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Summary Edition Credit Suisse Global
Investment Returns Yearbook 2020



Elroy Dimson, Paul Marsh, Mike Staunton

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Summary Edition

Credit Suisse Global Investment Returns Yearbook 2020

Coverage of the Summary Edition

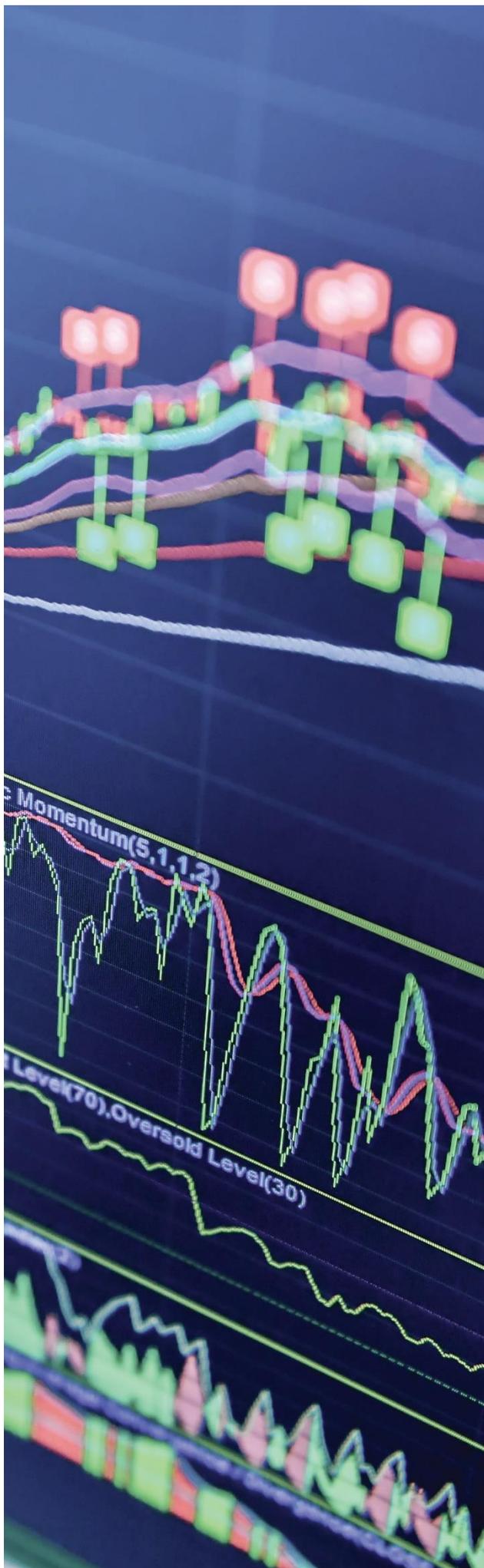
This report is a summary version of the full Credit Suisse Global Investment Returns Yearbook 2020, which is available in hardcopy only and contains four deep-dive chapters of analysis leveraging this unique dataset. The first chapter of the printed Yearbook describes the coverage of the DMS database, the industrial transformation that has taken place since 1900, explains why a long-run perspective is important, and summarizes the long-run returns on stocks, bonds, bills, inflation and currencies over the last 120 years. The second chapter of the 260-page volume deals with risk and risk premiums, documenting historical risk premiums around the world and how they have varied over time.

The third chapter of the hardcopy book – which is highlighted in this extract – turns to the very contemporary topic of responsible investing. The authors present conclusions drawn from a wealth of academic studies as well as new work of their own. They study the implications of exclusionary screening, the limitations of the ESG ratings that are the toolkit for many ESG investors, and whether ESG screening genuinely enhances performance. The authors show that the route by which ESG investors can combine the principles of responsibility with aims for material capital appreciation is to proactively use their powerful “voice,” and to harness the voices of others to engage deeply with investee companies. An active rather than passive approach to ESG drives returns. The fourth chapter of the full Yearbook focuses on factor investing: size, value, income, momentum, volatility and other smart-beta approaches to asset management.

The full 2020 Yearbook concludes with an in-depth historical analysis of the investment performance of 26 global markets – 23 countries and three transnational regions.

To highlight the new and impactful research for the 2020 Yearbook, the opening section of this Summary Edition starts with an insightful and broadly based review of ESG investing. The next section looks at investing for the long term, with a focus on long-run asset returns, risk and risk premiums, and factor investing – all based on evidence that runs from the beginning of 1900 to the start of 2020. The report concludes with a short review of the investment performance of the most important markets in the world since 1900, including China, Europe, Japan, Switzerland, the United Kingdom, the United States and the World.

To access the full Credit Suisse Global Investment Returns Yearbook or the underlying DMS dataset, please consult page 44.



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CREDIT SUISSE GLOBAL INVESTMENT RETURNS YEARBOOK 2020

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See page 44 for copyright and acknowledgement instructions, guidance on how to gain access to the underlying data, and for more extensive contact details.

Preface

This publication is a summary version of the full Credit Suisse Global Investment Returns Yearbook 2020 produced by Elroy Dimson of Cambridge Judge Business School, and Paul Marsh and Mike Staunton of London Business School. The authors are recognized as the leading authorities on the analysis of the long-run performance and trends of stocks, bonds, Treasury bills (cash), inflation and currencies. With its 120 years of financial history, this annual study remains the most comprehensive source of historical global investment returns. This year's edition also examines responsible investing, adhering to the Yearbook's typical long-term focus and presenting an objective analysis of the important topic of ESG investing.

Global Investment Returns Yearbook

As the Global Investment Returns Yearbook enters 2020, we move beyond a second decade that has proved highly rewarding for global investors with annualized real equity returns of 7.6% and a still robust 3.6% for bond investors. While it might be argued that equities are in many respects getting back much of what they lost in the first decade of the millennium, making returns over the 20-year period look less out of keeping with the history books, the same cannot be said of bonds where the extended period of premium real returns is unprecedented.

The backdrop has of course remained one of exceptionally low nominal and real interest rates supporting the value of all financial assets both in developed and emerging markets, a legacy of the Global Financial Crisis. A number of government bond markets have nominal long bond yields still rooted in negative territory, while many corporates enjoy the related benefit of also borrowing at negligible cost to retire equity, with central banks at the same time often happy to buy the paper they issue. Curious times indeed.

The value of a study that is shaped by more than a century of financial history is its ability to remind us how exceptional conditions such as these are and the need to check ourselves when we hear the typically costly phrase uttered "it's different this time." An equity risk premium exists for a reason; namely, the volatility of equity returns. Credit Suisse's House View does indeed see a healthy range of sources of potential volatility in the year ahead – corporate profit margins peaking, high levels of corporate debt from the releveraging we have seen, a polarized political backdrop in a US election year, and monetary easing that has all but run its course.

Being paid to take the risk

Beyond the immediate outlook, an ongoing and lively discussion remains as to what the equity risk premium should be in the years ahead. It assumes crucial significance with risk-free rates that are close to zero. In such circumstances, the return on equities is simply the payment for taking risk. The authors continue to stress that investors should assume a sober view of the likely excess returns equities can generate from here.

This is not just judged against the standards of the last decade, but also by comparison with the annualized 4.3% premium relative to bills observed across the life of the Yearbook. A more tempered view is in many respects a natural consequence of the world of low real interest rates in which we are living. The study has shown that, when real rates are low, future returns on equities and bonds tend to be lower rather than higher.

Shifts from one real interest rate environment to another can see step changes in returns as investors adjust their future expectations. The reset since the Global Financial Crisis as real rates collapsed has driven superior returns. Should a turn in the monetary cycle see an upward jump in real interest rates, the reset in financial assets can be in the opposite direction. This is still a scenario to keep in mind. The working premise that the authors still believe investors should factor into their long-term thinking and modelling is an annualized equity premium relative to cash of around 3½%. This is a consistent view they have held throughout this millennium. The prevailing straight-jacket of low real interest rates provides no reason to change it.

The ESG revolution

If low real interest rates are influencing the level of the equity risk premium, ESG investing is re-shaping the nature of asset management. Investments with products linked to environment, social and governance (ESG) issues now exceed USD 31 trillion. The 2020 Yearbook adds to the body of thematic ESG work with a comprehensive and objective examination of the challenges for investors integrating the considerations of ESG factors into their investment approach.

Conscious of the tendency of many to advocate for or against rather than genuinely analyze the merits of ESG, the authors present conclusions drawn from a wealth of academic studies as well as new work of their own. The study specifically analyzes the implications of exclusionary screening, the most prevalent of ESG approaches; the role of and, more specifically, limitations of the respective ESG ratings that invariably form the toolkit for many ESG investors; and whether ESG screening genuinely enhances returns.

For those pursuing exclusion-based strategies, the good news is that, over the longer term, such strategies need not compromise diversification and relative risk-adjusted returns. The caveat is that the shorter term can lead to significant deviation from such longer-term results, both positively and negatively. This could prove a material issue for the providers of ESG investment products if their performance is judged on a shorter-term time horizon. Quantitative strategies to mitigate such volatilities may assume a key significance.

For those relying on ESG screening to enhance returns and reduce risk, there is a vast literature with sometimes conflicting results depending on time horizons and approaches taken. However, long-term evidence dating back more than 20 years finds no conclusive evidence of this. This is in part due to lack of consistent data and universal agreement on what defines E, S and G or perhaps it is a logical reflection of efficient markets. However, neither does there seem to be a high price to be paid for ethical principles.

The authors' work shows that the way ESG investors can combine principles of responsibility with aims for material capital appreciation is to proactively use their powerful "voice." They should also harness the "voices" of others to engage deeply with companies to drive change rather than "exit" through policies of exclusion. An active rather than passive approach to ESG drives returns.

Factor investing meets ESG investing

If new ESG strategies are progressively dominating the investment landscape, factor investing and smart beta strategies also remain very much in vogue. According to FTSE Russell, 65% of European asset owners had adopted smart beta strategies by 2019. The 2020 Yearbook refreshes its analysis of factor returns around the world. It is designed to probe more robustly into the stability of a series of specific factors and their premia with the benefit of a long history of data.

It is hard to ignore the very weak performance of value since the Global Financial Crisis and extending into 2019 with yet another year of negative factor returns. It arguably stands out as another consequence of the low interest rate world which so rewards duration. However, and with alarming circularity, a moot point is whether ESG investing and the weight of flows attracted to it intrinsically carry negative consequences for value when one considers the sectors most likely impacted by exclusions.

The 2020 Yearbook is published by the Credit Suisse Research Institute with the aim of delivering the insights of world-class experts to complement the research of our own investment analysts. For previous editions and other studies published by the Research Institute, please visit: www.credit-suisse.com/researchinstitute.

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ESG investing

In this extract from the third chapter of the latest Global Investment Returns Yearbook, we contribute to the debate on environmental, social and governance issues. Led by millennials, investors want their assets to be a force for good, or at least to do no harm. Approaches range from “exit” – divesting or avoiding companies or sectors deemed to fail ethical criteria – through to “voice” – using active ownership and engagement. Does virtue have its own reward in terms of higher returns and lower risk? Or do ESG investors need to sacrifice return and diversification opportunities as the price for their principles? Our answers are evidence-based.

Investing responsibly

Investors are increasingly concerned about ESG (environmental, social and governance) issues and asset managers are under growing pressure to show they invest responsibly. The Global Sustainable Investment Alliance (GSIA, 2019) reports that, on a broad view, investment products linked to ESG had a total value in 2018 of USD 31 trillion. Industry projections for 2020 are around USD 40 trillion.

Exit and voice

ESG investing takes many forms. One distinction is between “exit” or divestment, based on ethical screening, and using “voice” through engagement. But approaches can differ markedly. **Box 1** overleaf contrasts the philosophy and tactics of two famous investors. Norway’s Government Pension Fund exits from companies deemed unethical, but engages when there is headroom to improve. Warren Buffett regards most ESG issues as being outside the remit of investment professionals: in his view, ESG interventions should be the responsibility of governments.

Voice is louder when many organizations are active on topics that concern them, and investors are increasingly forming coalitions to magnify their impact. The largest coalition is the Principles for Responsible Investing (PRI) with 2,372 investors whose assets are worth USD 86 trillion. The 410

signatories to Climate Action 100+ (CA100+) have USD 42 trillion in assets under management. The Sustainability Accounting Standards Board (SASB) has 116 member supporters with USD 40 trillion in assets. The 930 supporters of the Task Force on Climate-related Disclosures (TCFD) represent a market capitalization of USD 11 trillion.

The voices that are most heard are often those with the largest assets and the most votes. In January 2020, the world’s biggest investment firm, BlackRock, joined CA100+ and released two public letters, one to CEOs and the other to clients, both centered on climate change. CEO Larry Fink (2020) expressed a clear conviction that climate issues are reshaping finance and he demanded that companies disclose sustainability information in line with SASB requirements and that corporate reporting be aligned to TCFD guidelines. There is increasing support for collective action on the environment.

Divestment and exclusion

Even divestment can be regarded as a form of voice. If enough investors shun a stock, this will lower its stock price. As Asness (2017) puts it, “to make the world a better place you want the sinning companies to sin less, not just to suffer in the stock market.”

If investor actions lower the stock price, this will raise the company's cost of capital. The sinful companies will face a higher discount rate when evaluating new investments, which means that fewer sinful projects will show positive NPVs and fewer will be undertaken. Lower stock prices may also increase the likelihood of a takeover bid, while also punishing executives where it hurts – through their compensation.

Furthermore, "exit" can be a somewhat misleading term, suggesting only negative, exclusionary screening. While ESG investment typically involves screening, this may be of a positive nature. For example, a strategy of integration can include the systematic, explicit incorporation of ESG factors and rankings – good as well as bad – into portfolio selection. Sustainability-themed investing can involve buying into themes specifically related to environmental aspects such as clean energy, green technology or sustainable agriculture.

Seven strategies

The Global Sustainable Investment Alliance identifies seven broad ESG strategies. **Figure 1** shows their importance, broken down by region. The "Total" bar shows that ESG-managed investments had reached almost USD 31 trillion by start-2018.

The chart shows that negative/exclusionary screening is the largest ESG category worldwide (and in Europe), representing 36% of the global total. Next comes ESG integration (32%), and representing the most popular strategy in the USA, Canada and Australia/New Zealand. The third most frequently followed strategy (18% of the total) is corporate engagement/shareholder activism, the predominant strategy in Japan. These different approaches are not mutually exclusive. For example, many ESG integration strategies incorporate a certain level of exclusions.

The largest ESG category, representing USD 11 trillion of assets, is exclusionary screening. Historically, the largest exclusion category has been so-called sin stocks. Almost all definitions of sin stocks include tobacco, gambling and alcohol. Many investors also exclude weapons and pornography.

Exclusionary screening

Perceptions change over time. While tobacco was always regarded as somewhat questionable, it received full sin stock status only after its impact on health became apparent. Meanwhile, attitudes to alcohol have become more relaxed. Alcoholic beverages are now far more socially acceptable than at the time of the Temperance Movement or Prohibition. Similarly, until just a decade or

Box 1: Norway versus Nebraska

Norway: In 1996, Norway's Government Pension Fund Global was the world's smallest sovereign wealth fund. By 2011 it had become the biggest and by 2017 it exceeded USD1tn. Owing shares in over 9,000 companies in 73 countries, Norway aims to fund the welfare of future generations.

The fund wishes to share in the lasting economic success of its companies. Sustainable development can make companies more robust and can underpin long-term returns; the fund therefore aims to mitigate the environmental and social impacts of its holdings. It aspires to set high standards of governance and to engage actively with companies.

Norway does not invest in businesses that directly or indirectly contribute to killing, torture, deprivation of freedom, or conflict-based violations of human rights. Investment is allowed in some defense companies as only certain types of weapons (e.g. nuclear) are banned. Norway is regarded as the most responsible sovereign wealth fund in the world.

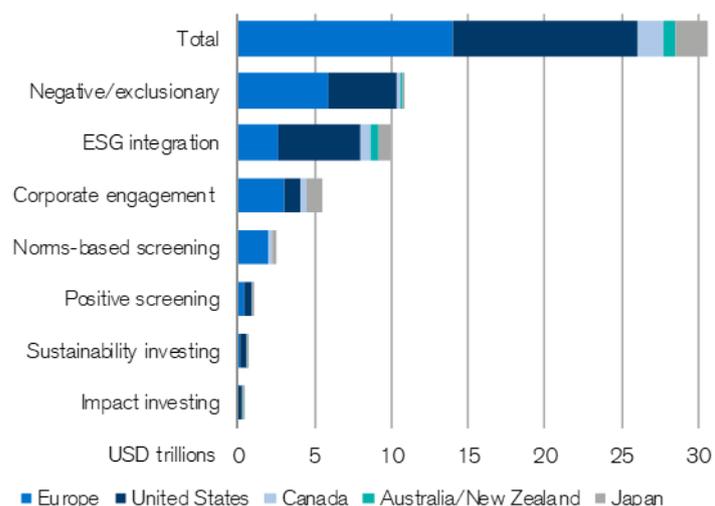
Nebraska: Born in 1930 in Nebraska, Warren Buffet became a millionaire in 1962, a billionaire in 1985, and the world's richest man in 2008. He has pledged to give more than 99% of his wealth to charity during his life or at death.

Buffet's company, Berkshire Hathaway, has invested about USD 30 billion in wind turbines and infrastructure. He might claim to be "doing well by doing good," but he insists that he invests in wind because of the government's production tax credit. Echoing Milton Friedman's view that "the social responsibility of business is to increase its profits," Buffett contends that ESG investing is wrong.

Berkshire Hathaway declines on principle to make charitable donations. Buffet says that government, not capitalism, must drive change: "If people want us to junk our coal plants, either our shareholders or the consumer is going to pay for it... The government has to play the part of modifying a market system."

