Uncommon truths
What can stop Biotech?

The biotech sector has generated stellar returns since its inception and we view it as a strategic pillar of our model allocations. However, the growth advantage is not what it was and we fear the short-term effect of rising bond yields.

If the early 1970s marked the birth of biotechnology, with the first genetically engineered organism (by Boyer and Cohen), and 1976 saw the first biotech company (Genentech, set up by Boyer), the sector has since been a profitable venture for investors.

For example, over the last 35 years, the Datastream US Biotechnology index has increased by a multiple of 615 (based on the total return index, measured from February 1986 to February 2021, as of 18 February). By comparison, the broad US market, and the pharmaceuticals and technology sectors have increased by multiples of 47, 63 and 74, respectively (all based on Datastream indices). That suggests an annualised total return of 20% over those 35 years for the biotechnology sector (versus 12% for the US market as a whole and 13% for the pharmaceuticals and technology sectors).

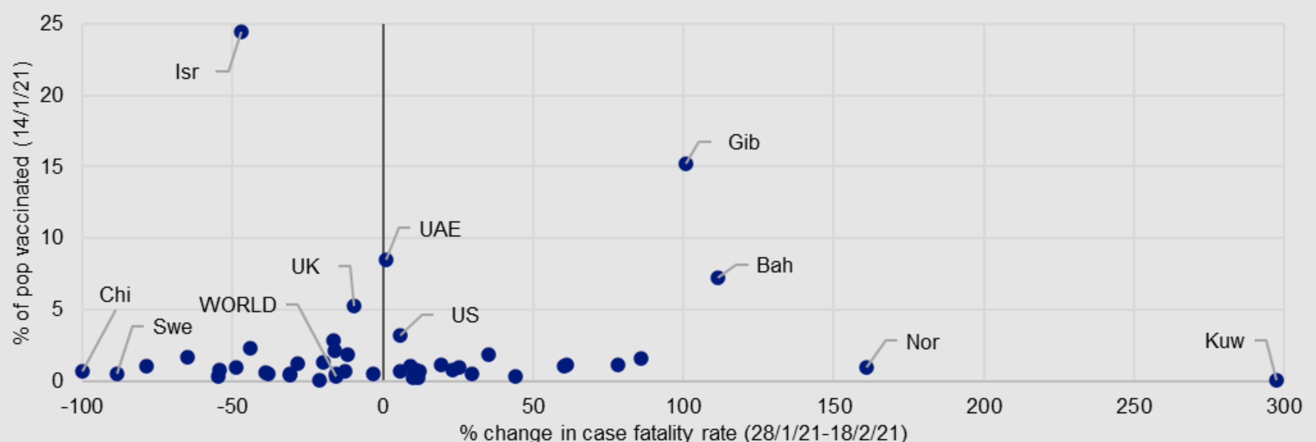
That is an impressive return for the biotechnology sector, though admittedly with roughly twice the standard deviation of monthly returns experienced by the total market and pharmaceutical sector indices (and 30% more than for the technology sector). As usual, there are no free lunches: those seeking the higher returns offered by biotechnology have had to be willing to accept greater volatility.

Can the sector continue to produce such strong returns? We can imagine three reasons why it wouldn't: first, if there is no room for further innovation; second, even if there is, the regulatory environment may change and/or sector valuations may have already priced-in a lot of innovation and, third, over the next few years, economic recovery and rising bond yields may penalise "growth" sectors such as biotechnology.

When it comes to future sources of growth, Covid-19 has shown that we are likely to always need new medicines and vaccines and that the discovery process relies increasingly on "high-tech" solutions. For example, the Moderna and BioNTech/Pfizer vaccines were applications of genome technology.

As vaccines have been rolled out across the world, we have seen promising results from Israel and the UK is perhaps starting to see the benefits (both of which are based on divergent Covid data for different age groups). Given that daily cases and deaths are falling in most parts of the world due to lockdowns and other non-pharmaceutical interventions (NPIs), it is hard to judge the effectiveness of vaccine rollouts across a broad range of countries when using those simple metrics. Now that testing regimes seem to have settled down, we wonder if changes in case fatality rates (deaths divided by cases) may not be a better way to judge if vaccines are having an independent effect, based on the assumption that they will have a greater effect on deaths than on cases (see **Figure 1**, with important methodological details in the footnote).

