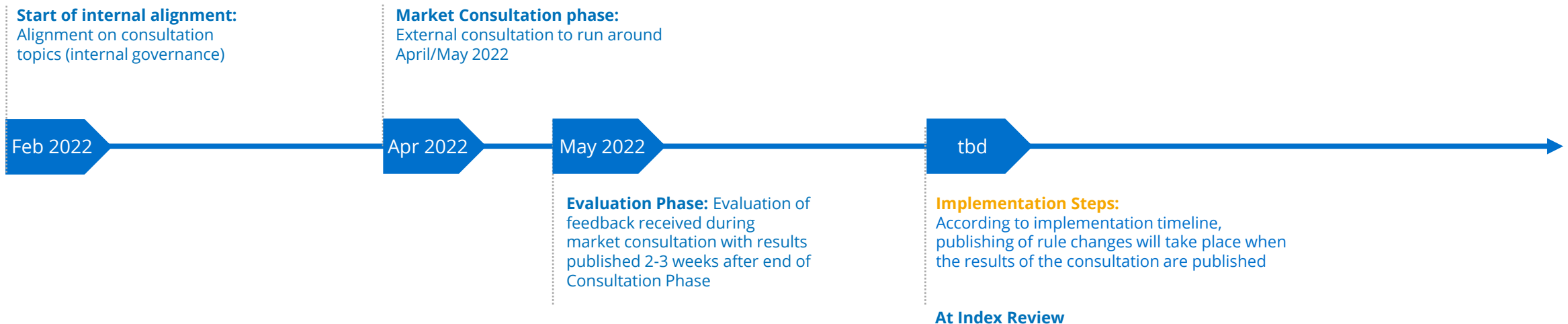
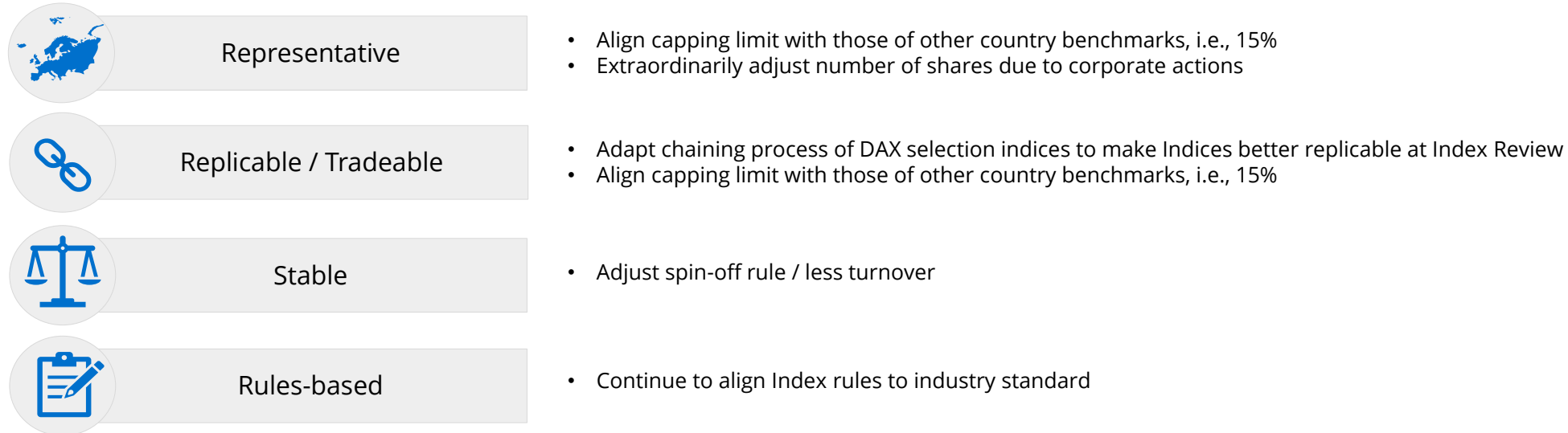


