Uncommon truths
Geography, demography and the value of life

There is a lot of data about Covid-19 but we take a different look and try to answer several questions. First, why do mortality rates vary so much across countries (is there a seasonal and/or demographic effect)? Second, what do current policy decisions tell us about the value of life?

When we published the Big Picture quarterly outlook in mid-March, we spoke of three potential circuit breakers that could stop financial market panic: massive policy support, a peaking of Covid-19 data and a vaccine. Policy makers have delivered the first of those in record speed and size. However, a viable vaccine still looks like a story for 2021 (though as seen with the reaction to some positive initial testing for Gilead Sciences' remdesivir treatment, markets will not wait for definitive proof).

What about the data for Covid-19 cases and deaths? Perhaps one reason for the recent buoyant market performance is a feeling that we are past the worst of the pandemic. **Figure 1** shows the regional data for daily cases and deaths, smoothed by using a five-day moving average. The use of a logarithmic scale makes it easier to compare across regions but exaggerates the volatility of small numbers and dampens the changes at higher levels. For example, the five-day moving average of cases in Europe peaked at 38,067 on 4 April 2020 and had fallen to 22,544 by 1 May 2020.

In general, it looks as though there has been at least a flattening of daily cases in Asia, Europe and North America. The same applies to daily deaths, with the recent bump in Asian data due to the revised estimate of deaths in Wuhan. There has also been a clear peaking of cases and (perhaps) deaths in Oceania, which includes Australia and New Zealand, though remember that the log scale exaggerates changes in small numbers.

So far, so good. However, there would appear to have been a steady climb in daily cases in Africa over recent weeks (though not deaths) and a more pronounced rise in South American cases and deaths. The climb in South America has been largely focused on Brazil, Peru and Ecuador, though the recent spike in cases apparent in **Figure 1a** was mainly due to a revision of data in Ecuador which added 11,000 new cases to the cumulative total (a virtual doubling) on 24 April 2020. Though the world scoffed when China revised its Wuhan data, other countries have gone through similar changes in methodology (France and the UK, for example) and it is worth bearing in mind that both cases and deaths are likely being underestimated around the world (in our opinion).

Nevertheless, the trend in daily cases in Africa and South America does seem to be on the rise and there is concern that they could be the next epicentres of the pandemic. If that were the case, the death tolls could be higher than we have seen elsewhere due to less well-developed healthcare systems. There could also be an increase in financing problems for many of the poorest countries in the world, though they are already troubled on that score due to the global recession.

What does the data tell us about how different countries have been impacted by this outbreak? Because the data on cases depends on how much testing has been done (in our opinion), we will stick with an analysis of deaths in the rest of what follows.

Figure 1a – Covid-19 daily cases (5-day MA)

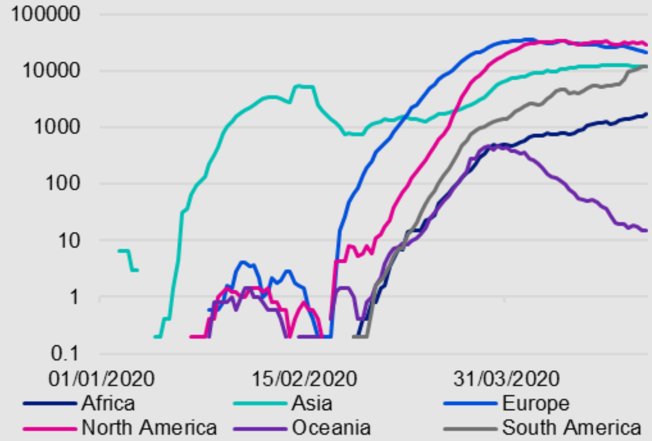
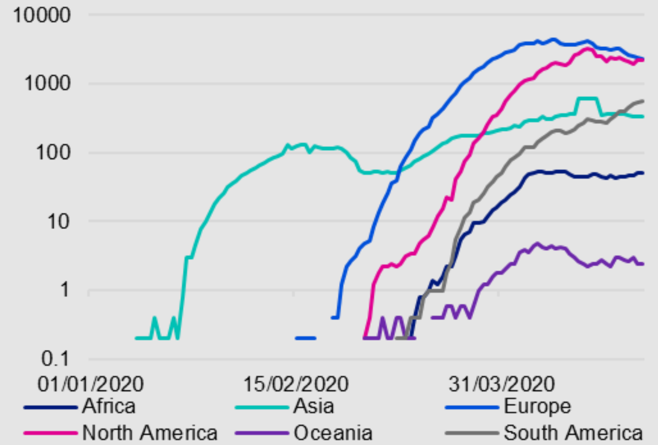


Figure 1b – Covid-19 daily deaths (5-day MA)



Based on daily data from 1 January 2020 to 1 May 2020. Scales are logarithmic. "5-day MA" is a five-day moving average. "North America" includes Bermuda, Canada, Greenland, Mexico, Puerto Rico and the United States. All other countries in the Americas and the Caribbean are included in "South America". Source: European Centre for Disease Prevention and Control and Invesco

Figure 2 shows a range of information across countries. The first chart ("Deaths versus population") suggests that Covid-19 mortality rates (deaths divided by 100,000 of population) are higher in Northern countries (those with latitude above 23.5 degrees) than in both Southern countries (those with latitude below -23.5 degrees) and those in the tropics (between -23.5 and +23.5 degrees).

That may be because the virus has spread more rapidly in Northern areas and, hence, mortality rates in the tropics and Southern countries may rise later. It could also be because the data from countries in the tropics and the South are less complete than that from Northern countries, though bear in mind that Australia and New Zealand are among Southern countries and Singapore is in the tropics.

Another explanation could be that Covid-19 is seasonal after all. This was much talked about at the beginning of the outbreak but hasn't really been discussed much of late. The second chart ("Mortality rate versus latitude") makes the relationship more explicit. Countries with high mortality rates are grouped in the Northern Hemisphere and all except two (Sint Maarten and Montserrat) are North of the tropics. By the way, the country with the mortality rate of 120 is the small European country of San Marino (population 34,000).

