approaches using various stock characteristics such as valuation ratios to choose their investments. This way they, wittingly or unwittingly, laid the foundations for what is called factor investing today. Later on these funds stepped up their game by resorting to long/short or even market-neutral implementation strategies in order to specifically target and capture a variety of risk factors. As a result, these funds are often called quantitative equity market-neutral funds. Similarly, statistical arbitrage strategies are also beta-neutral and bottom-up in nature. However, statistical arbitrage strategies base their buy or sell decisions



Source: Vescore

mainly on price dynamics of stocks using statistical and econometric techniques. Mean reversion and momentum principles often serve as a starting point. Stocks are put into pairs or other clusters and investments are made based on the hypothesis that these stocks behave in a predictable manner.[1]

As success attracts imitators, there is an ongoing transfer of knowhow from the alternative to the traditional space which has driven the proliferation of players and approaches in the quant domain. In the equity space, smart beta strategies have tapped into the alternatives’ armory by seeking exposure to systematic or behavioral risk factors that drive equity returns. Smart beta strategies harvest factor premia such as size, minimum volatility and momentum by means of rules-based index weighting schemes.

The early quant managers that operate exclusively in derivatives and, in particular, futures markets are labeled managed futures funds. They buy or sell futures contracts across a wide range of markets such as the equity, fixed

income, currency and commodity markets. Put simply, they go long markets that are expected to go up and short the ones that are expected to fall. However, the segment of managed futures is a vast domain that includes a wide range of strategies.

Among the more prominent ones are trend-following Commodity Trading Advisers (CTAs) and global macro funds. CTAs represent a highly specialized breed currently managing close to 350 billion U.S. dollars in assets.[2] They base their strategies on the technical analysis of market prices, rather than on fundamental economic models. More specifically, CTAs try to take advantage of short- to long-term price trends that are expected to drive various futures markets. In contrast, global macro funds create value by their expertise in global asset allocation. Using macroeconomic predictions based on fundamental and econometric models to derive their asset allocation, these funds engage in a wide range of directional or relative value trades in the areas of equity, volatility, commodity as well as currency and fixed income curve trading. Also in this area we have seen a spill-over of knowledge into the traditional domain. Notably, risk parity and multi asset funds apply many of the models in the traditional space used by their alternative counterparts. This is an area that has seen strong growth over the recent past.

Finally, overlay programs aim at increasing portfolio efficiency by applying derivative strategies to entire portfolios. They primarily serve large institutional investors such as pension plans. Overlay programs seek to add a source of return (return overlays) or risk management layer (risk overlays) to large traditionally constructed portfolios mainly composed of equities, bonds and currencies. They are used for a wide range of benefits such as equitizing idle cash, meeting target allocations as well as managing interest rate risk and currency exposure. Typically, overlays act as an umbrella to portfolios in their totality and, hence, have a big impact on the overall return of the assets under management. Given this high impact potential, investors prefer a rules-based, systematic and transparent investment approach to a discretionary investment style. This is especially true for risk overlays which are inherently quantitative in nature.

Knowledge expansion within the quant domain from alternative to traditional strategies is a trend that is unlikely to reverse as long as quant managers continue to be at the forefront of technological change in the financial industry. Players are bound to multiply and strategies will become more diverse. At the end of 2016, quant assets under management are estimated to have reached nearly 1,000 billion U.S. dollars which, however, does not include the assets managed by overlay programs. Looking back over the past ten years, this impressive number was driven by a growth rate of approximately 15 percent per year while smart beta was the segment that has seen the strongest increase over the period with a growth rate of 25 percent per year.[3] And it does not appear as if inflows are going to abate any time soon.

[1] One important distinction must be made in order to dissociate quantitative investing from the tarnished “black box” fund label that is often stuck on high frequency traders. HFT is an offshoot of the early quant investment approaches and developed in parallel to the expansion in modern computing power which allows HFTs to apply short-horizon trading strategies. Execution speed rather than the selection of promising stocks is important. Orders are executed based on a pre-configured computerized algorithm and aims at exploiting mathematical opportunities of often miniature numerical size. In contrast, quant strategies of the 21st century base their investment decision on quantitative models capturing the fundamental economic environment.