Sources: Chambers, Dimson and Ilmanen (2012), Henderson et al. (2019), NBIM (2019), Miller (2008), Armstrong (2019).

Figure 1: Prevalence of ESG approaches by region



Source: GSIA (2019)

so ago, investment in oil and gas stocks was largely unquestioned. Today, concerns about climate change are leading to increasingly strident demands that fossil fuel stocks be excluded from portfolios.

Exclusionary screening may also relate to a company's conduct, rather than to the nature of its underlying business. Investors may shun companies because of unacceptable labor practices within a firm or in its supply chain; examples include modern slavery or use of child labor. Similarly, environmental and ecological standards, climate change credentials, human rights, corruption, corporate governance, diversity and tax avoidance practices can all provide grounds for exclusion.

The rewards of sin

Does it pay to invest in the shares of saintly companies or sinful companies? Hong and Kacperczyk (2009) define sin stocks as tobacco, alcohol, gambling, and (in some of their tests) weaponry. Over the 81 years 1926–2006, US sin stocks outperformed by 3%–4% per year, while international sin stocks outperformed by 2½% per year over a shorter interval (1985–2006).

In another study, Fabozzi et al. (2008) examined a large number of sin stocks drawn from multiple markets from 1970 to 2007. Averaged within sin categories, the outperformance was at least 5.3% (for alcohol stocks). Other sin sectors performed even better: 9.6% (biotech), 10.0% (adult services), 14.7% (tobacco), 24.6% (weapons), and 26.4% (gambling). Their study spanned 21 countries, with sin-stock outperformance in 19 and minor under-performance (–1% and –2%) in two countries.

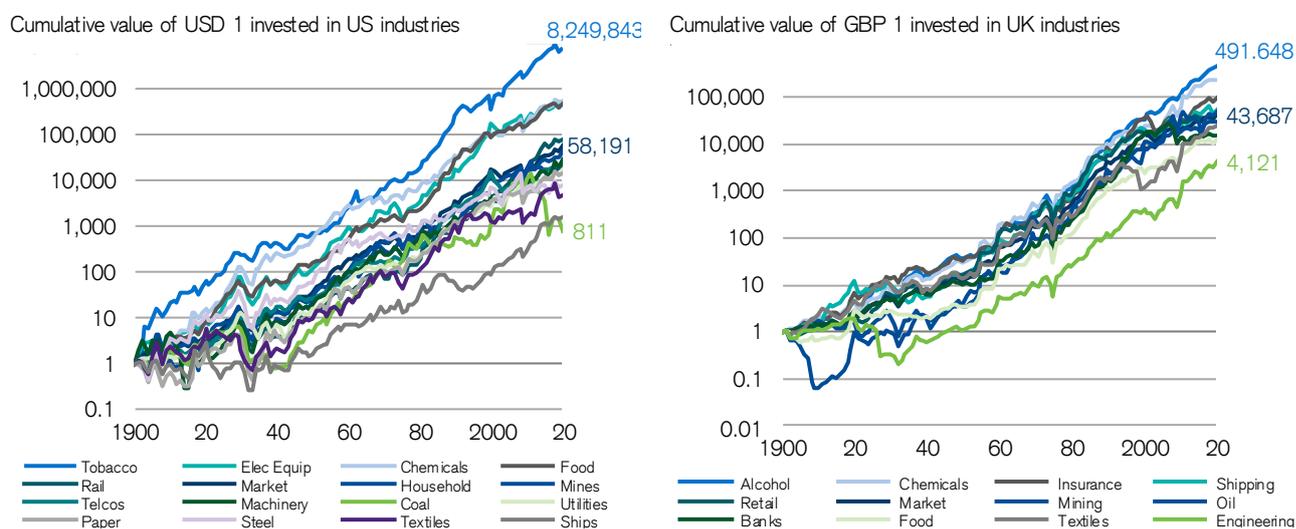
In the full 2020 Global Investment Returns Yearbook, we report on the long-run returns achieved by US and UK industries over our complete 120-year record. Our findings are shown in **Figure 2**. For the US, the left-hand chart plots the cumulative return, with dividends reinvested, for the 15 industries with 120 years of data. The dark blue line shows that one dollar invested in the US market in 1900 would have grown to USD 58,191, an annualized return of 9.6%. The best performer was a sin sector, tobacco, where one dollar grew to more than USD 8 million, an annualized return of 14.2%. Our series for the alcoholic beverage sector (not shown in the chart) starts in 1927; and from then to 2019, alcohol was the second-best performing US industry after tobacco.

For the UK, the right-hand chart shows that one pound invested in the UK market in 1900 grew to GBP 43,687, an annualized return of 9.3%. The best-performing industry was again a sin sector, alcohol, with a terminal value of GBP 491,648, an annualized return of 11.5%. Our series for the tobacco sector (not shown in the chart) starts in 1920; and from then to 2019, tobacco was the second-best performing UK industry after alcohol.

Why have sin stocks outperformed? The traditional argument is that downward share-price pressure raises a company's cost of capital. But a heightened cost of capital represents an elevated expected return. Choosing to exit "sinful" stocks can cause them to offer higher returns to those less troubled by ethical considerations.

There may, of course, be other explanations for the good performance of sin stocks. The apparent discount at which they sell may reflect regulatory and litigation risk. If realized, these could have a

Figure 2: Long-run industry returns, 1900–2019, USA (left) and UK (right)



Source: Cowles Commission; Ken French industry data; Elroy Dimson Paul Marsh and Mike Staunton; Top 100 Database; FTSE Russell; DMS US and UK indexes. Not to be reproduced without express written permission from the authors.

major impact on valuations, despite the fact that, to date, industries such as tobacco and gambling have escaped the worst scenarios. Favorable performance could also be driven by common factors. Many of the industries involved have significant barriers to entry and hence an element of monopoly power. Many are defensive sectors and there may be other common factors driving their performance.

Blitz and Fabozzi (2017) confirm earlier findings that sin stocks have generated a significantly positive market-adjusted alpha. However, the alpha disappears, is insignificant, or even turns negative when they control not only for classic factors such as size, value and momentum, but also for the newer profitability and investment factors referred to by Fama and French (2015) as “quality”. More analysis along these lines is presented in the full, printed version of the 2020 Yearbook.

Larger-scale divestments

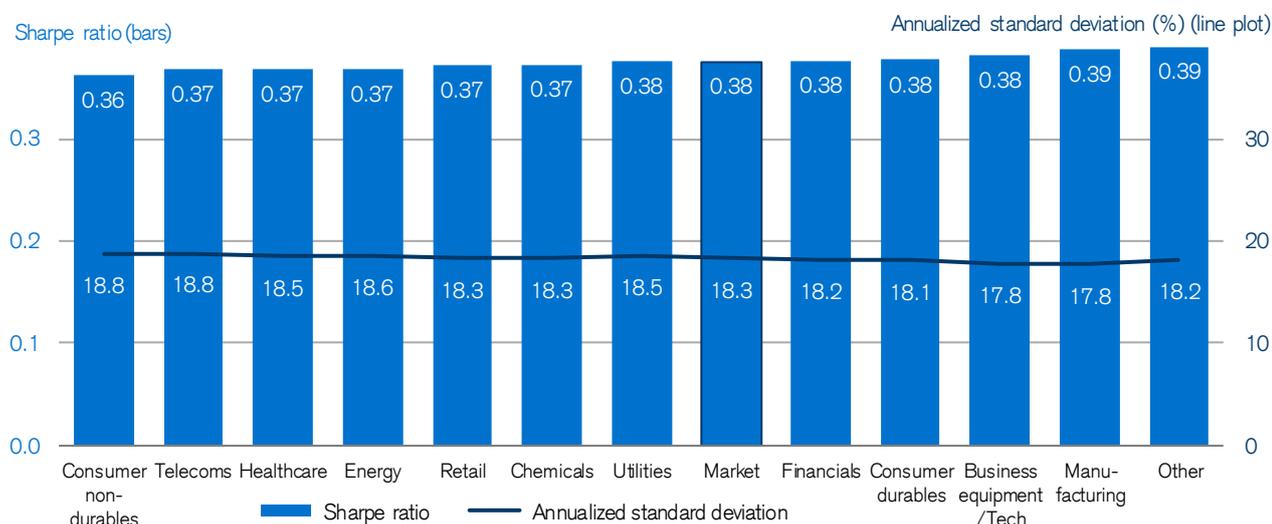
While traditional sin stocks have accounted for a high proportion of exclusionary screening, they are not a large part of the global market. Hong and Kacperczyk (2009) identified only 193 examples in the 81 years they study, with only 56 still alive by 2006. In the FTSE All World index, alcohol, tobacco and gambling each have a weighting below 1%. However, fossil fuel stocks have a larger weighting. Oil and gas has a 5% weighting in the FTSE All-World index, 4% in the USA, and 14% in the UK.

Selecting a portfolio subject to exclusionary criteria is a form of constrained optimization. By definition, investors must expect to be worse off financially in terms of risk-adjusted returns. The key question is by how much. This question was researched by GMO researchers

(Huebscher, 2017) who took the constituents of the S&P 500 and its predecessor index and assigned them to their Global Industry Classification Standard sector. They then excluded each of the (then) 10 sectors in turn and estimated the return impact over 1925–2017, 1957–2017 and 1989–2017. In each period, the lowest-return index underperformed the S&P 500 by just 16, 21 and 27 basis points, respectively. The researchers concluded that, “Yes, you can divest from oil, or anything else, without much consequence.” However, they looked at just three overlapping periods and used data for the narrow S&P 500 and (pre-1957) the ultra-narrow S&P 90.

Large sector exclusions: To dig deeper we replicated the GMO research using the 12 Fama-French industry indexes for the USA. Although similar to the GICS series used by GMO, the Fama-French indexes span the total US market from 1926 to 2019. The number of companies exceeds 500 in 1926, peaks at 7,275 in 1997, and settles at 3,412 by the end of 2019. We estimate 13 monthly return series: one for the market, and 12 for the market excluding, in turn, each sector. Over the entire 93½-year period from July 1926 to end-2019, the annualized market return was 10.09%, while excluding each of the 12 sectors in turn resulted in annualized returns in the range 10.03%–10.31%. We also examined the impact of sector exclusions on the Sharpe ratio (left-hand axis) which was 0.38 for the entire market, while for the market excluding individual sectors it was in the narrow band 0.36–0.39. Similarly, we examined the annualized standard deviations (right-hand axis) which was 18.3% for the entire market, while for the market excluding individual sectors it was in the narrow band 17.8%–18.8%. These results are displayed in **Figure 3**.

Figure 3: Impact of divesting sectors from the US market on volatility and Sharpe ratios, 1926–2019



Source: Ken French industry data; analysis by Elroy Dimson Paul Marsh and Mike Staunton. Not to be reproduced without express written permission from the authors.

We also examined Sharpe ratios for 1,003 rolling (and hence overlapping) 120-month sub-periods during 1936–2019. Out of the 12,036 ratios, sector exclusion had a marked impact on a few dates (see the full Yearbook). Ex-energy or ex-financial Sharpe ratios deviated from the market by up to ± 0.10 . Sector exclusion lowered the Sharpe ratio 55% of the time, although the mean decline in the ratio was only 0.0005. To summarize, there can be brief sub-periods where excluding entire, large sectors – such as big oil – can impact risk-adjusted returns. However, performance is almost as often improved as diminished, and the long-run impact of exclusion is modest.

ESG ratings

Rating services are the backbone of responsible investing. If investors are simply excluding sin stocks or sectors, they may require little more than industry codes. But for more sophisticated screening, and particularly for ESG integration, they need detailed stock-level information. Organizations providing ESG rankings include major index companies such as MSCI and FTSE Russell; standalone providers, some offering a full-range service, such as Sustainalytics, and others focusing on specialist niches such as emissions; rating agencies, such as Moody's and S&P (who are also index providers); and financial data companies, such as Refinitiv, Morningstar and FactSet.

An important issue is the extent to which different raters agree. Evaluations that purport to measure the same variable should generate positively correlated scores. Different raters may, of course, be measuring alternative aspects of ESG

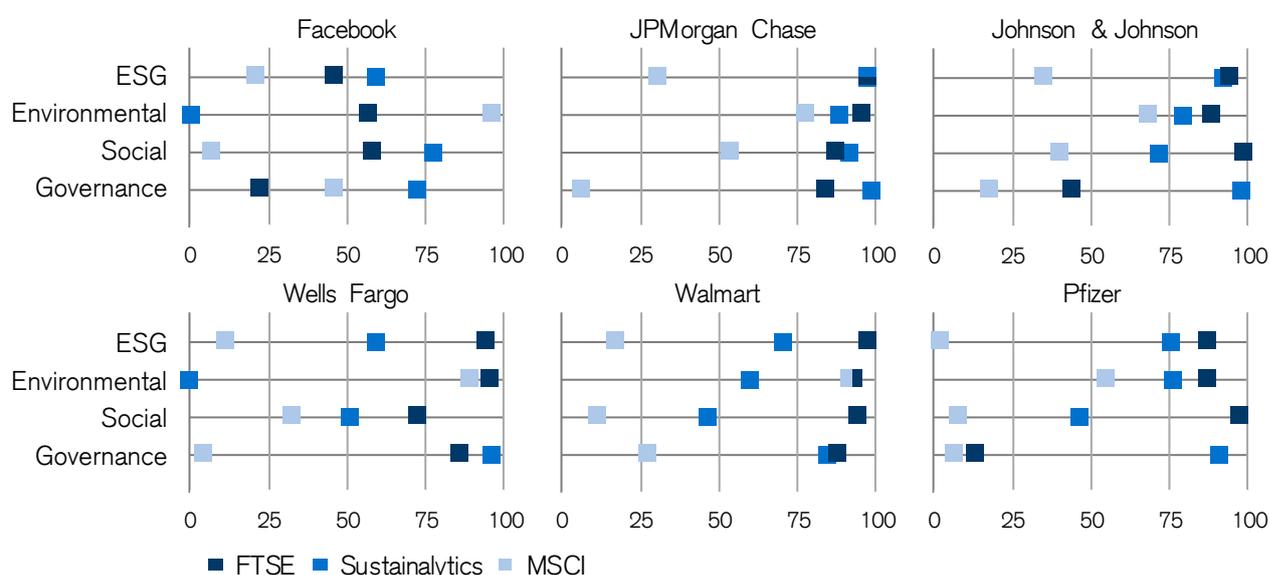
behavior. To illustrate, we would not necessarily expect a high correlation between rankings of the Top Twenty universities, if one rater were measuring research, another teaching, and a third sporting success. Similarly, rating agencies may focus on different dimensions.

One of the most cited examples recently has been America's most valuable automobile company – Tesla. MSCI ranks it at the top of the car industry for sustainability, whereas FTSE ranks it as the worst car producer globally; Sustainalytics puts it in the middle. The discrepancy reflects the fact that MSCI judges Tesla to be almost perfect on carbon emissions because of its clean technology, while FTSE, which evaluates factory emissions, regards the firm as a serious offender.

To emphasize the differences, we examine the ESG ratings provided by three providers (FTSE Russell, Sustainalytics, and MSCI) for some large, well-known companies: Facebook, JP Morgan Chase, Johnson & Johnson, Wells Fargo, Walmart and Pfizer. We focus on each company's current ratings for the E, S and G pillars taken separately, as well the overall ESG score. The divergences across raters can be quite stark.

We show the ratings pictorially in **Figure 4**. Consider Facebook. On the environmental pillar, Sustainalytics awards a very low ranking (1st percentile) while MSCI applauds it (96th percentile); on the social pillar the rankings are reversed, and MSCI gives Facebook a low score (7th percentile) while Sustainalytics ranks it high (78th percentile). On the governance pillar, MSCI ranks three companies (JP Morgan Chase, Wells Fargo and Pfizer) as being extremely poor (4th–7th

Figure 4: Divergence in ratings across large, US companies



Source: Data from MSCI, FTSE Russell and Sustainalytics; computations and analysis by Dimson, Marsh and Staunton. Not to be reproduced without express written permission from the authors.

percentiles) while Sustainalytics is the opposite (87th–99th percentiles). Even the overall ESG ratings can be strikingly different: MSCI rates Wells Fargo as poor (12th percentile), while FTSE rates the company highly (94th percentile).

Divergent ratings

One might expect that the frequent ownership changes of leading raters, coupled with fierce competition, would lead to convergence in ratings. However, although the mainstream rating agencies are regarded by many users as potential substitutes, they have a remarkably low level of agreement. **Figure 5** shows a scatter plot of the overall ratings for 878 US companies from two leading raters. There is a barely perceptible relationship, and the overarching impression is one of substantial disagreement.

To quantify this, **Figure 6** shows the pairwise correlations between the different raters for their environmental, social, governance, and overall ESG scores. These correlations are extremely low. In general, there is greater agreement between Sustainalytics and FTSE (mid-blue bars) than between the other pairs of raters (dark- and light-blue bars, respectively). Most striking is the exceptionally low correlations for governance. As one would expect, the aggregate ESG ratings show more agreement than is demonstrated on the component parts. However, the average of the pairwise correlations is still a very low figure of just 0.45. Our findings are confirmed by other researchers such as Berg et al. (2019), LaBella et al. (2019), and many others.

Explaining inconsistencies

In a recent survey, Kotsantonis and Serafeim (2019) highlight four factors that give rise to inconsistencies across ESG rating services. They are (1) data discrepancies, (2) benchmark choice, (3) data imputation, and (4) information overload. Considering them in turn, first, there is the variety and inconsistency of the metrics that purport to measure much the same thing. The diversity of measures gives rise to considerable dissimilarity in ratings reflecting firm-specific attributes, differing terminologies, metrics and units of measurement. Second, there are differences in how raters define the benchmark for comparisons. For example, Sustainalytics compares companies to constituents of a broad market index, whereas S&P compares companies to industry peers.