Obviously, we are not experts in this field but that data at least suggests the possibility that the incidence of Covid-19 in the Northern Hemisphere may fade as spring advances and summer arrives. The flip side is that it could become more of a problem in the Southern Hemisphere. Luckily, the world's population is concentrated in the North (3.9bn) and the tropics (3.5bn), rather than in the South (less than 0.2bn).

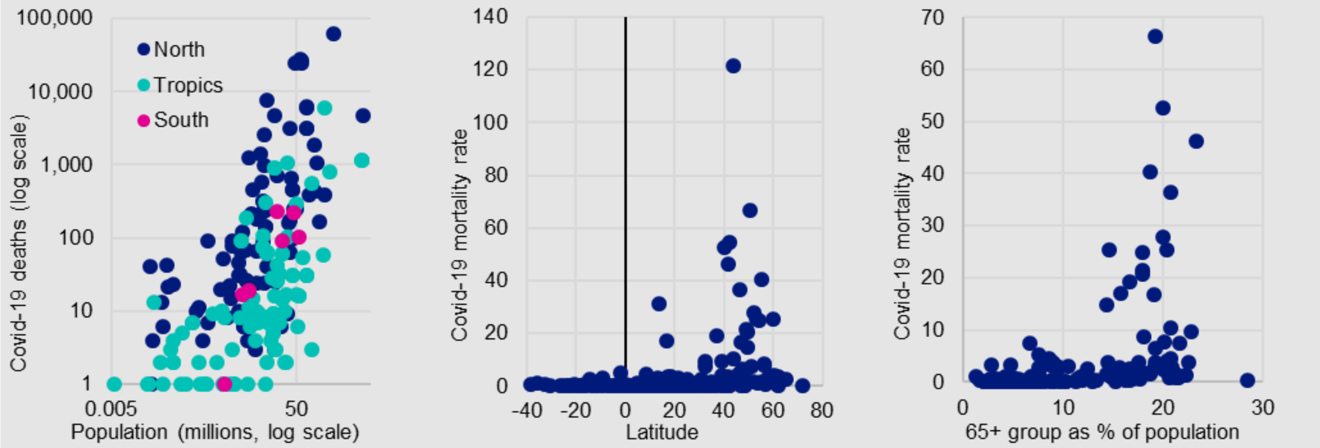
Another factor that could explain different mortality rates across countries is the age structure of the population. The UN doesn't provide such data for all countries in our sample but those for which it does suggest that high mortality rates are associated with countries where the 65+ age group is a high proportion of the population (see the "Mortality versus age" chart). The one obvious exception is Japan (the dot furthest to the right), which has the oldest population but a low Covid-19 mortality rate (0.3 deaths per 100,000 of population). By the way, the five countries in that chart with mortality rates above 30 per 100,000 are Belgium, Spain, Italy, the UK and France (in descending order).

No doubt there are many other factors that explain the difference in national mortality rates, such as the underlying health of the population. However, any serious analysis will run into the basic problem that Covid-19 deaths are measured and reported in different ways in different countries (and probably under reported in all, in our opinion). For example, the UK only started to include deaths in care homes on 29 April 2020.

This suggests the best way to capture the effect of Covid-19 will be some measure of excess deaths, which attempts to capture the total number of deaths over and above what would normally have occurred (especially since many of those taken by Covid-19 may have died during 2020 for other reasons).

Figure 2 – Are national Covid-19 mortality rates linked to geographic location and age of population?

Deaths versus population | **Mortality rate versus latitude** | **Mortality rate versus age**



Note: Covid-19 mortality rate is the number of Covid-19 deaths per 100,000 of population (the latter as of 2018). Latitude is the geographic latitude of each country as provided by Google Developers. "North" is the group of countries with latitude greater than 23.5 degrees. "Tropics" is the group of countries with latitude between -23.5 and +23.5 degrees. "South" is the group of countries with latitude less than -23.5 degrees. "65+ age group as percent of population" uses United Nations projections for 2020. As of 1 May 2020.
Source: European Centre for Disease Prevention and Control, Google Developers, United Nations and Invesco

On that basis, we will not know the true cost of Covid-19 (in terms of excess deaths), until well after the pandemic is over. A good example came from the swine flu pandemic of 2009-10 which at the time caused 18,138 recorded deaths, according to World Health Organisation (WHO) data. However, it was difficult to distinguish between deaths caused by swine flu and normal seasonal flu and a number of years later the US Centers for Disease Control and Prevention (CDC) estimated that the actual number of deaths lay somewhere between 151,700-575,000, based upon excess deaths and a probabilistic assignment of those deaths to swine flu.

We can of course already measure excess deaths during 2020, which gives a clue about the damage caused by Covid-19 (though doesn't yet tell us how many of the deaths were simply brought forward from later in the year). **Figure 3** shows such data for England and Wales, comparing weekly deaths in 2020 with the norms of the previous 10 years. **Figure 3a** compares weekly deaths with the average of the 2010-19 period. Having been in line with historical averages for most of this year, deaths in recent weeks have not only exceeded those norms but have gone well above the range seen over those 10 years.

Figure 3b shows the data in z-score format to give a statistical measure of the gap in weekly deaths versus historical norms. The total number of deaths in England and Wales exceed the historical average by around 9.5 standard deviations in the most recent week for which we have data (the week to 17 April 2020). Not surprisingly, it is the oldest groups that have suffered the most, with the 65-84 and 85+ age ranges recently 9 to 10 standard deviations above historical norms. More surprisingly, deaths for the youngest age range (0 to 14) are below historical norms, recently by between one and two standard deviations. However, we should be careful about the latter point, as deaths for the 0-14 age range are typically below 100 (versus 3,000-5,000 for the two older age groups), which renders it less reliable.

