Quantitative Research
20 August 2015

Implications of Rising Rates for Treasury and Risk-Parity Portfolios

- We consider the implications of a possible rise in rates for the performance of various Barclays Treasury indices, including short duration indices in each of the G4 currencies over the next 12 months.
- We examine three possible yield curve scenarios based on a one-year forecast from Barclays' rates team, the current forward curve, and assuming the current spot curve is unchanged.
- As these scenarios differ significantly, they allow investors to appreciate the large variation in Treasury returns possible over the near future.
- A rapid rise in rates could result in negative 12-month returns even for short-maturity Treasuries favoured by central banks for their low risk historically. We calculate the break-even (BE) yield changes needed to generate zero returns for each segment of the US Treasury Index, and find that the resulting BE yield changes are similar in magnitude to those reflected in Barclays' rates view. They are also reasonable in comparison to historical yield volatilities, and implied volatility estimates from the swaption market.
- Rising rates could also cause underperformance in risk parity portfolios, which tend to have increased exposures to bonds relative to more traditional stock/bond allocations. In a simple two-asset setting, we find the BE yield change that would be needed for a risk parity portfolio to match the performance of an equally weighted stock-bond portfolio, subject to different assumptions about equity market performance.

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Introduction

We examine the implications of a possible rise in rates for the performance of Barclays Treasury indices in each of the G4 currencies over the next 12 months. Specifically, we look at three possible yield curve scenarios based on Barclays' forecast, the current forward curve, and assuming the current spot curve is unchanged.[1] These scenarios differ significantly, and illustrate the large uncertainly investors face in regards to Treasury returns over the near future.

We also calculate two sets of break-even (*BE*) yield changes needed to generate zero returns in short-maturity Treasury portfolios favoured by central banks for their historically low risk and for risk-parity portfolios. We assess the likelihood of the BE changes given the three scenarios as well as based on historical realized yield volatilities, and implied volatility estimates from the swaption market.

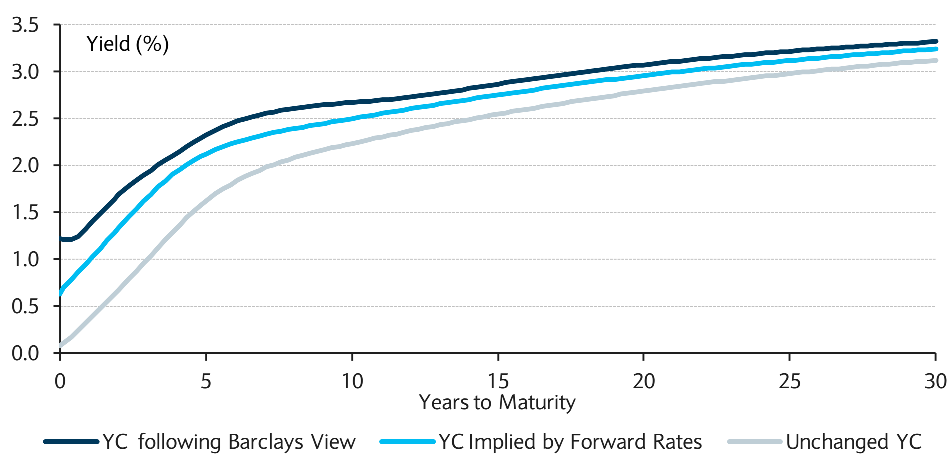
Treasury Index Returns under Various Yield Curve Scenarios

Figure 1 illustrates three possible zero-coupon U.S. yield curves on July 31, 2016. The first curve reflects Barclays' current expectations (July 2015) for par rates of key maturities (Fed funds, 2y, 5y, 10y, and 30y).[2] The second curve is based on the assumption that the yield curve evolves in accordance with July 31, 2015, forward rates, while the third curve simply reflects an unchanged zero-coupon curve based on Barclays US Treasury Strip yield curve.

Both Barclays' view and the forward curve imply higher yields with an overall flattening of the curve. Compared with the forward curve, Barclays' scenario predicts a higher increase in yields for the range of maturities up to 10 years and an increase of similar magnitude for longer maturities.