[2] “Assets Under Management - Hedge Fund And CTA”, Barclayhedge.Com, 2017 <https://www.barclayhedge.com/research/money_under_management.html> [accessed 18 August 2017].

[3] Own calculation, Vescore.

The revolutionary quant development timeline

Financial markets research*, financial product development and progress in computing power engage with each other like interlocking cogwheels. Modern quant investing would not have been possible without this powerful trio that revolutionized the investment world.

1943

The Colossus was the first electric programmable computer. It was developed by British codebreakers to decipher encrypted German messages during the Second World War. It allowed the Allies to read high-level military intelligence from intercepted radiotelegraphy messages between the German High Command and their troops.

1952

Portfolio Selection
Pioneering contribution in the field of financial economics about portfolio choice under uncertainty
— Harry Markowitz

1953

IBM introduces its first commercial computer.

1955

The MIT introduces the Whirlwind Machine, the first digital computer with magentic core RAM and real time graphics.

1957

The S&P 500 index is launched. Today it is the most watched equity index in the U.S. and 3 trillion USD track the index in index funds.

1964

Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk
Introduction of the Capital Asset Pricing Model (CAPM), a theory on the price formation for financial assets *— William Sharpe*

Hewlett Packard releases the first mass-marketed desktop computer: HP9100A.

The first programmable desktop computer Programma 101, is unveiled by Italian manufacturer Olivetti. It cost 3,200 USD at the time.

1965

Proof that Properly Anticipated Prices Fluctuate Randomly
Introduction of the concept that prices follow a random walk in an informationally efficient market
— Michael Jensen

1968

The Performance of Mutual Funds in the Period 1945-1964
Introduction of Jensen's Alpha and the conclusion that, on average, funds do not add value after cost
— Michael Jensen

1970

Efficient Capital Markets: A Review of Theory and Empirical Work
Introduction of the Efficient Market Hypothesis *— Eugene Fama*

1971

Nasdaq is the first stock market to trade electronically.

The International Monetary Market (IMM) is established as a spin-off of the Chicago Mercantile Exchange. It trades futures and options contracts.

1973

An Intertemporal Capital Asset Pricing Model
Intertemporal expansion of the CAPM and first formal introduction of additional pricing factors
— Robert Merton

The Chicago Board Options Exchange is established for standardized options trading.

1974

An Equilibrium Model of the International Capital Market
Introduction of an international CAPM
— Bruno Solnik

The Xerox Alto, although never sold to customers, is considered the first workstation that included a fully operational computer, display and mouse.

1975

IBM unveils the first portable personal computer of all times: the IBM5100. It weighed 23 kg.

1976

The Arbitrage Pricing Theory of Capital Asset Pricing
Introduction of the Arbitrage Pricing Theory (APT)
— Stephen Ross

The first index mutual fund, the Vanguard 500 index fund, is released. At first, the fund raised a meagre 11.4 million USD. However, over the next two decades the fund's assets saw a CAGR of 53% increasing them to 42 billion USD by June 1997.

Steve Wozniak and Jobs create Apple I and start their business.

Academic Research

Financial Products

Computers

*Financial markets research is limited to a selection of defining studies in equity research

1977

A Critique of the Asset Pricing Theory's Tests Part I: On Past and Potential Testability of the Theory
Demonstration of how difficult it is to test asset pricing models such as the CAPM since the market is unobservable
— *Richard Roll*

Investment Performance of Common Stocks in Relation to their Price-Earnings Ratios: A Test of the Efficient Market Hypothesis
Documentation of the value premium using the P/E ratio
— *Sanjoy Basu*

Apple II is the first consumer product sold by Apple. It has the feature to display color graphics and is one of the first highly successful mass-produced microcomputer products.

1978

Asset Prices in an Exchange Economy
First general equilibrium asset pricing model taking into account real activity and consumption preference
— *Robert Lucas*

1980

On the Impossibility of Informationally Efficent Markets
Questioning of perfectly informationally efficient markets due to gathering costs
— *Sanford Grossman and Joseph Stiglitz*

1981

The Relationship between Return and Market Value of Common Stocks
Documentation of the size effect
— *Rolf Banz*

Do Stock Prices Move Too Much to be Justified by Subsequent Changes in Dividends?
Questioning if equity prices are driven by rational expectations or by other forces
— *Robert Schiller*

1982

The first stock market futures start trading.