As an aside, **Figure 3a** shows that the lowest weekly death rate is typically the very last week of the year. This seems to confirm what many of us were taught at school, which is that those about to die often hold on for important occasions (birthdays and Christmas). However, that quirk may also be due to late reporting of deaths due to the closure of registry offices on public holidays (a notion supported by the fact that the other two dips in that chart are associated with the Whitsuntide and August bank holiday periods). This cautions against putting too much weight on the results of any one day or week.

The pattern seen in England and Wales is repeated across Europe as a whole, as witnessed by the EUROMOMO (European Mortality Monitoring Project) website. Most big European countries show similar excess death performance to England and Wales, with Germany the obvious exception (Berlin and Hesse data is in line with historical norms). A range of smaller countries have negative excess deaths in recent weeks (Finland, Greece, Hungary and Ireland, for example).

The age pattern for Europe is like that seen in **Figure 3b**, with the younger age ranges experiencing less deaths than normal in recent weeks. Indeed, the EUROMOMO data shows the real gap among the younger age groups is concentrated in the 5-14 year age range, which suggests that the lower than usual number of deaths could be linked to the closure of schools, perhaps due to less road accidents?

Figure 3a – England and Wales deaths by week

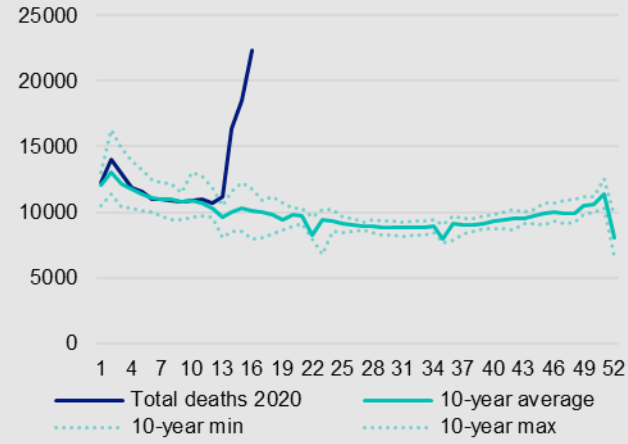
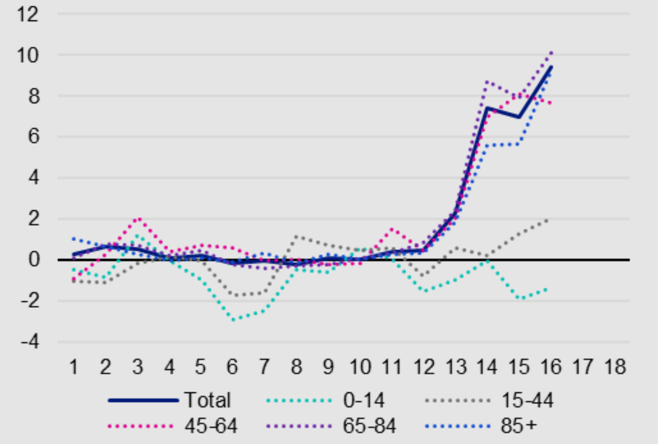


Figure 3b – England and Wales death z-scores



Based on weekly data from week ending 8 January 2010 to week ending 17 April 2020. 10-year average, 10-year min and 10-year max show the average, max and min for each week of the year, based on weekly data from 2010 to 2019. Z-scores show how far the 2020 weekly death tolls for each age range are from the 10-year average for that week and are calculated as 2020 deaths for each week minus the 10-year average for that week, divided by the standard deviation for that week. Source: UK Office for National Statistics and Invesco

Invesco

That latter point about the possibility of there being less road accident deaths for children because of lock downs, raises the possibility that Covid-19 may not only be bringing forward deaths that may have happened in the near future but also that the measures to control it may be reducing other types of death (road accidents and air pollution are obvious candidates). Unfortunately, it is also possible those same measures will cause an increase in other forms of death (for instance due to a lack of detection and treatment of cancer or the reluctance of patients with cardiac problems, say, to visit hospital A&E departments).

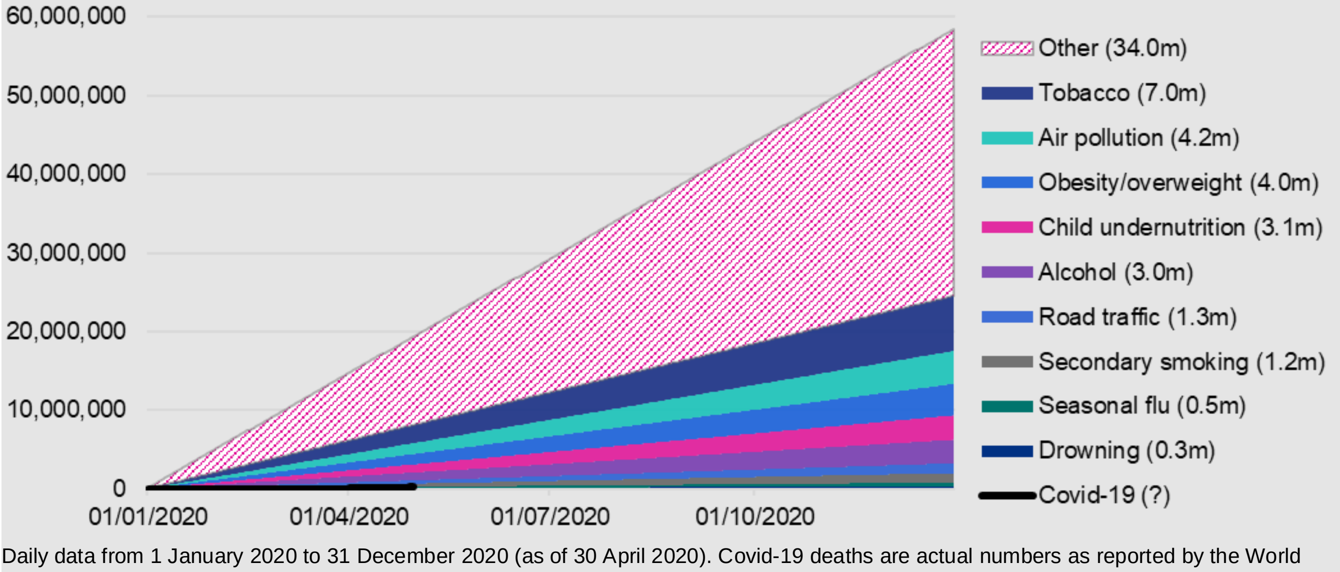
Again, it will only be with the help of excess deaths, measured over 2020 and future years, that we will have a fuller picture. Luckily, despite the data on excess deaths presented earlier, Covid-19 probably does not yet figure among the major causes of death so far during 2020. We estimate that if the 2020 global death rate (ex-Covid-19) was in line with the UN estimate for 2015-20 (7.5 deaths per thousand of population), there would have been around 58.5 million deaths this year (based on the UN population estimate of 7.795 billion). This is reflected in **Figure 4**, along with estimates of some common causes of death. The same chart shows actual Covid-19 deaths, which the WHO reported to be around 218,000, as of 30 April 2020. If deaths by other causes are evenly spread throughout the year, there would normally have been around 19.4 million deaths by this point in the year.