Figure 1 – Vaccination rates and changes in case fatality rates



Based on daily data from 14 January 2021 to 18 February 2021. "Case fatality rate" is daily deaths on a given day divided by daily cases three weeks earlier (assuming that is the lag between a positive test result and death). Case fatality rate is used to abstract from changes in cases and deaths that are occurring for reasons other than vaccines. It is assumed that vaccines need two weeks to become effective (hence the gap from 14 January to 28 January) and that another three weeks is needed to see the effect on deaths. "Bah" = Bahrain, "Chi" = China, "Gib" = Gibraltar, "Isr" = Israel, "Kuw" = Kuwait, "Nor" = Norway, "Swe" = Sweden, "UAE" = United Arab Emirates, "UK" = United Kingdom, "US" = United States of America. Source: Our World in Data, Reuters, Refinitiv Datstream, Invesco

Given the lag between cases and deaths (around three weeks) and the fact that vaccines are not immediately effective (it may take two weeks), we are forced to compare the change in case fatality rates over the most recent three weeks with vaccination rates of five weeks ago. Hence, it may be too soon to judge, given that most of the countries shown in **Figure 1** had vaccinated less than 5% of their populations on 14 January (each dot represents a country but only the most interesting are identified).

Indeed, the evidence in **Figure 1** is far from conclusive. Though the previously mentioned Israel and UK are where one would expect (relatively advanced vaccine rollouts and declining case fatality rates), the UAE, Gibraltar and the US are yet to display declining fatality rates. Further, a lot of countries (and the world as a whole) have seen a decline in case fatality rates, despite low vaccination rates, so it is hard to be sure that the decline in fatality rates noted in Israel and the UK are really due to vaccinations. As time passes, we would expect the pattern to become clearer, in which case the worth of the vaccines will be more evident.

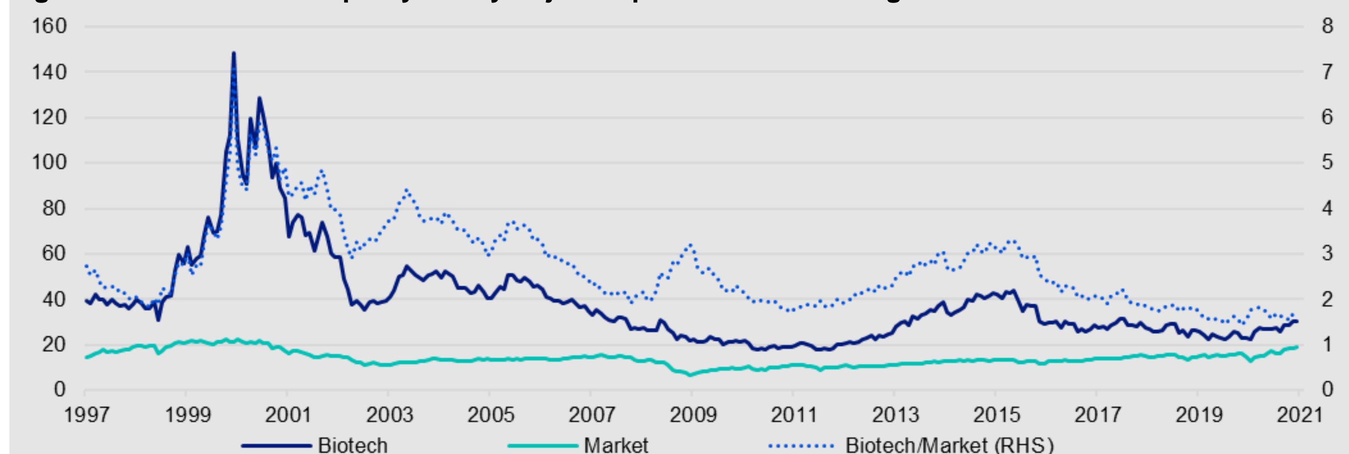
Vaccine sales are likely to receive a Covid boost over the coming years (for example, Pfizer BioNTech expect $15bn of Covid vaccine sales this year – see here). However, the bulk of vaccine sales are usually done by large pharmaceutical companies and Covid-related sales may not be that profitable (see this). That latter point may explain the limited boost received by biotech companies since the pandemic came to the fore: the total return on the US biotech sector was 39% between end-February 2020 and the end of 2020, versus 32% for the US market as a whole (both based on Datastream indices). Even worse, the return on the pharma sector was a “paltry” 20%.

This may also be because vaccine sales are a small part of total biotech and pharma industry revenues. According to Fortune Business Insights, the global market for vaccines was worth $47bn in 2019, whereas total sales of the biotechnology and pharmaceuticals industries were $448bn and $1300bn, respectively (according to Fior Markets and Statista). Luckily, there are many exciting new opportunities for biotech companies in the genetic engineering sphere that can help with food supply (both plant and animal based), disease control, therapies and eugenics. The synthetic generation of organisms is among the most recent advances. One of the more recent “hot” IPO areas has been the raising of capital by companies that use CRISPR-Cas9 genome editing technology, which could, for example, remove hereditary predispositions to coronary disease (if ever allowed by regulators).

