

STOXX

 DEUTSCHE BÖRSE
GROUP

Big Data meets Investing: STOXX AI Indices

January, 2018



Contents

2

Big Data & AI: Investors Need the
Right Strategy and Investment
Concepts

7

Making AI Investable

9

Investing in Big Data and AI: STOXX
Global AI Solutions

16

Putting Big Data and AI to Use:
STOXX AI Global Artificial Intelligence
Index

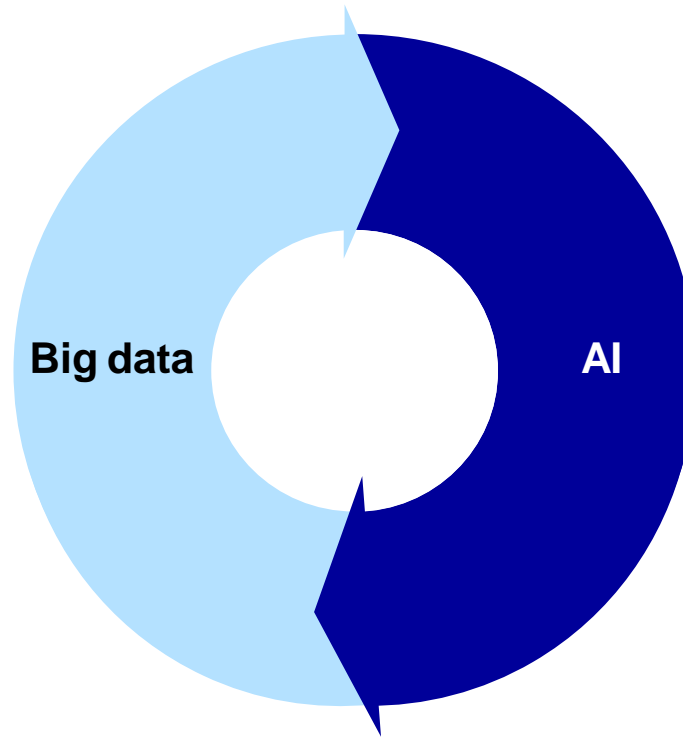


1

Big Data & AI: Investors
need the right strategy and
investment concepts

Big data and AI – two sides of the coin

“[...] large data sets that may be analysed computationally to reveal patterns, trends, and associations, especially relating to human behaviour and interactions”



“The theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages”

Big Data: The raw material of AI

Current State: AI enabled by Big Data¹⁾

- Billions of searches on Google every day provide a real-time data set for Google to learn from our search preferences.
- Billions of hours of spoken word now digitally available help Siri and Cortana learn our language.
- First concierge robot at Hilton Hotels, Connie, is fed extensive data to learn how to process future input for recommendations to hotel guests.
- AI now capable of learning without human support. E.g. Google's DeepMind algorithm taught itself how to win 49 Atari games.

Future State: Forecast for Next Decade²⁾

- Each year, the amount of data we produce doubles.
- In the next decade, there will be 150bn. networked sensors, i.e. more than 20 times the people on Earth.
- Big data helps AI devices learn how humans think and feel, and speeds up their learning curve.

- The explosion of data over the past few years fueled and will continue to fuel the advance of AI.
- The bigger "Big Data" gets, the more AI learns and ultimately the more accurate it becomes.

1) "Why AI Would be Nothing without Big Data", by Bernard Marr, Forbes, Jun. 9, 2017.

2) "Will Democracy Survive Big Data and Artificial Intelligence?" by Dirk Helbing et al., Scientific American, Feb. 25, 2017.

AI: A Megatrend and key Investment Opportunity

Current State: As of end 2017¹⁾

- There is a gap between R&D investments in AI and commercial applications.
- This is a typical sign of early technology development curves.
- AI has the potential to accelerate shifts in market share, revenue, and profit pools – these are characteristics of digitally disrupted sectors.

Future State: Forecast for 2035²⁾

- By 2035 AI technologies have the potential to increase productivity by 40% or more.
- AI will increase economic growth by an average of 1.7% across 16 industries by 2035.
- Top 3 Industries: Information and **Communication, Manufacturing and Financial Services** are expected to gain the **highest economic growth** in 2035 from AI's benefits.
- AI will have the most **positive effect on Education, Accommodation and Food Services and Construction** sectors' profitability in 2035.