DAX Market Consultation Supporting Analysis

Zug, April – May 2022

DAX Consultation April – May 2022: Goals & Timeline

Goal: Assure correct implementation of DAX' key objectives



DAX Consultation April – May 2022: Scope

> **Adjustments – Corporate Action**

- Extraordinary adjustment of weight factors (Q_{it}) if delta is sufficiently high and change is related to a Corporate Action, e.g. rights issues
- Adjust the methodology behind dividend reinvestment to have the dividend reinvested into the entire index
- Adjustment of Spin-Off rule with respect to the selection of the remaining constituent

> **Weighting & Capping**

- Preponement of the fixing of the component weightings for review implementation at review from t to $t-5$, change name of business forecast to Index Review file
- Adjustment of the Cap Limit: Increasing the capping from 10% to 15%

Impact analysis for DAX Index: Proposed Corporate Actions treatment vs current solution

April 11, 2022

Impact of different Corporate Action treatments (Distributions Reinvestment & Adjustment of no. of shares) becomes more visible in late 2020, minor impact from 2015 to Sep 2020

Risk and Return [Sep 18, 2015 – Mar 14, 2022]		
	DAX Current	DAX new CA
YTD return	-13.0%	-13.1%
1y return (actual)	-3.8%	-2.7%
3y return (actual)	16.1%	18.3%
5y return (actual)	17.5%	19.6%
Overall return (annual.)	5.4%	5.8%
1y volatility (annualized)	19.3%	19.3%
3y volatility (annualized)	24.2%	23.5%
5y volatility (annualized)	20.7%	20.2%
Overall volatility (annualized)	20.5%	20.2%
Maximum drawdown	-12.4%	-12.4%
Overall Sharpe ratio	0.26	0.29
Overall Tracking Error		0.24%