Hence, we think it unlikely that biotech companies will struggle to find new areas of growth, even if it would be naïve to expect the same rate of progress as witnessed in the early stages of development. This then begs the question as to whether an appropriate price is being paid for that growth. Finding an appropriate valuation metric for a high growth sector is not easy, especially as it may take several years for companies to make profit, let alone pay dividends. We usually fall back upon cyclically-adjusted price earnings ratios (CAPEs) to smooth out cyclical swings in earnings but the CAPE on the US biotech sector was still above 100 as recently as 2007. We have therefore chosen to cyclically adjust the price to cash-earnings ratio (CAPCE), as shown in **Figure 2**.

On this basis, the biotech sector is almost as “cheap” relative to the US market, as at any time since 1997 (as far back as we can go). The biotech CAPCE premium to the market is now “only” around 60%.

Figure 2 -- Is Biotech cheap? Cyclically-adjusted price to cash-earnings ratios for the US market



Based on monthly data (month-end) from March 1997 to February 2021 (the latter is as of 18 February 2021). “Cyclically-adjusted price to cash-earnings ratios” use a 10-year moving average of cash-earnings. Using Datastream US indices. Past performance is no guarantee of future results. Source: Refinitiv Datastream and Invesco

Of course, whether that really is cheap depends upon the assumed growth prospects for both the sector and the market. The 10-year moving average of cash-earnings has decelerated for both sector and market but the slowdown has been greater for biotech. Our calculations suggest the biotech sector generated 24% annualised growth in that moving average in the five years to March 2002 versus 7% for the market. On that calculation basis, the growth in biotech sector cash-earnings remained above 20% until 2012 (market growth remained above 6%). Thereafter, however, a gradual decline set in that brought the annualised growth in biotech cash-earnings down to 12% in the most recent five years (to February 2021), versus 5% for the market. Hence, a valuation premium would appear to be warranted for the biotech sector but not as much as in the past.

Exactly which valuation premium is justified is not obvious, as it should also depend upon the level of bond yields (an important ingredient in the discount factor to be applied to future cash-earnings). Growth sectors such as biotech can be considered as long duration instruments, with most of the value contained in distant years. Hence, we believe the premium paid for that growth should decline as bond yields rise.

On that basis, the recent decline in US treasury yields to all-time lows may explain some of the strong performance of the biotech and tech sectors during 2020. However, we suspect that yields have now bottomed, with 10-year treasury yields rising to 1.30% in recent days. Further, if the economy continues to recover during 2021, we believe it likely that bond yields will trend higher, in which case growth sectors may suffer relative to other parts of the stock market.

Is there any evidence to support that notion? Well **Figure 3**, shows not only that the biotech sector has far outstripped pharma and tech since the late 1990s but also that there appears to be some negative correlation between treasury yields (inverted in the chart) and the relative performance of biotech. That appears to lend some support to the theoretical notion outlined above and suggests we may not be in the easiest phase of the economic cycle for the sector.

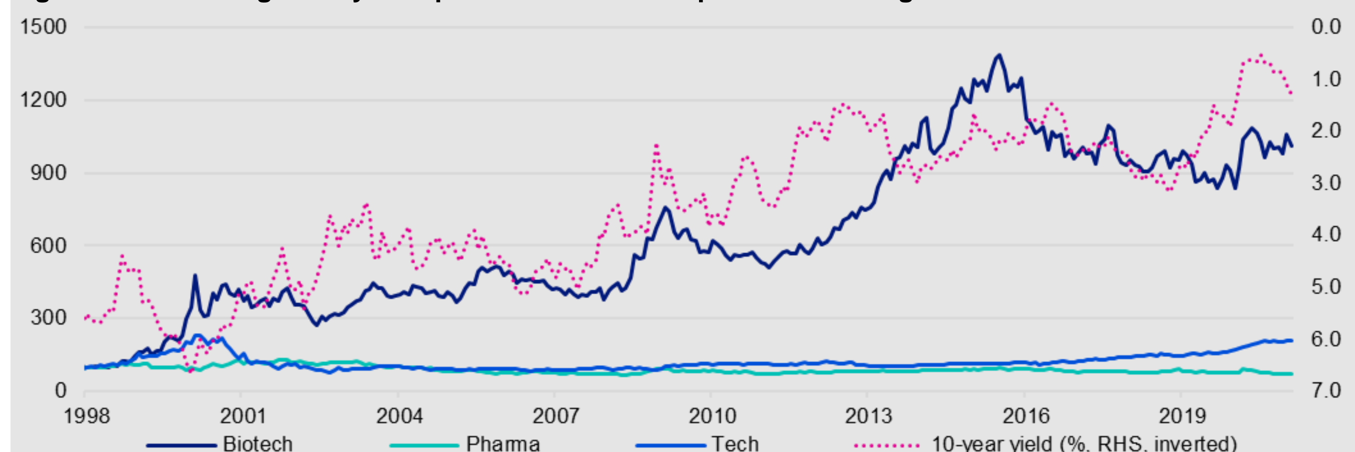
Another risk comes from government healthcare policies and regulation. For example, President Biden has previously favoured aligning US drug prices with those charged to non-US clients. This could reduce the profitability of future medicines. Further, the biotech sector is heavily regulated, especially when it comes to genome editing. For example, the embryos in the earlier mentioned CRISPR-Cas9 research to remove a predisposition to heart problems were not allowed to develop, as this is illegal in the US (there are fears something similar was allowed in China – see this). Realising the full value of ongoing research may rely upon changes to the global regulatory environment.