1983

The first index options are introduced.

Apple creates Lisa, their first personal computer.

1984

The Russell Small Cap Index is the first size index on the market.

The Apple Macintosh is released.

1985

The Equity Premium – A Puzzle
Documentation of the equity premium puzzle
— *Rajnish Mehra and Edward Prescott*

Does the Stock Market Overreact?
Research on the question if the market's overreaction to dramatic news events affects stock prices
— *Werner DeBondt and Richard Thaler*

1986

Economic Forces and the Stock Market
Documentation of macro-economic factors influencing equity
— *Nai-Fu Chen, Richard Roll and Stephen Ross*

The first bond index fund is launched.

1987

The first style indices are launched (Russell Value and Growth).

1988

The Equity Premium – A Solution
Introduction of crash risk in asset pricing models
— *Thomas Rietz*

1989

Business Conditions and Expected Returns on Stocks and Bonds
Documenting the relationship between risk premia and business conditions
— *Eugene Fama and Kenneth French*

The first ETF, the Toronto Index Participation Fund, is introduced.

The Apple Macintosh Portable is released. It is Apple's first battery-powered portable personal computer.

Intel introduces the 486DX processor. It has 1 million transistors and multitasking capabilities.

1991

Implications of Security Market Data for Models of Dynamic Economies
Generalized asset pricing model describing the stocastic discount factor
— *Lars Peter Hansen and Ravi Jagannathan*

The Variation of Economic Risk Premia
Documenting predictable components in stocks and bonds due to risk premia variation
— *Wayne Ferson and Campbell Harvey*

The Macintosh Powerbook OS Mac revolutionizes Apple's portable computer line.

1993

Common Risk Factors in the Returns on Stocks and Bonds
Introduction of the Fama-French three-factor model
— *Eugene Fama and Kenneth French*

Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency
Research on abnormal returns due to the momentum effect
— *Narasimhan Jegadeesh and Sheridan* Titman

The Risk and Predictability of International Equity Returns
Documenting predictability in global equity markets due to variation in risk premia
— Wayne Ferson and Campbell Harvey

The first U.S. ETF, the S&P 500 Depository Receipt (SPDR), is launched by State Street Global Advisors.

The CBOE introduces the VIX index to measure expected volatility.

The first OTC variance swap is introduced by UBS.

1994

The first credit default swaps are engineered by JP Morgan.

1997

The CME E-mini S&P 500 contract is launched. It is the first futures contract designed specifically for electronic trading.

1999

By Force of Habit: a Consumption-Based Explanation of Aggregate Stock Market Behavior
Introduction of habit as a component determining utility
— *John Campbell and John Chochrane*

2003

The Guggenheim S&P 500 Equal Weight ETF (RSP) is released tracking the equally weighted performance of the 500 companies making up the S&P 500. It is considered the first smart beta ETF.

2004

Risks for the Long Run: A Potential Resolution of Asset Pricing Puzzles
Introduction of a long-run risk asset pricing model
— *Ravi Bansal and Yaron*

2006

The first Mac Book Pro replaces Powerbook G4.

2007

Apple introduces the iphone.

2011

U.S. ETFs reach 1 USD trillion in assets.

2013

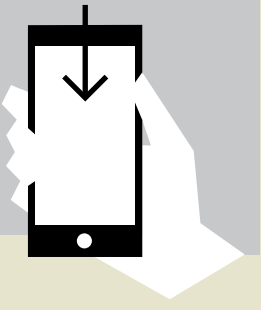
The Other Side of Value: The Gross Profitability Premium
Documentation of a simple quality criteria and hence the quality premium
— *Robert Novy-Marx*

