

Al and machine learning in regulatory compliance and supervision Luxembourg, 12 October 2018

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- Key messages from FSB's report on AI and machine learning in financial services
 - FSB (2017), Artificial intelligence and machine learning in financial services: Market developments and financial stability implications
 - Also FSB (2017), Financial stability implications from FinTech: regulatory and supervisory issues that merit authorities' attention
- Some use cases of AI/machine learning for RegTech / SupTech
- Some ethical and governance considerations around AI and machine learning in financial services
- Conclusions

Views are personal views only based on a mixture of FSB publication and own research – please don't post photos



Self-introduction







Financial stability implications of AI and machine learning in finance

	Micro-financial	Macro-financial
Potential benefits	 More efficient processing of information in markets Lower transaction costs, higher revenues and more accurate risk assessment by financial institutions 	 Enhanced efficiency in financial services Potential for economies of scale and scope Greater regulatory and supervisory effectiveness
Risks	 'Black box' problems in decision-making, especially during tail events Legal uncertainties around liability, data protection, etc. Potential for consumer protection issues (discrimination in credit scoring and insurance pricing, etc.) Overreliance on models Overfitting on training data 	 Third-party dependencies: emergence of new systemically important players New and unexpected forms of interconnectedness between financial markets and institutions Lack of interpretability or auditability: widespread use of opaque models, disinterest in investing in interpretation Inappropriate risk management and oversight: importance of unbiased training data and feedback mechanisms

FSB (2017), Artificial intelligence and machine learning in financial services



Potential macro-level benefits



Image source: CBS Television



Image sources: CB Insights (2017), Bank of England (2009)

I have a dream. It is futuristic, but realistic. It involves a Star Trek chair and a bank of monitors. It would involve tracking the global flow of funds in close to real time (from a Star Trek chair using a bank of monitors), in much the same way as happens with global weather systems and global internet traffic. Its centrepiece would be a global map of financial flows, charting spill-overs and correlations.

Andy Haldane (2014)





AI and machine learning in finance: use cases





UNITED STATES SECURITIES AND EXCHANGE COMMISSION Washington, D.C. 20549

FORM 10-K

ORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHA For the fiscal year ended September 30, 2017 or PORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCI For the transition period from _____ to ____ Commission File Number: 001-36743 Groups of use cases:

- RegTech and "SupTech:" uses by financial institutions and supervisors
- Consumer-focused ("front office"): credit scoring, insurance pricing, chatbots
- Operations-focused ("back office"): back-testing, capital optimisation, market impact analysis, etc.
- Trading and portfolio management



Know Your Customer (AML/CFT/sanctions-busting)

Creating risk scores for additional scrutiny or ongoing public register checks
Additional filter over rules-based alerts engine to reduce "false positives"
Image checking

Investor profiling (e.g. for MiFID II suitability / appropriateness tests)

Improved risk management and stress testing capabilities

Fraud monitoring systems in card services

Formal modelling/automation of contract compliance (e.g. margin exchange for OTC derivatives) or new regulations (e.g. MiFID II/AIFMD...)



SupTech use cases

Uses of AI/ML by market regulators for surveillance

Detection of insider dealing or market abuse syndicates

Using natural language processing (NLP) and other technology to:

- visualise and explore the extracted entities and their relationships
- identify and extract entities of interest from evidentiary documents

Identifying suspicious transactions that warrant further attention, allowing supervisors to focus their resources on higher risk transactions

Text analytics and ML algorithms to detect possible fraud and misconduct by associating regulatory filings with past regulatory outcomes

Identifying misleading marketing or unlicensed financial advice



SupTech use cases (cont.)