So, we believe the biotech sector could have a bright future, with new technologies able to solve an increasing array of problems. This should justify a valuation premium, in our opinion. However, the excess growth enjoyed by the sector relative to the market has narrowed, accompanied by a reduction in the valuation premium, which we think is fair. Perhaps the biggest threats over the next year or so will be the economic cycle (rising bond yields) and regulatory risk.

This is currently our favoured part of the healthcare sector. Though, tactical considerations point to the need for patience over the coming year or so, we consider biotechnology to be a strategic pillar of our model portfolios.

Unless stated otherwise, all data as of 18 February 2021

Figure 3 – Will rising bond yields penalise the relative performance of growth sectors?



Based on monthly data (month-end) from January 1998 to February 2021 (the latter is as of 18 February 2021). Using Datastream US sector indices divided by Datastream US Market Index. Relative indices are rebased to 100 on 31 January 1998. Past performance is no guarantee of future results. Source: Refinitiv Datstream and Invesco

Figure 4 – Asset class total returns

Data as at 18/02/2021		Current	Total Return (USD, %)					Total Return (Local Currency, %)				
	Index	Level/RY	1w	1m	QTD	YTD	12m	1w	1m	QTD	YTD	12m
Equities												
World	MSCI	679	-0.1	3.6	5.2	5.2	20.1	0.0	3.7	5.5	5.5	17.2
Emerging Markets	MSCI	1425	-0.2	5.0	10.5	10.5	33.4	-0.1	5.0	11.0	11.0	32.7
China	MSCI	126	-1.0	9.6	16.9	16.9	49.4	-0.9	9.5	16.9	16.9	47.9
US	MSCI	3833	-0.2	4.2	4.7	4.7	21.1	-0.2	4.2	4.7	4.7	21.1
Europe	MSCI	1880	0.0	1.1	2.3	2.3	8.8	0.2	0.5	2.9	2.9	-1.3
Europe ex-UK	MSCI	2353	-0.7	1.0	1.5	1.5	12.5	-0.2	1.1	2.9	2.9	1.0
UK	MSCI	1078	2.7	1.3	4.8	4.8	-2.6	1.8	-1.4	2.7	2.7	-9.0
Japan	MSCI	4071	-0.1	3.5	5.6	5.6	25.6	0.9	5.6	8.2	8.2	21.0
Government Bonds												
World	BofA-ML	0.38	-1.2	-1.6	-2.8	-2.8	5.6	-0.8	-1.3	-2.0	-2.0	0.8
Emerging Markets	BBloom	4.12	-1.5	-0.7	-3.0	-3.0	0.6	-1.5	-0.7	-3.0	-3.0	0.6
China	BofA-ML	3.17	-0.5	0.1	1.2	1.2	8.9	0.0	-0.2	0.1	0.1	0.6
US (10y)	Datastream	1.27	-0.8	-1.1	-2.7	-2.7	5.9	-0.8	-1.1	-2.7	-2.7	5.9
Europe	Bofa-ML	-0.05	-1.7	-1.6	-3.3	-3.3	11.7	-1.2	-1.6	-2.0	-2.0	0.2
Europe ex-UK (EMU, 10y)	Datastream	-0.38	-1.6	-1.7	-3.2	-3.2	11.1	-1.1	-1.7	-1.9	-1.9	-0.4
UK (10y)	Datastream	0.64	-0.5	-0.4	-1.8	-1.8	7.6	-1.4	-3.1	-3.7	-3.7	0.6
Japan (10y)	Datastream	0.09	-1.1	-2.4	-2.9	-2.9	2.8	-0.1	-0.4	-0.6	-0.6	-1.0
IG Corporate Bonds												
Global	BofA-ML	1.56	-0.7	-0.6	-1.7	-1.7	7.1	-0.6	-0.7	-1.4	-1.4	3.8
Emerging Markets	BBloom	3.53	0.1	0.9	0.3	0.3	8.7	0.1	0.9	0.3	0.3	8.7
China	BofA-ML	4.11	-0.4	0.2	1.4	1.4	10.4	0.1	-0.1	0.3	0.3	2.0
US	BofA-ML	2.00	-0.6	-0.8	-1.9	-1.9	4.8	-0.6	-0.8	-1.9	-1.9	4.8
Europe	BofA-ML	0.40	-0.9	-0.5	-1.8	-1.8	12.6	-0.4	-0.4	-0.4	-0.4	1.0
UK	BofA-ML	1.73	-0.2	0.7	-0.8	-0.8	10.2	-1.1	-2.0	-2.8	-2.8	3.0
Japan	BofA-ML	0.43	-1.1	-2.0	-2.5	-2.5	3.6	-0.1	-0.1	-0.1	-0.1	-0.2
HY Corporate Bonds												
Global	BofA-ML	4.61	0.0	1.1	1.0	1.0	8.2	0.0	1.0	1.2	1.2	6.0
US	BofA-ML	4.72	-0.1	0.9	1.3	1.3	6.4	-0.1	0.9	1.3	1.3	6.4
Europe	BofA-ML	2.98	-0.4	1.0	0.1	0.1	14.9	0.1	1.1	1.4	1.4	3.0
Cash (Overnight LIBOR)												
US		0.08	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2
Euro Area		-0.58	-0.3	0.0	-1.1	-1.1	11.4	0.0	-0.1	-0.1	-0.1	-0.6
UK		0.04	1.1	2.9	2.2	2.2	7.6	0.0	0.0	0.0	0.0	0.1
Japan		-0.08	-0.9	-1.9	-2.3	-2.3	3.9	0.0	0.0	0.0	0.0	-0.1
Real Estate (REITs)												
Global	FTSE	1812	-0.8	2.6	2.2	2.2	-10.0	-0.3	2.6	3.5	3.5	-19.3
Emerging Markets	FTSE	1979	0.5	-0.9	0.5	0.5	-11.5	1.0	-0.9	1.9	1.9	-20.7
US	FTSE	2936	-1.4	4.8	4.6	4.6	-10.8	-1.4	4.8	4.6	4.6	-10.8
Europe ex-UK	FTSE	3480	-2.5	-3.9	-7.3	-7.3	-8.6	-2.0	-3.9	-6.0	-6.0	-18.1
UK	FTSE	1365	1.3	2.3	1.4	1.4	-10.5	0.4	-0.5	-0.7	-0.7	-16.4
Japan	FTSE	2786	0.0	8.5	6.5	6.5	-7.6	1.0	10.7	9.1	9.1	-11.0
Commodities												
All	GSCI	2274	3.1	9.4	15.0	15.0	-3.3	-	-	-	-	-
Energy	GSCI	331	4.4	15.2	23.8	23.8	-23.1	-	-	-	-	-
Industrial Metals	GSCI	1523	2.8	7.0	8.8	8.8	32.9	-	-	-	-	-
Precious Metals	GSCI	2077	-2.5	-1.9	-5.6	-5.6	10.9	-	-	-	-	-
Agricultural Goods	GSCI	433	2.5	1.1	8.2	8.2	25.0	-	-	-	-	-
Currencies (vs USD)*												
EUR		1.21	-0.3	0.1	-1.0	-1.0	12.0	-	-	-	-	-
JPY		105.68	-0.9	-1.9	-2.3	-2.3	4.0	-	-	-	-	-
GBP		1.39	0.9	2.7	2.0	2.0	7.0	-	-	-	-	-
CHF		1.12	-0.7	-0.6	-1.2	-1.2	9.7	-	-	-	-	-
CNY		6.49	-0.5	0.1	0.6	0.6	7.8	-	-	-	-	-