Of course, if measures had not been taken to prevent the spread of Covid-19, it is likely the number of deaths would now be much higher than it is and still rising exponentially. An analysis by the Federal Reserve Bank of St. Louis (*How fast has Covid-19 been spreading?* published on 27 March 2020) suggests that in the early stages the number of cases in many countries was doubling every two to three days, although there was evidence of a slowdown as the number of cases grew (perhaps because of measures already being taken).

If we assume that the number of cases doubled each week, then it would have taken only 32-33 weeks for everybody in the world to have contracted it (whether or not we allow for herd immunity occurring when 60%-70% of the population have contracted and recovered from the virus – as suggested by a range of academics in "*Expert comments about herd immunity*" on the Science Media Centre). If the numbers doubled only every two weeks, it would take slightly more than a year for that point to be reached.

Unfortunately, if we assume a 1% fatality rate (experts seem to put it in the 1%-2% range, according to "*Estimating case fatality rates of Covid-19*" published on the Lancet Journal website on 30 March 2020), that explosion of cases would result in around 55 million deaths worldwide (assuming herd immunity occurs at 70% of the population). That is roughly in line with the number of deaths we would have expected from other causes (as mentioned above).

Figure 4 -- Projected 2020 global deaths by common cause versus Covid-19



Daily data from 1 January 2020 to 31 December 2020 (as of 30 April 2020). Covid-19 deaths are actual numbers as reported by the World Health Organisation (WHO), as of 30 April 2020. "Other" is the difference between estimated total global deaths and those caused by the other causes shown in the chart (excluding Covid-19). Estimated total global deaths is calculated by applying the UN estimate of the crude death rate in the 2015-20 period (7.5 deaths per 1000 of population) to the UN medium variant estimate of world population in 2020 (7.795 bn). Estimated deaths for all other causes is based on typical annual deaths as supplied by the WHO and Unicef. Apart from Covid-19, deaths are assumed to occur at an even pace throughout the year. Source: United Nations, Unicef, World Health Organisation and Invesco

This raises an interesting question about how much we are willing to sacrifice to save lives? Put another way, how much value do we place upon life? The University of Bristol published a short paper upon the topic which is useful (*Calculating the value of human life: safety decisions that can be trusted*, 25 April 2018). In summary, the UK Department of Transport published a value of a prevented fatality estimate (VPF), which was £1.8mn in 2016, whereas the US Department for Transportation middle estimate was £7.0 million in 2015. Methodological differences may explain a lot of that gap and the UK method suffers from the assumption that all lives (old and young) have equal value and is based upon stated preferences (in surveys) rather than revealed preferences. Using a more refined (revealed preference) method, the University of Bristol's J-Value put a value of £8.6 million upon UK lives in 2015.

How do those numbers compare with the sacrifices we are currently making? If we assume that current lockdowns cause global GDP to be 10% lower in 2020 than it would otherwise have been, that implies a loss of around $9.7 trillion (by assuming nominal GDP growth would have been 6% in both 2019 and 2020 and starting from the World Bank's $85.9 trillion 2018 World GDP estimate). If we then combine that with an estimated 55 million lives that were saved, we derive a roughly $176,000 value per life saved. This is an underestimate because it assumes no further economic damage beyond 2020 and the estimated number of lives saved may be excessive.

That appears good value compared to the various value of life estimates given above. However, another way to think of this cost is in comparison to the future income that can be generated by the individuals saved. As Covid-19 deaths are largely concentrated in the older (and probably retired) age groups with little income generating capability (87% of UK Covid-19 deaths have been in the 65+ group, according to ONS data), the true burden is much higher than the $176,000 figure stated above. Also, lifetime earnings in many parts of the world will not reach that figure.

Using the UK as a developed world example. If UK GDP is 15% lower than it would otherwise have been in 2020 (the Office for Budget Responsibility suggests GDP will fall by 13% in 2020), the lost GDP will be around £0.34 trillion (GDP was £2.2 trillion in 2019, according to ONS data, and we assume nominal growth would have been 3% in 2020).

If Covid-19 were allowed to spread freely in the UK, we estimate there would be around 475,000 deaths (assuming herd immunity at 70% of the population and a 1% fatality rate), so the current lockdown may save around 440,000 lives (assuming actual deaths continue to rise from the current 27,000). That gives a cost per life saved of £773,000. Given the age distribution of Covid-19 deaths, the 13% of those saved who are not retired must generate £5.9 million per person during their lifetime to make this a zero-cost proposition to the rest of the population (and is not too far from Bristol's J-Value). Even if they all worked for a further 40 years (which they will not), that would require them to generate £147,500 per year, which is well above the £36,611 average salary in 2019 (according to ONS data).