Macroprudential surveillance

- network analysis, stress testing
- big data to be deployed in economic forecasting

Data scrubbing/interpolation of regulatory data

- automatically identifying anomalies (potential errors)
- using ML to parse free text fields in OTC derivatives data

NLP/text mining (incl. combined with ML)

- Sentiment analysis to measure/detect/predict significant changes in liquidity, volatility, financial stress, consumer confidence
- identify patterns for further attention from supervisors in large and complex data
- link trading databases to other information on market participants
- extract key information from evidence bases



- Possible benefits
 - AI for KYC could drive cost savings and financial inclusion
 - AI for KYC could underlie KYC utilities, which may help to address the decline in correspondent banking
- Challenges
 - Careful tuning of machine learning systems will be important as different types of error may be weighted differently by firm, clients and regulators
 - Over-reliance on automated systems may mean that humans start to disengage, failing to exercise adequate oversight or apply common sense/intuition
 - Models must be kept up to date (e.g. sanctions lists) it may be hard to adequately assimilate contextual knowledge in systems given training cycle
 - Generic challenge of maintaining the customer experience in a highly automated environment



Not all errors are born equal ...



FSB FINANCE STABIL BOARD

Standardising entity data to support Al

Entity detail	ls		•
lei 353800Q2X	FMZ1DHST617		
LEGAL NAME		iシェアーズ ゴールドインデッ クス・ファンド(為替ヘッジあ り)	
OTHER ENTITY NAMES		Trust&Custody Services Bank,Ltd./0460744/729000	•
	Nevember 2017	he its ustry Update Nalogue that the PMPG started with the ents	•

- The Legal Entity Identifier (LEI) is a 20-character, alpha-numeric code, to **uniquely identify legally distinct entities** that engage in financial transactions
- Since 2012, the FSB and G20 have promoted LEI use to support authorities and market participants in identifying and managing financial risks
- FSB and CPMI recommended use of the LEI in correspondent banking to identify originators and beneficiaries of wire transfers:
 - reduces the costs of handling false positive results when screening names against sanctions lists
 - bridge between information in payment messages and information in KYC utilities and other databases
 - facilitate automated analysis at a lower cost
- SWIFT PMPG published an option in November to include LEI in payment messages
- FSB undertaking a peer review on the LEI





- Model/data governance some possible considerations
 - Training data IP, privacy, mixing of data, end of contract?
 - Documentation of objectives, tolerances, risk appetite, etc of model – challenger vs. champion model?
 - Model oversight boundary conditions; error function drift; kill switch; avoiding overreliance
 - Releases/upgrades process documentation, ownership
 - Transparency of models for regulatory / governance purposes
 - Discrimination-aware AI?
- BCBS 239 Principles for effective risk data aggregation and risk reporting
 - apply to an bank's "risk management data," all key internal risk management models
 - BCBS recently found significant delays in implementation



Anti-discrimination challenges

Input layer

Simple neural network architecture

Key parameters eg postcode, earnings, age, gender, wealth, education, etc.

. . .

(Note that age, gender may also be sensitive from a general antidiscrimination perspective)

> "Special categories" eg race, sexual orientation. etc. decision should not be "based" on these factors



"special categories", and tests correlations, won't know that the system is relying on them.

Solution – collect but test for and change weights to zero?

Solution – avoid hidden layers?

- Grant credit/insurance/claim
- Deny credit/insurance/claim

Hidden layer units may encode protected parameters if they are statistically meaningful for

... could rely on special categories, even if excluded from input



Conclusions

- Al and machine learning can bring macro- and microlevel benefits and risks for RegTech and SupTech
- Wide range of use cases are emerging, including KYC and market supervision
- Al and machine learning may entail ethical, governance, business and data protection challenges
- Not all errors are born equal error functions should be fit for purpose
- How to maintain effective oversight over AI and machine learning is perhaps the key challenge



Time for questions





Annex





- Al and machine learning, being data-driven, throw data protection into strong focus
- Legal requirements vs. client / community expectations may differ significantly
- Issues to be addressed / considered may include:
 - When is consent to use/transmission expected? Required?
 - Right of data subjects to access and correct own data
 - Limitations around processing of sensitive data
 - Limitations around purely automated decision-making
 - Transparency/right to information about logic involved
 - Right to be forgotten / data portability
 - Data export to third countries