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Understanding the Bloomberg MSCI Euro Corporate Climate Paris Aligned ESG Select Index

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A Fixed Income PAB Case Study

Kerry Angel
+44 20 3525 1630
kangel4@bloomberg.net

Antonios Lazanas
+1 212 617 0607
akazabas5@bloomberg.net

Zarvan Khambatta
+1 212 617 5418
zkhambatta4@bloomberg.net

Lingjuan Ma
+44 20 3525 0741
lma208@bloomberg.net

Aramian Wasielak
+1 212 617 3628
awasielak@bloomberg.net

AJ Lindeman
+1 212 617 7491
alindeman@bloomberg.net

Paris Aligned Benchmarks (PABs) have received significant recent attention in the financial industry. This is deservedly so, as their regulatory origin has brought much-needed standardization to ESG and sustainable investing, and therefore they are of global interest.

Notably, while key de-carbonization and ESG requirements are made clear, PABs are not fully prescribed. The flexibility is deliberate, as not only do investors have varying objectives and mandates concerning active risk, but regulations also allow for innovation.

In this paper our aim is to

- Provide a brief motivation for financial industry alignment with climate objectives.
- Review guidelines for PABs, highlighting both areas of flexibility and differences in asset classes.
- Analyze the design and historical performance of the Bloomberg MSCI Euro Corporate Climate Paris Aligned ESG Select Index, whose parent index is the Bloomberg Euro Aggregate Corporate Index, a widely referenced market-value weighted benchmark.

This featured PAB index offers a good demonstration in bringing risk management techniques into index construction, with the result being a PAB implementation that goes well beyond minimum requirements. Of particular interest to fixed income investors are rigorous controls for managing low tracking error while satisfying the dynamic path towards net zero portfolio emissions.

Introduction

"It is unequivocal that human influence has warmed the atmosphere, ocean and land." Indeed, the IPCC's most recent Summary for Policymakers declares that real-world climate risks are clear and manifest[1]:

> *Human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related* ***losses and damages to nature and people****. (SPM.B.1)*
>
> ***Global warming, reaching 1.5°C*** *in the near-term, would cause unavoidable increases in multiple climate hazards and* ***present multiple risks to ecosystems and humans*** *[…] Near-term* ***actions*** *that limit global warming to close to 1.5°C* ***would substantially reduce projected losses*** *and damages related to climate change in human systems and ecosystems, compared to higher warming levels,* ***but cannot eliminate them all****. (SPM.B.3)*

The Paris Agreement is an unprecedented framework for global action on climate change. It was adopted by 196 countries in Paris on 12 December 2015, and entered into force on 4 November 2016. Its goal is to limit global warming to well below 2°C, preferably 1.5°C or less, compared to pre-industrial levels[2].

While various factors contribute to global warming, human-induced GHG emissions comprise the largest contribution to *radiative forcing* – the physical term for drivers of the Earth's surface and atmospheric temperatures. Because GHGs remain in the atmosphere for decades, emissions are what really matter. The IPCC estimates that 300-500 Gt of CO_2-equivalents remain in the "carbon budget" for meeting Paris Agreement objectives. At a time when emissions are approximately 59 Gt/year, economy-wide reductions are paramount.

The Paris agreement recognizes that "aligning financial flows" is necessary for real-world emissions reduction. Thus in 2018 the European Commission formed a Technical Expert Group (TEG) to develop standards that investment products must meet to be designated as "Paris-aligned" or "Climate-transition" benchmarks (PAB/CTB). The capstone of these standards is a requirement for portfolios to de-carbonize along a simple prescribed pathway that is within the carbon budget and results near-zero emissions in 2050.[3]

Naturally, investors should manage their portfolios' carbon trajectory for reasons beyond regulation. Asset owners and managers – many of whom have responsibilities as universal owners – recognize that without sufficient climate-related analysis, portfolios are likely to be exposed to increased risk and may be missing opportunities arising from a world in transition. For many, PAB standards are only a reasonable starting point in the broader discussion of the interaction between financial and climate risks.

> *PABs [aim to mitigate] climate change through a shift of their investment allocation from GHG intensive activities – notably fossil fuels – to renewable energy and energy efficiency.*
>
> *[They] can be perceived as tools for investors with the willingness to be at the forefront of the transition, favoring today the players of tomorrow's economy.*
>
> TEG Final Report, 2019

Overview of PAB Framework

Before turning to the Bloomberg MSCI Euro Corporate Climate Paris Aligned ESG Select Index (hereafter "PAB ESG Select"), we provide an overview of PAB requirements, emphasizing that these are *minimum* requirements. This review includes an understanding the PAB trajectory relative to more sophisticated climate scenarios, some practicalities of incorporating GHG data, and choices of index construction methods. An understanding of the overall context should serve to better understand the choices made in what follows.

