Exploring S&P PACT™ Indices Weight Attribution

EXECUTIVE SUMMARY

We aim to provide transparency around the S&P PACT Indices (S&P Paris-Aligned & Climate Transition Indices), a sophisticated index solution to align with a 1.5°C trajectory (EU PAB and CTB Aligned) and mitigate a multifaceted range of potential financial risks, while assessing opportunities companies may face from climate change, as laid out by the Task Force on Climate-related Financial Disclosures (TCFD).

- The S&P PACT Index weights, relative to the benchmark index, are attributable to an exclusion effect (whether a stock is eligible for the index) or reweighting effect (how a stock performs from a climate perspective), as seen in Exhibit 1.

- The exclusion effect accounts for 30%-40% of active weights for the S&P Climate Transition (CT) Indices, while for the more ambitious S&P Paris-Aligned Climate (PA) Indices, exclusions account for 40%-60% of deviations from benchmark weights. The reweighting effect explains the remaining active share.

- The reweighting effect is driven by climate and index construction factors, which is affected by the strength of constraint, climate datasets distributions, and climate factor correlations.

- A company’s transition pathway, environmental score (as measured by the S&P DJI Environmental Score), physical risk, and high climate impact revenues are all key drivers of weighting S&P PACT Index constituents.

- The high-quality climate factor diversification helps better understand transition risk, physical risk, and opportunities due to low correlations.

- Eligible companies can be allocated a higher weight in the S&P PACT Indices by significantly reducing their carbon intensity year-on-year, disclosing more information regarding environmental policies and metrics, improving performance against environmental policies and metrics, divesting assets in locations highly exposed to physical risks, and reducing assets’ physical risk sensitivity factors.

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1 Transition to a 1.5°C World with the S&P Paris-Aligned & Climate Transition Indices (2020)
2 S&P Paris-Aligned & Climate Transition (PACT) Indices Methodology (2020)
3 Using the 1.5°C scenario with no or limited overshoot, as recommended by the TEG (2019) and IPCC (2018)
**INTRODUCTION**

The S&P PACT Indices aim to go beyond the Paris Agreement’s minimum goal by aligning with a 1.5°C trajectory while maintaining broad, diversified exposure. The S&P PACT Indices also incorporate the minimum standards of the EU’s Low Carbon Benchmark requirements and the TCFD’s recommendations. These objectives are possible due to innovative forward-looking data from Trucost, part of S&P Global, informing both transition and physical risks alongside an evidence-based approach.

The EU Low Carbon Benchmark requirements outlined minimum standards for two climate benchmarks: the Climate Transition Benchmark (CTB) and the more ambitious Paris-Aligned Benchmark (PAB). The S&P PACT Indices have two components—the S&P Climate Transition (CT) Index Series and the S&P Paris-Aligned Climate (PA) Index Series, which both aim to incorporate the respective regulatory standards.

The S&P PACT Indices offer a multifaceted solution to holistically mitigate potential climate risk and assess opportunities, as laid out by the TCFD. With many competing climate objectives, the S&P PACT Indices are a sophisticated solution and this paper aims to provide further transparency.

To supplement the forward-looking and evidence-based datasets from Trucost, the S&P PACT Indices uses data to understand product involvement (provided by Trucost and Sustainalytics), United Nations Global Compact (UNGC) alignment (from Arabesque), and environmental score data (from SAM, part of S&P Global).

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5 Using the 1.5°C scenario with no or limited overshoot, as recommended by the TEG (2019) and IPCC (2018)
7 TEG Final Report (2019)
TWO QUESTIONS TO CONSIDER

Stocks within the S&P PACT Indices largely receive their weighting for one of two reasons:

1. The Exclusion Effect: Is a stock eligible for the index?
2. The Reweighting Effect: How does a stock perform from a climate perspective?

The S&P PACT Index constituents’ exposures to controversial weapons, tobacco, public controversies, and UNGC misalignment are excluded. The S&P PA Indices go further by excluding potential index constituents based on fossil fuel exposure at specific thresholds. These can be seen in Appendix B. Companies that do not meet these minimum eligibility standards have a weight of zero in the S&P PACT Indices, as shown in Exhibit 1.

Companies passing this exclusion-based hurdle are reweighted to minimize possible modifications to the benchmark, while meeting climate and index construction criteria. The optimization’s objective function penalizes changes in stock’s weight the further it travels from its weight in the underlying index, in a manner that is less severe on larger stocks (see Equation 1).

**Equation 1: S&P PACT Index Objective Function**

\[
\text{Minimize } \sum \frac{(\text{Benchmark Weight}_i - \text{PACT Weight}_i)^2}{\text{Benchmark Weight}_i}
\]

Climate criteria and exclusions are largely driven by the EU Low Carbon Benchmark requirements and TCFD recommendations on climate-related financial risks and opportunities. Index construction constraints to maintain diversification, liquidity, and tradability of the index are included. Climate factor-based constraints are portrayed in Exhibit 2 and a full list of constraints is included in Appendix C.

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* The S&P PACT Indices were designed using the TEGs recommendations. At the time of writing this paper, the final EU delegated acts under the EU Low Carbon Benchmark requirements had not been implemented. Once the delegated acts have been passed into law, S&P DJI will review and update the S&P PACT Indices as required.
Ultimately, stock weights are determined by whether the company is eligible for the index...

...and if so, how it performs from a climate perspective.

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WEIGHT CHANGES FROM EXCLUSIONS AND REWEIGHTING

Index active share is an active risk measure between benchmarks and subindices, where active share represents the benchmark index percentage that would be sold to meet the subindex weights. Active share for an S&P PACT Index is calculated as the sum of the absolute weight difference between the benchmark and subindex, for stock \( i \), divided by two (see Equation 2). This largely resembles the S&P PACT Index objective function, which primarily seeks active share minimization.