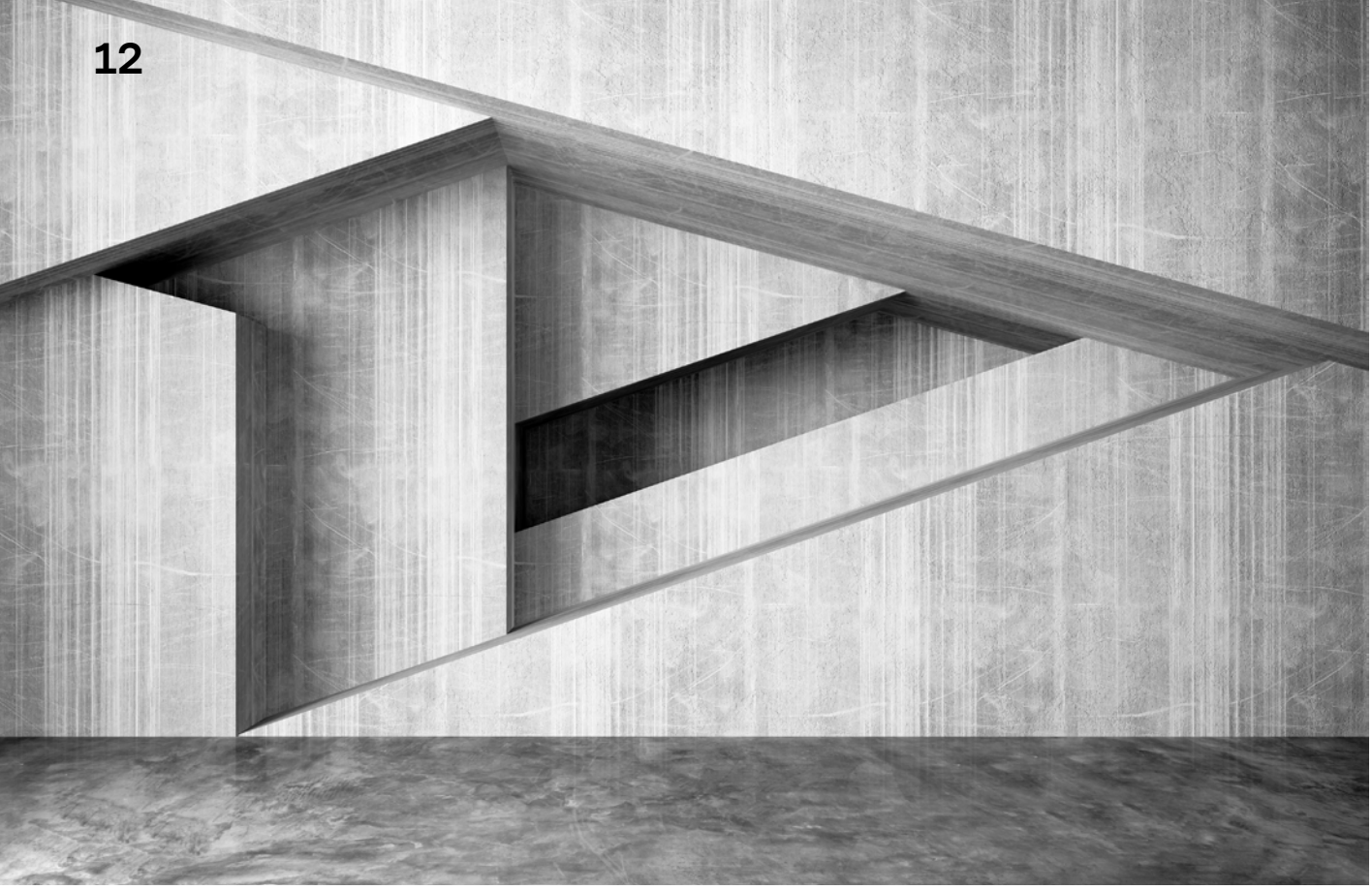
2015

A Five-Factor Asset Pricing Model
Introduction of the Fama-French five-factor model
— *Eugene Fama and Kenneth French*

2017

Apple releases the iphone X celebrating the 10th anniversary of the iphone. The device introduces Apple's new face ID technology that is used to unlock the phone. The device projects up to 30,000 infrared dots on the user's face and creates a 3D map. The data is evaluated by an artificial intelligence-powered engine that recognizes the user's face even despite small variations such as glasses.





