



# Enhancing Performance of Multi Asset Portfolios: A Carry-Based Approach

- We introduce carry-based signals for cross-country allocation in global equity and global bond markets. We find that equity-bond portfolios that utilize these signals delivered attractive performances.
- We show that carry-based allocations lead to strong performance results in both equities and bonds, as top-carry country indices tend to outperform bottom-carry country indices within each asset class.
- Equity market allocations based on dividend yield adjusted for retained earnings tend to outperform conventional global equity benchmarks. The results can be further improved by including market environment variables that account for economic conditions affecting equity markets on shorter horizons.
- Similarly, bond market allocations based on carry adjusted for anticipated changes in rates tend to outperform conventional global Treasury benchmarks.
- Risk parity (RP) portfolios that combine top equity and top bond carry-based allocations achieve strong diversification and persistently outperform bottom-carry RP portfolios and passive RP benchmarks.

**A long-short strategy that buys top carry and sells bottom carry RP portfolios produced high risk-adjusted returns between 2001 and 2020, with an information ratio of 1.22. Its performance was stable during different rates regimes and risk environments.**

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**FOR IMPORTANT EQUITY RESEARCH DISCLOSURES, PLEASE SEE PAGE 25**

## Introduction

Investors often use geographical diversification to manage country-specific risks.<sup>1</sup> Indeed, persistent financial, economic or structural factors can result in geographical segmentation for all major asset classes. Regulatory frameworks, fiscal policies, and political environments vary by country, as do endowments of natural resources and human capital.

For example, monetary policies are set by individual central banks that are national institutions.<sup>2</sup> Therefore, interest rate dynamics tend to be specific to individual markets, causing bond returns to differ depending on their currency of denomination.

While national economies are inter-connected, political decisions or country-specific shocks can affect the degree of globalization through, for example, the emergence of trade barriers or disruptions to international supply chains. Similarly, asset prices around the world can be affected by global shifts in risk aversion, but at the same time often remain subject to significant local fundamental and technical factors.

In this report, we utilize geographical segmentation by selecting countries with stronger performance potential in equity and in rates markets. We then use portfolios of selected top equity and bond markets to form building blocks of equity-bond risk parity (RP) allocations. These building blocks can include different countries when considering equity or bond asset classes.

To identify equity markets with strong performance potential, we introduce a carry-based signal for equities and use it in parallel with our existing carry-based signal<sup>3</sup> for global government bonds. In each asset class, we explain how the signal is formed and provide evidence of its ability to differentiate between strong and weak performers over long horizons. We investigate the performance of long-only and long-short portfolios in equity and in bond markets in isolation.

When combining equity and bonds according to risk parity, we find that top carry-based RP portfolios persistently outperform their bottom counterparts, as well as conventional RP benchmarks.

In Figure 1, we give the motivation for our approach by showing that carry is an important component of long horizon total returns for equity and bond markets.<sup>4</sup> Figure 1 covers our study universe of eleven developed markets for which long time series of MSCI equity indices and Bloomberg Barclays Treasury indices are available.

Panel A shows cumulative price and total returns of the MSCI USA equity index. The difference represents reinvested dividends – the core carry component in equities. Over a long horizon, the portion of equity return attributed to reinvested dividends can be substantial.

Panel B shows the percentage contributions of reinvested dividends to the total returns of eleven equity markets in 2001-20. Dividends represent a high proportion of total returns in all markets, especially in the UK, Australia, Germany, Norway, and Singapore. They represent a lower portion of returns in Denmark and the US.

<sup>1</sup> In this report, we focus on geography, as opposed to industry sectors or other dimensions of diversification, such as style factors.

<sup>2</sup> The European Monetary Union (EMU) is a notable exception, with its monetary policy decided by the ECB. This is one reason why we include Germany as the only EMU market in this study.

<sup>3</sup> Please see *Carry Strategies in Global Rates Markets* and *Introducing GRACE: The Global Rates Adjusted Carry Scorecard*.

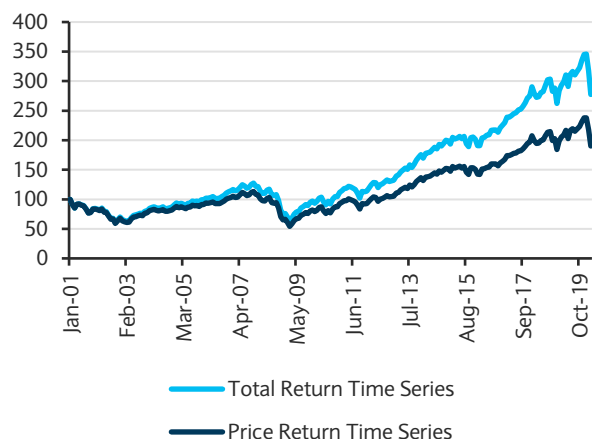
<sup>4</sup> Carry is known to be an informative performance indicator in different asset classes; see, eg, Kojien, Ralph S.J et al., "Carry," *Journal of Financial Economics*, February 2018.

FIGURE 1

# Contribution of Carry to Stock and Bond Returns, January 2001–March 2020

PANEL A

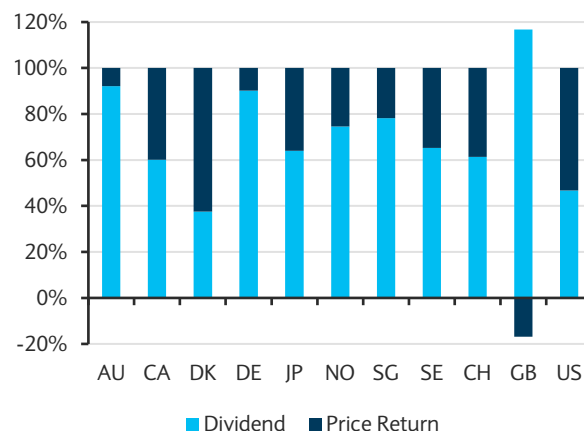
## MSCI USA Equity Index: Cumulative Price and Total Returns



Source: MSCI, Barclays Research

PANEL B

## Percentage Contributions of Dividends to Total Returns of MSCI Equity Indices by Country, 2001-20

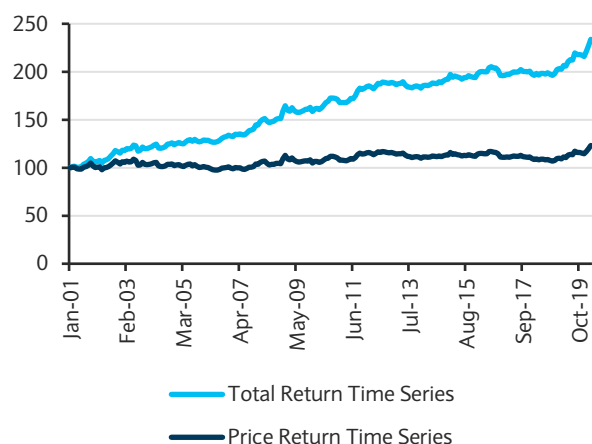


Note: Index returns are currency-hedged into USD

Source: MSCI, Barclays Research

PANEL C

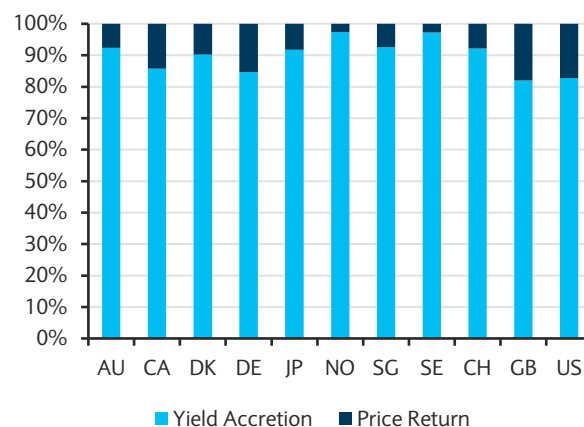
## Bloomberg Barclays US Treasury Index: Cumulative Price and Total Returns



Source: Bloomberg, Barclays Research

PANEL D

## Percentage Contributions of Accrued Yields to Total Returns of Government Bond Indices by Country, 2001-20



Note: Index returns are currency-hedged into USD

Source: Bloomberg, Barclays Research

While carry is a large contributor to equity total returns, it completely dominates bond total returns over long horizons, as shown in panels C and D. Panel C shows cumulative price and total returns of the US Treasury index. Panel D shows that accrued yield has contributed more than 80 percent to the total returns of the eleven government bond markets in 2001-20, despite the persistent rally in rates that occurred in that period.

This report includes five sections. The first explains the construction of our equity selection signal and illustrates its performance in eleven developed equity markets since 2001. The second provides robustness checks by expanding our analysis to developed equity markets to 1976 and applies the same methodology to a set of emerging markets. Next, in the third section, we introduce our carry signal for global rates markets and document its

performance in government bond portfolios. The fourth section discusses equity-bond risk parity portfolios where we select markets in equity and bond blocks according to their respective carry-based signals. We conclude with a performance analysis of carry-based strategies in different market regimes and during the recent COVID-19 crisis in March 2020.

## Introducing a Carry-Based Signal for Equity Market Selection

We form a carry-based signal to select equity markets from a universe of eleven developed countries.<sup>5</sup>

As illustrated in Figure 1, the dividend income can constitute a significant portion of equity returns over long horizons. We therefore use the twelve-month trailing dividend yield (DY) as the core element of the equity carry signal.

