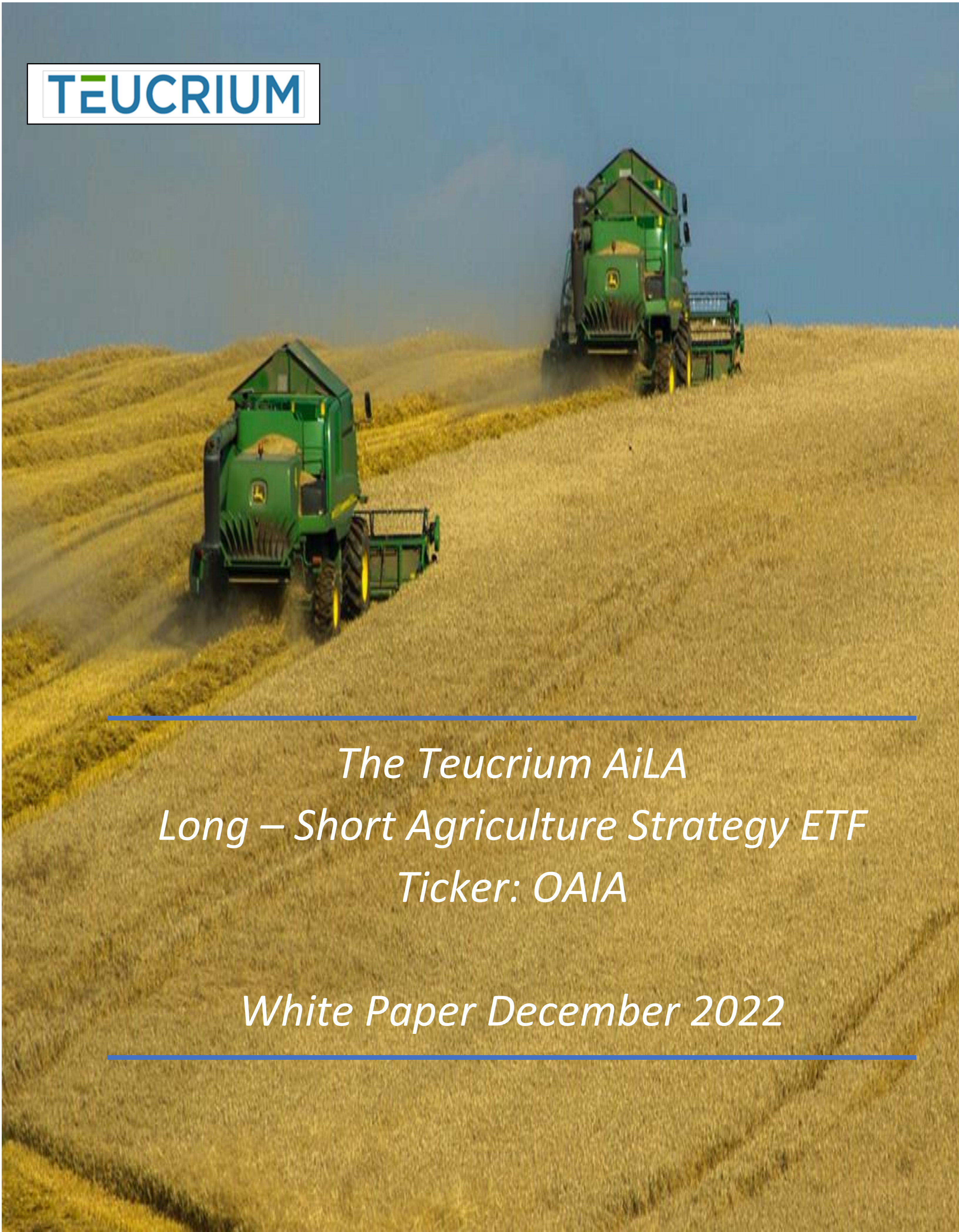

TEUCRIUM

The Teucrium AiLA
Long – Short Agriculture Strategy ETF
Ticker: OAIA

White Paper December 2022

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OAIA

Teucrium AiLA Long-Short Agriculture Strategy ETF

Read the prospectus carefully before investing.

A copy of the prospectus may obtained at: www.teucrium.com

Futures Risks: Commodities and futures generally are volatile and are not suitable for all investors.

Foreside Fund Services, LLC is the distributor for the Teucrium Funds.

INTRODUCTION

Derivative trading is deeply rooted in agriculture. The world's first recorded "derivative" trades occurring in the 5th century BC were based upon the Grecian olive harvest. As the story goes, a certain philosopher by the name of Thales of Miletus, having a knack for astronomy, determined that the upcoming olive season would be plentiful. Given that it was winter, and the harvest was still many months away, Thales was able to procure multiple olive presses for a small amount of money. When a bountiful harvest materialized Thales realized "large sums of money" by lending the olive presses at favorable terms.

As a derivative of the olive market, the olive *press* market provided Thales the means to materially express his worldview. He profited from his knowledge of the relationship between astronomy and agronomy. Additionally, he contributed liquidity to the olive press market.

Fundamentally, not much has changed in past 2,500 years. Derivative traders to this day are major liquidity providers in agricultural markets. Still, most modern-day traders/investors are likely far more *at home* speculating in stock and bond markets. These days it's rare for an investor to "cut their teeth," trading agricultural derivatives.

Yet, perhaps now more than ever, investors (professional and novice alike) are recognizing the role that agriculture can play in an investment portfolio. After all, advances in market structure and technology have leveled the playing field. Whereas not long-ago, *alternative markets,* such as the agricultural futures market, were all but reserved for institutional and/or accredited investors, today every investor with a brokerage account can obtain agricultural futures price exposure through ETFs (exchange traded funds). What's more, not only do ETF investors have access to *alternative markets,* but they also have access to *sophisticated* alternative market strategies.

Few among us are as gifted as Thales who conceived a profitable investment strategy by studying the night sky. Yet there are those among us who possess the fundamental, technological, and mathematical acumen required to intelligently design well-grounded investment strategies, strategies that incorporate the ability to take both *long* and *short* positions across multiple markets. in fact, quantitative strategies can harness the power of machine learning to uncover statistically significant inter-commodity relationships and predictive price patterns.

The 21st century investor is truly "standing on the shoulders of giants," as Sir Isaac Newton put it; possessing the potential to profit in markets and strategies previously available only to an elite few.