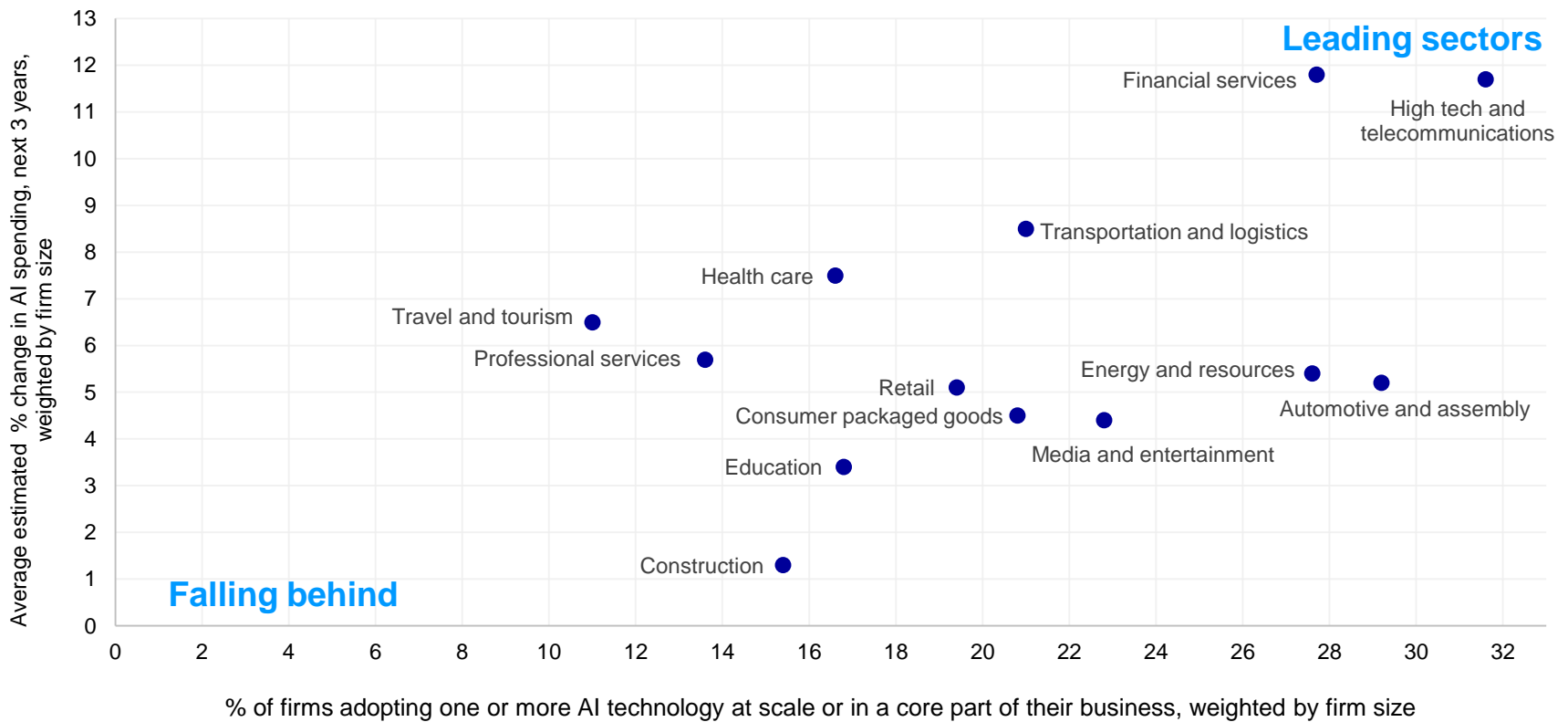
- AI is expected to drive economic growth and the profitability of entire industries.

1) "Artificial Intelligence: The Next Digital Frontier", Discussion paper by Jacques Bughin et al., McKinsey Global Institute, Jun. 2017.

2) "AI is the Future of Growth", by Mark Purdy and Paul Daugherty, Accenture, 2016.

AI: Transforming Industries and Boosting Growth

Current AI Leaders: Based on investment into and adoption of AI¹⁾



1) "Artificial Intelligence: The Next Digital Frontier", Discussion paper by Jacques Bughin et al., McKinsey Global Institute, Jun. 2017.

The background of the slide is a collage of various city skyline photographs. A large, semi-transparent white rectangle is positioned on the right side of the image, containing the text. The number '2' is rendered in a large, bold, blue font with a horizontal line underneath it. The text 'Making AI Investable' is in a smaller, blue, sans-serif font.