The second element of the signal includes retained earnings,<sup>6</sup> defined as the difference between earnings and paid dividends. Retained earnings invested into new business projects tend to translate into future growth and are eventually reflected in higher dividends.

Incorporating retained earnings into the carry measure also helps correct for potential differences in dividend pay-out policies across markets due to, for example, a different allocation to growth and value stocks. Indeed, value stocks tend to pay a high proportion of their earnings as dividends, while growth companies tend to retain a larger share of their earnings to invest in new projects. As a result, differences in dividend yields can be persistent across markets. Adjusting for retained earnings can help address these structural differences.

Because short-term earnings can vary significantly over time and these changes are well anticipated by the market, we focus on cyclically adjusted long-term earnings calculated over ten-year periods.<sup>7</sup> These cyclically adjusted earnings should capture variation in long-term profitability across different markets. To reflect different dynamics of business activity across countries, we scale long-term retained earnings by purchasing managers indices (PMI), which can be seen as forward-looking indicators of economic growth.<sup>8</sup>

Finally, we calculate the resulting adjusted dividend yield (ADY) of each market as a sum of its observed dividend yield and a fraction of its PMI-adjusted retained earnings.

While the ADY measure can help investors select high yielding markets, dividend and earning yields might not provide sufficient information about the relative medium-term prospects of individual countries. For example, asynchronous monetary policies can strongly influence the performance of equity markets. If a central bank enters a tightening cycle independently from other markets, the cost of capital in this country will be higher and corporate profitability will likely decline.<sup>9</sup> FX rates is another macro factor that can affect equity markets. In the case of a local negative growth shock, a decline in FX rates can actually benefit exporting sectors.

<sup>5</sup> We use USD-hedged returns of the following MSCI country indices: MSCI USA, MSCI UK, MSCI Germany, MSCI Japan, MSCI Canada, MSCI Australia, MSCI Singapore, MSCI Sweden, MSCI Switzerland, MSCI Denmark, and MSCI Norway.

<sup>6</sup> We conservatively assume that only half of earnings retained by a company is translated into future growth. This is consistent with long-term averages for the US economy reported in Arnott, R., and P. Bernstein, "What Risk Premium is Normal," *Financial Analyst Journal*, March 2002.

<sup>7</sup> This is similar to the approach adopted for cyclically-adjusted P/E (CAPE) ratios, see Campbell, J., and R. Shiller, "Valuation Ratios and the Long-Run Stock Market Outlook," *The Journal of Portfolio Management*, Winter 1998.

<sup>8</sup> We scale the retained earnings yield in proportion to recent levels of PMI releases. The magnitude of the scaling is in line with the long-term relationship that we observe between PMI levels and realized earnings growth. PMI releases provide a consistent measure of economic activity across countries: a PMI print above 50 reflects economic expansion, while below 50 reflects contraction. We find that PMIs are not strongly correlated across countries.

<sup>9</sup> This effect can also be viewed from a perspective of the dividend discount valuation model (DDM), where low rates increase valuation through the discounting effect. See Gordon, M. "Dividends, Earnings and Stock Prices," *Review of Economics and Statistics*, 1955, The MIT Press. 41 (2): 99–105.

We account for the market environment (ME) of individual countries by considering relative trends in government yields and trade-weighted FX rates.<sup>10</sup> These variables can be consolidated with ADY carry signals.

Figure 2 contrasts dividend yields adjusted for the retained earnings and ME variables of the eleven markets as of 31 March 2020. Panel A shows dividend yields and PMI-adjusted retained earnings by country. The UK has the highest dividend yield among the eleven markets, but its growth component associated with PMI-adjusted earnings is relatively low. At the same time, Germany and Singapore have relatively high growth components. The US and Canada have relatively low net dividend yields, but their growth components look substantial. At the same time, Denmark has a very low growth component, while its dividend yield is comparable with countries such as Canada and Sweden.

Panel B shows market environment variables (annualized trends in rates and FX rates) for the eleven countries. Germany and Australia experienced significant downward trends in both rates and FX, which should provide some help to their respective equity markets. In contrast, the Swiss franc and the British Pound trended upwards, potentially hampering economic growth of their respective markets.

We analyse ADY signals, either isolated or combined with ME indicators, as predictors of the performance of equity markets. The composite (ADY+ME) signal is obtained by averaging country ranks having first sorted countries on ADY and ME variables separately.

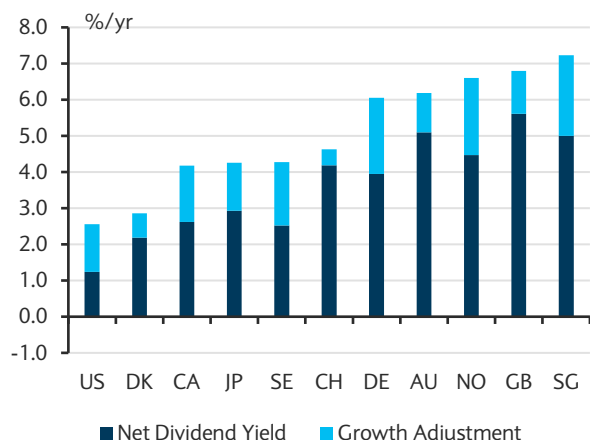
Figure 3 shows the average returns of portfolios sorted on either ADY or the composite (ADY+ME) indicators. The eleven markets are ranked at the beginning of each month and are allocated into three equally weighted portfolios: top, mid and bottom. The top portfolio includes three top-ranked countries, while the bottom one includes three countries ranked at the bottom. The five remaining countries are included in the mid-ranked portfolio. We then measure subsequent monthly returns of the sorted portfolios.

Figure 3 provides empirical evidence that ADY represents an informative signal for market selection. Indeed, top-ranked portfolios had more than 5.5%/year of return advantage over

FIGURE 2  
Carry and Market Environment Variables by Country, March 2020

PANEL A

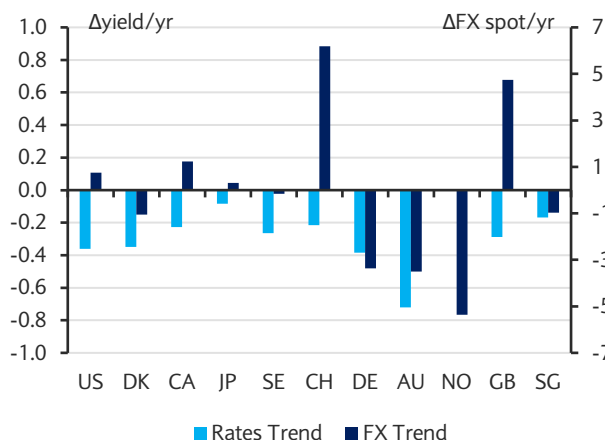
Dividend Yields and Growth-Adjustments by Country



Source: MSCI, Barclays Research

PANEL B

Market Environment (ME) Indicators by Country



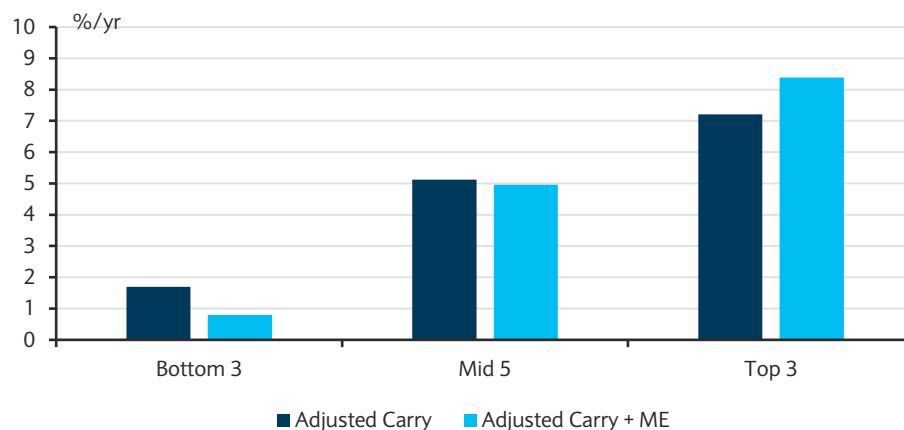
Source: MSCI, Barclays Research

<sup>10</sup> To reflect the macro economic environment of each country, we use trends in rates and FX as market environment (ME) indicators. We treat an upward trend in both indicators as a negative signal for the subsequent performance of an equity market, while downward trends are viewed positively.

bottom-ranked portfolios. Including ME variables improves results: the performance of the top portfolios becomes stronger, while that of the bottom ones weakens. The outperformance of top over bottom portfolios increases to 7.6%/year.

FIGURE 3

## Average Return of Ranked Carry-Based Equity Portfolios, February 2001-March 2020



Note: Portfolio returns are currency-hedged into USD and are reported in excess of 1-month USD Libor.

Source: Barclays Research

To better understand the contributions of the different factors to our results, we contrast the returns of top and bottom portfolios based on individual signal components taken in isolation: DY, ADY, ME, and the composite ADY+ME. Figure 4 shows the performances of the top and bottom portfolios sorted by each component. In each case, the top portfolios outperformed the bottom ones.