You are *one of those investors.* The agricultural futures market is *one of those markets.* The Teucrium AiLA Agricultural Long-Short ETF is *one of those strategies.*

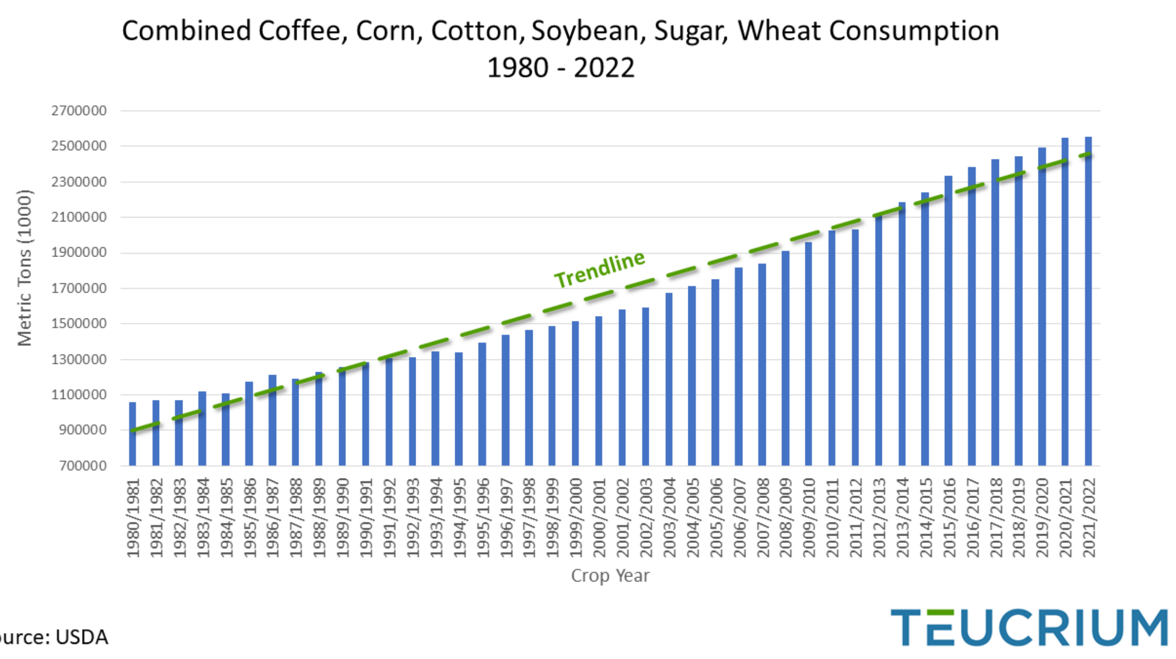
OPPORTUNITIES IN AGRICULTURE

Agricultural Commodities are Pervasive

Agricultural commodities are pervasive across the global economy. In fact, grain commodities (i.e. corn, wheat, and soybeans) are used in many of the products we consume each and every day. For example, corn is primarily used to feed livestock, but it is also used to create ethanol which is blended with gasoline. Wheat is mostly grown for human consumption, but it is also used as an ingredient in particle boards. Even soybeans, which are typically crushed to feed animals and produce cooking oil, are increasingly cultivated for use as a biofuel. Additionally, commodities such as cotton, coffee, sugar and even cocoa are so interwoven in our daily lives that it is hard to imagine life without them.

Therefore, it is no surprise that demand for agricultural commodities is largely inelastic. In other words, higher prices historically have not had significant impact on demand. In fact, combined demand for coffee, corn, cotton, soybeans, sugar, and wheat, has more than doubled since 1980.

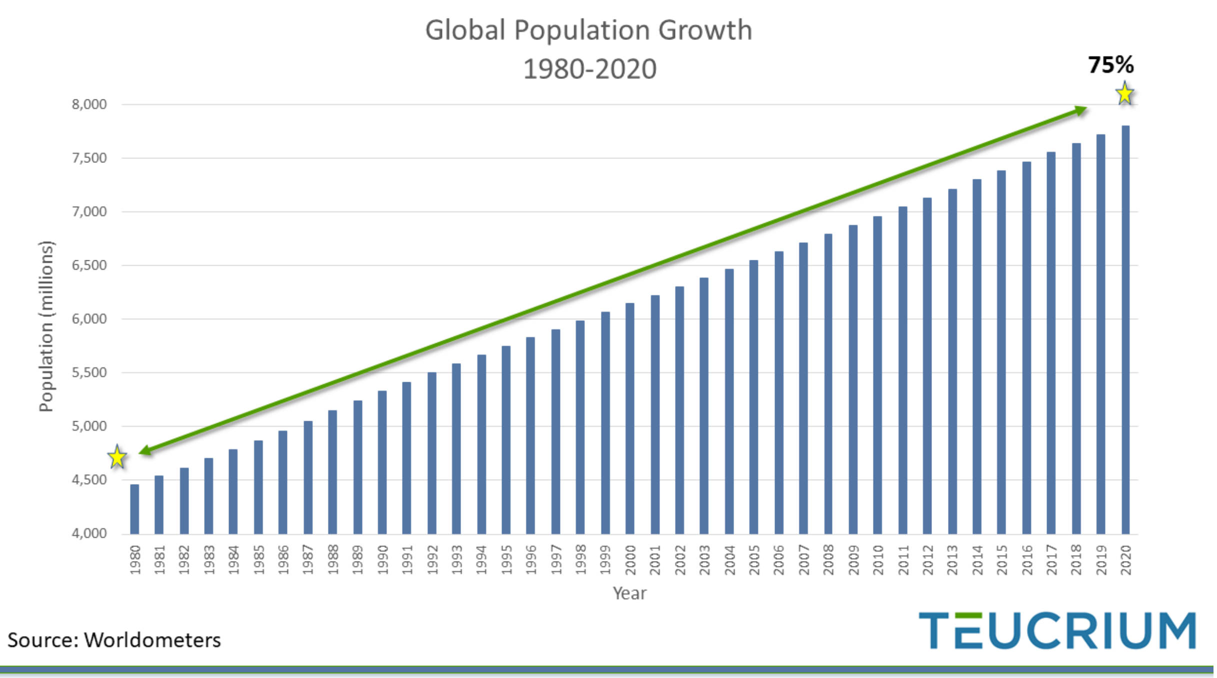
Chart #1



Population Growth & Grain Demand

Over 3.3 billion people were added to the planet between 1980 and 2020. If you lived through the Carter administration, then you have witnessed a **<u>75% growth in the global population over the past 40 years.</u>** (Chart #2)