Equation 2: Active Share

\[
Active\ Share = \sum \frac{|Benchmark\ Weight_i - PACT\ Weight_i|}{2}
\]

To understand the relative impact of exclusions and reweighting on S&P PACT Index weights, active share from each is considered. Exhibit 2 shows the total active share of the S&P PACT Indices. Unsurprisingly, due to extra exclusions and more ambitious climate constraints, the S&P PACT Indices have greater active share than their CT counterparts.\(^9\)

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\(^9\) The indices used in our analysis and (their respective abbreviations) are as follows: S&P 500® Climate Transition Index (500 CT), S&P Eurozone LargeMidCap Climate Transition Index (Eurozone CT), S&P Europe LargeMidCap Climate Transition Index (Europe CT), S&P Developed Ex-Korea LargeMidCap Climate Transition Index (Developed CT), S&P 500 Paris-Aligned Climate Index (500 PA), S&P Europe LargeMidCap Paris-Aligned Climate Index (Europe PA), S&P Eurozone LargeMidCap Paris-Aligned Climate Index (Eurozone PA), and S&P Developed Ex-Korea LargeMidCap Paris-Aligned Climate Index (Developed PA).
We define the exclusion effect as the sum of the weights of excluded companies in the benchmark...

...and define the reweighting effect as the S&P PACT Index active share minus the exclusion effect.

Exhibit 2: S&P PACT Indices Active Share

We define the exclusion effect as the sum of the weights of excluded constituents in the benchmark (equivalent to the active share of the excluded constituents) and define the reweighting effect as the S&P PACT Index active share minus the exclusion effect. An interaction effect between exclusions and climate factors will likely occur. Therefore, the reweighting effect can be attributed to climate and index construction factors, along with the interaction between these factors and exclusions.

Equation 3: The Exclusion Effect

\[ \text{Exclusion Effect} = \text{Weight of Excluded Constituents} \]

Equation 4: The Reweighting Effect

\[ \text{Reweighting Effect} = \text{PACT Index Active Share} - \text{Exclusion Effect} \]

As the index active share and the weight of excluded companies are known, the reweighting effect can be calculated (see Equation 4). Exhibit 3 shows the active share percentage that comes from exclusions and reweighting. This method has vague similarities to Brinson performance attribution.\(^\text{10}\)

\(^{10}\) Determinants of Portfolio Performance (1986)
The S&P PA Indices are observed to have 40%-60% of their active share coming from exclusions…

…while S&P CT Indices see 30%-40%.

The S&P PA Indices are observed to have a greater percentage of their active share coming from exclusions, about 40%-60%, than the S&P CT Indices, which see 30%-40%. While there are more ambitious constraints on the S&P PA Indices, such as an increased carbon intensity reduction and physical risk constraints, the added fossil fuel exclusions contribute more to the increased active risk relative to the S&P CT Indices.

THE EXCLUSION EFFECT

Similar weight is excluded among companies involved in controversial weapons and tobacco, as well as those that don’t comply with the UNGC or that have been flagged by SAM’s Media and Stakeholder Analysis (MSA)—these exclusions are consistent across S&P PACT Indices. Companies without product involvement or UNGC coverage are excluded, as we cannot ensure inclusion if coverage were available.

Differences between the S&P CT and PA Indices lay within fossil fuel exclusions, as these apply only to the S&P PA Indices. Again, the weight excluded by exclusions is similar across regions, with oil operations accounting for the highest number of exclusions. Some companies are excluded for multiple reasons, so “Excluded” bars do not represent a sum of all exclusion bars. Fossil fuel exclusions account for 6%-8% of market cap within the S&P CT Indices and 13%-18% within the S&P PA Indices.
THE REWEIGHTING EFFECT

While understanding the impact exclusions have on the eligible universe, and therefore the index, is simple, understanding the impact of climate-related factors is more nuanced. These climate factors are distributed differently, scaled differently, and have varying degrees of correlation. Addressing each climate factor with a constraint allows more control of the index-level outcome and greater efficiency.

Within the eligible universe, three aspects affect the climate factor impact on constituent weights:

1. Strength of constraint;
2. Distribution of data being constrained; and
3. Correlation of climate factors.

The strength of constraint represents the required difference from the benchmark index. The distribution of datasets will largely determine how much active share must be taken per unit of change toward the required constraint. Correlation of climate factors governs the interaction between climate factors. High correlation allows active share taken to fulfill one climate constraint to also help fulfill others. If not, greater active share is required.

More details on the strength of constraints can be found in the index methodology. We aim to shed light on the directional relationship between climate and index construction factors, the difference in distributions, and correlations between climate factors. Additionally, we approximate the significance and magnitude of the effect the climate and index construction factors have on S&P PACT Index weights.
UNDERSTANDING THE CLIMATE AND INDEX CONSTRUCTION FACTORS

Appendix D explains the expected directional relationship between the constituent weight change and climate and index construction factors. It is important to understand the magnitude of weight change required to meet index constraints, data distributions for climate and index construction factors, as well as the strength of constraint. Exhibit 5 shows the data distributions of the underlying climate data used to reweight the S&P PACT Indices. We can observe how different the underlying data distributions are for the various metrics.

Exhibit 5: Climate and Index Construction Factor Data Distributions

![Exhibit 5: Climate and Index Construction Factor Data Distributions](image)

The strong positive skew of carbon intensities makes hitting the 30% (CT) or 50% (PA) weighted average carbon intensity (WACI) reduction relatively simple, in terms of active share encountered. Making index weight changes to the most carbon-intensive constituents can have large WACI impacts. As WACI is reduced further, more active share is required per unit of carbon intensity reduction. Similar is true of fossil fuel reserve intensity and green-to-brown share. Far fewer companies have either green or brown revenues or fossil fuel reserves, meaning these likely have a direct impact on fewer stocks. Physical risk has a weaker positive skew, so more active share is required per unit of physical risk mitigation, compared with carbon intensity, green-to-brown share, and fossil reserve intensity.

The transition pathway data has a leptokurtic distribution—where the distribution has fatter tails. Appendix A shows the calculation for the index-level transition pathway budget alignment. Due to the leptokurtic distribution, and to take a conservative approach as not to be deemed 1.5°C compatible due to overweighting a small number of outlying stocks, we winsorize the left hand of the distribution. We want this climate factor to overweight companies that appear on the right trajectory to help the index “organically” decarbonize.

