

Grappling with the New Reality of Zero Bond Yields Virtually Everywhere

JULY 2020

Part 1: The Facts and the Implications

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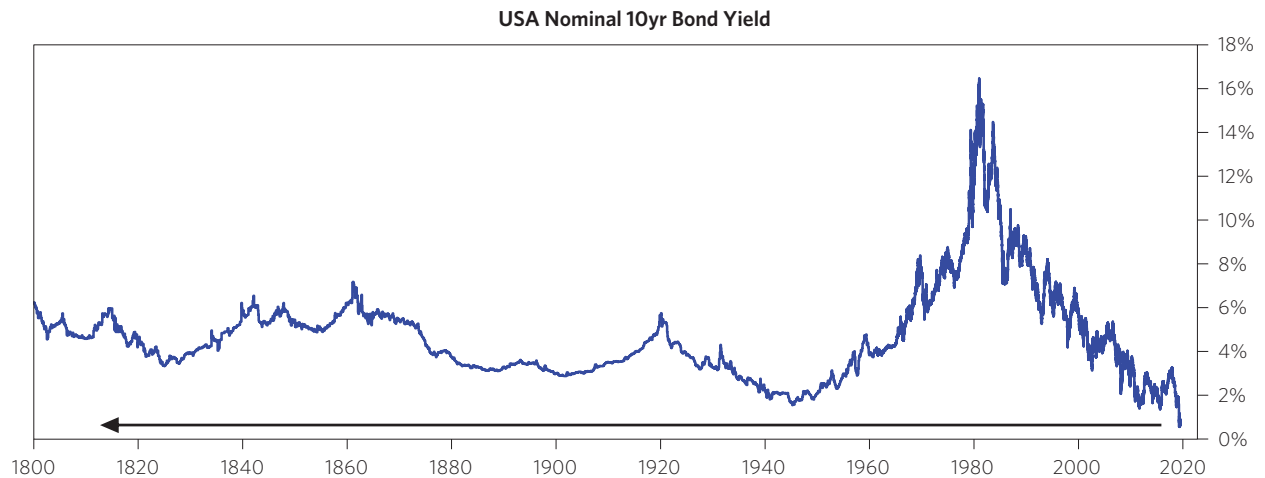
It is now a reality that long-term bond yields are at or near zero in the US and virtually everywhere. There are so many implications of this that it takes some time to recognize and absorb them all and then more time to work through what to do about it, which is what we've been doing and what we see the biggest and most sophisticated institutional investors doing as well. Given the status of the US dollar as the primary reserve currency and US bonds as the "risk-free asset," having the US bond yield at or near zero goes beyond the implications for bonds the asset because the interest rate is the price of credit and is the discount rate on all other cash flows. A zero interest rate effectively means that there is no interest rate, and if it stays at zero, it means no change in the interest rate. Thus, any asset or any form of credit that is impacted by the level or the change in the interest rate is impacted, which extends to all economies and markets and the policies that drive them.

For us to say that we are here is something, since, as you know, we've explained for a decade or more why *low* bond yields are not really a problem, and during this time, we've put low bond yields to good use in beta and in alpha. But we've now crossed a line, and we all have to deal with this new reality.

Among the questions that this raises are the following:

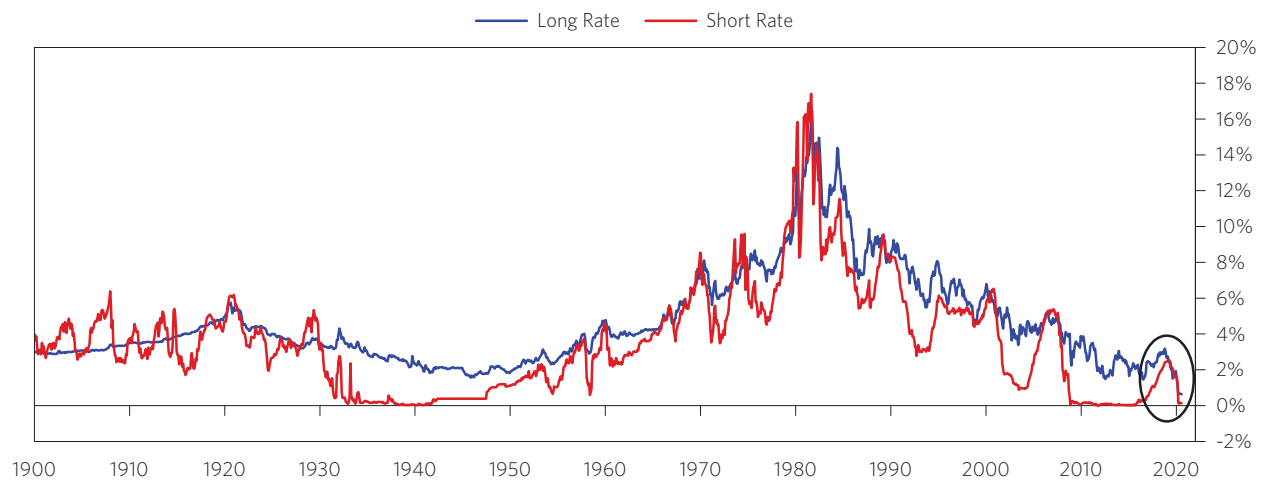
- How much room is left for bonds to rally?
- What is the potential to earn a risk premium by holding leveraged bonds funded by cash?
- What are the asymmetries pertaining to the range of potential bond returns?
- For portfolios that include equities and bonds, how much support is lost from bonds no longer being able to cushion a decline in equities?
- How does the downside of equities and other assets change if the discount rate on cash flows can't fall?
- For the economy and earnings, how does this impact the ability to cushion or pull out of a downturn?
- How does this impact the operation of monetary and fiscal policy?
- What are the portfolio implications, and what can be done to make portfolios more resilient?

Given such questions, in one way or another, the zero bond yield has been the gravitational center of our research in recent months, and we've both made adjustments and developed new insights related to it. The purpose of this research paper is to walk through some of this. The topics are obviously deep and complex. In Part 1, we will just touch on these questions and then in Parts 2 and 3 get into the what-do-you-do-about-it. Before we go to the specifics, the following chart showing US bond yields since 1800 starts to convey the uniqueness of the current circumstances.



The Uniqueness of a Zero Bond Yield and No Risk Premium/Yield Curve Slope versus Cash

Not only is the bond yield lower than ever, this is the first time it's been low with a flat yield curve. For example, in 2009 when the short-term interest rate was zero, the yield curve slope was about 3%, and in 1933 when short rates were zero and the Fed started printing, the bond yield was 3.5%. So in those cases, even though yields were low and the long-term expected return of holding bonds was similarly low, the potential for excess returns in leveraged bonds was very high due to the implied rise in bond yields as reflected in those steep yield curves and the long duration of the bonds. Today, we have long durations but little or no rise priced in, little or no risk premium versus cash, and obviously a low expected total return of holding those bonds.



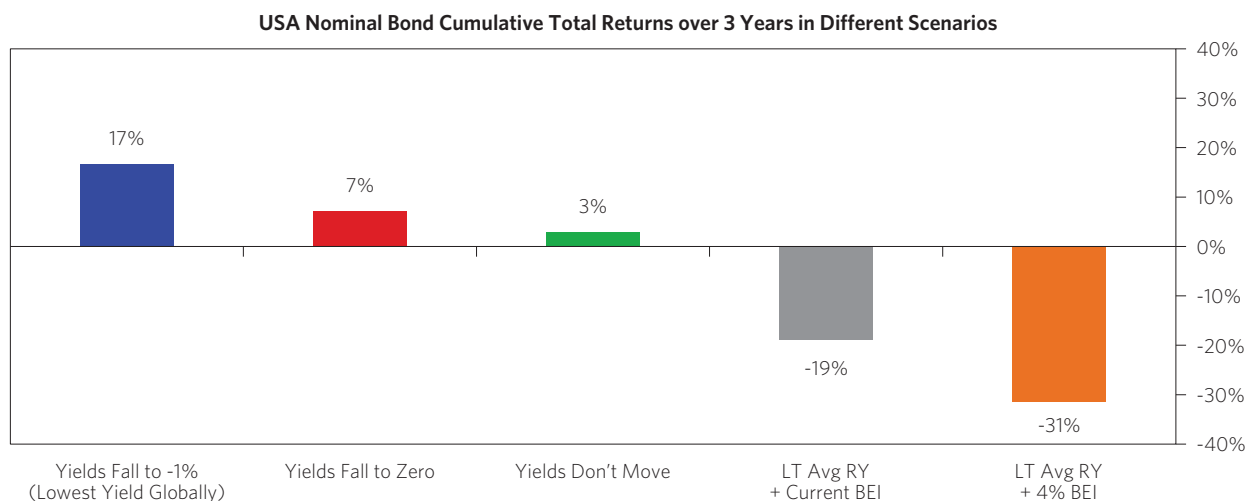
For additional perspective, the table below shows bond returns during a couple periods of zero short-term interest rates as well as projections based on today’s pricing. In past cases, there was a chance to accrue a higher starting forward yield and to benefit as yields gradually drifted down. Today, we have a lower starting point and less opportunity for yields to decline relative to what is discounted to further boost returns. Below, we show returns over the next three years if yields were to fall to zero or all the way to an extreme of -1%.

	1934-1947	End of 2008 to Today	Next 3 Years If Rates Fall to 0%	Next 3 Years If Rates Fall to -1%
Short Rate at Start of Period	0.2%	0.0%	0.1%	0.1%
Total Annualized Returns	4.3%	4.1%	2.3%	5.3%
Starting Yield	3.2%	2.9%	0.6%	0.6%
Impact of Yield Changes	1.1%	1.1%	1.7%	4.7%

While one can’t say for sure how low yields could go, the obvious limitation is that at a certain level, cash hoarding becomes a more attractive alternative. Given the frictions between the central bank policy rate and the rates facing other borrowers and lenders (we would guess around -1%), policy rates would be unlikely to trigger a move to cash in most countries. Below that point, it becomes less clear. And at least for now, central bankers across the world have expressed growing hesitancy about further use of negative rates as a policy tool, in particular focusing on the potential adverse effects for the banking system, which could weaken the efficacy of such policies.