2

Making AI Investable

STOXX Global AI Solutions Overview

STOXX AI Index Offering

Revenue exposure based

AI IP based

Target

Identifying and selecting companies exposed to Artificial Intelligence

Approach

- Considering revenue exposure to pre-defined sectors



STOXX Global Artificial Intelligence Index

- Applying knowledge graphs to interpret unstructured data



STOXX “AI” Global Artificial Intelligence Index



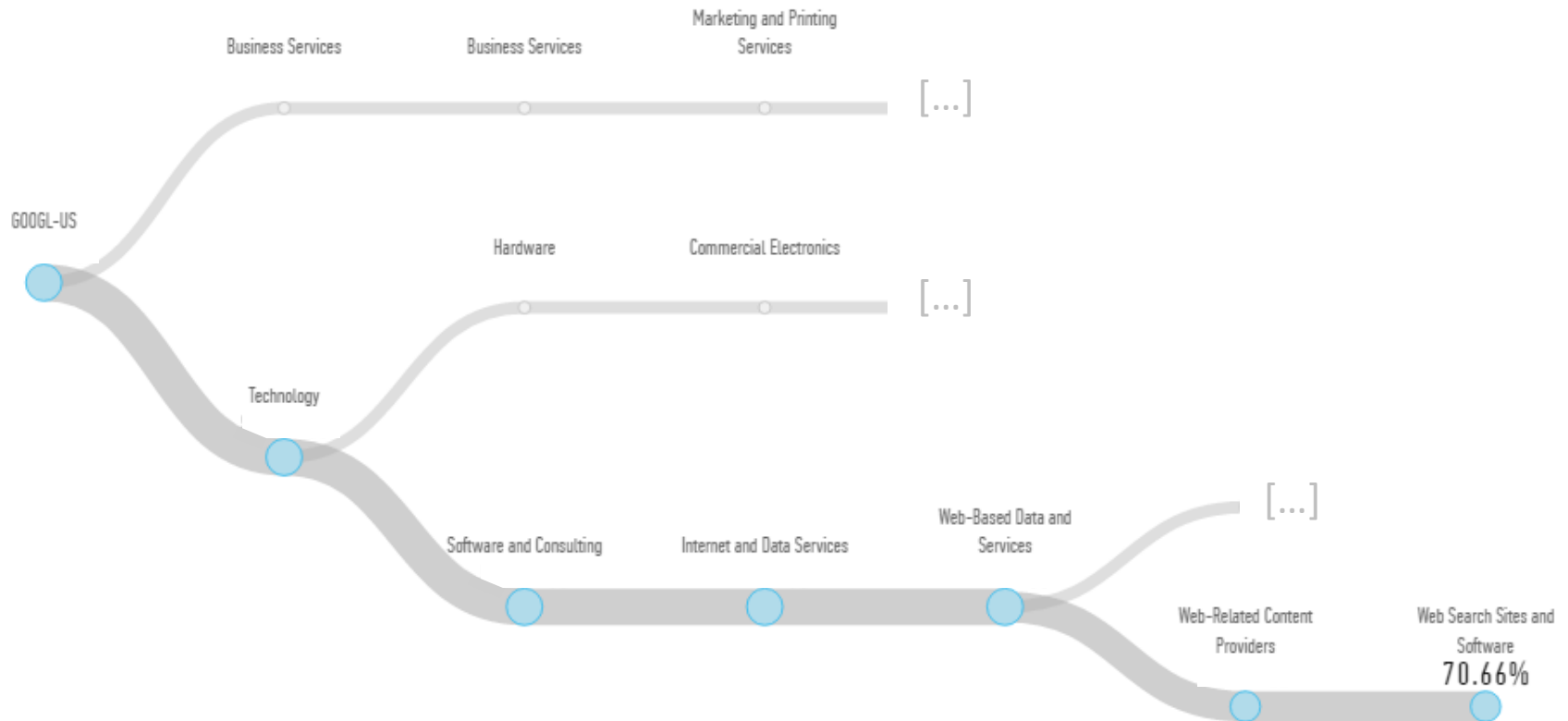
2.1

Investing in Big Data and AI: **STOXX Global AI Solutions**

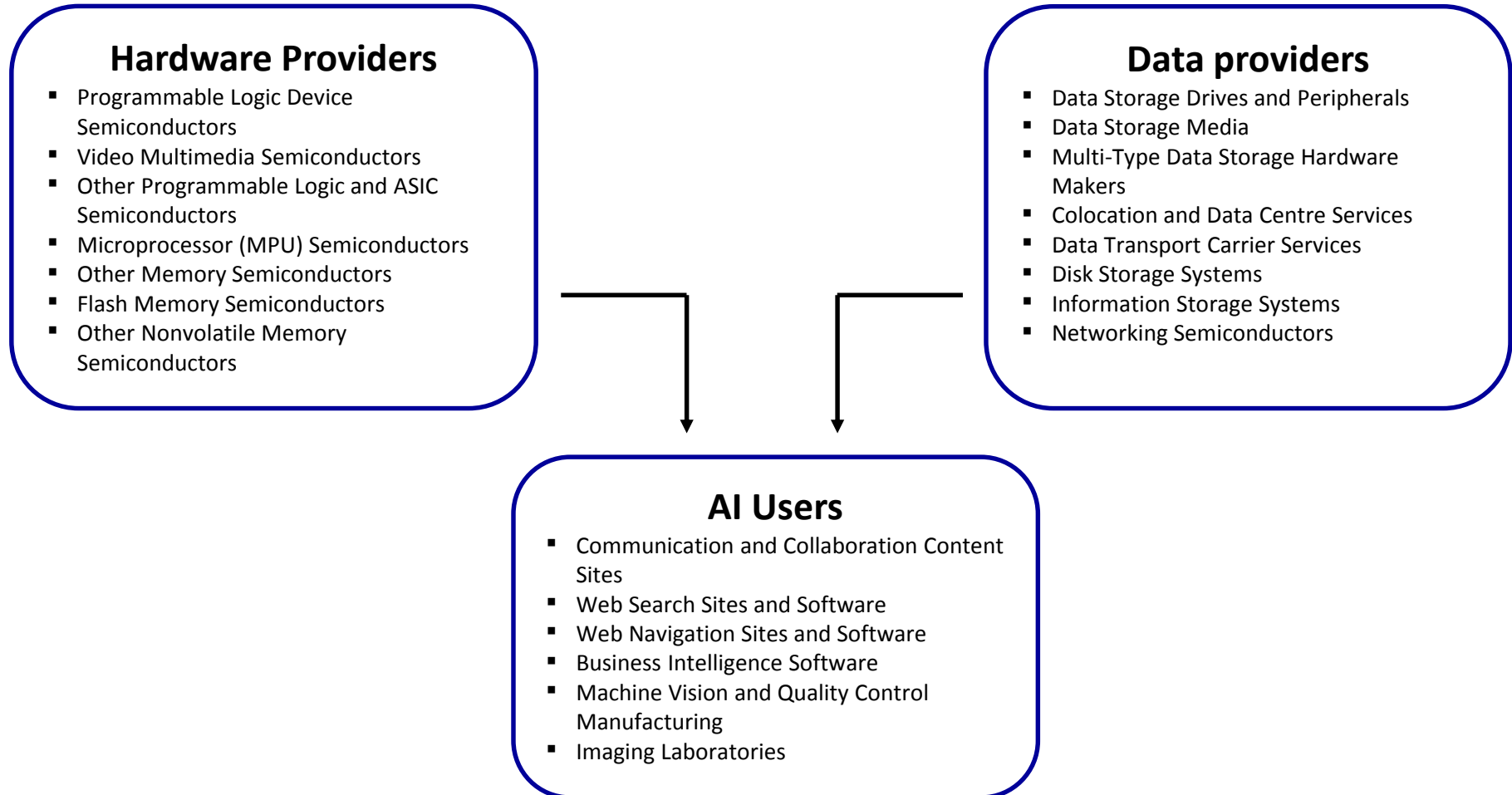
Step1: Finding the right data-source - FactSet RBICS

