



DATA DRIVEN FINANCIAL STABILITY

#datadrivenstability
#financialstability

2–3.12.2019

OPPORTUNITIES
AND CHALLENGES
IN BIG DATA



Session 7 Future of financial stability

Klaus Wiedner

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European Commission





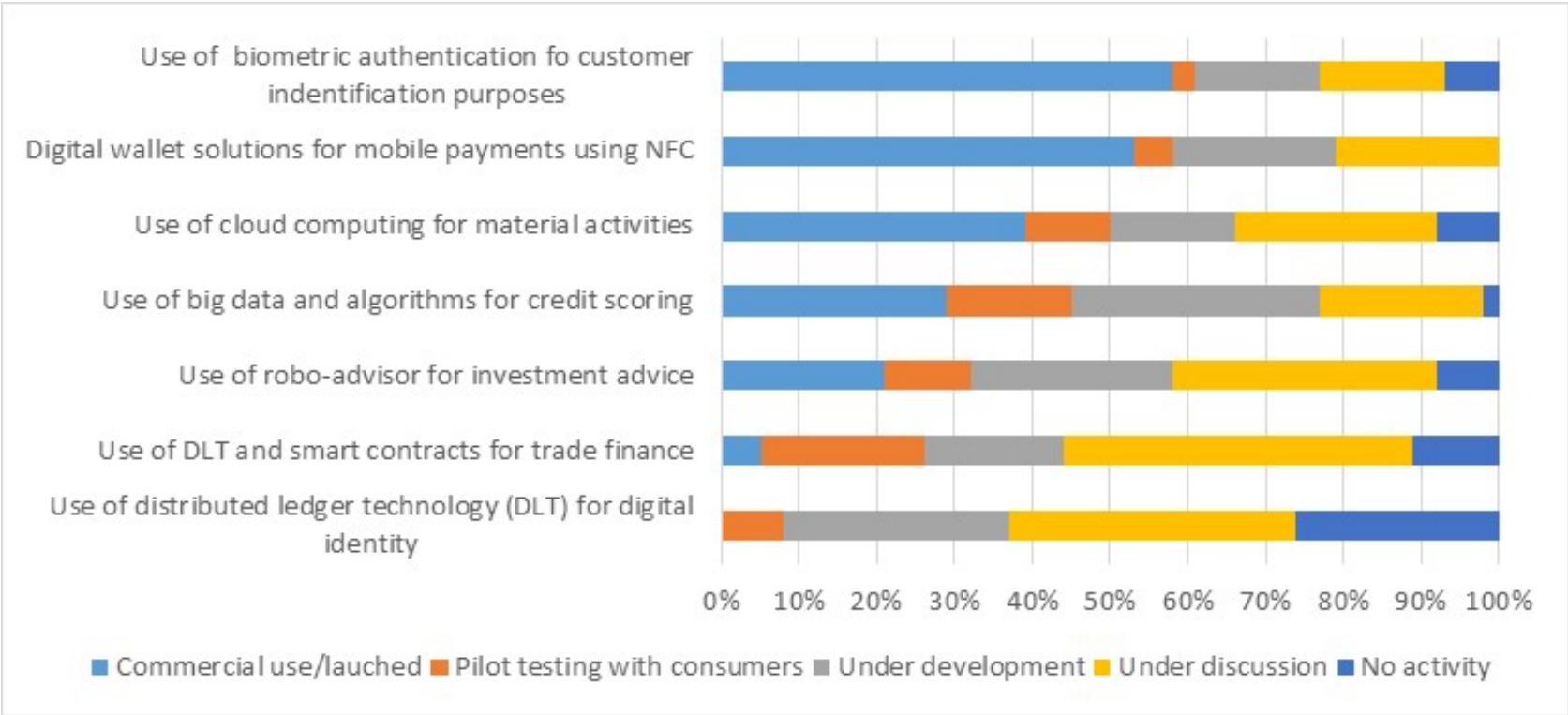
Data driven finance: Implications for policy