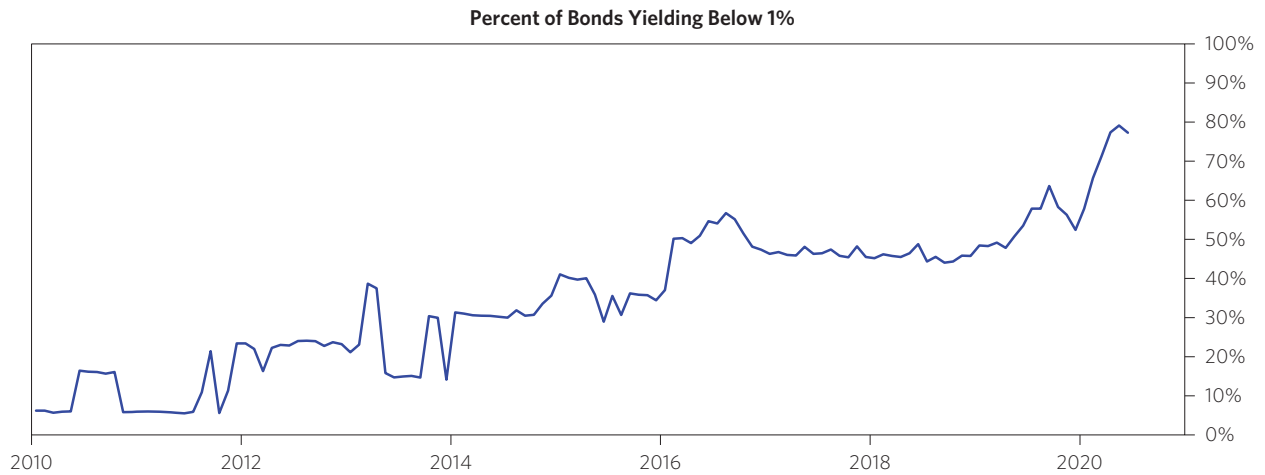
What are the asymmetries in the range of potential bond returns in this environment?

With limited room for yields to fall and no limit on how much they can rise, the distribution of potential returns for bonds and rates is adversely skewed. Of course, looking back there are underlying secular forces that have pulled yields down, and in practice, how yields evolve from here will depend on how economic conditions unfold, how policy makers respond, and how that impacts investor preferences. Considering the range of outcomes looking out over the next three years, a “best case” bond rally to -1% would bring bond returns to a cumulative 17%. Whereas if we were to see real yields return to their long-term average (a little over 2%) and a moderate rise in inflation to 4%, that would produce about -30% returns over the three years.



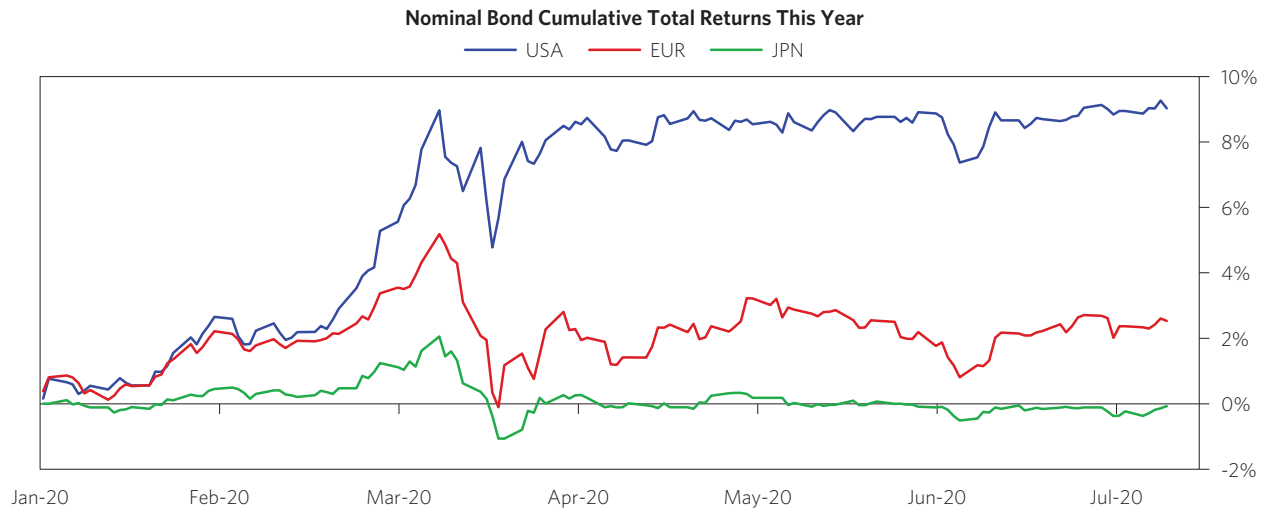
How widespread are these conditions globally?

After this year's bond rally, this problem is truly a global one. Roughly 80% of the market cap of local currency government debt has a yield below 1%.



For portfolios that include equities and bonds, how much support is lost from bonds no longer being able to cushion a downturn? How does the downside of equities and other assets change if the discount rate on cash flows can't fall?

This year, we got a glimpse of what it looks like when bond yields are already floored when a downturn arrives. While US bonds had room to fall and produce strong returns, there was much less support in Europe and none in Japan.



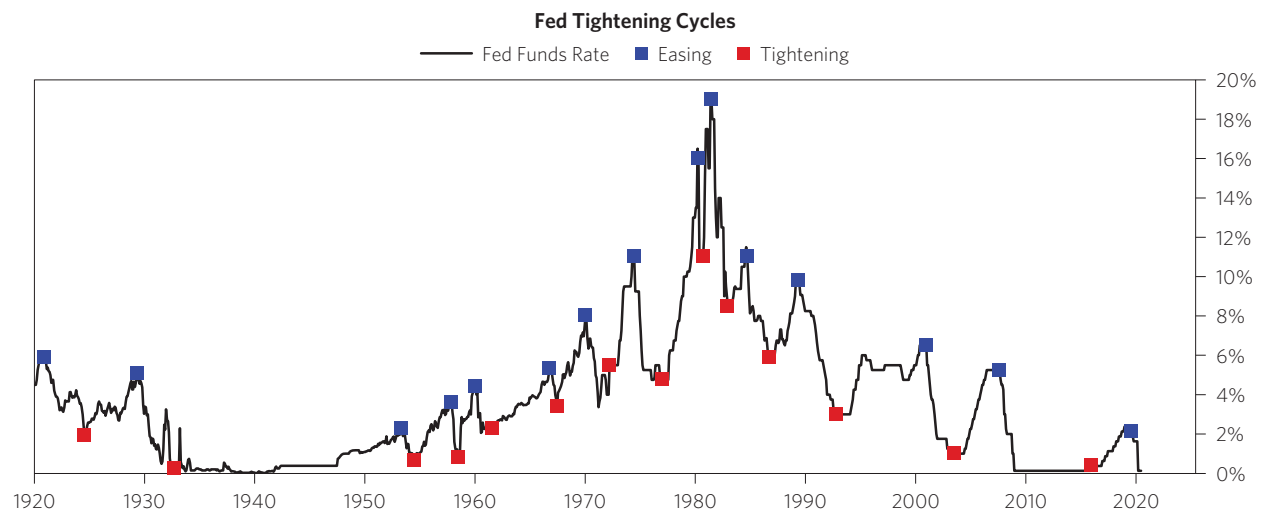
Normally when economic conditions are deteriorating and equities are falling, a bottom is formed when the central bank steps in and provides enough easing to offset these negative pressures. This supports equities in two ways: the support to the economy helps stabilize earnings prospects, and the declining discount rate pushes up the present value of future earnings. Looking across the US bear markets of the past several decades in the chart below, you can see how falling rates provided a cushion, especially when the Fed stepped in to offset the more extreme cases. Allowing for a duration of perhaps 7 to 10 years, you can ballpark the price impact of the decline in yields.

USA Equity Drawdowns Larger Than 20% since 1925

Period	Equity Drawdown	Max Decline in Interest Rates	
		Short Rates	Long Rates
1929-1945	-84%	-4.8%	-2.6%
2007-2012	-52%	-3.4%	-2.6%
2000-2006	-46%	-5.6%	-2.5%
1973-1976	-43%	-4.6%	-0.9%
2020	-34%	-1.5%	-0.9%
1987-1989	-29%	-0.6%	-1.5%
1968-1971	-29%	-5.0%	-2.5%
1962-1963	-22%	0.0%	-0.3%
1946-1949	-22%	-0.1%	-0.4%
Average	-40%	-2.9%	-1.6%

For the economy and earnings, how does this impact the ability to cushion or pull out of a downturn?

In prior downturns, the Fed helped arrest the downturn and engineered a recovery by lowering rates an average of 500bps. And in the financial crisis when they ran out of room to lower short rates, 500bps plus QE helped lower longer-term yields. Now, with that room depleted, the task before policy makers is much tougher and requires new policy tools, which we'll discuss in depth in Part 2 of this series.



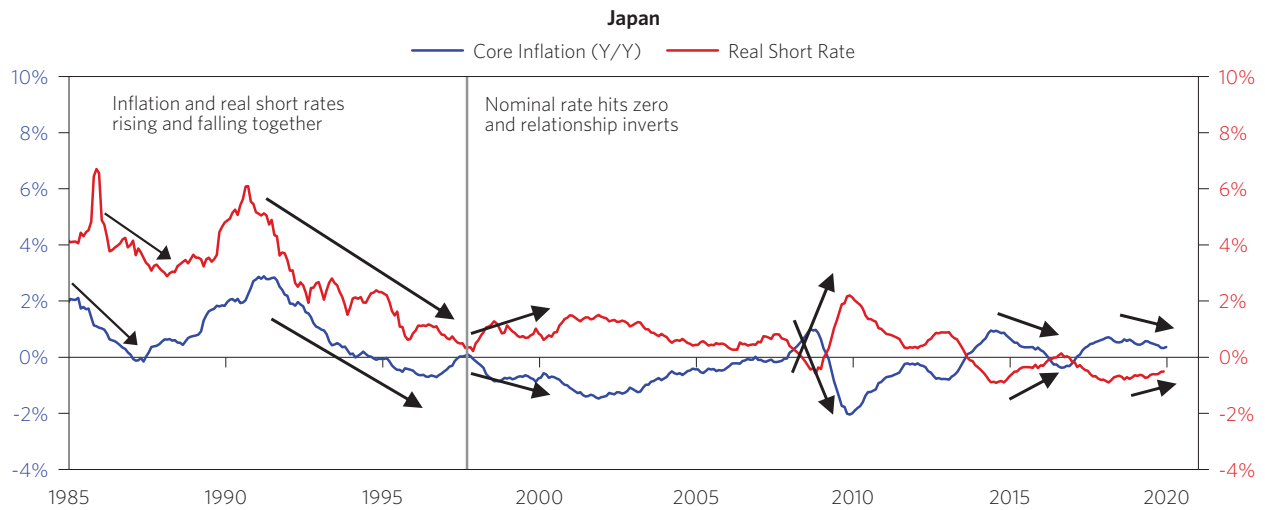
Fed Funds Rates*						
Low	Date	Nominal Change	Period (in months)	% Change	High	Date
3.96%	Oct-19	1.92%	14	49%	5.88%	Dec-20
		-3.96%	43	-67%		
1.92%	Jul-24	2.88%	64	150%	4.80%	Nov-29
		-4.80%	34	-100%		
0.00%	Sep-32	2.09%	251	—	2.10%	Aug-53
		-1.44%	10	-69%		
0.65%	Jun-54	2.94%	40	452%	3.59%	Oct-57
		-2.71%	8	-75%		
0.88%	Jun-58	3.69%	18	419%	4.57%	Dec-59
		-2.30%	19	-50%		
2.27%	Jul-61	3.32%	62	146%	5.59%	Sep-66
		-2.26%	9	-40%		
3.33%	Jun-67	4.75%	30	143%	8.08%	Dec-69
		-4.08%	26	-50%		
4.00%	Feb-72	7.00%	28	175%	11.00%	Jun-74
		-6.25%	30	-57%		
4.75%	Dec-76	11.75%	39	247%	16.50%	Mar-80
		-5.50%	5	-33%		
11.00%	Apr-80	8.00%	9	73%	19.00%	May-81
		-11.00%	18	-58%		
8.00%	Nov-82	3.44%	21	43%	11.44%	Sep-84
		-5.56%	26	-49%		
5.88%	Oct-86	3.87%	31	66%	9.75%	May-89
		-6.75%	40	-69%		
3.00%	Sep-92	3.50%	99	117%	6.50%	Dec-00
		-5.50%	30	-85%		
1.00%	Jun-03	4.25%	50	425%	5.25%	Aug-07
		-5.25%	100	-100%		
0.00-0.25%	Dec-15	2.25%	43	—	2.25%	Jul-19
		-2.25%	7	-100%		