FIGURE 1

Possible Scenarios for U.S. Zero-Coupon Yield Curve on 7/31/2016



Source: Barclays Research

Return Calculation Methodology

To flesh out the return implications of these various yield curve scenarios, we calculate the 12-month holding period return under each scenario for various Barclays Treasury Indices

[1] Barclays' current rate view was presented in Setia, R. and M. Pond. "Interest Rates Outlook: Finding a New Equilibrium." Barclays Research. June 25, 2015, and Aksu, C., A. Fukunaga, M. Islam, A. Pradhan, and R. Setia. "Global Bond Yield Forecasts." Barclays Research. July 30, 2015.

[2] Forward rates are linearly interpolated between any two key maturities (assuming they increase at a constant pace) to generate a complete curve used to calculate the zero-coupon yield curve. For each key maturity, we find the forward rates that correctly price the par bond whose coupon rate equals Barclay's par rate forecast for that maturity.

that span the entire maturity spectrum up to 30 years. However, projecting the return of a bond index over a 12-month horizon is not a straightforward exercise. The index is rebalanced monthly, selling off all bonds whose maturities fall below the lower maturity boundary and buying all newly eligible issues. This has the effect of keeping index durations fairly stable. In the case of a rising yield scenario, the newly issued bonds will be expected to have correspondingly higher coupons as well, causing the index to have higher carry. The effects of index rebalancing also introduce a dependence on the timing of any yield changes. If the entire yield change takes place in the first month, the index would suffer a large negative return initially, but then benefit from higher yields for the next 11 months.

We calculate scenario returns under two different assumptions: buy-and-hold and monthly rebalancing. Under the buy-and-hold assumption, a portfolio is assembled at the start of the holding period that includes all index constituents at their index weights; this portfolio is then held unchanged for the entire holding period. This assumption is straightforward to implement, as it allows for a direct and precise calculation of returns over the entire 12-month holding period. However, for portfolios that will indeed be rebalanced monthly to track an index, this method can be somewhat inaccurate, as the duration of the buy-and-hold portfolio will steadily decrease over the holding period. The monthly rebalancing assumption requires some additional assumptions about future issuance, but is designed to approximate the way the index itself will evolve.

Under both the buy-and-hold and monthly rebalancing assumptions, we split the scenario total return into three components: coupon carry, time return including accretion (pull-to-par) and rolldown, and mark-to-market. The coupon carry component includes all coupon income paid or accrued over the holding period.[3] The time return component is calculated by repricing all of the constituent bonds as of the end of the period under the assumption of an unchanged yield curve. Finally, the mark-to-market return is obtained by repricing the bonds using the projected scenario yield curve as of the end of the holding period. Portfolio total return is equal to the sum of the three components by construction.

Under the buy-and-hold assumption, the return calculation described above is applied once over the full 12-month holding period. The carry term and the time return reflect a full year of coupon accrual, pull-to-par and rolldown along the initial yield curve. The effect of the yield curve scenario is applied only at the end of the period; sensitivity to yield change will be somewhat muted because portfolio duration will have shortened by almost a year.

Under the monthly rebalancing approach, the process is repeated iteratively over 12 subsequent monthly holding periods. Although we do not know exactly what bonds will be issued each month, we know that over time the maturity profile of the index tends to remain relatively stable, with newly issued bonds entering the index at the long end of the maturity range as older issues flow out at the short end. To approximate this effect, we keep the portfolio composition constant, but shift the maturities of each constituent bond one month forward each month. This will ensure that broad portfolio characteristics such as duration and maturity profile remain unchanged.[4]

Under the buy-and-hold assumption, our horizon total return is insensitive to the timing of the change in the yield curve.[5] If rates rise at the start of the period, the immediate mark-to-

[3] We assume that coupons that occur during a holding period are not reinvested until the end of the period.

[4] This procedure does not reflect the reality that the coupons of bonds issued during the holding period will depend on then-current yield levels, and will thus be higher in a rising yield scenario. To quantify this effect would require a projection of the size, timing and coupon of each future bond issue. This small discrepancy should affect only the attribution of return to components, and not the total scenario return. In a rising yield scenario, our method will show all of the increased carry return in the time return component (accretion and rolldown), whereas some of it could have been attributed to a projected rise in coupon.

