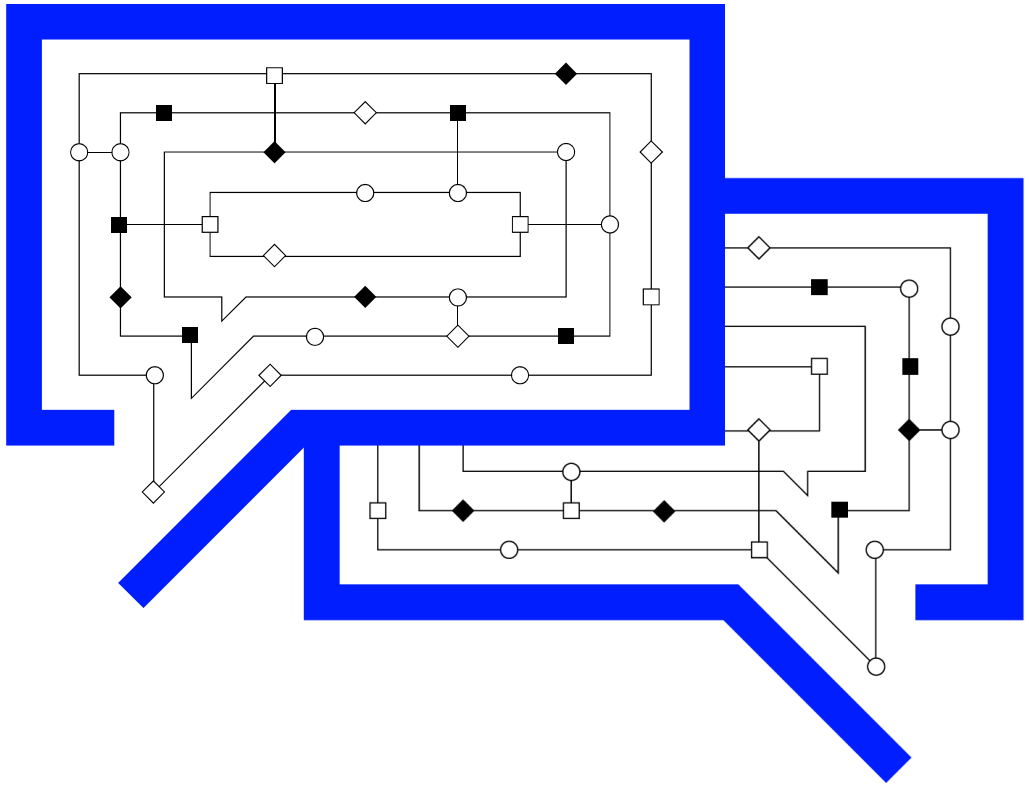
# REFINITIV™

DATA IS JUST
THE BEGINNING

# Agenda

- Introduction of Refinitiv
- Academia Research Support
- Partnership with WRDS



The Financial and Risk business of Thomson Reuters is now Refinitiv.

REFINITIV™

# Refinitiv: Who we are

The Financial and
Risk business of
Thomson Reuters
is now Refinitiv.

REFINITIV™

# Refinitiv launched in October 2018


**Blackstone Group LP** alongside **GIC** and **CPPIB** acquired 55% of the **Thomson Reuters Financial & Risk** unit

**Thomson Reuters** retains 45% equity stake


A bold new company, backed by one of the world's largest Private Equity firms, with focused investment in technology and product, and an accelerated pace of operation.

**We refine and deploy the world's data to power and connect global financial communities**

One of the world's leading investment firms repositions Refinitiv, focusing solely on the financial community and freeing up investment capital for growth.

# Our DNA - We have a rich 170 Year legacy as the first ever fintech

**1850**
PIGEON

Paul Julius Reuter used carrier pigeons and the new Calais-Dover cable to transmit stock market quotations

**1858**
CABLE

Cable from GB to U.S. laid, enabling Reuters to expand its expertise in global currency exchange

**1865**
TELEGRAPH

Reuters first to report President Lincoln assassination by telegraphing news to London

**1964**
STOCKMASTER

Market prices carried from New York to London for delivery around Europe on Stockmaster machines

**1973**
MONITOR

Monitor Money Rates Service launches, creating the first electronic marketplace for FX

**1980**
TRIARCH

Launched Trading Room Architecture (Triarch) – our first API

**1981**
DEALING

Reuters Monitor Dealing Service launches enabling FX trades via video. Quite literally the first social network

**1989**
DEALING 2000

Reuters launches Dealing 2000 enabling automated communication between traders and their back office

**1999**
REUTERS 3000XTRA

Private network links to Reuters. Gives live prices from global stock, commodity, futures, derivative and bond markets as well as FX price makers.

**2001**
RMDS

Reuters Market Data System launched to help clients integrate and distribute third-party data

**2006**
REP

Reuters Enterprise Platform launches, delivering a massive decrease in latency in the movement of complex financial content across a financial institution

**2007**
THOMSON REUTERS

Thomson and Reuters combine to form Thomson Reuters

**2010**
EIKON

Thomson Reuters launches next-generation desktop Eikon, providing access to trusted news, data & analytics for the financial community

**2013**
ELEKTRON

Enabling firms to function and run their operations by delivering powerful content and data integration services

**2016**
EIKON APP STUDIO

Open platform approach taken to a new level with Eikon App Studio and Thomson Reuters Professional Developer Community (TRPDC)

**2017**
ELEKTRON DATA PLATFORM

An open platform that supports an ecosystem where content, analytics and proprietary, customer and third-party technology come together to reveal hidden opportunities, potential risks and new pathways to profits

**2018**
OPEN CLOUD

Real-time pricing data and quantitative analytics easily accessible via cloud API

**2018**
**REFINITIV FORMATION**

Creation of the Refinitiv Brand, Company and new structure

**2019**
REFINITIV DATA PLATFORM

Unrivalled depth of coverage integrated with customer proprietary data and third-party sources. Introduced Refinitiv Wealth Advisor

# Creates a new global financial markets infrastructure leader

**London Stock Exchange Group**

- A leading global financial market infrastructure business
- Successful open access philosophy and customer partnership approach
- Systemically important, world-class businesses serving global customer base
- Leading global OTC clearer with over $1,000tn of notional cleared in 2018: **LCH**
- Leading global multi-asset index company with $15tn in AuM and $705bn ETF AuM: **FTSE Russell**
- Leading European equities trading business
- Strong track record of top-line organic growth and strategic M&A

**2018 Revenue: £2.1bn [1]**
**2018 Adj. EBITDA: £1.1bn**

1. **GLOBAL SCALE AND GEOGRAPHIC DIVERSIFICATION**
2. **WORLD CLASS DATA CONTENT, MANAGEMENT AND DISTRIBUTION CAPABILITY**
3. **MULTI-ASSET CLASS CAPITAL MARKETS FUNCTIONALITY**

**REFINITIV**

- A leading global provider of data, analytics and financial markets solutions
- Open platform promoting partner community, solutions and efficiency
- Global reach and significant customer connectivity
- Best-in-class capabilities in data collection, management and distribution
- Leading trading venues in FX and fixed income: **FXall** and **Tradeweb**
- 150,000 data sources, over 10,000 data partners and 24,000 developer community
- Significant recent investment to accelerate growth
- High quality, highly recurring subscription revenue base

**2018 Revenue: £4.3bn [2][3]**
**2018 Adj. EBITDA: £1.5bn [3]**

**Note:**
(1) Revenue includes treasury income and other income
(2) Revenue adjusted for business not transferred and excludes recoveries
(3) Refinitiv's performance for the 12 months to 31 December 2018 has been translated from USD to GBP using an FX rate of 1.34