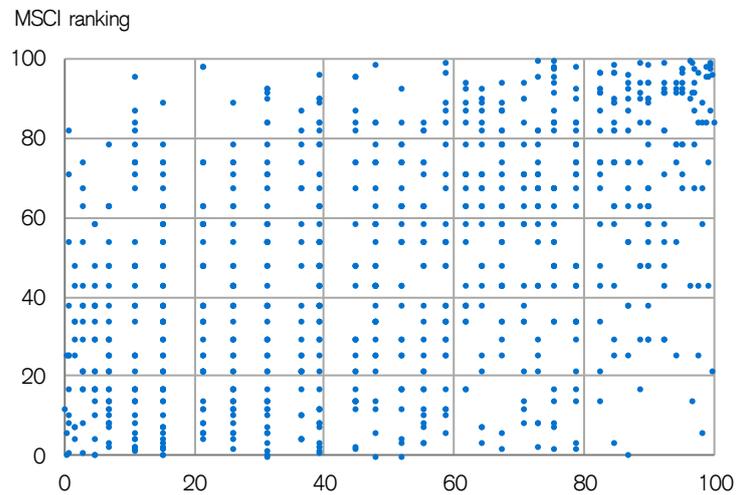
Third, at the company level, ESG ratings are plagued by missing data. When a company does not reveal metrics, some ESG raters assume the worst and (rather harshly) assign a score of zero. Others impute (somewhat generously) a score that reflects peers that do report the data. More sophisticated approaches use statistical models to estimate missing metrics,

but are often unclear about why a company gets a low or high rating. Fourth, reflecting the never-ending expansion in the volume of public information and the lack of consensus on metrics, there is greater scope for raters to disagree about the scores for particular companies. Christensen et al. (2019) provide additional insights on rater disagreement.

ESG screening

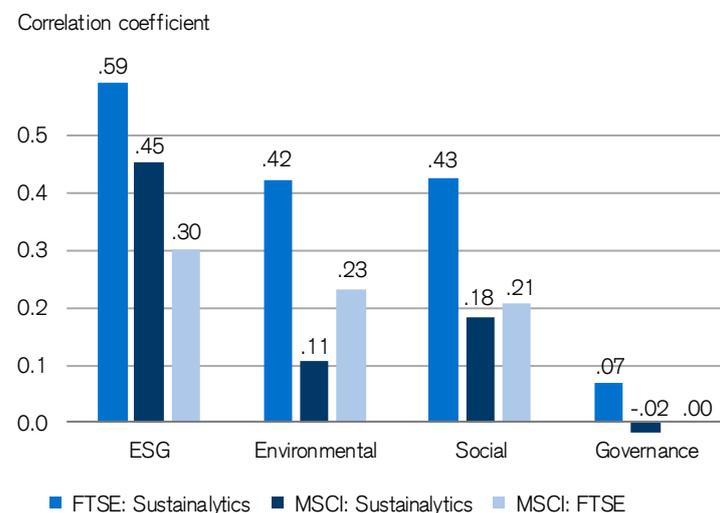
An understanding of ESG rankings and how and why they differ is important given their increasing usage, which extends well beyond negative screening. Indeed, there is a school of thought that positively slanting a portfolio toward responsible companies – positive screening – may be rewarded by better investment performance.

Figure 5: MSCI vs. Sustainalytics rankings at start-2019



Data: Overall ESG ratings from MSCI and Sustainalytics for 878 US companies
Source: MSCI and Sustainalytics; analysis by Dimson, Marsh and Staunton. Not to be reproduced without express written permission from the authors.

Figure 6: Correlations between ratings



Source: Data from MSCI, FTSE Russell and Sustainalytics; computations and analysis by Dimson, Marsh and Staunton. Not to be reproduced without express written permission from the authors.

Box 2: Rewards for saintliness or sinfulness

Claims for an ESG premium

WSJ: "Rather than a mere window-dressing exercise conducted for the benefit of conscientious investors, investing with the environment in mind is now seen as a way to gain an edge. Funds are pouring billions of dollars into technologies and industries they think will benefit from a transition to a clean-energy world."

FT: "For companies, ESG integration can provide a competitive edge, especially if rivals take a box-ticking approach to implementation. For investors, it can help them to beat the market through a discerning investment strategy — selecting companies that implement ESG well and avoiding ones that either "green-wash"... or invest in inconsequential practices."

WSJ: "Climate change is the growth story of our lifetime. We're not ideologically driven ... We want to make money. Climate investing is essentially a bet on a major repricing in markets"

FT: "I strongly believe that we can make good returns for clients while investing in companies that are doing well on... ESG criteria"

WSJ: "It's no longer about avoiding the bad. It's about positively affirming the good and knowing that in doing so your financial returns will improve."

Claims for a sin-stock premium

WSJ: "It is not a good idea to screen out opportunities just because those companies are seen as sinners, since some of these companies are not just open to change but are already taking steps to improve."

FT: "The sin stock ETF market is still in its infancy, though there is evidence to show that embracing contentious investments can pay off."

WSJ: "Sin stocks — alcohol, tobacco or gambling companies, for instance — outperform the market over time. That's presumably because investors' distaste creates a discount, causing those stocks to sell too cheaply in the short run and enabling them to outperform in the long run."

FT: "A battle is brewing at CalPERS, the USD 375 billion California state employees' pension fund, over this topic. Since divesting from tobacco stocks in 2001, CalPERS has lost out on approximately USD 3.6 billion."

WSJ: "Guns and coal are being split out of companies: One explanation is that they are reviled for ethical reasons, in which case some investors are selling good businesses on the cheap. Those who don't care about or agree with the ethics can pick them up for less than they're worth."

Sources: FT = Financial Times; WSJ = Wall Street Journal

Rankings also have a central role in ESG integration, which involves the systematic, explicit incorporation of ESG factors into investment analysis and portfolio selection.

Can screening — positive as well as negative — lead to higher risk-adjusted returns? The large and expanding body of research on ESG is often inconclusive, with findings sensitive to the choice of time frame and methodology. The data can be poor and may span just one or two decades — sometimes less. Compelling evidence extending over a sufficiently long period is in short supply. It should be no surprise that there are conflicting claims about the financial rewards from ESG investing. In **Box 2**, we show some of the claims that have appeared in the reputable media for the profitability of investing in companies or sectors whose ESG rating is high (upper panel of the Box) or low (bottom panel). Some commentators claim that "good" companies will generate an ESG premium, while other commentators see opportunities among companies whose share prices have become depressed.

Evidence on financial performance

In a meta-analysis of 251 studies, Margolis, Elfenbein and Walsh (2009) find a positive but small effect of corporate social responsibility (CSR) on corporate financial performance. The average correlation was 0.13, but this fell to 0.09 for studies over the (then) most recent decade. There have been several other meta-studies, and even a meta-study of meta-studies by Friede, Busch and Bassen (2015), which summarized 2,200 individual ESG studies. More recent work includes Busch and Lewandowski (2018), Eccles et al. (2018), Giese and Le (2019) and others.

In contrast to, say, pharmaceutical studies, these meta-studies give the same weight to poor quality, unpublished papers as to high-quality refereed articles in top journals (the latter being in a small minority). They lump together accounting and market-based performance measures, although the latter generally reveal smaller effects. Where market-based measures are used, they are seldom appropriately adjusted. Two-thirds of studies suffer from look-ahead bias by comparing coincident measures of CSR and financial performance.

At best, the studies indicate a correlation between CSR and corporate financial performance, with no indication of causality. We cannot say whether firms that do good do well, or whether firms that do well do good. Nor can we say whether a correlation comes from some unidentified variable that impacts both ratings and financials. These studies are also weakened by the assumption that responsible behavior is well measured by "E" and "S" scores.

Does CSR pay?

Rather than looking at correlations, Krüger (2015) identifies 2,116 CSR events from 2001–07 for 745 US companies from the KLD (now MSCI) database. He examines abnormal performance around the day the events become public. **Figure 7** shows that negative events have a damaging impact on stock value. This suggests a substantial cost to corporate social irresponsibility. For positive events, investors react slightly negatively, but the reaction is much weaker. Analysis of the positive events reveals that investors respond negatively when there are greater agency problems, and positively when the firm is seeking to remedy an earlier unfavorable event. Events with stronger legal or economic implications generate larger abnormal returns.

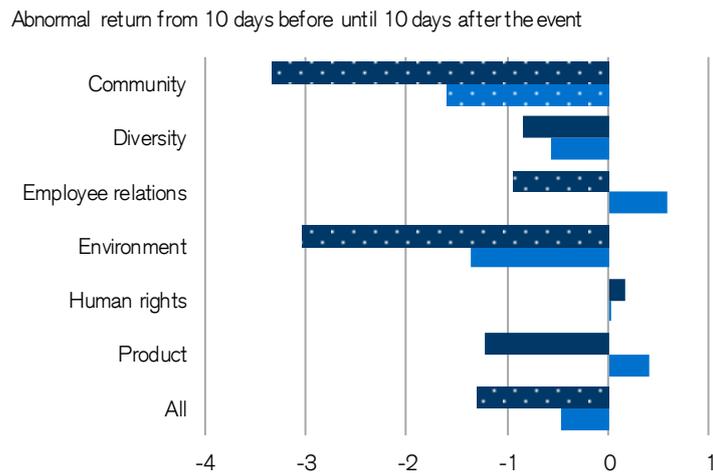
Other studies find that CSR information is impounded into stock prices with increasing speed. Halbritter and Dorfleitner (2015), using three rating providers and a sample period from 1990 to 2012, found that for all three raters the outperformance of a highly-rated over a lowly-rated portfolio was large and positive from 1990 to 2001, about half the size from 2002 to 2006, and completely absent from 2007 to 2012. This pattern resembles the findings for corporate governance. Investors learn over time, and markets become more efficient at discounting E&S information. The implications of ESG ratings may now be fully reflected in stock prices.

Climate change and the environment

Climate change is the key environmental issue within ESG. There is consensus that this is a global challenge – perhaps the greatest mankind faces. It is now a central concern of investors, and climate-risk analysis is now part of the mainstream of asset management. The threat is clear, and this provides investors with an opening to exert influence for good. It may also offer investment opportunities. Possibilities that are regularly suggested include avoiding likely “stranded assets,” investing in alternative energy, and focusing on low-carbon investments.

The 2015 Paris Agreement set out an international framework to limit global warming to below 2°C and ideally below 1.5°C. If this target is to be achieved, most of the world’s existing fossil fuel reserves will have to remain in the ground. According to McGlade and Ekins (2015), about a third of worldwide oil reserves, a half of gas reserves, and over three quarters of coal reserves would remain unused, as abandoned “stranded assets.” Not only would reserves be left behind, but committed extraction and processing resources, past and future, would be unneeded.

Figure 7: Market reaction to CSR events



Source: Krüger (2015)

If investors fail to recognize this, stranded assets may indeed impose losses. However, investors who were unaware of climate risk early in the 21st century have now had plentiful opportunities to impound this risk into current market prices. It follows that, as well as downside risk, stranded assets may provide upside potential to investors. Consequently, avoidance of potentially stranded assets could be financially costly.

Carbon premium

Investors today want access to information on the carbon exposure of their investee companies. This is essential if they are to exert influence. It is much less clear, however, whether this information is linked to investment performance. The simple question “is there a green factor premium (a reward for sustainable investing) or a carbon factor premium (a reward for tolerating environmental damage)?” has defied resolution.

Recent academic studies disagree on the effects that a firm’s carbon emissions have on its stock performance, despite using the same data. These studies suffer from methodological issues and are restricted to the short time interval dictated by emissions data availability. In a careful appraisal of conflicting empirical evidence, Lioui (2019) argues that we are still in the dark as to the existence of any carbon anomaly or pricing factor and that “we are very far from having convincing evidence.”

ESG fund performance

A direct way to investigate whether there is a cost or benefit to ESG investing is to examine the performance of ESG funds. Nitsche and Schröder (2018) examined 186 European and global ESG funds, matching their holdings to three ESG rating services. They found that the funds were not “closet” conventional funds, but, on average, exhibited a significantly higher ESG

score. However, there was almost a one-in-three chance that a randomly selected ESG fund would have a lower ESG rating than a randomly selected conventional fund.

Studies of sustainable fund performance date back to the 1970s and at the time mostly focused on exclusions. Earlier work typically concluded that there was little performance difference between ESG and conventional funds. However, they mostly looked at small samples, short time periods, specific countries and performance measures that failed to adjust for factor exposure. One of the first comprehensive studies, by Renneboog et al. (2008), examined 440 ESG funds in 17 countries, comparing them with 16,000 conventional funds. The ESG funds in the UK, USA and in many European and Asia-Pacific countries underperformed their domestic benchmarks by 2.2%– 6.5%. Nevertheless, compared with conventional funds, the underperformance was not statistically significant.

While most studies simply compare ESG with conventional funds, El Ghoul and Karoui (2017, 2019) adopted a novel approach. They selected a sample of 2,168 US equity funds without regard to whether they claimed to be ESG funds or not. They then constructed an asset-weighted composite CSR score for each fund and found that higher scoring funds had poorer and more persistently poor performance than their lower-scoring counterparts. In their later paper, they examine how closely funds track an ESG index. Somewhat in contrast to their earlier work, they find that, for a sample of 2,516 US mutual funds over the period 2010–2017, their “results are consistent with the hypothesis that SRI does not significantly damage fund performance.”

To sum up, despite the extensive literature with its varying findings, we find almost no convincing studies showing that ESG funds outperform on a sustained basis. Most studies find neutral to mildly negative relative performance by ESG funds. In Box 2 above, we cited claims that ESG investing leads to superior performance and/or lower risk. The ESG fund performance literature would struggle to support this. However, the balance of evidence suggests that the price that ESG investors pay for their principles is probably quite modest.

ESG index performance

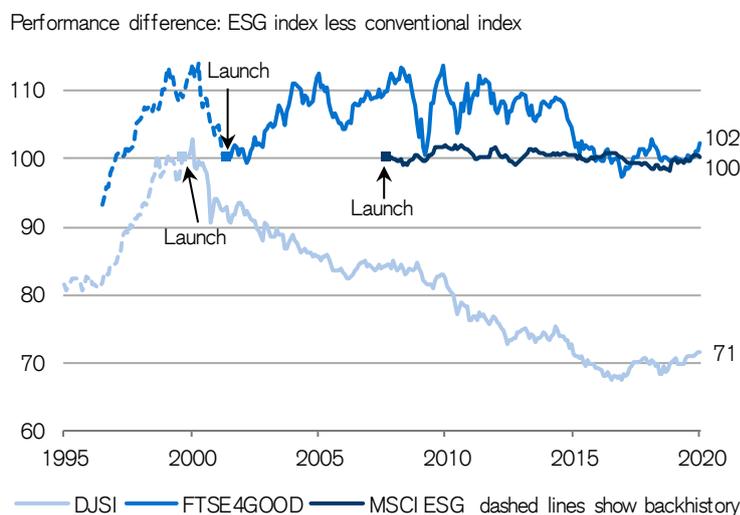
Several studies have examined the performance of ESG indexes, rather than funds. This has its attractions: the indexes are used as benchmarks by ESG investors; they apply the same types of screening, both negative and positive, as most funds; and performance is not distorted by costs, fees, timing or stock selection. However, ESG indexes vary in their construction rules and in how they deal with regional coverage and biases in ESG data connected to company size.

Schröder (2007) examined 29 ESG equity indexes from 11 suppliers and compared their performance with the closest available conventional indexes. He found neutral relative performance, although most of the indexes had a higher risk than their benchmarks. He also found clear evidence of look-back bias: in every case where the index history incorporated a pre-launch backhistory, performance over the back-history exceeded that over the post-launch period.

To provide an update to Schröder’s classic work, we examine the flagship global ESG indexes of three major index providers: the MSCI World ESG Leaders, FTSE Russell’s FTSE4GOOD and S&P’s Dow Jones Sustainability World index (DJSI). Using similar approaches, MSCI and FTSE Russell both exclude sin stocks and then select on ESG scores to target the highest-rated 50% free-float market capitalization of each sector of the parent index (the MSCI World and the FTSE Developed Markets index). DJSI adopts a rules-based selection of the top 10% by number of the most sustainable companies in the S&P Global BMI index, based on ratings from SAM (now owned by S&P).

While recognizing the differing index construction methodologies and related impacts, we compare each index to its conventional counterpart and plot the difference in cumulative performance. We do this from the launch date to end-2019. The plot is shown in **Figure 8**. After going live, both the FTSE4GOOD and MSCI ESG indexes experienced neutral relative performance (see the solid line plots). In contrast, since its August 1999 launch, the DJSI has underperformed the S&P Global BMI by 29%, equivalent to 1.6% per year.

Figure 8: Performance of Global ESG indexes (in USD)



Source: Data from MSCI, FTSE Russell and Dow Jones via Refinitiv Datastream; computations and analysis by Dimson, Marsh and Staunton. Not to be reproduced without express written permission from the authors.

Both the DJSI and the FTSE4GOOD have pre-launch back-histories (see dashed lines plot). Consistent with Schröder's finding, these indexes outperformed over the period from the start of the back-history until the launch date. Schröder claims that the back-histories for the indexes he examined were usually calculated retrospectively using the index composition at the launch date, which would virtually guarantee spurious outperformance because of survivorship and success bias. An alternative explanation is that index compilers use pre-launch data to develop a methodology with an attractive (albeit artefactual) performance record.

We find no unequivocal evidence of ESG outperformance. Equally, however, for the MSCI ESG and FTSE4GOOD, the two indexes that most closely approximate to what ESG investors actually do, there was no evidence of underperformance either.