Of course, it is impossible to put a value upon life but these estimates show two things: first, the debt burden (public and private) placed upon younger generations will again rise (largely to save older members of the community) and, second, perhaps it will cause a rethink about how much should be spent (and what measures we are willing to take) to prevent other ongoing deaths.

Is it acceptable that 7 million people die each year due to tobacco (with a further 1.2 million dying due to secondary smoking)? Or that there are 4 million deaths due to being overweight or obese, while there are 3 million children dying from undernutrition? Will we now prefer to live with less air pollution (4.2 million deaths) and road accidents (1.3 million)?

Clearly, not everything will change as a result of Covid-19 but perhaps it will cause us to place a different value upon life and to be braver in the restrictions governments are willing to impose to save lives.

Finally, as a note of caution, we are not epidemiologists nor scientists. However, we have tried to take a common sense look at some of the data and believe there are some interesting conclusions for investors and policy makers alike.

Unless stated otherwise, all data as of 01 May 2020.

Invesco

Figure 5 – Asset class total returns

Data as at 01/05/2020		Current	Total Return (USD, %)					Total Return (Local Currency, %)				
	Index	Level/RY	1w	1m	QTD	YTD	12m	1w	1m	QTD	YTD	12m
Equities												
World	MSCI	479	1.3	12.5	8.4	-14.7	-6.2	0.9	12.2	8.0	-13.4	-5.3
Emerging Markets	MSCI	917	4.3	11.0	8.2	-17.3	-12.5	3.5	10.6	8.2	-12.4	-7.9
US	MSCI	2702	-0.1	15.1	10.0	-11.6	-1.1	-0.1	15.1	10.0	-11.6	-1.1
Europe	MSCI	1412	4.2	9.2	5.6	-20.0	-13.6	2.4	8.2	4.9	-17.8	-12.1
Europe ex-UK	MSCI	1739	4.9	10.2	6.8	-17.4	-10.1	3.1	9.2	6.2	-16.0	-9.5
UK	MSCI	856	1.8	6.0	2.1	-27.3	-22.9	0.2	5.0	0.9	-23.2	-19.6
Japan	MSCI	2914	1.1	6.0	2.9	-14.2	-5.0	0.6	5.8	1.9	-15.6	-8.7
Government Bonds												
World	BofA-ML	0.31	0.8	0.7	1.0	3.7	8.1	0.1	0.3	0.5	4.3	7.9
Emerging Markets	BBloom	8.75	2.2	4.0	2.6	-13.3	-5.4	2.2	4.0	2.6	-13.3	-5.4
US (10y)	Datastream	0.64	-0.6	-0.5	0.1	14.4	22.2	-0.6	-0.5	0.1	14.4	22.2
Europe	Bofa-ML	0.22	2.9	1.3	0.8	-1.2	3.2	1.1	0.5	0.5	0.8	5.4
Europe ex-UK (EMU, 10y)	Datastream	-0.59	3.0	1.9	1.6	2.1	4.1	1.2	1.1	1.2	4.1	6.2
UK (10y)	Datastream	0.21	2.0	1.5	2.0	0.4	5.4	0.3	0.5	0.9	6.0	10.0
Japan (10y)	Datastream	-0.03	0.5	0.6	1.5	1.8	4.1	0.1	0.4	0.5	0.2	0.1
IG Corporate Bonds												
Global	BofA-ML	2.41	0.7	4.7	4.7	-1.1	5.2	0.2	4.4	4.5	-0.1	6.1
Emerging Markets	BBloom	6.35	0.7	6.8	6.7	-7.7	1.7	0.7	6.8	6.7	-7.7	1.7
US	BofA-ML	2.84	-0.1	4.9	5.1	0.8	9.0	-0.1	4.9	5.1	0.8	9.0
Europe	BofA-ML	1.20	2.8	4.4	3.9	-4.6	-2.5	0.9	3.6	3.6	-2.7	-0.5
UK	BofA-ML	2.39	2.4	5.7	6.7	-4.8	1.8	0.7	4.7	5.5	0.5	6.2
Japan	BofA-ML	0.51	0.5	0.1	0.9	1.3	4.0	0.0	-0.1	-0.1	-0.4	0.0
HY Corporate Bonds												
Global	BofA-ML	8.22	1.0	5.4	4.4	-10.3	-5.5	0.7	5.3	4.3	-9.9	-5.1
US	BofA-ML	8.27	0.5	4.9	3.5	-10.1	-5.6	0.5	4.9	3.5	-10.1	-5.6
Europe	BofA-ML	5.74	2.6	6.8	6.3	-11.3	-7.6	0.8	6.0	6.0	-9.5	-5.7
Cash (Overnight LIBOR)												
US		0.00	0.0	0.0	0.0	0.3	1.7	0.0	0.0	0.0	0.3	1.7
Euro Area		0.00	1.5	0.1	-0.5	-2.2	-2.4	0.0	0.0	0.0	-0.2	-0.5
UK		0.00	1.1	1.0	0.7	-5.6	-3.6	0.0	0.0	0.0	0.1	0.6
Japan		0.00	0.6	0.2	0.6	1.6	4.1	0.0	0.0	0.0	0.0	-0.1
Real Estate (REITs)												
Global	FTSE	1503	3.7	9.6	4.3	-25.3	-19.0	1.9	8.8	4.0	-23.8	-17.3
Emerging Markets	FTSE	1862	6.0	7.7	5.7	-24.6	-17.3	4.1	6.8	5.3	-23.1	-15.6
US	FTSE	2362	3.0	12.4	4.2	-26.0	-20.7	3.0	12.4	4.2	-26.0	-20.7
Europe ex-UK	FTSE	2856	5.2	6.7	2.8	-23.6	-13.1	3.3	5.9	2.5	-22.1	-11.3
UK	FTSE	1112	2.8	7.5	3.6	-29.6	-17.1	1.1	6.4	2.4	-25.7	-13.6
Japan	FTSE	2260	2.3	5.3	1.1	-24.0	-12.2	1.7	5.1	0.2	-25.2	-15.6
Commodities												
All	GSCI	1350	2.1	-6.6	-9.7	-47.9	-48.2	-	-	-	-	-
Energy	GSCI	156	3.1	-16.0	-19.5	-68.6	-69.4	-	-	-	-	-
Industrial Metals	GSCI	1014	0.1	3.4	1.0	-16.8	-17.3	-	-	-	-	-
Precious Metals	GSCI	1937	-2.4	6.5	6.0	8.3	28.0	-	-	-	-	-
Agricultural Goods	GSCI	300	0.7	-2.0	-4.8	-13.7	-7.4	-	-	-	-	-
Currencies (vs USD)*												
EUR		1.10	1.5	0.2	-0.4	-2.0	-1.9	-	-	-	-	-
JPY		106.95	0.6	0.2	0.6	1.6	4.2	-	-	-	-	-
GBP		1.25	1.7	0.9	1.2	-5.3	-4.1	-	-	-	-	-
CHF		1.04	1.2	0.4	0.0	0.7	5.9	-	-	-	-	-
CNY		7.06	0.3	0.5	0.3	-1.4	-4.6	-	-	-	-	-