Klaus Wiedner, Director
Financial surveillance and crisis management
European Commission

Overview

- *Digital transformation of the financial sector*
- *Possible consequences for consumers, business and financial stability*
- *Policy implications*

Digital transformation



Banks are leveraging a wide spectrum of opportunities created by new technologies

... with consequences for consumers, business and financial stability

Market integrity and consumers

- Improved business processes (e.g. fraud detection)
- Market integration
- Access to new products and personalised services
- Consumer protection, data protections
- Client discrimination

Competition

- Market entry of non-financial players
- Erosion of margins for incumbents
- Reliance on access to data
- Winner takes it all, platforms

Financial stability

- Crypto-assets, global stablecoins
- Cyber attacks
- Price volatility
- Lending practices
- New critical (data) infrastructures



Market integrity and consumers

- *Improved business process: fraud detection, AML and compliance reporting, etc*
- *Borderless technologies -> scope for enhanced market integration*
- *Access to new products and personalised services*
- *But: ensure consumers understand the risk they take – e.g. robo-advice*
- *Ensure consumers understand the risk they create – by providing data*
- *Contain discriminatory practices*

Level-playing field

- *Bigtech entry holds the promise of efficiency gains, but is likely to lead to higher concentration*
- *Regulatory level-playing field between bigtechs and incumbents needed to stimulate competition*
- *Access to data and data analysis capabilities are the main points of contention*
- *Future distribution of financial products likely to be concentrated on a few platforms (not necessarily owned by the providers of the financial products)*

Financial stability

1. *The "headline" risks: Crypto assets, global stablecoins*
 - *Value of crypto assets remains volatile - will they develop into a reliable and widespread store of value*
 - *Libra greeted with scepticism – if it started, would it develop into a widespread alternative money?*

Financial stability (ctd)

2. Operational risks: Cyber risks



Financial sector is particularly exposed to cyber risks

Financial stability (ctd.)

3. Market volatility

- Herding behaviour
- Will AI be able to detect mean-reversion, tail events or structural breaks?
- Lack of model transparency, leading to flash crash
- High-frequency trade – pulling the plug is possible.
Should we request the same for other AI applications?

4. Selection of counterparts

- Lending platforms apply AI to identify worthy borrowers
- If the same for all transactions, could small triggers lead to massive credit rejection? Could this frontload solvency risks?

5. Data-driven supervision, big data analytics for systemic risk detection

Resilience to developments abroad: EU economic sovereignty

- *Specific challenge for EU as most BigTech firms are domiciled abroad*
- *Ensure EU actors face fair competition and prevent abuse of dominant market positions*
- *Safeguard control and access to critical data, data storage and infrastructures*
- *Ensure compliance with our data protection rules*

Policy implications

- *Facilitate the digital transformation*
 - Technology-neutral regulation
 - Promote update of innovative technologies
 - Develop ICT skills
 - Address digital fragmentation, data standards, data sharing.

-> **Further efforts to fight market fragmentation to enable global competitiveness of EU firms**
- *But mitigate the risks to consumers, business and financial stability*

Policy implications (ctd.)

- *Data privacy and protection*
- *Level-playing field to safeguard competition*
- *Balance regulatory focus between activities and institutions*
- *Supervisory oversight*
- *Cyber resilience needs to be ensured*
- *Digital sovereignty as a stabilising force*

- *Can legislative procedures keep up with the pace of technical progress? Need for global responses and standard-setting*

Session 7 Future of financial stability

Steffen Kern

Chief Economist and Head of
Risk Analysis

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Data-driven finance – The future of financial stability

Suomen Pankki

Conference “Data-driven financial stability – opportunities and challenges in big data”