Chart #2



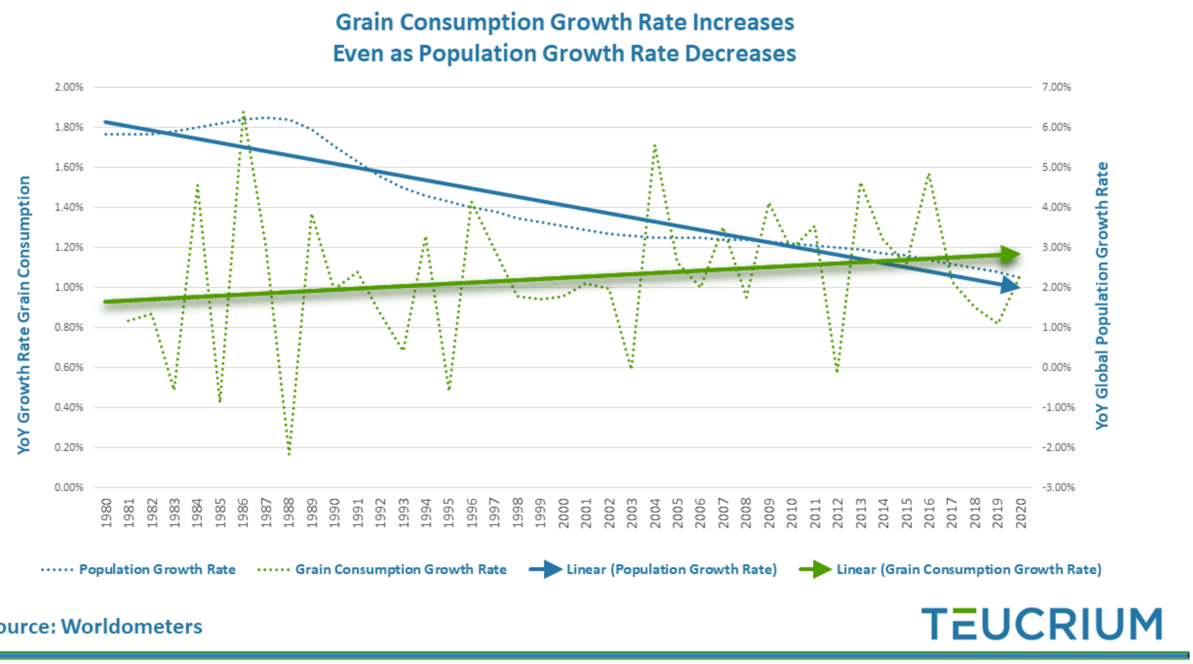
More people equates to more demand for just about everything. An increasing population absolutely means more demand for agricultural commodities, most notably food.

When discussing food-based commodities we will primarily focus on corn, wheat, and soybeans (henceforth referred to simply as *grains*).

It is important to note that even as the world population grew by 75% between 1980 and 2020, the population growth rate is slowing[1]. More importantly, the annual growth rate of grain consumption continues to trend higher. (Chart #3)

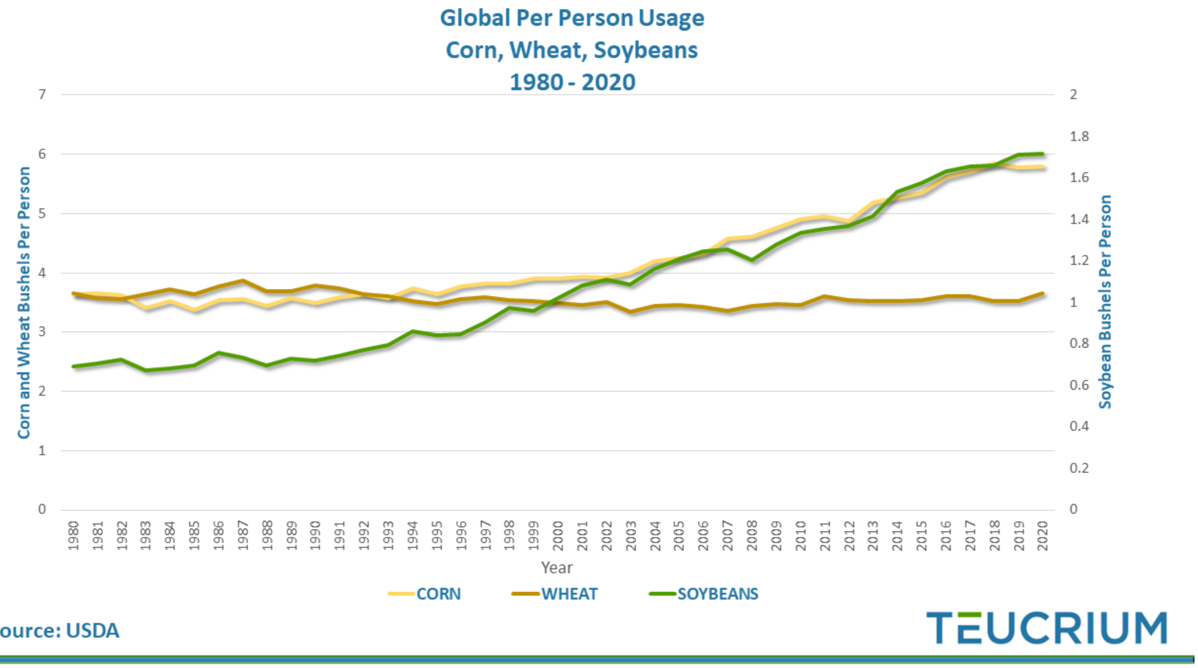
[1] The annual global population growth rate has slowed to 1.05% in 2020 versus 1.77% in 1980.

Chart #3



Even as the rate of population growth slows, there are still more people consuming more grain. In fact, per-person grain consumption jumped 40% in the 40-year period between 1980 and 2020. (Chart #4)

Chart #4



As you can see on chart #4 above, the increased consumption is showing up in the corn and soybean markets, whereas wheat consumption has held relatively steady for the past 40 years. The increased corn and soybean consumption makes sense when you consider the *other* primary factor driving demand: the expanding global middle class.

The Global Middle Class

In 2018 humanity crossed an exciting milestone. For the first time in history, the majority of people on the planet were considered middle-class.[2] This is perhaps the most under-reported good-news story of our time. There is no global standard by which to measure the middle class, however, Homi Kharas, Senior Fellow at the Brookings Institute, offers a compelling approach.

Mr. Kharas measures the middle class based on households whose spending is between $11 and $110 per capita per day.[3] People in this group have discretionary assets, i.e. the economic freedom to <u>choose</u> how to spend their money.[4]

As people move from sustenance living to join the middle class, a common <u>choice</u> is to incorporate more animal protein into their diets. As demand for animal protein rises so too does demand for grain to feed livestock.

Recall from chart #4 above that per-person wheat consumption has remained steady over the past 40 years, yet per-person corn and soybean consumption has grown rather significantly. Corn and soybeans are both primarily used as animal feed whereas wheat is primarily consumed by humans. Therefore, it's no surprise that as meat demand increases, so too does the demand for corn and soybeans.