— **High return potential**

According to Grinold's fundamental law of active management, achieving high risk-adjusted returns is a function of skill, the number of independent investment decisions taken and the translation of these insights into efficient portfolio implementation. Quantitative investing excels at all three. Relying heavily on computer-based algorithms, quantitative managers are able to harness immense data volumes and cover vast amounts of securities. This generates a large and strongly diversified number of high-quality actionable investment insights. These are then, in turn, fed into a rules-based portfolio construction and implementation process. Due to the sheer amount of securities covered, quantitative investing achieves rare levels of portfolio diversification. Even the portfolio's bottom line receives a significant boost since rules-based investing eliminates much of the expensive human ingenuity of star portfolio managers that traditional active managers depend on. Therefore, quantitative managers are able to offer their strategies at attractive fees. In addition, behavioral biases of traders are kept at bay. In moments of crises, human emotions are difficult to control and might trigger rash trading decisions which may result in inefficient capital allocations at the most critical moments. Large losses are often the consequence. With quantitative investment strategies, human intelligence is essentially codified into a set of algorithmic rules. These produce returns that are replicable across multiple datasets and scenarios. Therefore, they are transferable from one person to another. Ultimately, this removes key man risk from the investment and portfolio management process. Last but not least, the systematic approach of quantitative investing lends itself to a structured learning process on the mechanisms of the investment and portfolio management process. This way, quantitative models can be improved and adapted continuously which makes sure that returns are steady and sustainable.

— **Tight risk management**

In addition, quant managers have a firm grip on risk management which is a core quantitative discipline. Investment risk is captured by abstract measures such as standard deviation, value at risk and expected shortfall. These are inherently quantitative concepts that are clearly measurable and controllable. As such they lend themselves to rules-based implementation mechanisms. Quantitative investment tools keep these measures within clearly defined bounds without relying on a separate risk management function. Moreover, the question of what to do when the market goes down and volatility goes up can largely be automated by using intelligent and agile algorithms that monitor the portfolio in real time. More importantly, quantitative analysis has the ability of separating well-rewarded sources of risk from unrewarded ones. Thereby, they steer clear of the obscure pitfalls of risk exposures that carry no or only limited economic pay-off potential. Lastly, this dissecting quality of quantitative precision comes in handy when striving for transparency in the investment process. Investment strategies implemented by computerized algorithms offer strong look-through qualities by allowing the investor to drill down into a portfolio´s mechanisms and exposures. Each level of algorithmic rule can be identified, dissected, explained and ultimately tied to a specific set of fees by quantifying the value added for the investor at each step. This achieves the level of transparency that investors require to determine how valuable their chosen asset manager is – a requirement that has risen to great importance in an age of large retirement savings gaps.

— High liquidity and capacity

Big numbers are the quants' home turf as they exclusively operate in liquid markets of great depth. These markets are characterized by a variety of factors such as a high number of market participants willing to trade, reduced market impact of trades placed and low transaction costs. The investor welcomes these features as they allow him to remain agile and able to exit and enter into positions in a changing market environment. In addition, liquid strategies have high capacity. Capacity is determined by how much capital a strategy can deploy before bringing down performance. Computer-empowered, quantitative strategies cover immense universes and invest at quick intervals. Therefore, they are remarkably scalable across markets and various time frames. This combination ensures that the effect of diminishing returns sets in later. As a consequence, quant managers have a distinct advantage when it comes to putting to work the large pools of capital needed to fill the global retirement savings gap.

Quantitative managers are on the cusp of ushering in a new era of cost-efficient active management that couples computer power with human engineering. They offer high risk-adjusted returns at reasonable prices in a largely automated portfolio implementation and trading framework that is configured to benefit from further advances in technology. Their performance is explainable and transparent. Risk is on a short leash while upward potential remains vast. Equipped with these exceptional tools, quantitative managers are well positioned to implement the investment strategies that society is in urgent need of while meeting the dissecting gaze of regulators and investors. Quant managers have a strong competitive advantage within the asset management industry and an unmatched value proposition to society.

The asset manager of the next century

It does not stop here. In fact, the edge that quant managers have is growing since advancements in modern computing are evolving and changing face.