Example: Revenue breakdown of Google

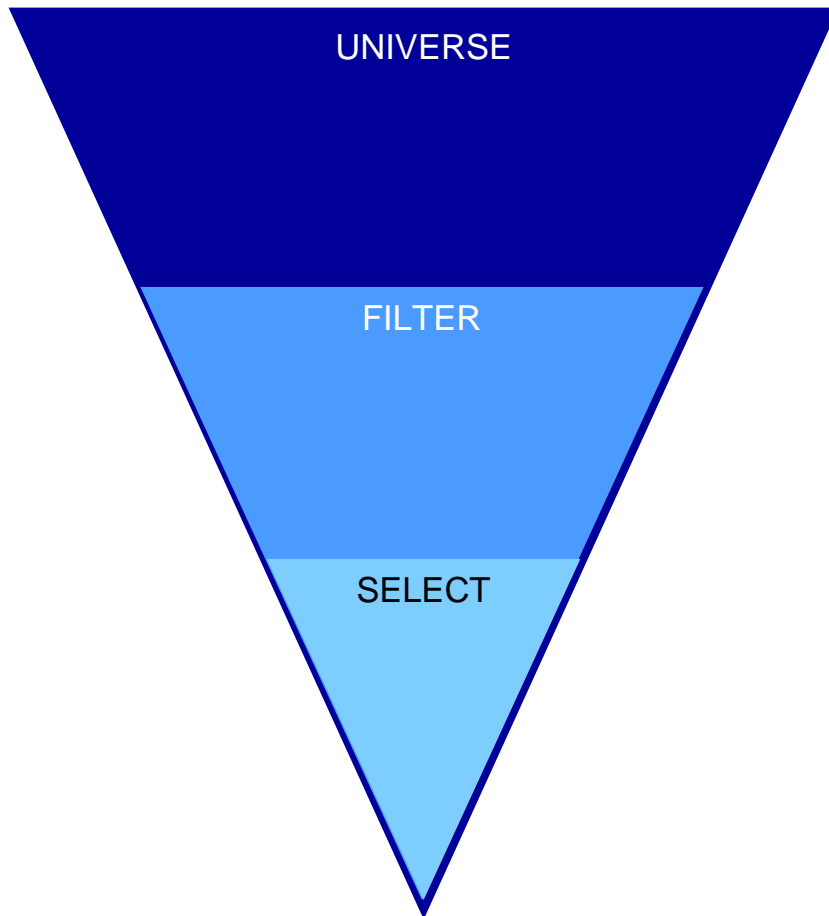
Revenue Exposure by Sector / Industry



Step 2: Identifying the relevant sectors



Step 3: Constructing the index



- The index universe is the STOXX Developed & Emerging Markets TMI.

-
- Companies are included in the index if they generate more than 50% of their revenues within the identified business segments.
 - Companies are filtered for liquidity by only including stocks with ADTV above €1,000,000.

-
- Weights are proportional to market cap times aggregate exposure, with dual listed companies and/or multiple share classes represented only by the most liquid stock.
 - Index components are selected once per year, index is rebalanced quarterly to mcap*exposure weights. UCITS caps of 35/8/4.5 are applied to get the final weights.

Index constituents (top 10 by FF-MC)