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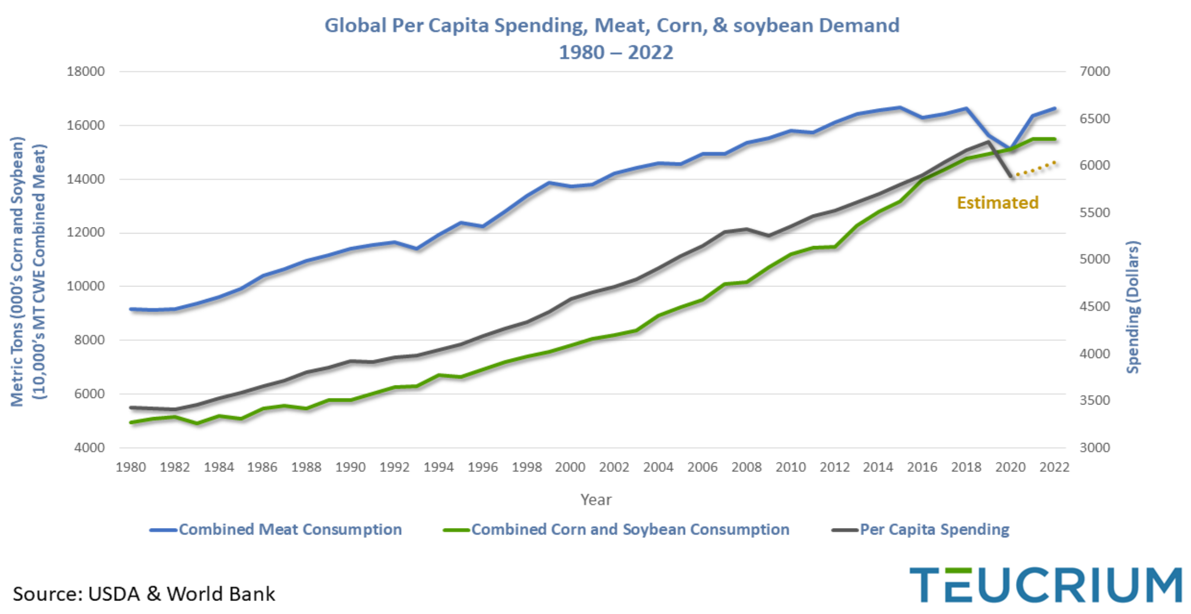
[2] https://www.brookings.edu/blog/future-development/2018/09/27/a-global-tipping-point-half-the-world-is-now-middle-class-or-wealthier/
[3] In 2011 dollars. Source: https://www.brookings.edu/wp-content/uploads/2021/09/DollarAndSense_Transcript_Kharas_GlobalMiddleClass.pdf
[4] Note that Mr. Kharas uses spending rather than income when measuring the middle class. This is important because a person with little or no income may be wealthy and could spend from savings. Additionally, someone with limited income may be receiving financial support from family members which allows them to live a lifestyle consistent with a middle-class experience.

Chart #5 below shows global per capita spending, combined meat consumption (beef, veal, swine), as well as combined corn and soybean usage. Note that the per capita spending data is through 2020. The COVID-19 pandemic took a bite out of consumer spending and global meat consumption. Still, the global average per capita spending was more than $16[5] per day in 2020 above the middle-class minimum of $11 per day.

What's more, meat demand has since rebounded. Current estimates for 2023 place combined meat consumption back above 160 million metric tons.

Chart #5



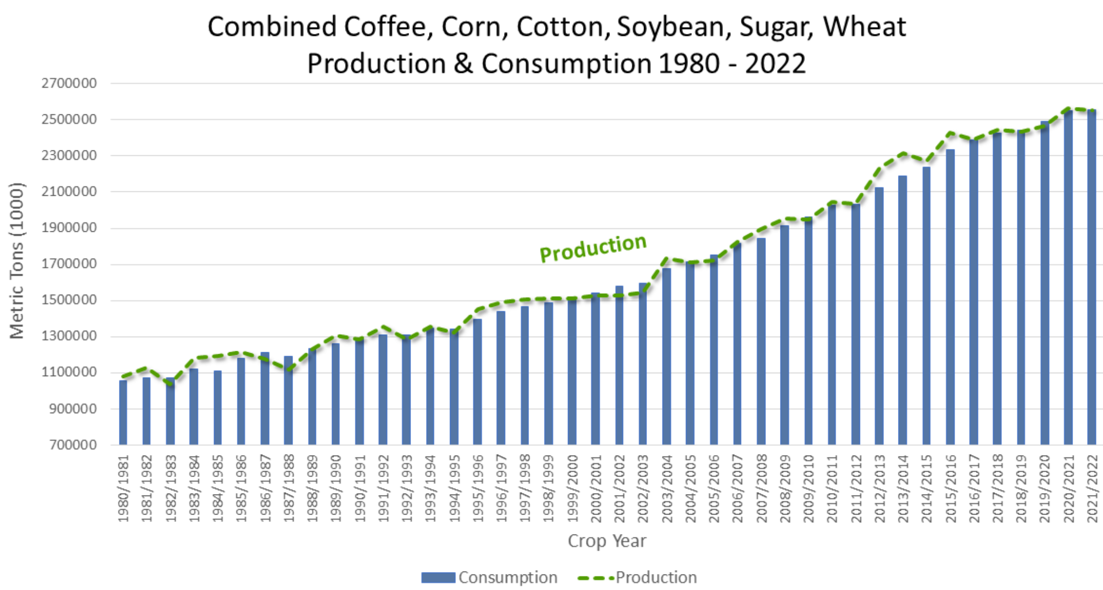
With history as a guide, it is reasonable to expect that as the global middle class grows so too will demand for animal protein. As meat demand increases so too does grain demand.

Meeting Demand

The world's population is increasing, and the global middle class is expanding. This is fundamentally supportive for continued growth in agricultural demand. Yet, while increasing demand is all but a foregone conclusion, production, and therefore supply, remains highly variable. As you can see on Chart #6 below, production does not always keep pace with demand.

[5] Measured in 2015 Dollars. https://data.worldbank.org/indicator/NE.CON.PRVT.PC.KD?end=2021&start=1960&view=chart

Chart #6



Source: USDA

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Production is highly variable relative to consumption (note the green dotted line and the blue columns respectively). In years where production exceeds consumption the market is left with a surplus known as ending stocks.[6] Those ending stocks are then drawn upon in years when the world consumes more than is produced.

Price Volatility

Agricultural commodity prices are primarily driven by underlying supply and demand conditions. Typically, prices will trend higher in markets where supply is inadequate relative to demand. The opposite is true of course, and prices trend lower in markets that are adequately supplied and/or are facing a surplus.

In either scenario agricultural futures markets have a reputation of being volatile and considerably risky (especially when compared to tradition stock and bond markets). The volatility stems from the daily engagement between buyers and sellers trading at various prices throughout the day on the endless voyage of price discovery. Volatility presents both a challenge and an opportunity.

As an investor, the challenge is to be *more right* than *wrong*. Volatility swings both ways and prices can quickly change direction. This volatility also provides opportunity. Investors have an opportunity to potentially profit can profit from being on the right side of the market.

Since 2010 Teucrium has provided ETF investors with long only futures price exposure to agricultural markets. For example, an investor believing that corn prices are heading higher may choose to invest in the Teucrium Corn Fund (ticker: CORN) in order to potentially capture the move higher. An investor in CORN is on the right side of the market so

[6] Ending Stocks (also known as carry-out): The amount of a crop that will be available at the end of the crop year given the estimated or actual beginning stocks, production, and usage.

long as corn futures prices are rising. If, however, prices turn lower, the investor must sell his position or risk losing money.

