PIMCO

Rotterdam, June 2019
Craig Dawson

Innovation in Investment Management

A company of **Allianz** ⑪

Important information

PIMCO
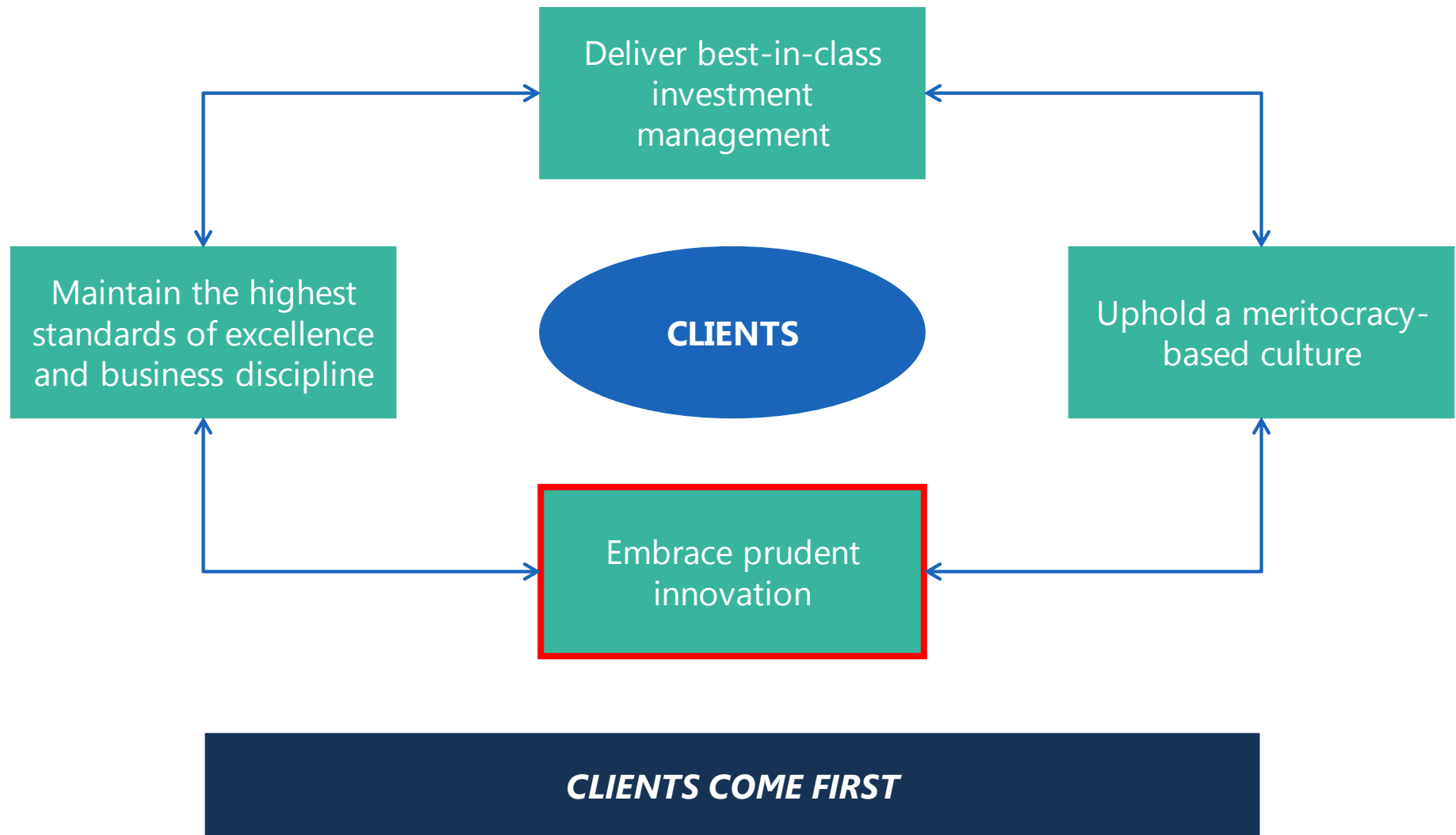
Agenda

- **Evolution of innovation at PIMCO**

- Current themes of innovation at PIMCO

- Conclusion

PIMCO evolution
Founding principles

Deliver best-in-class investment management

Maintain the highest standards of excellence and business discipline

CLIENTS

Uphold a meritocracy-based culture

Embrace prudent innovation

CLIENTS COME FIRST

PIMCO evolution
Summary of 45+ years of history

PIMCO

1971	1982	1994	2000
Founded as subsidiary of Pacific Mutual	Established autonomy from Pacific Mutual	Became public company through merger	Purchased by Allianz