[1] IPCC Climate Change 2022 - Summary for Policymakers
[2] The Paris Agreement on Climate Change. UN, 2015
[3] Handbook of climate transition benchmarks, Paris-aligned benchmark and ESG disclosures. EU TEG, 2019

Minimum Standards for PAB designation

A synopsis of minimum standards[4] for the PAB label is as follows:

- Determine a universe of securities via a *parent index* (that is, a set of securities with a weight assigned to each). Typically this is a market cap or market-value weighted index representing a broad investible opportunity set.
- For each company, determine a *per annum GHG emissions level*. Types of emissions covered can vary by sector and time, though within four years of implementation Scope 1, 2 and 3 must all be included. If a reported value is unavailable, estimated values are permissible. When relevant, benchmark administrators are encouraged to follow the precautionary principle by incentivizing dissemination of actual emissions levels.
- Generally, a *GHG intensity* is calculated. This is the emissions level divided by a financial metric controlling for firm size. Bloomberg uses an inflation-adjusted enterprise value for its equity PAB indices. Since a significant number of corporate bond issuers are private companies, for which no market value of equity is available, fixed income indices may optionally skip the intensity step and implement the trajectory in terms of *absolute levels*.
- Once the parent index and GHG data are determined, key requirements are:
    - Have an *initial reduction* of the GHG metric be 50% or more below that of the parent index, and remain at or below 50% of the parent index over time.
    - *Self-decarbonize* at a further 7% per annum.
    - Honor *baseline exclusions* by eliminating holdings in companies deriving significant revenue from controversial weapons and activities inconsistent with the UN Global Compact. (Such exclusions do not concern climate risk per se.)
    - Honor *activity exclusions* by eliminating companies having revenue above certain thresholds in coal, oil, natural gas; or electricity generation where lifecycle GHG emissions are above 100 gCO2e/kWh.
    - For equity indices, the PAB label requires *maintaining aggregate parent weight* among prescribed climate high-impact sectors[5]. Fixed income indices do not need to meet such a requirement.
- Optional features are
    - Consider increasing weight of companies that set evidence-based emissions targets.
    - Green to brown revenue share should be significantly larger than that of the parent index (a multiple of 4 or greater).

Should the ex-post GHG constraints be breached for 2 consecutive years, the index forfeits its PAB label.

Although we will not delve into details here, the PAB label also requires disclosure of various ESG metrics in support of index construction.

Before discussing the key steps in more detail, we note there is ample potential for innovation and financial product differentiation. There are many possible ways to meet the standards, and this flexibility is essential for fulfilling fiduciary responsibilities surrounding active exposures, turnover and transparency.

[4] TEG final report on EU climate benchmarks, 2019.
[5] NACE Section codes A-L, spanning Agriculture, Mining, Manufacturing, Power Supply, Water Supply, Construction, Trade, Transport and Real Estate.

Emissions pathways

The IPCC, which curates scientific and economic information on behalf Paris Agreement signatories, recommends global net anthropogenic GHG emissions decline by 45% from 2010 levels by 2030, reaching net zero around 2050[6]. However, there are many pathways that satisfy this aggregate target, as sector and regional trajectories can add up in different ways while being within the carbon budget. Figure 1 shows one illustrative scenario from BloombergNEF that is consistent with 1.75°C warming by the year 2100. This is a less aggressive target than 1.5°C, but it helps visualizes sector-based projections and gives us a peek into what climate pathway modeling involves. A "business-as-usual" scenario, labeled ETS, with an implied 3.3°C warming, is shown for reference.

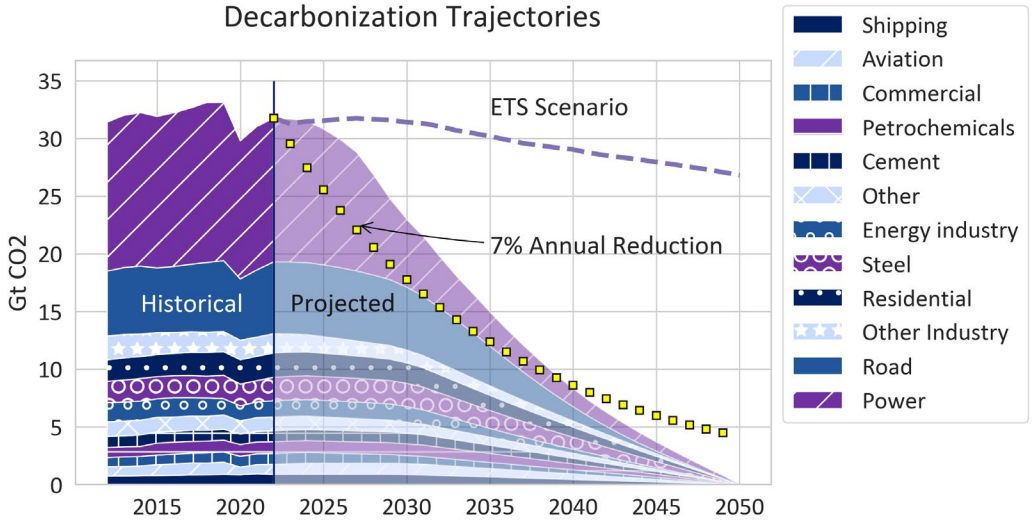


Figure 1. Sample de-carbonization trajectories for global GHG emissions – i.e. the entire global economy (not a portfolio). ETS is the *Economic Transition Scenario*, a projection of what could happen if no policy action is taken and only economic forces are in play. A 7% per annum trajectory starting from 2022 levels is also shown. Source: BloombergNEF.

The dotted yellow line is the 7% per annum trajectory. Since this graph represents global emissions and not a portfolio's footprint[7], we have not included the 50% initial haircut required by PAB.