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The environmental score is positively skewed, albeit significantly less than other datasets. Carbon disclosure is binary, either 1 (sufficiently disclosed, as researched by Trucost) or 0 (insufficiently disclosed).

Difference in distributions means optimization has a particularly strong benefit, allowing active share to be placed where it will most efficiently affect index-level characteristics. This is particularly beneficial if the benchmark index does not decarbonize over time, which would require a higher level of relative decarbonization in the future due to the 7% year-on-year decarbonization trajectory.  

Adding climate factors beyond carbon intensity will only provide a benefit if these are not perfectly correlated. The lower the correlation, the more benefit additional datasets bring in understanding a company’s potential climate risks and opportunities. Expecting backward-looking and forward-looking climate factors to assess transition risk, physical risk, and opportunities to have low or negative correlations, while adding further information, seems plausible.

This logic is similar to that of diversification. Modern Portfolio Theory (MPT) teaches us non-perfectly correlated assets underpin the benefit of portfolio diversification. S&P DJI analysis indicates the benefits of diversification across individual stocks, asset classes, factors, and sectors.

A climate risk premium associated with theoretical transition risk, physical risk, or climate opportunities is yet to be determined, so understanding the diversification of climate factors as improving an alpha signal requires further research. While MPT focuses on risk and return, diversifying high-quality climate factors with low or negative correlations to add greater insight seems credible.

In fact, if the goal is to understand potential physical risks, transition risks, and opportunities, there is increasing benefit from additional datasets, beyond carbon intensity, the further away from perfect climate metric correlation. The further from perfect the correlation, the higher the cost of concentrating on one or a small number of climate factors due to the increased potential diversification benefit.

Exhibit 6 does show climate factors are largely low or negatively correlated, thus confirming the theoretical idea that the addition of multiple climate

13 The Active Manager’s Conundrum (2020)
14 Asset Class Correlations Affect Portfolio Volatility and Return (2018)
15 The Merits and Methods of Multi-Factor Investing (2018)
16 The Importance of Sector Diversification in a Yield-Focused Strategy – Part I (2018)
Climate factors are in fact largely low or negatively correlated…

The further from perfect the correlation, the higher the cost of concentrating on fewer climate factors due to the increased potential diversification benefit.

Two pairs of climate factors have higher correlations. Carbon disclosure and environmental score have a 0.52 correlation, which is unsurprising since the environmental score rewards companies for disclosure. Physical risk also has a 0.47 correlation to high impact revenue streams, as defined by the EU Technical Expert Group (TEG).

### Exhibit 6: Correlations Between Climate and Index Construction Factors

<table>
<thead>
<tr>
<th>FACTOR</th>
<th>CARBON INTENSITY</th>
<th>TRANSITION PATHWAY</th>
<th>FOSSIL FUEL RESERVES INTENSITY</th>
<th>ENVIRONMENTAL SCORE</th>
<th>GREEN-TO-BROWN SHARE</th>
<th>PHYSICAL RISK</th>
<th>HIGH IMPACT REVENUE</th>
<th>CARBON DISCLOSURE</th>
<th>BENCHMARK INDEX WEIGHT</th>
<th>LIQUIDITY</th>
</tr>
</thead>
<tbody>
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<td>0.06</td>
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<td>0.14</td>
<td>-0.05</td>
<td>-0.04</td>
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<td>-0.13</td>
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<td>0.09</td>
<td>-0.03</td>
<td>-0.03</td>
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<tr>
<td>FOSSIL FUEL RESERVES INTENSITY</td>
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<td>1</td>
<td>0.03</td>
<td>-0.07</td>
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<td>0.18</td>
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<tr>
<td>GREEN-TO-BROWN SHARE</td>
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<td>0.07</td>
<td>-0.1</td>
<td>-0.17</td>
<td>1</td>
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<td>0.02</td>
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<td>-0.01</td>
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<tr>
<td>HIGH IMPACT REVENUE</td>
<td>0.2</td>
<td>0.11</td>
<td>0.08</td>
<td>0.02</td>
<td>0.13</td>
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<td>0.16</td>
<td>1</td>
<td>0.12</td>
<td>0.04</td>
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<tr>
<td>BENCHMARK INDEX WEIGHT</td>
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<td>-0.01</td>
<td>-0.04</td>
<td>0.04</td>
<td>0.77</td>
<td>1</td>
</tr>
</tbody>
</table>

Source: S&P Dow Jones Indices LLC, Trucost, part of S&P Global, SAM, part of S&P Global, and FactSet. Data as of March 31, 2020. Table is provided for illustrative purposes.
HOW ARE ELIGIBLE COMPANIES’ S&P PACT WEIGHTS DETERMINED?

Linear regression is employed to approximate the magnitude and significance that climate and index construction factors have in explaining the percentage weight change of eligible constituents. The starting universe impact is also examined.

The objective function and constraints are drivers of weight change. Some capping constraints are either not or rarely utilized, while for the Science Based Targets constraint, no companies meet eligibility criteria for overweighting. Other constraints are used as regression variables to explain the percentage weight change.

Index Construction Constraints

Exhibit 7 shows just one company across all universes, an S&P 500 PA Index constituent, was capped for a relative stock weight of ±2%. The constraint only affected one stock across regions and therefore had minimal impact on S&P PACT Index weights. Likewise, only six companies across S&P PACT Index variants had their weight capped at 5%. These constituents would likely have received more weight than they were allocated by the S&P PACT Indices without the cap. Of these six, two companies had more than 5% weight in the benchmark index (see Exhibit 8).

The lower threshold constraint for minimum stock weight can be understood by an interaction between constituents’ benchmark weight and climate factors. The lower the companies’ benchmark weight and the worse the company performs on climate factors, the more likely the 1 basis point threshold will be hit.