GLOBAL OFFICES AND EMPLOYEES

1971	1980		2000	2008	2018
1 global office	1 global office 30 employees		6 global offices 412 employees	10 global offices 1,217 employees	14 global offices 2,500+ employees

PRODUCTS

1970's	1980's	1990's		2000's				
• Core	• Long Duration • Enhanced Cash	• Credit • Emerging Markets	• Global • Municipals • Securitized	• Absolute Return • Asset Allocation • Commodities	• Enhanced Equity • ESG • Hedge Funds	• Income • Distressed/Private Credit	• Quantitative Strategies • Real Estate	

ASSETS*

1975	1980	1985	1990	1995	2000	2008	2012	2013	2014	2015	2016	2017	2018	2019 YTD[1]
$40 M	$1.5 B	$10.0 B	$28.9 B	$76.4 B	$220.0 B	$930.0 B	$2,003.8 B	$1,919.6 B	$1,680.4 B	$1,435.0 B	$1,467.0 B	$1,755.7 B	$1,664.6 B	$1,758.1 B

As of 31 March 2019. **Past performance is not a guarantee or a reliable indicator of future results.**
* Third party and affiliated assets
[1] Assets include $14.3 billion in assets of clients contracted with Gurtin Fixed Income Management, LLC, an affiliate and wholly-owned subsidiary of PIMCO.

PIMCO evolution
PIMCO's traditional structural alpha toolkit (examples)

VOLATILITY SELLING
Provide insurance

TERM PREMIUMS
5th Eurodollar contract

RATINGS
Fallen angles, CCC's

AMORTIZING VS. BULLETS

CARRY CURRENCIES

COMPLEX VS. SIMPLE

FRONT END VS. LONG END CREDIT

PROVEN THEMES ALSO APPLIED TO NEWER MARKETS

Source: PIMCO

Agenda

- Evolution of innovation at PIMCO

- **Current themes of innovation at PIMCO**

    - **Artificial Intelligence**

    - **Behavioral Science**

    - **ESG/SRI**

- Conclusion

Artificial Intelligence / Machine Learning
Academic partnership with Caltech

Caltech

Established the PIMCO Postdoctoral Fellowship in Computing and Mathematical Sciences and the PIMCO Graduate Fellowship in Computing and Mathematical Sciences

Objectives

- An edge in the rapidly developing field of quantitative analysis
- A link between PIMCO and researchers on data science, machine learning and economics
- Collaboration with researchers interested in AI/Machine Learning application to finance and economics
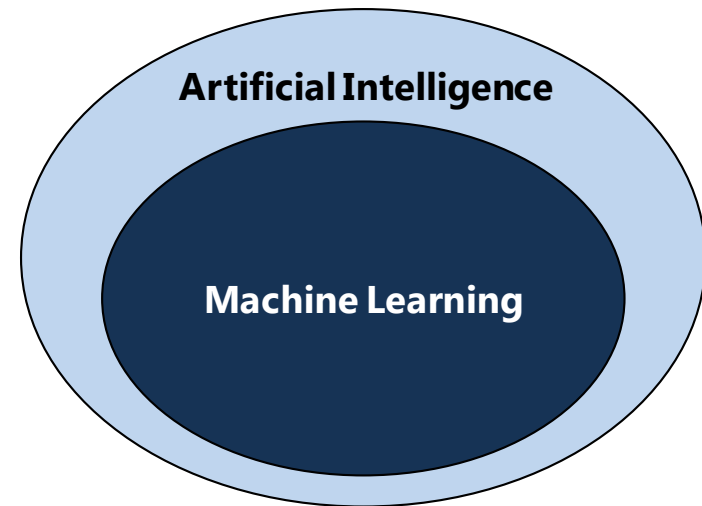
Artificial Intelligence
Umbrella term for the broader concept of machines being able to carry out tasks in a "smart" way.

Machine Learning:
Build a system to learn and infer rules (instead of defining a fixed set of rules). A common machine learning approach is to have the algorithm learn the rules using training data and then apply these rules to a different set of data to determine effectiveness.

Machine Learning applications at PIMCO
Practical examples

Sample applications at PIMCO
Macroeconomic analysis
Central Bank Sentiment Analysis
Estimating Recession Probability
Fundamental analysis
Predicting MBS Loan Level Default and Prepayment Behavior
Mining Changes in Corporate Filings
Trade execution
Decide Pace, Venue and Counterparty for Trade Execution

For illustrative purposes only.

Behavioral Science
An Innovative Partnership of Academic and Investment Excellence

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At PIMCO, we have long believed that cultivating diverse perspectives and challenging our own thinking can lead to stronger investment outcomes.