Two things are evident: first, to achieve a 50% haircut, the Power sector will likely be strongly affected according to this pathway. Secondly, the modeled de-carbonization rates vary by sector – for example Steel sector emissions are roughly flat through 2030, whereas Power and Road sectors decline earlier – reflecting BloombergNEF's views on sector capabilities. In any case, the overall shape of the trajectories can be different – this particular pathway declines more slowly than 7% initially, and faster later[8].

To be sure, there are many other sources of pathways, including the IPCC itself. These pathways are by no means unique, and they may not be equally realistic. The key advantage of the prescribed 7% rate is that investors and benchmark providers can be assured of 1.5°C alignment without having to analyze the myriad of available climate scenarios themselves.

Quantifying emissions

GHG emissions are the main ingredient for quantifying alignment to climate scenarios. At present, companies voluntarily disclose GHG emissions through various de-centralized channels — for example, sustainability reports or the CDP[9].

[6] Special report on global warming of 1.5C, IPCC 2016
[7] Although PAB/CTB regulations do not use the term, detailed standards are being developed for a portfolio's financed emissions.
[8] The total warming impact – temperature rise – depends on cumulative emissions, i.e. the area under the curves.
[9] A not-for-profit charity that runs the global disclosure system for investors, companies, cities, states and regions to manage their environmental impacts.

GHG emissions are divided into 3 categories, or *scopes*[10]:

- Scope 1 Emissions: All *direct* GHG emissions
- Scope 2 Emissions: *Indirect* GHG emissions from the consumption of purchased *electricity, heat or steam*
- Scope 3 Emissions: *Value chain emissions*: other indirect emissions from purchased materials, transport, outsourced activities, use of sold products and more

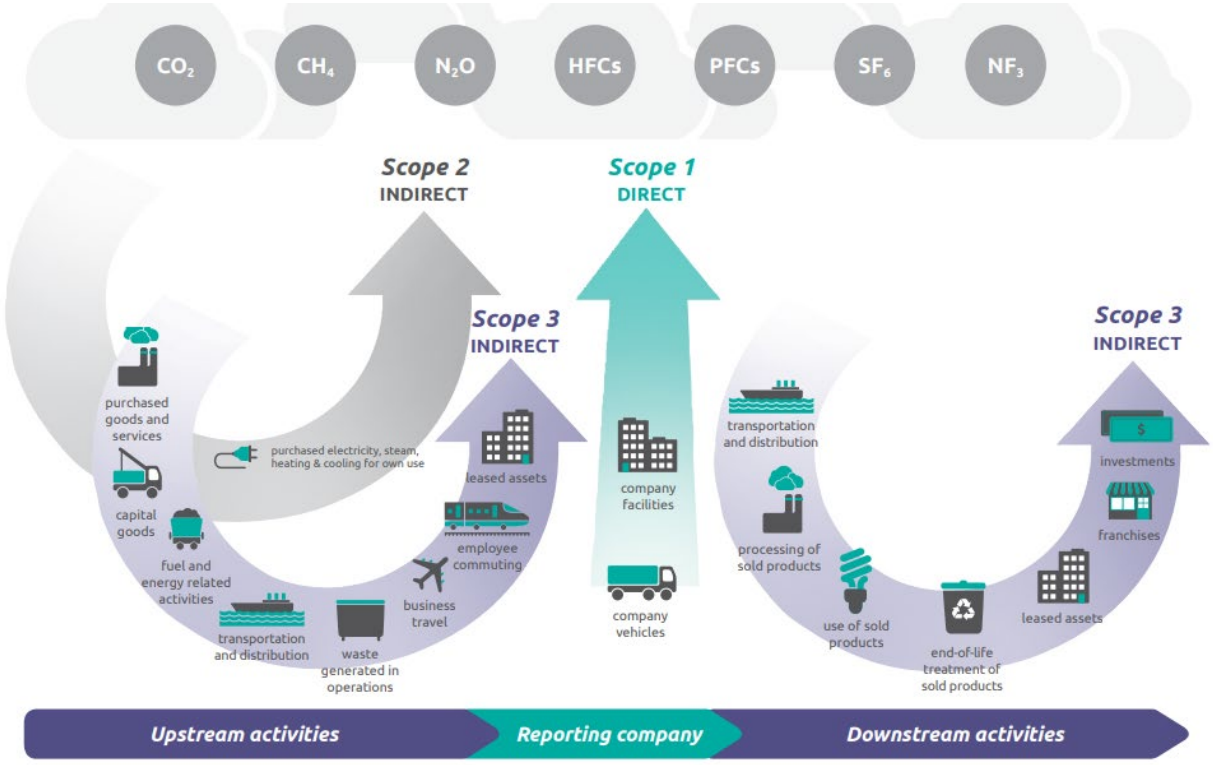


Figure 2: Overview of GHG Protocol scopes and emissions across the value chain. Source: ghgprotocol.org.

EU regulations encourage the use of Scope 1+2+3 data in measuring GHG, but it is understood that at present Scope 3 data and estimates are insufficiently standardized to be fully required for PAB labeling. Therefore, the inclusion of Scope 3 can be phased in by sector, starting with Oil, Gas and Mining at inception, followed by Transportation, Construction, Buildings, Materials and Industrials after two years, and every sector being included after four years. Because this is a minimum requirement, benchmark providers may include Scope 3 at inception.