[5] Note that we assume no reinvestment of coupons paid during the holding period. For the buy-and-hold case this means that these coupons remain uninvested over the remainder of the scenario; for the monthly rebalancing case they remain uninvested until the end of each month, as per actual index conventions. At current low yield levels, the missing reinvestment tends to amounts to just 1-3 bp over the 12-month horizon.

market effect would be greater than if it happens later in the year after portfolio duration has shortened, but then the portfolio would benefit from increased carry for the remainder of the period. These two effects should exactly cancel each other out, as the final portfolio value will be the same regardless of the scenario phase-in pattern.[6] For the monthly rebalancing case, the timing of the yield change matters a great deal. Since the index duration is assumed to remain constant from month to month, the mark-to-market effect should be the same regardless of when it occurs; but the earlier it occurs, the longer the portfolio will benefit from increased carry. For the monthly rebalanced results shown in this section, we assume that the yield change scenario will be phased in linearly over the 12-month horizon, such that the rebalanced indices should benefit somewhat from increased carry, providing a partial offset to the mark-to-market losses from a rate hike. In the next section of the article, we consider other phase-in assumptions as well.

Figure 2 reports the results for six U.S. Treasury Indices (1-3, 3-5, 5-7, 7-10, 10-20, and 20+) under the three rate scenarios described earlier. For each index, the table shows the average curve shift in the relevant maturity range, return components and total return assuming monthly rebalancing or on a Buy-and-Hold basis.

FIGURE 2

Returns to U.S. Treasury Indices by Rate Scenario

	Monthly Rebalancing					Buy-and-Hold			
	Avg. Curve Shift	Carry	Roll-down and Pull to Par	MTM	Total Return	Carry	Roll-down and Pull to Par	MTM	Buy&Hold Ret.
YC following Barclays View									
1-3 yr	1.01	1.42	0.21	-1.77	-0.13	1.41	-0.49	-0.89	0.03
3-5 yr	0.79	1.83	0.82	-3.05	-0.39	1.81	0.45	-2.64	-0.38
5-7 yr	0.63	2.27	0.58	-3.56	-0.70	2.23	0.47	-3.29	-0.59
7-10 yr	0.50	2.39	0.38	-3.94	-1.16	2.35	0.34	-3.78	-1.10
10-20 yr	0.33	4.25	-1.37	-3.86	-0.97	4.17	-1.44	-3.69	-0.96
20-30 yr	0.24	3.16	0.13	-4.76	-1.46	3.10	0.12	-4.66	-1.44
YC Implied by Forward Rates									
1-3 yr	0.63	1.42	0.10	-1.16	0.37	1.41	-0.49	-0.56	0.36
3-5 yr	0.59	1.83	0.79	-2.25	0.37	1.81	0.45	-1.90	0.36
5-7 yr	0.42	2.26	0.48	-2.37	0.37	2.23	0.47	-2.35	0.36
7-10 yr	0.30	2.37	0.36	-2.37	0.36	2.35	0.34	-2.33	0.35
10-20 yr	0.21	4.22	-1.37	-2.49	0.36	4.17	-1.44	-2.38	0.35
20-30 yr	0.14	3.14	0.13	-2.91	0.36	3.10	0.12	-2.87	0.35
Unchanged YC									
1-3 yr	0.00	1.41	-0.20	0.00	1.22	1.41	-0.49	0.00	0.92
3-5 yr	0.00	1.81	0.66	0.00	2.49	1.81	0.45	0.00	2.26
5-7 yr	0.00	2.23	0.48	0.00	2.75	2.23	0.47	0.00	2.71
7-10 yr	0.00	2.35	0.35	0.00	2.73	2.35	0.34	0.00	2.69
10-20 yr	0.00	4.17	-1.40	0.00	2.81	4.17	-1.44	0.00	2.73
20-30 yr	0.00	3.09	0.13	0.00	3.27	3.10	0.12	0.00	3.22

Note: All figures reflect percentage points. Avg. Curve Shift is the change in the zero-coupon yields averaged over the relevant maturity range of each of the indices. Carry is return from coupons, roll-down and pull-to-par are returns from rolling down the yield curve (as of the beginning-of-period), and mark-to-market is the price return resulting from the yield curve change. Source: Barclays Research

[6] Different phase-in assumptions would thus affect the attribution of the return to different components, but would not change the scenario total return. As described above, the return components that we present for the buy-and-hold assumption correspond to the assumption that the yield change occurs at the end of the period.