# We support communities of customers across the breadth of the financial sector

**Our Customers*** → **Our User Communities**

| Our Customers* | | Our User Communities |
|---|---|---|
| HSBC, 中国银行 BANK OF CHINA, Goldman Sachs, UBS, BARCLAYS | SELL-SIDE | TRADING |
| BLACKROCK, Fidelity INVESTMENTS, Invesco, GIC, Schroders, CPP INVESTMENT BOARD | FINANCIAL BUY-SIDE | INVESTING & ADVISORY |
| coinbase, credit karma, Revolut, robinhood | NEW 'TECH' ENTRANTS | WEALTH MANAGEMENT |
| vodafone, Shell, EUROPEAN CENTRAL BANK, bp, pwc, BANK OF JAPAN, BCA, 中国人民银行 THE PEOPLE'S BANK OF CHINA | NON-FINANCIAL BUY-SIDE | RISK AND COMPLIANCE MANAGERS |

**GLOBAL FINANCIAL COMMUNITY**

**40k** customers

**190** countries

**500k** users

*Illustrative

# Our content coverage is unmatched, doubling in scale annually

**3.5 MILLION**
Reuters News Headlines across 45,000 companies

**8,000**
Real-Time Newswires, Global press and Web News sources

**16 MILLION**
Active exchange traded & OTC derivatives

**2.6 MILLION**
Fixed income instrument evaluations daily

**49 MILLION**
Estimates and KPIs annually

**9.5 MILLION**
Fixed income securities

**68,000**
Active public companies

**375,000**
Company events

**52.8 MILLION**
Research pages per year from 1,300 firms

**600,000**
Indices covered

**140 BILLION**
OTC ticks per year

**9.5 MILLION**
Active Economic time series spanning 40 years

**92.5 MILLION**
Company financial data points per year

**1.2 MILLION**
Equity quotes from 325 exchanges

**8 MILLION**
Private companies covered

**102,000**
Deals Transactions annually

**32,000**
World-Check records created monthly

**4.1 MILLION**
Reports covering both individuals and entities on World-Check

**2 BILLION**
Information triples

**40 BILLION**
Market data updates delivered every day

# Academia research solution

# What data are most used by academia from Refinitiv

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# Partnership with WRDS

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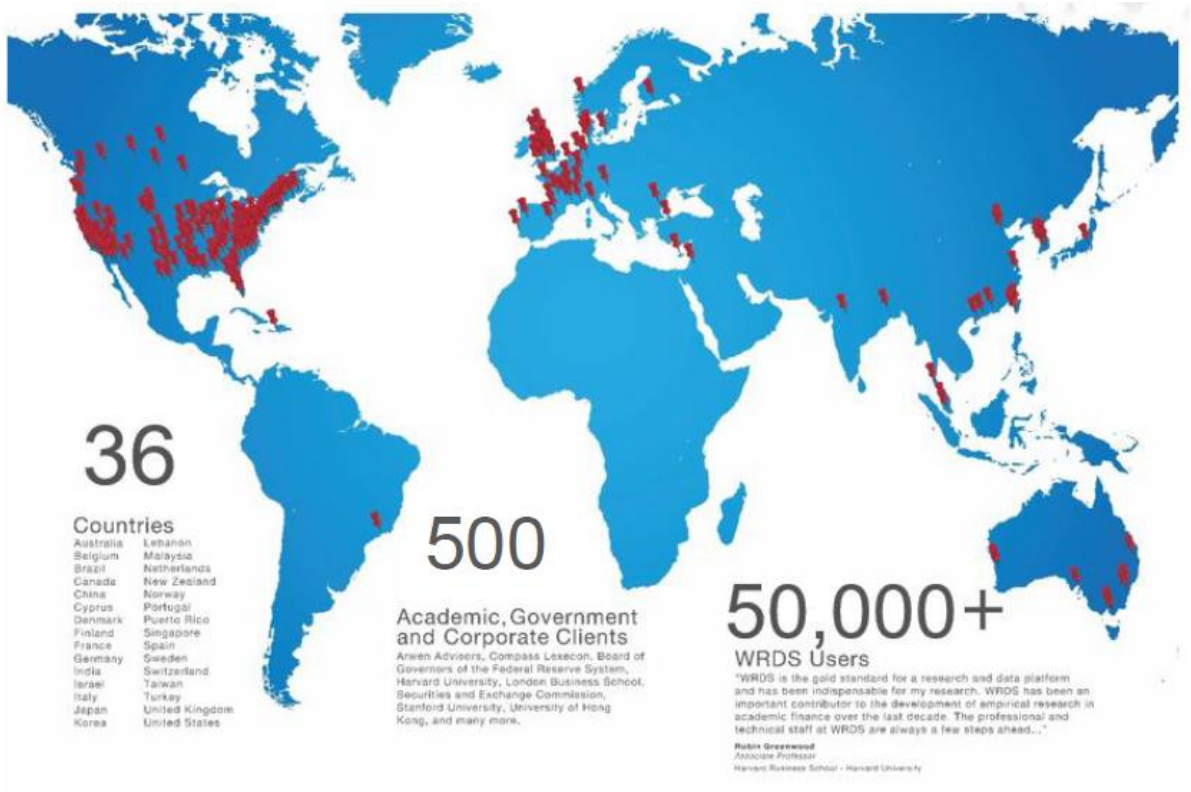
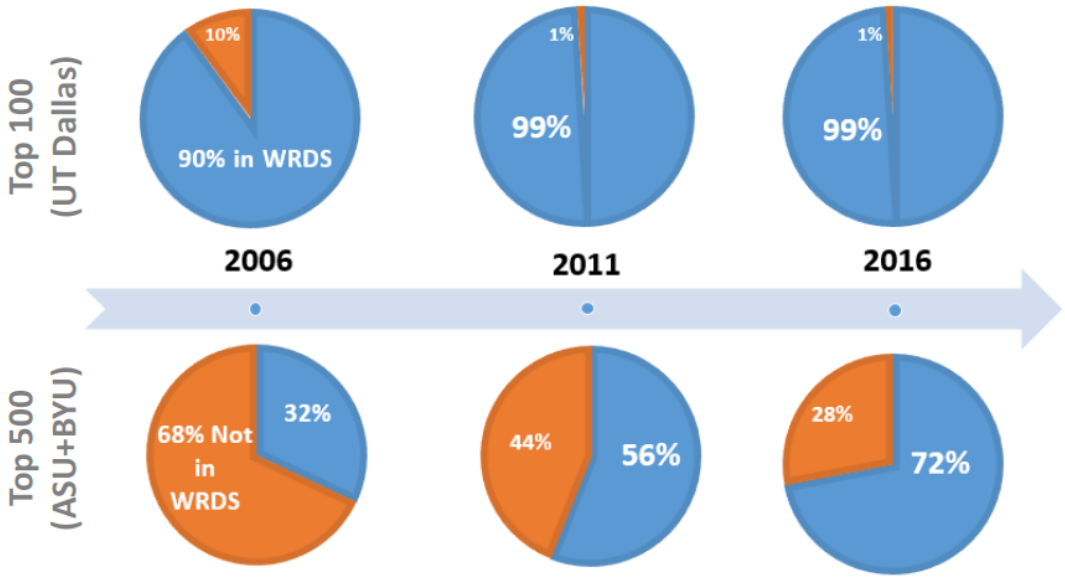
Wharton
UNIVERSITY of PENNSYLVANIA