Helsinki, 3 Dec 2019

Steffen Kern



Data-driven finance: Stylised facts

- **Financial markets: Use of various new technologies and data sources**
 - Big data: Fast-rising volumes of market and client information
 - Artificial intelligence (AI), machine learning (ML), deep learning (DL): Enhanced analytical capabilities, algorithm-based decision making
 - Cloud and quantum computing: Unprecedented storage and processing power
 - Distributed Ledger Technologies (DLT), self-enforcing contracts (SEC): Decentralised information processing networks, unaddressed data access issues
- **Policymakers: Growing data requirements and use**
 - Market transparency: Enhance market efficiency (e.g. MiFID)
 - Reporting: Data to improve entity oversight and market surveillance (e.g. EMIR, SFTR, AIFMD, MMFR)
 - Financial stability: Enhanced market and system level modelling, stress testing and analysis, exploiting new regulatory data sources
 - Data integrity: Rules for consumer and company data protection (GDPR, cyber risk guidelines, fair treatment); Cloud Guidelines; ESA Advice on cybersecurity
 - Business promotion: Facilitation of financial and technological innovation (FinTech Action Plan)

Data in ESMA remit: Wide variety of data generators...

Markets

Shares

Market cap: EUR 12tn
Listed: >9,000

Sovereign bonds

Outstanding: EUR 9tn
Instruments: >1,200

Corporate bonds

Outstanding: EUR 7tn
Instruments: >25,000

Securitised instruments

Outstanding: EUR 1,2tn
Transactions: >1,100

Derivatives

Outstanding: EUR 660tn
Open transactions: >74mn

Infrastructures

CCP

Transactions: EUR 233tn
CCPs: 16

CSD

Managed: EUR 36tn
CSDs: 37

Trading platforms

Regulated markets: 136
MTFs: 225
OTFs: 84
SIs: 215

Trade repositories

TRs: 9
Trade reports: >11bn p.a.