With rebalancing, Barclays' forecast implies that all indices are expected to generate negative returns, ranging from -13bp for the 1-3y Index to -146bp for the 20-30y Index. The Buy-and-Hold case also results in slightly less negative returns. The only exception is the 1-3y Index, in which the shorter duration results in smaller MTM loss and marginally positive returns (3bp).

Performance would be quite different if the yield curve evolved according to the forward rates. In this case, all indices would essentially earn identical returns of about 36-37bp. Under the third scenario in which current rates stay unchanged, the MTM is zero and the sum of carry, roll-down, and pull-to-par equals a bond's return (notice that a bond's yield-to-maturity would not equal its return in this case except when the yield curve is flat). In this case, the performance of all indices would be substantially higher, ranging from 122bp to 327bp for the 1-3y and 20-30y indices, respectively.

Figure 3 extends the results in Figure 2 to the rest of the G4 currencies with the euro being represented by German Bunds. For brevity we present results only for the case of monthly rebalancing, report the contribution of carry, roll-down and pull-to-par combined, and omit the MTM component.

FIGURE 3

Returns to G4 (ex U.S.) Treasury Indices by Rate Scenario

	YC following Barclays View			YC Implied by Forward Rates			Unchanged YC		
	Avg. Curve Shift	Carry, Rolldown, and Pull-to-Par	Total Return	Avg. Curve Shift	Carry, Rolldown, and Pull-to-Par	Total Return	Avg. Curve Shift	Carry, Rolldown, and Pull-to-Par	Total Return
U.K.									
1-3 yr	0.35	1.56	0.99	0.57	1.60	0.57	0.00	1.42	1.43
3-5 yr	0.42	2.21	0.54	0.36	1.96	0.57	0.00	1.79	1.80
5-7 yr	0.57	2.52	-0.31	0.34	2.36	0.57	0.00	2.25	2.28
7-10 yr	0.50	2.74	-0.91	0.28	2.72	0.57	0.00	2.64	2.67
10 - 30 yr	0.31	2.92	-1.57	0.14	2.78	0.57	0.00	2.75	2.79
Euro (Germany)									
1-3 yr	0.14	-0.17	-0.34	0.08	-0.10	-0.28	0.00	-0.18	-0.18
3-5 yr	0.15	0.48	-0.06	0.19	0.42	-0.28	0.00	0.31	0.31
5-7 yr	0.25	0.98	-0.36	0.22	0.94	-0.27	0.00	0.81	0.81
7-10 yr	0.24	1.49	-0.38	0.23	1.51	-0.28	0.00	1.43	1.44
10 - 30 yr	0.17	1.61	-0.86	0.12	1.57	-0.28	0.00	1.55	1.56
Japan									
1-3 yr	0.08	0.05	-0.07	0.02	0.05	0.00	0.00	0.01	0.01
3-5 yr	0.12	0.34	-0.12	0.06	0.23	0.00	0.00	0.16	0.16
5-7 yr	0.24	0.63	-0.70	0.09	0.50	0.01	0.00	0.31	0.31
7-10 yr	0.33	1.19	-1.42	0.13	1.02	0.00	0.00	0.86	0.86
10 - 30 yr	0.38	2.02	-3.54	0.11	1.90	0.00	0.00	1.79	1.79

Note: The results in the table assume monthly rebalancing. The results for euro are based on the German yield curve.
Source: Barclays Research

