Uncommon truths
Inflation: low probability; high impact

We are often asked about the risk of inflation. We think it is a low probability scenario but with sufficiently high impact to warrant investigation. History provides few easy answers but we conclude with a list of assets that we believe are most likely to mitigate against inflation.

Have you experienced serious inflation? If so, can you remember how it feels? I pose those questions because many investors are asking whether we expect inflation as a result of Covid-19. Our simple answer is that we would expect recession to drive inflation lower, but we can see why some are talking about the possibility of a resurgence. Given the lack of serious inflation for much of the last 20 years we thought it worth dusting off our memories of how different asset groups could react to such an outcome.

Some of us have long memories When I started my undergraduate studies in 1980, OECD CPI inflation had just peaked at 15.7% (core CPI, excluding food and energy, peaked at 14.8%). As was the case for all economics students at the time, we were often tasked with analysing the costs of inflation, while policy makers plotted how to rid the world of this curse. How times change.

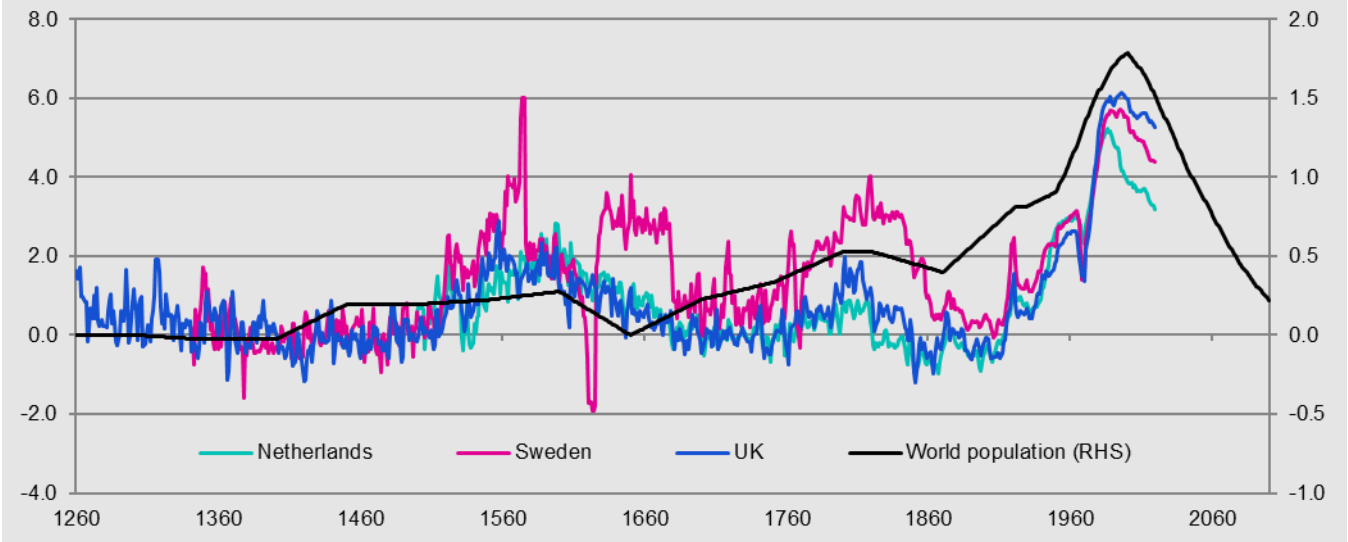
We have since become accustomed to moderate inflation: core CPI inflation in OECD countries has been between 1.5% and 2.5% for most of the period since the start of 2003. In fact, the only real deviation from that range was in the aftermath of the Global Financial Crisis (GFC): OECD core inflation first went below 1.5% in August 2009, bottomed at 1.1% in October 2010 and returned above 1.5% in May 2011.

With hindsight, it looks as though core OECD inflation had been trending up since that October 2010 low, reaching a peak of 2.4% in October 2018 and remaining above 2.0% for most of the period since. In fact, it didn't fall below 2.0% until the Covid-recession (having ended 2019 at 2.2%, it fell to 1.6% in April 2020 and remained there in May). Headline inflation (including food and energy prices) is more volatile and has fallen more than core during the current recession (under the influence of weak oil prices it fell from 2.2% at end-2019 to 0.7% in May 2020).