While Scope 1+2 are well disclosed in Europe[11], reporting levels vary by region – either way necessitating the incorporation of *estimates* into aggregate GHG measures. Estimates can be derived by associating company characteristics to a set of peers for which emissions are reported. This association could be implemented using group averages (pivot tables), regression or even other more sophisticated techniques. It is worth noting that estimated emissions do not necessarily lead to 100% coverage, because accurate estimates cannot be derived if sufficient company characteristics are unavailable for determining peers – a situation more likely to arise for private companies.

As mentioned above, at present, relatively few companies report Scope 3. Even when companies do report,

[10] Greenhouse Gas Protocol
[11] As of August 2022, 91% of Scope 1+2 emissions were based on reported data for the PAB ESG Select index

Scope 3 likely reflects a mix of actual (metered) readings and company-prepared estimate[12]. This observation suggests that even reported Scope 3 data reflects a material level of modeling, even if this is done under company oversight. For this reason, it is reasonable to consider using estimates for all Scope 3 data at this point in time, as it is easier to demonstrate a consistent set of assumptions is being applied.

Regardless of scope, the incorporation of estimates presents some challenges in meeting PAB requirements. As more companies report, the values may differ from the previously used estimates. This can result in an index's GHG metrics changing simply due to estimation error. Index providers may wish to protect against breaching constraints by incorporating a buffer (say using a de-carbonization rate greater than 7%) or using a quantile estimate (say using the 75th percentile in an estimated range instead of the distributional mean).

The de-carbonization inequality

The de-carbonization trajectory is the cornerstone of PAB and merits careful explanation. Conceptually, the central requirement is that at each rebalance date, the PAB emissions metric be the minimum of 50% of the parent index level and the previous target reduced by an "inflation"-adjusted factor. The "inflation" factor is subject to further definition depending on exactly how GHG is measured, but its role is to correct bias arising from nominal increases in revenue, market cap or EVIC (and not a price index such as CPI).

While there is much focus on the geometric 7% trajectory, it is worth noting that the parent index will be decarbonizing along with the regular economy; the regulation ensures that PAB indices do no worse than the parent at any point in time. This general process is represented by the following formula:

$$\text{PAB GHG}_t \leq \min\left(50\% \times \text{Parent GHG}_t, \frac{50\% \times \text{Parent GHG}_0 \times (1-R)^{t/f}}{IAF_t}\right), \text{ where}$$

- t is the number of rebalance periods since PAB inception
- f is the rebalance frequency per year
- PAB/Parent GHG are the weighted average index values[13]. The value must be an intensity for equity PABs but may be absolute GHG for fixed income indices.
- R is the annual reduction rate, which needs to be 7% or greater
- IAF is an inflation adjustment factor, which can differ depending on how GHG is measured.

Index construction

As with any investment product, PAB index construction needs to ensure all objectives are being met – in this case, both regulatory and traditional considerations surrounding tradability and risk management.

Figure 3 summarizes two basic approaches. *Optimized* approaches offer the most flexibility and specificity, as PAB requirements can all be implemented as constraints. Additional constraints to manage risk and turnover may be added. To obtain unique solutions, it is necessary to specify an objective function that determines which of the constraint-meeting portfolios is best. While the results do rely on numerical software, many investors appreciate the precision optimization techniques offer.

Alternatively, one can specify an order for removing securities from the portfolio. This *Rules-based Exclusions* approach checks if the emissions target is met at each step, and stops when the target is met. While this results in straightforward-to-verify security selection, the challenge is that risk exposures are not explicitly controlled – at least not without a significant increase of complexity that involves making the ordering scheme itself risk-aware.

[12] Technical Guidance for Calculating Scope 3 Emissions. Greenhouse Gas Protocol 2013. Scope 3 FAQs. Ibid, June 2022.
[13] Treatment of missing emissions data in the parent is not fully specified by regulation and can vary.