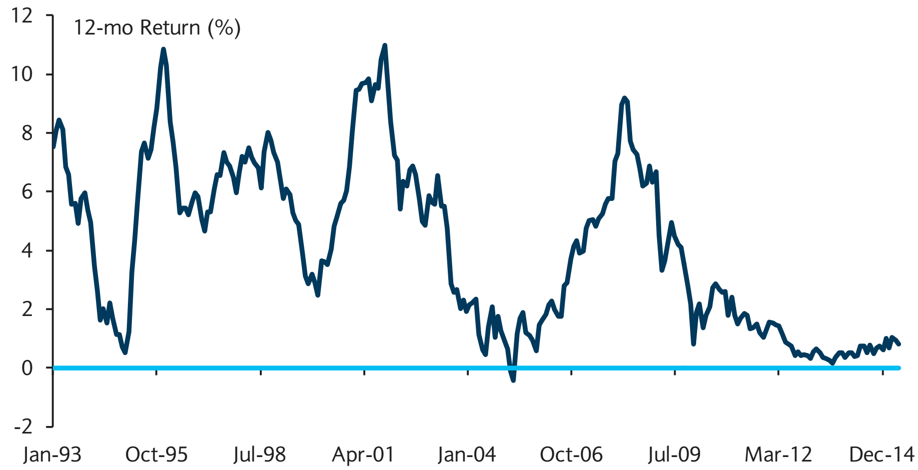
Several points are worth mentioning. Both the Barclays scenario and the forward rates imply non-positive returns to German and Japanese Treasuries across the maturity spectrum. Furthermore, they suggest that German yields are expected to stay negative up to the four-year maturity point. They differ substantially, however, when it comes to the Japanese market. For example, while the forward curve implies a zero return for long Japanese Treasuries, the Barclays forecast would lead to a -354bp loss. In the UK market, the forward rates indicate a more significant flattening of the Gilt curve compared with Barclays' outlook (i.e., a larger and smaller rise in the short- and long-end of the curve, respectively).

Breakeven Analysis for Short-Duration and Risk-Parity Portfolios

Investors with annual investment horizon and strong emphasis on principal preservation such as central banks have traditionally favoured the 1-3y Treasury Index.[7] Historically this index earned positive returns in all 12-month periods since 1993 with the exception of two in 2005, as shown in Figure 4. The 2004-5 event was the result of a steady series of Fed rate hikes, which caused the yield of this index to increase from 149bp in March 2004 to 372bp in March 2005. (Similar events in 1994 did not quite breach the threshold of negative one-year returns for this index.)

FIGURE 4

12-Month Trailing Total Returns for U.S. 1-3 Year Treasury Index



Source: Barclays Research

The likely rate hike coupled with current low yields at the short-end of the Treasury curve, which offer very little protection against the possibility of rising rates, may result in negative returns for the 1-3y Treasury Index in the coming year. Rather than assess the likelihood of such an event using Barclays' view, the forward curve or any other scenario, we follow Carmel and Dynkin (2001) and find the *BreakEven Shift (BE)* – the parallel yield increase needed for the index to earn a zero return over the next 12 months. Because the magnitude of the *BE* shift is related to the timing of the yield adjustment, we compute it under the assumption that the yield shift can occur at the start of the period, end of the horizon, or linearly throughout the period[8]. As in the previous section, the index returns are computed using the actual index composition, exact repricing, and assuming monthly rebalancing. We also find the BE shift for a buy-and-hold investor, in which case the magnitude is not affected by the timing of the rate change.

Figure 5 presents the *BE* shifts for the Barclays 1-3y Index over the 12-month period until July 31, 2016. The table also extends the calculations for the rest of the Treasury Indices and countries we covered earlier.

For the 1-3y index to have a negative 12-month return, the yield curve will have to shift up by more than 153bp, 91bp and 70bp if the rate increases immediately, linearly, or at end of the period, respectively. The BE shift is largest if yields rise at the start of the period because

[7] See Ben Dor, A., L. Dynkin, J. Hyman, and B. Phelps. "Total Return Management of Central Bank Reserves." Lehman Brothers Research. January 2005.

[8] The BE shift for the horizon start and end are the parallel yield shifts at the end of the first month, and last month that will set the portfolio's total 12-month return to zero. For the steady rate case, we find the parallel shift that will make the first month's return equal to zero. We then adjust the yield curve up accordingly, and find the parallel shift that result in the second month return being zero as well, and so on. The total BE shift is the sum of the monthly parallel shifts over the holding period.

the index would also benefit from higher carry over the reminder of the period. For a buy-and-hold portfolio, the results represent a middle case between the steady rate and immediate change BE shifts of the rebalanced portfolios.

How likely are the *BE* shifts? The steady rate case is in line with Barclays forecast that predicts a 101bp increase in 1-3y yields (as well as for the 3-5y Index where the *BE* is 74bp compared with 79bp by Barclays). Another way to put the magnitude of the *BE* shifts in perspective, is to scale them by two yield volatilities measures: the implied yield volatility from duration-matched 1-month forward swaptions and the annualized historical volatility since January 1988. In the steady rate case for example, the BE shift for the 1-3y index implies a 1.61 and 0.99 standard deviation change in yields, respectively.