CHICAGO BOOTH | **PIMCO**
Center for Decision Research | Decision Research Laboratories

Through our partnership with The Center for Decision Research (CDR) at The University of Chicago Booth School of Business, we support research to gain:

A deeper understanding of human behavior and decision-making

Insights that may help PIMCO better manage biases within our process

An edge in making better decisions for portfolios, clients and employees

"Understanding how we behave and the decisions we make are critical to building on PIMCO's strong culture of investing excellence and creating a diverse, engaging workplace, so we are excited to partner on this groundbreaking approach with Nick Epley and his incredible team at CDR".
Emmanuel Roman, PIMCO's Chief Executive Officer

Behavioral Science
## *Step #1: Build awareness for (cognitive) biases*

Experience effects

❝ Long-term effects of exposure to economic and political environments, macroeconomic shocks, and institutions affect even smart, successful, well-trained professional investors and decision-makers.❞

❝ Confirmation bias is the tendency to search for, interpret, favor, and recall information in a way that confirms one's preexisting beliefs❞

Anchored to Belief

Overconfidence
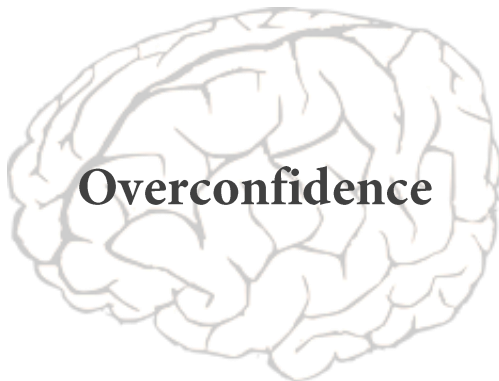
❝ Overconfidence leads to the false assumption that someone is better than others, due to their own false sense of skill, talent, or self-belief❞

Behavioral Science
Step #2: Take measures for optimal unbiased decision-making

Group Dynamic	Portfolio Management Decisions
"Credible Contrarians"	Trading Frequency
Broader Committee Representation	Winners vs. Losers? Sell early or late?

Measuring More

Detailed attribution	Within Investment Committee and Forums	Contests

Sustainable investing becoming mainstream
A $30.7T global story, but at different chapters regionally