Abstracting from the current recession, two theories of inflation push us in opposite directions: demographics and monetary economics. Malthus hypothesised that the exponential nature of population growth would result in problems when compared to the linear nature of agricultural productivity. Eventually, there would be too many mouths to feed, a problem that would find its solution in famine, plague or war. **Figure 1** shows that long periods of world population growth, have typically given way to (shorter) periods of deceleration (for example in the early 1600s and early/mid 1800s).

However, world population growth, which barely ever exceeded 0.5% before 1900 (annualised rolling 50-year basis), reached a peak of 1.8% in the 50 years to 2000. We believe this was an important factor behind the sharp rise in inflation in the post-WW2 period, with inflation now the solution to the Malthus conundrum.

Figure 1 – World population growth and consumer prices (annualised rolling 50-year changes, %)*



*Annual data from 1260 to 2100. Historical world population data comes from Global Financial Data and United Nations. Forecast population data (from 2020) is taken from the United Nations Medium Variant projection. Consumer price indices supplied by Global Financial Data and the rolling 50-year changes end in 2019 and start in 1260 (UK), 1340 (Sweden) and 1500 (Netherlands).
Source: Global Financial Data, United Nations and Invesco

Perhaps in reaction to the higher cost of raising a family, we are now witnessing a deceleration of world population growth (see **Figure 1)**, a trend which the UN and other forecasters expect to continue (see the demographics section in 21st Century Portfolio). If demographics provide the inflationary bass line (with the economic cycle providing the meandering lead riffs), then there are good reasons to suppose that inflationary pressures will remain low for some time to come. Interestingly, with OECD inflation now below 2%, it appears consistent with the -1%-2% range that has existed for much of the last 700-800 years (when looked at on a rolling 50-year basis). So, perhaps the current rate of inflation is not so much the new normal as the old normal.

However, there is another way of looking at the post-WW2 surge in inflation, that of inflation being a monetary phenomenon. When money was largely in the form of gold, silver or other metals, its supply was essentially fixed (or was growing very slowly). Hence, short of changes in the velocity of circulation, there was no scope for nominal GDP growth or inflation. Though prices did rise and fall, inflation in one period was followed by deflation in the next, which explains the very low average inflation rates in **Figure 1**.

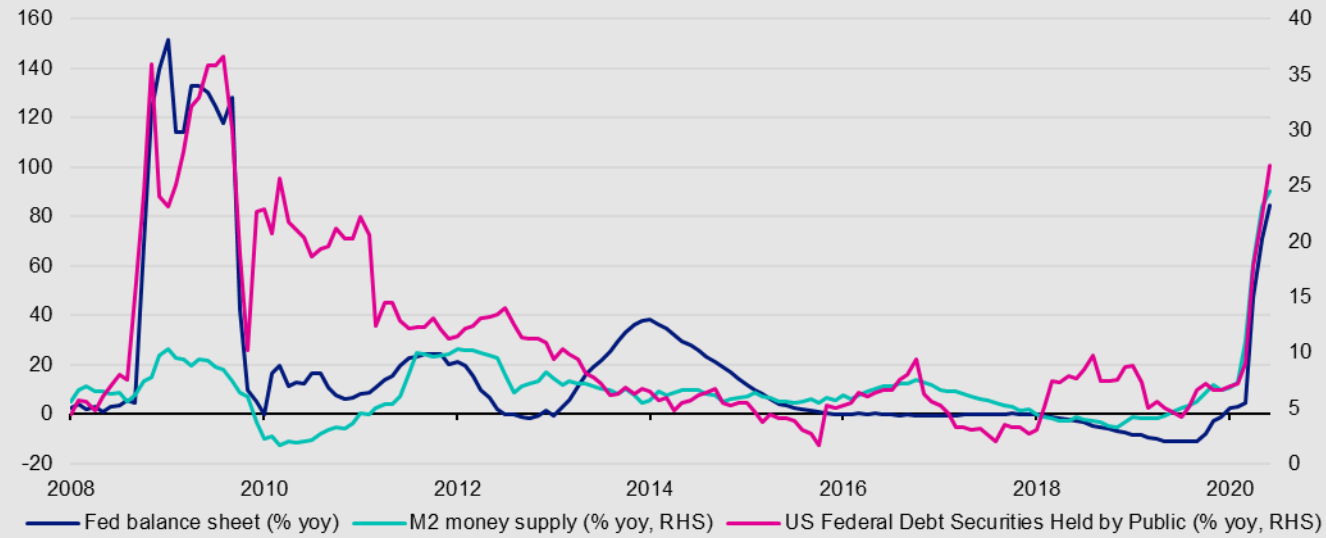
However, since the ending of the gold standard and the advent of fiat money, the supply of money has been largely (though not entirely) the choice of policy makers. Long term measures of monetary aggregates are hard to come by but we do have central bank balance sheet data for some countries. Data from Hills, Thomas and Dimsdale shows that spikes in the BOE balance sheet-to-GDP ratio have been rare but are not unknown.