## WRDS Among Top Tier Research Schools



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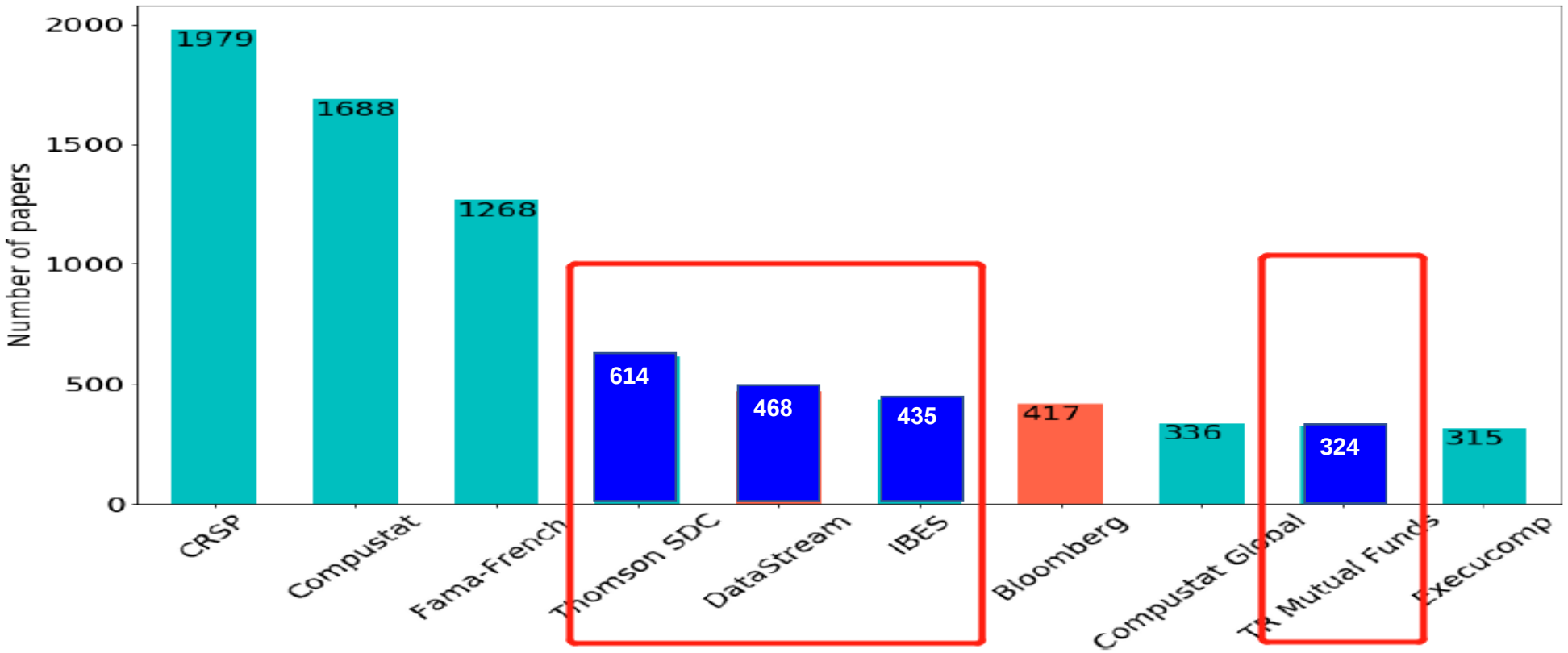
DATA IS JUST THE BEGINNING

# Partnership with WRDS



# SDC via WRDS

SDC MERGERS & ACQUISITIONS is the industry-standard source of investment banking transaction terms and conditions, covering 2 million M&A, bond and equity deals dating to the late 1970s. Comprehensively curated by Refinitiv's international team of expert analysts from thousands of primary and secondary sources, SDC deals content via WRDS features over 100 data points to power advanced analysis of deal structures, market trends and participant relationships in a fully normalized database. SDC via WRDS includes the full history of SDC M&A, including outright acquisitions, stake purchases, joint ventures and repurchases. The SDC M&A database is frequently used in conjunction with the SDC New Issues database.

SDC NEW ISSUES provides industry-leading capital markets transactions information to the global deal-making industry, comprising over 1 million global new debt deals priced since the 1970s and over 380,000 global equity and equity-related deals since the 1980s. SDC via WRDS includes a full history of SDC New Issues, including equity and equity-linked offerings plus corporate, FIG, sovereign/agency and securitized bond issues. The SDC New Issues database is frequently used in conjunction with the SDC M&A database.

## SDC M&A（SDC并购）

跟踪持续经营的最终母公司层面的经济所有权变动，包含150多个数据元素，包括目标公司及收购方简介、交易条款、财务顾问、法律顾问、股本溢价、摘要历史、交易状况等等。涵盖1970年以来的数据。

## SDC NEW ISSUES（SDC新发行证券）

访问全球股票和股权相关证券的发行数据，包括发售普通股（包括首次公开募股、二次发售、144a规则股票发售）、可转债和可转换优先股。

# Datastream via WRDS

REFINITIV DATASTREAM provides a historic global time series data to get the complete picture on any macro environment. Datastream allows for a better understanding of economic cycles to identify trends, generate and test hypotheses, and develop viewpoints and research. Loaded with 70 years of information across a mix of key asset classes.

## Historical Financial Time Series Databases

- 70 years of historical data
- Across 175 countries and 60 global markets
- Over 39 million individual instruments or indicators
- Totaling over 380 million time series