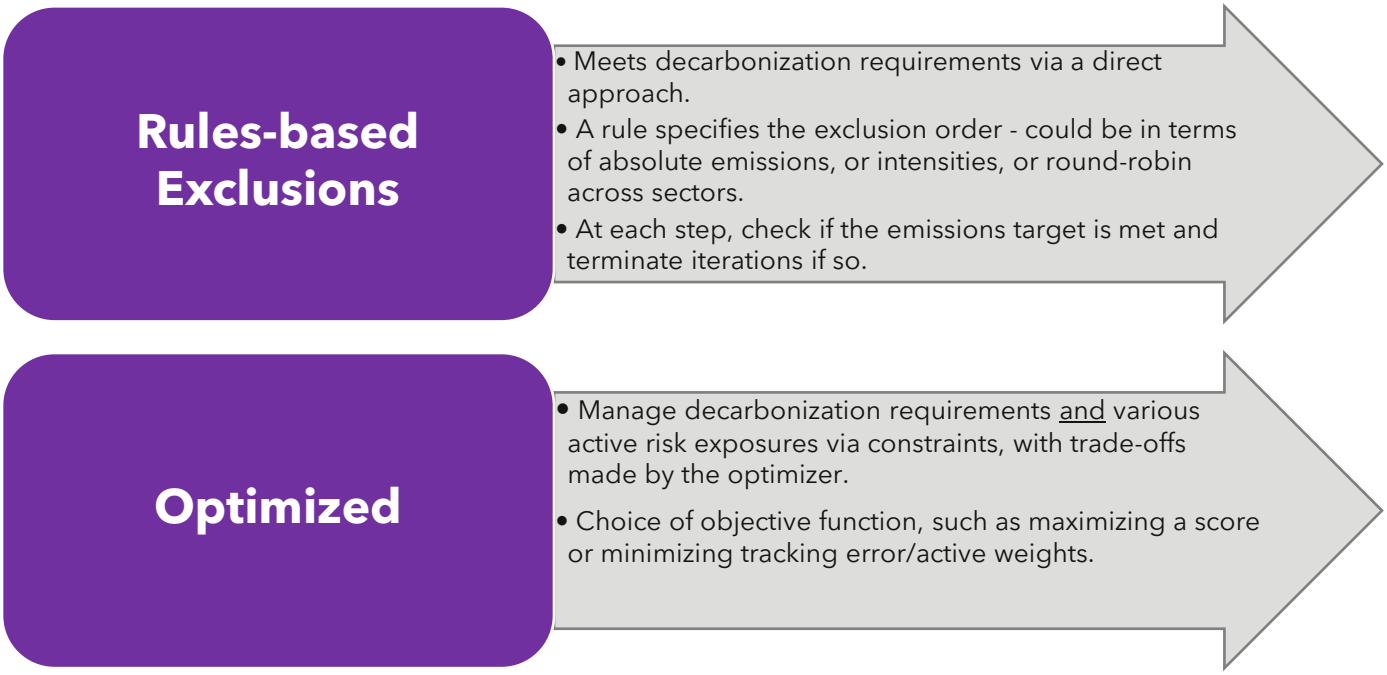


Figure 3. Summary of differences between Rules-based Exclusions and Optimized methods of index construction.

Comparing equity and fixed income PABs

Guidance from the EU TEG recognizes that in the steady-state (non-material changes in AUM), fixed-income funds mostly purchase bonds at issuance, meaning they largely affect the *primary market* and are directly funding corporations – potentially even financing projects detrimental to climate change mitigation and adaptation. On the other hand, equity investors transact on the secondary market and exert influence via engagement and voting[14]. Based on this reasoning, it is permissible for fixed income PABs to meet de-carbonization requirements via exclusions and weight reductions, even if this eliminates holdings in carbon-intensive sectors such as Energy. On the other hand, equity holders, are expected to maintain aggregate holdings in carbon intensive sectors, as owner influence remains paramount.

A second permissible difference is in the measurement of GHG. Ideally, all PABs would de-carbonize in terms of intensity, as this is neutral (invariant) under mergers, acquisitions, and divestitures. To see this, consider a company emitting 500 units of GHG comprising 5% of an index. Suppose they split into two companies emitting 250 units each. The original GHG contribution is 5% × 500 = 25 units, and post-split contribution is 2 × 2.5% × 250 = 12.5 units. However, in an intensity measure, the contribution to index intensity is unchanged provided the index weights are proportional to EVIC[15].

However, bond funds often have significant holdings in private companies, for which no market capitalization is available. While one could mix book and market values for EVIC, this is of concern to some investors. To alleviate such concerns, targeting absolute emissions is permitted in fixed income.

Finally, there is a more "mechanical" difference: both GHG and risk are affected by ticker (company) weight decisions in an equity index. In fixed income, ticker weights affect GHG and risk as well, but individual bond weights affect risk further. Such "tiering" of metrics between ticker and bond level makes fixed income index construction more complicated. A summary of these differences is given in Figure 4.

[14] Handbook of CTBs, PABs and ESG Disclosures, TEG 2019, sections 1.9 and 3.2.
[15] If the split in GHG is g and 1-g, and the split in EVIC is s and 1-s, note that (g×G+(1-g) ×G)/(s×E+(1-s)×E) and s×g×G/(s×E) + (1-s) ×(1-g) ×G/((1-s) ×E) both equal G/E.

Equity PAB

- Must maintain aggregate holdings in "high climate impact sectors"
- This ensures retaining influence via engagement and voting rights.
- GHG must be measured in terms of intensity
- GHG and risk are managed by the same security-level weights.

Fixed Income PAB

- Can meet de-carbonization goals by both exclusions (including sector exclusions) and under-weighting.
- This avoids funding activities which may be detrimental to climate mitigation.
- GHG may be measured in terms of absolute levels to avoid inconsistent treatment of enterprise value.
- GHG is associated to companies, whereas risk includes bond-level characteristics, increasing index construction complexity.

Figure 4. Summary of key differences between equity and fixed income PAB guidelines.

Case study

The Bloomberg MSCI Euro Corporate Climate Paris Aligned ESG Select Index

The PAB ESG Select Index demonstrates the opportunity to go above and beyond minimum requirements while also utilizing powerful tools to manage financial risk and ensure investability. Notably, the index targets a 10% per annum de-carbonization trajectory[16] in both absolute levels *and* intensities, and optimization is used to manage a wide variety of goals. Key elements of the specification are listed in Figure 5 below[17].