The first column shows the performance of the MSCI World index.<sup>11</sup> The index delivered an average return of 3.8%/year in excess of 1-month USD Libor between 2001 and 2020, with a Sharpe ratio of 0.27. In comparison, the equally weighted portfolio of the top three markets sorted on DY delivered an average return 6.3%/year with a Sharpe ratio of 0.42. It significantly outperformed the index in the early sub-period (2001-09), but slightly underperformed it in the recent sub-period (2010-20). In contrast, the portfolio of bottom three markets sorted on DY underperformed the index and the top portfolio in all sub-periods.

Columns 4 and 5 show the performance of the top and bottom portfolios sorted on ADY, the carry measure that includes PMI-adjusted retained earnings. Adding retained earnings improves returns of the top portfolios by 0.9%/year over the full sample.

The next two columns report the performance of portfolios sorted on ME indicators in isolation. These provide a very informative signal, as the top ME portfolios outperformed the bottom ones in all periods. The strategy based on ME variables also persistently outperformed the MSCI World index.

Finally, the last two columns show the performance of the top and bottom portfolios based on the composite signal. Including ME variables significantly improves the relative performance of the top portfolios based on ADY. Indeed, the top portfolios outperformed the bottom ones and the MSCI World index by 7.6%/year and 4.6%/year, respectively. The outperformance was weaker in the recent sub-period between 2010 and 2020.

<sup>11</sup> Investors frequently use this index as a benchmark for global equity portfolios.

FIGURE 4

## Performance of Carry-Based Equity Portfolios Sorted on Individual Signal Components

	MSCI World	Dividend Yield (DY)		Adjusted Dividend Yield (ADY)		Market Environment (ME)		Composite (ADY + ME)	
		Top 3	Btm 3	Top 3	Btm 3	Top 3	Btm 3	Top 3	Btm 3
February 2001 – March 2020									
Avg. Return, %/yr	3.8	6.3	1.1	7.2	1.7	8.2	1.8	8.4	0.8
Volatility, %/yr	14.1	14.8	14.9	15.8	13.9	14.4	15.7	16.0	14.9
Sharpe Ratio	0.27	0.42	0.08	0.46	0.12	0.57	0.12	0.52	0.05
MSCI World Beta	1.0	0.9	1.0	1.0	0.9	0.9	1.0	1.0	1.0
Max. Drawdown, %	-50.0	-49.9	-53.5	-49.2	-52.5	-47.3	-54.4	-48.1	-53.2
February 2001 - December 2009									
Avg. Return, %/yr	-1.4	5.0	-4.0	7.0	-4.3	5.0	-1.7	7.4	-4.2
Volatility, %/yr	15.8	18.1	17.5	19.0	16.1	16.5	19.4	18.7	17.7
Sharpe Ratio	-0.09	0.27	-0.23	0.37	-0.27	0.30	-0.09	0.39	-0.24
MSCI World Beta	1.0	1.0	1.0	1.1	0.9	1.0	1.1	1.1	1.0
Max. Drawdown, %	-50.0	-49.9	-53.5	-49.2	-52.5	-47.3	-54.4	-48.1	-53.2
January 2010 – March 2020									
Avg. Return, %/yr	8.2	7.4	5.6	7.4	6.9	11.1	4.9	9.3	5.2
Volatility, %/yr	12.4	11.2	12.2	12.5	11.4	12.4	11.5	13.2	11.9
Sharpe Ratio	0.66	0.66	0.46	0.59	0.61	0.89	0.42	0.70	0.44
MSCI World Beta	1.0	0.8	0.9	0.9	0.8	0.9	0.9	1.0	0.9
Max. Drawdown, %	-19.7	-16.0	-22.1	-23.9	-19.8	-19.4	-16.1	-22.4	-18.8

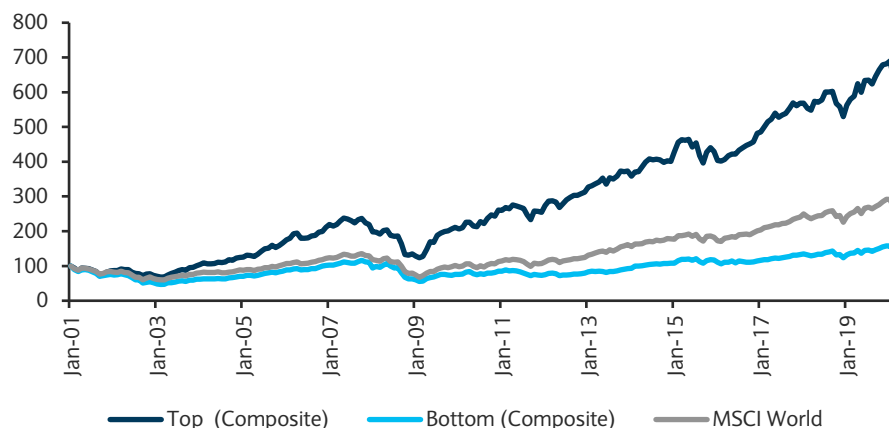
Note: Portfolio returns are currency-hedged into USD and are reported in excess of 1-month USD Libor. Source: Barclays Research

Returns of the top and bottom portfolios based on the composite signal are generally more volatile than those of the MSCI index: 16.0%/year versus 14.1%/year. This is expected because the index is diversified across more than 20 markets, while the carry-based portfolios include three markets only. The differences in volatilities are larger in 2001-09, which includes the crises of 2002 and 2008. In 2010-20, volatilities of the carry-based portfolios and the index are closer to each other. The top portfolios also have slightly lower drawdowns than the bottom ones or the index. Finally, the market betas of the top and bottom portfolios are comparable in all periods, indicating that the two portfolios had, on average, similar exposures to the global equity market.

The outperformance of the top carry-based portfolios reported in Figure 5 is quite persistent over time. Figure 5 plots cumulative total returns of the top and bottom portfolios based on the composite (ADY+ME) signal, as well as those of the MSCI World index. The top portfolios persistently outperformed the bottom ones and the index since 2001. At the same time, the bottom portfolios persistently underperformed the index.

FIGURE 5

**Cumulative Total Returns of Top and Bottom Equity Portfolios Based on the Composite (ADY+ME) Signal**



Note: Returns are currency-hedged into USD. Source: Barclays Research

As per the results reported in Figures 4 and 5 suggest, a long-short strategy that buys the top and sells the bottom portfolios should deliver high risk-adjusted returns, potentially uncorrelated with the global equity market. We therefore implement long-short strategies using top and bottom portfolios sorted on the indicators used in Figure 4: DY, ADY, ME, and ADY+ME.

Figure 6 reports their performance. The version of the strategy based on DY in isolation delivered a return of 5.1%/year with an information ratio of 0.65. Including PMI-adjusted retained earnings increased returns to 5.5%/year. The strategy based on the ME indicators delivered a return of 6.4%/year with information ratio of 0.75. Finally, the return of the strategy based on the composite signal was 7.6%/year with an information ratio of 0.93. Hence, adding ME variables significantly improved the performance of the ADY strategy, especially in the recent sub-period.

FIGURE 6

**Performance of Long/Short Carry-Based Equity Strategy: Equally Weighted Top-Bottom Portfolios**

	Dividend Yield (DY)	Adjusted Dividend Yield (ADY)	Market Environment (ME)	Composite (ADY + ME)
February 2001-March 2020				
Avg. Return, %/yr	5.1	5.5	6.4	7.6
Volatility, %/yr	7.8	8.8	8.5	8.2
Inf. Ratio	0.65	0.62	0.75	0.93
MSCI World Beta	-0.1	0.1	-0.1	0.0
February 2001-December 2009				
Avg. Return, %/yr	8.9	11.3	6.7	11.6
Volatility, %/yr	9.3	10.0	9.8	9.0
Inf. Ratio	0.96	1.13	0.68	1.30
MSCI World Beta	0.0	0.1	-0.1	0.0
January 2010-Mar 2020				
Avg. Return, %/yr	1.8	0.5	6.2	4.1
Volatility, %/yr	6.0	7.4	7.4	7.3
Inf. Ratio	0.30	0.06	0.85	0.56
MSCI World Beta	-0.1	0.1	0.0	0.1

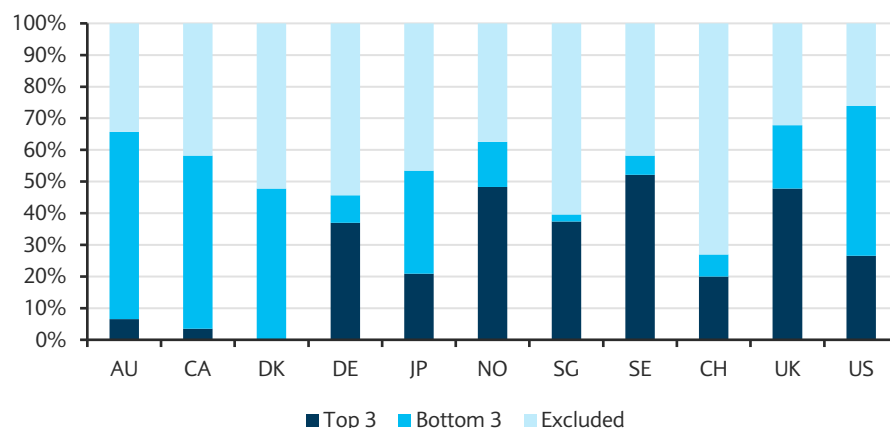
Note: Returns are currency-hedged into USD. Source: Barclays Research



Do different markets play equally important roles in the composition of the carry-based portfolios? To answer this question, we measure the number of months a particular country spends in the top or bottom portfolios as a percentage of the whole sample period. Figure 7 reports the percentage of months in the sample different markets of the top and bottom three portfolios when sorted on the composite signal.