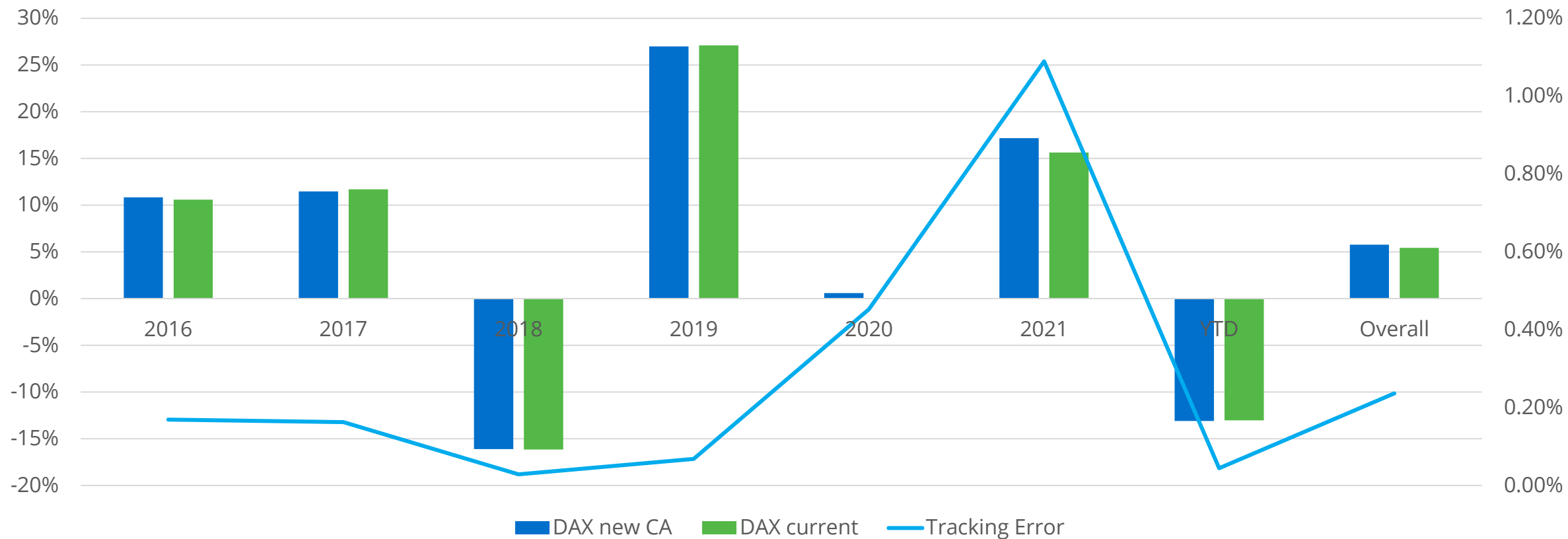


> **Model description:** Back-test [Sep 18, 2015 – Mar 14, 2022] assumes that the following rules were initially implemented in September 2015 instead of 2018 and 2021 for the sake of comparability:

- > Extension of MDAX from 50 to 60 and SDAX from 60 to 70 components
- > Removal of separation between “tech” and “classic” for MDAX and SDAX
- > Extension of universe from prime standard to Regulated market of FWB (Frankfurt Stock Exchange)
- > Addition of profitability criterion for DAX inclusion
- > Extension of DAX from 30 to 40, reduction of MDAX from 60 to 50
- > Removal of selection by rank turnover
- > “DAX current” to represent the DAX applying methodology as outlined in DAX Equity Index Guide w.r.t. corporate actions adjustments
- > “DAX new CA” represents DAX with identical composition as DAX Current, but calculated using a different corporate actions treatment, similar to the STOXX calculation methodology

Comparison of treatment of Corporate Action Treatments: DAX current vs. DAX new shows marginal differences over the past 7 years; low overall Tracking Error, only in 2020 and 2021 TE picks up

Annual Performance: DAX current vs. DAX new CA



Statistics for impact of different component cap limits applied to DAX, MDAX, SDAX

April 11, 2022

Introductory note to the performance comparison provided for different cap limits per Index

- > Over the past years, DAX Indices have seen some significant rule changes:
 - > In 2018, the separation between TECH and CLASSIC was removed for MDAX and SDAX inclusion and DAX companies from TECH Sector were allowed to enter TecDAX. As a result, the composition and number of constituents of MDAX and SDAX was impacted.
 - > In 2020/2021 the universe underlying the selection of components to DAX, MDAX, SDAX and TecDAX was changed and extended from Prime Standard only to regulated market of FWB (Frankfurt Stock Exchange), also basic criteria defining companies eligibility became stricter and also the number of constituents in DAX was increased from 30 to 40, consequently in MDAX the number was cut from 60 to 50. On top, selection rules are now based on Market Cap only.
- > In the back-test calculation all of these changes were applied with the start date of the back-test period in 09/2015. This helps to extract the impact from the proposed changes and separate it from the impact of former rule changes in the back-test. For comparison reason a back-test is provided for each Index based on current ruleset and for each Index based on the proposed ruleset.
- > In contrast to analysing the original index levels and compositions, this has some concrete impact, especially for DAX and MDAX:
 - > Component Capping was less often applied in back-tested DAX 40 with 10% cap-limit compared to original DAX 30/40
 - > No capping was applied to MDAX throughout the back-tested period neither with a 10% cap nor with a 15% cap. This is because MDAX was calculated with 50 constituents throughout the back-test following the 40 constituents in DAX. Hence, the one company that was originally dominating MDAX over several years is a component of DAX throughout the back-tested period. This allows to draw a conclusion of the impact on MDAX performance overtime under the current rule set.

Impact on DAX performance of increasing the component cap limit from 10% to 15%

Risk and Return¹⁾

	DAX with 10% Cap	DAX with 15% Cap
YTD return	-13.03%	-13.03%
1y return (actual)	-3.82%	-3.82%
3y return (actual)	16.07%	16.07%
5y return (actual)	17.52%	17.52%
Overall return (annual.)	5.42%	5.42%
1y volatility (annualized)	19.30%	19.29%
3y volatility (annualized)	24.20%	24.19%
5y volatility (annualized)	20.68%	20.67%
Overall volatility (annualized)	20.55%	20.54%
Maximum drawdown ²⁾	-12.41%	-12.40%
Overall Sharpe ratio ²⁾	0.26	0.26
Tracking Error		0.06%

