WisdomTree **STRATEGY INSIGHT**

BUILDING AN INVESTMENT IN ARTIFICIAL INTELLIGENCE EQUITIES

June 2019

WisdomTree brought together the expertise of both NASDAQ and the Consumer Technology Association (CTA) to build an exposure to an important megatrend. Artificial Intelligence (AI) and Machine Learning are the tools that will help society make sense of the massive amounts of data being generated each day.

Figure 1 indicates the array of UCITS exchange traded funds (ETFs) that focus on Artificial Intelligence, Automation, and Robotics—fields that clients frequently compare to one another.

Figure 1: UCITS ETFs Focused on Artificial Intelligence, Automation & Robotics			
Fund Name	**Fund Ticker**	**Expense Ratio**	**Inception Date**
WisdomTree Artificial Intelligence UCITS ETF - USD Acc	WTAI	0.40%	30-Nov-18
Amundi Stoxx Global Artificial Intelligence - UCITS ETF	GOAI	0.35%	4-Sep-18
Lyxor Robotics & AI UCITS ETF	ROAI	0.40%	20-Jun-18
iShares Automation & Robotics UCITS ETF	RBOT	0.40%	8-Sep-16
L&G ROBO Global Robotics & Automation UCITS ETF	ROBO	0.80%	23-Oct-14

Sources: WisdomTree, Morningstar Direct. Data current as of 30 April 2019.

WISDOMTREE'S APPROACH TO MEGATREND INVESTING: PARTNER WITH EXPERTS

There is no substitute for human experts looking at the business model of every company that could touch AI and Machine Learning in order to verify their involvement in the space.

WHO IS NASDAQ?

Many investors have familiarity with the NASDAQ 100 Index, an important barometer of US equity performance focused on the technology sector. Importantly, the breadth of NASDAQ's business and focus goes well beyond this well-known index.

WHO IS CTA?

CTA is the trade association representing the US consumer tech industry, providing policy advocacy, market research, technical education, and the development of market standards. The US consumer technology industry is approximately $377 billion in size. CTA serves more than 2,200 member companies. The association has a working group that is focused on AI and Machine Learning, with more than 40 years of combined industry experience. Their team can track and understand the market for AI services as well as monitor enhancements and investments within the field. Each company's exposure to AI can be evaluated on a bespoke basis.

One of the most widely publicised activities undertaken by CTA is the annual Consumer Electronics Show (CES). Artificial Intelligence is prominently featured at CES within the conference programming, keynote addresses, and exhibits on the show floor focused on the AI marketplace of exhibitors in numerous product categories.

The NASDAQ CTA Artificial Intelligence Index (the index tracked by WTAI) benefits from both NASDAQ's breadth of business experience and CTA's AI expertise.

THE THREE TIERS: ENGAGERS, ENABLERS AND ENHANCERS

In evaluating AI companies, it quickly became clear that there were different levels and types of involvement within the space. When considering constituents within the NASDAQ CTA Artificial Intelligence Index, three tiers were created to account for these differences.

1) **Engagers:** The term "engagers" is meant to encompass those companies that are currently selling AI products or services to the market today. When their revenues are considered, the critical part is determined by selling AI directly to customers.

2) **Enablers:** The engagers depend on certain other capabilities and hardware developed by other companies, and within the methodology of the NASDAQ CTA Artificial Intelligence Index these companies are termed "enablers." The most prevalent sub-industry within this category is semiconductors, which makes sense since in AI and Machine Learning processing power is paramount.

3) **Enhancers:** There are companies that focus on aspects of AI as part of much larger, much broader business initiatives. Frequently, these firms were not founded with selling AI as their main strategy, but they are important in pushing the field forward and they frequently have massive troves of capital with which to make important investments.

Figure 2 shows the top 5 companies within each of these respective categories. This indicates some concrete examples of each category to help illustrate the meaning behind them.