* Prior to 1975, T-bills used as proxy for Fed funds target rate

Avg Increase	4.38%	53
Range of Increases	1.9% to 11.8%	9 to 251
Avg Decrease	-4.64%	27
Range of Decreases	-11.0% to -1.4%	5 to 100

Zero nominal yields also create a unique linkage between real yields and inflation. Because there is an arbitrage between the breakeven inflation rate and actual inflation, a deflationary downturn that pushes breakeven inflation down is extra risky because the combination pushes real yields up as the economy contracts (because the real yield plus breakeven inflation must equal the nominal yield, and the nominal yield is relatively stable), i.e., you have a higher discount rate on cash flows as cash flows fall. On the other hand, if reflation is successful, central banks will likely delay the rise in nominal yields relative to inflation, forcing real yields to fall. And there is no lower limit to either real yields or breakeven inflation. As a result, a successful reflation can drive real yields much lower even if they start at low levels, and policy failure (i.e., deflation) will drive them higher.

As shown below, Japan has experienced these dynamics since the '90s. Before rates reached the zero lower bound (marked below with a gray vertical line), inflation and short rates fell and rose together, reflecting the central bank's responsiveness to conditions. But after rates reached zero, the relationship inverted. Falling inflation, when rates are already at zero, forces real yields higher, producing a tightening as conditions are deteriorating.



How to build a resilient portfolio in such a world?

We'll share our thoughts on this below.

Part 2: Achieving Balance in a “Monetary Policy 3” World

JULY 14, 2020

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In Part 1 of this series, we laid out the problem that 0% bond yields presents for all investors. In Part 2, we explore how we are approaching this challenge in our own balanced portfolios; in Part 3 to follow, we will approach the issue from the perspective of more traditional portfolios, exploring more incremental steps toward improving diversification and reducing portfolio vulnerabilities.

In terms of building a balanced strategic asset allocation, it is pretty obvious that with interest rates near zero and being held stable by central banks, bonds can provide neither returns nor risk reduction. It is also true that policy makers have had to move on in terms of their tools for dealing with downturns. Instead of interest rate cuts, policy has moved to MP3 (i.e., the coordination of monetary and fiscal policy). Understanding the nature of MP3 and how it will affect different asset classes allows us to logically balance assets for an MP3 world.

While the loss of nominal bonds as a source of return and diversification is a big deal for most asset allocations, our balanced approach to beta has never been about a particular asset allocation, nor has it ever been reliant on any particular asset class. Rather, it is an approach to getting the most out of the full menu of assets that are available. Near-zero interest rates changes the menu of choices that one has available; it doesn't change the principles of asset pricing and balance. The two key building blocks of balance for us are:

1. Select assets that will outperform cash over time;
2. Diversify those assets based on how they will react to future economic scenarios.

As long as you can achieve 1 and 2, “balanced beta” is achievable, and we expect it will likely offer superior risk-adjusted returns compared to typical portfolios. We believe we can achieve these conditions going forward by taking the following steps:

- First, we are moving into alternatives to nominal bonds that we believe can balance equity risk in an MP3 world. In an MP3 world, policy makers will respond to a downturn through coordinated monetary and fiscal policy—putting money to work in the real economy, financed by money printing. If this does not succeed in reflating equities, logically we would expect this printed money to end up in inflation-hedge assets like inflation-linked bonds and gold. This has been borne out by our historical studies of reflations across time and economies. So while we continue to hold nominal bonds in markets where there is potential room for one more bond rally, we are increasingly using these inflation-hedge assets as well to get balance where we previously would have used nominal bonds.
- Second, we are bolstering our geographic diversification. The price of any asset, of any type, can be thought of as a stream of future cash flows discounted by a rate that includes the risk-free discount rate (the expected return of cash) and a risk premium. In a world in which risk-free discount rates are relatively stable, diversification of risk premiums and cash flows themselves takes on heightened importance. Cross-asset diversification can help with the cash flows, but assets within a region and, more generally, with similar investor bases tend to have highly related risk premiums, so historically it has been a challenge to diversify this risk. With the opening up of markets in China and the surrounding Asia bloc, a third pole of global importance comparable to the US and Europe has become available as a source of diversification. Different economic conditions, independent monetary policy, and distinct savings patterns mean risk premiums and cash flows in this third pole are lowly related to those in the developed world. Geographic diversification will likely be both more impactful and more needed going forward than it has been in recent decades, given the potential for de-globalization and increased fragmentation, if not outright conflict.

There is no guarantee expected performance can or will be achieved.

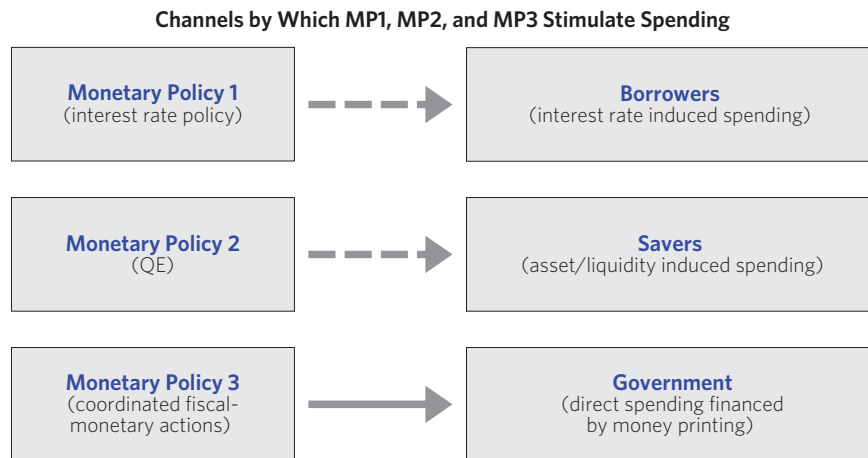
- Third, we are exploring ways to structure an equities allocation to reduce the need for balancing assets in the first place. By identifying specific types of demand and connecting those forms of spending to the companies that receive that spending in the form of revenue, and then screening for the quality of balance sheets and operating stability, we are able to hold a set of publicly traded companies whose earnings we expect to approach the consistency of the coupon on a bond. We believe these portfolios can serve as more stable storeholds of wealth than broad equities, reducing (though not eliminating) the need to hold diversifying assets against them. Because for now this is playing a relatively modest role in our own beta portfolios, we'll save further discussion of the topic for another time.

Below, we elaborate on how we are approaching balance in this environment; given the importance of the topic, we are sharing our thinking in real time and will share more as our research progresses.

We Are Now in an MP3 World: Monetary and Fiscal Reflation as the Tool to Stimulate

To us, the question of how to invest in a world with yields at zero is the question of how to invest in an MP3 world—a world in which interest rates (Monetary Policy 1/MP1) and quantitative easing (MP2) have been exhausted as tools to stimulate, and coordinated monetary and fiscal stimulus (MP3) becomes the policy tool of choice. The necessary shifts in the overarching policy regime are what have brought us here, and it was the nature of the prevailing policy regime that was to a significant degree responsible for nominal bonds being such a good diversifier to equities in the first place.

To briefly review, MP1 is interest rate policy—raising and lowering short-term interest rates to tighten and ease monetary policy. That channel primarily affects borrowers, by raising or lowering borrowing costs across the economy. When rates hit zero, the next step is MP2—quantitative easing, which targets savers. QE lifts savers out of assets, with the hope that those savers will then invest in riskier assets (thus boosting asset prices and stimulating spending through the wealth effect) or spend in the real economy. MP3 is fiscal spending monetized by central bank printing, where the central bank effectively prints money and the government puts it to work in the real economy.



The fact that MP1 and MP2 have been the operative policy paradigms has been a key reason why nominal bonds have historically been such a good balancer of equities: the lever used by central banks to stimulate in the event of a downturn was to lower interest rates (in the case of MP1) and then to buy assets and flatten yield curves when short rates could be lowered no more (in the case of MP2). With short rates now zero and yield curves essentially flat in most of the developed world, this dynamic is now behind us.

There is no guarantee expected performance can or will be achieved.