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

Data as at 01/05/2020	Global				
	1w	**1m**	**QTD**	**YTD**	**12m**
Energy	**2.1**	**3.7**	**-23.7**	**-23.7**	**-28.8**
Basic Materials	**1.0**	**3.2**	**-3.1**	**-3.1**	**-3.5**
Basic Resources	0.4	4.0	-3.8	-3.8	-3.7
Chemicals	1.6	2.5	-2.3	-2.3	-3.5
Industrials	**1.5**	**0.0**	**-5.3**	**-5.3**	**-5.4**
Construction & Materials	3.7	-0.6	-6.4	-6.4	-7.0
Industrial Goods & Services	1.3	0.1	-5.2	-5.2	-5.1
Consumer Discretionary	**-0.2**	**2.2**	**1.2**	**1.2**	**0.3**
Automobiles & Parts	1.7	2.9	-6.7	-6.7	-5.5
Media	1.3	-0.2	-3.8	-3.8	-5.2
Retailers	-3.1	3.1	16.8	16.8	16.1
Travel & Leisure	1.6	4.5	-17.0	-17.0	-18.3
Consumer Products & Services	1.2	0.4	0.5	0.5	-0.5
Consumer Staples	**-1.5**	**-4.6**	**4.6**	**4.6**	**1.1**
Food, Beverage & Tobacco	-1.0	-4.4	1.8	1.8	-4.2
Personal Care, Drug & Grocery Stores	-2.4	-4.9	10.1	10.1	7.1
Healthcare	**-3.2**	**1.2**	**16.4**	**16.4**	**21.1**
Financials	**2.4**	**-2.7**	**-13.8**	**-13.8**	**-15.2**
Banks	3.4	-4.0	-18.5	-18.5	-21.0
Financial Services	2.3	1.3	-8.2	-8.2	-6.4
Insurance	0.7	-4.6	-10.6	-10.6	-12.8
Real Estate	**1.0**	**-2.2**	**-5.6**	**-5.6**	**-9.2**
Technology	**-0.5**	**2.7**	**14.7**	**14.7**	**25.7**
Telecommunications	**-0.9**	**-3.2**	**7.3**	**7.3**	**2.2**
Utilities	**-1.3**	**-3.6**	**2.4**	**2.4**	**-0.5**

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

Invesco

Figure 7a – US factor index total returns (%)

Data as at 30/04/2020	Absolute					Relative to Market				
	1w	1m	QTD	YTD	12m	1w	1m	QTD	YTD	12m
Growth	7.4	14.7	16.9	-10.2	1.2	3.2	3.3	3.6	-1.0	0.4
Low volatility	1.7	8.2	11.0	-6.8	2.6	-2.3	-2.5	-1.6	2.8	1.7
Price momentum	2.0	8.1	10.8	-8.9	-2.9	-2.0	-2.6	-1.8	0.4	-3.8
Quality	6.1	11.4	13.3	-15.6	-9.7	1.9	0.4	0.4	-6.9	-10.5
Size	12.6	21.3	23.1	-27.8	-24.8	8.2	9.3	9.1	-20.4	-25.5
Value	13.3	23.1	24.7	-27.8	-23.2	8.8	10.8	10.5	-20.4	-23.8
Market	4.1	11.0	12.8	-9.3	0.9					
Market - Equal-Weighted	6.6	12.3	14.4	-16.1	-8.9					

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 7b – European factor index total returns relative to market (%)