Beyond the ESG and climate-related objectives, we want to draw attention to the investability objectives. Firstly, there are explicit constraints in terms of yield-to-worst (YTW), option-adjusted duration (OAD), duration-times-spread (DTS) and sector/country/issuer weight differences versus the screened parent index[18]. These constraints alone control headline sources of active exposures in sector, rates and credit spread factors.

Beyond these first-order controls, the index also utilizes the Bloomberg Fixed Income Multi-Factor Risk model to minimizing ex-ante tracking error to the parent index. This risk model generates a robust portfolio covariance matrix based on a rich set of factors including curve, volatility and spread factors. Finally, we note that relative bond-to-ticker weights are maintained between this PAB index and its parent index. This ensures that each issuer's curve characteristics are maintained in the PAB index, as well as preventing GHG and ESG objectives being met at the cost of introducing curve, coupon and idiosyncratic active risk.

We emphasize that optimization is necessary to manage this comprehensive array of goals. As we shall see below, not all constraints are necessarily binding. As might be intuitive, ESG constraints can work in conjunction – for example, higher ESG scores, and "green" revenue ratios are correlated to each other and to lower emissions. Having multiple metrics in the specification may be *statistically* redundant at any point in time, but they provide assurance that the portfolio is not over-fit to any specific metric. Additionally, binding constraints can be a source of turnover; correlation among constraint variables reduces the likelihood all constraints are binding.

[16] In addition to being nominally higher than the required 7%, a 10% de-carbonization rate provides a strong buffer in the event reported emissions exceed estimates.
[17] Details are further provided in the index's methodology guide
[18] The screened parent index is that result of applying baseline, activity and ESG exclusions, but prior to optimization.

Parent & Base Date

- Bloomberg Euro Aggregate Corporate Index
- Base date for GHG baseline is June 30, 2020

Objective

- Minimize total active risk
- Minimze turnover

ESG and Climate Data

- GHG, revenue, ESG ratings/scores, controversy flags are all provided by MSCI.
- Scope 1+2 emissions are mixture of reported and estimated. Scope 3 emissions are included for **all sectors** using estimates only.

Climate Constraints

- 50% initial reduction in both weighted absolute emissions and intensity versus parent
- Minimum 10% per annum reduction in both weighted absolute emissions and intensity
- Minimum 100% increase in weighted average green revenue versus parent
- Minimum 4x increase in green-to-fossil-fuel revenue ratio relative to parent
- Minimum 20% increase in weight for issuers having and meeting reduction targets

ESG Constraints

- Minimum 15% increase in weighted average MSCI ESG score
- MSCI ESG rating of B or higher
- Exclude any issuer with MSCI ESG Controversies score of "Red" or that are not covered by MSCI ESG Controversy Research
- If neither a reported nor estimated GHG **level** is available, the issuer is excluded. If only the **intensity** is unavailable, the issuer is included in the index, and only ignored in the intensity constraint.

Baseline Exclusions

- EU delegated acts: controversial weapons, tobacco producers, UNGC violations.

Activity Exclusions

- EU delgated acts: environment controversy, thermal coal revenue (1%), oil & gas revenues (10%), power generation (50%).
- Additional: nuclear weapons, civilian firearms (5%), unconventional oil & gas (5%), tobacco (5%), conventional weapons (5%), weapons systems (10%).

Investability Constraints

- Ticker weight relative to screened parent 0.1x - 5x and ±1%, with max of 4.5%
- DTS ±5%
- YTW greater than or equal to parent
- OAD ±0.25
- BCLASS3 sector weight difference ±5%
- Country weight ±5%
- Turnover, parent index +4%

Optimization variables

- The optimizer works in terms of *ticker-level trades*, meaning that the relative bond weight of each ticker is the same as that of the parent index.
- Risk measures continue to include the effect of bond-level positions.

Infeasibility

- If, on any month, the optimization task is not feasible, the ESG Score constraint will be reduced in increments of 2.5% until a result is found.

Figure 5. Summary of the PAB ESG Select Index specification. Source: Bloomberg MSCI.

Carbon Trajectory. We begin our quantitative performance analysis by looking at the de-carbonization trajectory through the August 31, 2022 index re-balance. Figure 6 shows the parent trajectory, the two operative constraints (50% of parent and 10% annual), and the standard 7% trajectory, for both level and intensity. At inception, the 10% trajectory was a binding constraint for level. Since late 2021, re-balances have resulted in both being below constraints, consequences of exclusions, weight reductions, and meeting other constraints.

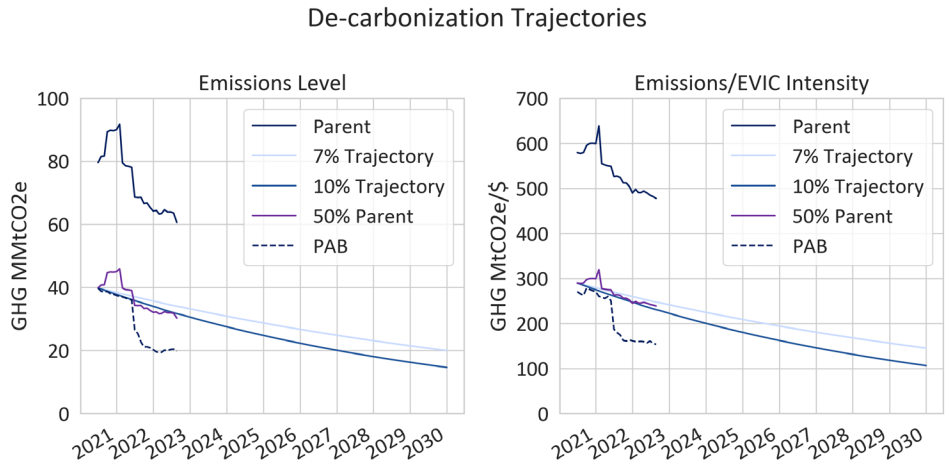


Figure 6. Summary of de-carbonization trajectories as of August 31, 2022. Source: Bloomberg MSCI.