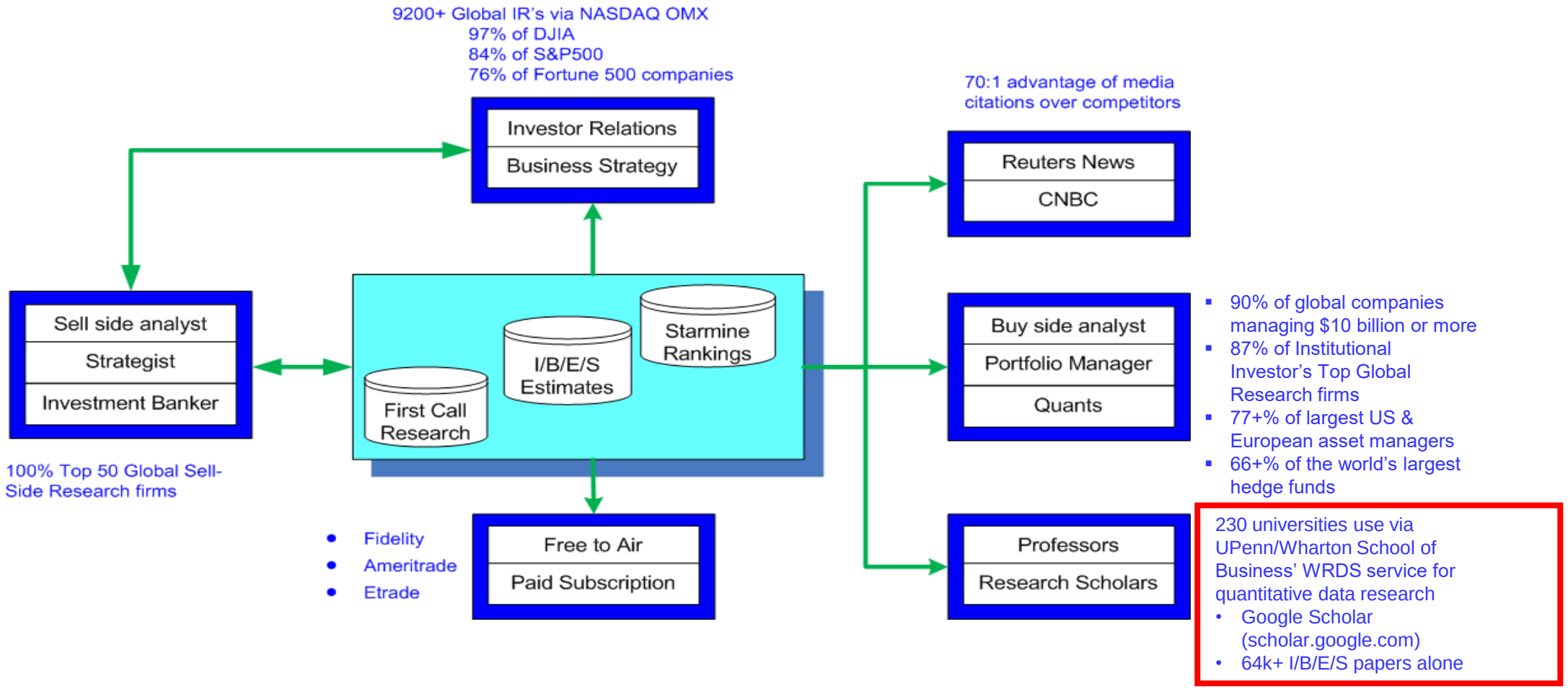
## Content

- Global Macroeconomics
- Equities
- Equity Indices and Bond Indices
- Bond
- Commodity
- Futures and Options
- Mutual Funds and Investment Trusts
- Interest Rates
- Exchange Rates
- Credit Default Swaps
- Constituent Lists

# I/B/E/S via WRDS

## NETWORK EFFECT

**The value of a service increases as more people use it**



# I/B/E/S Value Proposition

**COVERAGE**
**22K+** companies
**900+** contributors
**100+** countries
**270+** KPI & Other Measures across 15 industries

**HISTORY**
**56k+** companies covered
North America covered since **1976**
Other Markets covered since **1987**


**ANALYTICS**
Patented Starmine **Smart Estimates**
Predicted Surprise & Analyst Performance data

**GUIDANCE**
Comparable Guidance for **14 measures**
History since **1994**

**QUALITY & SPEED**
**40+** Years Collection Experiences
**Time Tested** Methodologies of work
**World class QC/Audit systems**
**Preliminary** Estimates
**Real-time** updated on Desktop & Datafeeds

**AGGREGATES**
History from **1985**
**15000+** indices across 13 measures
**112**+ datatypes
Earnings at country/index/market/sector

# I/B/E/S via WRDS

**REFINITIV® I/B/E/S® ESTIMATES** delivers a complete suite of estimates content with the broadest global view and the largest contributor base in the industry. Over 40 years of collection experience and extensive quality controls, including thousands of automated error checks and stringent manual analysis, establish us as a leader and give our clients the content they need for superior insight and research. Our consensus estimates are calculated using only underlying estimates that have been created on the same basis, giving maximum comparability between companies. Coverage is available from 1976.

**REFINITIV® I/B/E/S® GUIDANCE** in conjunction with Refinitiv® I/B/E/S® Estimates provides comments and insight directly from management about a company's future expectations. This is a global database with over 15,000 companies in 55 countries and history back to 1994. When used in conjunction with Refinitiv® I/B/E/S® Estimates, Guidance allows academic clients to directly compare analyst and management expectations on company performance. Academics can conduct analysis confidently knowing that a consistent accounting framework is used across companies.

**REFINITIV® I/B/E/S® GLOBAL AGGREGATES** with history from 1985, helps you assess the risks, value and growth opportunities across industries, sectors, indexes and markets. It provides bottom-up earnings forecasts plus related data for 56 countries and major international indices, with data as far back as 1985. This powerful service provides a unique source of data for use in many global investment applications, including global asset allocation, cross-border valuation, sector and industry aggregation, and derivatives.

**REFINITIV® I/B/E/S® KEY PERFORMANCE INDICATORS** let you dig even deeper into the specific metrics that give you better insight into current and future company earnings. These are the telling details that set your analysis apart. Same-store sales in retail; rent per unit in real estate; net and gross premiums in insurance; refining and supply in energy. All told, over 200 key performance indicators across key sectors and industries are available, with continued expansion in the future.

# THOMSON REUTERS I/B/E/S

## EXPANDED KEY PERFORMANCE INDICATORS FOR DEEP INSIGHT & ANALYSIS

Now available in Thomson Reuters leading desktop products & feed platforms.


### ENERGY & MINING

30+ including Total & Daily Production, Realized Prices, Cash Costs


### TECH & TELECOM

10+ including R&D Expense, Subscribers, CHURN, Average Revenue per Unit, Acquisition Costs

### HEALTHCARE & PHARMA

Including Drug Unit Sales, by Product

### RETAIL

10+ including Same Store Sales, by Segment # of Stores, Floor Space

### INSURANCE

15+ including Net/Gross Premiums Earned/Written, Combined/Catastrophic Loss/Claims Ratios

### AIRLINES

10+ including Passenger Load Factor, Revenue Passenger Miles


### BANKING & FINANCE

30+ Market leading metrics including Net Interest Income, Tier 1 Capital Ratio, Non-Performing Assets, Deposits

### REAL ESTATE, HOTELS & HOMEBUILDERS

30+ including NAREIT FFO p/s, NOI, Rent per SF, Development Costs, Vacancy Rate, New Orders/Backlogs/Deliveries

THOMSON REUTERS™

Learn more about the newly expanded I/B/E/S Key Performance Indicators offering, contact a local sales representative.1-877-365-1455 or go to financial.thomsonreuters.com

# IBES - Fast facts

•Why Refinitiv?

**I/B/E/S**

**90%**

of companies worldwide managing USD 10 billion or more

**100%**

of Institutional Investor's Top Global Research Firms

**77%**

of largest U.S. and European asset managers

**50+%**

of the world's largest hedge funds

23 of Top 30 largest brokers

use StarMine Research View to validate data

StarMine SmartEstimate™, Predicted Surprise and Analyst Performance data reveals unique insight by overweighting the most accurate analyst estimates

StarMine is globally recognized as the **gold standard** in objective measurement of analyst performance

# Ownership via WRDS

## Ownership

### Who Owns What

- Substantial shareholdings
- Insider transactions & summary
- Mutual Fund Aggregates
- Full Shareholdings (UK Market)

- Shareholdings
- Equity Value
- Buys & Sells
- Insider holdings
- Free Float
- Strategic & Non-strategic Holders

### MUTUAL FUNDS （共同基金）

提取了向美国证监会汇报持仓的所有注册共同基金以及3,000只全球基金的证券持仓信息。

### 13F INSTITUTIONAL HOLDINGS （13F表机构持仓）

访问由管理资产达到或超过1亿美元的机构管理人，向美国证监会备案的13F表上报告的机构普通股持仓和交易

### INSIDER FILINGS（内幕人士备案，IFDF）

收录表3、4、5和144上每一行详细报告的所有美国内幕人士活动。汤森路透采用独特的净化程序，对报告数据的准确性进行系统性诠释，并插入“净化”字段作对比，使数据库更有价值。