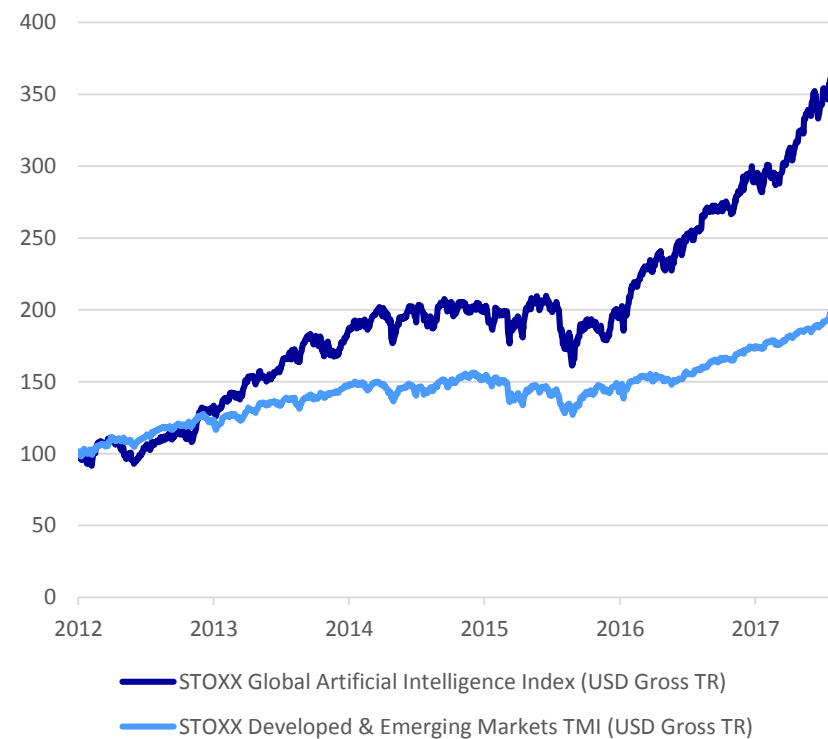
| Name | ISIN | FF-MC | 3-m ADTV | Weight |
|-------------------------|--------------|-------------------|-----------------|--------|
| FACEBOOK CLASS A | US30303M1027 | \$428,603,657,802 | \$2,282,464,846 | 8.0% |
| ALPHABET CLASS C | US02079K1079 | \$331,575,186,963 | \$1,112,165,927 | 8.0% |
| Intel Corp. | US4581401001 | \$217,375,753,627 | \$912,182,344 | 8.0% |
| NVIDIA Corp. | US67066G1040 | \$117,750,507,438 | \$2,407,217,462 | 8.0% |
| Equinix Inc. | US29444U7000 | \$35,528,946,835 | \$169,152,778 | 4.5% |
| Western Digital Corp. | US9581021055 | \$24,682,795,457 | \$297,808,563 | 4.5% |
| Xilinx Inc. | US9839191015 | \$17,287,750,447 | \$122,935,753 | 4.5% |
| TWITTER | US90184L1026 | \$17,091,824,564 | \$273,504,402 | 4.5% |
| NetApp Inc. | US64110D1046 | \$15,573,106,207 | \$111,622,140 | 4.5% |
| Seagate Technology Inc. | IE00B58JVZ52 | \$12,437,806,535 | \$152,628,512 | 4.5% |

Risk and return - overview

Risk and return characteristics¹⁾

| | STOXX Global Artificial Intelligence Index | STOXX Developed & Emerging Markets TMI |
|--------------------------------|--|--|
| YTD return | 6.1% | 4.5% |
| 1y return | 45.2% | 27.7% |
| 3y return | 24.9% | 12.3% |
| 5y return | 27.9% | 11.8% |
| 1y volatility | 13.5% | 5.6% |
| 3y volatility | 17.9% | 10.8% |
| 5y volatility | 17.7% | 10.3% |
| Maximum drawdown ²⁾ | -23.1% | -18.8% |
| 5y Sharpe ratio | 1.46 | 1.10 |

Index performance²⁾

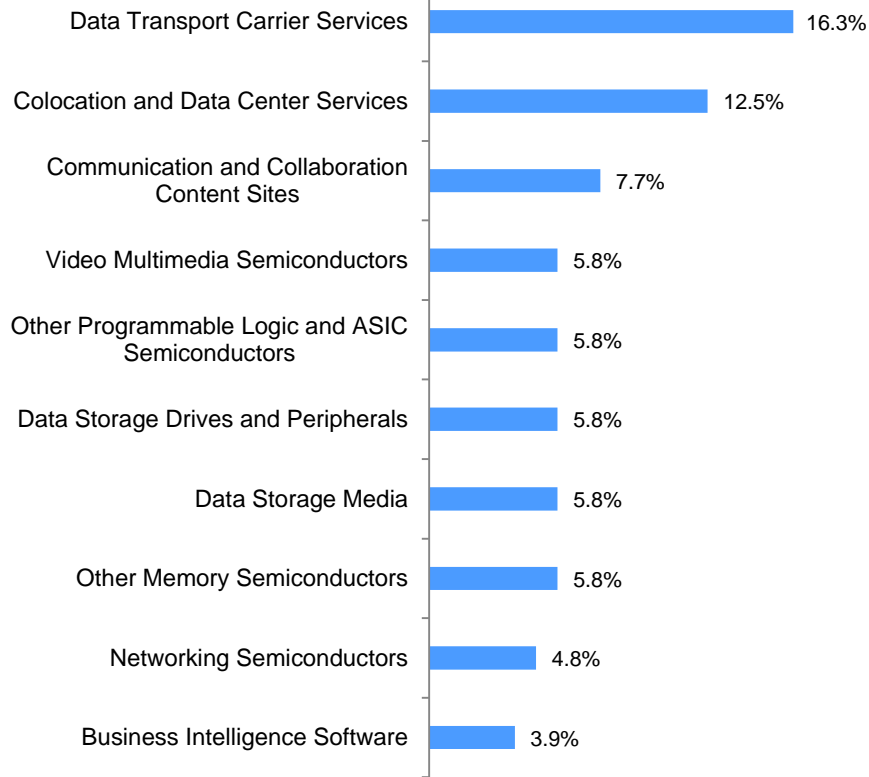


1) STOXX data as of 17 Jan. 2018. Annualised returns and annualised volatility (standard deviation) figures are used for returns other than YTD.