Prior to the GFC (from 1700 to 2008), that ratio averaged 11% but reached almost 20% on three war-finance related occasions: in the 1730-50 period, in the 1840's (preceded by the Great Recoinage of 1816) and in the 1940s. After each of those occasions, the BOE spent numerous decades bringing the balance sheet back into some sort of normal relationship with GDP. For example, after WW2 the ratio declined gradually to reach a post-1700 low of around 3% in the 1990s.

It was still only 5% in 2007, just prior to the onset of the GFC, but had more than doubled to 11% by 2009 and reached 24% in 2013, in the aftermath of the Eurozone crisis (the first time it had gone above 20%). That seemed like it would be the peak, but the Brexit vote of 2016 brought another surge, taking the ratio to 29% in 2018. We reckon it fell back to 23% in 2019 but expect the ratio to approach 40% by the end of 2020, based on current BOE asset purchase plans and assuming UK nominal GDP falls by 5% this year.

The BOE is not alone and we reckon the Fed's balance sheet-to-GDP ratio will reach 39% by the end of 2020 (up from 6% in 2007). How do these developments relate to inflation? Apart from the concern that such policy experimentation could bring unforeseen consequences (risks), the obvious mechanism is via monetary aggregates. **Figure 2** shows that US M2 money supply growth recently touched 25%, the highest since records began in 1980. The relationship between the Fed's balance sheet and money supply growth is complex but with the US government issuing so much debt and the Fed buying so many assets, we need to consider the possibility that monetary growth may remain elevated.

Figure 2 – US government debt, Federal Reserve balance sheet and money supply growth



Note: Based on monthly data from January 2008 to June 2020.
Source: Board of Governors of the Federal Reserve System (US), Refinitiv Datastream and Invesco

Though in recent decades there has been many a slip 'twixt the cup and lip when it comes to the relationship between money supply and inflation, it is hard for somebody who graduated in monetary economics in the early 1980s to completely set aside that relationship. However, as Fisher's MV = PT identity suggests, growth in the supply of money (M) is simply the first step in a potential path to inflation. If the velocity of circulation (V) falls or the number of transactions (T) rises, then a rise in money supply need not lead to inflation.