Notes: *The currency section is organised so that in all cases the numbers show the movement in the mentioned currency versus USD (+ve indicates appreciation, -ve indicates depreciation). Past performance is no guarantee of future results. Please see appendix for definitions, methodology and disclaimers. Source: Refinitiv Datastream and Invesco

Figure 5 – World equity sector total returns relative to market (%)

Data as at 18/02/2021	Global				
	1w	1m	QTD	YTD	12m
Energy	**1.7**	**-2.3**	**0.7**	**0.7**	**-23.8**
Basic Materials	**1.1**	**-1.1**	**0.7**	**0.7**	**15.0**
Basic Resources	2.3	0.1	2.7	2.7	22.8
Chemicals	-0.5	-2.6	-1.8	-1.8	6.2
Industrials	**-0.3**	**-1.0**	**-2.1**	**-2.1**	**-1.7**
Construction & Materials	-1.2	-2.9	-1.8	-1.8	-4.0
Industrial Goods & Services	-0.2	-0.8	-2.1	-2.1	-1.4
Consumer Discretionary	**-0.1**	**1.5**	**0.5**	**0.5**	**11.9**
Automobiles & Parts	-2.0	-1.5	3.8	3.8	43.5
Media	-0.2	5.2	0.1	0.1	7.0
Retailers	0.7	0.8	-0.6	-0.6	11.0
Travel & Leisure	1.0	2.5	-0.6	-0.6	-8.6
Consumer Products & Services	-0.6	2.7	0.7	0.7	14.9
Consumer Staples	**-0.2**	**-3.5**	**-5.8**	**-5.8**	**-12.6**
Food, Beverage & Tobacco	-0.1	-2.6	-5.5	-5.5	-13.8
Personal Care, Drug & Grocery Stores	-0.4	-5.1	-6.3	-6.3	-10.4
Healthcare	**-0.8**	**-2.7**	**-1.8**	**-1.8**	**-0.9**
Financials	**1.5**	**-0.1**	**1.6**	**1.6**	**-12.0**
Banks	2.4	0.2	2.9	2.9	-16.2
Financial Services	0.6	0.8	2.2	2.2	-3.1
Insurance	0.6	-1.8	-1.6	-1.6	-13.9
Real Estate	**-0.5**	**-0.9**	**-3.0**	**-3.0**	**-21.5**
Technology	**-0.7**	**4.5**	**4.5**	**4.5**	**27.4**
Telecommunications	**0.3**	**-1.2**	**-2.0**	**-2.0**	**-9.6**
Utilities	**-1.3**	**-5.6**	**-6.4**	**-6.4**	**-17.4**