Figure 2: Examples of Engagers, Enablers and Enhancers					
Top 5 Engagers by Weight		**Top 5 Enablers by Weight**		**Top 5 Enhancers by Weight**	
Blue Prism Group plc	3.51%	Qualcomm Inc.	3.36%	Amazon.com Inc	0.64%
Cadence Design Systems Inc	3.40%	NVIDIA Corp	2.45%	Microsoft Corp	0.64%
PROS Holdings Inc	3.37%	NXP Semiconductors NV	2.41%	Akamai Technologies Inc	0.63%
Synopsys Inc	3.34%	Microchip Technology Inc	2.40%	SoftBank Group Corp	0.62%
Nice Ltd	3.29%	STMicroelectronics NV	2.34%	Autodesk Inc	0.60%

Sources: Bloomberg, NASDAQ. Weights current as of 30 April 2019.

BUILDING A "BETA" EXPOSURE TO AI

CTA's knowledge is invaluable in two aspects of what we have discussed thus far. First, it is their expertise that determines the category of each company (engager, enabler or enhancer). Second, CTA also measures which companies are close enough to AI and Machine Learning to be included within each group, as only the top 15 "intensity scores"[1] are eligible for inclusion within each category.

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[1] The Intensity Score is how CTA measures and ranks the closeness of exposure to AI & Machine Learning within each category. If two companies have the same score and that score is within the top 15 total scores, then both can be included.

How are these rankings determined? CTA can look at each company within a bespoke manner, accounting for the fact that these businesses can be quite different. A few (but not all) of the measures they are considering include:

+ How core AI is to the company's product offering

+ How meaningful is the AI theme in driving the companies' revenue

+ The company's investment in AI R&D

+ Relevance of the AI solutions the company is developing

+ The company's significance and contribution to the AI ecosystem

The results of this process and subsequent rankings are based on CTA's discretion and expertise, and they are not the result of any formulas or standardized approaches applied across all companies.

The most important singular point to take away is that CTA is not selecting the "best" company or the company that will have the "strongest" performance within any of the categories. CTA is also not looking at things like earnings growth potential or valuation. As long as there is a case that companies are closely exposed to AI and Machine Learning, the NASDAQ CTA Artificial Intelligence Index can include them, as a primary goal is a broad exposure to the field.

A CLOSER LOOK AT COMPETITOR FUNDS

Amundi Stoxx Global Artificial Intelligence – UCITS ETF (Ticker: GOAI)

GOAI tracks the total return performance of the STOXX AI Global Artificial Intelligence ADTV5 Index. In creating this index, STOXX partnered with Yewno to utilise knowledge graph technology in identifying AI innovators and adopters based on AI-related patent filings. Eligible companies can be from both developed and emerging markets. Qualifying companies are equally weighted.

It is very interesting to use such a technological approach to select constituent stocks. From a performance perspective, it would be impossible to know ahead of time if this approach would outperform or underperform any other approach. The one cautionary note that we would make, however, is whether it is possible to also know if those patents are being used to successfully commercialise an AI product or service.

Lyxor Robotics & AI UCITS ETF (Ticker: ROAI)

ROAI tracks the total return performance of the Rise of the Robots Index. Companies are selected for inclusion based on a proprietary, data-driven industry classification by Societe Generale's Thematic Research team.

Weighting of the eligible companies is based on three primary criteria:

1) Research & Development expenditure

2) Return on invested capital

3) 3-Year sales growth

Within this approach, it is possible to see the linkage between the connection to AI and a few relevant investment metrics. However, it would also be impossible to know ahead of time if this approach would outperform or underperform any other approach. The critical question is how the industry classifications are made, since understanding this is a crucial point in understanding the potential breadth of companies available to the approach.

iShares Automation & Robotics UCITS ETF (Ticker: RBOT)

RBOT tracks the total return performance of the iSTOXX Factset Automation & Robotics Index. This index is created with the use of the Revere Business Industry Classification System (RBICS) level 6 sectors within Factset. Sectors relevant to Automation & Robotics are determined, and then 50% or more revenue needs to come from those sectors. Eligible constituents are then equally weighted.