AUM: $21 trillion

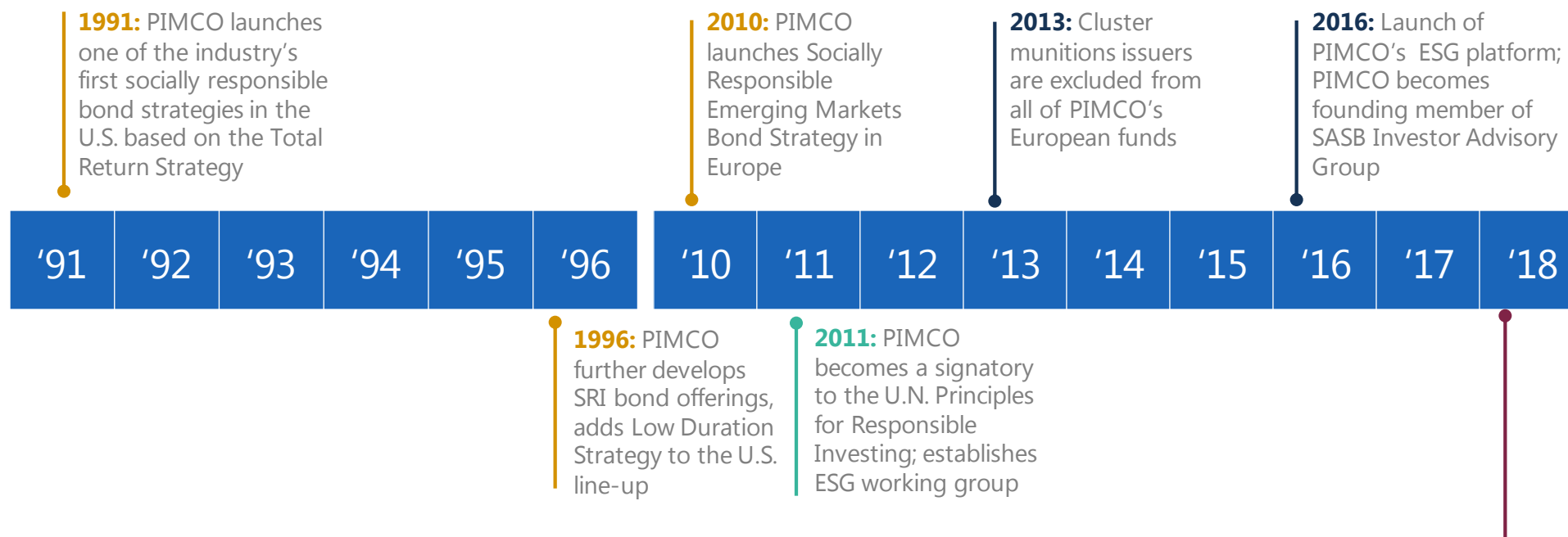**AUM: $23 trillion**

AUM: $31 trillion

2014

2016

2018

As of 31 December 2018
Source: Global Sustainable Investment Alliance. All 2014 assets are converted to U.S. dollars at the exchange rates as of year-end 2013. All 2016 assets are converted to U.S. dollars at the exchange rates as of year-end 2015. All 2018 assets are converted to U.S. dollars at the exchange rates at the time of reporting.

The evolution of sustainable investing at PIMCO

1991: PIMCO launches one of the industry's first socially responsible bond strategies in the U.S. based on the Total Return Strategy

2010: PIMCO launches Socially Responsible Emerging Markets Bond Strategy in Europe

2013: Cluster munitions issuers are excluded from all of PIMCO's European funds

2016: Launch of PIMCO's ESG platform; PIMCO becomes founding member of SASB Investor Advisory Group

'91	'92	'93	'94	'95	'96	'10	'11	'12	'13	'14	'15	'16	'17	'18

1996: PIMCO further develops SRI bond offerings, adds Low Duration Strategy to the U.S. line-up

2011: PIMCO becomes a signatory to the U.N. Principles for Responsible Investing; establishes ESG working group

2018:

PIMCO's ESG Integration: UN PRI A+ Assessment Report on the quality of PIMCO's firm-wide ESG integration[1]

PIMCO's SRI AUM: $311B**

PIMCO's ESG-Oriented AUM: $7.4B (3rd party assets)

Expanded our ESG analysis to securitized products and municipals

Improved proprietary ESG IT systems and capabilities

More than 250 engagements since 2017 used to accelerate the sustainable development agenda & issued first annual ESG and engagement report

* As of 31 March 2019. It includes ESG focused funds only.
** Values-based exclusion, including EMEA Fund complex with cluster munition exclusion
Past performance is not a guarantee or a reliable indicator of future results.
[1] Source: UNPRI assessment report limited to asset managers signed up to the Principles for Responsible Investment (PRI) and based on how well ESG metrics are incorporated into their investment processes. UNPRI Transparency Reports 2018 are available at https://www.unpri.org/signatories/transparency-reports-2018/3350.article. For methodology, please refer to About PRI Assessment: https://www.unpri.org/signatories/about-pri-assessment.
[2] As of 31 March 2019. SRI AUM includes all exclusions based strategies (including European domiciled funds). ESG AUM includes dedicated ESG focused funds only.
Refer to Appendix for additional investment strategy, risk and strategy availability information.

PIMCO's ESG Process: "The Three Es"
Investing for performance and impact

EXCLUDE

Restrict investment in issuers fundamentally misaligned with sustainability practices

Examples of exclusions

- Controversial weapons
- Tobacco
- Adult entertainment
- Coal

EVALUATE

Emphasize best-in-class (BIC) ESG issuers and prime ESG engagement candidates in portfolio construction

Attributes of BIC issuers

- Good environmental practices
- Strong corporate governance
- Industry-leading social policies

ENGAGE

Engage collaboratively with issuers to change ESG-related business practices

Sample engagement questions

- Are you developing a framework for climate risk reporting?
- What is your policy on parental leave?
- Do you have a culture and conduct committee?

Agenda

- Evolution of innovation at PIMCO

- Current themes of innovation at PIMCO

- **Conclusion**

Conclusion
Cutting through the hype

- **Continuously invest** and accept failure along the way

- Embrace **partnership with academic excellence** for idea generation

- Lay the groundwork by **enhancing data infrastructure**

- It's not only about tools – analyze and **understand your own behavior and measure more**

- There's **no silver bullet** – but tremendous potential to increase productivity and enhance decision-making when used properly

Appendix

Common Economic and Financial Problems Recast into a Machine Learning Framework

Regression	Classification	Unsupervised

Regression

What's the next GDP number?
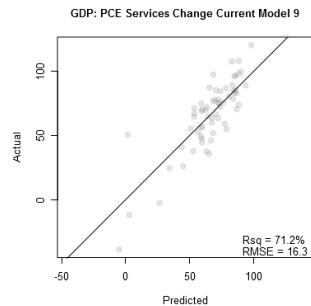
What is every house worth?
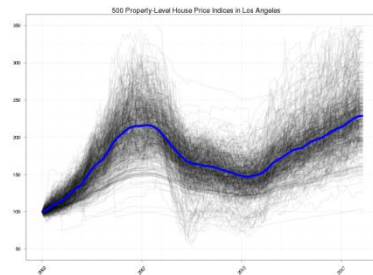
What will prepayments be?
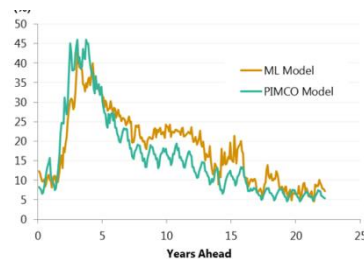
Classification

Hawk or dove?