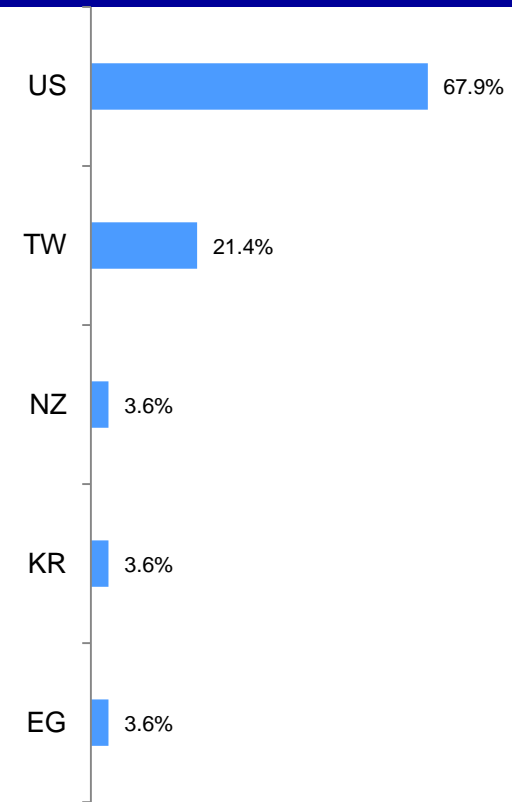
2) Computed for the period Jun. 2012 to Jan. 2018.

Industry and country allocation


Industry allocation [Top 10]¹⁾



Country allocation¹⁾



1) STOXX data as of Dec. 2017. Companies with exposure to multiple sectors are counted against all sectors.



2.2

Putting Big Data and AI to
use

- **STOXX AI Global
Artificial Intelligence Index**

Step1: Finding the Right Partner

Yewno

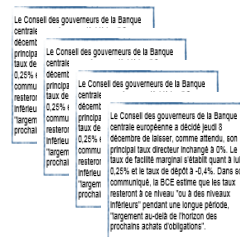
The logo for Yewno, featuring the word "Yewno" in a bold, black, sans-serif font on a light gray rectangular background.

- Yewno builds knowledge discovery software and services, leveraging machine learning, computational linguistics, and a vast reservoir of information from the most respected content providers in the world.
- Their technology began as academic research in applied mathematics. The goal was to understand political, economic, financial, and social data better.
- Headquartered in Redwood City, California, and with offices in New York and London.

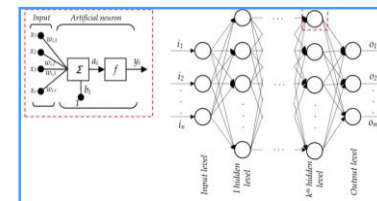
Step 2: Setting the Stage – The Development of Knowledge Graphs

The use of “Knowledge Graphs” to *understand* and *identify* Artificial Intelligence

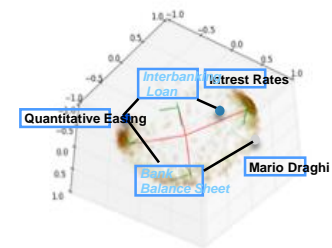
- Interpreting “**Artificial Intelligence**” as a **concept**.
- A concept** is an *abstraction of an idea, a thought, a theme or an expression portrayed in various forms.*
- Yewno’s **Knowledge Graph** is able to recognize a concept amongst an enormous volume of unstructured data and to project its significance into an inferential semantic space where such a concept is correlated to others so as to create a mesh of potential inferences.



Identification and extraction of concepts



Analysis of correlation and construction of Inferential space



Projection of Knowledge space and elaboration of Inferences

Step 3: Putting Knowledge Graphs to Use

Asset Universe

AI Patents

AI Producers & Consumers¹⁾

Knowledge graph assists decision making process on determining Patents that are related to AI.

Portfolio of companies with IP in AI, i.e., with granted patents that are related to Artificial Intelligence.

Global universe of asset constituents of the STOXX Developed and Emerging Market Total Market Index



List of International Patent Classification (IPC) Codes relevant for AI



US and International patents database



1) The analysis is repeated on a quarterly basis based on a 3 year historical time window.