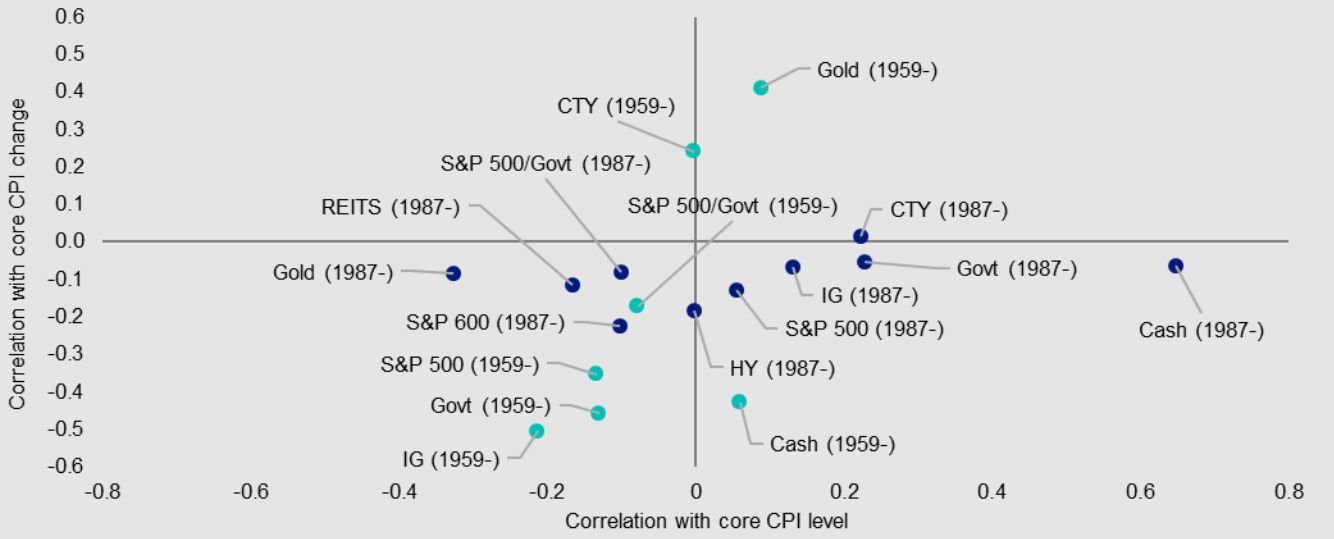
The current circumstances should make an interesting test case. Judging by the rise in the savings ratio in the US (to 32% in April 2020) and by changed travel, entertainment and spending patterns around the world, it seems likely that V has fallen, at least temporarily. However, it is also possible that T may fall because of supply side limitations (output falling not because of lack of demand but because of supply constraints). In the short term these would be conflicting forces and the outcome on inflation is not clear. Over the long term (12-24 months), if confidence returns (V normalises) but M remains elevated and productive potential is reduced, there could be an inflationary outcome.

Though we suspect demographics will limit the potential for core inflation over the very long term and that the Covid-recession will depress it in 2020, we admit the possibility of a rebound in the coming years. The monetary conditions necessary for a sharp rise in inflation would appear to be in place (our measure of global M3 growth increased to near 12% in May 2020 from around 7% at the start of the year) but whether they prove sufficient is another matter.

Let's assume for the moment that inflation does rise to levels not seen for some time, taking OECD core inflation durably into the 3%-5% range, say. What impact would that have on financial assets? Given that policy makers and markets have been so focused on low inflation and fears of deflation for so long (decades), we suspect that adjusting to that new environment would involve a big psychological shift. We believe this could have important implications for asset markets.

Like most investors, we have several prior beliefs about how assets perform when there is inflation (equities perform better than bonds, for example) but the evidence in **Figure 3** blows a hole in many of those preconceived ideas.

Figure 3 – Correlation of CPI adjusted US asset returns with core CPI inflation



Note: Based on calendar year data, showing two periods: 1959-2019 and 1987-2019. "Core CPI Level" shows the correlation of CPI-adjusted asset returns in a calendar year with the level of US core inflation during that year (calculated as the average between inflation at the end of the year and that at the end of the previous year, based on the US CPI index excluding food & energy). "Core CPI Change" shows the correlation of CPI-adjusted asset returns in each calendar year with the change in core inflation during that year (calculated as the difference between core inflation at the end of the year and that at the end of the previous year). All asset returns are CPI-adjusted (using headline CPI) and are in total return format, unless stated otherwise: "Cash" is the 3mth US T-bill total return calculated by Global Financial Data (GFD) until Dec 2018 and then the Bank of America Merrill Lynch (BAML) 0-3mth treasury total return index; "Gold" is the London bullion market spot price in USD/troy ounce (from GFD and Refinitiv Datastream); "CTY" is the Reuters CRB Total Return Index until November 1969 and then the Standard & Poor's Goldman Sachs Commodity Index (S&P GSCI) from Dec 1969; "Govt" is an Invesco calculated total return based on 10 year treasury yield (provided by Robert Shiller and Refinitiv Datastream) until Jan 1978 and is based on BAML US treasury index thereafter; "IG" is based on GFD's AAA Total Return index until Feb 1976 and then BAML US Corporate Index; "HY" is based on BAML US High Yield index; "REITS" is based on the GPR General US total return index; "S&P500/Govt" is based on the ratio between the S&P 500 and Govt total return indices, as defined above. Past performance is no guarantee of future results.
Source: BAML, CRB, Global Financial Data, Refinitiv Datastream, Robert Shiller, Standard & Poor's, S&P GSCI, GPR, and Invesco