ESG Metrics. Results for other ESG metrics are presented in Figure 7. We observe that as of the August 31, 2022 index rebalance, the Green Revenue and ESG Score improvement constraints are binding at +100% and +15%, respectively. On the other hand, there is a considerable buffer of Green to fossil fuel ratio at 13x – again a consequence of exclusions and meeting other constraints.

Metric	Requirement	Parent	PAB
Green Revenue	PAB index is required to have an increase in weighted average green revenue relative to parent of +100% at rebalance date.	5.023	10.027 +100%
Green to Fossil Fuel Ratio	PAB index is required to have green to fossil-fuel ratio of at least 4x vs. the parent at rebalance date	1.418	18.463 13x
Issuers with GHG Reduction Targets	PAB index is required to have reduction target coverage 20% greater than the parent in relative terms.	7.4%	13.1% +77.5%
ESG Score	PAB index is required to have an increase in ESG score revenue relative to parent of +15% at rebalance date	7.179	8.230 +15%

Figure 7. Summary of non-GHG ESG constraints as of August 31, 2022. Source: Bloomberg MSCI.

Let's look in more detail at how exclusions and optimization work in tandem to lower emissions. Figure 8 shows the weighted-average emissions levels at different stages of the rebalance for August 31, 2022. We see immediately that the standard exclusions have the largest effect, removing 33.6 $MMTCO_2e$, with the majority stemming from down-weighting Energy and Consumer Cyclicals. Because weights must sum to one, exposure to some sectors must be increased, which can increase emissions contribution. This is depicted by the portion of the second bar that is above the black line. We can also see that the additional exclusions have negligible impact on emissions. However, the optimization step, where ESG and revenue constraints are enforced, removes an additional 5 $MMTCO_2e$. We can also observe that in the PAB index, the largest contribution of emissions level comes from the remaining Industrials, Banking and Consumer Cyclicals sectors.

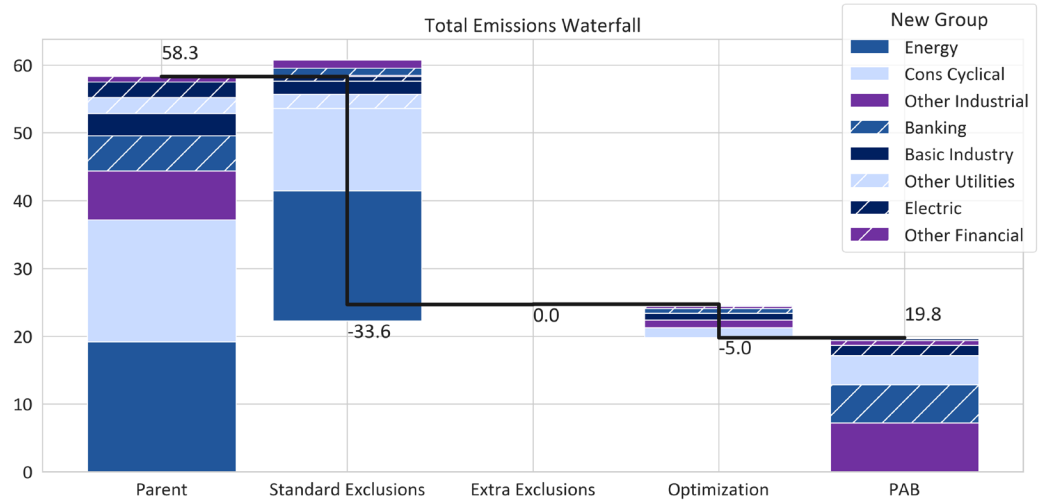


Figure 8. Waterfall depicting weighted-average emissions levels at different stages for the August 31, 2022 rebalance. Source: Bloomberg MSCI.

Non-ESG Investability Constraints. Keeping our attention on sector differences, which must be within 5% (except for Energy), we see from Figure 9 below that REITs, Technology and Finance gain weight (but less than 5% upper bound), and Energy, Consumer Cyclical and Natural Gas have decreased weights (but remain greater than the lower bound). In fact, the PAB weight of Energy is zero, due to the baseline exclusions of revenues greater than 10% to oil and gas.