Buy or sell?

Unsupervised

What factors drive the economy?
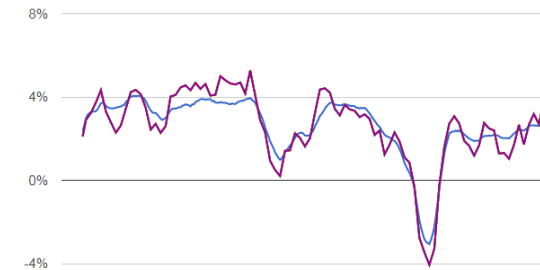
What topics occur in FOMC Mins?

Which regions are similar?
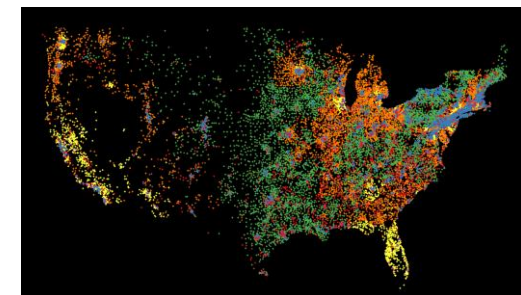
For illustrative purposes only.

Machine Learning case study #1
Natural Language Processing for Mining Changes in Corporate Filings

① **Hypothesis**
- Companies tend to keep the same language in their filings
- When they see potential large risk events, they mention them to avoid legal trouble

② **Big Data**
- We downloaded historical 10-K and 10-Q filings of S&P1500 constituents and constructed similarity scores between each filing and the filing a year ago

③ **Strategy**
- We rank companies into quintiles based on similarity scores
- We find "changers" indeed underperform

④ **Results**
- Long/short excess returns range between 20 to 40 bps per month
- Sharpe ratios range between 0.35 to 0.6
- The positive returns are quite robust

Cumulative Returns Excess to Market *

— Difference — Little Changes in Filings — Large Changes in Filings
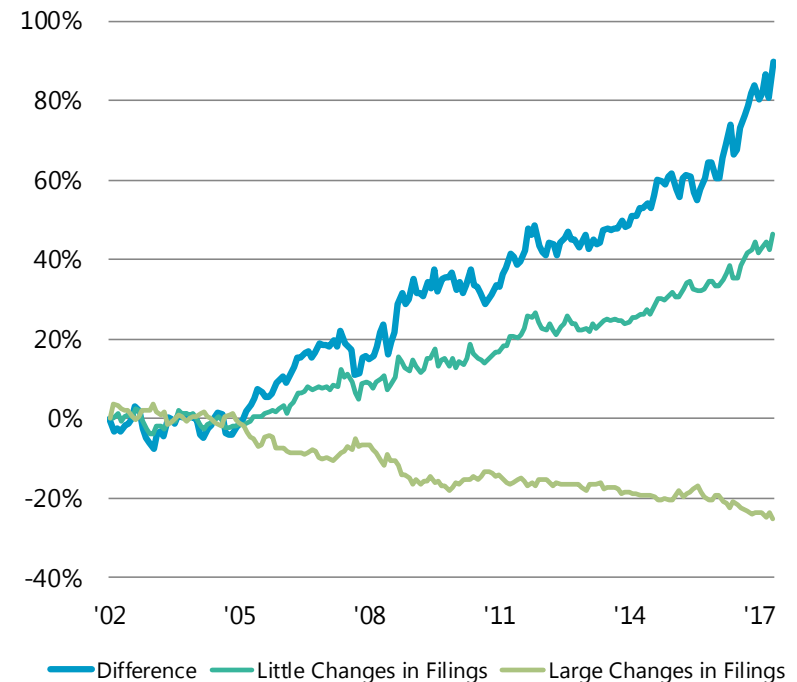
For illustrative purposes only.
*Market is S&P500

Machine Learning case study #2
Agency MBS Prepayment Modeling - AI Model benefits from economic intuition