Uncomfortable as it seems, we may need to change our inflation mindset (sometimes the facts do get in the way of a good story). **Figure 3** shows the correlation between US core CPI inflation and calendar year US asset returns (inflation adjusted). Data is shown for two periods: 1987 to 2019 for the full set of US assets and 1959 to 2019 for the subset of assets with longer histories (core CPI data does not allow us to go back further). The horizontal axis shows the correlation with the level of core inflation (defined as the average of the inflation rates at the start and the end of the year in question). The vertical axis shows the correlation with the change in the core inflation rate from the beginning to the end of the year. The combination allows us to judge how assets react to both the level and changes in the level of inflation.

The first thing to note from **Figure 3** is that many of the correlations are close to zero, giving little confidence that there is any relationship between inflation-adjusted asset class performance and inflation. Second, most assets produce lower returns when core inflation is rising (negative correlations, measured on the vertical axis). Notable exceptions appear to be commodities and gold, though the picture is less clear when looking only at data since 1987. Third, there is a better spread of correlations with the level of inflation (measured horizontally), though again the results are often contradictory when looking at the two periods in question (there was a richer mix of inflation experiences if we go back to 1959).

We draw the following conclusions from **Figure 3** (with confidence levels in parenthesis based on consistency and levels of correlation):

- Most assets have performed less well when inflation rises than when it falls (medium/high)
- Cash has produced better real returns at higher levels of inflation (medium/high)
- Cash has performed well when inflation is high and falling (medium/high)
- Gold and commodities have been alone in producing better returns when inflation is rising (low/medium)
- Equities have performed less well at higher levels of inflation (low/medium)
- Equities have tended to underperform treasuries when inflation is rising (low/medium)
- Gold and commodities have performed well when inflation is high and rising (low)

Why are the results not as straightforward as our preconceived ideas would suggest? Perhaps the main reasons are that inflation comes in different forms and that the behaviour of policy makers has changed over time. Even the theoretical reaction of assets to inflation should vary with circumstances.

Just as the wrong type of snow can play havoc with the British transportation network, the wrong type of inflation can be corrosive for some so-called “real assets”. It is important to distinguish between demand-pull and cost-push inflation, as the former tends to widen business profit margins, while the latter compresses them. From this perspective, equities and other assets that in some way rely on profit margins (credit, say) should react better to demand pull than to cost push inflation. For this reason, the OPEC inspired oil price hikes of the 1970s and 1980s produced the perfect storm for equities and credit: rising interest rates and bond yields, collapsing profit margins and recession. Talking of OPEC, the two-way relationship between commodities and inflation makes it hard to interpret the correlations in **Figure 3**, which is why we prefer to use core inflation).

On the other hand, periods of demand-pull inflation could be beneficial to equities and credit because of the positive effect on margins. Even generalised inflation, when selling prices are rising at the same rate as costs, does not have to be a problem: though margins remain unchanged, higher inflation leads to higher profits which should balance the rise in bond yields (assuming there is no inflation illusion, whereby investors take note of the rise in bond yields but forget that profits will also rise).

In assessing the future risk to portfolios from a possible rise in inflation, we need to not only understand the nature of that inflation (demand-pull versus cost-push) but also to allow for how behaviours might change as a result of moving to an environment unseen during the working lives of many market participants. The first behavioural issue might be that of central bankers, who we believe would allow economies and inflation to “run hot” for longer than they might have done in the past, implying that support will be removed gradually and that policy rates may take time to catch up with the new reality (cash may be even less remunerative in the early stages than in past inflation episodes and yield curves could steepen sharply). Second, we believe that investors are likely to suffer from inflation illusion, making it more likely that higher bond yields will initially have a negative effect on equity prices (especially for long-duration growth stocks). Third, uncertainty about how to react to this new environment could cause higher volatility and we suspect cause a flight to perceived safe havens (inflation protected bonds and perhaps gold).

The reason we hesitate about gold is that our models suggest that since the GFC, its price has tended to fall

when inflation expectations rise (see Could gold reach $7000?). Our interpretation is that most buyers have been focused on the risk of deflation and financial meltdown, rather than hedging against inflation (the post-1987 data in **Figure 3** also suggests a negative correlation with inflation). We suspect that gold may suffer during the early stages of any return to inflation but that, if it proves durable, the yellow metal would again be viewed as an inflation hedge and demand would rise.