Exhibit 7: Absolute S&P PACT Index Weight Change Distributions

Source: S&P Dow Jones Indices LLC. Data as of March 31, 2020. Charts are provided for illustrative purposes.
Climate Factors and Benchmark Index Weight Effects

The climate factors and benchmark index weight are standardized to create a comparable scale among variables. As carbon disclosure is binary, this variable is not standardized. We regress standardized climate factors on the percentage weight change to understand their impact on S&P PACT Index weights within the eligible universe—those stocks left after exclusion (see Equation 5).

This method is not too dissimilar from using the regression-based Fama-French model to attribute performance to equity risk factors,\textsuperscript{17} the difference being in what we are trying to explain and with what factors (see Equation 6). Theoretically, there are similarities.

Equation 5: PACT Percentage Weight Change

\[
\text{Percentage Weight Change}_i = \frac{\text{PACT Weight}_i - \text{Benchmark Weight}_i}{\text{Benchmark Weight}_i} \times 100
\]

Equation 6: Weight Attribution Regression Model

\[
\text{Percentage Weight Change}_i = \text{Constant}_i + \sum_{j=1}^{n} \beta_{ji} \text{Climate Factors}_{ij} + \beta_i \text{Benchmark Weight}_i + \epsilon_i
\]

Where $\beta_{ji}$ is the sensitivity of stock $i$’s percentage weight change to climate factor $j$ and $\beta_i$ is the sensitivity of stock $i$’s weight change to the weight of stock $i$ in the benchmark index.

We do not include fossil fuel reserves in these climate factors, as we observe the fossil fuel reserve reduction goes beyond the required constraints (80% reduction for S&P PA Indices and no worse for S&P CT Indices), as seen in Exhibit 9. This is likely due to interactions between other climate factors, exclusions, and fossil fuel reserves. We conclude

\textsuperscript{17} Asset pricing models used to attribute performance to equity risk factors (1997) (2015) (1992)
fossil fuel reserves have no significant impact on S&P PACT Index weights and is employed as a safety net to control future exposures.

The aim of the analysis is to attribute the percentage change in S&P PACT Index weight to the benchmark weight and climate factors. We propose significant coefficients (significant at a 5% level) to reasonably proxy the magnitude and significance of the climate factor impact on the S&P PACT Indices constituent percentage weight changes. This enables understanding of what companies can improve from a climate perspective, in order to gain a higher S&P PACT Index weight.

Exhibit 10 shows significant coefficients for each regression. With both, the direction of significant coefficients is largely consistent across regions.

The transition pathway, environmental score, physical risk, and high climate impact show the most effect on percentage changes in constituent weights, while interaction effects between factors and exclusions likely play a significant role.
As the S&P PACT Indices aim to reduce the carbon intensity, we would expect a negative coefficient. However, an exclusions and reweighting interaction effect plays a role. Exhibit 11 shows the difference in mean carbon intensity of excluded versus eligible stocks. This indicates a carbon intensity reduction caused by exclusions, which contributes to the 30% and 50% carbon intensity reductions required for the S&P CT Indices and S&P PA Indices, respectively.

Additionally, carbon intensities have a high positive skew, as seen in Exhibit 5. Consequently, the index can be substantially decarbonized by underweighting a small number of companies. Carbon intensity also has a low but positive correlation to the transition pathway model—an interaction effect here may help reduce carbon intensity.
Between the positive skew of carbon intensity data and potential interaction effect between the carbon intensity of companies and the exclusions, carbon intensity has little, if any, significant effect on the percentage weight change of S&P PACT Indices constituents.

These data are for the first live basket, where the carbon intensity reduction is 30% (CT) or 50% (PA). Over time, depending on the carbon intensity trajectories of the benchmark indices, we may see larger carbon intensity reductions required, which may increase the impact carbon intensity has on S&P PACT Index weights.

### Transition Pathway Effect

While carbon intensity may have limited, if any, direct impact on S&P PACT Index weights, a company’s trend of carbon intensity plays an important role when looking at the transition pathway of companies.

For each region, the transition pathway is significant and highly impactful on S&P PACT Index weights. Exhibit 12 shows the relationship between the transition pathway (on a logarithmic scale) and the percentage weight change. There is distinctive overweight of companies that are significantly under their 1.5°C budget—those at the bottom right of the chart—and underweight of those above their 1.5°C budget. The curve is more pronounced for the S&P CT Indices, and the largest S&P PA Index overweights are more distinct. This is likely due to the S&P PA Indices having a higher number of ambitious constraints, while the transition pathway constraint is consistent across all S&P PACT Indices. Therefore, the transition pathway constraint has less competition from other constraints within the S&P CT Indices compared with the S&P PA Indices.
There is distinctive overweight of companies that are significantly under their 1.5°C budget.

The transition pathway constraint has less competition from other constraints within the S&P CT Indices compared with the S&P PA Indices.

The non-linearity of weight distribution from the optimizer illustrates the efficiency gains of optimization over a less sophisticated approach.

We observe a line of company’s weight increases at 10%—capped due to a lack of carbon disclosure. These caps are less prominent in the S&P PA Indices, where an environmental score improvement constraint, which has a moderate-to-high correlation to carbon disclosure, is present.

The non-linearity of weight distribution from the optimizer illustrates the efficiency gains of optimization over a less-sophisticated approach. This does, however, mean using linear regression to attribute weight changes to climate factors is imprecise.

Similar to carbon intensity, the transition pathway is an absolute constraint. Consequently, the impact the transition pathway has on the index may change over time depending on the number and extent of companies that transition (or lack thereof).
Environmental score shows a significant impact on the percentage weight change of S&P PA Index constituents, while being insignificant in explaining the weight change of S&P CT Index constituents. This effect is owing to the 10% environmental score improvement constraint within the S&P PA Indices, while the S&P CT Indices aim to be no worse.

Exhibit 13 demonstrates the difference in environmental score impact on company weights between the S&P CT and PA Indices. Constituents with higher scores, on average, observe higher increases in weight than their lower-scoring counterparts.