### GLOBAL OWNERSHIP HOLDINGS （全球股权持股）

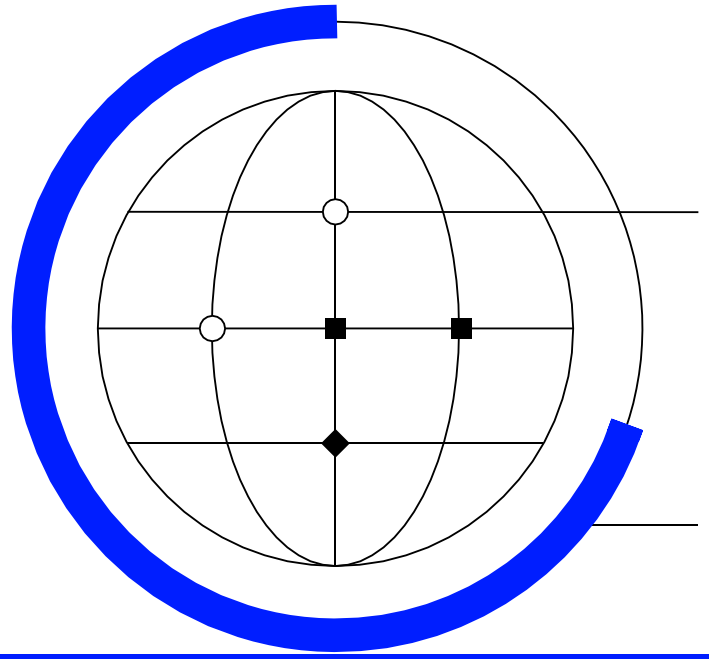
访问有关机构、共同基金和内幕人士的全面全球股权持股数据。股权数据涵盖13F表上机构、共同基金、退休基金、保险基金、内幕人士以及在逾70个国家进行证券交易的应申报持股人和英国股票名册

# ESG via WRDS

Refinitiv recognizes the increasingly critical importance of transparent, accurate and comparable ESG data for the financial industry.

*Data accurate as of May 2020

## At Refinitiv, our ESG data covers:



**76**
countries

**80%**
of global market cap

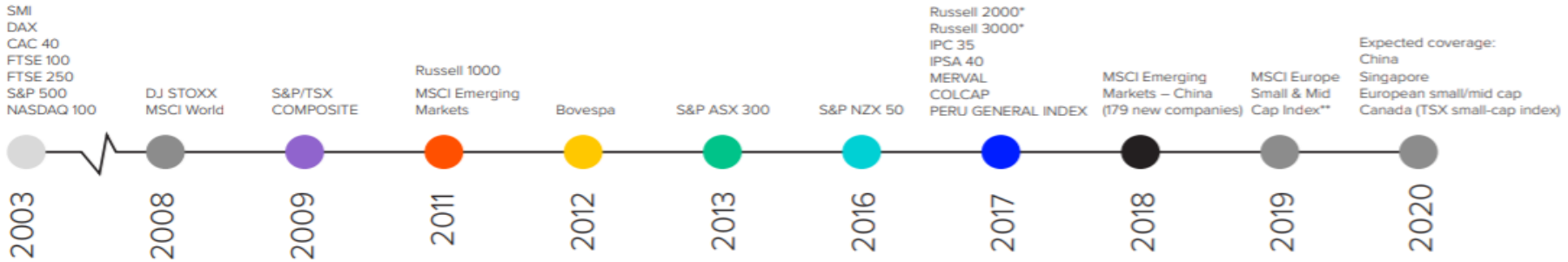
**10K** companies with ESG data

**450+** ESG metrics, including scores and grades

**1.8M** officers and directors

**2002** History from

# ESG Global Coverage


*Market cap > 400MM USD
** 1.1k companies covered



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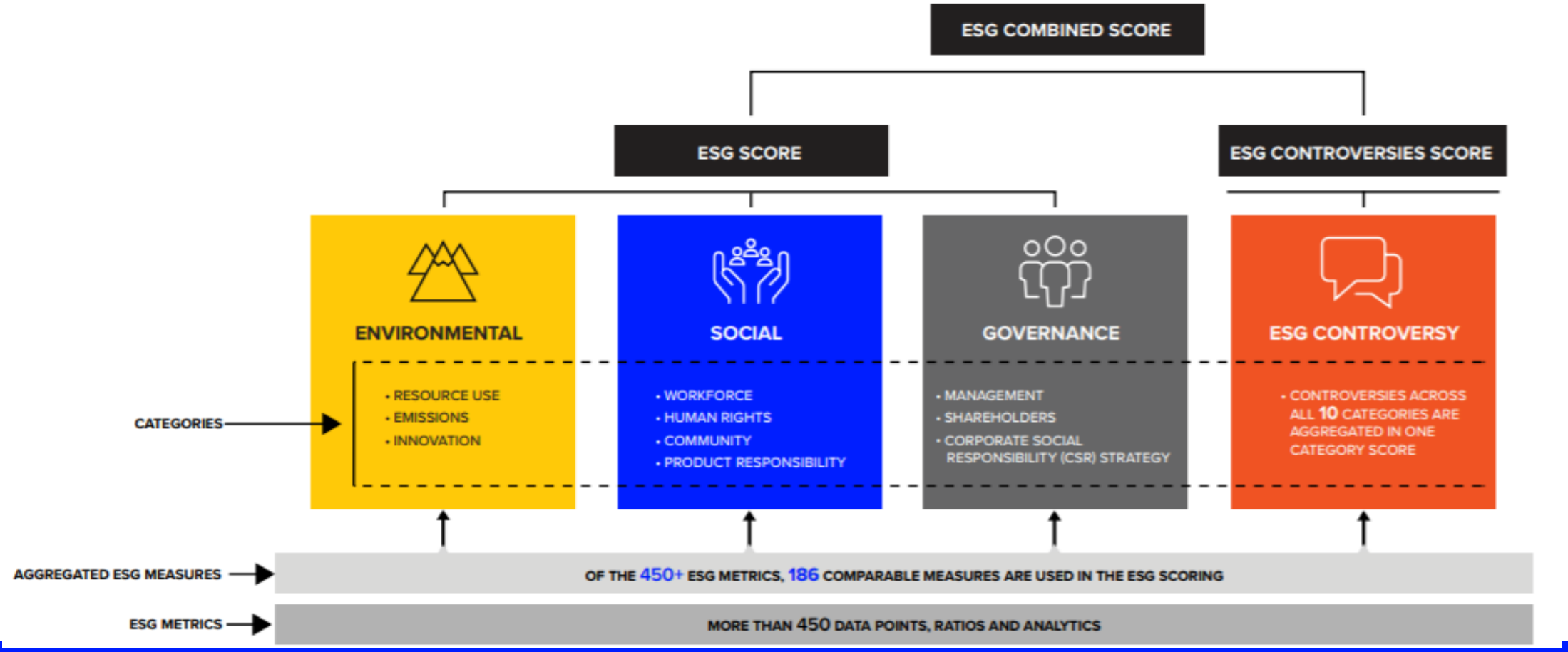
# Core ESG Data Model



# Other Content via WRDS

## WORLDSCOPE

访问全面、准确、及时的基本面和股票数据，在分析公司时优势显著，其全球覆盖率前所未见。尽管大型交易所已经在统一方面有了进步，但财务会计实务仍然各不相同，公司报告依然极不一致。汤森路透Worldscope用统一的定义和标准化的报表结构来解决这一复杂问题。