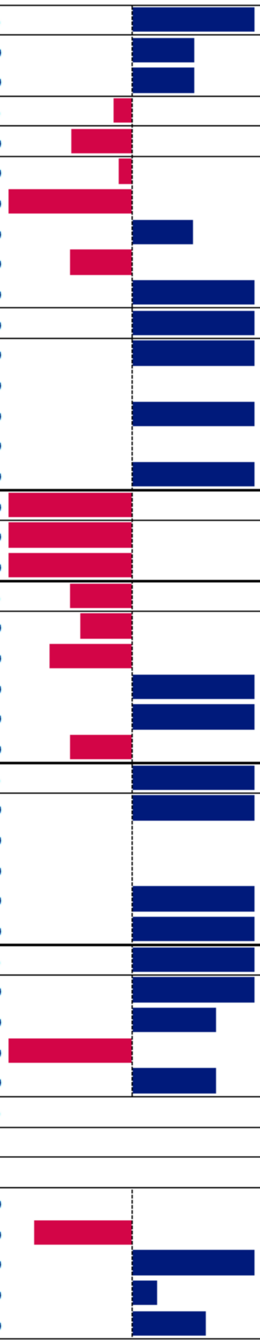
Data as at 30/04/2020	Absolute					Relative to Market				
	1w	1m	QTD	YTD	12m	1w	1m	QTD	YTD	12m
Growth	2.5	14.1	11.1	-10.0	0.7	0.2	5.3	4.2	8.8	12.2
Low volatility	0.7	9.4	7.6	-12.5	-2.4	-1.6	0.9	0.9	5.9	8.7
Price momentum	0.7	11.6	9.1	-8.8	2.2	-1.6	2.9	2.3	10.3	13.9
Quality	3.9	17.0	13.2	-18.9	-9.8	1.6	8.0	6.1	-1.9	0.5
Size	7.5	19.2	15.1	-22.3	-11.1	5.1	10.0	7.9	-6.0	-1.0
Value	7.4	11.6	9.4	-32.7	-30.0	5.0	3.0	2.6	-18.6	-22.0
Market	2.3	8.4	6.6	-17.3	-10.3					
Market - Equal-Weighted	3.8	11.7	9.1	-19.3	-12.2					

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

Invesco

Figure 8 – Model asset allocation

	Neutral	Policy Range		Allocation	Position vs Neutral	Hedged	Currency
Cash	**5%**	**0-10%**	↑	**10%**			
Cash	2.5%			5%			
Gold	2.5%		↑	5%			
Bonds	**45%**	**10-80%**	↓	**40%**			
Government	30%	10-50%	↑	20%			
US	10%		↑	9%			
Europe ex-UK (Eurozone)	8%			0%			
UK	2%		↑	3%			
Japan	8%			4%			
Emerging Markets	2%			4%			
Corporate IG	10%	0-20%		20%			
US Dollar	5%			10%			
Euro	2%		↓	2%			
Sterling	1%		↑	4%			
Japanese Yen	1%		↓	1%			
Emerging Markets	1%		↑	3%			
Corporate HY	5%	0-10%	↓	0%			
US Dollar	4%		↓	0%			
Euro	1%		↓	0%			
Equities	**40%**	**20-60%**	↓	**30%**			
US	24%		↑	14%			
Europe ex-UK	6%		↓	2%			
UK	3%		↑	6%			
Japan	3%		↓	6%			
Emerging Markets	4%		↓	2%			
Real Estate	**8%**	**0-16%**		**16%**			
US	2%		↑	5%			
Europe ex-UK	2%			2%			
UK	1%		↑	1%			
Japan	2%		↑	5%			
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	49%		↑	47%			
EUR	20%		↓	7%			
GBP	7%		↑	16%			
JPY	15%		↑	18%			
EM	8%		↓	13%			
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

Invesco

Figure 9 – Model allocations for Global sectors

	Neutral	Invesco	
Energy	**4.1%**	**Overweight**	↑
Basic Materials	**4.0%**	**Neutral**	↑
Basic Resources	2.1%	Underweight	↓
Chemicals	1.9%	Overweight	↑
Industrials	**12.4%**	**Underweight**	
Construction & Materials	1.5%	Underweight	↓
Industrial Goods & Services	10.9%	Underweight	
Consumer Discretionary	**13.7%**	**Underweight**	↓
Automobiles & Parts	2.0%	Neutral	
Media	1.3%	Underweight	↓
Retailers	4.9%	Neutral	↑
Travel & Leisure	1.9%	Underweight	↓
Consumer Products & Services	3.7%	Underweight	↓
Consumer Staples	**8.0%**	**Overweight**	
Food, Beverage & Tobacco	5.1%	Overweight	
Personal Care, Drug & Grocery Stores	2.9%	Overweight	
Healthcare	**11.2%**	**Neutral**	↓
Financials	**15.6%**	**Neutral**	↑
Banks	7.3%	Overweight	↑
Financial Services	4.4%	Neutral	↑
Insurance	3.9%	Underweight	
Real Estate	**4.2%**	**Overweight**	
Technology	**17.6%**	**Overweight**	↑
Telecommunications	**5.2%**	**Neutral**	↑
Utilities	**4.0%**	**Underweight**	

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.

Invesco

Definitions of data and benchmarks for Figure 5

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

Invesco

Important information

Your capital is at risk. You may not get back the amount you invested.
By accepting this document, you consent to communicating with us in English, unless you inform us otherwise.

This document is for informational purposes only and is intended only for Professional Clients and Financial Advisers in Continental Europe (as defined in important information); Qualified Investors in Switzerland; Professional Clients only in Dubai, Ireland, the Isle of Man, Jersey, Guernsey, Malta and the UK; for Qualified Clients in Israel, for Professional/Qualified/Sophisticated Investors in Bahrain, Jordan, Kuwait, Lebanon, Mauritius, Oman, Qatar, Saudi Arabia, South Africa, Tunisia, Turkey, and the United Arab Emirates; for Professional Investors in Hong Kong, for certain specific sovereign wealth funds and/or Qualified Domestic Institutional Investors approved by local regulators only in the People's Republic of China, for Institutional Investors in Australia, the United States and Singapore; for Wholesale Investors in New Zealand; for certain specific Qualified Institutions and/or Sophisticated Investors only in Taiwan, for Qualified Professional Investors in Korea, for certain specific institutional investors in Brunei, for Qualified Institutional Investors and/or certain specific institutional investors in Thailand and for certain specific institutional investors in Malaysia, upon request, for informational purposes only. This document is only intended for use with Qualified Institutional Investors in Japan; in Canada, this document is restricted to Accredited Investors as defined under National Instrument 45-106. It is not intended for and should not be distributed to, or relied upon by, the public or retail investors. It is not intended for solicitation of any security. Please do not redistribute this document.