Exhibit 13: Environmental Score Effect on S&P PACT Index Weight Change


We observe that companies whose weight is capped at a 10% increase tend to have lower environmental scores, further evidencing the positive relationship between environmental scores and carbon disclosure.
Physical Risk Effect

Physical risk shows a significant, meaningful impact on constituent reweighting across most S&P PACT Indices.

Exhibit 14 presents the dynamic physical risk cap, observed as the curve topping each chart. This cap is in place to reduce acute physical risks—event-driven risks that may represent significant tail risk to companies. To reduce potential risk, the S&P PACT Indices cap constituent weights based on their physical risk score. A company with high exposure and high sensitivity to any one underlying physical risk will have an aggregated physical risk score of 40. Scores that are higher than this figure indicate higher potential physical risk.

Consequently, the S&P PACT Indices are designed so a company with a physical risk of 40 sees its weight capped at its benchmark index weight. This curve rises sharply as the physical risk increases, capping those with higher risk more severely. The physical risk cap appears to have a larger impact than the weighted average reduction.

Exhibit 14: Physical Risk Cap Effect on S&P PACT Index Weight Change

The high climate impact constraint exemplifies the interaction effect between exclusions and climate factors. Exhibit 15 shows, within each index, the mean high climate impact revenue of excluded constituents is higher than their eligible peers.

To avoid greenwashing, the indices are constrained to ensure, at rebalance, they have no fewer high climate impact revenues than the benchmark. The exclusion of companies with more high climate impact revenues means constituents with high climate impact revenues will need to be overweighted more heavily, on average, relative to those with few or no high climate impact revenues. This is particularly true for the S&P PA Indices, where the exclusion based on fossil fuels intensifies the need to overweight companies with high climate impact revenues.

Exhibit 15: Mean High Climate Impact Revenue Percentage of Excluded Constituents

To avoid greenwashing, the indices are constrained to ensure, at rebalance, they have no fewer high climate impact revenues than the benchmark.

The exclusion of companies with more high climate impact revenues means constituents with high climate impact revenues will need to be overweighted more heavily.

In Exhibit 16 we can grasp the extent of overweighting potential for those constituents that have most revenues from high climate impact revenue streams. Those with substantially more than 100% overweight all have high impact revenue streams, with some of these being overweighted by almost 700%, relative to the benchmark index.

When this is considered, it is unsurprising to see high climate impact revenues significantly and meaningfully affect S&P PACT Index constituent weight change.

High Climate Impact Revenues Effect

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It is unsurprising to see high climate impact revenues significantly and meaningfully affect S&P PACT Index constituent weight change.

Weight that is excluded needs to be redistributed among eligible stocks, and due to the objective function, larger companies have more potential for weight change.

Companies can only have a 100% underweight, as this is a long-only strategy, but there are stocks overweighted by over 600%. This may further add to the impact of benchmark index weight on S&P PACT Indices weights, due to the objective function.

**Benchmark Index Weight Effect**

Weight that is excluded needs to be redistributed among eligible stocks, and due to the objective function, larger companies have more potential for weight change. On average, companies must receive an overweight so the index weights sum to one, and companies with higher weight in the benchmark index have greater potential for overweight; therefore we would expect larger companies, on average, to receive a higher weight increase. This allows the index to minimize any size bias and more closely reflect the characteristics of a market-cap-weighted index.

Also, there is an asymmetry of relative weighting—companies can only have a 100% relative underweight, as this is a long-only strategy, but there are stocks overweighted by over 600%. This may further add to the impact of benchmark index weight on S&P PACT Indices weights, due to the objective function.

**HOW CAN COMPANIES IMPROVE THEIR S&P PACT INDEX WEIGHT?**

For companies to understand how they can gain more weight within S&P PACT Indices, they need to understand the two simple principles laid out in Exhibit 1:

1. Exclusion: Is a stock eligible for the index?
2. Reweighting: How does a stock perform from a climate perspective?
If companies want to improve their weight in the indices, they must perform well on climate metrics driving the S&P PACT Index methodology.

The transition pathway, environmental score, physical risk, and high climate impact have the greatest effect on constituent weight changes.

Simply put, if companies want to improve their weight in the indices, they can’t be excluded and must perform well on climate metrics driving the S&P PACT Index methodology. The transition pathway, environmental score, physical risk, and high climate impact have the greatest effect on constituent weight changes, as can be seen in Exhibit 17. Exhibit 17 visualizes the impact on percentage weight change for climate or index design factor c. This is calculated for each climate or index design factor as the absolute coefficient (where insignificant coefficients are given a coefficient of zero), divided by the sum of all climate and index construction factor coefficients for that index, multiplied by 100 (see Equation 7).

**Equation 7: Impact on Percentage Weight Change**

\[
\text{Impact on Percentage Weight Change}_c = \frac{|\text{Significant Coefficients}_c|}{\sum |\text{Significant Coefficients}|} \times 100
\]

Exhibit 17: Climate Factor and Benchmark Weight Impact on S&P PACT Index Percentage Weight Change


The three factors to focus on are the transition pathway, environmental score, and physical risk. Companies’ high climate impact revenues are due to their business activities rather than climate factor performance.

Transition pathway is driven by the carbon intensity trend of companies. Companies within the cement, power generation, steel, air transportation, or aluminum sectors, as defined by the Sectoral Decarbonization Approach (SDA), have unique decarbonization pathways.\(^\text{18}\) Companies not within these SDA sectors are required to reduce their carbon-to-gross-profit footprint by 7% year-on-year, after adjusting for inflation, in line with the greenhouse gas emissions per unit of value added (GEVA) approach.\(^\text{19}\)


\(^\text{19}\) Greenhouse gas emissions per unit of value added ("GEVA") – A corporate guide to voluntary climate action (2012)
To improve the environmental score, a company should focus on the identification of key environmental risks, articulation of relevant mitigation and opportunity strategies, and disclosure against key risks, mitigation strategies, and opportunities.

Companies’ physical risk can be reduced via the divestment of assets in highly exposed locations or the reduction of sensitivity factors, such as water intensity. This will decrease their sensitivity-adjusted physical risk score.