FIGURE 5

BE Parallel Yield Shifts Generating 12-Month Zero Return for Barclays Treasury Indices

		U.S.			U.K.	Germany	Japan
Index	Timing of Yield chg.	12M BE Shift	BE Shift/ Implied Yield Volatility	BE Shift/ Historical Yield Volatility	12M BE Shift		
1-3 yr	Period Start	1.53	2.71	1.68	1.54	-0.20	0.02
	Steady Rate	0.91	1.61	0.99	0.97	-0.13	0.02
	Period End	0.70	1.24	0.77	0.76	-0.10	0.01
	Buy&Hold	1.05	1.85	1.15	1.24	-0.24	0.01
3-5 yr	Period Start	0.90	1.26	0.90	0.64	0.11	0.07
	Steady Rate	0.74	1.04	0.74	0.53	0.09	0.06
	Period End	0.67	0.94	0.67	0.48	0.08	0.05
	Buy&Hold	0.77	1.07	0.76	0.57	0.06	0.05
5-7 yr	Period Start	0.63	0.83	0.64	0.55	0.18	0.08
	Steady Rate	0.55	0.72	0.56	0.48	0.16	0.07
	Period End	0.52	0.68	0.52	0.45	0.15	0.07
	Buy&Hold	0.58	0.77	0.59	0.49	0.14	0.06
7-10 yr	Period Start	0.42	0.56	0.44	0.43	0.22	0.13
	Steady Rate	0.38	0.50	0.40	0.39	0.20	0.13
	Period End	0.37	0.49	0.39	0.37	0.19	0.12
	Buy&Hold	0.40	0.52	0.42	0.39	0.19	0.12
10-20 yr (U.S.) 10 - 30 yr (Others)	Period Start	0.34	0.45	0.38	0.22	0.12	0.13
	Steady Rate	0.31	0.41	0.35	0.21	0.11	0.13
	Period End	0.31	0.40	0.34	0.20	0.11	0.12
	Buy&Hold	0.31	0.41	0.35	0.21	0.11	0.12
20-30 yr (U.S)	Period Start	0.21	0.27	0.25			
	Steady Rate	0.19	0.26	0.23			
	Period End	0.19	0.25	0.23			
	Buy&Hold	0.19	0.26	0.23			

Note: 12m BE shift is the parallel shift that will make the return of the relevant index equal to zero over the next 12-months (until July 2016). Implied yield volatility is calculated from duration-matched 1m forward swaptions. Historical yield volatility is the volatility of an index monthly yield changes (annualized) since 1988. Source: Barclays Research

The numerical procedure by which we calculate the scenario returns, while accurate, requires analytics for the complete universe of securities comprising the index. In addition, the calculation may need to be updated once the curves and projections change.

Instead, one may estimate the total return of an index using a simple approximation based on the sum of carry, roll-down and MTM. The first component comprises the initial index yield y earned over the horizon, plus the additional carry earned as a result of the change in yield Δy.

The magnitude of the second part would depend on the timing of the change in yield. The roll-down return is computed as the product of the yield curve slope (the difference in yields between the index duration and one month shorter) with the index duration and the horizon length, while the MTM would simply be the product of the parallel yield change of the index times its duration. Formally, the index annual return can be expressed as:

$$\text{Ann. Index Return.} \approx [y\Delta t + \text{carry due to } \Delta y] + \text{YC slope}_{D,D\text{-}1\text{ month}}(D\text{-}1/12)\text{x}12 - \Delta y\ (D\text{-}1/12)$$

Notice that because the Treasury Indices are rebalanced monthly, we assume that the index duration (D) should be adjusted only slightly.

Applying this approximation to compute the BE shifts for the Barclays 1-3y US Treasury Index results in estimates of 142bp, 93bp, and 69bp if the rate increase takes place at the period start, at a constant rate, or at the period end, respectively.[9] These numbers are quite similar to the results in Figure 5 using exact repricing with differences ranging from 1bp to11bp (the largest difference being 11bp for the case where the yield change occurs at the start of the period). Furthermore, for the buy-and-hold case, the results are essentially identical (105.3bp compared with 105bp with exact re-pricing).[10]

Thus, our linear approximation, which is far simpler to compute and does not require constituent level data, results in figures very similar to those of the full repricing approach. Investors can use this approximation to update their estimates of BE shifts in response to yield curve changes.