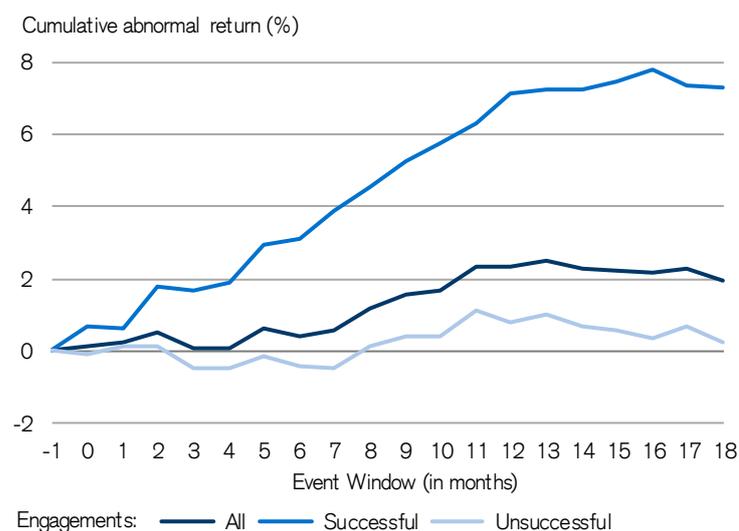
Active ownership

Until a few years ago, there had not been any publications in the top finance journals on investor engagement or responsible investing. The literature had been dominated by research on corporate governance and, to a limited extent, studies of ESG investing such as the mutual fund research described above. The first study on environmental and social engagements was a paper entitled "Active Ownership," authored by Dimson, Karakaş and Li (2015). This examined a proprietary dataset of 2,152 engagement sequences with 613 US public firms between 1999 and 2009. The institutional investor involved actively engaged in dialogue with investee companies and kept a precisely dated record of these engagements.

Compared to a matched sample, firms were more likely to be engaged if they were large, mature, and performing poorly. The likelihood was further increased if the asset manager had a large shareholding, if other socially conscious institutions were shareholders, if there were reputational concerns for the target company, and if it had poor governance. The success rate for engagements was 18% and on average it took a sequence of two to three engagements over one to two years until success could be recorded. Successful prior experience of engagement with the same target firm increased the likelihood of subsequent engagements being successful. In addition, collaboration among the asset manager and other active investors and/or stakeholders contributed positively to the success of engagements.

The stock market's reaction to engagements was measured in terms of investment performance, including reinvested dividends, from the date of initial engagement with the target company. Cumulative abnormal returns were

Figure 9: Cumulative abnormal returns after engagements



Source: Dimson, Karakas and Li (2015). Fama-French size decile returns from Professor French's website. Not to be reproduced without express written permission from the authors.

adjusted for the market and for company size. The performance record is plotted in **Figure 9**. Over the year following initial engagement, the firms experienced an average abnormal return of +2.3%. Unsuccessful engagements – those that failed to achieve the objectives set out prior to engagement – were followed by neutral investment performance. But successful engagements yielded a superior abnormal return of 7.1% after one year. They were also followed by improved performance and governance and increased institutional ownership.

Since publication of the Dimson et al. (2015) article, there have been several papers that analyze other datasets using a similar framework. Hoepner et. al. (2019) find that successful ESG engagements are followed by a reduction in target firms' exposure to downside risk. Several other studies have recorded an uplift after successful engagement.

Coordinated engagement

The Dimson et al. (2015) active ownership paper was the first to demonstrate the value of working cooperatively with other investors. Collaboration was shown to enhance the likelihood of success in engagements. Yet despite its attractions, collaborative engagement also has some downsides. "Free-riding" is a serious concern, where a group that hopes to work cooperatively may include members who shirk their share of the effort.

Achieving agreement among investors from diverse backgrounds may be time consuming and costly. In certain jurisdictions, such as the United States, investors may feel constrained from acting as a concert party. Involvement of a third-party can help mitigate these challenges.

Critical to this process is how investors can engage in active ownership strategies on a cooperative basis. Dimson, Karakas and Li (2020) look at the nature of and outcomes from coordinated engagements by PRI, the leading international network of long-term shareholders who cooperate to influence firms on environmental and social issues.

The authors' dataset is comprehensive and includes all PRI engagement projects initiated between 2007 and 2015. Each project is originated and coordinated by PRI, but is carried out by a group of investment organizations, including investment managers, asset owners, and service providers. A project involves dialogues with numerous targets—on average, with 53 public firms across the globe. Each target in a project may be engaged by a different group of owners, managers and service providers. On average, the group comprises 26 different organizations (two domestic and 24 foreign). The study examines a total of 1,654 engagement sequences targeting 960 unique publicly listed firms located in 63 countries. These engagements involve 224 different investment organizations (87 asset owners, 121 investment managers, and 16 service providers) from 24 countries, representing aggregate assets under management of USD 23 trillion.

Secrets of success

Dimson et al. find that a two-tier engagement strategy, combining lead investors with supporting investors, increases the success rate of an engagement substantially (by 26%–39%, depending on the specification). An investor is more likely to lead the collaborative dialogue when the investor's stake in and exposure to the target firm are higher, and when the target is domestic. Success rates are elevated when lead investors are domestic, and the investor coalition is capable and influential.

A high degree of participation by pension plans is also found to improve the chance of executing a successful collaborative engagement. Furthermore, engagements are more likely to be successful when they involve influential investors with greater assets under management, larger aggregate holdings in the target company, and more satisfied employees. Investors' decisions to engage and lead are shaped by home bias (cultural similarities) and free-riding concerns outside and within a coalition.

Conclusion

There are two key questions. First, can ESG investing enhance returns, or does it involve sacrifice? We find that investment strategies based on exclusions are on average likely to face a small return and diversification sacrifice. The magnitude of this is unlikely to be material: the price for ethical principles appears small, and one that many virtuous investors may be content to bear.

Second, how should investors implement different approaches to ESG investing? One aspect of ESG investing that does appear to offer a financial as well as a non-financial reward is deep engagement with investee companies. When an activist cooperates with other investors, this enhances the success rate for such interventions. Active ownership strategies are on average rewarded with a worthwhile increase in the value of the target company.



Investing for the long term

In this section, we review the financial market history that is the backdrop to our study and describe our long-run global returns database, which now covers the main asset categories in 26 markets over the past 120 years. We summarize the returns on stocks, bonds, bills, inflation and currencies since 1900 and present evidence on the historical equity risk premium and maturity premium. Finally, we estimate the long-term risk premiums earned from factor investing. We guide investors to seek premiums supported by robust evidence and to diversify portfolios across multiple factors.

The Great Transformation

At the beginning of 1900 – the start date of our global returns database – virtually no one had driven a car, made a phone call, used an electric light, heard recorded music, or seen a movie; no one had flown in an aircraft, listened to the radio, watched TV, used a computer, sent an e-mail, or used a smartphone. There were no x-rays, body scans, DNA tests, or transplants, and no one had taken an antibiotic; as a result, many would die young.

Mankind has enjoyed a wave of transformative innovation dating from the Industrial Revolution, continuing through the Golden Age of Invention in the late 19th century, and extending into today's information revolution. This has given rise to entire new industries: electricity and power generation, automobiles, aerospace, airlines, telecommunications, oil and gas, pharmaceuticals and biotechnology, computers, information technology, and media and entertainment. Meanwhile, makers of horse-drawn carriages and wagons, canal boats, steam locomotives, candles, and matches have seen their industries decline. There have been profound changes in what is produced, how it is made, and the way in which people live and work.

Figure 10 shows the relative sizes of world equity markets at our starting date of end-1899 (left panel), and how they had changed by the start of 2020 (right panel). The right panel shows that the US market dominates its closest rival and today accounts for over 54% of total world equity market value. Japan (7.7%) is in second place, ahead of the UK (5.1%) in third place, and China (4.0%) in fourth position. France, Germany, Canada and Switzerland each represent around 3% of the global market. Australia occupies ninth position with 2.2%.

In the right panel, nine of the Yearbook countries – all of those accounting for 2% or more of world market capitalization – are shown separately, with 14 smaller markets grouped together as “Smaller Yearbook.” The remaining area of the right-hand pie chart labelled “Not in Yearbook” represents countries comprising 8.9% of world capitalization, for which our data does not go all the way back to 1900. Mostly, they are emerging markets. Note that the right-hand panel of the pie-chart is based on the free-float market capitalizations of the countries in the FTSE All-World index, which spans the investable universe for a global investor. Emerging markets represent a higher proportion of the world total when measured using full-float weights, when investability criteria are relaxed, or if indexes are GDP-weighted (see the 2019 Yearbook).

The left panel shows the equivalent breakdown at the end of 1899 – the base date of the DMS database. The chart shows that, at the beginning of the 20th century, the UK equity market was the largest in the world, accounting for a quarter of world capitalization, and dominating even the US market (15%). Germany (13%) ranked in third place, followed by France, Russia, and Austria-Hungary. Countries that are not in our 1900–2019 dataset are again labelled “Not in Yearbook.” In total, the DMS database covered over 98% of the global equity market at the start of our period in 1900. By the end of 2019, our 23 countries still represented over 91% of the investable universe. Of course, while an investment in some countries proved fortunate, investment in others brought financial disaster or dreadful returns.

If unsuccessful or non-surviving countries are omitted, there is a danger of overstating worldwide equity returns. In 2013, we therefore added Russia and China to our database – the two best known cases of markets that failed to survive. China was a small market in 1900 and even in 1949, but Russia accounted for some 6% of world market capitalization at end-1899. Similarly, we also added Austria-Hungary, which had a 5% weighting in the end-1899 world index. While Austria-Hungary was not a total investment disaster, it was the worst-performing equity market and the second worst-performing bond market of our 21 countries with continuous investment histories. Adding Austria, China, and Russia to our database and the world index was important in eliminating non-survivorship and “unsuccess” bias. In 2014, we added another “unsuccessful” market, Portugal, to our dataset.

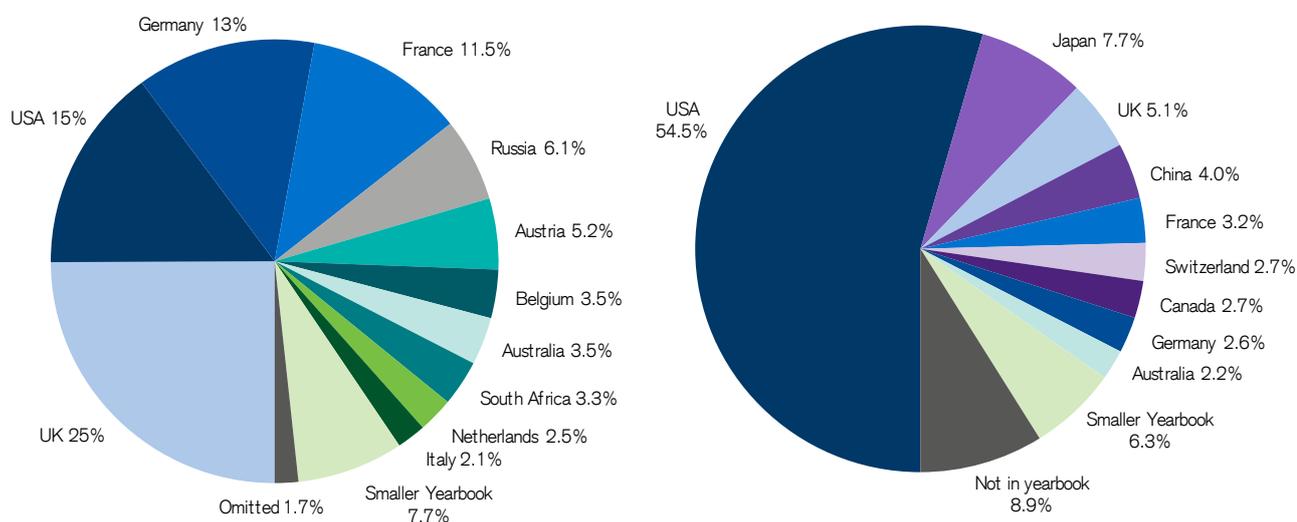
New industries

The changing country composition of the global equity market has been accompanied by evolution in the industrial composition of the market. **Figure 11** shows the composition of listed companies in the USA and the UK. The upper two charts show the position at start-1900, while the lower two show start-2020. Markets at the start of the 20th century were dominated by railroads, which accounted for 63% of US stock market value and almost 50% of UK value. Over a century later, railroads declined almost to the point of stock market extinction, representing under 1% of the US market and close to zero in the UK.

Of the US firms listed in 1900, over 80% of their value was in industries that are today small or extinct; the UK figure is 65%. Beside railroads, other industries that have declined precipitously are textiles, iron, coal, and steel. These industries have moved to lower-cost locations in the emerging world. Yet there are also similarities between 1900 and 2020. The banking and insurance sectors continue to be important. Industries such as food, beverages (including alcohol), tobacco, and utilities were present in 1900 and survive today. And, in the UK, quoted mining companies were important in 1900 just as they are in London today.

Even industries that initially seem similar have often altered radically. For example, compare telegraphy in 1900 with smartphones in 2020. Both were high-tech at the time. Or contrast other transport in 1900 – shipping lines, trams, and docks – with their modern counterparts, airlines, buses, and trucking. Similarly, within industrials, the 1900 list of companies includes the world’s then-largest candle maker and the world’s largest manufacturer of matches.

Figure 10: Relative sizes of world stock markets, end-1899 (left) versus start-2020 (right)



Source: MSCI, FTSE Russell, S&P, Elroy Dimson, Paul Marsh, and Mike Staunton. Not to be reproduced without express written permission from the authors.

Another aspect that stands out in the pie-charts is the high proportion of today's companies that come from industries that were small or non-existent in 1900, 63% by value for the USA and 44% for the UK. The largest industries in 2020 are technology (in the USA, but not the UK), oil and gas, banking, healthcare, the catch-all group of other industrials, mining (for the UK, but not the USA), telecommunications, insurance, and retail. Of these, oil and gas, technology, and healthcare (including pharmaceuticals and biotechnology) were almost totally absent in 1900. Telecoms and media, at least as we know them now, are also new industries.

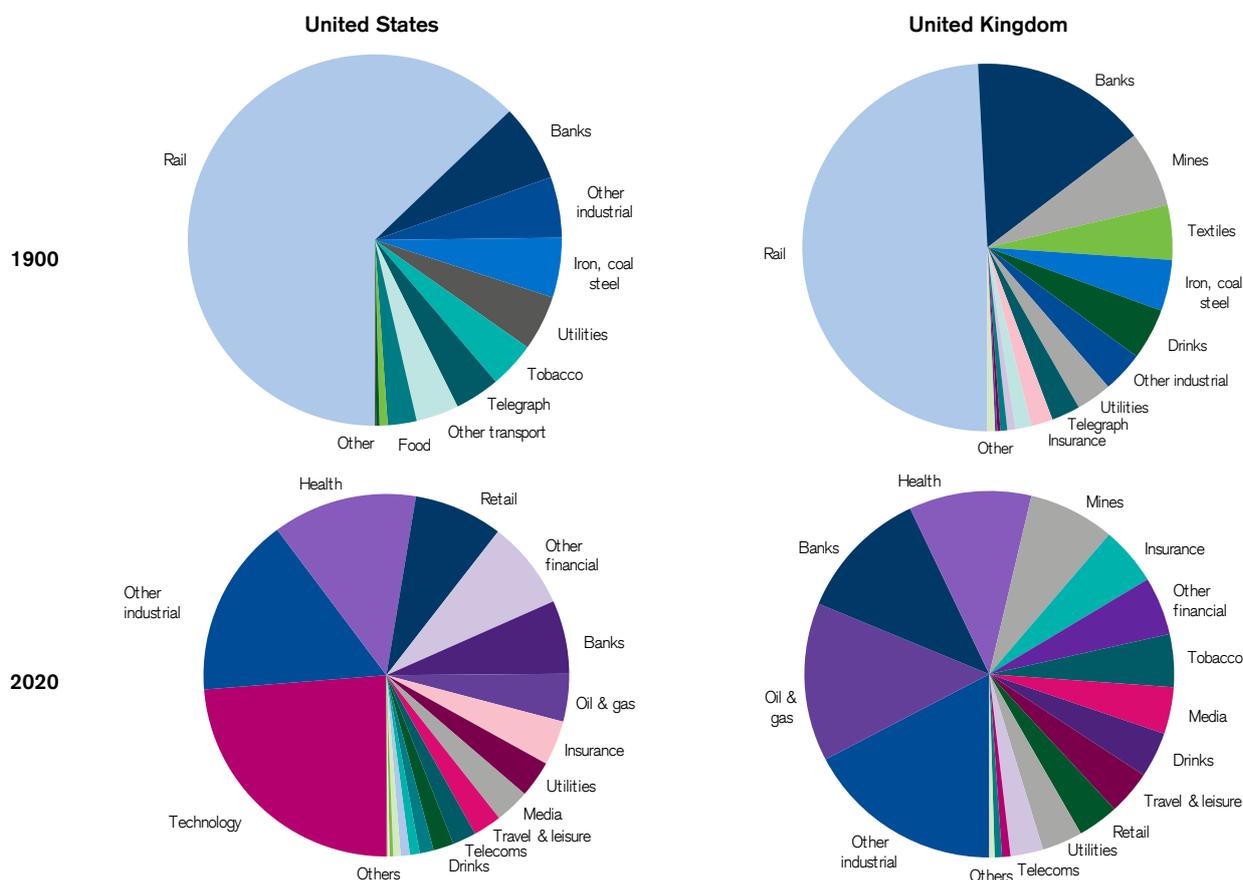
Our analysis relates to exchange-listed businesses. Some industries existed throughout the period, but were not always listed. For example, there were many retailers in 1900, but apart from the major department stores, these were often small, local outlets rather than national and global retail chains like Walmart or Tesco, or online global giant, Amazon. Similarly, in 1900, more manufacturing firms were family owned and unlisted. In the UK and other countries, nationalization has also caused entire industries – railroads, utilities, telecoms, steel, airlines, and airports – to be delisted, often to be re-privatized later. We included listed railroads, for example,

while omitting highways that remain largely state-owned. The evolving composition of the corporate sector highlights the importance of avoiding survivorship bias within a stock market index, as well as across indexes (see Dimson, Marsh and Staunton, 2002).