As with the environmental score improvement, companies may consider disclosing information on their exposure to risks and opportunities related to climate change. Disclosure of plans to manage or capitalize on risks and opportunities, in line with the recommendations of the TCFD, will not necessarily affect their weight in the S&P PACT Indices, but it may enable both the company and its external stakeholders to better understand the risks they face.

If companies are not excluded, there are clear paths to a higher weight in the S&P PACT Indices:

- Significant reduction in carbon intensity year-on-year;
- More disclosure around environmental policies and metrics;
- Improvement in performance against environmental policies and metrics;
- Divestment of assets in locations highly exposed to physical risks; and
- Reduction of assets’ physical risk sensitivity factors.

**CASE STUDIES**

Exhibit 18 highlights stock-level examples of the reweighting attribution model used to explain the S&P PACT Indices, according to different climate factors for eligible companies. The table aims to provide transparency by depicting examples of how an individual stock is reweighted in the S&P PACT Indices relative to its benchmark index, based on its climate factors.

The table employs a color-coding system, in which green shades represent relatively positive climate metric exposure, while orange tones depict weaker values compared with the benchmark index counterparts. For instance, where a strong transition pathway factor (green) is achieved through being below the 1.5°C carbon budget on a forward-looking basis, the opposite is true for the environmental score, in which a higher value (green) denotes a better overall score. Similarly, while a lower physical risk score (green) drives stock overweight, a lower green-to-brown revenue ratio (copper) negatively impacts weighting, especially in the Utilities sector. We go on to provide a comparison of pairs of companies within the same sub-industry to further provide transparency around the effect of climate factors’ to its relative S&P PACT Index weighting.
Exhibit 18: Reweighting of Individual Stocks in the S&P PACT Indices Based on Climate Factors

<table>
<thead>
<tr>
<th>COMPANY</th>
<th>SUB-INDUSTRY</th>
<th>CARBON INTENSITY</th>
<th>CARBON DISCLOSURE</th>
<th>TRANSITION PATHWAY</th>
<th>ENVIRONMENTAL SCORE</th>
<th>PHYSICAL RISK</th>
<th>GREEN-TO-BROWN SHARE</th>
<th>HIGH CLIMATE IMPACT REVENUES</th>
<th>BENCHMARK INDEX WEIGHT</th>
<th>S&amp;P PA INDEX WEIGHT CHANGE</th>
<th>S&amp;P CT INDEX WEIGHT CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albemarle Corp</td>
<td>Specialty Chemicals</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>-100.00</td>
<td>-100.00</td>
</tr>
<tr>
<td>PPG Industries Inc</td>
<td>Specialty Chemicals</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>429.79</td>
<td>308.07</td>
</tr>
<tr>
<td>McDonald’s Corp</td>
<td>Restaurants</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>64.28</td>
<td>39.90</td>
</tr>
<tr>
<td>Starbucks Corp</td>
<td>Restaurants</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>-51.88</td>
<td>-25.00</td>
</tr>
<tr>
<td>Eli Lilly &amp; Co</td>
<td>Pharmaceuticals</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>22.35</td>
<td>14.69</td>
</tr>
<tr>
<td>Pfizer Inc</td>
<td>Pharmaceuticals</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>64.48</td>
<td>38.22</td>
</tr>
<tr>
<td>Exelon Corp</td>
<td>Electric Utilities</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>-9.38</td>
<td>-9.38</td>
</tr>
</tbody>
</table>

Source: S&P Dow Jones Indices LLC, Trucost, part of S&P Global, and SAM, part of S&P Global. Data as of March 31, 2020. Table is provided for illustrative purposes.

In the Specialty Chemicals sub-industry, a significant discrepancy in the percentage weight change within the S&P PACT Indices can be seen between Albemarle Corp and PPG Industries Inc. This can be attributed not only to PPG Industries Inc’s better-aligned 1.5°C budget, translating into a stronger transition pathway factor but also to its higher environmental score; therefore, PPG Industries Inc is overweight in both S&P PACT Indices.

Within the Restaurants sub-industry, McDonald’s Corp is overweight in the S&P PACT Indices more than its industry peer Starbucks Corp. In fact, despite showing a similar transition pathway budget alignment, McDonald’s Corp’s stronger environmental score and lower physical risk score drove its overweight.

In the Pharmaceuticals sub-industry, Eli Lilly & Co and Pfizer Inc experienced overweights in the S&P PACT Indices, with a greater overweight being captured by Pfizer Inc due to a stronger environmental score, lower physical risk score, and an improved transition pathway figure. Pfizer Inc’s higher benchmark weight may also play a role.

Within Electric Utilities, Exelon Corp was underweighted within the S&P PA Indices enough to fall below the 1 basis point threshold, so therefore received a zero weight. Meanwhile, Exelon Corp received a small overweight within the S&P CT Indices. This poorer weight in the S&P PA Indices was caused largely by its poor environmental score and green-to-brown share, which both have more impact on weights within the S&P PA Index methodology, and this drove the weight below 1 basis point. Exelon Corp performed well on the transition pathway, environmental score, and green-to-brown share. However, due to its high physical risk, it was capped below its benchmark weight.
LIMITATIONS OF THIS APPROACH

Optimization is employed, as it allows active weight to be distributed to where they will best meet the objective, subject to constraints. This means weights are not distributed in a linear fashion. While this is beneficial from an efficiency perspective when aiming to meet multiple constraints, it does make the use of linear regression imprecise as a means of interpreting the weight change.

As linear regression is sensitive to outliers, the results from the regression analysis should be taken more as an indication of impact on constituent weights rather than precise truth.

Due to the distributions of data, it would be possible to transform the climate factors to improve the predictive power of the regression analysis. However, this would make interpreting the magnitude of the climate factor impact quite difficult, which is the use case of this method.