Looking back, the evolution of quant investing cannot be dislodged from the drop in computing costs which has been driven mostly by a powerful hypothesis put forward by Gordon Moore in 1965. What came to be known as Moore's Law predicted that the number of transistors per square inch on integrated circuits would double every two years. This has proven to be true as ever smaller computer chips have generated ever increasing output. In 1955, one megabyte of random-access memory (RAM) was available at a cost of 500 million U.S. dollars. Today it is priced at 0.01 U.S. dollar. When RAM prices started to come down from sky-high levels in the 1970s, quant investing naturally gained traction.[6] However, the law seems to have reached its limits as recent research suggests that the miniature sizes of transistors have started to impede efficiency.[7] This implies that technological innovation in computing is no longer driven by decreasing high-capacity chip sizes but by powerful cloud computing systems and artificial intelligence technology uncovering unforeseen capacities in the management of financial assets. This means a new playground for quantitative asset managers who, from the moment of their emergence, have embraced computers for what they do best: gathering and dissecting information at high speed. This has consistently improved the quants' ability to explore unconventional sources of return in new and systematic ways that are fundamentally different, not only from the traditional pursuit of alpha but also from passively replicating beta. In the future, quant managers' value proposition is likely to become irresistible as they stand to benefit from the vast realm of artificial intelligence, which is likely to continue to make

[6] Gina Marie Moore, Quantitative Investing Is Fundamental, 4th edn (Philadelphia, 2016) <http://www.cfapubs.org/doi/pdf/10.2469/cp.v33.n4.3> [accessed 11 July 2017].

[7] International Technology Roadmap For Semiconductors 2.0 (2015) <http://www.semiconductors.org/clientuploads/Research_Technology/ITRS/2015/0_2015%20ITRS%202.0%20Executive%20Report%20(1).pdf> [accessed 2 August 2017].

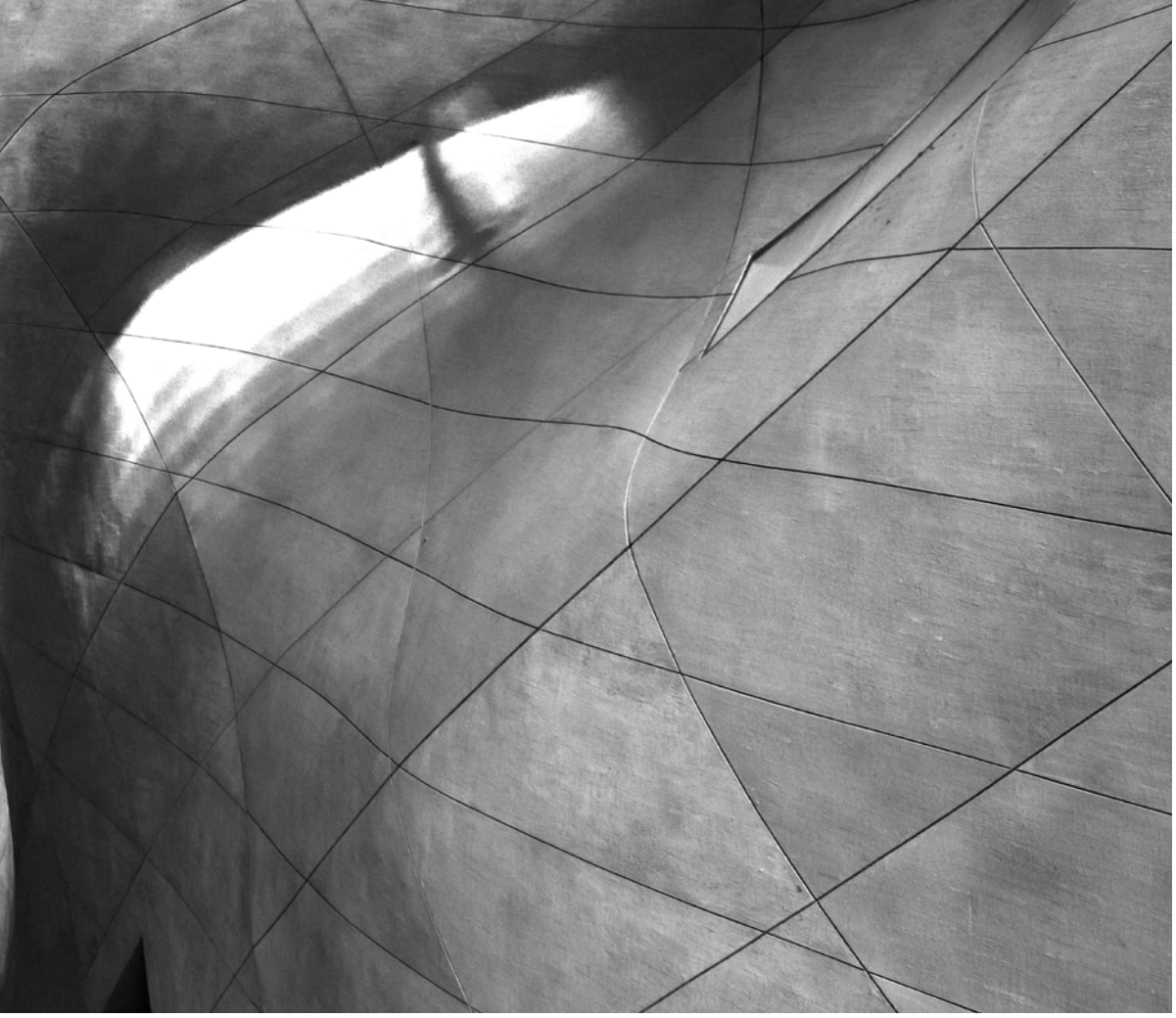
inroads into the asset management industry over the coming decades. Intelligent machines may give rise to a new approach to managing investor assets which relies on a new assortment of tools that is able to turn big data into smart alpha with minimal human interference. If asset managers, as a next step, were to buy into the ability of machines to learn, adapt and evolve, machines could soon replace human managers by making recommendations based on fundamental data. As a result, ingenious super algorithms would break down the seemingly insurmountable wall dividing the industry into traditional and quantitative managers, profoundly changing the way how asset managers deliver investor results.[8] Technological advances such as these are likely to benefit those willing to capitalize on them and leave those behind who are unable to do so.