In the 2015 Yearbook, we asked whether investors should focus on new industries – the emerging industries – and shun the old, declining sectors. We showed that both new and old industries can reward as well as disappoint. It depends on whether stock prices correctly embed expectations. For example, we noted that, in stock market terms, railroads were the ultimate declining industry in the USA in the period since 1900. Yet, over the last 120 years, railroad stocks beat the US market, and outperformed both trucking stocks and airlines since these industries emerged in the 1920s and 1930s.

Indeed, the research in the 2015 Yearbook indicated that, if anything, investors may have placed too high an initial value on new technologies, overvaluing the new, and undervaluing the old. We showed that an industry value rotation strategy helped lean against this tendency and had generated superior returns.

Figure 11: Industry weightings in the USA (left) and UK (right), 1900 compared with 2020



Sources: Elroy Dimson, Paul Marsh and Mike Staunton, *Triumph of the Optimists*, Princeton University Press, 2002, and *Global Investment Returns Yearbook*, Credit Suisse, 2020; FTSE Russell All-World Index Series Monthly Review, December 2019. Not to be reproduced without express written permission from the authors.

Long-run asset returns

The left- panel of **Figure 12** shows the cumulative total return from stocks, bonds, bills, and inflation from 1900 to 2019 in the world's leading capital market, the United States. Equities performed best. An initial investment of USD 1 grew to USD 58,191 in nominal terms by end-2019. Long bonds and Treasury bills gave lower returns, although they beat inflation. Their respective index levels at the end of 2019 are USD 327 and USD 77, with the inflation index ending at USD 30. The chart legend shows the annualized returns. Equities returned 9.6% per year versus 4.9% on bonds, 3.7% on bills, and inflation of 2.9% per year.

Since US prices rose 30-fold over this period, it is more helpful to compare returns in real terms. The right side of the chart shows the real returns on US equities, bonds, and bills. Over the 120 years, an initial investment of USD 1, with dividends reinvested, would have grown in purchasing power by 1,937 times. The corresponding multiples for bonds and bills are 10.9 and 2.6 times the initial investment, respectively. As the legend to the chart shows, these terminal wealth figures correspond to annualized real returns of 6.5% on equities, 2.0% on bonds, and 0.8% on bills.

It is clear that US equities totally dominated bonds and bills. There were severe setbacks of course, most notably during World War I; the Wall Street Crash and its aftermath, including the Great Depression; the OPEC oil shock of the 1970s after the 1973 October War in the Middle East; and the two bear markets in the first decade of the 21st century. Each shock was severe at the time. At the depths of the

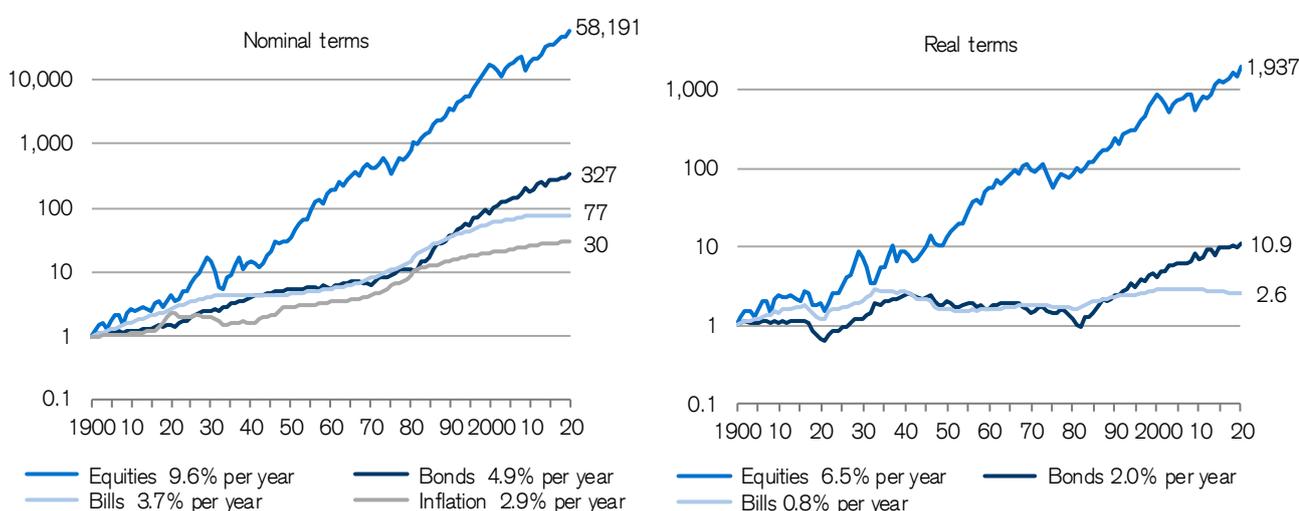
Wall Street Crash, US equities had fallen by 80% in real terms. Many investors were ruined, especially those who bought stocks with borrowed money. The crash lived on in the memories of investors for at least a generation, and many subsequently chose to shun equities.

The chart sets the Wall Street Crash in its long-run context by showing that equities eventually recovered and gained new highs. Other dramatic episodes, such as the October 1987 crash hardly register while the bursting of the technology bubble in 2000 and the financial crisis of 2009 certainly register, but are placed in context. Besides revealing impressive long-run equity returns, the graph thus helps to set the bear markets of the past in perspective. Events that were traumatic at the time now just appear as setbacks within a longer-term secular rise.

We should be cautious about generalizing from the USA, which, over the 20th century, rapidly emerged as the world's foremost political, military, and economic power. By focusing on the world's most successful economy, investors could gain a misleading impression of equity returns elsewhere, or of future equity returns for the USA itself. For a more complete view, we also need to look at investment returns in other countries.

Fortunately, the DMS data allow us to examine asset-class comparisons for every Yearbook market. The 120-year real equity return was positive in every location, typically at a level of 3% to 6% per year, and equities were the best-performing asset class everywhere.

Figure 12: Cumulative returns on US asset classes in nominal terms (left) and real terms (right), 1900–2019



Sources: Elroy Dimson, Paul Marsh and Mike Staunton, *Triumph of the Optimists*, Princeton University Press, 2002, and *Global Investment Returns Yearbook*, Credit Suisse, 2020. Not to be reproduced without express written permission from the authors.

Long-term stock and bond returns

Statistics on real equity returns from 1900–2019 are provided for selected markets in the upper panel of **Table 1**. The geometric means in the second column show the 120-year annualized returns achieved by investors. The arithmetic means in the third column show the average of the 120 annual returns for each country/region.

The arithmetic mean of a sequence of different returns is always larger than the geometric mean. For example, if stocks double one year (+100%) and halve the next (–50%), the investor is back where he/she started, and the annualized, or geometric mean, return is zero. However, the arithmetic mean is one-half of +100 – 50, which is +25%. The more volatile the sequence of returns, the greater will be the amount by which the arithmetic mean exceeds the geometric mean. This is verified by the fifth column of the table which shows the standard deviation of each equity market's returns.

The USA's standard deviation of 19.9% places it among the lower risk markets, ranking sixth after Canada (16.9%), Australia (17.5%), New Zealand (19.2%), Switzerland (19.4%), and the UK (19.6%). (Detailed statistics are available in the Yearbook.) The World index has a standard deviation of just 17.4%, showing the risk reduction obtained from international diversification.

Turning to the lower panel of the table, the 120 years from 1900–2019 were not especially kind to investors in government bonds. Across the 21 countries, the average annualized real return was 1.0% (1.2% excluding Austria's very low figure). While this exceeds the average return on cash by 1.3%, bonds had much higher risk. As

already noted, real bond returns were negative in five countries. German bonds performed worst, and their volatility was truly grim.

In the UK, the annualized real bond return was 1.9%, while US bondholders did a little better with a real return of 2.0% per year. These findings suggest that, over the full 120-year period, real bond returns in many countries were below investors' prior expectations, with the largest differences occurring in the highest-inflation countries.

Particularly in the first half of the 20th century, several countries experienced extreme and disappointingly low returns arising from the ravages of war and extreme inflation. This was followed by a degree of reversal, with the countries experiencing the lowest returns in the first half of the 20th century being among the best performers thereafter.

As reported in the full Yearbook, over the entire period, Sweden was the best-performing country in terms of real bond returns, with an annualized return of 2.7%, followed by Switzerland, New Zealand and Canada with annualized returns of 2.4%, 2.3% and 2.2%, respectively. New Zealand bonds had the lowest variability of 8.9%.

The average standard deviation of real bond returns was 12.9% versus 23.3% for equities and 7.6% for bills (these averages exclude Austria). US real equity returns had a standard deviation of 19.9% versus 10.3% for bonds and 4.6% for bills. Clearly stocks are the riskiest asset class, and we saw above that they have beaten bonds in every country. Similarly, bonds, which are less risky than equities, but riskier than bills, have beaten bills in every country, except Portugal.

Table 1: Real (inflation-adjusted) equity and bond returns in selected markets, 1900–2019

Country	Geometric mean (%)	Arithmetic mean (%)	Standard error (%)	Standard deviation (%)	Minimum return (%)	Minimum year	Maximum return (%)	Maximum year
Real equity returns								
Europe	4.3	6.1	1.8	19.7	–47.5	2008	75.2	1933
Japan	4.2	8.7	2.7	29.2	–85.5	1946	121.1	1952
Switzerland	4.6	6.4	1.8	19.4	–37.8	1974	59.4	1922
United Kingdom	5.5	7.3	1.8	19.6	–56.6	1974	99.3	1975
United States	6.5	8.5	1.8	19.9	–38.6	1931	55.8	1933
World	5.2	6.6	1.6	17.4	–41.5	2008	67.6	1933
Real bond returns								
Europe	1.3	2.5	1.4	15.8	–52.6	1919	72.2	1933
Japan	–0.8	1.7	1.8	19.4	–77.5	1946	69.8	1954
Switzerland	2.4	2.7	0.8	9.3	–21.4	1918	56.1	1922
United Kingdom	1.9	2.7	1.2	13.5	–29.9	1974	59.4	1921
United States	2.0	2.5	0.9	10.3	–18.1	1917	35.2	1982
World	2.0	2.5	1.0	10.9	–31.6	1919	46.0	1933

Note: Europe and World indexes are in common currency (USD). Sources: Elroy Dimson, Paul Marsh and Mike Staunton, *Triumph of the Optimists*, Princeton University Press, 2002, and *Global Investment Returns Yearbook*, Credit Suisse, 2020. Not to be reproduced without express written permission from the authors.

Real returns in local or US currency

To convert the currency of nominal returns, we use changes in the nominal exchange rate. Investors, however, focus on real returns in their local currency. To convert real returns in one currency into real returns in another, we simply adjust by the change in the real exchange rate.

We report in the full Yearbook that over the period 1900–2019, the real (inflation-adjusted) Swiss franc was stronger than the US dollar by 0.69% per year. An American who invested in Switzerland had a real return of 4.61% (from Swiss equities) plus 0.69% (from the Swiss franc), giving an overall return of $(1+4.61\%) \times (1+0.69\%) - 1 = 5.34\%$ (all numbers rounded). In contrast, the Swiss investor who invested in America had a real return of 6.51% (from US equities) minus 0.69% (from the US dollar), namely $(1+6.51\%) \times (1-0.69\%) - 1 = 5.78\%$ (again, rounded).

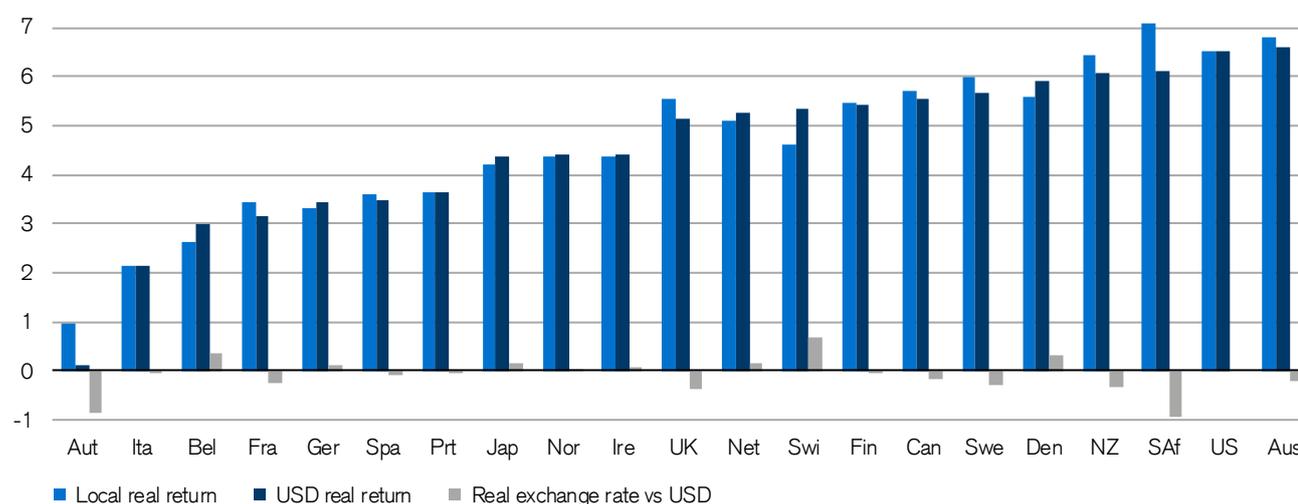
Instead of comparing domestic returns, an alternative way of making cross-country comparisons is thus to translate all countries' returns into real returns in a common currency using the real exchange rate. For equity returns around the world, **Figure 13** shows the results from translating out of local currency and into the US dollar. The light blue bars show the annualized real domestic currency returns over 1900–2019. The small gray bars, close to the horizontal axis, show the annualized real exchange rate movement over the same period, with positive values indicating currencies that appreciated against the dollar, and vice versa. The dark blue bars are common-currency returns, in real US dollars, from the US investor's perspective.

So the adjustment from local-currency real returns to dollar-denominated real returns is simple: it involves (geometric) addition of the real exchange rate movement. In the case of Switzerland, for example, the domestic real return is 4.61% and the real exchange rate movement is +0.69%. Adding these (geometrically) gives a real dollar return of 5.34% – as in the sample calculation shown above (again, all numbers are rounded). We obtain a similar ranking of equity markets, whether we rank by domestic real returns or real dollar returns.

We see that purchasing power parity has held over the very long term (120 years) within a cohort of countries that are predominantly developed markets. Because we are adjusting for both exchange-rate changes and relative inflation rates, the annualized returns in each area of the chart are consequently close to each other.

In **Figure 13**, countries are shown in ascending order of the dark blue bars, which show the annualized real returns to a US investor (returns converted into dollars and adjusted for US inflation). For US investors, their domestic equity market gave a hard-to-beat annualized real return of 6.51%, exceeded in US dollar terms only by Australia. For comparisons like this, we can use any common currency; for example, the annualized real returns denominated in UK inflation-adjusted sterling, are obtained by adjusting for the movement in the real sterling-dollar exchange rate.

Figure 13: Real annualized equity returns (%) in local currency and US dollars, 1900–2019



Sources: Elroy Dimson, Paul Marsh and Mike Staunton, *Triumph of the Optimists*, Princeton University Press, 2002, and *Global Investment Returns Yearbook*, Credit Suisse, 2020. Not to be reproduced without express written permission from the authors.

Risk and risk premiums

The annualized equity premiums for our 21 countries with continuous investment histories and for the world indexes are summarized in **Figure 14**, where countries are ranked by the equity premium measured relative to bills, displayed as bars. The line-plot shows each country's risk premium measured relative to bonds. Over the entire 120 years, the annualized (geometric) equity risk premium, relative to bills, was 5.7% for the USA and 4.5% for the UK. Averaged across the 21 countries, the risk premium relative to bills was 4.8%, while the risk premium on the world equity index was 4.3%. Relative to long government bonds, the story is similar. The annualized US equity risk premium relative to bonds was 4.4% and the corresponding figure for the UK was 3.6%. Across the 21 markets the risk premium relative to bonds averaged 3.6%, while for the world index, it was 3.1%.

Our global focus also results in rather lower risk premiums than were previously assumed. Prior views have been heavily influenced by the experience of the USA, yet we find that the US risk premium is higher than the average for the other 20 countries in our dataset.