FIGURE 7

**Percentage of Months Spent by Each Country in Top or in Bottom Portfolios when Sorted on the Composite (ADY+ME) Signal, February 2001-March 2020**



Source: Barclays Research

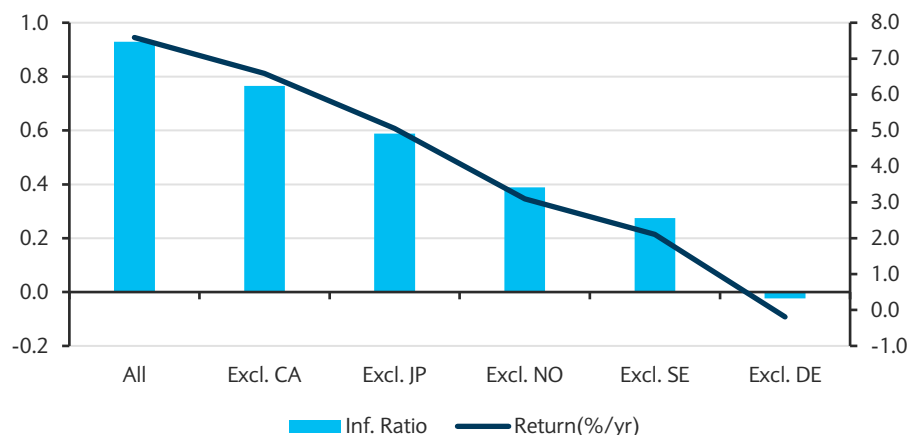
All countries in our sample, with the exception of Denmark, were at some point part of the top and bottom portfolios. Australia, Canada and Denmark spent almost 50% of the months in the bottom portfolio. In contrast, Sweden, the UK, and Norway were in the top portfolio for almost 50% of the time. Denmark is the only market that was never included in the top portfolio, while Canada and Australia were included in the top portfolio on only a few occasions. In contrast, Germany, Singapore, and Switzerland were rarely found in the bottom portfolios. Figure 7 suggests that the contributions of different countries to the performance of the strategy are very different. We would expect markets frequently included in the top and bottom portfolios to contribute more to strategy returns.

Figure 8 reports the effects on strategy performance from sequentially excluding countries with the largest contributions to risk-adjusted returns. We start with the original set of eleven equity markets sorted on the composite signal. We then remove countries one at a time by finding which market corresponds to the biggest drop in Sharpe ratio and take it out of the universe. We repeat this exclusion process until the investment universe is reduced to six markets, the minimum number necessary to form our long-short strategy with three markets in the top and bottom portfolios each. This exercise therefore represents the worst-case scenario for strategy performance as a consequence of reducing the set of investable countries.

We find that Canada has been the most important market for the risk-adjusted performance of the strategy. Excluding it from the set of eligible markets reduces the information ratio from 0.93 to 0.77. Indeed, we know from Figure 7 that Canada was often found in the short leg of the strategy. Subsequently removing Japan, which often populated the long and short legs of the strategy, would lower the information ratio to 0.58. Excluding Norway, the UK and Germany would completely neutralize the performance of the strategy. Therefore, the performance steadily declines as the breadth of the strategy is reduced. Note that this simulation of the effect of narrowing the investment universe on performance is quite conservative, as we have selected and sequentially excluded the largest contributors to performance with hindsight.

FIGURE 8

Effect on Performance of the Long-Short Carry-Based Strategy from Sequentially Excluding Individual Markets from the Investment Universe, February 2001-March 2020



Note: Returns are currency-hedged into USD. Source: Barclays Research

While our analysis demonstrates attractive results on a universe of eleven markets, we find that a market selection strategy based on carry and market environment indicators requires a sufficiently large number of markets (breadth) to achieve a reasonable performance.

## Robustness Checks: Testing Equity Carry-Based Strategy Out-of-Sample

We have so far proposed a market selection strategy that operates in a relatively narrow universe of eleven developed markets. Even though it delivered attractive returns in 2001-20, we seek further evidence to validate the robustness of our approach. For this, we back-test our carry-based model on data sets that were not included in the original sample.

First, we extend our sample period to 1976 and back-test the performance of the carry-based strategy on the same set of eleven markets between 1976 and 2001. Second, we use a new sample of ten emerging markets to back-test our approach and validate its applicability to these.

### Extended Historical Sample: 1976-2001

We collect historical returns of the eleven developed markets in 1976-2001. As before, we exclude FX contributions by hedging returns of individual markets into USD using 1-month FX forward contracts.<sup>12</sup> We then construct composite carry-based indicators for all markets in our sample. The same methodology is utilized to derive DY and ME variables. However, we do not include PMI-adjusted retained earnings in our signal because historical PMI data were not available in that early period.

In Figure 9, we report the performance of top and bottom portfolios based on the composite (DY+ME) signal from January 1976 to January 2001. The top portfolio outperformed the bottom one by 7.8%/year, with an information ratio of 0.65. This outperformance was stronger in the first sub-period (1976-1989), when the average return of the top portfolio was 10.0% higher than that of the bottom portfolio.

<sup>12</sup> All returns are USD-hedged using forward contracts. However, our dataset of historical forward rates stops in January 1990. Therefore, we built synthetic forward contracts using spot FX rates and interbank rates provided on the IMF website (<https://data.imf.org/>) for 1976-1989.

FIGURE 9

**Performance of Carry-Based Equity Portfolios in Earlier Periods: January 1976-January 2001**

	Top 3 (DY+ME)	Btm 3 (DY+ME)	Top-Btm
<b>Jan 1976-Jan 2001</b>			
Avg. Return, %/yr	10.5	2.8	7.8
Volatility	14.3	16.0	12.0
Sharpe Ratio	0.73	0.17	0.65
Max. Drawdown, %	-28.3	-46.3	-26.2
<b>Jan 1976-Dec 1989</b>			
Avg. Return, %/yr	13.4	3.4	10.0
Volatility	14.0	16.4	12.6
Sharpe Ratio	0.95	0.20	0.80
Max. Drawdown, %	-28.3	-38.2	-26.2
<b>Jan 1990-Jan 2001</b>			
Avg. Return, %/yr	6.9	2.0	4.9
Volatility	14.7	15.6	11.2
Sharpe Ratio	0.47	0.13	0.44
Max. Drawdown, %	-23.9	-39.2	-19.1

Note: Portfolio returns are currency-hedged into USD and are reported in excess of 1-month USD Libor. Source: Barclays Research.

The outperformance in the second sub-period (1990-2001) was weaker: the top portfolios outperformed the bottom ones by 4.9%/year.

The back-test results in the early sample suggest that the strategy based on carry and market environment indicators was able to deliver persistent performance over time. These findings are consistent with our results in 2001-20.

### Applying the Carry-Based Approach to Emerging Markets

Next, we apply our methodology to a universe of ten emerging markets: South Africa, Turkey, Mexico, Brazil, Chile, China, Indonesia, South Korea, Taiwan, and Poland. For all of them, we use respective MSCI emerging market country indices.

We build the carry and market environment indicators using the methodology applied to the developed markets. However, we do not include PMI-adjusted earnings and rate trends in the construction of the carry and market environment signals, due to data unavailability.

Similarly, to developed markets, we use 1-month FX forwards to hedge all returns into USD. Hedging FX is especially important for EM markets, as it helps isolate equity returns from potentially large moves in EM currencies against the US dollar.

Figure 10 reports the performance of the top and bottom EM portfolios sorted on the composite (DY+ME) signal in 2001-20. The top portfolios outperformed the bottom ones by 8.7%/year in the full sample. They also had lower volatilities and maximum drawdowns than the bottom portfolios in all sub-periods.

The top portfolios have also outperformed the MSCI EM index in each sub-period, while the bottom carry-based portfolios have consistently underperformed the index.

FIGURE 10

**Performance of Carry-Based Equity Portfolios in Emerging Markets (USD hedged), February 2001-March 2020**

	MSCI EM	Top 3	Btm 3	Top-Btm
February 2001-March 2020				
Avg. Return, %/yr	6.8	10.4	1.7	8.7
Volatility	16.8	15.7	17.8	12.5
Sharpe Ratio	0.41	0.66	0.09	0.70
MSCI EM Beta	1.0	0.8	0.9	-0.1
Max. Drawdown, %	-51.8	-41.2	-51.5	-22.3
February 2001-December 2009				
Avg. Return, %/yr	10.4	15.0	7.7	7.2
Volatility	21.1	19.1	21.2	14.7
Sharpe Ratio	0.49	0.78	0.36	0.49
MSCI EM Beta	1.0	0.8	0.9	0.0
Max. Drawdown, %	-51.8	-41.2	-51.5	-22.3
January 2010-March 2020				
Avg. Return, %/yr	3.7	6.4	-3.5	9.9
Volatility	11.8	11.8	14.2	10.2
Sharpe Ratio	0.31	0.54	-0.25	0.97
MSCI EM Beta	1.0	0.7	0.9	-0.2
Max. Drawdown, %	-20.7	-20.2	-40.1	-16.4

Note: Portfolio returns are currency-hedged into USD and reported in excess of 1-month USD Libor.