Notes: Returns shown are for Datastream sector indices versus the total market index. Past performance is no guarantee of future results.
Source: Refinitiv Datastream and Invesco

Figure 6a – US factor index total returns (%)

Data as at 18/02/2021	Absolute					Relative to Market				
	1w	1m	QTD	YTD	12m	1w	1m	QTD	YTD	12m
Growth	0.0	4.3	6.6	6.6	33.9	0.0	0.3	2.1	2.1	13.3
Low volatility	0.2	0.7	-0.4	-0.4	8.6	0.2	-3.2	-4.7	-4.7	-8.1
Price momentum	-0.4	4.2	6.4	6.4	20.6	-0.4	0.2	1.9	1.9	2.0
Quality	0.0	2.5	5.4	5.4	21.3	0.0	-1.5	0.9	0.9	2.6
Size	-0.4	3.5	10.1	10.1	19.7	-0.3	-0.5	5.5	5.5	1.3
Value	1.2	3.8	12.2	12.2	19.1	1.2	-0.2	7.5	7.5	0.7
Market	0.0	4.0	4.4	4.4	18.2					
Market - Equal-Weighted	0.1	2.6	5.5	5.5	16.4					

Notes: All indices are subsets of the S&P 500 index, they are rebalanced monthly, use data in US dollars and are equal-weighted. Growth includes stocks in the top third based on both their 5-year sales per share trend and their internal growth rate (the product of the 5-year average return on equity and the retention ratio); Low volatility includes stocks in the bottom quintile based on the standard deviation of their daily returns in the previous three months; Price momentum includes stocks in the top quintile based on their performance in the previous 12 months; Quality includes stocks in the top third based on both their return on invested capital and their EBIT to EV ratio (earnings before interest and taxes to enterprise value); Size includes stocks in the bottom quintile based on their market value in US dollars. Value includes stocks in the bottom quintile based on their price to book value ratios. The market represents the S&P 500 index. Past performance is no guarantee of future results.
Source: Refinitiv Datastream and Invesco

Figure 6b – European factor index total returns relative to market (%)

Data as at 18/02/2021	Absolute					Relative to Market				
	1w	1m	QTD	YTD	12m	1w	1m	QTD	YTD	12m
Growth	-0.4	2.2	3.1	3.1	19.3	-0.8	1.1	-0.5	-0.5	21.2
Low volatility	-0.4	0.1	1.4	1.4	-2.9	-0.8	-1.0	-2.1	-2.1	-1.3
Price momentum	-0.8	3.1	5.1	5.1	14.2	-1.2	2.0	1.5	1.5	16.0
Quality	-0.4	1.5	4.5	4.5	7.8	-0.8	0.4	0.9	0.9	9.5
Size	-0.7	1.4	4.5	4.5	7.3	-1.1	0.3	0.9	0.9	9.0
Value	1.3	2.1	6.2	6.2	-2.7	0.9	1.0	2.5	2.5	-1.2
Market	0.4	1.1	3.6	3.6	-1.6					
Market - Equal-Weighted	0.0	1.4	3.7	3.7	2.4					

Notes: All indices are subsets of the STOXX 600 index, they are rebalanced monthly, use data in euros and are equal-weighted. Growth includes stocks in the top third based on both their 5-year sales per share trend and their internal growth rate (the product of the 5-year average return on equity and the retention ratio); Low volatility includes stocks in the bottom quintile based on the standard deviation of their daily returns in the previous three months; Price momentum includes stocks in the top quintile based on their performance in the previous 12 months; Quality includes stocks in the top third based on both their return on invested capital and their EBIT to EV ratio (earnings before interest and taxes to enterprise value); Size includes stocks in the bottom quintile based on their market value in euros; Value includes stocks in the bottom quintile based on their price to book value ratios. The market represents the STOXX 600 index. Past performance is no guarantee of future results.
Source: Refinitiv Datastream and Invesco