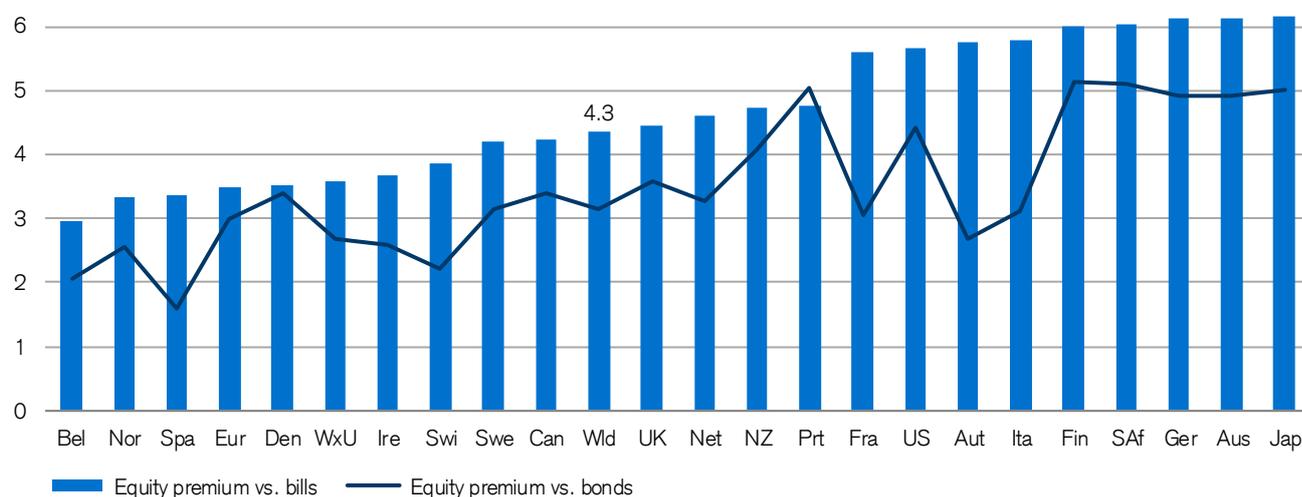
Since the start of the Yearbook project, we have expressed concern about potential survivorship bias in our estimates of the equity risk premium. This concern arose from recognition that, at least until a few years ago, the DMS database accounted for only some 87% of world equity market capitalization in 1900. The other 13% came from markets that existed in 1900, but for which we as yet had no data.

Some of these omitted markets failed to survive and, in some cases such as Russia in 1917 and China in 1949, investors lost all their money. Until eight years ago, we had addressed this problem by providing an estimate of the likely magnitude of this bias, based on the likely magnitude of this bias, based on the assumption that most of the missing 13% of market capitalization became valueless.

Seven years ago, we moved away from assumptions and addressed the issue of survivorship bias head-on. Our objective was to establish what had actually happened to the missing 13% of world market capitalization, and to assess the true impact of countries that had performed poorly or failed to survive. The two largest missing markets were Austria-Hungary and Russia, which, at end-1899, accounted for 5% and 6% of world market capitalization, respectively. The two best-known cases of markets that failed to survive were Russia and China. We therefore used new data sources to add these three countries to our database.

In total, our database now contains 23 countries, covering over 98% of world equity market capitalization in 1900. Two countries, Russia and China, have discontinuous histories, but we include them fully in our world index.

Figure 14: Worldwide annualized equity risk premium (%) relative to bills and bonds, 1900–2019



Sources: Elroy Dimson, Paul Marsh and Mike Staunton, *Triumph of the Optimists*, Princeton University Press, 2002, and *Global Investment Returns Yearbook*, Credit Suisse, 2020. Not to be reproduced without express written permission from the authors.

Maturity premiums

A bond maturity premium is required in order to compensate investors for the greater volatility and inflation risk of investing in long bonds. This is borne out by two key observations. First, the yield curve has historically on average been upward sloping; that is, long bonds have typically offered a higher yield to redemption than shorter dated bonds and bills. Second, real bond returns are far more volatile than real bill returns. As was the case with the equity risk premium, we cannot easily measure investors' ex ante requirements or expectations relating to the maturity premium, but we can measure the bond maturity premiums actually achieved. The formula for the bond maturity premium is $1 + \text{Long bond rate of return}$, divided by $1 + \text{Treasury bill rate of return}$, minus 1.

Figure 15 shows the data pictorially, with the bright blue bars representing the geometric mean premiums. It shows that over the last 120 years, the bond maturity premium has been positive in every country except Portugal (the premium for Germany excludes 1922–23). The premium for the European index is quite low at just 0.5% as it is measured from the perspective of a US investor, relative to US bills, i.e. US holders would have been only slightly better off holding European bonds rather than US bills. The (unweighted) average maturity premium for the 21 countries is 1.2%, while the maturity premium on the World index (in USD) is also 1.2% per year.

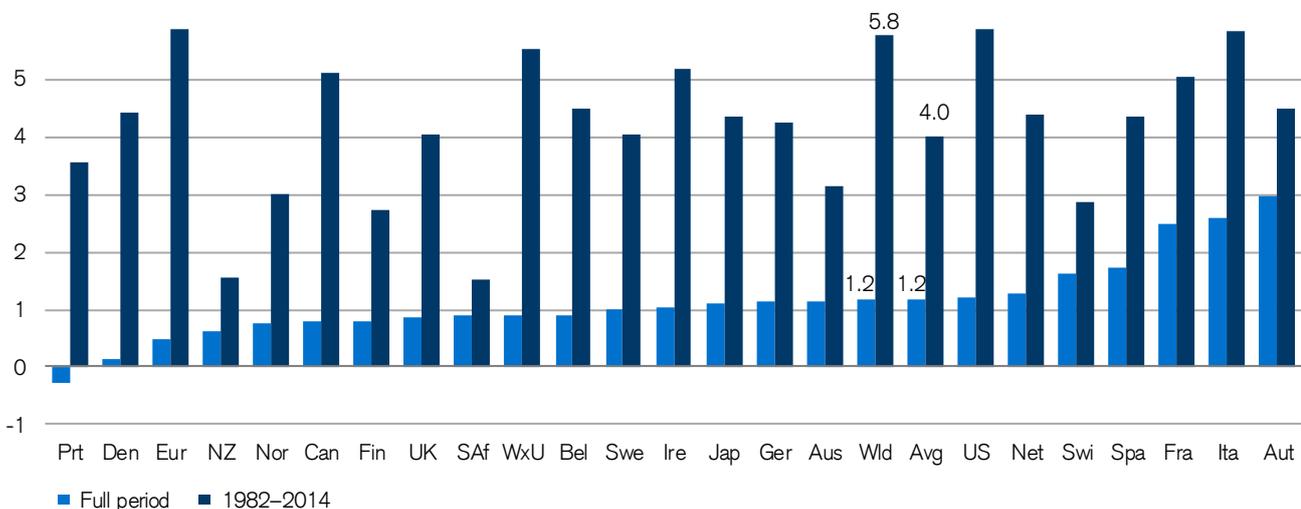
US bond investors could not reasonably have “required” a maturity premium as large as the 27% that they obtained in 2011. Very high realizations such as this must have been pleasant

surprises – typically good news on the inflation front, or a fall in the expected level of real interest rates, plus perhaps a flight to safety. Strictly speaking, therefore, we should refer to the annual maturity premiums simply as “excess returns,” that is, long bond returns in excess of (or under) the Treasury bill rate.

Over long-enough periods, we might expect the pleasant and unpleasant surprises to cancel each other out, providing us with an estimate of investors' ex ante required maturity premium. Once again, however, we need to examine very long periods before we can place confidence in this approach. Furthermore, the 120-year averages conceal a game of two halves. During the first half of the 20th century, when conditions for bond investors were clearly unfavorable, the average maturity premium across the 21 countries was 0.4%. During 1950–2019, the average premium was 1.7%. From 1982–2014, a period of 33 years, bonds enjoyed a golden age, with mostly unprecedented favorable conditions. The corresponding maturity premiums over this period were very large indeed.

Extrapolating these recent remarkably high bond returns and maturity premiums into the future would be fantasy. An alternative would be to take the long run, 120-year historical maturity premium on the world bond index of 1.2% per year as our estimate of the future maturity premium (or the equally weighted long-run average premium across the 21 countries which has the same value). For major markets, where there is very low risk of government default, we therefore estimate a forward-looking maturity premium of 1% per year.

Figure 15: Bond maturity premiums – full period (1900–2019) and “golden age” from 1982 to 2014



Over the full period, premiums for Austria and Germany are based on 118 years, excluding 1921–22 for Austria and 1922–23 for Germany. Sources: Elroy Dimson, Paul Marsh and Mike Staunton, *Triumph of the Optimists*, Princeton University Press, 2002, and *Global Investment Returns Yearbook*, Credit Suisse, 2020. Not to be reproduced without express written permission from the authors.

Factor investing

Factor investing remains in vogue as investors seek to harvest additional risk premiums. However, many of the premiums associated with specific factors are simply the result of data mining. To mitigate this trap, we estimate risk premiums earned from factor investing over long periods (up to 120 years) and across many markets (up to 23). We report in the full Global Investment Returns Yearbook 2020 on the profitability of following strategies based on market capitalization, value versus growth, dividend yield, stock-return momentum and low volatility investing, and here we present a few tasters.

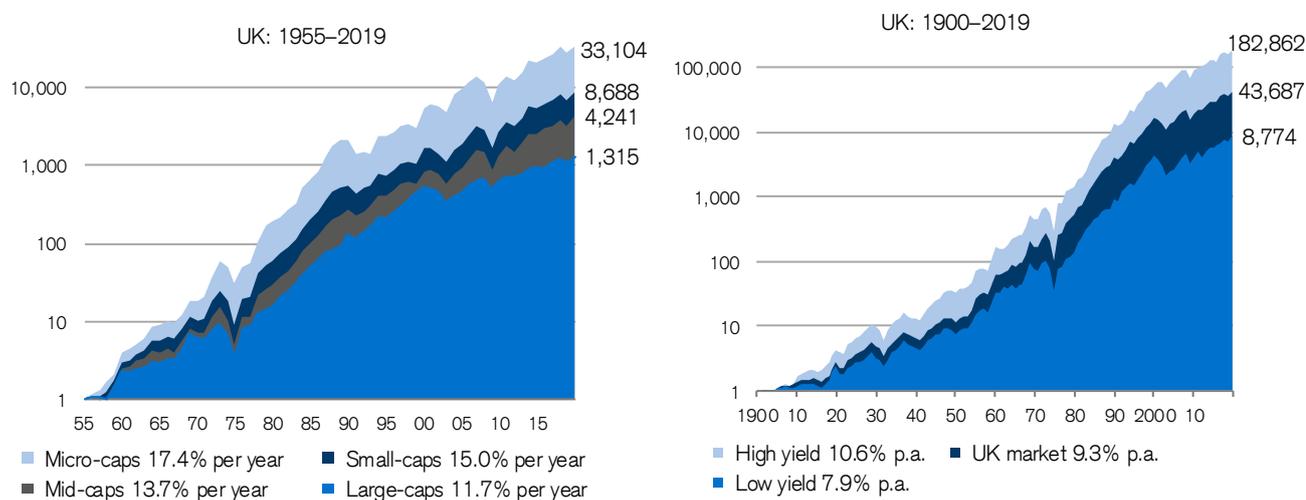
The latest FTSE Russell survey of major global investors reports that 78% of survey respondents have implemented or are evaluating factor-based strategies. Just 6% of respondents reported no existing allocation and no plans to evaluate factor investing. Adoption rates are evenly distributed between small (46%), medium (50%) and large (66%) asset owners. In 2019, smart beta adoption rates globally reached a record high of 58%, with European asset owners having the highest rate of adoption (65%), followed by North America (60%). Worldwide, a majority of asset owners now participate in factor investing.

Of those with an allocation to smart beta, over half (57%) are evaluating additional allocations, and the proportion of asset owners using at least three smart-beta indexes has risen to 80%. These market participants, with over USD 5 trillion in assets, include corporations,

governments, pension plans and non-profit organizations, and they have adopted factor investing as an integral part of their strategy. It is not just institutional fund managers who have expanded their involvement in factor investing. Exchange traded funds (ETFs) and exchange traded products (ETPs) have provided further opportunities for investors to target asset exposures selectively. At the end of 2019, the consulting and research firm ETFGI reported that globally there were 1,340 smart beta equity ETFs and ETPs, with 2,512 listings, from 167 providers on 41 exchanges in 33 countries, and assets of USD 860 billion, which had grown over five years at a compound rate of 21.5% per year.

Smart-beta investing seeks to harvest the long-run premiums highlighted by academic researchers. While industry and sector membership have long been a part of how we categorize investments, our focus here is on attributes that go beyond industry membership. To illustrate, **Figure 16** shows the cumulative investment performance of companies with a low market capitalization (on the left) and a high dividend yield (on the right).

Figure 16: Long-run cumulative performance from UK stocks selected by size (left) and dividend yield (right)



Source: Elroy Dimson, Paul Marsh and Mike Staunton, *Triumph of the Optimists*, Princeton University Press, 2002, and *Global Investment Returns Yearbook*, Credit Suisse, 2020. UK size-based returns are for the Numis Smaller Companies indexes ex investment companies. Not to be reproduced without express written permission from the authors.

The value premium

Perhaps the most celebrated risk premium of the last two decades is associated with the value factor, which was documented using data for the United States by Fama and French (1993) and most recently revisited by them in their latest paper, Fama and French (2020). Value has fallen out of favor, and many academic papers report realized value premiums that are low and close to zero. In their latest research, however, Fama and French reject such strong assertions for the US value premium. This suggests that it is worth looking at the worldwide experience.

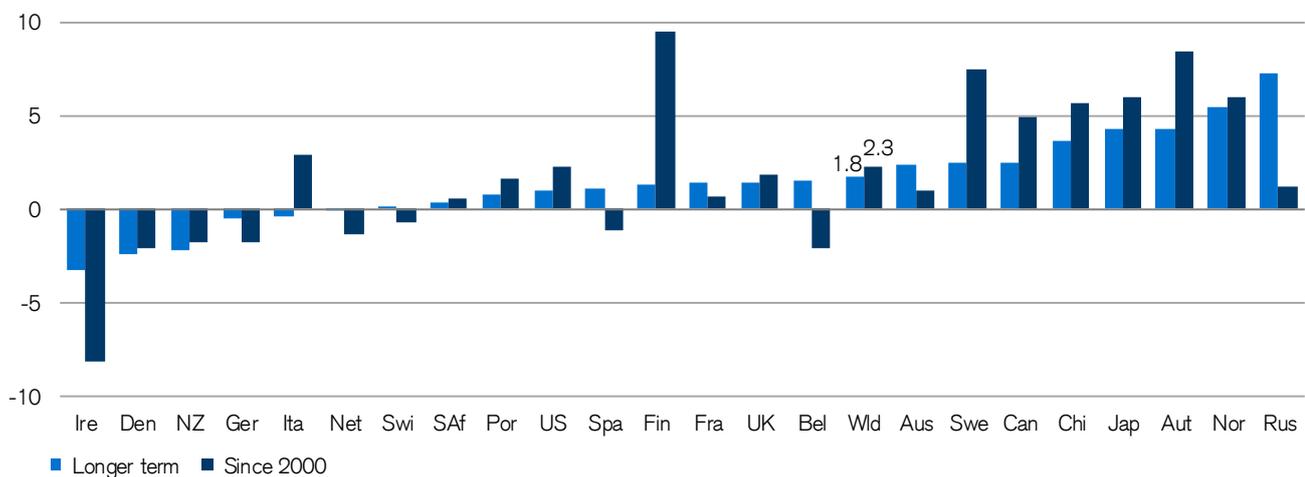
We therefore compute an annualized value premium for each country as the geometric difference between the MSCI Investable Value and Growth indexes from inception (1975 in most countries) to date. MSCI constructs these indexes using eight historical and forward-looking fundamental variables for every security. They define value using a combination of book value-to-price, earnings-to-price, and dividend yield, while they define growth based on a combination of variables measuring short- and long-term growth in EPS and sales per share. They place each security into either the Value or Growth Indexes, or partially allocate it to both.

The lighter bars in **Figure 17** show the value premium for the 23 Yearbook countries over the 45 year period 1975–2019 or for some countries starting in the 1980s (Finland and New Zealand) or 1990s (Ireland, China, Portugal, Russia, and South Africa). They show that, taking a global and long-term perspective, value investing mostly outperformed growth investing. The value premium was positive in

16 countries, negative in five, and essentially zero in two. The long-term value premium on the world index was 1.8% per year, and for the 21st century, 2.3% per year. Since the onset of the Global Financial Crisis in 2008, the value investing style has performed poorly.

There is still much controversy over the source of the value premium. Dimson, Marsh, and Staunton (2004) review some of the disputes about the robustness of the premium, and whether it relates to behavioral factors or is simply a reward for greater investment risk, an issue to which we return in the following section. The fundamental issue, of course, is whether value will ultimately triumph over the long run and, if so, whether its superiority more than compensates for any higher investment risk.

Figure 17: Annualized value premium in 23 countries, 1975–2019, % per year



Source: Elroy Dimson, Paul Marsh and Mike Staunton, *Triumph of the Optimists*, Princeton University Press, 2002, and *Global Investment Returns Yearbook*, Credit Suisse, 2020; MSCI Value and Growth indexes. Not to be reproduced without express written permission from the authors.

Multifactor investing

To summarize, smart-beta investing seeks to harvest the long-run factor premiums highlighted by academic researchers. Factors are the security-related characteristics that give rise to common patterns of return among subsets of listed securities. To identify factors, researchers typically construct long-short portfolios. These portfolios are long the preferred exposure and short the unwanted exposure. In the equity market, for example, an income factor portfolio would contain high-dividend yield stocks accompanied by a short position in lower-yielding stocks. It is far easier to buy stocks you do not own than to sell stocks you do not own. Long-short strategies can therefore be relatively expensive – on occasion impossible – to construct, and they can certainly be difficult to scale up. “Pure play” long-short strategies are sometimes called style strategies.

What are the smart-beta strategies that researchers have highlighted? Fama and French focus on four factors in addition to the market: size, value, profitability, and investment; Black (1972) and Frazzini and Pedersen (2014) identify low risk; and Jegadeesh and Titman (1993) and Carhart (1997) introduce momentum. Asness, Iltmanen, Israel and Moskowitz (2015) argue that there are four classic style premiums, namely value, momentum, income (or “carry”), and low-volatility (or “defensive”) investing.

Ang, Hogan, and Shores (2016) focus on size, value, momentum, volatility, and profitability.