The RBICS classifications give the impression of a significant degree of precision. However, at this point in the development of AI, it is important to remember that the industry is growing and changing at a rapid rate. Additionally, the RBICS classifications alone cannot help in understanding the nature of an AI-related business, as they merely use available revenue data to help in knowing where to look. All that being said—there is no way to know whether this approach would outperform or underperform any other on a going-forward basis.

L&G ROBO Global Robotics & Automation UCITS ETF (Ticker: ROBO)

ROBO is designed to track the total return performance of the ROBO Global Robotics and Automation UCITS Index. In a way, this index methodology is the closest to the expertise used by CTA within the NASDAQ CTA Artificial Intelligence Index. ROBO Global does bring significant experience and expert knowledge to bear when it comes to assessing the eligible universe of these companies. The key to remember, however, is that having robotics as the central focus is different from having AI as the central focus.

Companies within the ROBO Global Robotics and Automation UCITS Index are selected based on their revenue exposure to the robotics and automation industry as per ROBO Global's industry classifications. Specifically:

+ Technology companies are those that enable robots to "think, sense and act."

+ Application companies are those deploying robotic and automation technology.

Constituents are then weighted within a modified equal-weighted scheme. 40% of the total index weight are in "bellwether" companies with their core business related to robotics and automation. 60% of the total index weight is in companies that are "non-bellwether", which in other words means those companies with a distinct portion of their business related to robotics and automation.

NUMBER OF HOLDINGS

The number of holdings within a given strategy is an important measure of how the approach is treating the question of "focus" or "concentration." Sometimes, diversification is of paramount importance, and in these cases a greater number of holdings is more typical. In other cases, the types of eligible companies are more precisely defined, leading to a lower number of total holdings.

There is no "one way" or "right way" to approach this—the key is making sure if one expects a concentrated, focused thematic exposure, they aren't exposed to hundreds of companies.
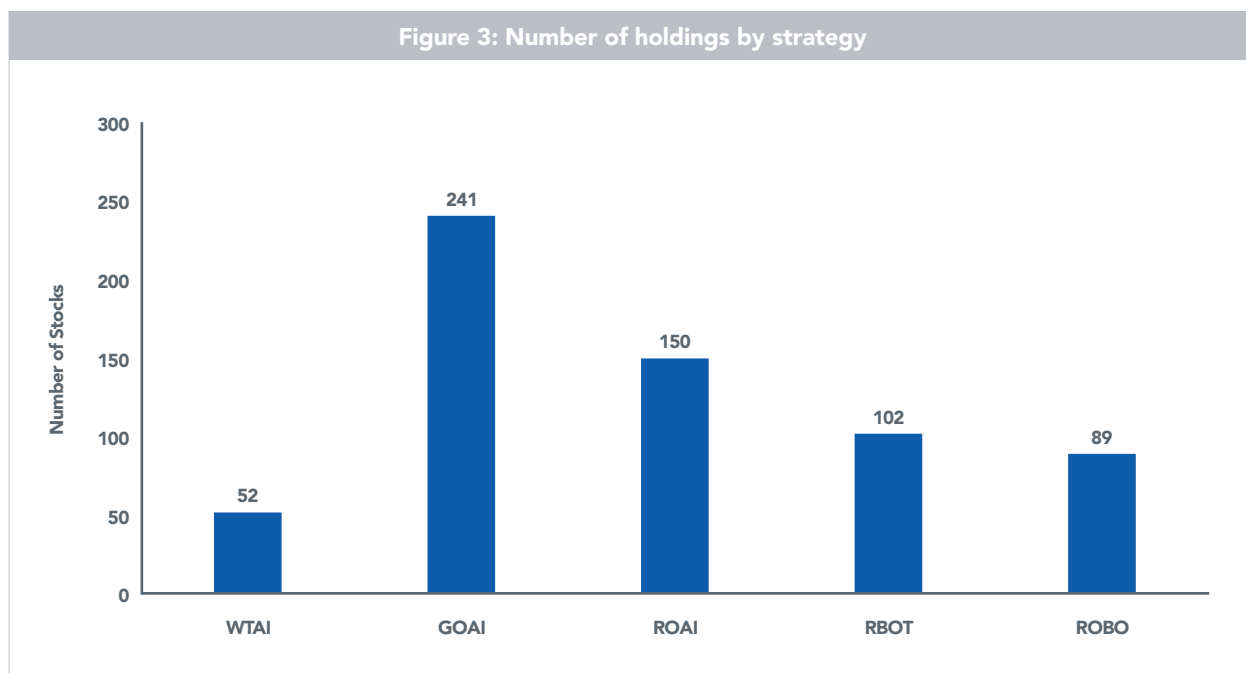
Figure 3: Number of holdings by strategy