CRA

CRAs: 41
Credit ratings: >700.000

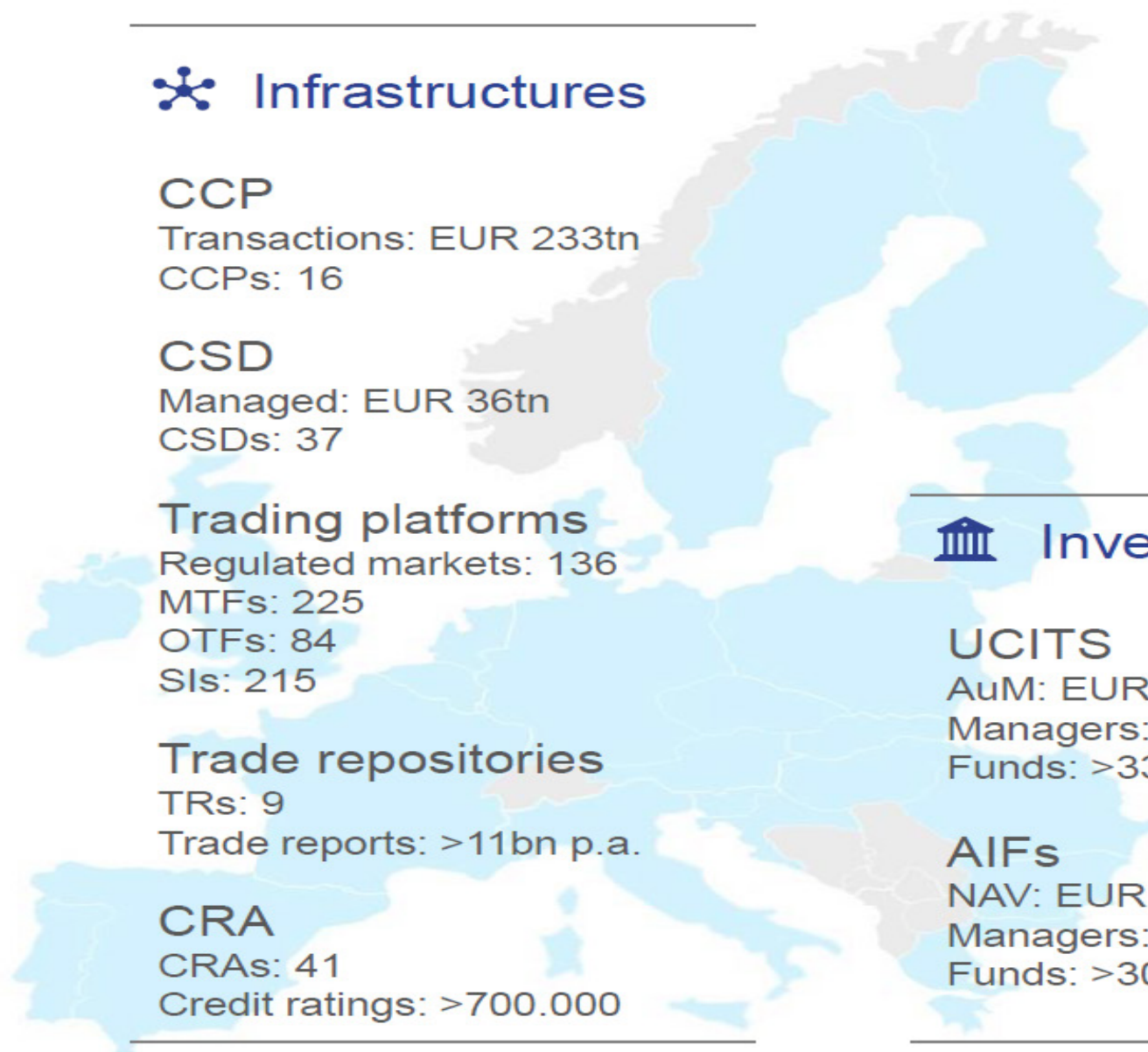
Investors

UCITS

AuM: EUR 10tn
Managers: >1,800
Funds: >33,000

AIFs

NAV: EUR 6tn
Managers: >3,100
Funds: >30,000



... high-volume data, progressing technology adoption

	Data output		Technology take-up			
	Volumes	Complexity	Big data	Cloud	AI/ML/DL	DLT
Markets						
Securities trading	Orange	Orange	Red	Grey	Orange	Green
Derivatives trading	Red	Red	Red	Grey	Orange	Green
Crypto assets	Grey	Grey	Red	Red	Grey	Red
Infrastructures						
CCPs	Orange	Orange	Red	Grey	Green	Green
CSDs	Orange	Orange	Red	Grey	Grey	Green
Trade repositories	Red	Red	Red	Grey	Grey	Grey
Trading platforms	Red	Orange	Red	Grey	Grey	Green
CRAs	Orange	Orange	Red	Grey	Grey	Green
Investors						
UCITS	Grey	Grey	Grey	Grey	Grey	Grey
AIFs	Orange	Red	Orange	Grey	Orange	Grey

Note: Indicative, qualitative assessment, based on market intelligence. No supervisory evidence. Data relevant from an EU-level regulatory and supervisory perspective only. Red=High, orange=moderate, green=not significant or exploratory use, grey=no EU-level data or unknown. Overlaps between sources of data possible.

Outlook: 5 theses on the future of data in finance

1. **Much more data: Exponential rise of market, consumer data set to continue**
 - Higher granularity, broader reach (esp. matching with non-financial data)
 - More data-driven business decisions and regulatory and supervisory actions
 - Trend for efficiency in data processing (esp. cloud services and data providers)
2. **Faster markets: Continued acceleration of market transactions**
 - Sales, trading, clearing, settlement, investment decisions and portfolio allocation, analytics and market information expected at faster paces
3. **Rising automation: Machines decide, humans set parameters**
 - AI/ML plus self-enforcing contracts as decision tools, future role of XAI
 - Inherent trend towards greater data, process standardisation and homogeneity
4. **Greater complexity: More linkages among financial players, and beyond**
 - AI/ML to uncover new transaction patterns, i.e. new correlations
 - New data-driven activities (stablecoins, crypto assets, DLT-based infrastructures, AI/ML processes) raising fundamental questions (prudential, conduct, blockchain data access and processing)
 - New, potentially systemically relevant players (CSPs, data providers, BigTech)
5. **Dash for resources: Investment and human capital in high demand**
 - Coders, data scientists to establish and maintain AI/ML/DL, DLT capacities
 - Rising valuation of intellectual property (incl. algos, AI/ML models and output)