## THOMSON REUTERS LIPPER HEDGE FUND （汤森路透理柏对冲基金）（前身为TASS）

数据收录了逾7,500只主动呈报的对冲基金/对冲基金之基金的量化表现数据，以及逾11,000只已经清盘或停止呈报的退场基金。

## REUTERS DEALSCAN （路透DEALSCAN）

这个强大的数据库是有关全球银团贷款市场广泛可靠信息的卓越来源，收录逾240,000宗贷款交易的详尽条款和条件。

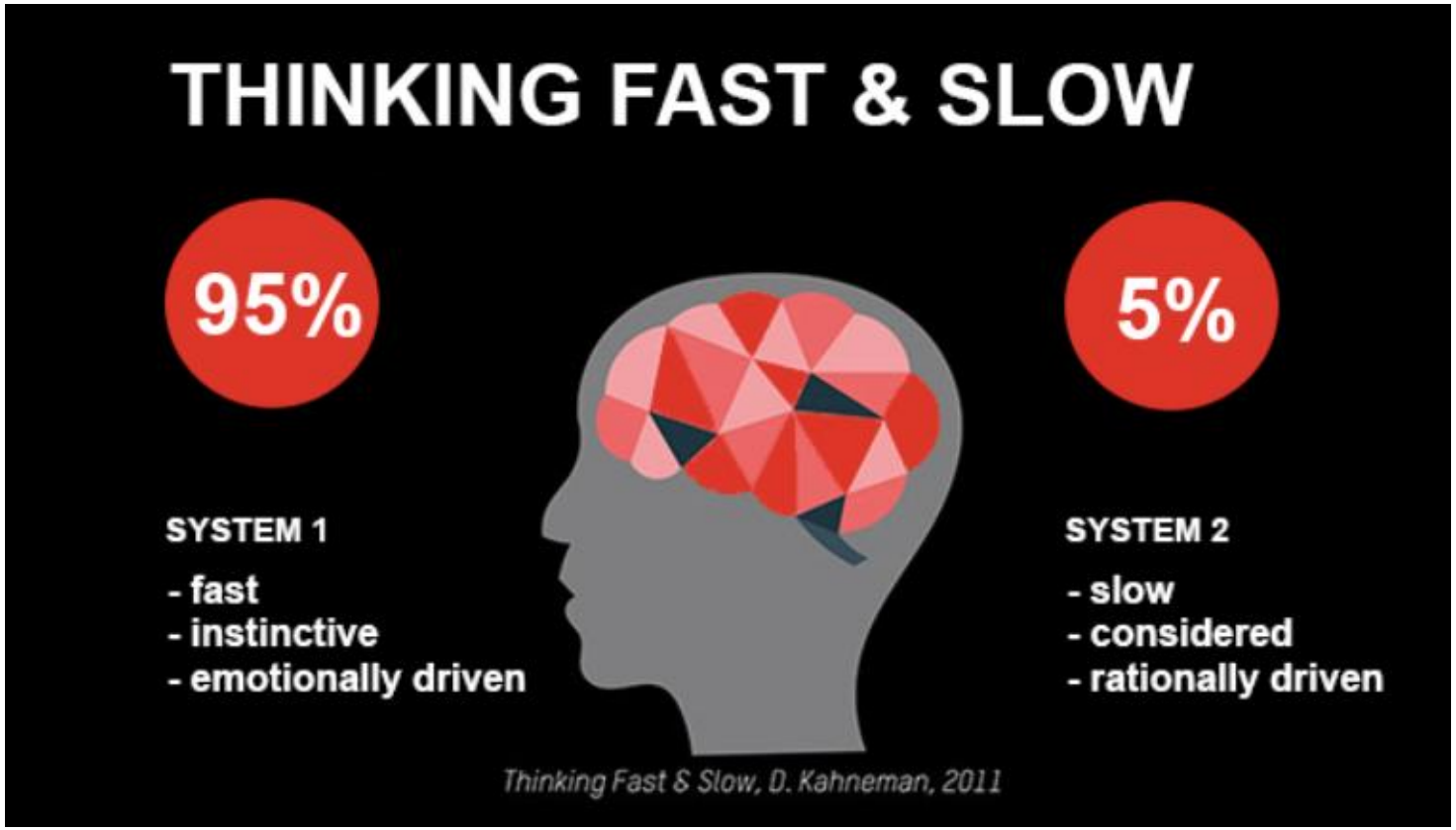
# Decision fatigue and heuristic analyst forecasts

Hirshleifer et al, 2019, JFE

# Analyst forecast behavior literature review

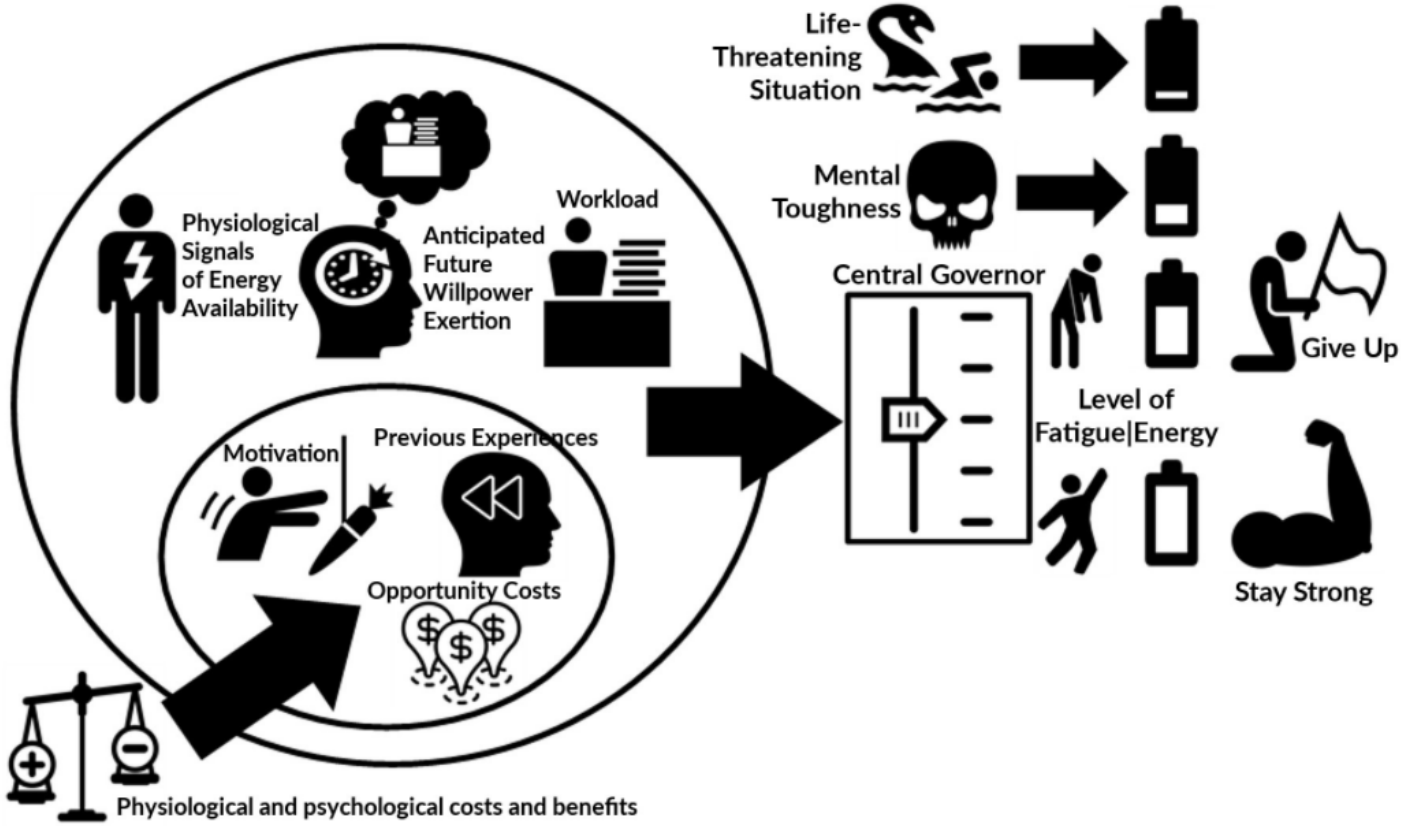
Judgements and decisions made under greater pressure distraction, or fatigue tend to be made more heuristically

Heuristic decision making:
-conforming forecasts to the consensus or reiterating a previous forecast




Non- Heuristic decision making:
-requires more mental resources
- Produce higher-quality forecasts

# Analyst forecast behavior literature review




Ego depletion → decision fatigue

Parole judges rule less favorably toward prisoners as the morning approaches lunchtime and as the afternoon approaches the end of workday

# Author’s hypothesis

Hypothesis 1: An analyst’s relative forecast accuracy decreases with the number of forecasts the analyst has made earlier in the day.