Source: Bloomberg, with data as of 30 April 2019. Holdings for GOAI as of 27 December 2018 with weights as of 30 April 2019.

+ WTAI stands out on the lower end of the spectrum, with only 52 holdings as of 30 April 2019. ROBO was closest at 89 holdings.

+ GOAI (241 holdings) and ROAI (150 holdings) stand out on the other end of the spectrum.

+ It is also instructive to think of overlapping holdings across the different strategies—another way to think of how different they really are. We also cite the overlapping weight within companies that are defined as Engagers in the NASDAQ CTA Artificial Intelligence Index methodology, since these companies are the most purely exposed to deriving revenues from selling AI products and services.

  • GOAI had 28 constituents in common with WTAI, with overlapping weight of approximately 12%. Within the Engagers category the weight in overlapping companies was less than 4.0%.

  • ROAI had 27 constituents in common with WTAI, with overlapping weight of nearly 18%. Within the Engagers category, the weight in overlapping companies was less than 6%.

  • RBOT had 10 constituents in common with WTAI, with overlapping weight of below 10%. Within the Engagers category, the weight in overlapping companies was 3.18%.

  • ROBO had 11 constituents in common with WTAI, with overlapping weight of 12%. Within the Engagers category, the weight in overlapping companies was 6.52%.

In our view, the most important conclusion to draw out comes from the weight in overlapping companies within the Engagers category. If this figure was high, it would mean that other approaches are touching more pure-play, AI companies in their strategies. Since these numbers tended to be quite low, it indicates that the strategies other than WTAI were touching many areas and were not as concentrated on AI as was the case within WTAI's approach.

COUNTRY BREAKDOWN

Figure 4 breaks down the top 10 country exposures within WTAI and how the other strategies compare within these exposures. What's clear across these five strategies is that it is really a tale of three main country exposures, with some smaller exposures outside of that.

+ **United States:** Across all strategies, this is the crucial exposure and greatest individual weight. RBOT and ROBO are in the "below 50%" exposure grouping, clearly the lower end of the range. ROAI is on the upper end of the range with exposure to the US above 60%.

+ **Taiwan:** There are a number of world-class semiconductor companies in Taiwan, so in a way exposure to Taiwan does indicate one measure of exposure to semiconductors. WTAI and RBOT are in the double digits here. GOAI is on the lower end of the range, below 5.0%.

+ **Japan:** Japan is a very sophisticated market for technology companies and the field of robotics has proliferated quite strongly here. RBOT and ROBO set the higher end of the range here. WTAI and ROAI are on the lower end. We would note that, while there may be companies that touch both AI and robotics, it is also often the case that those specialising in one area may not touch on the other.

Figure 4: Country exposures by strategy					
Country Name	**WTAI**	**GOAI**	**RBOT**	**ROAI**	**ROBO**
United States	55.4%	56.1%	33.4%	62.3%	45.5%
Taiwan	12.7%	4.3%	10.5%	5.3%	5.5%
Japan	5.4%	18.1%	25.7%	6.7%	24.0%
United Kingdom	3.5%	2.3%	5.2%	3.4%	3.2%
Israel	3.3%	N/A	N/A	2.5%	N/A
France	3.0%	2.9%	N/A	1.9%	2.0%
Canada	3.0%	2.5%	2.1%	N/A	N/A
South Korea	2.8%	3.6%	4.4%	N/A	1.5%
Germany	2.8%	3.2%	6.6%	2.0%	7.7%
Switzerland	2.3%	1.3%	N/A	2.4%	3.3%