Source: Barclays Research

We conclude that our carry-based signal can be effectively applied to emerging equity markets. The consistent performance results of the strategy across different samples, including markets outside of the original universe, provide evidence of robustness of the proposed methodology.

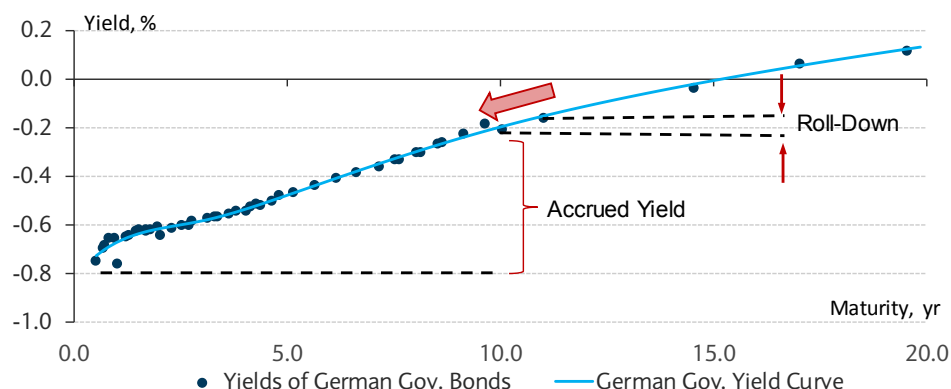
## Carry-Based Government Bond Portfolios

Carry has been known as a useful signal in global government bond markets. In *Carry Strategies in Global Rates Markets*, we documented that rates carry defined as yield accretion and curve roll-down represents an informative signal for interest rate swaps (IRS) and government bond markets. In March 2018, in *Introducing GRACE: The Global Rates Adjusted Carry Scorecard*, we presented a quantitative framework designed to differentiate government bonds in various markets based on carry adjusted for anticipated changes in rates. In this section, we provide a short overview of the model and discuss its performance.

We define *bond carry* as the return of a bond assuming the yield curve remains unchanged over a one-month horizon. Thus, bond carry includes two components: accrued yield and curve roll-down.

Figure 11 illustrates the accrued yield and curve roll-down components of bond carry. Accrued yield is the interest accrued over time. The curve roll-down is the return earned due to price appreciation (for a positively sloped yield curve) as the maturity of a bond declines. The roll-down component is a function of yield curve slope and of the duration of a bond. For long maturity bonds, the roll-down can be a sizable portion of carry.

FIGURE 11  
Accrued Yield and Roll-Down Components of Bond Carry: German Yield Curve, December 2019



Source: Barclays Research

We obtain the roll-down return of a government bond by repricing it at a one-month horizon while keeping the yield curve constant. The carry return is obtained by adding accrued interest, net of funding costs, to the curve roll-down component. As a result, a steeper yield curve leads to a higher estimated carry return.

In practice, however, a steep curve often indicates an anticipated increase in rates. Therefore, we adjust the carry measure of a government bond for anticipated changes in rates. The adjustment is derived as a fraction of the difference between the unobservable “target rate” and the actual rate. Indicators of inflation and economic activity are used to help forecast target rates. This methodology is similar to the Taylor rule, which has been historically used to gauge the possible evolution of policy rates.<sup>13</sup> We then assume that actual rates gradually converge to the target over time.

Figure 12, taken from our monthly report *Global Rate Adjusted Carry (GRACE) Scorecard – March 2020*, provides country ranking by the GRACE measure in different maturity buckets as of 31 March 2020. Bond carry changes with maturity, so a country can have different ranks in different maturity buckets. For example, Japan is ranked No. 4 in the 3-5y maturity bucket, but No. 2 in the 10+ year buckets because of the relatively steep slope of the yield curve. The right panel of Figure 12 shows monthly changes in country ranks.

<sup>13</sup> See Discretion versus policy rules in practice, Taylor 1993.

FIGURE 12  
Country Ranks by GRACE Score, 31 March 2020

Country Ranks by GRACE						MoM Change in Rank				
Rank	1-3Y	3-5Y	5-7Y	7-10Y	10+Y	1-3Y	3-5Y	5-7Y	7-10Y	10+Y
1 - Top	CH	CH	CH	AU	AU	=	=	↑ +1	↑ +1	↑ +1
2	AU	AU	AU	CH	JP	↑ +1	=	↓ -1	↑ +1	↓ -1
3	JP	SG	SG	JP	CH	↓ -1	↑ +1	↑ +2	↓ -2	↑ +3
4	SG	JP	JP	SG	GB	=	↓ -1	↓ -1	↑ +3	↑ +1
5	GB	GB	DK	GB	DE	↑ +2	↑ +2	↓ -1	↑ +1	↓ -2
6	NO	DK	GB	DK	SG	↑ +2	↓ -1	↑ +1	↓ -2	↑ +1
7	DK	NO	NO	DE	DK	↓ -2	↑ +1	↑ +3	↓ -2	↓ -3
8	DE	DE	DE	NO	CA	↓ -2	↓ -2	↓ -2	↑ +2	↑ +3
9	SE	SE	US	CA	US	=	=	↓ -1	↑ +2	↓ -1
10	CA	CA	SE	US	NO	=	↑ +1	↓ -1	↓ -2	=
11 - Bottom	US	US	CA	SE	SE	=	↓ -1	=	↓ -2	↓ -2

Source: Barclays Research

We evaluate the performance of the GRACE model by selecting countries with top and bottom three ranks for the top and bottom GRACE portfolios respectively. The portfolios equally weight constituent countries in each maturity bucket,<sup>14</sup> but apply index weights across maturity buckets to ensure similar duration profiles of the aggregated top and bottom GRACE portfolios. Portfolios are rebalanced at the beginning of each month using updated GRACE scores. The subsequent portfolio returns are recorded.

Figure 13 reports the performance of the GRACE portfolios. The top portfolios outperformed the bottom ones by 1.8%/year in 2001-20, with an information ratio of 0.89. The outperformance is persistent in the two sub-periods.

We also compare the performance of the top GRACE portfolios with that of the Bloomberg Barclays Global Treasury Index. The top GRACE portfolios outperformed the index, while having slightly higher market beta. We also find that the beta of the long/short strategy, which buys the top and sells the bottom GRACE portfolios, has been consistently low in the two sub-periods, indicating low directionality on market returns.

<sup>14</sup> Bonds in each country-maturity bucket are market-weighted.

FIGURE 13

**Performance of the Top and Bottom GRACE Portfolios**

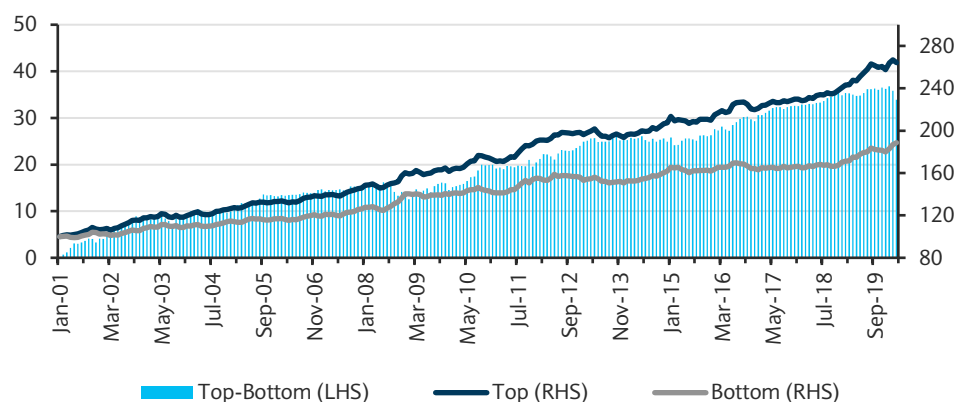
Bloomberg Barclays Global Agg. Treasuries Index		GRACE		
		Top 3	Btm 3	Top-Btm
February 2001- March 2020				
Avg. Return, %/yr	2.8	3.4	1.7	1.8
Volatility, %/yr	2.9	3.5	3.3	2.0
Sharpe/Inf. Ratio	0.96	0.99	0.52	0.89
Global Treasury Beta	1.0	1.1	1.0	0.1
Max. Drawdown, %	-3.6	-4.2	-5.3	-3.6
February 2001-December 2009				
Avg. Return, %/yr	2.1	2.7	1.0	1.6
Volatility, %/yr	3.0	3.4	3.3	1.9
Sharpe/Inf. Ratio	0.70	0.77	0.32	0.84
Global Treasury Beta	1.0	1.1	1.0	0.1
Max. Drawdown, %	-2.8	-3.1	-3.0	-3.6
January 2010 – February 2018				
Avg. Return, %/yr	3.1	3.9	1.7	2.2
Volatility, %/yr	2.7	3.6	3.2	2.0
Sharpe/Inf. Ratio	1.13	1.10	0.53	1.10
Global Treasury Beta	1.0	1.2	1.0	0.2
Max. Drawdown, %	-3.6	-4.2	-5.3	-2.1
March 2018 - March 2020 (Out-Of-Sample Period)				
Avg. Return, %/yr	4.5	4.8	4.3	0.5
Volatility, %/yr	3.1	3.4	3.3	2.0
Sharpe/Inf. Ratio	1.44	1.43	1.31	0.27
Global Treasury Beta	1.0	1.0	1.0	0.0
Max. Drawdown, %	-1.8	-2.0	-2.0	-2.8

Note: Portfolio returns are currency-hedged into USD and are reported in excess of 1-month USD Libor. Source: Barclays Research

In addition to the back-test results, the last panel of Figure 13 reports the out-of-sample performance of the GRACE scorecard, as published monthly on Barclays Live. In these two years, the top portfolios outperformed the bottom ones by 0.50%/year, with an information ratio of 0.27. As we will discuss in the last section, the long-short GRACE strategy has significantly underperformed over the past quarter. Indeed, the underlying assumption of the carry strategy is yield curve stability, so it would not be surprising that the strategy underperformed during the recent market volatility.