Furthermore, an investor who does not currently own CORN, but believes that corn futures prices are heading lower, would not have a way to express that view outside of trading options, or selling CORN shares short if so, permitted by his broker.

Finally, an investor seeking to diversify their long-only commodity holdings by strategically allocating to agriculture may also desire a long-short strategy; especially given the volatile nature of the agricultural markets.

A NEW OFFERING

The Teucrium AiLA Long-Short Agriculture Strategy ETF

Ticker: OAIA

For investors seeking a strategy with the potential to profit regardless of market direction, while providing exposure to agriculture Teucrium offers the Teucrium AiLA Long-Short Agriculture Strategy ETF. The fund seeks to track the total return performance (before fees and expenses) of the AiLA-S033 Index. OAIA provides investors with access to a quantitative strategy informed by proprietary machine-learning technology. The strategy trades nine agricultural commodity markets:

Arabica Coffee	NY Cocoa	Soybean Oil
Corn	Soybean	Sugar #11
Cotton	Soybean Meal	Wheat

This type of strategy has historically only been made available to qualified investors at the institutional level. Even today, long-short futures-based strategies are most commonly accessible through private placements and hedge funds. Given our position as a leader in the futures based exchanged-traded-product market, we recognize the opportunity to deliver sophisticated strategies via a low cost, liquid offering.

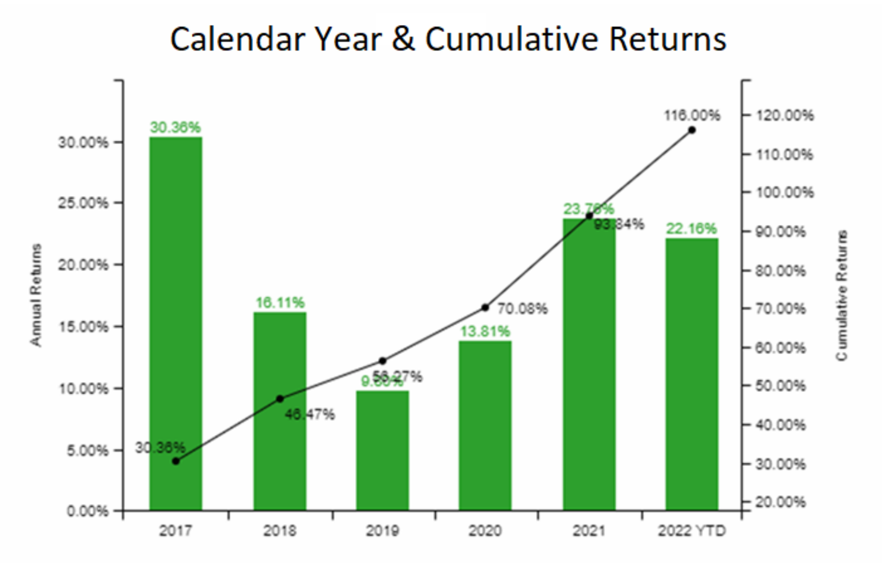
Fund Facts

The Teucrium AiLA Long-Short Agriculture Strategy ETF is registered under the Investment Company Act of 1940. This means that investors can expect to receive the common 1099 tax form. The fund is listed on the New York Stock Exchange under the ticker symbol: OAIA. The fund carries an expense ratio of 1.49% per the prospectus dated 12/16/2022.

As mentioned, the fund seeks to track the total return performance (before fees and expenses) of the AiLA-S033 Index. Actual fund performance will likely vary versus the index as it is not possible to invest directly in the index. The AiLA-S033 Index has a published performance history dating back to January of 2017.

Monthly Index Returns

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2017	1.37%	1.57%	2.89%	0.33%	-0.04%	9.97%	5.91%	3.12%	1.84%	1.69%	-0.57%	2.29%
2018	1.89%	0.93%	0.71%	2.77%	0.22%	6.54%	0.07%	-0.32%	2.14%	-0.02%	1.91%	-0.72%
2019	1.51%	-0.67%	1.88%	0.09%	0.30%	0.75%	1.43%	1.41%	2.20%	0.99%	-0.77%	0.70%
2020	1.91%	0.85%	5.53%	2.06%	1.23%	1.39%	1.04%	0.80%	1.11%	-1.99%	1.05%	-1.19%
2021	-1.03%	4.58%	3.49%	4.28%	1.99%	3.51%	0.41%	1.46%	0.22%	0.65%	3.93%	0.26%
2022	0.70%	5.15%	4.12%	2.26%	-1.34%	4.69%	3.52%	4.06%	-0.58%	-1.90%		



Index performance from January 2017 – September 2022. Unlike fund performance, indexes are not subject to fees, expenses or taxes. Indexes are unmanaged and direct investment is not possible. Fund performance will differ. Past performance is no guarantee of future results.

CONCEPT BEHIND THE CREATION OF THE INDEX

AiLA-S033 was created to offer investors an alternate source of Alpha where index returns are typically statistically independent of market trends. The index is driven by a verifiable robotic process which focused on delivering alpha.

FROM DATA TO ASSET ALLOCATION OUTPUT

Figure 1: Process of Data to Asset Allocation Output

1). Raw Input Data

Microfeatures

The microfeatures chosen are specifically related to the asset (i.e. the specific futures market). These include but are not limited to:

- Curve structure data
- Prior day closing price
- Recent trading range
- Trader positioning (CFTC CoT Report data)[7]

Macrofeatures

Macro features are used as common features for all assets. These features include but are not limited to:

- Market indices
    - Stocks
    - Bonds
    - Commodities
    - Baltic-Dry Index[8]
- Foreign exchange rates,
- Economic indicators

2) Training and Validation of the Model

The training data set is segmented into the following periods for all assets for conducting the training and validation of the models.

Table 1: Dataset break up by period

Dataset break up	Description
Training Period	Period when data is used to train the model
Testing Period/ Validation interchangeably used	This period is when the model is validated
Holdout Period	The period when live results are recorded and there are no changes made to the model or its parameters

The AiLA-S033 Index is currently in the "Holdout Period," and has been since January 1, 2017.

3) Asset Allocation – Entry/Exit

Entry Decision:

[7] The Commodity Futures Trading Commission (CFTC), Commitment of Traders Report (COT). "The Commitment of Traders report is a weekly publication that shows the aggregate holdings of different participants in the U.S. futures market." - https://www.investopedia.com/terms/c/cot.asp

[8] The Baltic Dry Index – "…a shipping and trade index created by the London-based Baltic Exchange. It measures changes in the cost of transporting various raw materials…" - https://www.investopedia.com/terms/b/baltic_dry_index.asp

The decision to enter an allocation is based on a positive daily asset allocation signal generated by either the *long* or the *short* asset allocation model. This is determined by the model predicting a favorable risk/reward opportunity for a long/short allocation. The model prediction is based on data included in the micro/macrofeatures listed above.