In all, researchers have identified at least 316 factors, most of which are unlikely to be robust in independent testing. Novy-Marx and Velikov (2015) and Green, Hand and Zhang (2017) express complementary doubts about the prospective profits from exploiting factors that appear promising on an in-sample basis. The problem of apparently significant in-sample results being non-robust in out-of-sample tests has been discussed for more than a quarter of a century; see, for example, Dimson and Marsh (1990) and Markowitz and Xu (1994). But seeking genuine out-of-sample evidence would try most investors’ patience. It is important, therefore, to understand risk exposures when evaluating a fund manager’s performance.

A factor that is ranked high in performance in a particular year may remain high, may slip to low, or may end up in the middle in the following year. **Figure 18** lists each year’s factor returns since the financial crisis, ranked from highest to lowest, and reports (on the right) the annualized factor premium for the entire period. Since the onset of the crisis, the ranking of factor returns has not been stable, and earlier years (not shown here) are similar. Because of the inherent unpredictability of risk premiums, perceptive investors diversify their portfolios across risk exposures.

Figure 18: Post-crisis equity factor return premiums in the USA (upper panel) and UK (lower panel)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2008–19	
USA	Highest	Low vol 90.2	Size 28.4	Size 13.6	Low vol 41.0	Value 11.4	Size 5.3	Low vol 10.7	Momentum 42.4	Value 17.0	Low vol 6.3	Low vol 14.0	Momentum 10.1	Low vol 6.4
		Income 20.6	Value -8.0	Momentum 8.6	Income 29.7	Size 7.7	Momentum 4.5	Income 1.6	Low vol 12.8	Income 14.8	Momentum 6.1	Momentum 13.3	Low vol 4.9	Size 1.7
		Momentum -2.5	Income -17.2	Income 7.0	Momentum 1.3	Momentum -0.9	Value 4.4	Value -2.2	Income -0.2	Size 9.6	Size -3.3	Income 3.5	Size -2.9	Income 0.8
		Size -4.3	Low vol -32.9	Value -4.6	Size -3.6	Low vol -1.6	Income -8.2	Momentum -5.3	Size -9.4	Low vol -1.9	Value -9.7	Size -8.3	Value -7.0	Momentum -2.2
	Lowest	Value -6.3	Momentum -50.7	Low vol -15.4	Value -12.7	Income -7.6	Low vol -9.4	Size -6.7	Value -12.0	Momentum -22.1	Income -13.9	Value -13.8	Income -9.7	Value -4.1
UK	Highest	Low vol 127.0	Size 24.9	Size 12.4	Low vol 35.0	Size 17.0	Momentum 32.4	Momentum 7.8	Low vol 23.7	Value 20.2	Momentum 11.0	Low vol 18.2	Low vol 6.3	Momentum 8.1
		Momentum 78.8	Income 1.1	Value 3.2	Income 28.3	Value 14.8	Size 15.5	Income -1.3	Momentum 20.1	Income 15.3	Size 6.1	Momentum 6.6	Size 5.9	Low vol 5.2
		Income 15.7	Value -6.9	Momentum 0.7	Momentum 20.6	Momentum -1.7	Low vol 11.5	Size -2.9	Size 11.1	Size -4.9	Value 3.3	Income -2.4	Momentum -3.6	Size 4.0
		Value -11.8	Low vol -20.1	Income -13.7	Size -4.9	Income -8.1	Income 0.0	Low vol -6.2	Income -11.2	Momentum -18.3	Income -0.6	Size -6.8	Value -7.7	Income 0.6
	Lowest	Size -17.5	Momentum -25.4	Low vol -22.9	Value -10.7	Low vol -15.7	Value 0.0	Value -10.0	Value -20.9	Low vol -21.2	Low vol -9.6	Value -7.0	Income -7.9	Value -3.4

Source: Elroy Dimson, Paul Marsh and Mike Staunton, *Triumph of the Optimists*, Princeton University Press, 2002, and *Global Investment Returns Yearbook*, Credit Suisse, 2020. Not to be reproduced without express written permission from the authors.



Individual markets

The Credit Suisse Global Investment Returns Yearbook covers 23 countries and three regions, all with index series that start in 1900. The markets comprise two North American nations (Canada and the USA), ten Eurozone states (Austria, Belgium, Finland, France, Germany, Ireland, Italy, the Netherlands, Portugal, and Spain), six European markets that are outside the euro area (Denmark, Norway, Russia, Sweden, Switzerland and the UK), four Asia-Pacific countries (Australia, China, Japan and New Zealand) and one African market (South Africa). In addition, there is a 23-country world index, a 22-country world ex-US index, and a 16-country Europe index.

Our 23 countries represent over 98% of world equity market capitalization at the start of 1900 and over 91% of the investable universe in 2020. The list of countries included in the Yearbook database has expanded over time, but has been stable since 2015. Our data series are comprehensive: we cover five assets in each of 23 countries. For all 115 asset/market combinations, we estimate total returns for 120 years from the start of 1900 to the end of 2019 (with a gap for each of China and Russia). The underlying annual returns are distributed as the DMS data module by Morningstar Inc.

Guide to countries and regions

Countries are listed alphabetically, followed by three regional groups. In the full Yearbook, six pages are allocated to each market with an unbroken historical record (more for the UK). Each country opens with a short historical overview and economic snapshot. We summarize the evolution of securities exchanges in each individual country and spotlight a few financial descriptors of the economy in more recent

times. We compare the local stock market with other markets around the world, identify industry sectors that are dominant in the country's stock exchange, and identify particular listed companies that are prominent in the national stock market.

The first page for each market includes an overview of long-term investment performance, encapsulated in two charts. The left-hand chart reports the annualized real returns on equities, bonds and bills over this century, the last 50 years, and since 1900. For the latter two periods, the right-hand chart reports the annualized premiums achieved by equities relative to bonds and bills, by bonds relative to bills, and by the real exchange rate relative to the US dollar (the periods differ for China and Russia). These snapshots are presented for selected countries in this Summary Edition.

In the full (printed) version of the Yearbook, we provide additional content which we summarize briefly here. On the second page for each market, we list our data sources, covering equities, bonds, bills, currencies, and inflation. The primary data sources are listed and we provide additional bibliographic references. A table

summarizes the asset returns and risk premiums for that market. For both nominal and real (inflation-adjusted) asset returns and for three risk-premium series, we show the geometric and arithmetic mean return, the standard error of the arithmetic mean, the standard deviation and serial correlation of annual returns and the lowest and highest annual return, together with the dates in which these extremes occurred. We also show the lowest and highest ten-year returns, together with the end-year for those returns, as well as the rank of the most recent year's returns (where the highest return has rank 1, and the lowest, for a country with a complete history, has rank 120). These statistics are based on the entire 120-year period spanned by our study.

The third page for each market shows a graph of the real (inflation-adjusted) returns achieved on equities, bonds, and bills, together with the real exchange rate against the US dollar, all based at the start of 1900 to a value of one.

The fourth page for each market provides "return triangles" of the annualized real returns on each of the principal asset categories, the three premiums relating to equities, bonds, and bills, real and nominal exchange rates against the dollar, plus the annualized inflation rate. These returns span all multiples of a decade from one to twelve decades. The penultimate page illustrates the dispersion of real returns on equities and on bonds.

In the following pages we provide a short review of the investment performance of the most important markets in the world since 1900, including China, Japan, Switzerland, the United Kingdom, the United States and the World. To access the full Credit Suisse Global Investment Returns Yearbook or the underlying DMS dataset, please consult page 44.



The biggest economy

Despite the occasional wobble, China's economic expansion has had a huge cumulative impact. According to the International Monetary Fund, China now has the world's largest GDP measured using PPP exchange rates, although at market exchange rates, the USA is still the world's largest economy. The world's most populous country, China has over 1.3 billion inhabitants, and more millionaires and billionaires than any country other than the USA.

After the Qing Dynasty, it became the Republic of China (ROC) in 1911. The ROC nationalists lost control of the Mainland at the end of the 1946–49 civil war, after which their jurisdiction was limited to Taiwan (Chinese Taipei) and a few islands. Following the communist victory in 1949, privately owned assets were expropriated and government debt was repudiated.

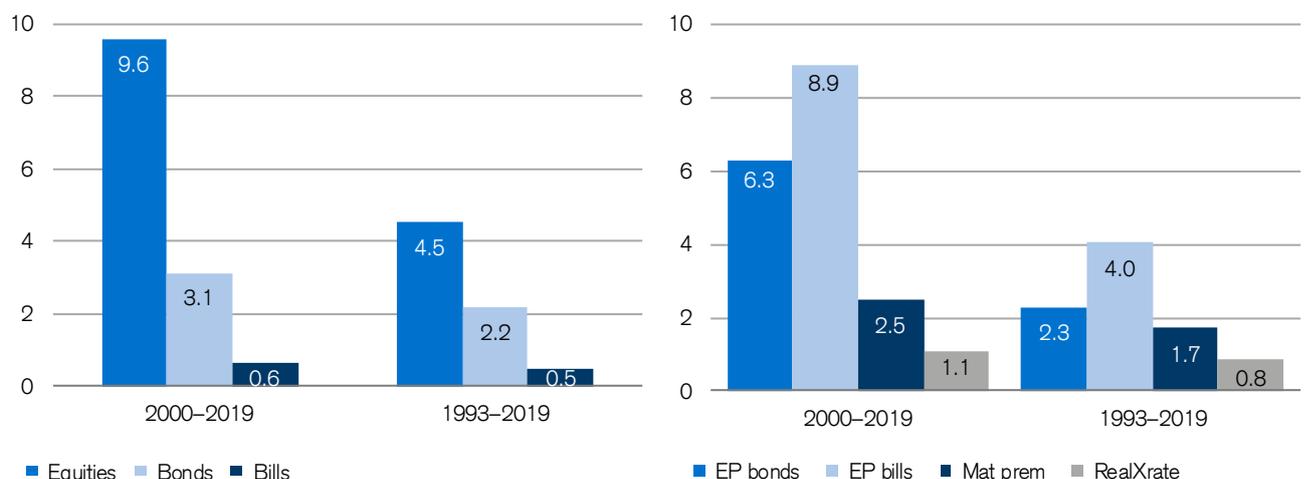
The People's Republic of China (PRC) has been a single-party state since then. We therefore distinguish between (1) the Qing period and the ROC, (2) the PRC until economic re-forms were

introduced, and (3) the modern period following the second stage of China's economic reforms of the late 1980s and early 1990s.

The communist takeover led to total losses for local investors. Chinese returns from 1900 are incorporated into the world and world ex-US indexes, including these total losses. However, a minuscule proportion of foreign assets retained some value (some UK bondholders received a tiny settlement in 1987).

As discussed in the 2019 Yearbook, China's astonishing GDP growth was not accompanied by superior investment returns. Today, over one-quarter (27%) of the FTSE World China index is represented by financials, mainly banks and insurers. Technology accounts for a further 20% of the index. Alibaba Group is the biggest holding in the index, followed by Tencent Holdings, China Construction Bank, Ping An Insurance, the Industrial and Commercial Bank of China and then China Mobile.

Figure 19: Annualized real returns on asset classes and risk premiums for China, 1993–2019 (%)



Note: The three asset classes are equities, long-term government bonds, and Treasury bills. All returns include reinvested income, are adjusted for inflation, and are expressed as geometric mean returns.

Note: EP bonds and EP bills denote the equity premium relative to bonds and to bills; Mat prem denotes the maturity premium for bonds relative to bills; RealXRate denotes the inflation-adjusted change in the exchange rate against the US dollar.

Sources: Elroy Dimson, Paul Marsh and Mike Staunton, *Triumph of the Optimists*, Princeton University Press, 2002, and *Global Investment Returns Yearbook*, Credit Suisse, 2020. Not to be reproduced without express written permission from the authors.



The Old World

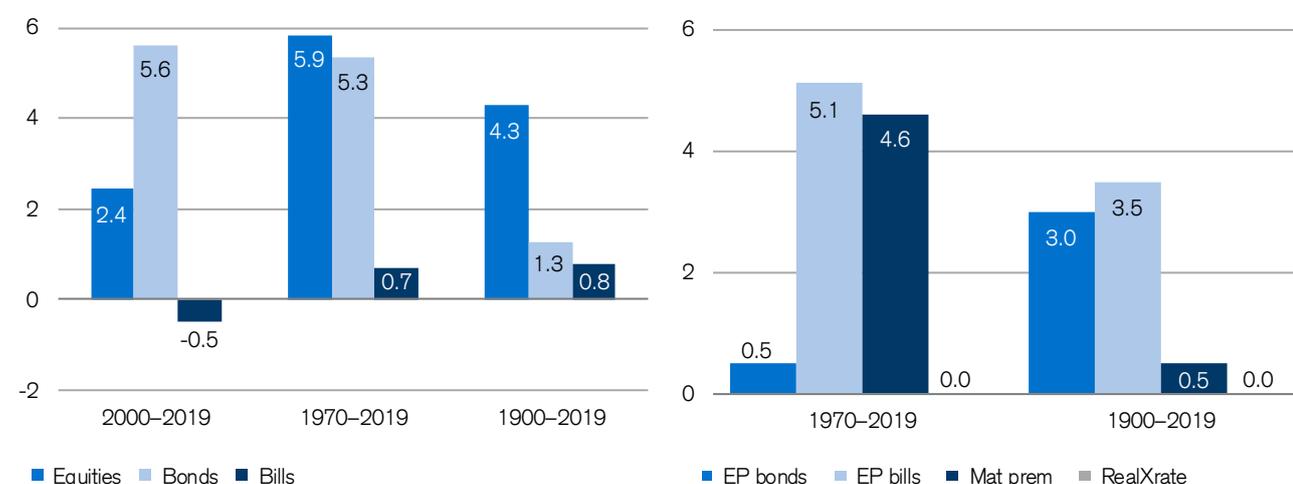
The Yearbook documents investment returns for 16 European countries, most of which are in the European Union. They comprise ten EU states in the Eurozone (Austria, Belgium, Finland, France, Germany, Ireland, Italy, the Netherlands, Portugal and Spain), two EU states outside the Eurozone (Denmark and Sweden), two European Free Trade Association states (Norway and Switzerland), and two others, namely, the UK and the Russian Federation. Loosely, we might argue that these 16 countries represent the Old World.

It is interesting to assess how well European countries as a group have performed, compared with our world index. We have therefore constructed a 16-country European index using the same methodology as for the world index. As with the latter, this European index can be designated in any desired common currency. For consistency, the figures on this page are in US dollars from the perspective of a US international investor.

The left-hand chart below shows that the real equity return on European equities was 4.3%. This compares with 5.2% for the world index, indicating that the Old World countries have underperformed. This may relate to some nations' loss of imperial powers and colonial territories, the destruction from the two world wars (where Europe was at the epicenter), the fact that many New World countries were resource-rich, or perhaps to the greater vibrancy of New World economies.

We follow a policy of continuous improvement with our data sources, introducing new countries when feasible, and switching to superior index series as they become available. As we noted above, we recently added three new European countries, Austria, Portugal and Russia. Two of them have a continuous history, but Russia does not; however, all of them are fully included in the Europe indexes from 1900 on-ward, even though Russia registered a total loss in 1917. Russia re-enters the Europe index after its markets reopened in the 1990s.

Figure 20: Annualized real returns on asset classes and risk premiums for Europe, 1900–2019 (%)



Note: The three asset classes are equities, long-term government bonds, and Treasury bills. All returns include reinvested income, are adjusted for inflation, and are expressed as geometric mean returns.

Note: EP bonds and EP bills denote the equity premium relative to bonds and to bills; Mat prem denotes the maturity premium for bonds relative to bills; RealXRate denotes the inflation-adjusted change in the exchange rate against the US dollar.

Sources: Elroy Dimson, Paul Marsh and Mike Staunton, *Triumph of the Optimists*, Princeton University Press, 2002, and *Global Investment Returns Yearbook*, Credit Suisse, 2020. Not to be reproduced without express written permission from the authors.



Birthplace of futures

The FutureBrand Index ranks Japan as the world's number one country brand. Futures have a long history in financial markets and, by 1730, Osaka started trading rice futures. The city was to become the leading derivatives exchange in Japan (and the world's largest futures market in 1990 and 1991), while the Tokyo Stock Exchange, founded in 1878, was to become the leading market for spot trading.

From 1900 to 1939, Japan was the world's second-best equity performer. But World War II was disastrous and Japanese stocks lost 96% of their real value. From 1949 to 1959, Japan's "economic miracle" began and equities gave a real return of 1,565% over this period. With one or two setbacks, equities kept rising for another 30 years.

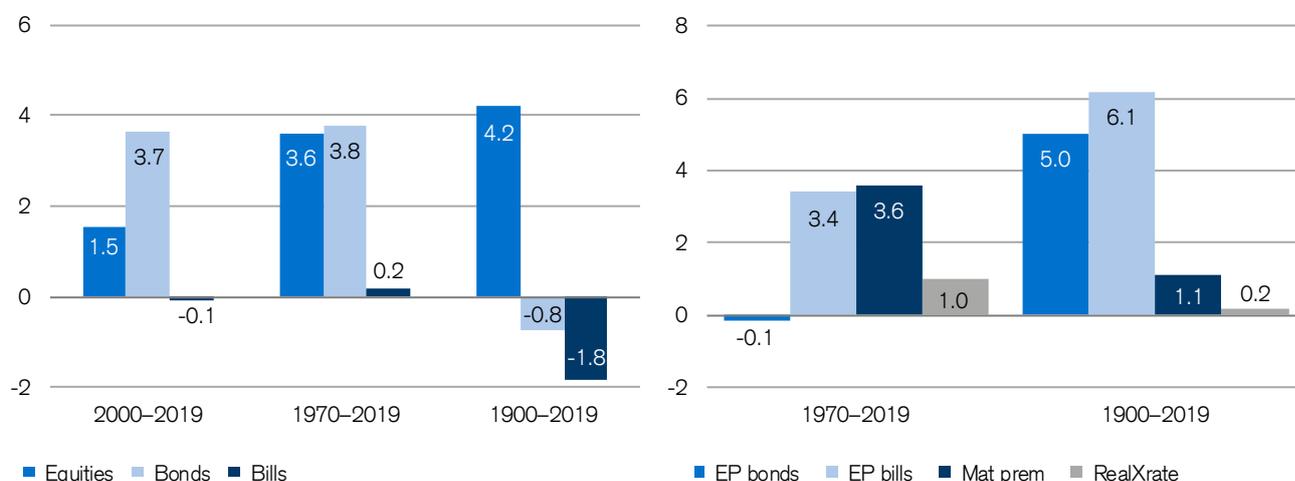
By the start of the 1990s, the Japanese equity market was the largest in the world, with a 45% weighting in the world index compared to 29% for the USA. Real estate values were also riding high: a 1993 article in the Journal of Economic

Perspectives reported that, in late 1991, the land under the Emperor's Palace in Tokyo was worth about the same as all the land in California.