> **Model description:** Back-test assumes that the following rules were initially implemented in September 2015 instead of 2018 and 2021 for the sake of comparability:

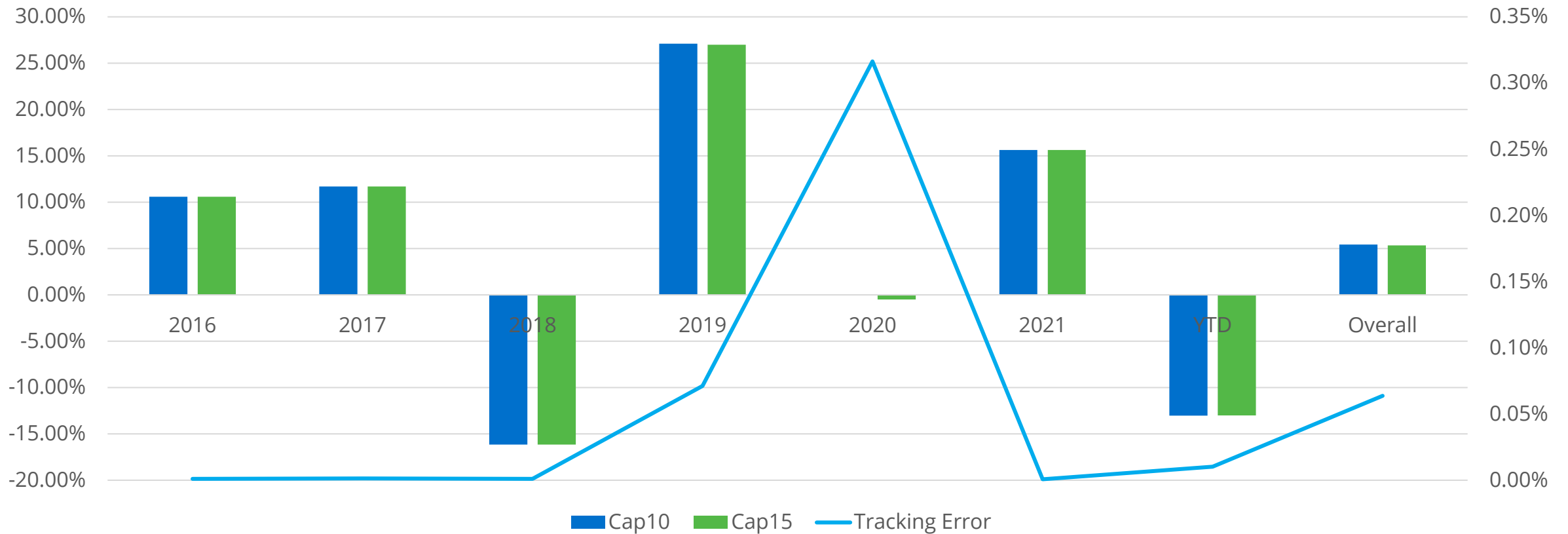
- > Extension of MDAX from 50 to 60 and SDAX from 60 to 70 components
- > Removal of separation between "tech" and "classic" for MDAX and SDAX
- > Extension of universe from prime standard to Regulated market of FWB (Frankfurt Stock Exchange)
- > Addition of profitability criterion for DAX inclusion
- > Extension of DAX from 30 to 40, reduction of MDAX from 60 to 50
- > Removal of selection by rank turnover

Index Performance¹⁾



Increase of Cap limit from 10% to 15% has zero impact on index performance until 2018. Tracking Error increases in 2019 and 2020, almost no TE ytd.