Figure 7 – Model asset allocation

	Neutral	Policy Range		Allocation	Position vs Neutral
Cash Equivalents	**5%**	**0-10%**		**10%**	
Cash	2.5%			10%	
Gold	2.5%			0%	
Bonds	**40%**	**10-70%**	↓	**20%**	
Government	25%	10-40%		15%	
US	8%		↓	2%	
Europe ex-UK (Eurozone)	7%		↑	4%	
UK	1%		↑	2%	
Japan	7%		↓	3%	
Emerging Markets	2%			4%	
China**	0.2%			1%	
Corporate IG	10%	0-20%	↓	0%	
US Dollar	5%		↓	0%	
Euro	2%		↓	0%	
Sterling	1%		↓	0%	
Japanese Yen	1%		↓	0%	
Emerging Markets	1%		↓	0%	
China**	0.1%			0%	
Corporate HY	5%	0-10%	↓	5%	
US Dollar	4%		↓	4%	
Euro	1%		↓	1%	
Equities	**45%**	**20-60%**	↑	**50%**	
US	25%		↑	18%	
Europe ex-UK	7%		↑	12%	
UK	4%		↑	6%	
Japan	4%			6%	
Emerging Markets	5%		↑	8%	
China**	2%			3%	
Real Estate	**8%**	**0-16%**	↑	**16%**	
US	2%		↑	3%	
Europe ex-UK	2%		↑	4%	
UK	1%			3%	
Japan	2%		↓	3%	
Emerging Markets	1%		↑	3%	
Commodities	**2%**	**0-4%**	↑	**4%**	
Energy	1%		↑	2%	
Industrial Metals	0.3%		↑	1%	
Precious Metals	0.3%			0%	
Agriculture	0.3%		↑	1%	
Total	**100%**			**100%**	

Currency Exposure (including effect of hedging)					
USD	48%		↓	36%	
EUR	20%		↑	23%	
GBP	7%		↑	12%	
JPY	15%		↓	13%	
EM	9%		↑	15%	
Total	**100%**			**100%**	

Notes: This is a theoretical portfolio and is for illustrative purposes only. See the latest The Big Picture document for more details. It does not represent an actual portfolio and is not a recommendation of any investment or trading strategy. Arrows indicate the direction of the most recent changes. Source: Invesco

Figure 8 – Model allocation for global sectors

	Neutral	Invesco	Preferred Region
Energy	**5.8%**	**Neutral**	**US**
Basic Materials	**4.3%**	**Underweight ↓**	**Europe**
Basic Resources	2.4%	Underweight	Europe
Chemicals	1.9%	Neutral ↓	US
Industrials	**12.8%**	**Neutral ↓**	**US**
Construction & Materials	1.6%	Neutral	Europe
Industrial Goods & Services	11.3%	Neutral ↓	US
Consumer Discretionary	**16.5%**	**Overweight ↑**	**Japan**
Automobiles & Parts	2.7%	Underweight	Japan
Media	1.4%	Overweight ↑	US
Retailers	6.1%	Underweight ↓	EM
Travel & Leisure	2.1%	Overweight ↑	US
Consumer Products & Services	4.2%	Overweight ↑	Japan
Consumer Staples	**6.6%**	**Overweight**	**Europe**
Food, Beverage & Tobacco	4.3%	Overweight	Europe
Personal Care, Drug & Grocery Stores	2.3%	Underweight	Europe
Healthcare	**10.3%**	**Underweight ↓**	**Europe**
Financials	**13.7%**	**Neutral**	**EM**
Banks	6.3%	Neutral	EM
Financial Services	4.1%	Overweight	US
Insurance	3.2%	Neutral ↑	Europe
Real Estate	**3.4%**	**Overweight**	**EM**
Technology	**19.0%**	**Overweight**	**US**
Telecommunications	**4.2%**	**Neutral**	**Europe**
Utilities	**3.4%**	**Neutral**	**Europe**

Notes: These are theoretical allocations which are for illustrative purposes only. They do not represent an actual portfolio and are not a recommendation of any investment or trading strategy. See the latest Strategic Sector Selector for more details.
Source: Refinitiv Datastream and Invesco

Appendix

Methodology for asset allocation, expected returns and optimal portfolios

Portfolio construction process

The optimal portfolios are theoretical and not real. We use optimisation processes to guide our allocations around "neutral" and within prescribed policy ranges based on our estimations of expected returns and using historical covariance information. This guides the allocation to global asset groups (equities, government bonds etc.), which is the most important level of decision. For the purposes of this document the optimal portfolios are constructed with a one-year horizon.

Which asset classes?