Exit Decision:

The exit decision is made once the opportunity horizon is reached, such as if the risk target has been met.

4) Index Construction

The main assumptions are various parameters such as rebalancing caps to avoid significant liquidity impacts. These parameters include:

- Risk Target: Volatility Target of 10% annualized standard deviation[9]
- Target Annual Sharpe Ratio – Target Sharpe Ratio[10] of 1.00
- Max Allocation Range – This is set to 100% to ensure there is no leverage[11]

You can find further details on the index Methodology at https://ailaindices.com/methodology.php.

Parameters and methodology is for Index Construction only and does not apply to the fund itself. As mentioned, the fund seeks to track the total return performance (before fees and expenses) of the AiLA-S033 Index.

5) Daily Weights

Automated index process

The model generates daily signals for individual assets, e.g. the Corn July and December contracts are modelled separately.

The automated index process takes these signals as inputs and index weights are calculated through three sequential steps.

[9] Standard Deviation – "…is a statistic that measures the dispersion of a dataset relative to it's mean and is calculated as the square root of the variance." - https://www.investopedia.com/terms/s/standarddeviation.asp
[10] Sharpe Ratio – "The Sharpe ratio compares the return of an investment with its risk. It's a mathematical expression of the insight that excess returns over a period of time may signify more volatility and risk…" - https://www.investopedia.com/terms/s/sharperatio.asp
[11] Leverage – "Financial leverage results from using borrowed capital as a funding source when investing." - https://www.investopedia.com/terms/l/leverage.asp

Definitions

General conventions

Business Day for an asset refers to a day where the asset is trading and has a settlement Close Price.
Asset refers to one of the selected components of the Index. Assets can be in the form of a fixed contract or a rolling contract.
Price, $P_{(t,i)}$ refers to the close price on business day *t* of Asset *i*.
Return, $r_{(t,i)}$ refers to percentage returns, $(P_{(t,i)} - P_{(t-1,i)}) / P_{(t-1,i)}$.
Product refers to the AiLA-S033 Index, where its output are daily weights for each asset in the index.
Mid Cap Logic requires the execution of instructions on the close of the next Business Day. This is typically used for indices with a capacity lower than US$1 billion.
Large Cap Logic is typically used for indices with a capacity of US$1bn and above, where a different execution process is applied as described below.
Weights are calculated just after close on each business day.

Rebalancing Caps

In line with the other types of AiLA indices, each Asset is assigned Daily Rebalancing Caps across the curve to prevent trading with a significant amount of slippage[12]. These are specified under the following four Durations to the Expiry Date[13]:

- ≤ 1M (≤ 22 Business Days)
- 1 – 3M (23 – 66 Business Days inclusive)
- 3 – 6M (67 to 132 Business Days inclusive)
- > 6M (More than 132 Business Days)

Asset Caps

Each Asset is assigned Daily Asset Caps equal to a given multiple of their rebalancing cap value, where the multiple used is 1x (4x) for the Mid (Large) Cap logic. The multiple hence suggests the number of days necessary to trade in/out of the max allowed weight.

Unconstrained weights *(w^U)*

- The ideal weights are determined based on mean/variance[14] portfolio construction principles, however, due to the dynamic nature of the signals, only aspects that are empirically shown relevant for our circumstances are included in order to achieve a robust and transparent portfolio construction process.

---

[12] Slippage – Slippage refers to the difference between the assumed price of a trad according to the index methodology and actual price as executed by the fund manager.
[13] Expiry Date – Futures contracts have expiration dates. The index rules take into a contract's expiration date into consideration.
[14] Mean/Variance – Refers to standard deviation as defined above.

- The purpose of the unconstrained weights is to represent the ideal index before any practical constraints have been imposed. The following steps will then aim to achieve an index as close as possible to the unconstrained one while respecting the various user/execution constraints.
- Unconstrained weights are calculated for the set of assets which have an active long/short position signal on a given date.
- The unconstrained weights are calculated with the following aspects considered, of which some are optional.
    - **Volatility:** equally weighted w.r.t. [15]asset risk.
    - **N effective:** varying allocation w.r.t. estimated effective number of assets.
    - **Index correlation:** induce a correlation preference to the standard index BCOM or GSCI.
    - **Risk target:** scale weights in line with index risk target.

Unconstrained weight calculation

Volatility:

- Distribute the allocation equally w.r.t. asset risk among the assets *(i)* with an active signal *(s)* on a given business day *(t)*.
- The asset volatility *(σ)* is calculated from historical returns using an exponentially moving average with a lookback window of 2-3 months.
- In case both long and short signals are active, it is possible to assign a relative weight between them. The intention of this option (Long/Short Ratio = r_{LS}) is primarily w.r.t. indices with a larger number of assets and to impact a general long/short bias .

$$w^{vol}(t,i) = c_N \cdot \frac{w_{LS}(\,s(t,i)\,)}{\sigma(t,i)} \; ; \qquad c_N = \text{const} \Rightarrow \sum_i w^{vol} = 1 \; ; \qquad w_{LS}(s) = \begin{cases} 1 & if\ s > 0 \\ 0 & if\ s = 0 \\ r_{LS} & if\ s < 0 \end{cases}$$

N effective: (optional)

- For indices where the number of assets vary significantly over time, a Risk Balance option is available.
- If enabled, the index allocation is varied based on the effective number of assets *(N_{eff})* estimated on a given business day, in order to increase (decrease) the allocation when the variance is expected to be reduced (enhanced) by the large (small)*(N_{eff})*.
- Further details about the *(N_{eff})* and corresponding calculation is found in the dedicated section below.

[15] w.r.t. – abbreviation, "with respect to…"

$$w^{neff}(t,i) = w^{vol} \cdot c'_N \cdot \sqrt{N_{eff}}$$

c'_N = const

(* arbitrary due to risk target below)

Unconstrained weight calculation

Index Correlation: (optional)

- In case of a particular correlation preference w.r.t. the standard index BCOM or GSCI (Correlated Index), an option is available to bias the weights accordingly.
- This is achieved by rotating the weight vector w.r.t. the standard index weights, within a common risk space.
- The option is currently implemented with a positive/negative (Correlation) preference and four different levels (Degrees of Correlation) of angular (correlation) constraints.
- To maximize the effect, all available assets associated with the corresponding standard index are used to achieve the bias.
- Further details about the standard index bias calculation is found in the dedicated section below.

$$w^{IC}(t,i) = f\left(w^{sign}\right); \qquad w^{sign} = sign(s) \cdot w \quad \text{(multiplied elementwise)}$$

Risk Target:

- The weights obtained from the above steps are finally scaled in order to normalize the total allocation of the ideal/unconstrained index in line with the user defined risk target.
- The scale factor is determined based on the historical index PL, where the scaling is either based on a (Risk Target Type) Max Daily Drawdown[16] (RT_{ddd}) or annual Volatility Target (RT_{vol}) value.
- The index volatility (σ) is calculated using an exponentially moving average with a lookback window of about 2-3 months.