Hypothesis 2: The likelihood that an analyst herds increases with the number of forecast and analyst has made during that day.

Hypothesis 3: The likelihood that an analyst reissues an outstanding previous forecast increases with the number of forecasts the analysts has made during the day.

Hypothesis 4: The likelihood that an analyst issues a rounded forecast increases with the number of forecasts the analyst has made during the day.

Hypothesis 5: The more forecasts an analyst has issued earlier in the same day, the weaker the reaction of investors when the analyst issues a forecast revision.

# Data and Methodology

Analysts' one-year ahead EPS forecast 2002-2015→ Institutional Brokers' Estimate System (I/B/E/S)

Limit the sample estimates between the working hours of 9am and 7pm.

Define key variables:

Decision rank: the log of the number of forecasts an analyst has issued+1 (Proxy for Decision Fatigue)

Relative accuracy: $= \frac{Median\ forecast\ error\ of\ all\ analysts_{j,t} - Analyst's\ forecast\ error_{i,j,t}}{Standard\ deviation(Forecast\ error\ of\ all\ analysts_{j,t})}$

Herding: binary variable 1 or 0

Reissue: dummy variable 1 or 0

Rounding: dummy variable 1 or 0

| Number of forecasts per day | Number of analyst days | Number of forecasts |
|---|---|---|
| 1 | 255,613 | 255,613 |
| 2 | 27,975 | 55,950 |
| 3 | 6536 | 19,608 |
| 4 | 2796 | 11,184 |
| 5 | 1559 | 7795 |
| 6 | 1020 | 6120 |
| 7 | 766 | 5362 |
| 8 | 534 | 4272 |
| 9 | 405 | 3645 |
| ≥ 10 | 1326 | 17,375 |
| Average: 1.3 | Total: 298,530 | Total: 386,924 |

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# Results – Accuracy – hypothesis 1

$$Relative\ accuracy_{i,j,t} = \alpha + \beta_1 Decision\ rank_{i,j,t} + \beta_2 Controls + \epsilon_{i,j,t},$$

**Table 3**
Relative accuracy and decision fatigue.
The dependent variable is as follows: *Relative accuracy*$_{i,j,t}$ is analyst *i*'s EPS forecast error of company *j* at day *t*. This EPS forecast error is compared to the median EPS forecast error for all analysts issuing EPS forecast error for company *j* up until day *t* (consensus). The relative accuracy is standardized across firms by deflating the standard deviation of EPS forecasts error across all analysts who cover the firm. The independent variables are as follows: *Decision rank* is the log value of the number of forecasts an analyst has made before the forecast being evaluated, plus one. Definitions of the control variables are provided in Appendix A. *t*-statistics are provided in parentheses with heteroskedastic-consistent standard errors clustered at the analyst level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| *Decision rank* | −0.303*** | −0.225*** | −0.181*** | −0.169*** | −0.042** | −0.067*** |
| | (−22.90) | (−16.71) | (−9.60) | (−9.11) | (−2.08) | (−2.85) |
| *Time of day* | | −0.007*** | | −0.006*** | | 0.006 |
| | | (−6.12) | | (−4.65) | | (1.17) |
| *Firm experience* | | 0.137*** | | 0.046*** | | 0.041* |
| | | (14.08) | | (3.17) | | (1.74) |
| *Broker size* | | 0.038*** | | 0.033 | | 0.006 |
| | | (3.26) | | (1.18) | | (0.11) |
| *Effort* | | 0.024** | | −0.088*** | | −0.101*** |
| | | (2.22) | | (−6.00) | | (−3.71) |
| *Firms followed* | | 0.004 | | 0.016 | | 0.022 |
| | | (0.32) | | (0.80) | | (0.54) |
| *Forecast age* | | −0.183*** | | −0.170*** | | 0.044 |
| | | (−15.93) | | (−12.40) | | (1.16) |
| *NUMEST* | | −0.232*** | | −0.184*** | | −0.088*** |
| | | (−46.10) | | (−25.51) | | (−6.65) |
| Constant | 0.693*** | 1.224*** | 0.599*** | 1.151*** | 0.491*** | 0.706*** |
| | (64.10) | (61.68) | (41.20) | (39.23) | (31.76) | (12.85) |
| Fixed effects | N | N | Analyst | Analyst | Analyst−day | Analyst-day |
| Adjusted *R*-squared | 0.001 | 0.010 | 0.045 | 0.049 | 0.398 | 0.398 |
| Observations | 386,924 | 386,924 | 386,924 | 386,924 | 386,924 | 386,924 |

# Results – Herdings – Hypothesis 2

$$Pr\left(Herding_{i,j,t}\right) = f\left(\alpha + \beta_1 Decision\ rank_{i,j,t} + \beta_2 Controls + \epsilon_{i,j,t}\right).$$

**Table 4**
Herding and decision fatigue.
The dependent variable, $Herding_{i,j,t}$, is a binary variable with a value of one if analyst $i$ forecast of company $j$ at time $t$ is between the consensus forecast at time t and his own previous forecast, and zero otherwise. The independent variables are as follows: *Decision rank* is the log value of the number of forecasts an analyst has made before the forecast being evaluated, plus one. Definitions of the control variables are provided in Appendix A. $z$-statistics are provided in parentheses with heteroskedastic-consistent standard errors clustered at the analyst level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| *Decision rank* | 0.348*** | 0.267*** | 0.167*** | 0.162*** | 0.082** | 0.086** |
| | (13.03) | (10.05) | (7.49) | (7.18) | (2.40) | (2.04) |
| *Time of day* | | 0.008*** | | 0.003* | | 0.003 |
| | | (3.87) | | (1.73) | | (0.33) |
| *Firm experience* | | −0.008 | | 0.170*** | | 0.009 |
| | | (−0.37) | | (5.39) | | (0.25) |
| *Broker size* | | −0.058** | | 0.093** | | 0.216** |
| | | (−2.18) | | (2.18) | | (2.48) |
| *Effort* | | 0.006 | | 0.141*** | | 0.074 |
| | | (0.23) | | (6.09) | | (1.60) |
| *Firms followed* | | 0.064* | | −0.006 | | 0.060 |
| | | (1.83) | | (−0.19) | | (0.93) |
| *Forecast age* | | −0.170*** | | −0.137*** | | −0.243*** |
| | | (−8.76) | | (−7.96) | | (−3.45) |
| *NUMEST* | | 0.217*** | | 0.182*** | | 0.145*** |
| | | (21.30) | | (14.13) | | (6.89) |
| Constant | −1.199*** | −1.620*** | | | | |
| | (−53.41) | (−41.47) | | | | |
| Fixed effects | N | N | Analyst-firm | Analyst-firm | Analyst-day | Analyst-day |
| Pseudo $R$-squared | 0.0009 | 0.0048 | 0.0002 | 0.0016 | 0.0001 | 0.0013 |
| Observations | 324,456 | 324,456 | 263,839 | 263,839 | 61,276 | 61,276 |

# Results – Reissued forecasts – Hypothesis 3

$$Pr(Reissue_{i,j,t}) = f(\alpha + \beta_1 Decision\ rank_{i,j,t} + \beta_2 Controls + \epsilon_{i,j,t}).$$

**Table 5**

Reissuance of a previous outstanding forecast and decision fatigue.