Figure 14 shows cumulative monthly total returns of the top and bottom GRACE portfolios. The outperformance of the top over bottom portfolios has been persistent. We conclude that carry-based market selection strategies have performed well in global rates over the long term.

FIGURE 14  
Cumulative Total Returns of GRACE Portfolios



Note: Portfolio returns are currency-hedged into USD. Source: Barclays Research

## Carry-Based Risk Parity Portfolios

We have established that carry-based signals work well for market selection in both equities and bonds. In this section, we analyse the performance and characteristics of carry-based equity-bond RP portfolios. Similar to the previous analysis, we build top and bottom carry-based RP portfolios to compare their performance. We also analyse the performance of the long/short strategy that buys top and sells bottom carry-based RP portfolios.

A typical motivation for combining equities and bonds in a multi-asset RP portfolio is risk diversification, as the returns of bond and equity markets tend to be negatively correlated. Indeed, Figure 15 shows that correlations between bond and equity returns have been low in 2001-20 for both top and bottom carry portfolios in each asset class. Returns of long-short strategies, which buy top and sell bottom carry markets in each asset class, have also exhibited low correlations (11%) across asset classes. Therefore, combining long-short strategies based on top and bottom portfolios in bonds and equities is also likely to benefit from diversification.

FIGURE 15  
Correlations of Carry-Based Portfolios in Bond and Equity Markets, February 2001-March 2020

	Top Equity	Bottom Equity	Top Bonds	Bottom Bonds	Top-Btm Equity	Top-Btm Bonds
Top Equity	100%					
Bottom Equity	86%	100%				
Top Bonds	-26%	-35%	100%			
Bottom Bonds	-34%	-41%	83%	100%		
Top-Btm Equity	39%	-13%	12%	6%	100%	
Top-Btm Bonds	10%	4%	40%	-18%	11%	100%

Source: Barclays Research

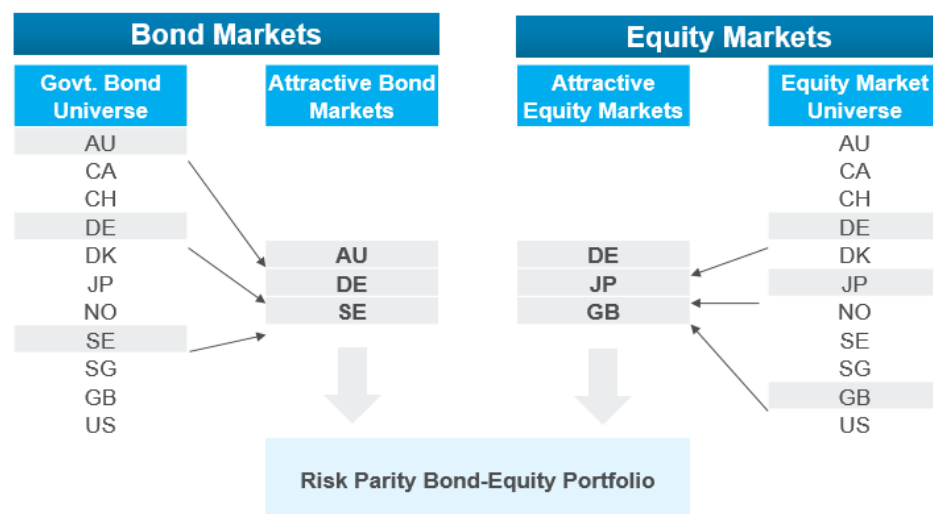
To build top RP portfolios, we first separately rank bond and equity markets according to their respective carry-based signals, as outlined in the previous sections. The top (bottom) portfolios in the equity block include the equally weighted top (bottom) three equity



markets sorted on the ADY+ME carry signal, while the top and bottom bond portfolios include markets sorted on GRACE. Figure 17 illustrates this selection process.

To equate risk contributions of bonds and equities in the RP portfolio, we apply leverage to the bond basket.<sup>15</sup> The leveraged bond allocation and the top-carry equity allocation have similar contributions to the overall volatility of the RP portfolio.

FIGURE 16

**Carry-Based Risk Parity Methodology**

Source: Barclays Research

Carry-based signals for equity and bond markets are updated monthly at the end of each month. Portfolio returns are hedged into USD using 1-month FX forwards.

To obtain a performance reference for the carry-based RP portfolio, we build a passive RP portfolio using a combination of the MSCI World Equity and Bloomberg Barclays Global Treasury indices. In Figure 17, we compare the performance of the top and bottom carry-based RP portfolios with that of the passive RP benchmark.

The top portfolio significantly outperformed the passive RP benchmark in terms of absolute and risk-adjusted returns. In particular, the top RP portfolio return was 12.0% for the entire period, while the RP benchmark return was 8.1%: an outperformance of 3.9%/year.

Figure 17 also demonstrates that carry-based signals remain very useful for selecting bond and equity markets for the RP allocation. Indeed, as reported in the two rightmost columns, the top RP portfolio significantly outperformed the bottom one in all sub-periods. While the top RP portfolio had slightly more volatile returns than its bottom peer did, it experienced higher risk-adjusted returns. The bottom RP portfolio also underperformed the passive RP benchmark in all sub-periods.

<sup>15</sup> Leverage of 4.5x is applied to all bond baskets in RP portfolios throughout our analysis. This corresponds to the long-term volatility ratio of the top equity and bond portfolios and makes the volatilities of the equity and bond blocks roughly the same.

FIGURE 17

**Performance of Carry-Based RP Portfolios: Combining Top (Bottom) Carry Markets in Equities and Bonds**

Passive RP Benchmark		Carry-Based RP	
MSCI World / Global Treasury		Top	Bottom
<b>February 2001 – March 2020</b>			
Avg. Return, %/yr	8.1	12.0	4.2
Volatility, %/yr	8.0	9.6	8.1
Sharpe Ratio	1.01	1.24	0.52
Passive RP Benchmark Beta	1.0	1.0	0.8
Maximum Drawdown, %	-18.2	-22.2	-27.9
<b>February 2001-December 2009</b>			
Avg. Return, %/yr	4.0	9.7	0.2
Volatility	8.5	9.9	8.9
Sharpe/Inf. Ratio	0.46	0.98	0.02
Passive RP Benchmark Beta	1.0	1.0	0.9
Maximum Drawdown, %	-18.2	-22.2	-27.9
<b>January 2010 – March 2020</b>			
Avg. Return, %/yr	11.7	13.9	7.6
Volatility	7.4	9.4	7.1
Sharpe/Inf. Ratio	1.58	1.48	1.07
Passive RP Benchmark Beta	1.0	1.1	0.8
Maximum Drawdown, %	-7.5	-12.0	-9.1

Note: Portfolio returns are currency-hedged into USD and are reported in excess of 1-month USD Libor. Source: Barclays Research

The significant performance difference between top and bottom portfolios motivates us to consider a long-short strategy that systematically buys the top carry-based RP portfolio and sells the bottom one. Figure 18 reports the performance of this long-short strategy. The first two columns show the performance of the long-short carry-based strategies implemented in bond and in equity markets in isolation. These repeat the results for the long-short carry strategies in equities and rates (before leverage) reported in Figures 6 and 13 and constitute the building blocks of the carry-based RP strategy.

The last column reports the performance of the long-short carry based RP strategy, which buys the top carry RP portfolio and sells the bottom carry one. It delivered higher risk-adjusted returns than its single-class counterparts, as it benefits from bond-equity risk diversification. The average return of the strategy in 2001-20 is 7.8%/year, with an information ratio of 1.22. This compares with information ratios of 0.89 and 0.93 for the carry-based long-short strategies in equity and bond markets taken in isolation.