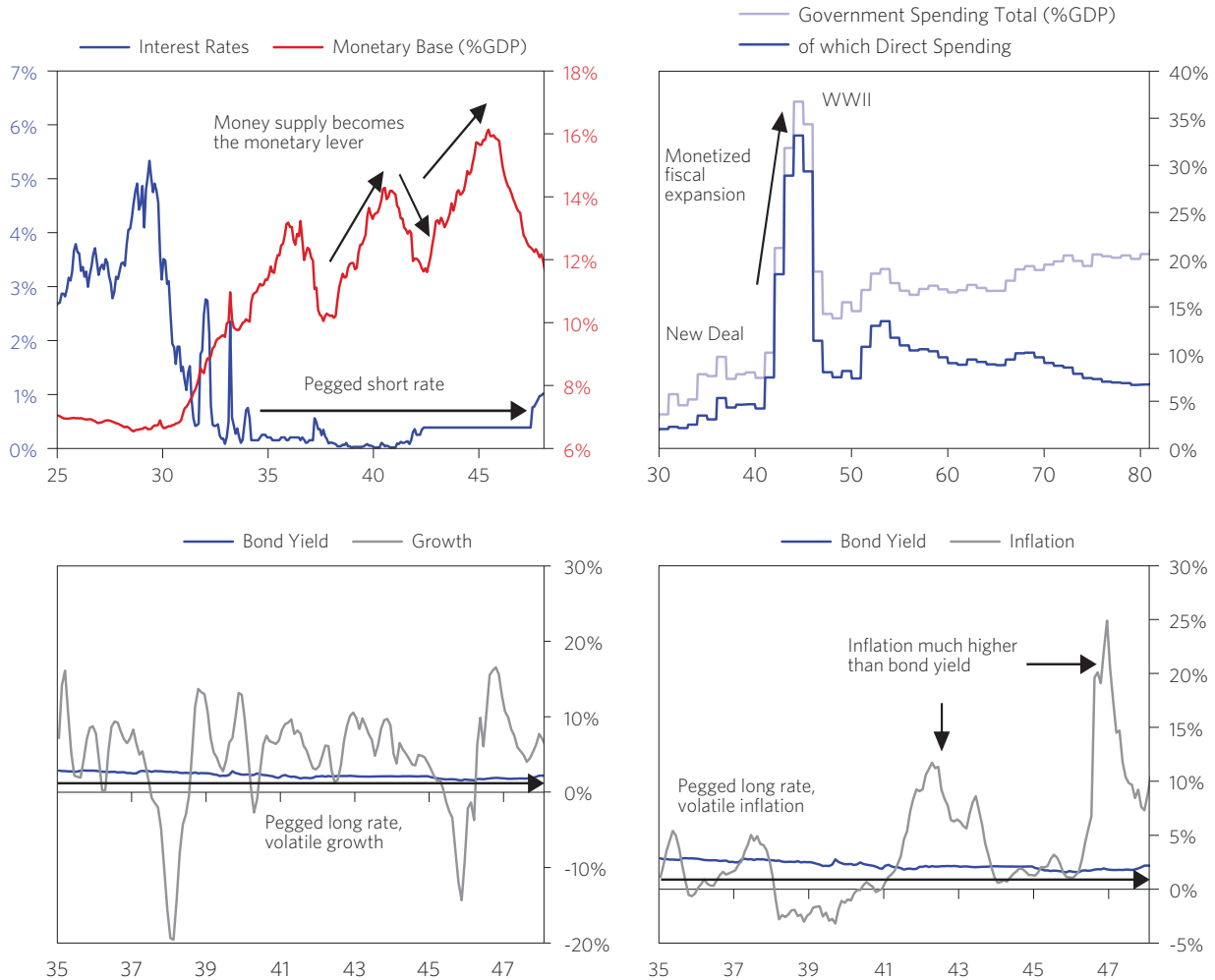
The end of the prior policy paradigm and the shift to MP3 occurred in two steps: 1) the shift away from preemptive tightening following the Fed's 2018 tightening; and 2) the exhaustion of interest rates and QE and the shift to coordinated monetary and fiscal policy in response to the global pandemic. It's noteworthy that even with the 2008 shift toward QE, the inflation-fighting mentality of the Volcker era was still in the background until very recently, with the Fed raising rates at the end of 2018 based on cyclical conditions. We think that was the last preemptive tightening we will see for some time. Given the outsize impact that tightening had on the economy and assets, central banks very quickly changed their tune, with every major developed world central bank making it clear that they will wait for substantially higher-than-target inflation for a significant period before tightening policy. 2019 was then a transition year, with no more preemptive tightening but some small room left in MP1 and MP2. The virus shock required central banks to spend that remaining fuel essentially all at once, with the need for direct fiscal stimulus at the same time as "whatever it takes"/unlimited QE signaling the dawn of MP3.

1940s US Wartime Policy Helps Illustrate MP3 Mechanics: Pegged Yields; Reflation Through Money Printing and Fiscal; Inflation Much Higher Than Bond Yields

We are still early in the MP3 era, with many open questions about what form it will take and a high likelihood it will evolve over time through experimentation. But the yield curve targeting environment of the 1940s in the US is a good case study on what such policies can look like. The period has rather striking parallels to present circumstances—the end of a long-term debt cycle, a relatively modest cyclical tightening leading to a big economic and market decline, an abrupt policy reversal, and then the need for a new form of policy to finance a massive fiscal expansion once interest rates and QE have been exhausted. And as described in our June 23 research, the Fed is explicitly considering yield curve targeting, with many market participants expecting the Fed to announce a front-end target later in the year.

In the aftermath of the Great Depression and after a tightening of monetary and fiscal policy in 1937 that led to a collapse in growth and equities, the US pinned yields at low levels and printed significant quantities of money to fund the growing wartime fiscal deficit. You can see both how bonds behaved and how stimulation worked during this period of "wartime MP3" in the charts below. Short rates were kept near zero and long rates were pegged slightly higher to maintain a fairly steep yield curve (to ensure a low but steady return to bondholders). But rates did not move at all with cyclical conditions (growth and inflation), meaning bonds would have provided no diversification benefit. Rather, the Fed expanded and contracted the monetary base to manage the cycle, with a big upward trend to finance the deficit. Notably, inflation rose significantly above the bond yield in the early and then late '40s, well into double digits, which had the beneficial effect of inflating away nominal debts.

1930s-1940s



While MP3 in today’s world might look significantly different than how policy makers managed the ‘40s, the basic elements of highly managed and near-zero rates, money printing to fund fiscal deficits, and higher inflation being tolerated if not desired given high debt levels are very likely going forward. And some have argued explicitly that exceptional “wartime” policies like what we saw in the ‘40s are called for in the face of the ongoing threat posed by the pandemic.

Balancing Successful Reflation and Stagflation

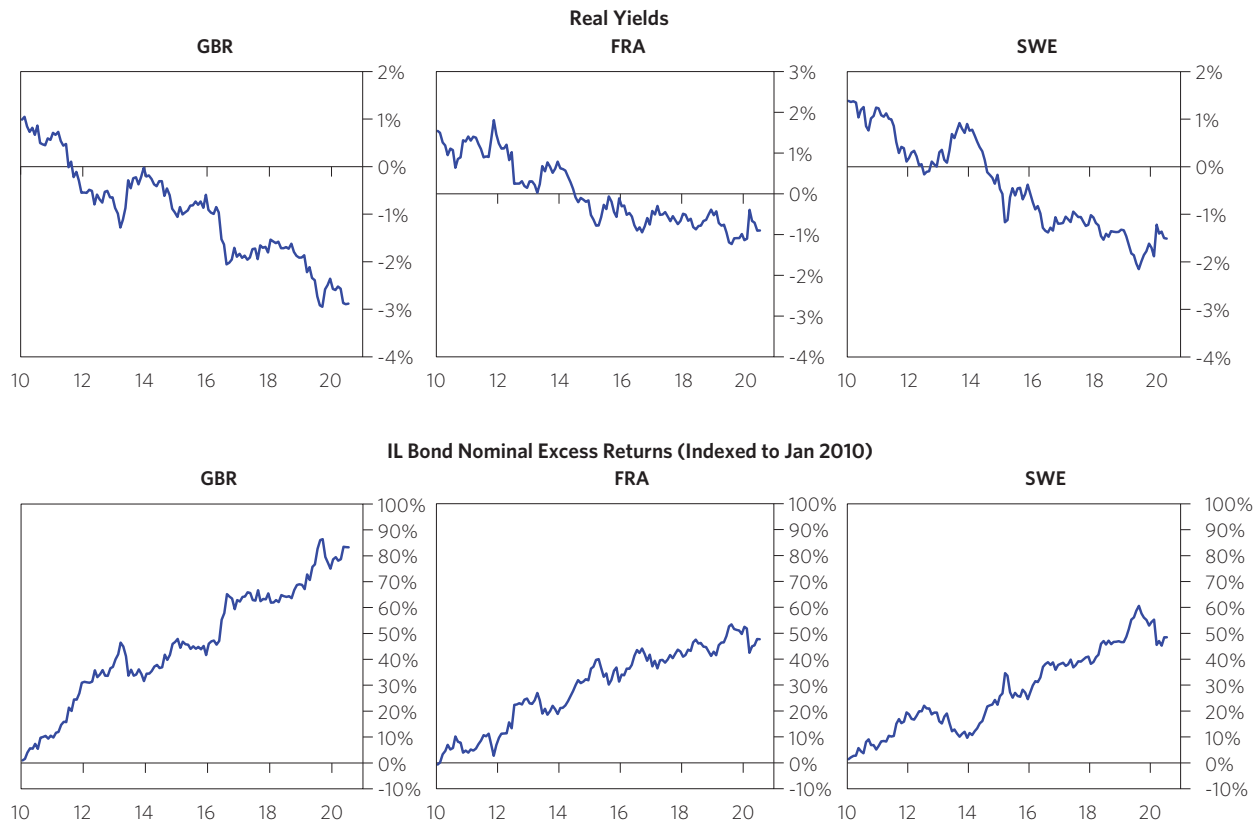
The question then becomes what can provide balance in an MP3 world if it won’t be nominal bonds. In an MP3 world, in the event of a downturn, central banks and fiscal authorities will try to reflate by printing money and spending it in the real economy. This has already happened in response to the pandemic shock, and there will be more of it as necessary. These periods can be great for assets generally (at least in nominal terms) if policy results in a recovery in economic conditions and the production of money that would earn nothing sitting in cash makes its way into assets (call it “successful reflation”). But stimulation can also result in stagflation—weak growth and higher inflation—in the event that economic conditions remain weak but printed money results in higher inflation. In an MP3 world, these are key scenarios to balance: successful reflation versus stagflation. In the stagflation scenario, equities tend to underperform, but inflation-hedge assets like inflation-linked bonds and gold tend to outperform and therefore provide balance. This is logical, and it is borne out by our studies of past reflations, where we have looked as far back as 1800 to study 127 cases of market panics and reflations across 39 economies.

There is also the risk that policy makers fail to stimulate assets in aggregate. This is always the risk to beta investing, and the only way to hedge this risk—the risk of deflation/broad asset underperformance—is to hold cash. But if policy makers have tools to reflate, history has shown that they will use them, as a collapse of asset prices across the board will cause a depression. The lesson from the last decade was that the risk of doing too little is much greater than the risk of doing too much, and as described in our July 9 research, the warp speed of the Fed’s response to the current crisis (much quicker than in ‘08, which was much quicker than in the Great Depression) reflects the evolution of policy makers’ approach. All in all, we expect that policy makers will keep pushing to do whatever it takes to achieve their goals, until they encounter limits in the form of inflation or a loss of faith in the currency. But this is what one has to monitor in any beta portfolio and what we are monitoring in ours—whether policy makers have the tools to stimulate and how much room they have left. For the time being, our assessment is that policy makers can get what they want.