Source: Bloomberg, with data as of 30 April 2019. The 10 countries shown are the top 10 country exposures within WTAI. "N/A" would indicate that the respective country was not within the top 10 exposures of the specified strategy, i.e. Israel is not one of the top 10 country exposures within GOAI. Holdings for GOAI as of 27 December 2018 with weights as of 30 April 2019.

INDUSTRY BREAKDOWN

The final section of our comparisons involves industry exposure. Within Figure 5, we did see some important stories emerging.

+ Semiconductors: Whether one is thinking of robots, automation or AI, the processing power in all these areas comes from semiconductors. Some of the strategies, like WTAI and RBOT, had very large exposure here. WTAI was at nearly 40%. GOAI, on the other hand, was below 10%.

+ Software: Currently, AI and Machine Learning are represented by software, which is then run on semiconductors and other hardware. WTAI has the greatest exposure here, nearly 40%, followed by ROAI, which did break the 30.0% mark. ROBO, on the other hand, was below 10% in this Industry.

+ Machinery: In a way this shows the difference between focusing on AI in some fashion versus focusing more on robotics. ROBO had a greater than 35% weight to this industry. RBOT had a greater than 24% exposure to this industry. However, Machinery was not an exposure within WTAI, and it was a less than 5% exposure in both GOAI and ROAI.

Figure 5: Bloomberg Industry Classification Breakdown (BICS)

BICS Industry Classification	WTAI	BICS Industry Classification	GOAI	BICS Industry Classification	RBOT	BICS Industry Classification	ROAI	BICS Industry Classification	ROBO
Semiconductors	39.1%	Software	16.8%	Semiconductors	26.8%	Software	30.4%	Machinery	35.6%
Software	38.3%	Hardware	15.2%	Machinery	24.3%	Semiconductors	16.2%	Electrical Equipment	16.9%
Technology Services	6.7%	Semiconductors	9.9%	Software	24.1%	Hardware	13.6%	Hardware	11.2%
Hardware	5.9%	Automotive	6.9%	Hardware	9.9%	Medical Equipment & Devices	7.1%	Semiconductors	10.8%
Automotive	3.9%	Electrical Equipment	6.9%	Electrical Equipment	9.4%	Electrical Equipment	6.7%	Software	8.0%
Medical Equipment & Devices	2.8%	Media	6.5%	Technology Services	1.3%	Technology Services	5.4%	Medical Equipment & Devices	7.5%
Retail - Discretionary	1.2%	Technology Services	5.2%	Medical Equipment & Devices	1.0%	Media	5.3%	Aerospace & Defense	2.3%
Media	1.2%	Telecom	5.0%	Media	0.9%	Machinery	2.8%	Manufactured Goods	2.1%
Telecom	0.5%	Aerospace & Defense	4.1%	Automotive	0.9%	Specialty Finance	2.1%	Oil, Gas & Coal	2.0%
Electrical Equipment	N/A	Machinery	3.7%	Oil, Gas & Coal	0.8%	Retail - Discretionary	1.9%	Home & Office Products	1.3%

Source: Bloomberg, with data as of 30 April 2019. Holdings for GOAI as of 27 December 2018 with weights as of 30 April 2019.

THE IMPORTANCE OF KNOWING YOUR EXPOSURE

Importantly, we must indicate the critical limitation of this analysis in that there is no factor that we can consider that would allow us to know, ahead of time, which strategy will perform best. We do, however, know a lot about the exposure. If investors are looking for AI, that could be quite different from looking for robotics or looking for a combination of robotics, automation and AI. The exposure investors seek should match the strategy in which they allocate, as the ETF has become such a versatile vehicle for thematic exposures.

Related products

WisdomTree Artificial Intelligence UCITS ETF – USD Acc

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