Ready to invest in quant? Let us help

Vescore is a true quantitative manager of the 21st century with a special mission:[9] it taps into the developments in the asset management industry with the intent to bring them full cycle by blending active and passive management characteristics with the goal of harnessing the power of both. By transcending the traditional dichotomy of active versus passive, Vescore looks at investing through a comprehensive lens that ignores the stumbling blocks of divisive categorizations. Vescore is a forward-looking organization that is ready to be carried by the exponential rise in and the vast proliferation of computing capabilities with the ultimate goal of embracing and driving industry change.

Active and passive investing approaches have very different strengths and weaknesses. On the one hand, passive investing impresses on the cost and transparency side of things. Transparency resolves the principal-agent problem that investors face when choosing an investment fund. Hence, a passive manager is much easier to choose than an active one. In addition, powerful theories, such as the Efficient Markets Hypothesis, tend to be on the passives' side which suggests that beating the market on average is ultimately impossible - a tenet based on the fact that, generally, active strategies tend to underperform passive ones in the long run. On the other hand, active management excels at asset allocation when it comes to implementing complex strategies since they have the freedom to rely on dynamic adjustments to their portfolios instead of predefined static implementation mechanisms. Furthermore, investors tend to place more confidence in the risk management capabilities of active managers as they have become wary of strategies that mechanically replicate an index without allowing for reaction to the market environment in moments of crises.

Mirroring the advantages of passive managers is a natural extension of Vescore's key asset: technology. Owning state-of-the-art technological infrastructure, Vescore has the ability to effortlessly implement passive investment strategies across a vast swath of securities and markets. This lays the foundations for Vescore's investment philosophy which revolves around the precept that risk premia are the only sustainable sources of return. The goal is to generate above average market returns on a risk-adjusted



basis by harvesting intelligently selected risk premia in the market place. This is done by means of investment strategies that are firmly rooted in empirically proven concepts of financial markets theory. Since risk premia cannot be observed in the wild, quantitative tools are applied to identifying, isolating and harvesting risk premia through rules-based processes. Vescore employs various risk premia which are extracted from the areas of equities, fixed income and alternative investments (see table).