Risks: Data-driven finance affects financial stability

- **Interconnectedness risks — contagion**
 - Correlations: New correlations, e.g. investments-based AI/ML pattern recognition
 - Exposures: New services, new players (algo-based lending, crypto assets)
 - Technology: Propagation of volatility by shared algos, similar ML patterns
- **Market, credit and liquidity risks — leverage and procyclicality**
 - Homogeneity: AI/ML-induced homogeneity in lending and investment decisions (directional trading)
 - Uncertainty: Lower predictability of market movements, esp. where Black-box-AI/ML decides; interplay of algos, esp. in distress or non-trained situations
 - Arbitrage: More efficient arbitrage resulting in lower capital, margins, liquidity
- **Operational risks — data, models, technology**
 - Data: Data selection and data quality risks under AI/ML; data certainty, e.g. DLT immutability; infrastructure re-design (big-data systems)
 - Models: Model risk, incl. model misspecification and miscalibration, inherent information asymmetry between AI/ML and humans – “Black-box-AI” vs “Explainable AI” (XAI); limited training data from crises
 - Technology: Rising risks from system-downs, cyber-intrusion; growing dependence on unregulated technology and third-party data providers; data ownership and market concentration (esp. BigTech)
 - Reputational: Stability impact in case of loss of trust in data (CSP, DLT, BigTech)

Authorities: Beneficiaries in the age of data

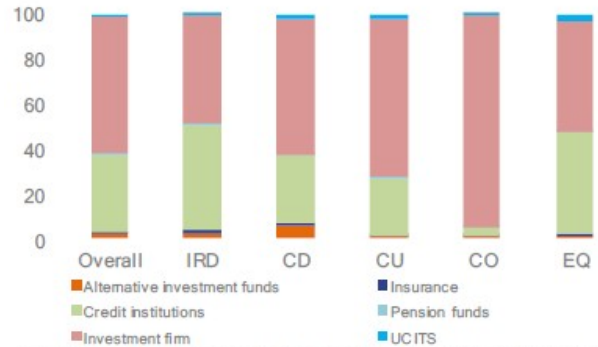
- GFC response: New requirements enable data-driven supervision
 - Trading: MiFID2 transparency requirements
 - Derivatives: EMIR trade state and position reporting
 - Securities lending: SFTR transactions and position reporting (forthcoming)
 - Securitisation: Instruments and underlying portfolios
 - Alternative funds: Industry and key fund-level statistics and metrics
- Authorities dispose of unprecedented amounts and granularity of data – from “in the dark” to “blinded by the light”
- Data use: Important progress on exploiting new data sources
 - Data operations: Continuous operation of complex data systems, e.g. processing 4bn records on >16mn financial instruments, >26bn derivatives trading records; incl. ML-based data quality management
 - Policy implementation: Automated system for calibration of MiFID2 transparency requirements, Double-Volume Cap, Systematic Internalisers
 - Risk analytics: Range of KPIs/KRIs to support entity supervision and system oversight, e.g. on derivatives market participants (CCPs, counterparties; TRs), AIF risks, investment fund performance and prices
- ESMA as leading authority in processing and analysing very large, complex sets of market data, and providing model parameters used by markets