The dependent variable, $Reissue_{i,j,t}$, is a binary variable with a value of one if analyst $i$ forecast of company $j$ at time $t$ is the reissuance of her own previous forecast, and zero otherwise. The independent variables are as follows: *Decision Rank* is the log value of the number of forecasts an analyst has made before the forecast being evaluated, plus one. Definitions of the control variables are provided in Appendix A. $z$-statistics are provided in parentheses with heteroskedastic-consistent standard errors clustered at the analyst level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| *Decision rank* | 1.230*** | 1.151*** | 1.419*** | 1.349*** | 1.845*** | 1.927*** |
| | (28.98) | (27.90) | (117.95) | (110.68) | (57.79) | (39.00) |
| *Time of day* | | 0.022*** | | 0.027*** | | −0.014** |
| | | (6.20) | | (26.48) | | (−2.30) |
| *Firm experience* | | 0.089*** | | 0.230*** | | 0.052 |
| | | (3.92) | | (12.57) | | (1.35) |
| *Broker size* | | 0.558*** | | 0.434*** | | −0.048 |
| | | (19.74) | | (17.81) | | (−0.59) |
| *Effort* | | 0.088*** | | 0.105*** | | −0.017 |
| | | (3.30) | | (8.19) | | (−0.40) |
| *Firms followed* | | −0.080*** | | −0.045** | | −0.053 |
| | | (−2.99) | | (−2.48) | | (−0.85) |
| *Forecast age* | | −0.798*** | | −0.893*** | | −0.972*** |
| | | (−61.24) | | (−84.97) | | (−17.75) |
| *NUMEST* | | 0.106*** | | 0.183*** | | 0.113*** |
| | | (8.39) | | (21.87) | | (5.60) |
| Constant | −0.571*** | −0.673*** | | | | |
| | (−17.30) | (−11.16) | | | | |
| Fixed effects | N | N | Analyst-firm | Analyst-firm | Analyst-day | Analyst-day |
| Pseudo $R$-squared | 0.02 | 0.03 | 0.02 | 0.04 | 0.10 | 0.11 |
| Observations | 696,884 | 696,884 | 653,156 | 653,156 | 52,252 | 52,252 |

# Results – Rounding – Hypothesis 4

$$Pr(Rounding_{i,j,t}) = f(\alpha + \beta_1 Decision\ rank_{i,j,t} + \beta_2 Controls + \epsilon_{i,j,t}).$$

**Table 6**
Rounding and decision fatigue.
The dependent variable, $Rounding_{i,j,t}$, is a binary variable with a value of one if analyst $i$'s forecast of company $j$ at time $t$ ends with a zero or five in the penny digit, and zero otherwise. The independent variables are as follows: *Decision rank* is the log value of the number of forecasts an analyst has made before the forecast being evaluated, plus one. Definitions of the control variables are provided in Appendix A. $z$-statistics are provided in parentheses with heteroskedastic-consistent standard errors clustered at the analyst level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| *decision rank* | −0.046 | 0.016 | 0.037 | 0.052* | 0.061 | 0.136** |
| | (−0.68) | (0.24) | (1.27) | (1.75) | (1.31) | (2.36) |
| *time of day* | | 0.001 | | −0.005** | | −0.027** |
| | | (0.24) | | (−1.97) | | (−2.38) |
| *herding* | | −0.012 | | 0.002 | | 0.049* |
| | | (−0.91) | | (0.14) | | (1.79) |
| *firm experience* | | 0.260*** | | 0.045 | | 0.011 |
| | | (5.16) | | (0.99) | | (0.20) |
| *broker size* | | 0.066 | | 0.067 | | −0.285** |
| | | (1.15) | | (1.16) | | (−2.05) |
| *effort* | | −0.531*** | | −0.137*** | | −0.066 |
| | | (−9.90) | | (−4.48) | | (−1.00) |
| *firms followed* | | −0.007 | | −0.000 | | 0.073 |
| | | (−0.12) | | (−0.01) | | (0.78) |
| *forecast age* | | 0.628*** | | 0.778*** | | 0.773*** |
| | | (22.15) | | (34.33) | | (7.75) |
| *NUMEST* | | −0.146*** | | −0.010 | | −0.013 |
| | | (−7.16) | | (−0.62) | | (−0.41) |
| Constant | −0.742*** | −0.518*** | | | | |
| | (−15.07) | (−5.41) | | | | |
| Fixed effects | N | N | Analyst-firm | Analyst-firm | Analyst-day | Analyst-day |
| Pseudo $R$-squared | 0.0000 | 0.0097 | 0.0000 | 0.0086 | 0.0001 | 0.0029 |
| Observations | 205,228 | 205,228 | 165,802 | 165,802 | 34,747 | 34,747 |

# Results – Market Reaction – Hypothesis 5

$$CAR_{i,j,t} = \alpha + \beta_1 Decision\ rank_{i,j,t} + \beta_2 Forecast\ revision_{i,j,t} + \beta_3 Decision\ rank_{i,j,t} * Forecast\ revision_{i,j,t} + \beta_4 Controls + \epsilon_{i,j,t}, \quad (5)$$

CAR is the 3day market-adjusted excess return for a firm centered on the forecast revision issued by an analyst at a given day

**Table 7**
Stock market reaction to analyst forecast revision and decision fatigue.
The dependent variable $CAR_{i,j,t}$ is the three-day market-adjusted excess return for firm $j$ centered on the forecast revision issued by analyst $i$ at time $t$. The independent variables are as follows: *Decision rank* is the log value of the number of forecasts an analyst has made before the forecast being evaluated, plus one. *Forecast revision* is a measure of the difference between the current annual earnings forecast for analyst $i$ who follows firm $j$ in time $t$ and the annual earnings forecast issued immediately before current annual earnings forecast, scaled by the standard deviation of forecasts of all analysts who cover firm $j$ in time $t$. Definitions of the control variables are provided in Appendix A. $t$-statistics are provided in parentheses with heteroskedastic-consistent standard errors clustered at the analyst level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| *Decision rank* | 0.002*** | 0.001** | 0.001 | 0.001 | −0.000 | −0.001 |
| | (2.68) | (2.24) | (1.06) | (0.94) | (−0.01) | (−1.40) |
| *Forecast revision* | 0.017*** | 0.014*** | 0.017*** | 0.014*** | 0.011*** | 0.010*** |
| | (48.77) | (24.28) | (44.07) | (21.67) | (21.00) | (10.05) |
| *Decision rank** | −0.007*** | −0.006*** | −0.007*** | −0.005*** | −0.002*** | −0.001** |
| *Forecast revision* | (−15.02) | (−12.57) | (−13.20) | (−11.02) | (−4.63) | (−2.27) |
| Controls | N | Y | N | Y | N | Y |
| Controls* Forecast revision | N | Y | N | Y | N | Y |
| Fixed effects | N | N | Analyst-firm | Analyst-firm | Analyst-day | Analyst-day |
| Adjusted $R$-squared | 0.117 | 0.122 | 0.168 | 0.172 | 0.565 | 0.568 |
| Observations | 324,456 | 324,456 | 324,456 | 324,456 | 324,456 | 324,456 |

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# Conclusion

- Analysts become decision fatigued during the day
- Analysts become less accurate as they become more decision fatigued
- Analysts become more heuristic in their forecasting strategies as they become more decision fatigued: more likely to herd towards the consensus forecast, to self-herd by reissuing heir own previous outstanding forecast, and to issue a forecast that is rounded to end with a 0 or 5
- The stock market's reaction to a forecast revision is weaker when the issuing analyst is more decision fatigued.

# Thank you

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