We look for investibility, size and liquidity. We have chosen to include equities, bonds (government, corporate investment grade and corporate high-yield), REITs to represent real estate, commodities and cash (all across a range of geographies). We use cross-asset correlations to determine which decisions are the most important.

Neutral allocations and policy ranges

We use market capitalisation in USD for major benchmark indices to calculate neutral allocations. For commodities, we use industry estimates for total ETP market cap + assets under management in hedge funds + direct investments. We use an arbitrary 5% for the combination of cash and gold. We impose diversification by using policy ranges for each asset category (the range is usually symmetric around neutral).

Expected/projected returns

The process for estimating expected returns is based upon yield (except commodities, of course). After analysing how yields vary with the economic cycle, and where they are situated within historical ranges, we forecast the direction and amplitude of moves over the next year. Cash returns are calculated assuming a straight-line move in short term rates towards our targets (with, of course, no capital gain or loss). Bond returns assume a straight-line progression in yields, with capital gains/losses predicated upon constant maturity (effectively supposing constant turnover to achieve that). Forecasts of corporate investment-grade and high-yield spreads are based upon our view of the economic cycle (as are forecasts of credit losses). Coupon payments are added to give total returns. Equity and REIT returns are based on dividend growth assumptions. We calculate total returns by applying those growth assumptions and adding the forecast dividend yield. No such metrics exist for commodities; therefore, we base our projections on US CPI-adjusted real prices relative to their long-term averages and views on the economic cycle. All expected returns are first calculated in local currency and then, where necessary, converted into other currency bases using our exchange rate forecasts.

Optimising the portfolio

Using a covariance matrix based on monthly local currency total returns for the last 5 years and we run an optimisation process that maximises the Sharpe Ratio. Another version maximises Return subject to volatility not exceeding that of our Neutral Portfolio. The optimiser is based on the Markowitz model.

Currency hedging

We adopt a cautious approach when it comes to currency hedging as currency movements are notoriously difficult to accurately predict and sometimes hedging can be costly. Also, some of our asset allocation choices are based on currency forecasts. We use an amalgam of central bank rate forecasts, policy expectations and real exchange rates relative to their historical averages to predict the direction and amplitude of currency moves.

Definitions of data and benchmarks for Figure 4

Sources: we source data from Datastream unless otherwise indicated.

Cash: returns are based on a proprietary index calculated using the Intercontinental Exchange Benchmark Administration overnight LIBOR (London Interbank Offer Rate). The global rate is the average of the euro, British pound, US dollar and Japanese yen rates. The series started on 1st January 2001 with a value of 100.

Gold: London bullion market spot price in USD/troy ounce.

Government bonds: Current levels, yields and total returns use Datastream benchmark 10-year yields for the US, Eurozone, Japan and the UK, and the Bank of America Merrill Lynch government bond total return index for the World and Europe. The emerging markets yields and returns are based on the Barclays Bloomberg emerging markets sovereign US dollar bond index.

Corporate investment grade (IG) bonds: Bank of America Merrill Lynch investment grade corporate bond total return indices, except for in emerging markets where we use the Barclays Bloomberg emerging markets corporate US dollar bond index.

Corporate high yield (HY) bonds: Bank of America Merrill Lynch high yield total return indices

Equities: We use MSCI benchmark gross total return indices for all regions.

Commodities: Goldman Sachs Commodity total return indices

Real estate: FTSE EPRA/NAREIT total return indices

Currencies: Global Trade Information Services spot rates

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Authors

Paul Jackson
Global Head of Asset Allocation Research
Telephone +44(0)20 3370 1172
paul.jackson@invesco.com
London, EMEA

András Vig
Multi-Asset Strategist
Telephone +44(0)20 3370 1152
andras.vig@invesco.com
London, EMEA

Global Market Strategy Office

Kristina Hooper
Chief Global Market Strategist
Kristina.Hooper@invesco.com
New York, Americas

Brian Levitt
Global Market Strategist, Americas
Brian.Levitt@invesco.com
New York, Americas

Talley Léger
Investment Strategist, Equities
Talley.Leger@invesco.com
New York, Americas

Ashley Oerth
Investment Strategy Analyst
Ashley.Oerth@invesco.com
London, EMEA

Arnab Das
Global Market Strategist
Arnab.Das@invesco.com
London, EMEA

Luca Tobagi, CFA*
Product Director / Investment Strategist
Luca.Tobagi@invesco.com
Milan, EMEA

Paul Jackson
Global Head of Asset Allocation Research
paul.jackson@invesco.com
London, EMEA

András Vig
Multi-Asset Strategist
andras.vig@invesco.com
London, EMEA

David Chao
Global Market Strategist, Asia Pacific
David.Chao@invesco.com
Hong Kong, Asia Pacific

Tomo Kinoshita
Global Market Strategist, Japan
Tomo.Kinoshita@invesco.com
Tokyo, Asia Pacific

* Affiliated member

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