Conclusions

We expect core inflation to remain subdued in the immediate future but can see pathways to higher inflation over the medium term (from a mix of policy settings and supply constraints). Though we believe a high inflation scenario is low-probability, the fact that it could be a high-impact outcome (in our opinion) means that it is worth taking seriously.

Unfortunately, inflation is a complex beast and drawing investment conclusions is not easy, especially given the behavioural changes that could arise from a shift to an environment unknown during the careers of many investors. Our historical analysis suggests that many preconceived ideas about inflation and asset returns are false. Though inflation is less problematic once it has risen to the new higher level, portfolios could suffer while it climbs to that new plateau. We would consider using the following assets within our Model Asset Allocation as hedges against higher inflation:

- **Inflation protected government bonds** (negative/low yields mean the hurdle for buying them is high)
- **Gold** (it may initially suffer but we think a strong bout of inflation would see it perform as a hedge)
- **Cash** (like gold, it may not work in the short term if policy makers raise rates slowly, but we expect that it would eventually produce real returns)
- **Commodities** (the relationship with inflation is two way but we suspect they could rise with inflation)
- **Emerging marke**ts (many EM currencies are likely to benefit from higher commodity prices, as are some EM equity markets)
- **Value versus growth** (higher inflation and bond yields could finally bring an end to the outperformance of growth stocks, which are long duration in nature)

Unless stated otherwise, all data as of 10 July 2020.