FIGURE 18

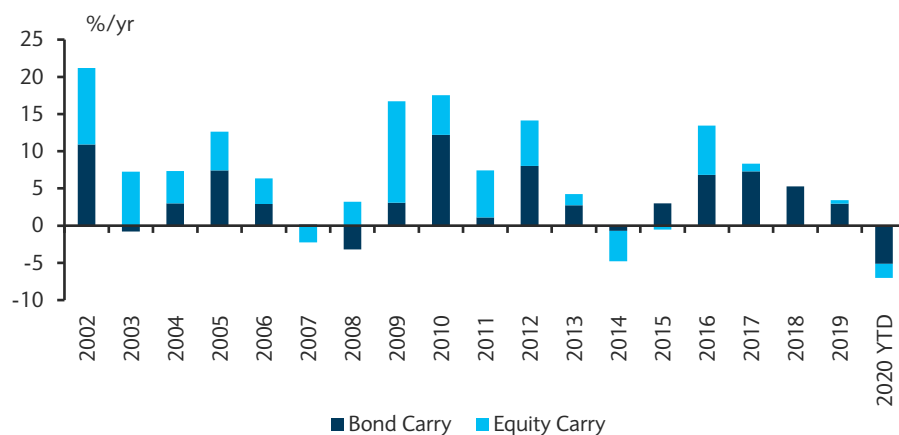
**Performance of Carry-Based Long-Short Strategies: Top-Bottom in Bonds, Equities, and Risk-Parity**

	Rates	Equities	Risk-Parity
February 2001 - March 2020			
Avg. Return, %/yr	1.8	7.6	7.8
Volatility, %/yr	2.0	8.2	6.4
Sharpe / Inf. Ratio	0.89	0.93	1.22
Max. Drawdown, %	-3.6	-13.1	-8.7
February 2001-December 2009			
Avg. Return, %/yr	1.6	11.6	9.5
Volatility, %/yr	1.9	9.0	6.5
Sharpe / Inf. Ratio	0.84	1.30	1.45
Max. Drawdown, %	-3.6	-12.9	-7.9
January 2010 - March 2020			
Avg. Return, %/yr	1.9	4.1	6.3
Volatility, %/yr	2.0	7.3	6.3
Sharpe / Inf. Ratio	0.93	0.56	1.01
Max. Drawdown, %	-2.8	-13.1	-8.7

Note: Returns are currency-hedged into USD. Source: Barclays Research

Both the equity and bond building blocks of the long-short strategy contribute significantly to its performance. Figure 19 attributes strategy annual returns to the equity and bond components. Strategy returns were positive in most years, except for 2007, 2014 and 2020 (YTD). Return attribution clearly illustrates the effect of diversification between bonds and equities. For several years (2003, 2008, 2015), negative returns in one asset class were offset by positive returns in the other. The equity component significantly contributed to strategy returns in 2002, 2003, 2009, 2011, and 2016, while the bond component contributed to a larger portion of strategy returns in recent years. 2014 and 2020 are the only years when both bonds and equities had a negative contribution.

FIGURE 19

**Annual Returns of Long-Short RP Strategy: Top over Bottom RP Portfolios**

Note: Returns are currency-hedged into USD. Source: Barclays Research

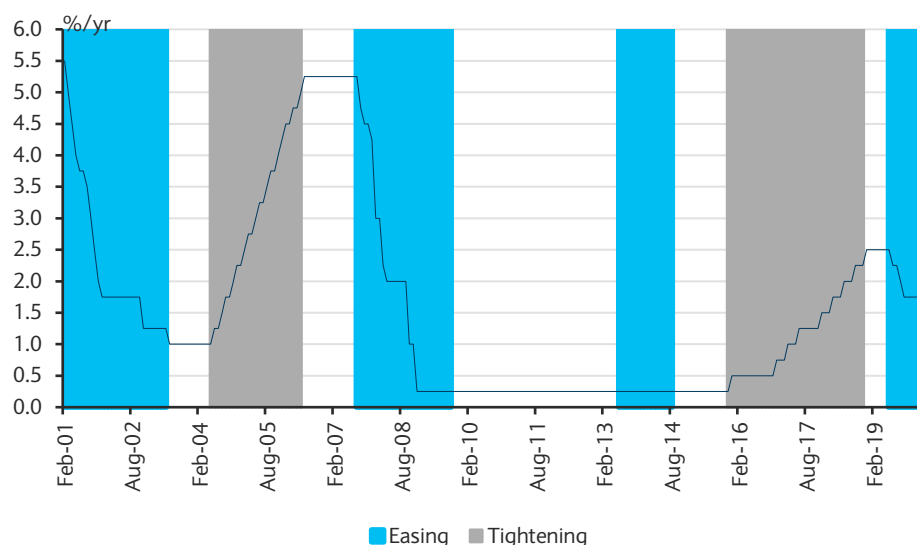
## Performance of Carry-Based Portfolios in Different Market Regimes

How do returns of carry-based portfolios and long-short strategies change in different market environments? How did these portfolios perform during the recent market sell-off? To answer these questions, we first analyse the performance of carry-based strategies through different monetary policy and risk regimes. Next, we show that the top carry-based portfolios in equities and rates significantly underperformed the bottom ones during the COVID-19 crisis in March 2020.

### Performance during different Monetary and Risk Regimes

Figure 20 identifies Fed easing and tightening regimes. We define easing cycles as periods of a declining fed funds rate<sup>16</sup> and tightening cycles as periods of a rising fed funds rate.

FIGURE 20  
Federal Reserve Monetary Policy Regimes with Fed Funds Target Rate



Source: Bloomberg, Barclays Research

In addition, we study the performance of the carry-based portfolios in risk-on/risk-off regimes. We define risk-on regimes as months when the drop of the 10y US Treasury yield is in the bottom 30% of monthly yield changes of the full sample. Similarly, we define risk-off regimes as months when the 10y yield widened enough to be in the top 30% of monthly yield changes in the sample.

We also analyse returns of carry-based portfolios in different volatility regimes. We split the sample into low and high volatility regimes, using the VIX index. We define low (high) volatility regimes as months starting with a VIX index level in the bottom (top) 30% of the sample.

Figure 21 reports average returns of the carry-based portfolios and strategies in each of the regimes.<sup>17</sup> As expected, bond portfolios did well during Fed easing, risk-off and high VIX regimes. As regards Fed regimes, both top and bottom bond carry portfolios performed best during easing. The performance of the long-short bond strategy actually improved during

<sup>16</sup> Easing regimes also include post-2008 periods of aggressive expansion of Fed balance sheet. Specifically, we identify periods of annualized balance sheet growth higher than 20% as easing cycles.

<sup>17</sup> When interpreting the results reported on Figure 21, one needs to keep in mind that while we deal with bond and equity portfolios allocated across several geographies, Fed and VIX regimes are specific to the US market. This choice is probably less important for distressed episodes (eg, Fed easing or high VIX), as global markets tend to be strongly correlated during volatile periods. However, the consequences of defining regimes using US-centric indicators are likely to be more significant in benign regimes (Fed tightening or low VIX), when markets tend to be less synchronized.

tightening periods because the decline in performance was more pronounced for bottom carry portfolios.

In risk-on regimes, bond portfolios delivered a negative performance and the long-short strategy was flat. In risk-off environments, bond portfolios performed well and the long-short strategy captured an outperformance of 2.9%/year of the top over the bottom portfolio.

In high VIX regimes, bond portfolios performed well, serving as safe havens. However, the performance of the top-carry portfolio was significantly stronger: 5.1%/year versus 2.5%/year. As expected, the bond portfolios demonstrated weak performance in low VIX regimes. The long-short strategy had positive average returns in both VIX regimes, but it demonstrated better results in the high VIX environment.

Long-only equity carry portfolios expectedly performed poorly during Fed easing. However, the bottom carry significantly underperformed the top carry equity portfolios. The top portfolios performed well in all other Fed regimes, while the bottom portfolios experienced notably weaker performance. As a result, the performance of the long-short equity carry strategy was positive in all Fed regimes.

While the performance of top and bottom equity carry portfolios is dramatically different across the risk-on and -off regimes, the equity carry long-short strategy had similar performances in the two regimes, 9.7%/year vs. 9.6 %/year.

Both top and bottom equity carry portfolios performed well in low volatility environments, but their performance significantly diverged in high VIX regimes. Indeed, the average return of the top carry portfolio was positive (+4.0%/year), while that of the bottom carry portfolio was significantly negative (-11.2%/year). As a result, the long-short equity carry strategy delivered a return of 115.2%/year in high VIX regimes, but only 4.5%/year in low VIX regimes.

The performance of the RP bond-equity portfolios in different Fed, risk and VIX regimes is consistent with the above observations. Both top and bottom RP portfolios experienced weaker returns in Fed easing periods, while the long-short strategy based on top and bottom RP portfolios performed well. Both RP portfolios underperformed during risk-on regimes, but the long-short strategy was able to capture the large return differential of the equity component. In the risk-off regime, the top RP portfolio delivered strong returns, with an outperformance of 25.0%/year over the bottom portfolio. The top RP portfolio performed very well in high VIX regimes, while its performance during low VIX episodes was significantly weaker: 13.6%/year versus 6.9%/year. As a result, the long-short RP strategy demonstrated much higher average returns during the volatile environment: 13.6%/year versus 5.3%/year.

FIGURE 21

**Annualised Returns of Carry-Based Portfolios in Different Market Regimes, February 2001-March 2020**

	Rates Regime (FED Fund Rate)		Rates Regime (1M Change in US Tsy 10Yr)		Equity Regime (VIX)		Sample Period
	Easing	Tightening	Risk On	Risk Off	Low Volatility	High Volatility	
Bonds Top	4.5	2.3	-9.0	15.8	0.9	5.1	3.4
Bonds Btm	3.0	-0.2	-9.2	12.9	-0.5	2.5	1.7
Top-Btm	1.5	2.5	0.2	2.9	1.4	2.7	1.8
Equities Top	-5.2	14.2	26.7	-21.2	9.7	4.0	8.4
Equities Btm	-12.4	7.9	17.0	-30.8	5.2	-11.2	0.8
Top-Btm	7.2	6.3	9.7	9.6	4.5	15.2	7.6
Risk Parity Top	7.6	12.2	-6.8	25.0	6.9	13.6	12.0
Risk Parity Btm	0.6	3.5	-12.1	13.6	1.6	0.0	4.2
Top-Btm	7.0	8.7	5.3	11.3	5.3	13.6	7.8

Note: Portfolio returns are currency-hedged into USD and are reported in excess of 1-month USD Libor. Source: Barclays Research

### Performance during COVID-19 (March 2020)

In Figure 22, we report the performance of each market selected in the top and bottom portfolios in equities and rates during the COVID-19 crisis in March 2020.