BE Yield Changes for Risk-Parity Portfolios

In this section, we illustrate the possible impact of rising Treasury rates on the performance of a risk parity (RP) portfolio. The main idea of the RP approach to asset allocation is to create portfolios with an equal share of risk coming from each asset class, thereby maximizing the diversification benefit. This tends to overweight low-volatility asset classes – often represented by bonds – and underweight high volatility asset classes such as stocks. Rising Treasury rates may reduce the Sharpe ratio of bonds to a point that would negate the diversification benefit of equal risk allocations.

The notion of a BreakEven Shift can thus serve as a useful metric in the context of risk-parity portfolios as well. We follow the example of RP studied recently in Desclée, Hyman and Polbennikov (2015). To illustrate the RP concept, they start by only considering equities and bonds (represented by the S&P500 and Barclays U.S. Aggregate Indices, respectively). Desclée et al. compare the performance of the RP portfolio, which allocates equal shares of risk to bonds and equities (representing 80% and 20% in terms of market values, respectively) to that of an equally weighted (EW) allocation, where 93% of risk is attributed to equities.[11]

The *RP* portfolio outperformed (in risk-adjusted terms) the EW portfolio between January 1991 and June 2015, with Sharpe ratios of 0.91 and 0.69, respectively, due to their secular overweight to bonds. This outperformance however, was significantly helped by the downward trend in bond yields. This trend is unlikely to continue going forward. In fact, many investors anticipate interest rates to increase in the near future.

[9] The timing of the yield change affects only the carry due to Δy. The BE shift Δy is equal to: $(y + \text{roll-down})/(D - a)$ with a being equal to 1, 13/24, and 1/12 when the shift takes place at the start of the period, at a constant rate, and at the end of the period.

[10] For the buy-and-hold, we use the approximation formula: Index Ret = $(y\Delta t) + (y_D - y_{D-1})*(D-1) - (D\Delta y) + (1-yD)\Delta t\Delta y$ based on a quadratic approximation. The last component is ignored in the monthly-rebalanced case, since each holding interval ($\Delta t = 1/12$) is small enough.

[11] Notice that in this example, both portfolios were considered to be fully funded. In practice, RP portfolios may be leveraged up to help translate the higher Sharpe ratios into additional return. A leveraged exposure to interest rates is thus a typical characteristic of RP portfolios, giving cause for concern about their performance in rising rates scenarios.

As a result, Desclée et al. compare the portfolios after de-trending the realized bond returns. The adjustment was meant to eliminate the effects of the trend in yields and high carry associated with the high historical yields based on following expression:

Adj. Return = Return - Trend x OAD – Hist. Yield/12 + Current Yield/12

Specifically, they subtract approximately 2bp/month, which is the portion of return associated with the realized yield decline. This figure was estimated as the difference in yields between the starting and ending dates (January 31, 1990, and June 30, 2015) of the analysis divided by the length of the period. Given the Aggregate Index average duration of five years, the monthly yield contraction contributed approximately 10bp per month to index returns. In addition, they replaced the historical carry, (estimated as the accrued yield of the index), with the monthly yield carry as of June 2015 (0.2%).

Figure 6 reports the average return (over 1m Libor), volatility and Sharpe Ratio of the S&P500 Index, U.S. Aggregate (actual and adjusted) along with the EW and RP portfolios based on the adjusted returns of the U.S. Aggregate. The results indicate that while the average return of bonds over 1-m Libor declined from 2.94% per year to 1.92% per year after the adjustment, the *RP* portfolio still outperformed its EW counterpart with a Sharpe ratio of 0.72 versus 0.62, respectively.