[16] Drawdown – "…a peak-to-trough decline during a specific period for an investment…" https://www.investopedia.com/terms/d/drawdown.asp

$$PL(t) = \sum_i w \cdot r^{\%}$$

$$f_{rt}(t) = \begin{cases} \dfrac{RT_{ddd}}{|min(PL)|} \\ \dfrac{RT_{vol}}{\sqrt{252} \cdot \sigma(PL)} \end{cases}$$

$$w^{RT} = f_{rt}(t) \cdot w$$

N effective calculation

- The effective number of assets could typically be estimated from the assets with non-zero weights on a given business day, together with their return correlation.
- To estimate asset correlations which are stable out-of-sample is generally difficult, however, in contrast to many scenarios in quantitative finance, our indices are typically comprised of a medium number of assets (e.g. ≤ 100) with either very high (e.g. between Zinc contracts, or WTI vs Brent) or low (e.g. Zinc vs Soybean) correlations.
- For these reasons, the N_{eff} calculation uses a very simple risk model (R), where assets are grouped together with an assumed correlation of 1 (*0*) within (between) groups.
- The N_{eff} is then calculated using a signal vector (*S*) where all non-zero long (short) weights are assigned 1 ($-r_{LS}$ = Long/Short Ratio).

$$R = \begin{pmatrix} 1 & 1 & 0 & 0 & \dots \\ 1 & 1 & 0 & 0 & \dots \\ 0 & 0 & 1 & 0 & \dots \\ 0 & 0 & 0 & 1 & \dots \\ \vdots & \vdots & \vdots & \vdots & \ddots \end{pmatrix}$$

$$s = (1 \quad 1 \quad -r_{LS} \quad -r_{LS} \quad \dots)$$

$$\sqrt{N_{eff}} = \left(\frac{(N_L + N_S \cdot r_{LS})^2}{s\ R\ s^T} \right)^{\frac{1}{2}}$$

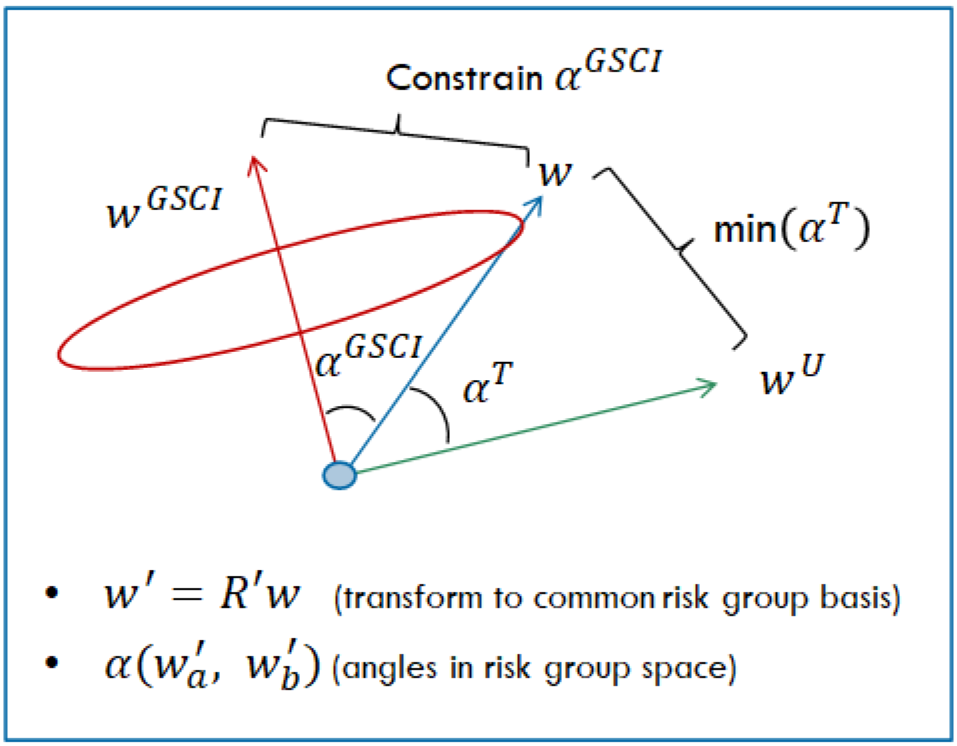
(* N_L (N_S) refers to the number of long (short) assets)

Note: further details w.r.t. this subject are discussed in [Diversification Benefit]

[Diversification Benefit]: Perspectives, https://ailaindices.com/diversification-benefit.php

Standard index bias

- The standard index bias is constructed using a fit w.r.t. to the weights associated with either BCOM or GSCI.
- The current implementation uses the long and short w^U weights (i.e. here w^{vol} or w^{neff}) for all assets associated to the standard index constituents, through a common risk model [same as used for the N_{eff} calculation].
- The fit is performed on each business day where at least 5 assets have non-zero weights, where the resulting weights are different to w^U in size, but not sign.
- The index biased weights are obtained using the minimize function of the scipy library [*SciPy*], where the set of weights are determined by the weight vector that minimize the angle w.r.t. the w^U vector, while being within a given angular distance to the standard index weight vector.
- The fit preserve the sum of weights equal to sum(w^U), however, this cannot be guaranteed under all circumstances.



Note: further details w.r.t. this subject are discussed in [Controlling correlation]

[SciPy]: E. Jones et al., Open Source Scientific Tools for Python (2001), http://www.scipy.org
[Controlling Correlation]: Perspectives, https://ailaindices.com/controlling-correlation.php

Constrained weights (w^C)

- The constrained weights are taking the unconstrained weights as an input and then determine the most similar set of weights given a set of linear constraints.

- The calculation is only considering the assets with active (non-zero) weights on any given business day.
- The constrained weights are calculated with the following constraints.
  - **Asset cap:** upper bound w.r.t the individual asset weights.
  - **Sector cap:** upper bound w.r.t. the sum of weights within a sector.
  - **Sharpe ratio:** lower bound w.r.t. historical index Sharpe ratios.
  - **Index allocation:** equality bound w.r.t. the sum of all weights.
- The constrained output weights are signed, i.e. weights are (elementwise) multiplied by signal sign.
- In case of a maximum allocation preference, an option (Allocation Range - Max) is available to scale down the output weights to the max value on business days where the sum of weights exceeds this value.
- It should be noted that the sector caps are used without the target risk scaling in order to refer to the USD allocation, therefore if sector caps are used an allocation max option of 100% should be specified to avoid distortion from leverage.