AI — PIMCO Model, AI Model

AI + Expertise — PIMCO Model, Guided AI Model

FN 3.5 — Pimco Model, ML Model

FN 4 — Pimco Model, ML Model
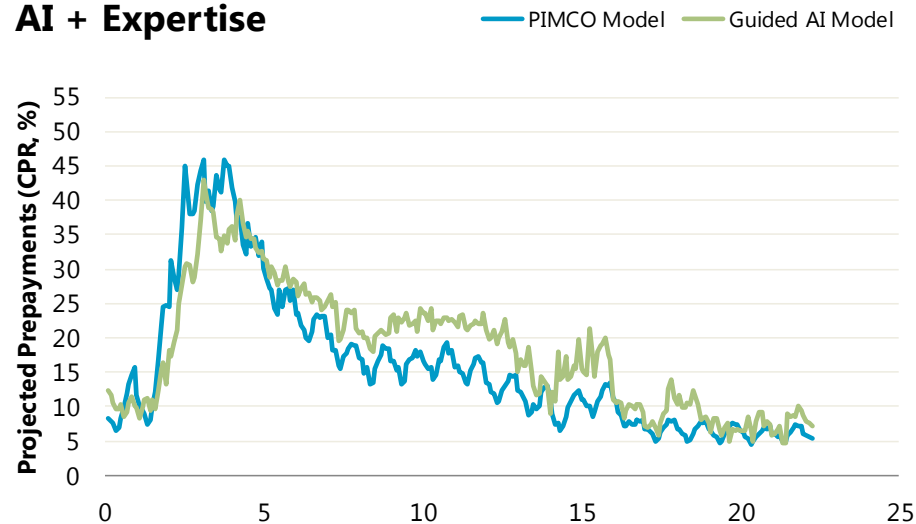
For illustrative purposes only.
Source: PIMCO, Fannie Mae

Behavioral science case study #1 - Analyzing corporate bond trading
Do we herd with the crowd when we sell corporate bonds? 2013 – 2018 evidence

- Compare our trading with the majority of market participants using TRACE data.

- We find that **we are 35% less likely to sell** when other customers display strong preference of selling

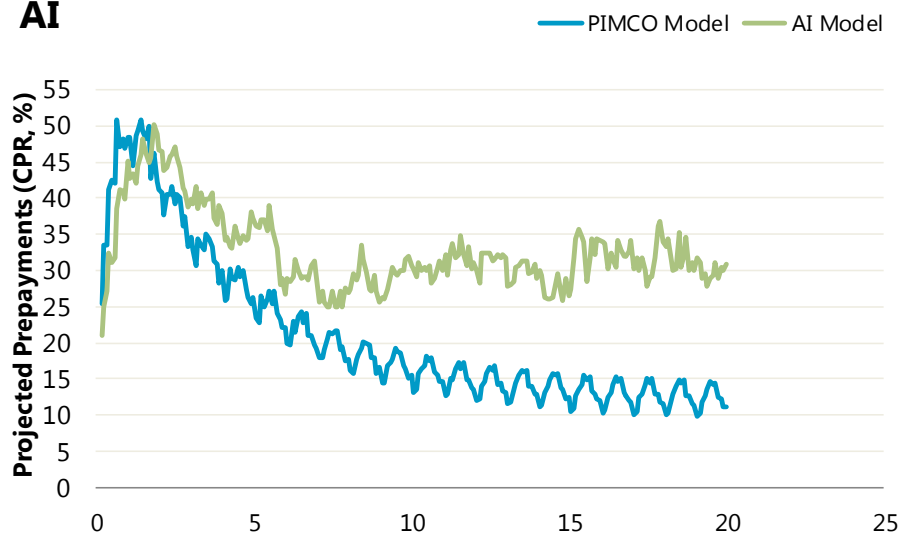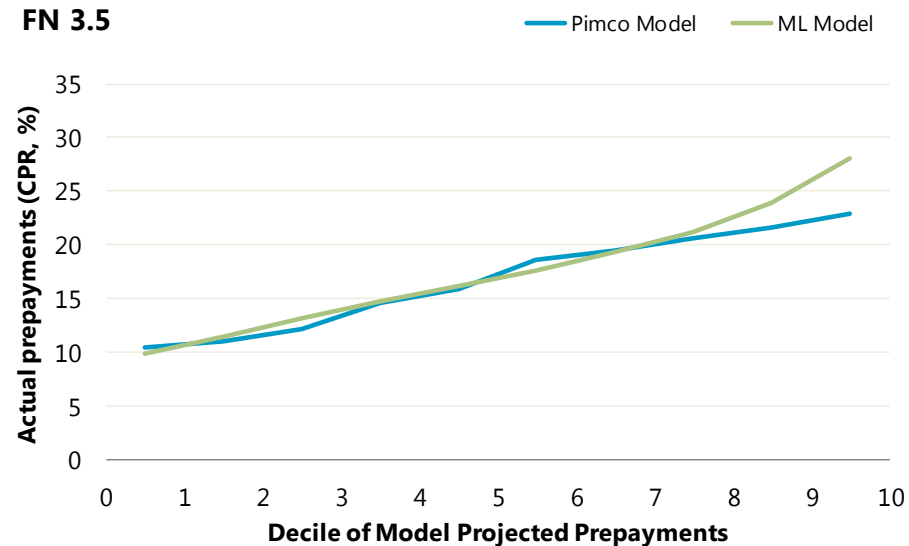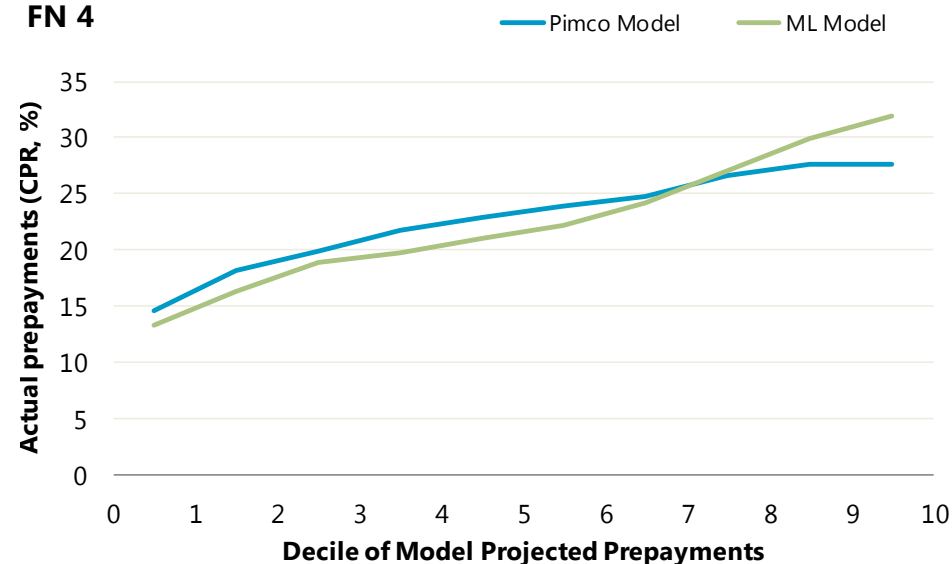- This result is consistent across PMs: Investment Grade (IG) Credit dedicated vs. Generalist portfolios, indicative of an integrated process