After various risk premia have been combined in a portfolio construction process, they are actively managed in order to ideally position the portfolio in an ever changing market environment. Finally, rigorous risk management processes are ingrained in Vescore's portfolio management approach. They define and control risk while allowing for agile responses to market movements and minimizing downside risks. In sum, dynamic asset allocation and risk management are Vescore's core strengths. As a result, Vescore infringes on the areas of expertise traditionally attributed by investors to active managers. By harvesting risk premia in the market place and managing them actively, Vescore bridges the gap between passive and active investing and creates a new synthesis.

[8] Inigo Fraser-Jenkins and others, Fund Management Strategy: A Short Proposal For The Future Of Asset Managers (2017).

[9] Vescore is the quantitative investing boutique of Vontobel Asset Management. Vescore AG was acquired by Vontobel Holding AG in 2016 and is now the Munich branch of Vontobel Asset Management S.A..

TABLE

The below selection of Vescore's actively managed risk premia offers a snapshot of the possibilities that investors can draw on to construct well diversified portfolios

RISK PREMIUM	DESCRIPTION
Equity risk premium	The equity risk premium is the most relevant risk premium and captures the reward for investing in the market. It is the excess return of the general market over the risk-free rate. The equity risk premium varies over time due to a changing economic environment. In a bear market the equity risk premium tends to be higher than in a bull market. The equity risk premium is best captured by investing in a global, well diversified equity portfolio.
Equity factor premia	By taking exposure to specific systematic or behavioral factor risks such as value, minimum volatility, momentum, quality and size, various risk premia can be harvested, in addition to the equity market premium. This is implemented via proprietary index weighting schemes to achieve maximum exposure to the desired factor on a specific stock universe.
Volatility risk premium	The equity volatility risk premium compensates sellers of equity options for taking on the risk of possible losses in periods of market stress when realized volatility spikes. Generally, the volatility risk premium causes implied volatility in equity options to exceed on average the realized volatility of the underlying. Therefore, by systematically selling options, the volatility risk premium can be captured.
Term risk premium	The term premium on government bonds is the excess yield that investors require to hold a long-term bond instead of rolling short-term notes over the same time span as the lifetime of the long-term bond. As bonds of longer maturities are more sensitive to interest rate changes, they carry a positive term premium. Essentially it is the amount by which the yield to maturity of a long-term bond exceeds the one on a short-term bond. The exact amount depends on investor expectations on future short-term interest rates.
Inflation premium	The inflation risk premium is defined as the additional yield which investors demand for holding assets that are exposed to inflation risk. The latter can be best understood by comparing nominal and inflation-linked government bonds. In the case of an unexpected surge in inflation, the value of inflation-linked bonds falls by less than the one of nominal bonds. Hence, investors require a premium for holding nominal bonds.
Credit premium	The credit risk premium is defined as the excess return of corporate bonds, which carry default risk, over government bonds that are considered default-free. Although intuitively convincing, the empirical evidence for the existence of a positive credit risk premium is mixed at best. Typically, there is not much left after controlling for the equity as well as the term premium.
Commodity risk premia	Commodity risk premia can be viewed as a reward for accepting price risk which commodity producers want to hedge themselves against by selling commodity futures. As such, the risk premia in the commodity markets have individual characteristics. The size of each risk premium depends heavily on the market structure as well as on the temporary dynamics driving the market of that particular commodity.
Currency risk premium	The currency premium is an investor's additional reward for holding high interest rate currencies instead of low interest rate currencies. Essentially it is derived from an FX carry trade. The strategy works well in a market environment with global financial and exchange rate stability. However, during periods with higher volatility substantial losses can occur.

A final note

There are challenging times ahead for the asset management industry that faces an investor landscape undergoing profound demographic change. Asset managers are called on to deliver sustainable investor results that add true value. This demand is driven by the current shift in regulatory focus and investor needs. Quant investing has the answer as it possesses the capacities, tools and skills to deploy the capital pools and generate the level of net return needed to improve society's welfare. However, the question remains if the asset management industry's many players will be able to achieve a seamless alignment of the industry's interests with those of the investor. While in the grip of fundamental change, the industry's value chain will be re-calibrated over time so as to put its high-quality results at the full disposal of investors. Embracing change and transcending the disruptive categorizations of passive versus active will become key if the industry as a whole is to rise to the challenge of improving the global population's financial well-being. Quant managers are the pioneers to follow.

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