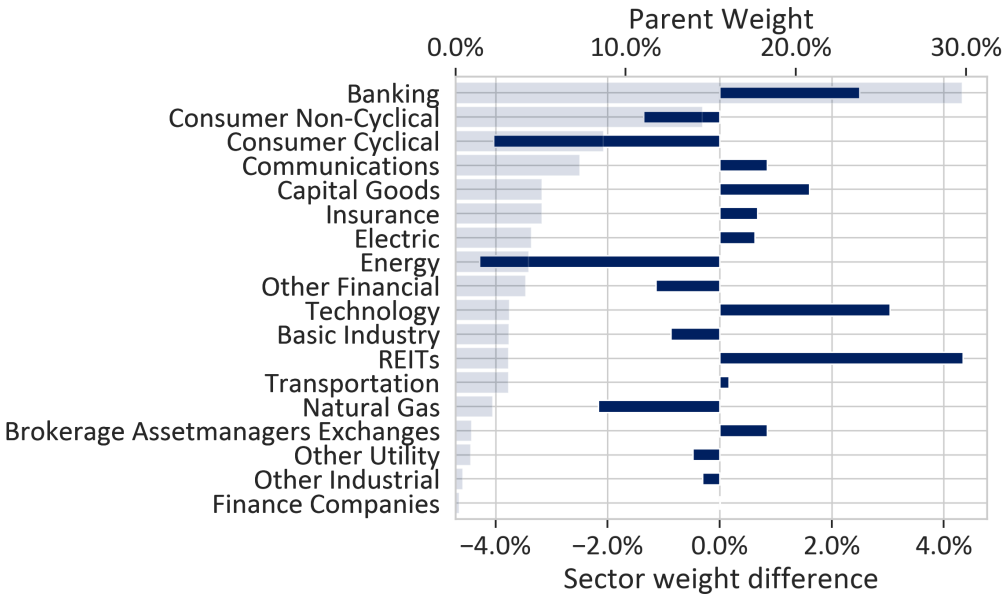


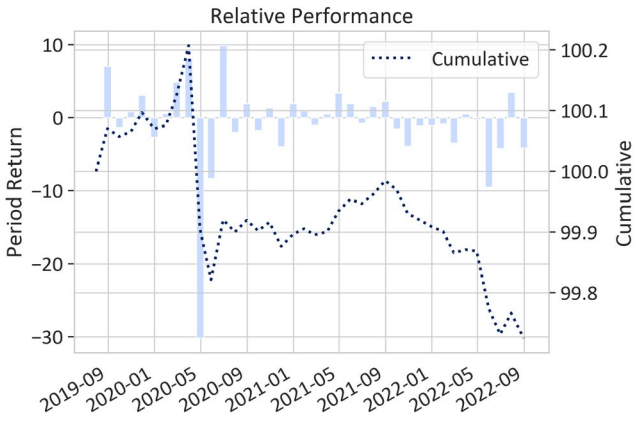
Figure 9. Sector weight differences as of August 31, 2022. Weight differences are in dark blue and correspond to the bottom axis. The top axis is for total PAB weight, depicted as shaded bars. Source: Bloomberg MSCI.

The headline financial objectives are to achieve similar-or-better expected return, as measured by YTW, with similar levels of rate and credit risk (OAD and DTS), and, as seen, sector exposures. Figure 10 shows that as of the August 31, 2022 rebalance, the PAB index has a slightly longer duration (by 0.03), and a slightly lower DTS (by 0.2); neither is binding. The objective function is minimized with 2.81bp of remaining active risk.

Risk Metric (August 2022)	Requirement	Parent	PAB
Yield to Worst (YTW)	Greater than or equal to parent	2.99	2.99
Option Adjusted Duration (OAD)	Within 0.25 of parent	4.78	4.81
Duration Times Spread (DTS)	Within 5% of parent	6.02	5.82
Total Active Risk	Minimize (subject to all constraints, as discussed)	-	2.81bp

Figure 10. Summary of risk metrics for the August 31, 2022 portfolio rebalance. Source: Bloomberg MSCI.

As the direction of duration and DTS differences may change during rebalances, we are reminded that some tracking error is inevitable. For this reason, the PAB ESG Select Index includes the objective of minimizing total active risk using Bloomberg's Fixed Income Multi-Factor Risk Model.



Historical Performance Metric (June 2020 – August 2022)	Parent	PAB
Annualized Return	-3.59%	-3.67%
Annualized Volatility	6.84%	6.79%
Maximum Drawdown	-13.38%	-13.58%
Annualized Relative Return	-	-8.9bp
Tracking Error Volatility (TEV)	-	22.4bp
Maximum Relative Drawdown	-	-48.3bp

Figure 11. Relative performance between PAB and Parent index. Data from August 2019 through index launch (March 2022) is pro forma. Bars depict monthly excess returns (left axis, in basis points), and the line shows cumulative excess return (right axis, 100 base). Source: Bloomberg MSCI.

Examining Figure 11, we see that over the available historical period the realized tracking error is 22.4bp annualized – roughly 6.4bp per month. In this period, the annualized excess return was slightly negative at -8.9bp, which is -0.7bp per month. Given the strength of risk controls in the index construction process, one can expect that sources of tracking error will remain limited to specified risk exposures and non-diversifiable risk.

Conclusion

In this paper we have reviewed the motivation and key criteria for Paris aligned indices and have used the Bloomberg MSCI Euro Corporate Climate Paris Aligned ESG Select Index as a case study to demonstrate index design considerations and consequences. This PAB index exhibits ambitious de-carbonization objectives by tracking both levels and intensities at 10%, exceeding what is necessary by 3%. Moreover, the index implements a variety of risk controls in order to limit active risk and, ultimately, remain positioned for low realized tracking error.

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