Trades ranked by net customer flows per bond

	Total Return Fund		IG Credit Account	
	1st quartile (more sellers)	4th quartile (more buyers)	1st quartile (more sellers)	4th quartile (more buyers)
Likelihood of PIMCO selling	0.71	1	0.65	1
t-stat	-4	0	-5	0.2

References:
[1] Lakonishok, Josef, Andrei Shleifer, and Robert W. Vishny. "The impact of institutional trading on stock prices." Journal of financial economics 32.1 (1992): 23-43.
[2] Grinblatt, Mark, Sheridan Titman, and Russ Wermers. "Momentum investment strategies, portfolio performance, and herding: A study of mutual fund behavior." The American economic review (1995): 1088-1105.
[3] Wermers, Russ. "Mutual fund herding and the impact on stock prices." the Journal of Finance 54.2 (1999): 581-622.

Behavioral science case study #2 - Selling winners early vs. holding on to losers
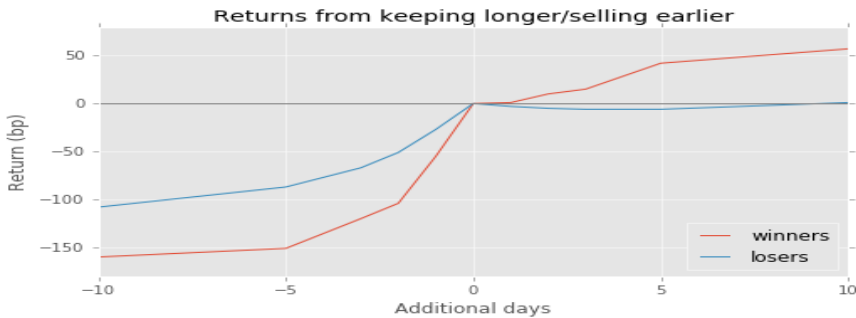*Analysis of disposition effect in commodity hedge fund (May '14 – Jun '18)*

- We are 79% more likely to sell winners than the losers.