CONCLUSION

The weighting methodology of the S&P PACT Indices can be split into two main parts—the effect exclusions play and a reweighting effect. The exclusion effect counts for between 30%-40% of the weight differences for S&P CT Indices, while for the more ambitious S&P PA Indices, exclusions account for 40%-60% of deviations from benchmark weights. This equates to 6%-8% of weight being excluded from the S&P CT Indices and 13%-18% from the S&P PA Indices.

The reweighting effect is driven by climate and index construction factors, which are each affected by the strength of the constraint, distribution of underlying climate datasets, and correlation of different climate factors. Within the reweighting effect, the transition pathway, environmental score, physical risk, and high climate impact revenues a company has are the key drivers of percentage weight changes S&P PACT Index constituents observe. The diversification of high-quality climate factors may add an informational advantage, due to their low correlations.

For companies to gain a higher weight in the S&P PACT Indices, they should first ensure they meet the eligibility criteria. If eligible, companies can significantly reduce carbon intensity year-on-year, disclose more around environmental policies and metrics, improve performance against environmental policies and metrics, divest of assets in locations highly exposed to physical risks, and reduce assets’ physical risk sensitivity factors.
WORKS CITED


APPENDIX

Appendix A: Transition Pathway Calculation

The Transition Pathway Budget Alignment (TPBA) of each company $i$ is calculated as the sum of the difference between the company’s carbon budget and emissions (either realized or predicted), using both historical and future projections. A TPBA of 0 would be compatible with a 1.5°C climate scenario, a budget below 0 would be compatible with better than a 1.5°C climate scenario, and a budget above 0 would not be compatible with a 1.5°C climate scenario. The alignment of the index is calculated as follows.

$$\sum w_i \times Winsorized\ TPBA_i$$

where: $w_i =$ weight of the company $i$ in the index.
## Appendix B: Exclusions

### S&P PACT Index Series Exclusions

<table>
<thead>
<tr>
<th>EXCLUSION</th>
<th>THRESHOLD</th>
<th>DATA SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ESG EXCLUSIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controversial Weapons</td>
<td>Any direct exposure of 25% or greater ownership</td>
<td>Sustainalytics</td>
</tr>
<tr>
<td>Low UN Global Compact Score</td>
<td>Worst 5% globally</td>
<td>Arabesque</td>
</tr>
<tr>
<td>Controversies (SAM MSA)</td>
<td>Daily filtering, screening, and analyzing of controversies related to companies within the index; Index Committee reviews and excludes worst offenders.</td>
<td>S&amp;P Global</td>
</tr>
<tr>
<td>Tobacco</td>
<td>Any direct exposure of 25% or greater ownership</td>
<td>Sustainalytics</td>
</tr>
<tr>
<td><strong>FOSSIL FUEL OPERATIONS AND POWER GENERATION (ONLY APPLIES TO THE S&amp;P PA INDICES)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td>1% or more of revenue derived from coal exploration or processing activities</td>
<td>Trucost</td>
</tr>
<tr>
<td>Oil</td>
<td>10% or more of revenue derived from oil exploration or processing activities</td>
<td>Trucost</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>50% or more of revenue derived from natural gas exploration or processing activities</td>
<td>Trucost</td>
</tr>
<tr>
<td>Highly Intensive Electricity Generation</td>
<td>50% or more of revenue derived from electricity generation with a GHG intensity of lifecycle GHG emissions above 100 gCO2e/kWh</td>
<td>Trucost</td>
</tr>
</tbody>
</table>

Source: S&P Dow Jones Indices LLC, Sustainalytics, Arabesque, S&P Global, and Trucost, part of S&P Global. Table is provided for illustrative purposes.
## Appendix C: Constraints

### S&P PACT Index Constraints Relative to the Underlying Benchmark

<table>
<thead>
<tr>
<th>CONSTRAINT</th>
<th>PAB</th>
<th>CTB</th>
<th>DATA SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TRANSITION RISK-RELATED CONSTRAINTS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weighted Average GHG Emissions per US. Dollar Invested (relative to 1.5°C budget)</td>
<td>≤ 0</td>
<td>≤ 0</td>
<td>Trucost</td>
</tr>
<tr>
<td>GHG Emissions Intensity(^{20})</td>
<td>50% lower</td>
<td>30% lower</td>
<td>Trucost</td>
</tr>
<tr>
<td>Decarbonization Trajectory (adjusted for enterprise value growth)</td>
<td>WACI must stay below the 7% year-on-year trajectory</td>
<td>WACI must stay below the 7% year-on-year trajectory</td>
<td>Trucost</td>
</tr>
<tr>
<td>Exposure to Companies with Science-Based Targets (based on 1.5°C scenario and 7% decarbonization)</td>
<td>Increase collective index weight of all companies with SBTs by 20% overall</td>
<td>Increase collective index weight of all companies with SBTs by 20% overall</td>
<td>Trucost/Science Based Targets Initiative</td>
</tr>
<tr>
<td>Fossil Fuel Reserve Exposure</td>
<td>80% lower</td>
<td>No higher</td>
<td>Trucost</td>
</tr>
<tr>
<td>Environmental Score</td>
<td>20% higher</td>
<td>No lower</td>
<td>S&amp;P DJI ESG Scores</td>
</tr>
<tr>
<td>Revenue from High Climate Impact Sectors(^{21})</td>
<td>Maintain at least same proportion</td>
<td>Maintain at least same proportion</td>
<td>Trucost</td>
</tr>
<tr>
<td>Weight of Non-Disclosing Companies</td>
<td>Capped at x 1.1</td>
<td>Capped at x 1.1</td>
<td>Trucost</td>
</tr>
<tr>
<td><strong>PHYSICAL RISK-RELATED CONSTRAINTS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Risk Exposure</td>
<td>10% lower</td>
<td>No higher</td>
<td>Trucost</td>
</tr>
<tr>
<td>Physical Risk Cap</td>
<td>Dynamic cap based on the level of physical risk of each stock</td>
<td>Dynamic cap based on the level of physical risk of each stock</td>
<td>Trucost</td>
</tr>
<tr>
<td><strong>OPPORTUNITY-RELATED CONSTRAINTS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green-to-Brown Revenue Share from Power Generation</td>
<td>4x higher</td>
<td>No lower</td>
<td>Trucost</td>
</tr>
<tr>
<td><strong>INDEX CONSTRUCTION RULES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constituent Weights</td>
<td>±2%</td>
<td>±2%</td>
<td>-</td>
</tr>
<tr>
<td>Minimum Weight</td>
<td>0.01%</td>
<td>0.01%</td>
<td>-</td>
</tr>
<tr>
<td>Liquidity</td>
<td>Company weight capped based on an investment of EUR 1 billion and the length of time it would take to trade, based on the company’s three-month median daily value traded</td>
<td>Company weight capped based on an investment of EUR 1 billion and the length of time it would take to trade, based on the company’s three-month median daily value traded</td>
<td>-</td>
</tr>
<tr>
<td>Diversification</td>
<td>Individual stock weights capped at 5%</td>
<td>Individual stock weights capped at 5%</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: S&P Dow Jones Indices LLC, Science Based Targets Initiative, and Trucost, part of S&P Global. Table is provided for illustrative purposes.