In equities, the top carry-based portfolio included Australia in March, due to the country's favourable ME indicators (negative trends in rates and FX), as shown in Panel B of Figure 23. Germany and the UK were also included because both countries had relatively high dividend yields adjusted for retained earnings. The bottom portfolio included the US, Canada, and Switzerland: the former two countries had relatively low dividend yields, while the last had a strong up-trend in FX.

Although both top and bottom equity portfolios had negative returns in March, the market sell-off was more pronounced for the top portfolio, so that the long-short strategy delivered a negative return of -5.7%. Figure 22 shows that the underperformance was due mainly to a difference in return between Australia and Switzerland: -20.0% versus -4.2%. Returns of MSCI USA and MSCI UK, as well as of MSCI Germany and MSCI Canada, were comparable.

The reason for the performance difference between Australia and Switzerland is likely related to the market structure of the two indices. Indeed, according to MSCI, the Australian index is represented by high weights in the Financial (33.7%) and Materials/Mining (17.0%) sectors, which were strongly affected during the crisis. In contrast, the Swiss market has relatively low allocations to Financials (14.3%) and Materials/Mining (6.3%), while its largest proportion is represented by defensive sectors, such as Healthcare (39.5%) and Consumer Staples (27.1%).<sup>18</sup> As a result, the Swiss market has defensive characteristics, which helped it withstand the recent sell-off. As documented in *Dividends – big cuts, big market discount* from our equity strategy team, European Healthcare and Consumer Staples performed better than other industry sectors.

The magnitude of the drawdown for the Australian equity market was likely exacerbated by its strong links to China, the first country to be significantly affected by the COVID-19 crisis. In contrast, companies in the Swiss equity index tend to be less exposed to the Chinese economy.

FIGURE 22

#### Decomposing the Performance of Carry-Based Portfolios in March 2020

Composition of Top and Bottom Portfolios, Beginning of March 2020								Monthly Return (%/m), March 2020						RP
	Equities	Rates					Equities	Rates						
		1-3Y	3-5Y	5-7Y	7-10Y	10+Y		1-3Y	3-5Y	5-7Y	7-10Y	10+Y	All Maturities	
1	AU	CH	CH	AU	JP	JP	-20.0	-0.35	-1.07	0.72	-1.09	-2.75		
2	DE	JP	AU	CH	AU	AU	-16.9	-0.04	0.74	-1.64	0.68	-1.52		
3	GB	AU	JP	JP	CH	DE	-13.1	0.59	-0.37	-0.70	-3.34	-2.86		
Top							-16.7	0.07	-0.24	-0.54	-1.25	-2.37	-1.15	-10.9
9	CH	SE	SE	SE	SE	SE	-4.2	-0.03	-0.26	-0.72	-1.13	-1.96		
10	CA	CA	US	NO	NO	NO	-15.8	1.32	2.17	2.17	2.09	2.15		
11	US	US	CA	CA	CA	CA	-12.8	1.29	2.00	2.36	3.22	0.89		
Btm							-10.9	0.86	1.30	1.27	1.39	0.36	0.76	-3.7
Top - Btm							-5.7	-0.79	-1.54	-1.81	-2.64	-2.73	-1.91	-7.2

Note: Portfolio returns are currency-hedged into USD and are reported in excess of 1-month USD Libor. Source: Barclays Research

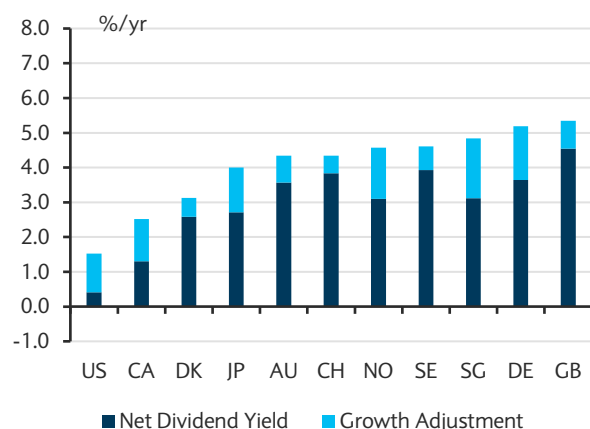
<sup>18</sup> See respective monthly updates for the MSCI Australia and MSCI Switzerland indices.

FIGURE 23

## Carry and Market Environment Variables by Country, Beginning of March 2020

## PANEL A

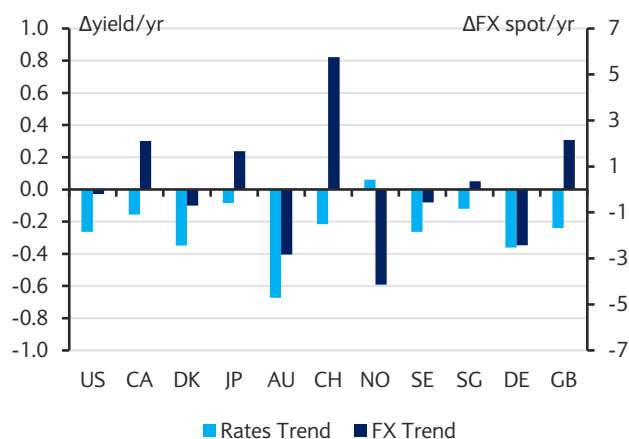
## Dividend Yields and Growth-Adjustments by Country



Source: MSCI, Barclays Research

## PANEL B

## Market Environment (ME) Indicators by Country



Source: MSCI, Barclays Research

In bonds, top carry-based portfolios also underperformed the bottom ones across all maturity buckets. Indeed, most government bond markets, except for the US, Canada and Norway, experienced sell-offs, especially at the longer end of the curve. We therefore observe negative returns of the top and positive returns of the bottom portfolios.

At the beginning of March, the top portfolio included Switzerland, Australia, and Japan, as their negative local funding rates or relatively steep curves made net carry attractive. The bottom portfolio included the US and Canada in the beginning of March because of the flat or inverted curves as shown in Figure 24.

In March, the Federal Reserve and Bank of Canada aggressively cut interest rates, causing a significant rally of the respective government bond markets. Indeed, Panel A and B of Figure 24 show that the US and Canadian yields of short maturity bonds declined approximately 1%.

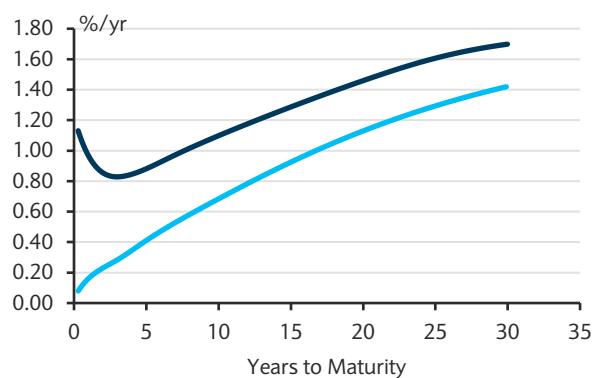
In contrast, Japanese, Australian, and German yield curves shifted upwards, defying the safe haven status of the respective government bond markets.

Consequently, the return difference between the top and bottom bond carry portfolios in March was -1.91%/month, which exacerbated the negative return of the equity carry-based strategy and the long-short RP strategy, which bought top carry and sold bottom carry portfolios in equities and bonds, delivered a negative return of -7.2% in March.

FIGURE 24  
Changes of government yield curves through March 2020

PANEL A

US Treasury Curves

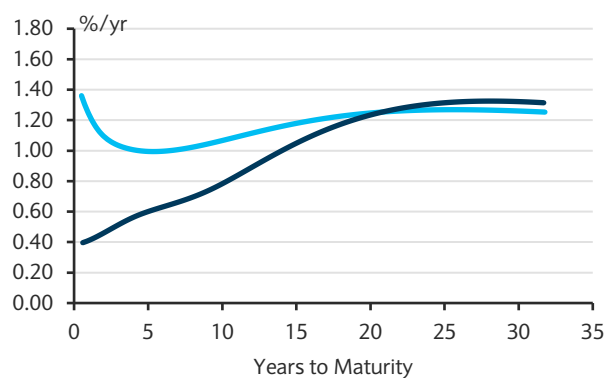


— Beginning of March 2020 — End of March 2020

Source: Barclays Research

PANEL B

Canada Government Bond Curves



— Beginning of March 2020 — End of March 2020

Source: Barclays Research

## Conclusion

Our carry-based signal in equity encompassed two measures of companies' fundamentals, dividends and earnings, as well as control variables for the current market environment of each equity market. Based on this signal, we found that high carry equity markets persistently outperformed low ones. To verify the robustness of the signal, we extended our approach to earlier periods and to emerging markets. We also documented the performance of our carry strategy in government bonds, GRACE.

We then built multi-asset portfolios using a risk parity approach. Our approach aimed to capitalize on carry signals in bonds and equities and exploit risk diversification across asset classes. We found that a multi-asset risk parity strategy outperformed carry-based strategies implemented in each asset class taken in isolation.

Finally, we showed that although our carry-based long-short RP strategy performed well in different rates regimes and risk environments, it experienced a negative return during the recent market sell-off in March 2020.



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