Case 1: EU derivatives markets

ASRD.6

Gross notional amount by sector of counterparty

Credit institutions and investment firms prevail

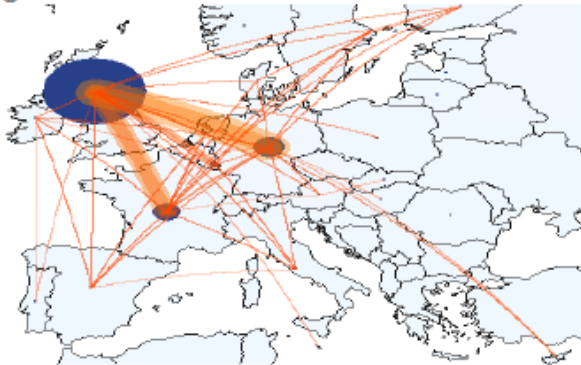


Note: Gross notional amount outstanding (not reconciled) by counterparty, in % of gross notional amount outstanding, by asset class.
Sources: TRs, ESMA.

ASRD.8

Credit derivatives: Geographical network

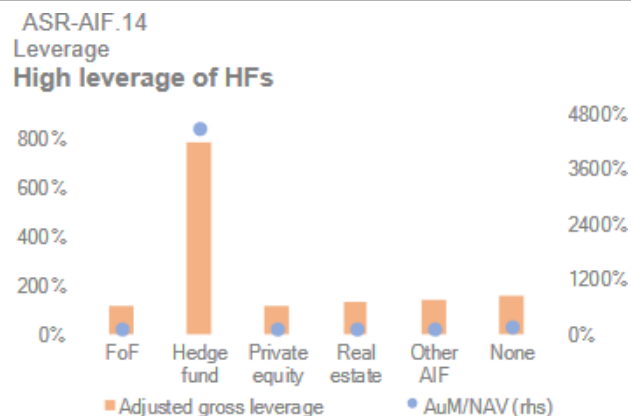
High concentration in UK



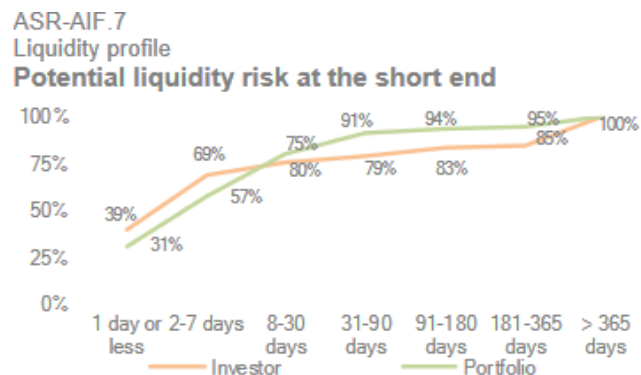
Note: Undirected network of gross notional amount outstanding. The size of the bubbles is proportional to the gross notional amount outstanding for counterparties domiciled in the Member State. The thickness of the line is proportional to the gross notional amount outstanding between counterparties from the two Member States.
Source: ESMA.

- First-time market risk monitoring based on EMIR TR data
 - EUR 660tn gross notional
 - >74mn transactions
- Plethora of analytical dimensions
 - Contract type, asset, class, underlying
 - Clearing members, counterparties
 - Clearing, trading methods
 - Maturities, currencies
- Risk metrics to monitor exposures and vulnerabilities
 - Network metrics, traced over time
 - Risk concentration metrics

Case 2: EU alternative fund risk metrics



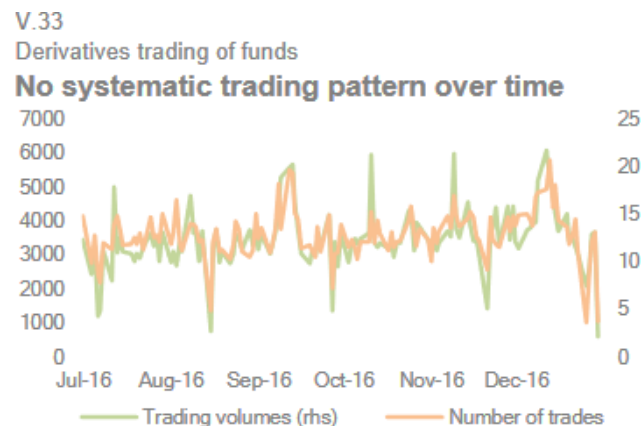
Note: Adjusted gross leverage of AIFs managed and/or marketed by authorised EU AIFMs, end of 2017, in % of NAV. Adjusted gross leverage does not include IRDs. FoF= Fund of funds, None=No predominant type. Data for 24 EEA countries. Sources: AIFMD database, National competent authorities, ESMA.