To go a level deeper on the mechanics of IL bonds and gold in an MP3 environment:

- In terms of IL bonds, as alluded to in Part 1 of this series, a critical aspect of why they can provide diversification in an MP3 world is that real yields have no floor in the way that nominal yields likely do. Inflation-linked bonds pay a real yield plus actual accrued inflation. And the real yield is equal to the nominal yield minus breakeven inflation, which is a measure of markets’ discounting of future inflation. Even with a nominal yield near zero, with positive discounted inflation, the real yield will be negative—and if discounted inflation rises, the real yield will go further negative.

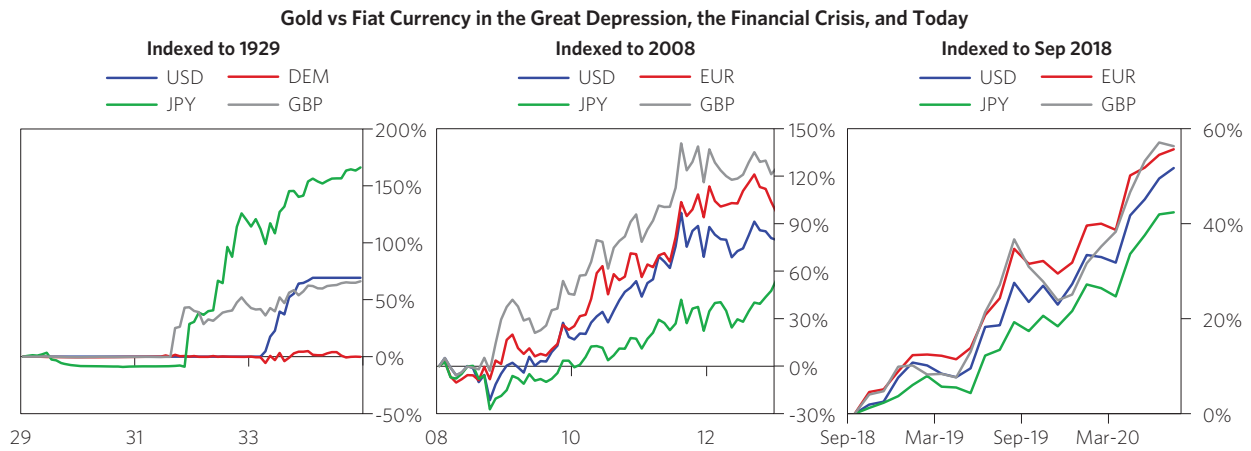
Below, we show the real yields and returns of IL bonds in the UK, France, and Sweden since 2010; as shown, even after real yields became negative they continued to fall, and IL bonds generated strong performance as a result.



The circumstances that tend to produce the need for reflations typically involve high debt levels, and policy makers have an incentive to lower real debt burdens by lowering real yields, often by generating inflation, as in the '40s “wartime MP3” case discussed above. Falling real yields cause IL bonds to outperform, and as inflation accrues, it also supports IL bond returns, as IL bonds will pay out that actual inflation.

- In terms of gold: we think of gold as a contra-currency and storehold of wealth whose value tends to increase when fiat currencies are being debased (i.e., monetary inflation). As central banks reflate and the forward value of cash falls, investors look elsewhere for a storehold for their wealth, and gold has always served this role to a significant degree, as it has a constrained supply and cannot be printed.

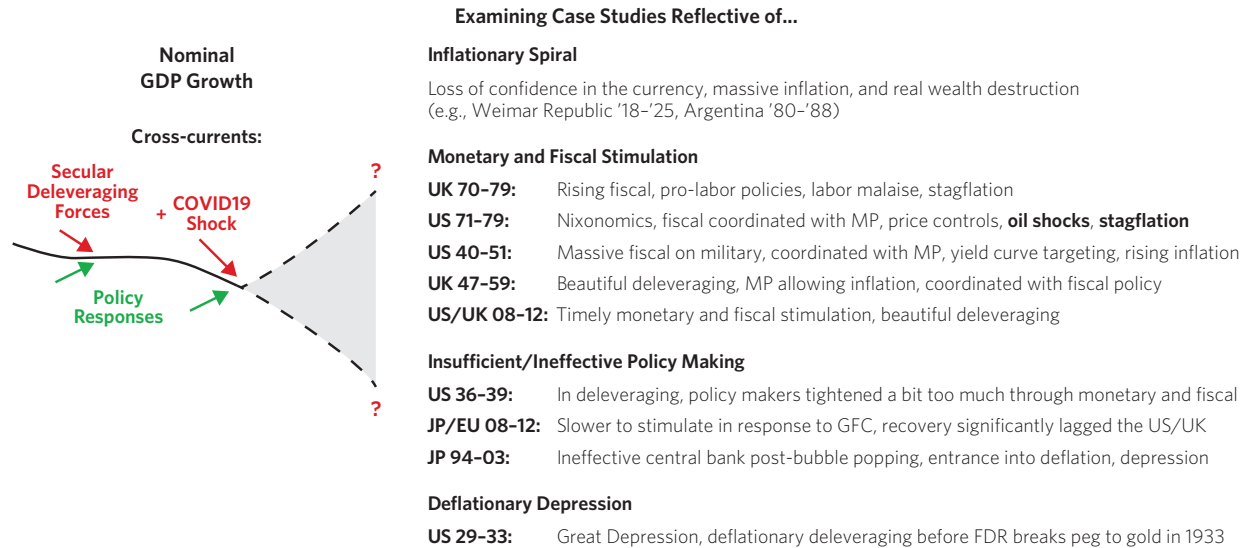
As three examples of this dynamic, below we show the performance of gold versus fiat currencies in the Great Depression, the financial crisis, and the past several years. In these periods of stimulative/reflationary policy, gold performed well against all fiat currencies (and flat against the Reichsmark, which was pegged to gold).



Inflation-linked bonds and gold are just two examples of inflation-hedge assets that we would expect to provide balance in an MP3 world and that we are using given their liquidity and ease of implementation—the broader and more important point is to get balance to the reflationary versus stagflationary outcomes. And the same logic that favors IL bonds and gold as balancers would apply to other assets as well. For example, breakeven inflation itself would likely be a good diversifier in an MP3 world—i.e., long an IL bond and short a nominal bond of the same duration—with the downside being that it does not offer a risk premium over time (so in that respect it is more similar to gold than IL bonds in being more of a pure hedge). Similar logic would also apply to some degree to any asset that has inflation-sensitive cash flows, e.g., real assets of many forms. Any investor can examine the menu of choices they have available to them and apply these concepts to make the most out of that menu.

Stress Testing IL Bonds and Gold Through a Range of Potential Outcomes

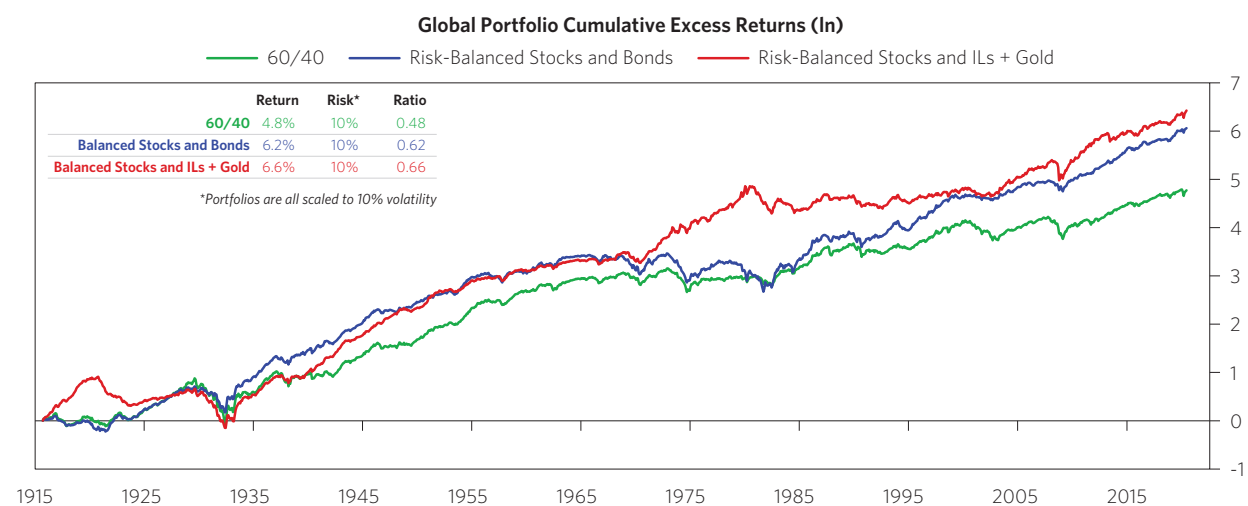
To help illustrate the balancing role that IL bonds and gold can play, we consider a range of scenarios broadly indicative of the paths that the world could plausibly take given the secular forces and the recent pandemic shock. These range from an inflationary spiral on one extreme to a deflationary depression on the other, and everything in between. From a beta perspective, our goal is not to predict which scenario is most likely and bet on it, but rather to ensure tolerable outcomes across as many scenarios as possible.



If you look at asset performance across these scenarios (scaled to the same 10% risk level to make comparisons apples to apples), it's evident that a mix of IL bonds and gold tends to do well when equities don't. In particular, equities don't do well when stimulation results in stagflation (the top two cases)—nor do nominal bonds—but IL bonds and gold both do well. Equities also underperform when there is too little stimulation relative to what is required (lower group of four cases), and so long as this results in a downturn but not an outright depression, IL bonds do well and gold is flat to up. In the successful reflation cases (upper group of four cases), all assets tend to do well. In an outright deflationary depression, only nominal bonds have the potential to do well, though given current yield levels their upside would be highly limited in such a case today. We also show a 60/40 portfolio as well as a balanced portfolio without nominal bonds that is risk-balanced between equities and IL bonds plus gold. Even without nominal bonds, the balanced portfolio outperforms in every case except for the deflationary depression, in which the performance of the two portfolios is similar, with a 500bps+ higher return on average. We also show the average of the worst drawdown within each period, which is again materially better for the balanced portfolio (-22% versus -29%).