FIGURE 6

Performance of Equities, Bonds, Risk Parity and Equally Weighted Portfolios

	S&P 500	U.S. Aggregate	U.S. Aggregate (Adjusted)	Equally Weighted (EW)	Risk Parity (RP)
Avg. Return over 1M Libor (%/year)	7.43	2.94	1.92	4.68	3.02
Volatility (%/year)	14.41	3.6	3.56	7.55	4.2
Sharpe Ratio	**0.52**	0.82	**0.54**	**0.62**	**0.72**

Note: Based on monthly data between January 1991and June 2015. The performance of the EW and RP portfolios is based on the adjusted returns of the U.S. Aggregate Index. Source: Barclays Research

The return adjustment to the historical performance of the U.S. Aggregate Index captures the secular trend in yields between 1991 and 2015 but does not reflect the impact of the possible rise in yields on the relative performance of two portfolios. Hence, we calculate the break-even change in bond yield that would result in the RP and EW portfolios having the same risk-adjusted performances.

We perform this calculation for three different scenarios for equity returns: base case return, which is simply the historical average equity (S&P500) return since the start of the sample in 1991 (7.43%/year), base case return minus one standard deviation, and base return plus one standard deviation.

Formally, the break-even return x is the return of the US Aggregate index that equalizes the Sharpe ratios of the *RP* and *EW* portfolios as follows:

$$\frac{0.2\ \text{Equity ret. in relevant scenario} + 0.8\ x}{\text{Vol. of } RP \text{ Port.}} = \frac{0.5\text{Equity ret. in relevant scenario} + 0.5\ x}{\text{Vol. of } EW \text{ Port.}}$$

Where 0.2 and 0.8 represent the average equity and bond market weights in the RP portfolio, respectively. The volatilities of the *RP* and *EW* portfolios during the sample period (4.20% per year and 7.55% per year, respectively) are assumed unchanged.

Figure 7 reports the break-even yield changes for the U.S. aggregate Index (derived from the break-even returns using the index duration) for the three equity return scenarios. The results suggest that in the base case scenario, the break-even yield change (16bp) is well within the range predicted by both Barclays and the forward curve for the relevant part of the curve (63bp and 42bp, respectively, for the 5-7y Treasury Index). Even in the scenario in which equities perform poorly with an average decline of almost 7% per year, a yield change of more than 58bp per year would suffice to generate loses on the bond part of the portfolio that would more than offset the diversification benefit they generate.

FIGURE 7

Risk-Parity BE Yield Change by Equity Scenario

	Base Case (Historical Equity Ret. Avg.)	Base - 1 StDev	Base + 1 StDev
Equity Return Scenario, %/yr	**7.43**	**-6.98**	**21.84**
Avg. Adjusted Return US Agg, %/yr	1.92	1.92	1.92
Required BE Return US Agg, %/yr	1.11	-1.04	3.27
Implied Change in Agg Return , %/yr	-0.81	-2.97	1.35
Break-Even Yield Change per year (bp)	**16**	**58**	**-26**

Note: Based on monthly data between January 1991and June 2015. Source: Barclays Research

A number of caveats must be mentioned, however. The analysis is based on a very simplistic representation of risk parity portfolios. In practice, risk parity portfolios would aim to achieve equal allocations of risk to more than just two asset classes or risk factors. In addition to equity and rates, they could include allocations to inflation risk and various alternatives, and they could further diversify the strategy by currency. The effect of changes in US rates on a more diversified portfolio would of course be less severe than that illustrated for our simple two-factor example. In addition, the adoption of a risk parity approach is often a strategic one taken on a through-the-cycle basis by long-horizon investors. For them, the one-year horizon on which we have based our analysis may not be fully aligned with their performance goals. Over a longer horizon, higher interest rates will lead to higher returns for fixed-income assets. Perhaps for such investors, the anticipation of rising rates is not so much cause for a strategic change of paradigm, but just a tactical downward adjustment in duration.

Conclusion

We examine the implications of three rate scenarios on the performance of Barclays Treasury Indices over the next year in the U.S., Germany, Japan, and the UK We find that Barclays' view implies negative returns across most maturities and markets, with the short end of the UK market being the only exception. Forward rates predict slightly higher returns at short maturities and similar returns at the long maturities.

We also show that a negative 12-month return from the U.S. 1-3y Treasury index is quite likely given yield volatility estimates based on either history or current information from the swaption market, with very similar results for the other countries.

A possible rate hike also has important implications for risk-parity portfolios. In particular, in the case of the most basic RP portfolio, comprised of equities and bonds, the current yield environment leads to underperformance of the RP portfolio relative to its EW counterpart with very mild rate increases under several equity market scenarios.

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