Constrained weight calculation

Constrained weight fit:

- The fit is performed on each business day for all assets with non-zero unconstrained weight (w^U), given that at least three assets have non-zero weights.
- As described above, the asset caps are determined by the rebalancing cap values and differs for the Mid/Large Cap logic.
- The sector caps are user defined (Allocation Max %) values.
- The Sharpe ratio (SR) constraint provide an option to require that the weights corresponds to an average historical SR above a given threshold (Target Annual Sharpe Ratio). The historical asset Sharpe ratio values used are capped at ±5.
- The last equality constraint make the fit preserve the sum of weights.
- In case the sum(w^U) is too large for the weight region defined by the sector and asset caps, the w^U are scaled down so that the sum(w^U) fits inside the allowed region.
- The constrained weights are obtained using the minimize function of the scipy library [*SciPy*], where the set of weights are determined by the weight vector that minimize the angle w.r.t. the w^U vector, while respecting the linear constraints (1) to (4).
- In case the fit is not possible, the w^U values are used with weights associated to assets/sectors scaled down in case they breach the corresponding caps.

1) Asset caps (each asset)

e.g. $w_{(i)} \leq 5\%$

2) Sector caps (asset groups)

e.g. $w_{(bean)} + w_{(oil)} + w_{(meal)} \leq 10\%$

3) Historical SR (all assets)

e.g. $\sum w_{(i)} \cdot SR_{(i)} > 1.0$

4) Index allocation (all assets)

e.g. $\sum w = \sum w^{uc}$

[SciPy]: E. Jones et al., Open Source Scientific Tools for Python (2001), http://www.scipy.org.

Index weights (w^T and w^A)

Constrained weight fit:

- The index weights are calculated using the constrained weights (w^C) as input.
- In addition, a trade balancing period criteria is applied, where weights are set to zero when the number of business days to expiry or end-of-year is less than 2 (7) using the Mid (Large) Cap logic.
- The w^C weights with the trade balancing period criteria applied is referred to as the target weights, which the actual index weights try to achieve.
- However, the actual index weights are often not able to equal the target weights, due to the rebalancing restrictions implied by the different caps.

Index weight calculation

- The index weights involve two type of weights,
  - **Target weights** (w^T) are the constrained weights (w^C) with the additional trade balancing period criteria applied, discussed above.
  - **Actual weights** (w^A) are the weight used in the calculation of the index value, i.e. the weight that an asset should be rebalanced to on the close of the next Business Day.

- On each business day (t) the rebalancing values for the next business day are calculated by the following steps,
  - $reb(t,i) = w^T(t,i) - w^A(t,i)$
  - $re(t,i)$ is set to its rebalancing cap value, if the cap is exceeded.
  - $reb(t,i)$ values are reduced to meet asset and sector caps, if the actual weight values after rebalancing exceed any such caps, i.e. the affected assets are reduced to equal the $reb(t,i)$ allowed by the corresponding cap.
- The final $re(t,i)$ values are then used to rebalance the actual weights on the next business day, i.e. $t+1$, and the index is calculated using the same methodology as other types of AiLA indices.

End-of-day Units

$$U_{(1,i)} = 0 \quad ; \quad I_{(1)} = 100$$

$$U_{(t,i)} = I_{(t)} \cdot w^A_{(t-1,i)} / P_{(t,i)}$$

(* w^A is positive/negative for long/short signals)

Profit and Loss

$$PNL_{(t,i)} = U_{(t-1,i)} \cdot \left(P_{(t,i)} - P_{(t-1,i)}\right)$$

$$= I_{(t-1)} \cdot w^A_{(t-2,i)} \cdot r^{\%}_{(t,i)}$$

Index Value

$$I(t) = I(t-1) + \sum_i PNL_{(t,i)}$$

Index wide aspects

Currency

- The default currency used for valuation of all asset prices is USD, i.e. including the PNL and index calculation.
- In case another index currency is specified through the user option, or an asset's domestic price is in another currency, all prices are converted into that index currency, using London 4pm Fixed rates on the same business day as the price.
- Therefor the index performance should reflect the prevailing value of its assets in the given index currency.

Holidays

- Given that the index weights on a given business day are cross sectionally linked to each other due to various steps of the calculation, e.g. the calculation of $w_{(t,i)}^{vol}$, $w_{(t,i)}^{neff}$ or $w_{(t,i)}^{C}$ *weights etc., the target weights of all assets can change on a date which is only a business day for a fraction of the assets.*
- Therefore, in the scenario where a date is an exchange holiday for some, but not all, assets it should be expected that the rebalancing values can be updated for all assets. The next business day for the assets affected by the holiday will, however, remain the same date.
- For example,
    - If the 1st and 3rd of May are business days for all assets and the 2nd May is an exchange holiday for some assets;
    - Rebalance values for the assets affected by the holiday will be calculated on the 1st, to be rebalanced on the 3rd;
    - The assets not affected by the holiday, can result in new target weights for all asset on the 2nd;
    - On the 2nd, the target weights yield updated rebalance values for assets affected by the holiday, still to be rebalanced on the 3rd.

RISK and DISCLOSURE

Read the prospectus carefully before investing.

A copy of the prospectus may obtained at: www.teucrium.com

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Investments involve risk. Principal loss is possible.

OAIA is a "non-diversified" fund and because it can invest a greater percentage of its assets in particular securities including agricultural commodities, changes in the market value of a single investment could cause greater fluctuations in share price than would occur in a diversified fund. Agricultural commodities are affected by consumer tastes, demand, government, economic conditions, weather and seasonal factors and demographic trends. OAIA is a commodity pool regulated by the CFTC. OAIA is new and has a limited operating history to evaluate.

Commodities and futures generally are volatile, and instruments whose underlying investments include commodities and futures are not suitable for all investors.

Futures investing is highly speculative and involves a high degree of risk. An investor may lose all or substantially all their investment. Investing in commodity interests subject each Fund to the risks of its related industry. These risks could result in large fluctuations in the price of a particular Fund's respective shares. Funds that focus on a single sector generally experience greater volatility. Futures may be affected by **Backwardation**: a market condition in which a futures price is lower in the distant delivery months than in the near delivery months. As a result, the fund may benefit because it would be selling more expensive contracts and buying less expensive ones on an ongoing basis; and **Contango:** A condition in which distant delivery prices for futures exceeds spot prices, often due to costs of storing and inuring the underlying commodity. Opposite of backwardation. As a result, the Fund's total return may be lower than might otherwise be the case because it would be selling less expensive contracts and buying more expensive one.

The Fund's short selling involves the sale of commodities. The short seller profits if the commodity's price declines. If a shorted commodity increases in value, a higher price must be paid to cover the short sale, resulting in a loss. The amount the Fund could lose on a short sale is theoretically unlimited.

The Fund employs a "passive management" approach that seeks investment results that correspond (before fees and expenses) generally to the performance of its underlying index. There is no guarantee that the Fund will achieve a high degree of correlation to the underlying Index and therefore achieve its investment objective. Differences in timing of trades and valuation as well as fees and expenses, may cause the fund to not exactly replicate the index known as tracking error.

Sharpe Ratio: A risk-adjusted measure calculated using standard deviation and excess return to determine reward per unit of risk.

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