		Local Asset and Portfolio Excess Returns at 10% Volatility (Ann)				60/40 Portfolio	Balanced Portfolio w/o Nom Bonds		
		Growth vs Exp	Inflation vs Exp	Equities	Bonds	IL Bonds	Gold		
Stagflation	UK 1970-1979	↓	↑	1.4%	-0.3%	14.5%	12.6%	1.3%	14.6%
	US 1971-1979	↓	↑	0.0%	-2.3%	7.2%	15.4%	-0.5%	10.5%
Successful Reflation	US 1940-1951	↑	↑	6.9%	5.0%	12.7%	0.3%	7.7%	11.5%
	UK 1947-1959	↑	↑	6.2%	0.1%	4.7%	-0.4%	6.1%	6.7%
	US 2008-2012	↑	↑	4.0%	11.7%	17.6%	9.7%	6.8%	15.9%
	UK 2008-2012	↑	↑	3.8%	12.9%	13.4%	11.5%	6.5%	15.1%
Insufficient Stimulation	US 1936-1939	↓	↓	0.7%	8.7%	7.1%	-0.1%	2.7%	4.2%
	EU 2008-2012	↓	↓	-1.1%	7.7%	11.0%	11.7%	0.5%	8.5%
	JP 2008-2012	↓	↓	-2.1%	7.2%	10.2%	5.0%	-1.4%	3.8%
	JP 1994-2003	↓	↓	-1.4%	8.7%	7.9%	-0.1%	-0.6%	1.8%
Deflationary Depression	US 1929-1933	↓	↓	-18.4%	6.0%	-15.6%	-0.9%	-16.3%	-19.9%
Avg. Return				0.0%	5.9%	8.2%	5.9%	1.2%	6.6%
Avg. Worst Drawdown				-29.4%	-17.9%	-18.3%	-14.9%	-28.6%	-22.2%

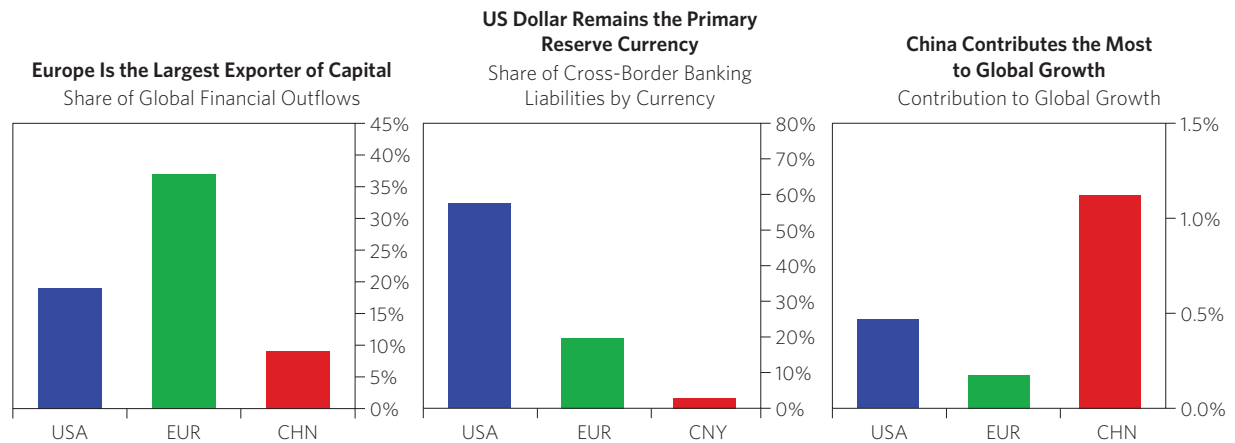
It's noteworthy that in the middle eight cases—cases in which nominal bonds historically did well—a mix of IL bonds and gold would have done about as well. The same is true more generally: over time, a mix of IL bonds and gold tends to have a diversification benefit to equities that is similar to nominal bonds. IL bonds and gold provide rising inflation protection that nominal bonds don't, which is a plus, but in MP1/MP2 environments gold has a less reliable bias to falling growth than nominal bonds, which is a minus, and the two roughly net out over time. As a simple illustration, below we compare a global risk-balanced portfolio of stocks and nominal bonds, and then the same but swapping out the nominal bonds for IL bonds and gold, versus a traditional 60/40. The two balanced portfolios end up in a similar place over time and are similarly more efficient than a 60/40. This is a simple illustration of the fact that there are many ways to get balance.



Given all of this, in our beta portfolios we have started to use IL bonds and gold as a diversifying mix of assets to equities where we previously would have used nominal bonds. In an MP3 world, we expect this form of balance to be comparably reliable to the form of balance that we held in an MP1/MP2 world.

The Tri-Polar World and the Increased Potential and Need for Geographic Diversification

Another important element of our approach to balance in this environment is geographic diversification, which we believe is taking on heightened urgency. For some time, we have spoken of the increasingly “tri-polar” world, with the US, Europe, and China of comparable global importance at this point and therefore deserving of much more similar weight in portfolios than they typically have had. Each pole has a distinct role: Europe is the largest exporter of capital, the US remains the primary reserve currency and therefore primary source of funding, and China contributes the most to global growth.



These differences call for diversification, and the zero-interest-rate environment only strengthens the case. In a world in which risk-free discount rates are relatively stable, diversification of risk premiums and cash flows takes on more importance, and geographic diversification offers a way there. In particular, the China/Asia-bloc pole offers risk premiums and cash flows that are lowly related to those in the developed world, and these markets are now open to global investors. It is rare to have large, scalable, lowly correlated assets come along in this way. And while the Asia bloc offers diversifying risk premiums and cash flows, it's also worth noting that Chinese bonds are one of the only remaining nominal bond markets in the world where yields have some room to fall. So, to take advantage of what little does remain in nominal bonds, we have increasingly shifted into Chinese bonds as developed world bonds have fallen to zero.

Beyond the argument just from asset mechanics, the global pandemic has in many ways accelerated underlying pressures toward de-globalization, and fragmentation could make global diversification both more impactful and more needed than it has been in recent decades. The virus has already resulted in quite different policy responses across the three poles, both in terms of the direct handling of the virus and the monetary/fiscal responses, with China having the most aggressive response to the virus itself (and as a result the best virus and economic outcomes), the US having the worst response to the virus but (in part as a result of the destruction that it then wrought) the biggest stimulus, and Europe somewhere in between on both fronts. The different policy responses have produced divergent economic and market outcomes, and we expect this differentiation will grow across economies. The virus has renewed US-China tensions and accelerated the broader dynamic of a rising power threatening an existing power, with the US at times directing blame at China over the virus and recently escalating sanctions, and China seeking to position itself in a leadership role of extending aid to other economies via its “Health Silk Road.” And we have started to see the repatriation of supply chains as the global shutdowns highlighted the vulnerabilities produced by global supply chains.

In other words, there is real risk that the secular trend toward increased globalization is reversing, a trend that has been an important force supporting global growth and productivity but also increased correlations across global markets. Even over the past roughly 50 years, while globalization has surged, it's still striking just how divergent and variable the outcomes across economies have been, which can be masked by correlations (e.g., markets can be positively correlated but end up in quite different places). The table below ranks different economies' respective equity returns over every decade since the 1900s. As shown, the differences between the best- and worst-performing equities markets were typically massive. And there was no pattern to it: an equities market that outperformed in one decade often underperformed in the next, with no one economy consistently outperforming. In the 1980s, the US was one of the worst performers; that flipped in the 1990s when the US was nearly the top performer, flipped again in the 2000s when the US underperformed, and then reversed again in the 2010s when the US has been on top. An equal-weight mix of equity markets would have performed well across most of the cases and would have avoided the disastrous outcomes.

Rankings of Equity Excess Returns (Hedged) by Decade

2010s		2000s		1990s		1980s		1970s		1960s	
USA	235%	CHN	76%	CHE	231%	SWE	503%	KOR	456%	ESP	312%
NZL	209%	NOR	48%	USA	217%	KOR*	354%	JPN	66%	AUS	148%
SWE	198%	BRZ	45%	SWE*	190%	JPN	310%	CAN	30%	Equal Weight	75%
CHE	140%	CAN	42%	FRA	117%	ESP	188%	Equal Weight	10%	JPN	74%
DEU	139%	AUS	36%	GBR	110%	Equal Weight	185%	GBR	8%	CAN	71%
FRA	137%	KOR	22%	ESP	96%	DEU	179%	CHE	-5%	USA	41%
JPN	135%	ESP	17%	DEU	92%	GBR	173%	AUS	-12%	SWE	31%
GBR	105%	Equal Weight	6%	AUS	59%	ITA	169%	USA	-17%	GBR	28%
TAI	98%	NZL	-3%	Equal Weight	53%	FRA	158%	FRA	-20%	DEU*	21%
Equal Weight	97%	CHE*	-4%	CAN	52%	CHE	96%	SWE	-22%	ITA	-1%
NOR	95%	SWE	-13%	ITA	40%	USA	96%	DEU	-31%	FRA	-6%
CAN	70%	TAI	-23%	NOR	2%	AUS	39%	ESP*	-69%		
RUS	61%	GBR	-23%	NZL	-6%	NOR	23%	ITA	-74%		
AUS	61%	USA	-27%	JPN	-47%	CAN	-4%				
ITA	48%	FRA	-32%	TAI	-49%						
KOR	33%	ITA	-35%	KOR	-66%						
ESP	23%	DEU	-36%								
CHN*	10%	JPN	-41%								
BRZ	-13%										
Avg Correl	64%	74%	50%	46%	38%	26%					
Best-Worst	247%	117%	296%	507%	530%	319%					

*Previous decade's top-performing economy

Rankings of Equity Excess Returns (Hedged) by Decade

1950s		1940s		1930s		1920s		1910s		1900s	
DEU	739%	ESP	140%	GBR	6%	Equal Weight	249%	USA*	10%	USA	83%
JPN	662%	Equal Weight	138%	DEU	2%	DEU	178%	FRA	-35%	Equal Weight	9%
ITA	484%	AUS	132%	CAN	-9%	USA*	170%	GBR	-44%	FRA	9%
FRA	484%	USA	122%	Equal Weight*	-10%	CAN	134%	Equal Weight	-54%	DEU	9%
Equal Weight	384%	GBR*	117%	USA	-12%	GBR	87%	DEU	-92%	RUS	-7%
USA	376%	CAN	115%	SWE	-22%	ESP	72%	RUS	-100%	GBR	-34%
AUS	277%	SWE	100%	FRA	-54%	FRA	41%				
GBR	270%	FRA	-19%	ESP	-61%	SWE	24%				
SWE	240%	DEU	-35%								
CAN	222%										
ESP*	98%										
Avg Correl	20%	17%		37%		26%		3%		19%	
Best-Worst	641%	176%		68%		225%		110%		116%	

*Previous decade's top-performing economy

Together with better asset balance in an MP3 world through assets like gold and inflation-linked bonds, we believe that maximizing the benefits of global diversification will be a critical element of managing money in the new paradigm, and these are two important steps that we are taking in our own portfolios. In Part 3 of this series, we will discuss how to apply this thinking from the starting point of a more typical asset allocation.