Step 4: Defining AI IP Exposure and AI IP Contribution

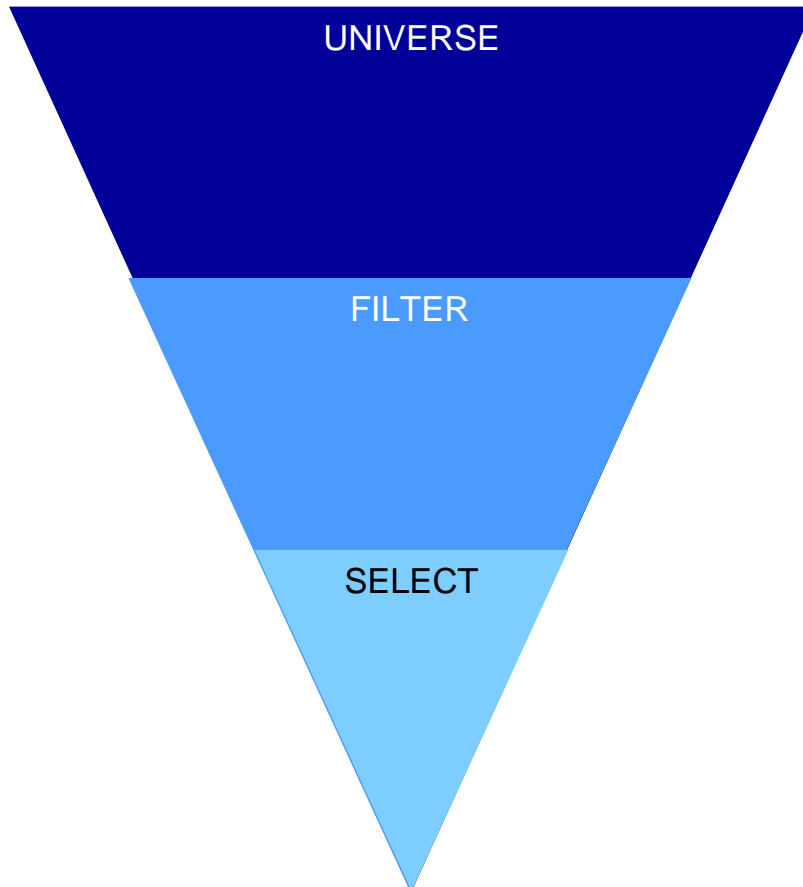
AI IP Exposure

- This measure indicates the **percentage of total AI patents** granted to a company vs. the total number of patents granted to that company over the same period.
- Indicates the significance of AI intellectual property to the company's business activities.

AI IP Contri- bution

- This measure indicates the percentage of total AI patents granted to a company vs. the total number of AI patents granted globally over the same period.
- Indicates the significance of each company in the AI space.

Step 5: Constructing the Index



- The index universe is the STOXX Developed & Emerging Markets TMI.

-
- Companies are included in the index if they own significant AI-related AI IP, indicated by having an:
 - AI IP Exposure as well as an
 - AI IP Contributionwhich falls into the top three fourth in both dimensions.

-
- Companies are equally weighted.

Index Constituents (top 10 by FF-MC)

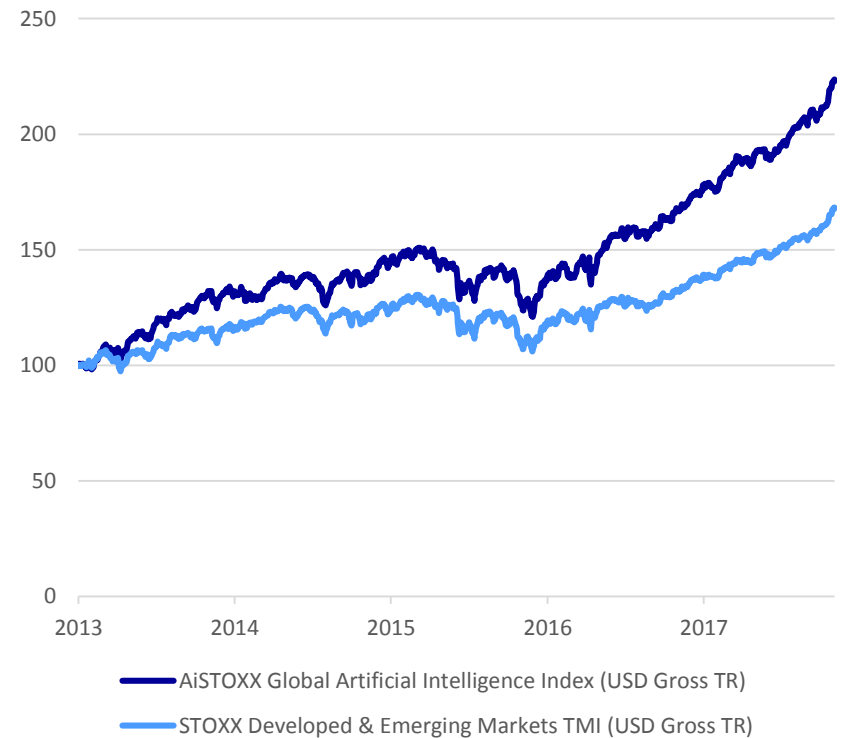
| Name | ISIN | FF-MC | 3-m ADTV | Weight |
|-----------------------------|--------------|-------------------|-----------------|--------|
| Apple Inc. | US0378331005 | \$911,249,581,611 | \$4,544,241,000 | 0.49% |
| Microsoft Corp. | US5949181045 | \$666,386,342,703 | \$1,733,159,000 | 0.49% |
| Amazon.com Inc. | US0231351067 | \$477,104,240,669 | \$3,851,007,000 | 0.49% |
| FACEBOOK CLASS A | US30303M1027 | \$428,603,657,802 | \$2,892,265,000 | 0.49% |
| JPMorgan Chase & Co. | US46625H1005 | \$380,007,918,714 | \$1,276,939,000 | 0.49% |
| ALPHABET CLASS C | US02079K1079 | \$331,575,186,963 | \$1,396,993,000 | 0.49% |
| Bank of America Corp. | US0605051046 | \$286,861,628,287 | \$1,857,400,000 | 0.49% |
| Samsung Electronics Co Ltd | KR7005930003 | \$280,032,240,541 | \$512,521,100 | 0.49% |
| AT&T Inc. | US00206R1023 | \$236,144,414,736 | \$1,305,403,000 | 0.49% |
| Verizon Communications Inc. | US92343V1044 | \$217,226,432,255 | \$829,992,800 | 0.49% |