Then the bubble burst. From 1990 to 2019, Japan was the worst-performing stock market of all the Yearbook countries. At the start of 2020, its capital value remains below that attained by the end of the 1980s. Its weighting in the world index fell from 41% to 8%. Meanwhile, Japan has suffered a prolonged period of stagnation, banking crises and deflation. Hopefully, this will not form the blueprint for other countries.

Despite the fallout after the asset bubble burst, Japan remains a major economic power. It has the world's second-largest equity market and its third-biggest bond market. It is a world leader in technology, automobiles, electronics, machinery and robotics, and this is reflected in the composition of its equity market. One-quarter of the FTSE World Japan index (23%) comprises consumer goods, while industrials account for 23%.

Figure 21: Annualized real returns on asset classes and risk premiums for Japan, 1900–2019 (%)



Note: The three asset classes are equities, long-term government bonds, and Treasury bills. All returns include reinvested income, are adjusted for inflation, and are expressed as geometric mean returns.

Note: EP bonds and EP bills denote the equity premium relative to bonds and to bills; Mat prem denotes the maturity premium for bonds relative to bills; RealXrate denotes the inflation-adjusted change in the exchange rate against the US dollar.

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Traditional safe haven

For a small country with just 0.1% of the world's population and less than 0.01% of its land mass, Switzerland punches well above its weight financially and wins several gold medals in the global financial stakes. The Swiss stock market traces its origins to

exchanges in Geneva (1850), Zurich (1873), and Basel (1876). It is now the world's sixth-largest equity market, accounting for 2.7% of total world value. Since 1900, Swiss equities have achieved a real return of 4.6% (equal to the median across our countries).

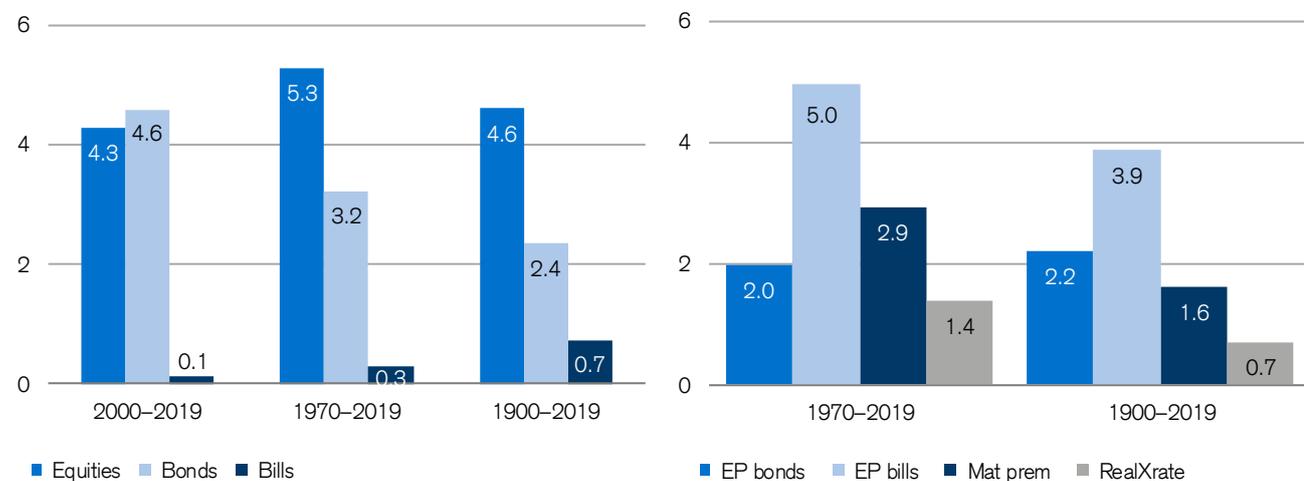
Meanwhile, Switzerland has been the world's best-performing government bond market, with an annualized real USD return of 3.1% (it ranks second-best in real local currency return terms, with an annualized return since 1900 of 2.4%). Switzerland has also had the world's lowest 120-year inflation rate of just 2.1%.

Switzerland is one of the world's most important banking centers, and private banking has been a major Swiss competence for over 300 years. Swiss neutrality, sound economic policy, low inflation and a strong currency have bolstered the country's reputation as a safe haven.

A large proportion of all cross-border private assets invested worldwide is still managed in Switzerland.

Switzerland's pharmaceutical sector accounts for a third (34%) of the value of the FTSE World Switzerland index. Nestle (22%), Roche (17%), and Novartis (14%) together account for over half of the index's value.

Figure 22: Annualized real returns on asset classes and risk premiums for Switzerland, 1900–2019 (%)



Note: The three asset classes are equities, long-term government bonds, and Treasury bills. All returns include reinvested income, are adjusted for inflation, and are expressed as geometric mean returns.

Note: EP bonds and EP bills denote the equity premium relative to bonds and to bills; Mat prem denotes the maturity premium for bonds relative to bills; RealXRate denotes the inflation-adjusted change in the exchange rate against the US dollar.

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Global center for finance

Organized stock trading in the United Kingdom dates from 1698, and the London Stock Exchange was formally established in 1801. By 1900, the UK equity market was the largest in the world, and London was the world's leading financial center, specializing in global and cross-border finance. Early in the 20th century, the US equity market overtook the UK and, nowadays, New York is a larger financial center than London. What continues to set London apart, and justifies its claim to be the world's leading international financial center, is the global, cross-border nature of much of its business.

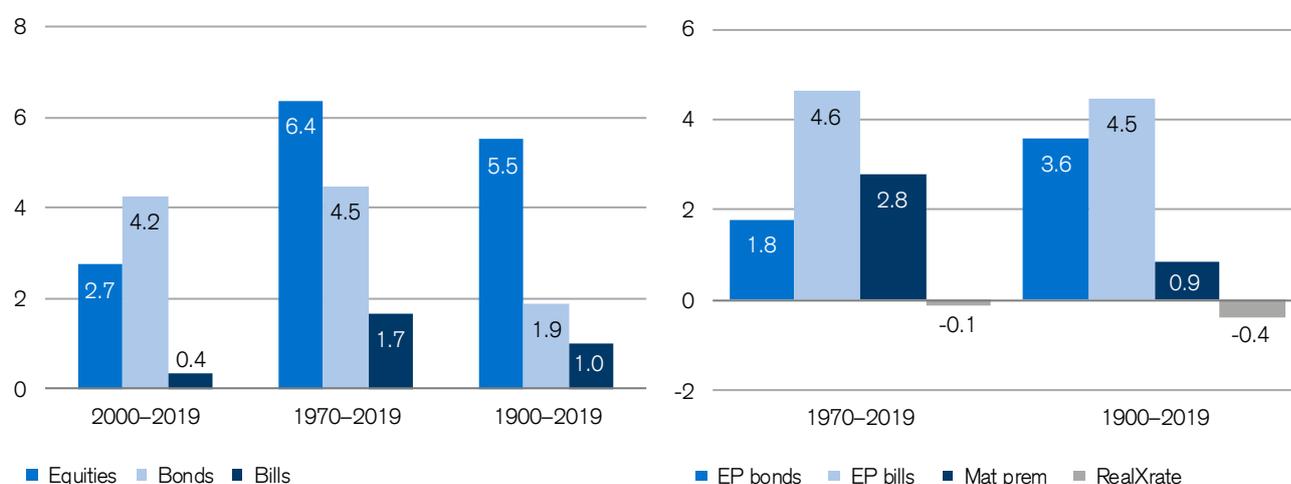
Today, London is ranked as the second most important financial center (after New York) in the Global Financial Centers Index. It is the world's banking center, with 550 international banks and 170 global securities firms having offices in London. The UK's foreign exchange

market is the biggest in the world, and Britain has the world's number-three stock market, number-three insurance market, and the fourth-largest bond market.

London is the world's largest fund management center, managing almost half of Europe's institutional equity capital and three-quarters of Europe's hedge fund assets. More than three-quarters of Eurobond deals are originated and executed there. More than a third of the world's swap transactions and more than a quarter of global foreign exchange transactions take place in London, which is also a major center for commodities trading, shipping and many other services.

Royal Dutch Shell is the largest UK stock by market capitalization. Other major companies include HSBC Holdings, Astra Zeneca, BP, Glaxo SmithKline, British American Tobacco, and Diageo.

Figure 23: Annualized real returns on asset classes and risk premiums for the UK, 1900–2019 (%)



Note: The three asset classes are equities, long-term government bonds, and Treasury bills. All returns include reinvested income, are adjusted for inflation, and are expressed as geometric mean returns.

Note: EP bonds and EP bills denote the equity premium relative to bonds and to bills; Mat prem denotes the maturity premium for bonds relative to bills; RealXRate denotes the inflation-adjusted change in the exchange rate against the US dollar.

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Financial superpower

In the 20th century, the United States rapidly became the world's foremost political, military, and economic power. After the fall of communism, it became the world's sole superpower. It is also the world's number one oil producer.

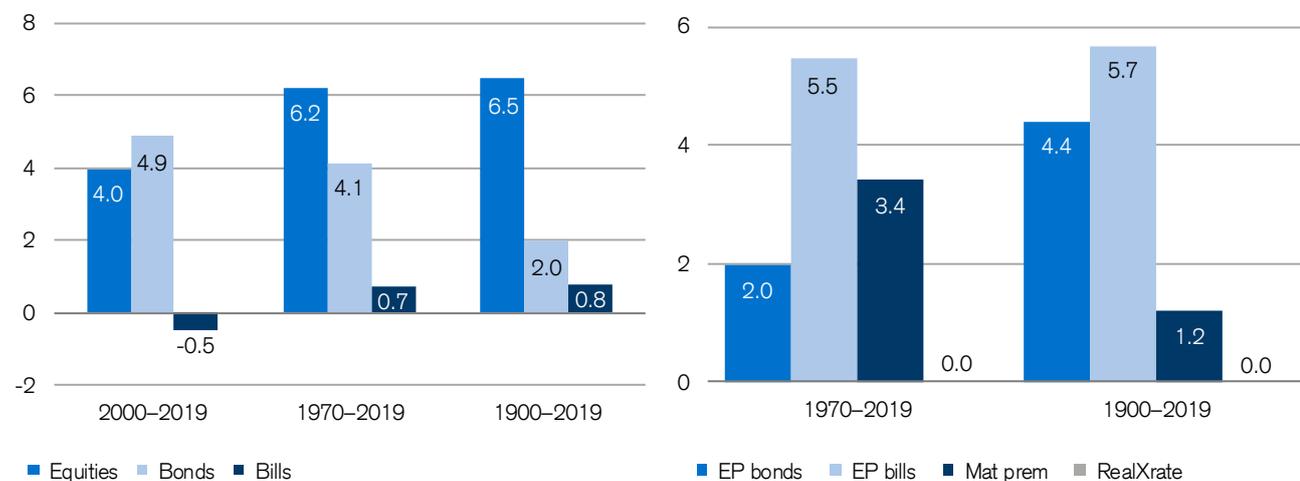
The USA is also a financial superpower. It has the world's largest economy, and the dollar is the world's reserve currency. Its stock market accounts for 54% of total world value (on a free-float, investible basis), which is seven times as large as Japan, its closest rival. The USA also has the world's largest bond market.

US financial markets are by far the best-documented in the world and, until recently, most of the long-run evidence cited on historical investment performance drew almost exclusively on the US experience. Since 1900, equities and government bonds in the USA have given annualized real returns of 6.5% and 2.0%, respectively.

There is an obvious danger of placing too much reliance on the excellent long-run past performance of US stocks. The New York Stock Exchange traces its origins back to 1792. At that time, the Dutch and UK stock markets were already nearly 200 and 100 years old, respectively. Thus, in just a little over 200 years, the USA has gone from zero to more than a majority share of the world's equity markets.

Extrapolating from such a successful market can lead to "success" bias. Investors can gain a misleading view of equity returns elsewhere, or of future equity returns for the USA itself. That is why this Yearbook focuses on global investment returns, rather than just US returns.

Figure 24: Annualized real returns on asset classes and risk premiums for the USA, 1900–2019 (%)



Note: The three asset classes are equities, long-term government bonds, and Treasury bills. All returns include reinvested income, are adjusted for inflation, and are expressed as geometric mean returns.

Note: EP bonds and EP bills denote the equity premium relative to bonds and to bills; Mat prem denotes the maturity premium for bonds relative to bills; RealXrate denotes the inflation-adjusted change in the exchange rate against the US dollar.

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Globally diversified

It is interesting to see how the Credit Suisse Global Investment Returns Yearbook countries have performed in aggregate over the long run. We have therefore created an all-country world equity index denominated in a common currency, in which each of the 23 countries is weighted by its start-year equity-market capitalization.

We also compute a similar world bond index, weighted by GDP. These indexes represent the long-run returns on a globally diversified portfolio from the perspective of an investor in a given country. The charts below show the returns for a US global investor. The world indexes are expressed in US dollars, real returns are measured relative to US inflation, and the equity premium versus bills is measured relative to US Treasury bills.

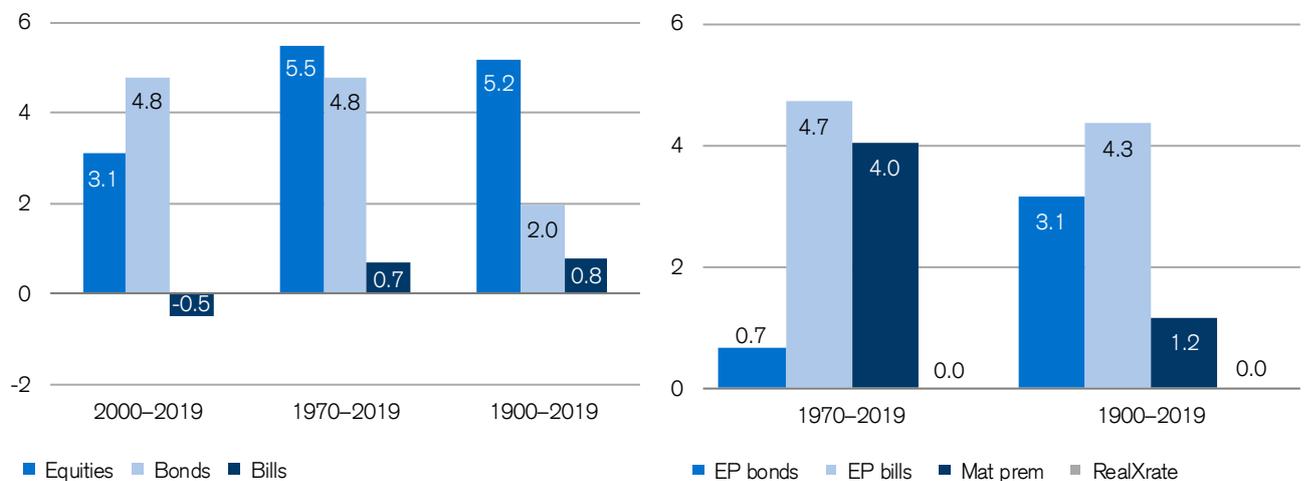
Over the 120 years from 1900 to 2019, the left-hand chart shows that the real return on

the world index was 5.2% per year for equities and 2.0% per year for bonds. The right-hand chart shows that the world equity index had an annualized equity risk premium, relative to Treasury bills, of 4.3% over the last 120 years, and a similar premium of 4.7% per year over the most recent 50 years.

We follow a policy of continuous improvement with our data sources, introducing new countries when feasible, and switching to superior index series as they become available. Most recently, we have added Austria, Portugal, China and Russia. Austria and Portugal have a continuous history, but China and Russia do not.

To avoid survivorship bias, all these countries are fully included in the world indexes from 1900 onward. Two markets register a total loss – Russia in 1917 and China in 1949. These countries then re-enter the world indexes after their markets reopened in the 1990s.

Figure 25: Annualized real returns on asset classes and risk premiums for the World index, 1900–2019 (%)



Note: The three asset classes are equities, long-term government bonds, and Treasury bills. All returns include reinvested income, are adjusted for inflation, and are expressed as geometric mean returns.

Note: EP bonds and EP bills denote the equity premium relative to bonds and to bills; Mat prem denotes the maturity premium for bonds relative to bills; RealXRate denotes the inflation-adjusted change in the exchange rate against the US dollar.

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Data sources for the underlying database

The DMS database draws on the efforts of many researchers around the world. The reader's attention is drawn to the comprehensive list of studies catalogued at the end of the Credit Suisse Global Investment Returns Yearbook 2020.



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Elroy Dimson, Paul Marsh, and Mike Staunton jointly wrote the influential investment book, *Triumph of the Optimists*, published by Princeton University Press. They have authored the *Global Investment Returns Yearbook* annually since 2000. They distribute the Yearbook's underlying dataset through Morningstar Inc. The authors also edit and produce the Risk Measurement Service, which London Business School has published since 1979. They each hold a PhD in Finance from London Business School.

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