\(^{20}\) Calculated using weighted average carbon intensity (WACI), which is measured as tCO2e divided by enterprise value including cash (EVIC), based on Trucost emissions data that account for all scopes 1, 2, and 3 emissions from inception.

\(^{21}\) High climate impact sectors are defined by The EU Technical Expert Group on Sustainable Finance (2019).
### Appendix D: Climate and Index Construction Factor

<table>
<thead>
<tr>
<th>CLIMATE/INDEX CONSTRUCTION FACTORS</th>
<th>EXPECTED RELATIONSHIP WITH WEIGHT CHANGE</th>
<th>EXPLANATION OF EXPECTATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Intensity</td>
<td>Negative</td>
<td>The index reduces carbon intensity by 30% (S&amp;P CT Indices) or 50% (S&amp;P PA Indices) at inception, then 7% year-on-year.</td>
</tr>
<tr>
<td>Transition Pathway</td>
<td>Negative</td>
<td>The Transition Pathway Model shows the benchmark indices are over their 1.5°C budget. 79% of the benchmark index weight within the developed universe, 79% within the U.S. universe, 83% within the Europe large-mid-cap universe, and 82% within the eurozone large-mid-cap universe are over their 1.5°C budget. The indices are constrained below their transition pathway budget at rebalance. There must be a reduction in the weighted average transition pathway intensity to fulfill the constraint.</td>
</tr>
<tr>
<td>Fossil Fuel Reserve Intensity</td>
<td>Negative</td>
<td>The S&amp;P CT Indices have a fossil fuel reserve intensity requirement of no higher than the benchmark index, while the S&amp;P PA Indices has an 80% reduction requirement at rebalance. The fossil fuel exclusions may exclude a lot of companies with fossil fuel reserves within the S&amp;P PA Indices. This may mean the constraint has little, if any, work to do.</td>
</tr>
<tr>
<td>Environmental Score</td>
<td>Positive</td>
<td>The S&amp;P PA Indices require an increased weighted average environmental score, whereas the S&amp;P CT Indices require it to be no worse.</td>
</tr>
<tr>
<td>Green-to-Brown Share</td>
<td>Positive</td>
<td>The S&amp;P PA Indices require a four times greater green-to-brown share, while the S&amp;P CT Indices require it to be no worse.</td>
</tr>
<tr>
<td>Physical Risk</td>
<td>Negative</td>
<td>A higher physical risk score represents greater physical risk. Both the S&amp;P PA and CT Indices have the constituent weights dynamically capped, and the S&amp;P PA Indices also have a weighted average physical risk reduction.</td>
</tr>
<tr>
<td>High Impact Revenue</td>
<td>Dependent on Companies Excluded</td>
<td>The S&amp;P PACT Indices are constrained to have no less revenue from high climate impact revenues than the benchmark index. Revenues from high climate impact will likely have higher carbon intensity and fossil fuel reserves, while having a greater transition pathway spread (due to their greater carbon intensity). Therefore, we would expect to see the S&amp;P PACT Indices' high impact revenue at the same level or close to that of the benchmark. The S&amp;P PA Indices exclude more companies with high climate impact revenues than low climate impact revenues, due to the fossil fuel exclusions.</td>
</tr>
<tr>
<td>Carbon Disclosure</td>
<td>Positive</td>
<td>Company weights are capped at 10% more than their benchmark weight, if they do not sufficiently disclose their scopes 1 and 2 of carbon intensity. Therefore, we may see a positive relationship between companies disclosing and their weight, if this cap is used in practice.</td>
</tr>
<tr>
<td>Benchmark Index Weight</td>
<td>Positive</td>
<td>The objective function is minimized, and the denominator is the benchmark index weight. Therefore, the higher the company weight, the more chance there is for a change in company weight. As companies are excluded from the S&amp;P PACT Indices, the remaining weight needs to be redistributed. On average, companies will have a higher weight in the S&amp;P PACT Indices than in the benchmark. The combination of the need to, on average, overweight eligible companies and the potential for larger overweights of companies with a larger weight in the benchmark index means there will likely be a positive relationship between the benchmark index weight and S&amp;P PACT Index weight change. From an index design perspective, this is because larger companies tend to have higher liquidity and capacity. Overweighting large companies to a greater extent than smaller companies is beneficial. S&amp;P DJI’s Index Investment Strategy research22 alludes to a correlation between capacity and size. Exhibit 6 shows a 0.77 correlation between liquidity and benchmark index weight.</td>
</tr>
<tr>
<td>Liquidity</td>
<td>Positive</td>
<td>There is a dynamic liquidity cap based on three-month median value traded of the company. Therefore, more liquid companies will have a greater chance for overweight.</td>
</tr>
</tbody>
</table>

Source: S&P Dow Jones Indices LLC. Table is provided for illustrative purposes.

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22 The Value of Research: Skill, Capacity, and Opportunity (Ganti, Preston, Edwards, & Lazzara, 2018)
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