Risk and Return Overview

Risk and return characteristics¹⁾

| | STOXX AI Global Artificial Intelligence Index | STOXX Developed & Emerging Markets TMI |
|--------------------------------|---|--|
| YTD return | 5.4% | 4.5% |
| 1y return | 34.6% | 27.7% |
| 3y return | 18.5% | 12.3% |
| 5y return | 18.4% | 11.5% |
| 1y volatility | 6.7% | 5.6% |
| 3y volatility | 11.4% | 10.8% |
| 5y volatility | 11.0% | 10.3% |
| Maximum drawdown ²⁾ | -19.9% | -18.8% |
| 5y Sharpe ratio | 1.56 | 1.07 |

Index performance²⁾



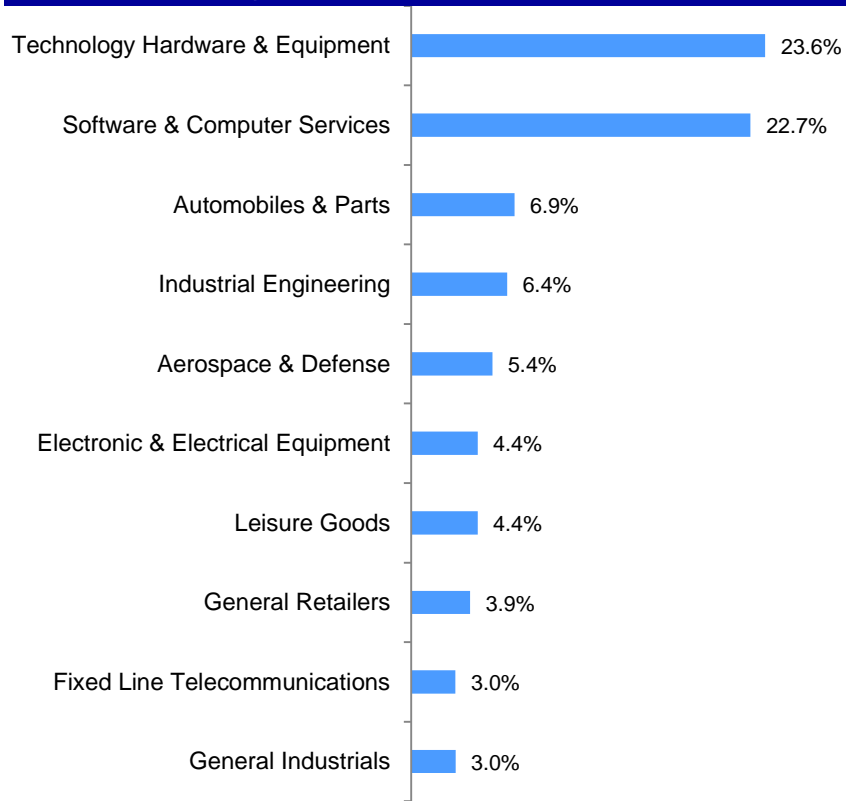
1) STOXX data as of 17 Jan 2018. Annualised returns and annualised volatility (standard deviation) figures are used for returns other than YTD.

5y values calculated from Mar. 2013 to Jan. 2018.

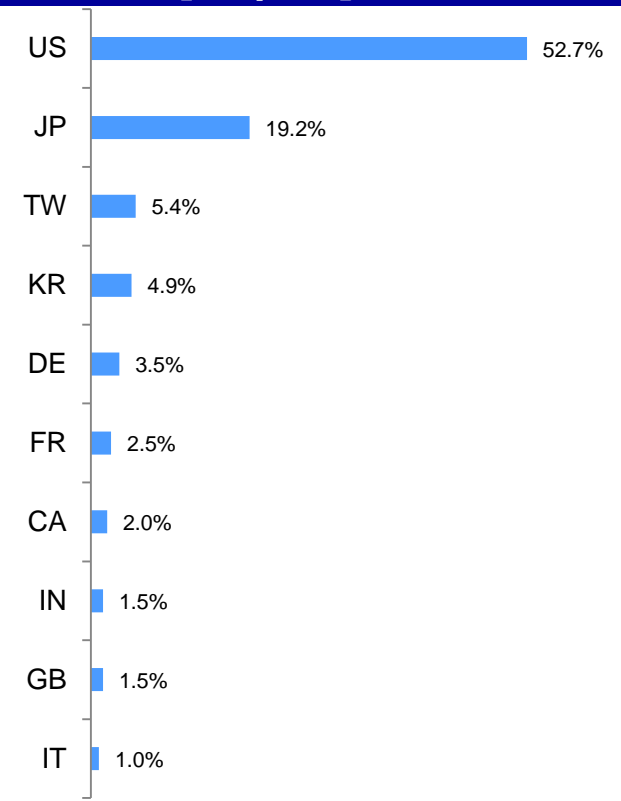
2) Computed for the period Mar. 2013 to Jan. 2018

Industry and country allocation

ICB Industry allocation [Top 10]¹⁾



Country allocation [Top 10]¹⁾



1) STOXX data as of Dec 18, 2017.



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