Invesco

Figure 4 – Asset class total returns

Data as at 10/07/2020		Current	Total Return (USD, %)					Total Return (Local Currency, %)				
	Index	Level/RY	1w	1m	QTD	YTD	12m	1w	1m	QTD	YTD	12m
Equities												
World	MSCI	542	1.8	0.6	3.3	-2.9	5.1	1.6	0.8	2.9	-2.3	5.3
Emerging Markets	MSCI	1069	3.7	6.3	7.8	-2.6	4.8	3.6	7.0	7.4	1.6	9.3
US	MSCI	3072	2.1	0.6	3.1	0.9	9.8	2.1	0.6	3.1	0.9	9.8
Europe	MSCI	1572	1.1	-0.5	2.6	-10.1	-3.3	0.2	-0.3	1.4	-10.0	-4.7
Europe ex-UK	MSCI	1965	1.3	0.7	3.1	-5.8	1.3	0.6	0.7	2.2	-7.0	-0.3
UK	MSCI	909	0.5	-4.4	1.3	-22.3	-16.2	-1.0	-3.7	-1.2	-18.7	-17.3
Japan	MSCI	3157	-0.2	-4.4	0.1	-6.9	3.1	-0.9	-4.8	-1.0	-8.5	1.4
Government Bonds												
World	BofA-ML	0.25	0.9	1.0	0.9	5.1	6.1	0.4	1.0	0.3	4.7	5.4
Emerging Markets	BBloom	5.21	0.1	1.8	1.3	-1.4	1.5	0.1	1.8	1.3	-1.4	1.5
US (10y)	Datastream	0.63	0.2	1.1	0.0	14.6	17.5	0.2	1.1	0.0	14.6	17.5
Europe	Bofa-ML	0.04	1.1	1.7	1.1	3.3	4.6	0.5	2.0	0.3	2.4	4.0
Europe ex-UK (EMU, 10y)	Datastream	-0.51	1.0	1.4	0.8	4.1	2.8	0.4	1.7	0.1	3.2	2.2
UK (10y)	Datastream	0.10	1.9	0.3	2.7	2.4	8.6	0.4	1.1	0.2	7.1	7.2
Japan (10y)	Datastream	0.01	0.8	0.6	1.3	1.6	0.6	0.1	0.2	0.2	-0.2	-1.1
IG Corporate Bonds												
Global	BofA-ML	1.83	0.9	1.3	1.3	4.0	7.5	0.6	1.4	1.0	4.1	7.4
Emerging Markets	BBloom	4.78	0.7	1.1	1.0	2.3	8.2	0.7	1.1	1.0	2.3	8.2
US	BofA-ML	2.16	0.8	1.9	1.3	6.2	10.8	0.8	1.9	1.3	6.2	10.8
Europe	BofA-ML	0.85	1.0	0.2	1.2	0.0	0.3	0.3	0.5	0.4	-0.9	-0.3
UK	BofA-ML	1.90	2.2	0.6	3.3	-0.6	7.8	0.6	1.3	0.8	4.0	6.4
Japan	BofA-ML	0.50	0.9	0.7	1.2	1.5	1.3	0.1	0.2	0.1	-0.3	-0.4
HY Corporate Bonds												
Global	BofA-ML	6.57	0.4	-0.5	1.1	-3.1	0.5	0.3	-0.4	0.9	-3.2	0.3
US	BofA-ML	6.75	0.3	-0.9	1.1	-3.7	-0.2	0.3	-0.9	1.1	-3.7	-0.2
Europe	BofA-ML	4.61	0.8	-0.4	1.3	-3.7	-1.2	0.1	-0.1	0.5	-4.5	-1.8
Cash (Overnight LIBOR)												
US		0.08	0.0	0.0	0.0	0.3	1.2	0.0	0.0	0.0	0.3	1.2
Euro Area		-0.57	0.4	-0.7	0.6	0.5	-0.1	0.0	0.0	0.0	-0.3	-0.5
UK		0.05	1.1	-1.0	1.8	-4.7	1.5	0.0	0.0	0.0	0.2	0.5
Japan		-0.08	0.6	0.2	1.0	1.6	1.4	0.0	0.0	0.0	-0.1	-0.1
Real Estate (REITs)												
Global	FTSE	1577	-2.4	-5.2	0.5	-20.7	-17.3	-3.0	-4.9	-0.3	-21.4	-17.8
Emerging Markets	FTSE	2018	-1.0	2.4	7.6	-16.3	-10.1	-1.6	2.7	6.8	-17.0	-10.6
US	FTSE	2472	-3.6	-6.9	-1.5	-21.9	-20.0	-3.6	-6.9	-1.5	-21.9	-20.0
Europe ex-UK	FTSE	3114	0.2	-1.7	2.9	-15.4	-6.1	-0.5	-1.4	2.1	-16.1	-6.6
UK	FTSE	1152	0.9	-2.7	3.5	-26.8	-8.6	-0.7	-1.9	1.0	-23.4	-9.8
Japan	FTSE	2277	-2.7	-9.9	-2.1	-23.1	-17.1	-3.4	-10.3	-3.1	-24.4	-18.5
Commodities												
All	GSCI	1708	1.2	2.7	3.4	-34.1	-33.2	-	-	-	-	-
Energy	GSCI	239	0.5	2.6	4.1	-51.9	-50.9	-	-	-	-	-
Industrial Metals	GSCI	1182	5.0	6.2	5.6	-3.0	-1.9	-	-	-	-	-
Precious Metals	GSCI	2075	0.9	4.8	0.3	16.0	25.4	-	-	-	-	-
Agricultural Goods	GSCI	307	0.8	1.1	1.8	-11.8	-12.7	-	-	-	-	-
Currencies (vs USD)*												
EUR		1.13	0.5	-0.6	0.6	0.8	0.4	-	-	-	-	-
JPY		106.91	0.6	0.2	1.0	1.6	1.5	-	-	-	-	-
GBP		1.27	1.6	-0.7	2.5	-4.4	1.3	-	-	-	-	-
CHF		1.06	0.5	0.4	0.7	2.9	5.2	-	-	-	-	-
CNY		7.00	0.9	0.8	0.9	-0.6	-1.8	-	-	-	-	-

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 (%)