Part 3: Considering the Traditional Portfolio

JULY 15, 2020

BOB PRINCE
GREG JENSEN

In Part 1 of this series, we laid out the problems that near-zero bond yields present for all investors, and in Part 2, we explored how we are approaching this challenge in our own balanced portfolios. In Part 3, we approach the issue from the perspective of more traditional portfolios, exploring steps to sustain returns while reducing portfolio vulnerabilities.

Every portfolio is unique, but most have equities and bonds, and the traditional 60/40 mix is a reasonable starting point for considering the impact of zero bond yields. Taking this as a prototype, there is the bond portion and there is the equity portion, and both are impacted by zero bond yields. Obviously, at near-zero yields, the bond portion has a near-zero expected return. And because there is a limit to how much yields can fall and no limit to how much they can rise, the bond portion has a limited upside return and an unlimited downside return. A zero bond yield also raises the risk related to the equity portion. In economic downturns, the bond portion can no longer provide capital gains to offset losses in the equity portion. And lacking the ability for interest rates to fall, there is less ability for an interest rate cut to stabilize a decline in economic growth and earnings, as well as less ability for a decline in the discount rate to cushion a decline in prices due to a decline in earnings. The net of it is that zero bond yields reduce the return of the traditional 60/40 portfolio while raising its downside risk relative to its upside potential.

As we work with clients to consider alternatives, we look to the same principles that we apply ourselves:

1. Select assets that will outperform cash over time.
2. Diversify those assets based on how they will react to future economic scenarios.

Applying these two principles to the 60/40 portfolio, we see two key shifts that have the potential to provide a lot of impact:

1. Balance the portfolio's exposure to inflation by shifting part of the portfolio from nominal bonds into inflation-sensitive assets.
2. Balance the portfolio's exposure to the major monetary and credit systems of the world, of which the big three are the US dollar, the euro, and the RMB.

Balancing Disinflation and Inflation

Central bankers have largely taken away the excess return of nominal bonds relative to cash by pressuring them lower through direct purchases and communicating as much as possible that tightening is nowhere on the horizon.¹ However, there is potential to diversify better, and in the process, the limitations on returns relative to cash can be relieved to some extent.

With respect to their structural environmental biases, stocks and bonds both perform better in disinflationary environments and perform worse in inflationary environments. For example, the following table summarizes the returns of each during periods of rising and falling inflation. Both asset classes have generated nearly all of their returns when inflation is falling and have generated close to a zero return when inflation is rising. This bias reduces the potential consistency of returns.

Excess Returns over Cash (Since 1970)			
	Stocks	Bonds	60/40
Rising Inflation	-1.5%	0.4%	-0.7%
Falling Inflation	8.5%	3.5%	6.5%

¹ We are treating the credit spread as equity-like exposure.

To have a disinflationary bias has been favorable since 1980 but was bad in other decades. With bond yields now at or near zero, the exposure to rising inflation remains while the benefit from falling inflation doesn't have much to offer.

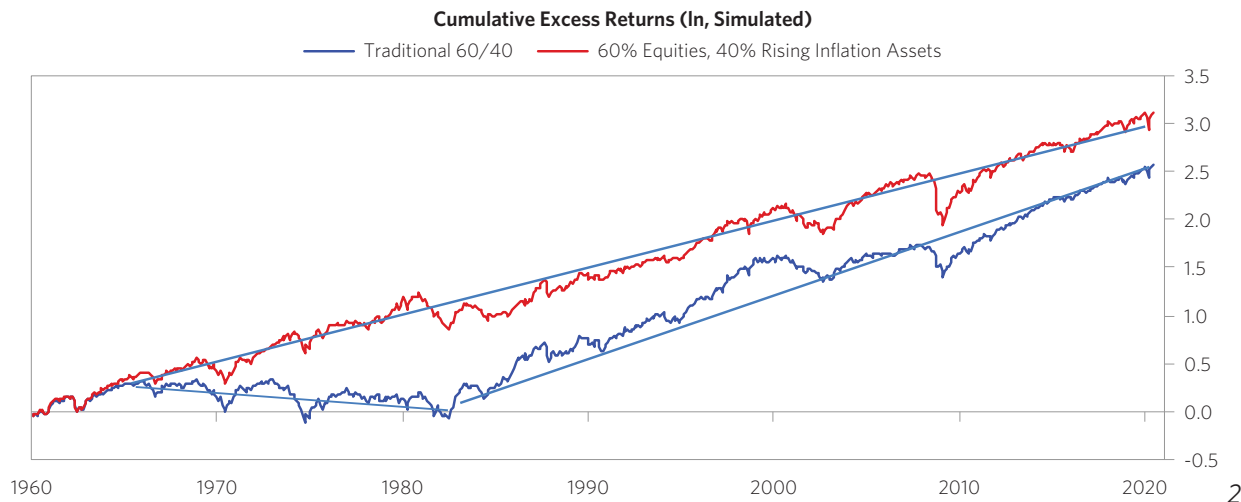
The diversification benefit of holding nominal bonds with stocks is due to their opposite exposure to economic downturns, as shown below. With zero bond yields, this diversification benefit is no longer significant.

Excess Returns over Cash (Since 1970)

	Stocks	Bonds	60/40
Rising Growth	8.4%	0.7%	5.3%
Falling Growth	-0.7%	3.3%	0.9%

Given these conditions, a shift that makes a lot of sense to consider is a movement of the nominal bond portion of the portfolio into assets that would benefit from rising inflation. Nominal bonds add to the disinflationary bias of equities. Rising inflation assets would diversify that exposure. And unlike nominal bonds, the future returns of rising inflation assets are not constrained by zero bond yields. Furthermore, reducing the existing exposure to rising inflation is in better alignment with central bankers' current reflationary policies.

As an example of the potential impact of such a shift, the following chart shows the cumulative excess return of the traditional 60/40 portfolio compared to moving the 40% bond portion into a diversified set of liquid inflation-sensitive assets. The significant disinflationary bias of the 60/40 portfolio is largely neutralized without sacrificing return because inflation-sensitive assets pay a comparable risk premium.



² Data shown through June 2020. The Traditional 60/40 is a mix of 60% U.S. equities and 40% U.S. nominal bonds. The Inflation-Protected 60/40 replaces the nominal bonds with a mix of inflation-hedge assets (commodities, IL bonds, gold, and BEI) represented by the All Weather Asset Mix rising inflation subportfolio and held at 10% volatility. It is expected that the simulated performance will periodically change as a function of both refinements to our simulation methodology and the underlying market data. HYPOTHETICAL OR SIMULATED PERFORMANCE RESULTS HAVE CERTAIN INHERENT LIMITATIONS. UNLIKE AN ACTUAL PERFORMANCE RECORD, SIMULATED RESULTS DO NOT REPRESENT ACTUAL TRADING OR THE COSTS OF MANAGING THE PORTFOLIO. ALSO, SINCE THE TRADES HAVE NOT ACTUALLY BEEN EXECUTED, THE RESULTS MAY HAVE UNDER OR OVER COMPENSATED FOR THE IMPACT, IF ANY, OF CERTAIN MARKET FACTORS, SUCH AS LACK OF LIQUIDITY. SIMULATED TRADING PROGRAMS IN GENERAL ARE ALSO SUBJECT TO THE FACT THAT THEY ARE DESIGNED WITH THE BENEFIT OF HINDSIGHT. NO REPRESENTATION IS BEING MADE THAT ANY ACCOUNT WILL OR IS LIKELY TO ACHIEVE PROFITS OR LOSSES SIMILAR TO THOSE SHOWN. Note that the All Weather Asset Mix is being shown to demonstrate either how assets have performed relative to cash or how a balanced portfolio of assets has performed. The All Weather Asset Mix does not represent a product or service that is available for purchase by any investor. Past performance is not indicative of future results. Please review the Important Disclosures located at the end of this research paper.

To put a few numbers on it, the following table shows the by-decade total return, excess return, and real return of each of these portfolios since 1960. The ratio of the average by-decade excess return and real return relative to their respective ranges is almost twice as high for the more inflation-balanced portfolio.

		Traditional 60/40 vs Inflation-Protected 60/40 (Simulated)									
		1960s	1970s	1980s	1990s	2000s	2010s	Average	Range	Avg/Range	
Total Return	Traditional	5.8%	6.7%	16.7%	14.5%	3.3%	10.0%	9.5%	3.3% to 16.7%		
	Inflation-Protected	8.8%	14.5%	13.0%	12.7%	4.8%	9.2%	10.5%	4.8% to 14.5%		
Excess Return	Traditional	1.5%	-0.1%	7.1%	9.2%	0.4%	9.4%	4.6%	-0.1% to 9.4%	0.49	
	Inflation-Protected	4.5%	7.7%	3.4%	7.5%	1.9%	8.5%	5.6%	1.9% to 8.5%	0.84	
Real Return	Traditional	3.3%	-0.7%	11.6%	11.5%	0.8%	8.3%	5.8%	-0.7% to 11.6%	0.47	
	Inflation-Protected	6.2%	7.1%	7.9%	9.8%	2.2%	7.4%	6.8%	2.2% to 9.8%	0.90	

There are many ways to obtain rising inflation exposure by holding assets whose cash flows rise with rising prices. There are, of course, inflation-indexed bonds and commodities. And within commodities, there is gold, which should really be thought of as a currency that one can hedge their assets into without giving up the risk premium on those assets. The important thing is the opportunity to bring the portfolio into better balance with respect to inflation. And whether you start with 60/40 or some other mix, and whether you move all of the bonds or some of them into rising inflation assets, on the margin, there is likely to be an improvement in the consistency of returns.³

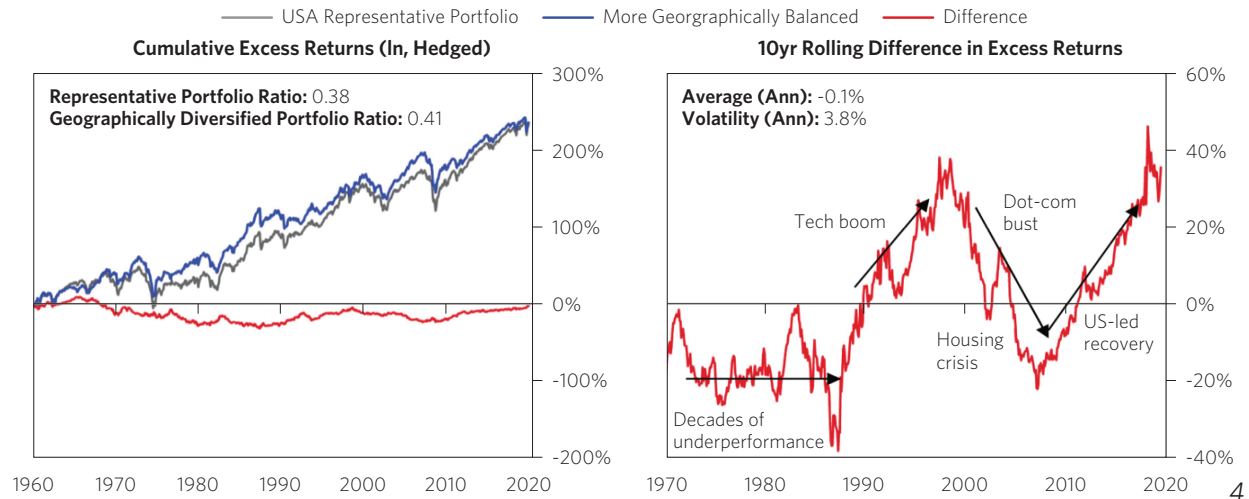
This is but one case and one portfolio shift. The main point is that by recognizing the environmental biases of assets, balance can be improved, and with that, the consistency of returns can be improved. This has always been the case, but the zero bond yield is forcing a reconsideration of portfolio structuring that requires bigger changes to really make a difference.