Annual Performance: DAX 10% vs. DAX 15%



1) Backtest calculated from Sep 18, 2015 – Mar 14, 2022

Component Capping applied in back-test of DAX with 40 constituents and a 10% cap-limit against component capping applied in original DAX (10%) over the same period

Review Date	DAX Original 30/40	DAX 40 Back-tested 10%
21/09/2015	Company A	Company A
21/12/2015	Company A	
19/09/2016	Company D	
19/12/2016	Company D	
20/03/2017	Company D	
18/06/2018	Company C	
24/09/2018	Company C	
27/12/2018	Company C	
18/03/2019	Company C	
24/06/2019	Company C	Company C
23/09/2019	Company C	Company C
23/12/2019	Company C	Company C
23/03/2020	Company B	
23/03/2020	Company C	Company C
22/06/2020	Company B	
22/06/2020	Company C	Company C
21/09/2020	Company B	
21/09/2020	Company C	Company C
21/12/2020	Company B	
21/12/2020	Company C	
22/03/2021	Company B	
21/06/2021	Company B	
21/06/2021	Company C	
20/12/2021	Company B	Company B

- ✓ Number of constituents in DAX has been extended from 30 to 40 in September 2021
- ✓ With the help of the back-tested DAX 40 with 10% that has 40 constituents over the full back-tested period it can be shown, that the extension of number of constituents in DAX from 30 to 40 helps to mitigate the impact of components capping on component weights over time
- ✓ No component ever exceeded maximum cap limit proposed (15%) which was also back-tested. Hence no entries are shown in the table for back-tested DAX 40 with 15% cap
- ✓ But still, even with 40 constituents, concentration in DAX become more significant and domination of index performance from large companies will increase with increasing cap limit from 10% to 15%
- ✓ Due to the fact, that no component reached the 15% cap limit, raising cap limit to 15% can be seen equivalent to removing the cap limit in DAX

No Impact on MDAX performance when increasing the component cap from 10% to 15%

Risk and Return¹⁾

	MDAX with 10% Cap	MDAX with 15% Cap
YTD return	-13.1%	-13.1%
1y return (actual)	-6.5%	-6.5%
3y return (actual)	27.9%	27.9%
5y return (actual)	32.9%	32.9%
Overall return (annual.)	6.7%	6.7%
1y volatility (annualized)	17.2%	17.2%
3y volatility (annualized)	20.0%	20.0%
5y volatility (annualized)	17.6%	17.6%
Overall volatility (annual.)	18.2%	17.7%
Maximum drawdown ²⁾	-10.1%	-10.1%

> **Model Description:** The back test assumes that the following rules were initially implemented in September 2015 instead of 2018 and 2021 for the sake of comparability:

- > Extension of MDAX from 50 to 60 and SDAX from 60 to 70 components
- > Removal of separation between "tech" and "classic" for MDAX and SDAX
- > Extension of universe from prime standard to Regulated market of FWB (Frankfurt Stock Exchange)
- > Addition of profitability criterion for DAX inclusion
- > Extension of DAX from 30 to 40, reduction of MDAX from 60 to 50
- > Removal of selection by rank turnover

Index Performance¹⁾



No Impact on SDAX performance when increasing the component cap from 10% to 15%

Risk and Return¹⁾

	SDAX with 10% Cap	SDAX with 15% Cap
YTD return	-16.4%	-16.4%
1y return (actual)	-4.9%	-4.9%
3y return (actual)	34.2%	34.2%
5y return (actual)	49.7%	49.7%
Overall return (annual.)	10.3%	10.3%
1y volatility (annualized)	21.1%	21.1%
3y volatility (annualized)	22.6%	22.6%
5y volatility (annualized)	19.7%	19.7%
Overall volatility (annual.)	18.9%	18.9%
Maximum drawdown ²⁾	-11.6%	-11.6%

> **Model Description:** The back test assumes that the following rules were initially implemented in September 2015 instead of 2018 and 2021 for the sake of comparability:

- > Extension of MDAX from 50 to 60 and SDAX from 60 to 70 components
- > Removal of separation between "tech" and "classic" for MDAX and SDAX
- > Extension of universe from prime standard to Regulated market of FWB (Frankfurt Stock Exchange)
- > Addition of profitability criterion for DAX inclusion
- > Extension of DAX from 30 to 40, reduction of MDAX from 60 to 50
- > Removal of selection by rank turnover

Index Performance¹⁾



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