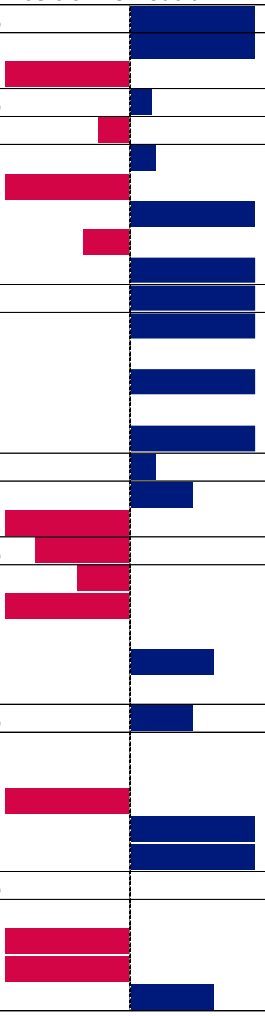
Data as at 10/07/2020	Global				
	1w	1m	QTD	YTD	12m
Energy	**-3.2**	**-9.0**	**-1.4**	**-28.1**	**-31.2**
Basic Materials	**0.5**	**0.1**	**6.8**	**-0.8**	**-0.8**
Basic Resources	1.7	1.6	10.8	0.5	2.6
Chemicals	-0.8	-1.6	2.4	-2.2	-4.9
Industrials	**-1.9**	**-3.5**	**-1.9**	**-6.5**	**-6.8**
Construction & Materials	-1.8	-1.4	-2.1	-7.7	-5.9
Industrial Goods & Services	-2.0	-3.7	-1.9	-6.3	-6.9
Consumer Discretionary	**2.0**	**2.8**	**7.6**	**6.6**	**5.4**
Automobiles & Parts	2.8	2.9	11.9	2.3	4.1
Media	4.5	4.2	3.8	-0.2	-1.1
Retailers	4.1	8.0	14.0	28.0	26.0
Travel & Leisure	-2.1	-8.9	-4.2	-22.6	-24.8
Consumer Products & Services	0.0	1.3	4.1	4.7	4.4
Consumer Staples	**-0.6**	**-0.9**	**-8.2**	**-1.0**	**-3.9**
Food, Beverage & Tobacco	-0.5	-1.8	-8.6	-4.1	-9.6
Personal Care, Drug & Grocery Stores	-0.7	0.7	-7.5	5.0	3.8
Healthcare	**-1.8**	**-0.4**	**-3.9**	**9.9**	**14.7**
Financials	**-0.3**	**-3.7**	**-6.8**	**-17.0**	**-17.5**
Banks	-1.0	-5.2	-9.8	-23.1	-23.8
Financial Services	0.6	-1.4	0.8	-7.8	-7.0
Insurance	-0.2	-3.4	-9.8	-15.0	-16.3
Real Estate	**-3.1**	**-3.6**	**-7.9**	**-10.7**	**-11.6**
Technology	**2.8**	**7.4**	**12.5**	**26.5**	**32.2**
Telecommunications	**-0.4**	**-1.2**	**-7.4**	**1.4**	**-1.7**
Utilities	**-1.4**	**-2.0**	**-8.9**	**-2.6**	**-3.5**

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

Figure 6 – Model asset allocation

	Neutral	Policy Range	Allocation	Position vs Neutral	Hedged	Currency
Cash	**5%**	**0-10%**	↑ **10%**			
Cash	2.5%		↑ 10%			
Gold	2.5%		↓ 0%			
Bonds	**45%**	**10-80%**	↑ **51%**			
Government	30%	10-50%	↑ 25%			
US	10%		↑ 12%			
Europe ex-UK (Eurozone)	8%		0%			
UK	2%		↑ 4%			
Japan	8%		↑ 5%			
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%	↑ 6%			
US Dollar	4%		↑ 6%			
Euro	1%		0%			
Equities	**40%**	**20-60%**	↓ **25%**			
US	24%		14%			
Europe ex-UK	6%		↓ 0%			
UK	3%		↓ 3%			
Japan	3%		↓ 5%			
Emerging Markets	4%		↑ 4%			
Real Estate	**8%**	**0-16%**	↓ **12%**			
US	2%		↓ 2%			
Europe ex-UK	2%		2%			
UK	1%		↓ 0%			
Japan	2%		5%			
Emerging Markets	1%		3%			
Commodities	**2%**	**0-4%**	↓ **2%**			
Energy	1%		↓ 1%			
Industrial Metals	0.3%		↓ 0%			
Precious Metals	0.3%		0%			
Agriculture	0.3%		1%			
Total	**100%**		**100%**			

Currency Exposure (including effect of hedging)				
USD	49%	↑	51%	
EUR	20%	↓	4%	
GBP	7%	↓	12%	
JPY	15%		18%	
EM	8%	↑	14%	
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 7 – 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.

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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