Geographic Diversification Is Increasingly Important for All Portfolios

Geographic diversification is now underappreciated and underutilized. Today, there are three dominant monetary/credit systems driving increasingly divergent risk premiums and economic conditions across major sections of the global economy. Investors have tended to rely on trailing correlations to make their diversification assessments. But trailing correlations do not reflect the current and future benefits of geographic balance across these regions because these correlations reflect the world we've been in, not the world that we are in today. For example, the RMB only began its process of de-linking from the dollar in late 2015. And since then, China and what we refer to as an Asian economic bloc have continued to be more independent and inwardly focused, trends that have been reinforced and accelerated by the trade war and now by differences among Asia, Europe, and the US in their approaches and outcomes regarding the coronavirus.

³ There is no guarantee that expected performance can or will be achieved.

Even so, while short-term correlations have been high, longer-term differences have big, compounded effects. The charts below compare a representative US institutional investor portfolio (gray line) against a simple, more geographically balanced version of the same portfolio (blue line); for example, we swap a US-heavy equity allocation for an equal-weighted global equity mix, keeping equities' overall share of the portfolio the same. The difference between these two portfolios roughly isolates the uncompensated geographic risk in the portfolio, shown in the red line below. It is striking that since 1960, a period over which the US has been the single best equity market in the world, it *still* didn't consistently pay to be geographically concentrated in the US. A US-heavy portfolio slightly underperformed its more geographically balanced counterpart. The benefits have been even bigger from the perspective of other equity markets and will be bigger in the future than they have been in the recent past.



While the purpose of this three-part series is to work through the implications of a zero bond yield, and what might be done about it, it is important to recognize that the problem does not exist in China, a huge and under-invested market for most global investors. The 10-year bond yield in China is near 3% and in this turbulent period has varied by enough that a) it was able to cushion some of the decline in the Chinese economy and Chinese equities and b) it provided sufficient balance against the declines in other assets. So another path to addressing the zero bond yield problem is to go where the problem does not exist.

⁴ Past results are not necessarily indicative of future results. Returns for the representative and more geographically balanced portfolios are simulated. Please review the Important Disclosures located at the end of this research paper.

USA Representative Portfolio Disclosure

The table below contains the allocation information for the historical simulation of the USA Representative Portfolio, from 1960 onwards, as well as forward looking assumptions for expected ratio, volatility, and tracking error, used in this analysis. Correlations are based on either historical market returns when available or Bridgewater Associates' estimates, based on other available data and our fundamental understanding of asset classes. The portfolio capital allocation weights (illustrated below) are estimates based either upon Bridgewater Associates' understanding of standard asset allocation (which may change without notice) or information provided by or publicly available from the recipient of this presentation. Asset class returns are actual market returns where available and otherwise a proxy index constructed based on Bridgewater Associates understanding of global financial markets. Information regarding specific indices and simulation methods used for proxies is available upon request (except where the proprietary nature of information precludes its dissemination). Results are hypothetical or simulated and gross of fees unless otherwise indicated. HYPOTHETICAL PERFORMANCE RESULTS HAVE MANY INHERENT LIMITATIONS, SOME OF WHICH ARE DESCRIBED BELOW. NO REPRESENTATION IS BEING MADE THAT ANY ACCOUNT WILL OR IS LIKELY TO ACHIEVE PROFITS OR LOSSES SIMILAR TO THOSE SHOWN. IN FACT, THERE ARE FREQUENTLY SHARP DIFFERENCES BETWEEN HYPOTHETICAL PERFORMANCE RESULTS AND THE ACTUAL RESULTS SUBSEQUENTLY ACHIEVED BY ANY PARTICULAR TRADING PROGRAM. ONE OF THE LIMITATIONS OF HYPOTHETICAL PERFORMANCE RESULTS IS THAT THEY ARE GENERALLY PREPARED WITH THE BENEFIT OF HINDSIGHT. IN ADDITION, HYPOTHETICAL TRADING DOES NOT INVOLVE FINANCIAL RISK, AND NO HYPOTHETICAL TRADING RECORD CAN COMPLETELY ACCOUNT FOR THE IMPACT OF FINANCIAL RISK IN ACTUAL TRADING. FOR EXAMPLE, THE ABILITY TO WITHSTAND LOSSES OR TO ADHERE TO A PARTICULAR TRADING PROGRAM IN SPITE OF TRADING LOSSES ARE MATERIAL POINTS WHICH CAN ALSO ADVERSELY AFFECT ACTUAL TRADING RESULTS. THERE ARE NUMEROUS OTHER FACTORS RELATED TO THE MARKETS IN GENERAL OR TO THE IMPLEMENTATION OF ANY SPECIFIC TRADING PROGRAM WHICH CANNOT BE FULLY ACCOUNTED FOR IN THE PREPARATION OF HYPOTHETICAL PERFORMANCE RESULTS AND ALL OF WHICH CAN ADVERSELY AFFECT ACTUAL TRADING RESULTS.

Asset Type	Asset	Nominal Exposure	% Hedged Fx	Beta Volatility	Beta Ratio	Alpha Volatility	Alpha Ratio
Equities	Developed World Ex US Equities	19.0%	0%	14.9%	0.29	—	—
Equities	United States Equities	15.0%	0%	16.2%	0.25	—	—
Equities	United States Equities	15.0%	0%	16.2%	0.25	5.00%	0.25
Equities	United States PE	9.0%	0%	26.7%	0.25	10.00%	0.25
MBS	United States MBS	6.0%	0%	3.9%	0.25	—	—
Corporate Bonds	United States Corporate Bonds	5.0%	0%	7.3%	0.30	—	—
Nominal Government Bonds	United States Govt Bonds	5.0%	0%	4.8%	0.25	—	—
Absolute Return	Absolute Return	5.0%	0%	—	—	7.00%	0.50
Real Estate	United States Real Estate	5.0%	0%	19.9%	0.25	6.00%	0.25
Nominal Government Bonds	United States Govt Bonds	5.0%	0%	4.8%	0.25	2.00%	0.25
Equities	Emerging Market Equities	3.0%	0%	21.1%	0.25	5.00%	0.30
High Yield Bonds	United States High Yield Bonds	2.0%	0%	11.4%	0.30	—	—
Nominal Government Bonds	Developed World Bonds	2.0%	0%	4.1%	0.31	2.00%	0.30
Real Estate	Developed World Real Estate	2.0%	0%	18.0%	0.31	6.0%	0.30
IL Bonds	United States IL Bonds	1.0%	0%	6.0%	0.25	—	—
IL Bonds	United States IL Bonds	1.0%	0%	6.0%	0.25	1.00%	0.25

More Geographically Balanced Portfolio Disclosure

The "More Geographically Balanced" version of the portfolio preserves the portfolio's asset class composition, but within each asset class distributes capital equally across the following regions:

- *Public Equities:* USA, EUR, JPN, GBR, AUS, CAN, and EM
- *Private Equities:* USA, DEU, JPN, GBR, AUS, and CAN
- *Nominal Government Bonds:* USA, EUR, JPN, GBR, AUS, and CAN
- *Inflation-Linked Bonds:* USA, EUR, JPN, GBR, AUS, and CAN
- *Corporate Bonds:* USA, DEU, JPN, GBR, and AUS

For other asset classes, where data on the performance of individual regions' assets are unavailable, the "More Geographically Balanced" version of each portfolio retains that portfolio's asset allocation. These asset classes include High-Yield Bonds, MBS, and Infrastructure. Results are hypothetical or simulated and gross of fees unless otherwise indicated. Past results are not necessarily indicative of future results.

IMPORTANT DISCLOSURES

This research paper is prepared by and is the property of Bridgewater Associates, LP and is circulated for informational and educational purposes only. There is no consideration given to the specific investment needs, objectives or tolerances of any of the recipients. Additionally, Bridgewater's actual investment positions may, and often will, vary from its conclusions discussed herein based on any number of factors, such as client investment restrictions, portfolio rebalancing and transactions costs, among others. Recipients should consult their own advisors, including tax advisors, before making any investment decision. This material is for informational and educational purposes only and is not an offer to sell or the solicitation of an offer to buy the securities or other instruments mentioned. Any such offering will be made pursuant to a definitive offering memorandum. This material does not constitute a personal recommendation or take into account the particular investment objectives, financial situations, or needs of individual investors which are necessary considerations before making any investment decision. Investors should consider whether any advice or recommendation in this research is suitable for their particular circumstances and, where appropriate, seek professional advice, including legal, tax, accounting, investment or other advice.

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The All Weather asset mix performance is simulated by applying All Weather asset mix weights, which are determined by Bridgewater's proprietary process for building an environmentally balanced portfolio, to historical market returns. We use actual market returns when available and otherwise use Bridgewater Associates' proprietary estimates, based on other available data and our fundamental understanding of asset classes. In certain cases, market data for an exposure which otherwise would exist in the simulation may be omitted if the relevant data is unavailable, deemed unreliable, immaterial or accounted for using proxies. In the case of omitted markets, other markets in the same asset class, which represent the majority of positions in each asset class, are scaled to represent the full asset class position. Simulated asset returns are subject to considerable uncertainty and potential error, as there is a great deal that cannot be known about how assets would have performed in the absence of actual market returns. It is expected that the simulated performance will periodically change as a function of both refinements to our simulation methodology (including the addition/removal of asset classes) and the underlying market data. There is no guarantee that previous results would not be materially different.

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