	Overall	Directional	Calendar	Substitution
Likelihood of selling winner vs loser	1.79	1.97	1.90	1.71
t-stat	17	5	14	9

- Holding on to winning positions for a bit (10 extra days) would have paid off.
- In contrast, we exit losing trades optimally

Additional days	1	2	3	5	10
Keeping winner longer	1	10	15	42	57
Keeping loser longer	-3	-5	-6	-6	1
Sell winner earlier	-55	-104	-120	-151	-160
Sell loser earlier	-27	-51	-67	-87	-108

Returns from keeping longer/selling earlier

Distribution of keeping winners 10 days (winsorized)

Sustainable investing becoming mainstream
A $30.7T global story, but at different chapters regionally

Region	2016	2018	% Change*	% Total FI Market
Europe	$12,040	$14,075	11%	48.8%
United States	$8,723	$11,995	38%	25.7%
Japan	$474	$2,180	307%	18.3%
Canada	$1,086	$1,699	42%	50.6%
Australia/New Zealand	$516	$734	46%	63.2%
TOTAL	**$22,839**	**$30,683**		**35.5%**

Sustainable Investing Assets by Strategy and Region 2018
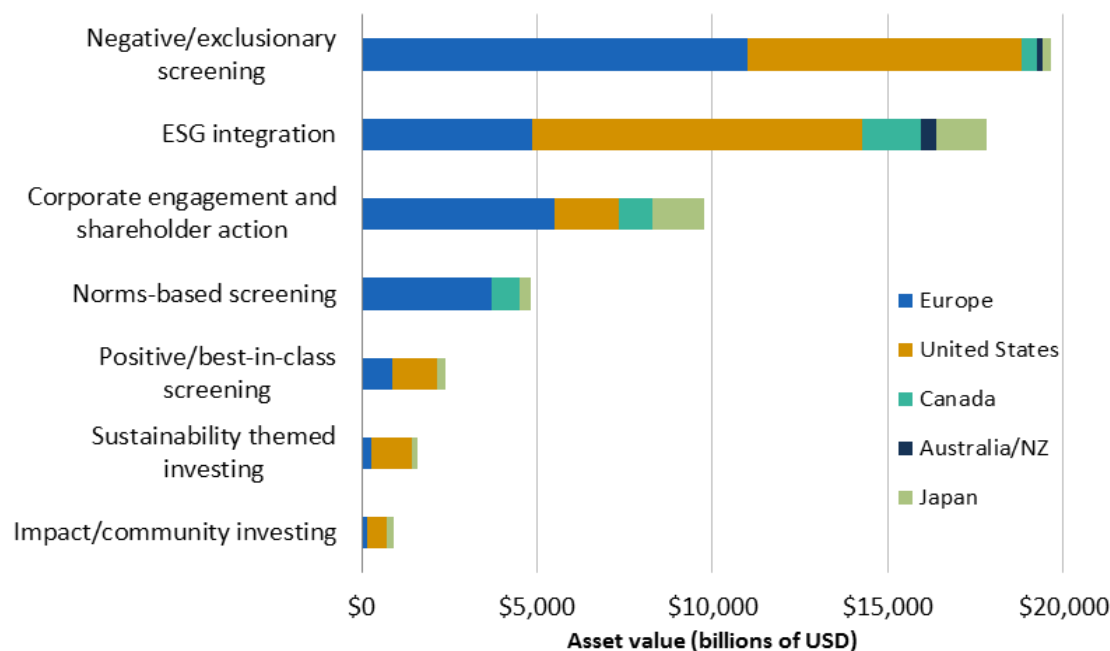
As of 31 December 2018
Bottom Chart Source: US SIF Foundation, UN PRI; Top Chart Source: Global Sustainable Investment Alliance. All 2016 assets are converted to U.S. dollars at the exchange rates as of year-end 2015. All 2018 assets are converted to U.S. dollars at the exchange rates at the time of reporting.

ESG/SRI case study #1 – Corporates
EM National Oil Company

Effective tool to encourage change in behavior

- **PIMCO successfully engaged with an EM National Oil Company** (NOC) on social issues, specifically a higher than-industry-average health & safety incident rate.

- Escalation of the issue (incl. credit, sovereign and ESG views), resulted in this **issuer agreeing to move towards international accreditation** (i.e. applying best practice standards) of its operations.

PIMCO contacts the NOC for information required to assess ESG risks, with spotlight on its Health & Safety

PIMCO escalates issues after insufficient response & dialogue

Written commitment by issuer to commence H&S certification

Dec '17

Aug '18

Oct '18

As of 31 January 2019
SOURCE: PIMCO, Bloomberg, IEA
Refer to Appendix for additional outlook and risk information.