For the distribution of this document, Continental Europe is defined as Andorra, Austria, Belgium, Czech Republic, Croatia, Denmark, Finland, France, Germany, Gibraltar, Greece, Hungary, Italy, Latvia, Liechtenstein, Luxembourg, Monaco, Netherlands, Norway, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden.

This document is not an offering of a financial product and should not be distributed to retail clients who are resident in jurisdiction where its distribution is not authorized or is unlawful. Circulation, disclosure, or dissemination of all or any part of this document to any unauthorized person is prohibited. This document is only intended for and will be only distributed to persons resident in jurisdictions where such distribution or availability would not be contrary to local laws or regulations.

This document is solely for duly registered banks or a duly authorized Monegasque intermediary acting as a professional institutional investor which has such knowledge and experience in financial and business matters as to be capable of evaluating the contents of this document. Consequently, this document may only be communicated to banks duly licensed by the "Autorité de Contrôle Prudentiel et de Résolution" and fully licensed portfolio management companies by virtue of Law n° 1.144 of July 26, 1991 and Law 1.338, of September 7, 2007, duly licensed by the "Commission de Contrôle des Activités Financières. Such regulated intermediaries may in turn communicate this document to potential investors.

This document has been prepared only for those persons to whom Invesco has provided it. It should not be relied upon by anyone else. Information contained in this document may not have been prepared or tailored for an Australian audience and does not constitute an offer of a financial product in Australia. You may only reproduce, circulate and use this document (or any part of it) with the consent of Invesco.
The information in this document has been prepared without taking into account any investor's investment objectives, financial situation or particular needs. Before acting on the information the investor should consider its appropriateness having regard to their investment objectives, financial situation and needs.

You should note that this information:

- may contain references to dollar amounts which are not Australian dollars;
- may contain financial information which is not prepared in accordance with Australian law or practices;
- may not address risks associated with investment in foreign currency denominated investments; and
- does not address Australian tax issues.

Issued in Australia and New Zealand by Invesco Australia Limited (ABN 48 001 693 232), Level 26, 333 Collins Street, Melbourne, Victoria, 3000, Australia which holds an Australian Financial Services Licence number 239916.

This document is issued only to wholesale investors in New Zealand to whom disclosure is not required under Part 3 of the Financial Markets Conduct Act. This document has been prepared only for those persons to whom it has been provided by Invesco. It should not be relied upon by anyone else and must not be distributed to members of the public in New Zealand. Information contained in this document may not have been prepared or tailored for a New Zealand audience. You may only reproduce, circulate and use this document (or any part of it) with the consent of Invesco. This document does not constitute and should not be construed as an offer of, invitation or proposal to make an offer for, recommendation to apply for, an opinion or guidance on Interests to members of the public in New Zealand. Applications or any requests for information from persons who are members of the public in New Zealand will not be accepted. The distribution and offering of this document in certain jurisdictions may be restricted by law. Persons into whose possession this marketing material may come are required to inform them about and to comply with any relevant restrictions. This does not constitute an offer or solicitation by anyone in any jurisdiction in which such an offer is not authorised or to any person to whom it is unlawful to make such an offer or solicitation. This does not constitute a recommendation of any investment strategy or product for a particular investor. Investors should consult a financial professional before making any investment decisions.

This overview contains general information only and does not take into account individual objectives, taxation position or financial needs. Nor does this constitute a recommendation of the suitability of any investment strategy for a particular investor. It is not an offer to buy or sell or a solicitation of an offer to buy or sell any security or instrument or to participate in any trading strategy to any person in any jurisdiction in which such an offer or solicitation is not authorized or to any person to whom it would be unlawful to market such an offer or solicitation. It does not form part of any prospectus. All material presented is compiled from sources believed to be reliable and current, but accuracy cannot be guaranteed. Investments have risks and you may lose your principal investment. Please obtain and review all financial material carefully before investing. Asset management services are provided by Invesco in accordance with appropriate local legislation and regulations.

The opinions expressed are those of the authors and may differ from the opinions of other Invesco investment professionals. Opinions are based upon current market conditions and are subject to change without notice. Past performance is no guarantee of future results.

This material may contain statements that are not purely historical in nature but are “forward-looking statements.” These include, among other things, projections, forecasts, estimates of income, yield or return or future performance targets. These forward-looking statements are based upon certain assumptions, some of which are described herein. Actual events are difficult to predict and may substantially differ from those assumed. All forward-looking statements included herein are based on information available on the date hereof and Invesco assumes no duty to update any forward-looking statement. Accordingly, there can be no assurance that estimated returns or projections can be realized, that forward-looking statements will materialize or that actual returns or results will not be materially lower than those presented. All information is sourced from Invesco, unless otherwise stated.

Effective 8/18/17, Invesco Ltd completed the acquisition of Source. Links to documents published prior to this date are from Source as a predecessor firm and are provided for historical and informational purposes only.

Investment strategies involve numerous risks. The calculations and charts set out herein are indicative only, make certain assumptions and no guarantee is given that future performance or results will reflect the information herein. Past performance is not a guarantee of future performance.

The Directors of Invesco do not guarantee the accuracy and/or the completeness of any data included herein and we shall have no liability for any errors, omissions, or interruptions herein. We make no warranty, express or implied, as to the information described herein. All data and performance shown is historical unless otherwise indicated. Investors should consult their own business, tax, legal and accounting advisors with respect to this proposed transaction and they should refrain from entering into a transaction unless they have fully understood the associated risks and have independently determined that the transaction is appropriate for them. In no way should we be deemed to be holding ourselves out as financial advisers or fiduciaries of the recipient hereof and this document is not intended to be "investment research" as defined in the Handbook of the UK Financial Conduct Authority.

Invesco

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

Ashley Oerth
Investment Strategy Analyst
Ashley.Oerth@invesco.com
New York, Americas

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

Timothy Horsburgh, CFA
Investment Strategist
Timothy.Horsburgh@invesco.com
New York, Americas

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

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

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

* Affiliated member

Telephone calls may be recorded.