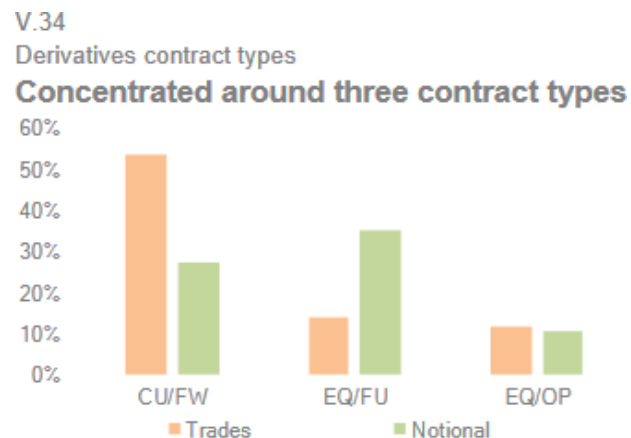
Note: Portfolio and investors liquidity profiles of AIFs managed and/or marketed by authorised EU AIFMs, end of 2017. Portfolio profile determined by percentage of the funds' portfolios capable of being liquidated within each specified period, investor liquidity profile depend on shortest period within each fund could be withdrawn or investors could receive redemption payments. d=Days. Data for 24 EEA countries. Sources: AIFMD database, National Competent Authorities, ESMA.

- AIFMD data for granular market statistics...
 - >30,000 funds
 - EUR 5,9tn net asset value
- ... across 5 fund categories...
 - hedge funds
 - private equity
 - funds of funds
 - real estate funds
 - others, incl. special funds
- ... and key risk metrics at fund and aggregate levels, esp.
 - fund liquidity profiles, incl. investor liquidity and portfolio liquidity
 - financial and synthetic leverage

Case 3: Data matching for UCITS derivatives risks



Note: Total number of derivatives transactions reported under EMIR, and gross notional amounts traded (right axis), EUR bn.
Sources: TRs, ESMA.



Note: Share of the top 3 derivatives contracts, in % of all derivatives trades and total notional. CU/FW=currency forwards; EQ/FU=equity futures; EQ/OP=equity options.
Sources: TRs, ESMA.

- Matching large data systems as key to advanced risk monitoring
 - Interconnectedness as core risk ca
 - Analysis of interplay with cyclicity
 - Here: Granular UCITS portfo (commercial), matched with daily transactions from EMIR TR data

- Data standardization and quality indispensable

- ESMA as driver of EU and international use of data standards, esp. ISIN, LEI, GLEIF
- Extensive, automated routines for data quality control and cleaning

Outlook: Keeping up with technology and markets

1. Data policy and supervision

- Standardisation: Re-enforce implementation of data codes and standards in EU markets, esp. ISIN, LEI, GLEIF, UTI, ISO standards
- Supervision: Ensure correct fulfilment of data reporting obligations
- Technology: Advise policymakers on data policy (e.g. XAI, DLT, cyber risks)

2. Big data system implementation

- Rationale: More complex regulatory data coming (securitisation, SFTR); growing demands on supervisory analytics (esp. CCPs, DRSPs)
- Realities: 90% of ESMA systems based on structured data and limited in size, complexity; implementation costs (incl. capex, highly valued expertise)

3. Advanced analytics development

- Data analysis: Enhanced use of web scraping, natural language processing (NLP), AI/ML-based pattern recognition

4. Data-driven regulation, convergence and supervision

- General: Intensify and promote data and evidence driven approaches to regulation, convergence and supervision in ESMA and among members
- Monitoring, analysis: Further enhance coverage of KPIs/KRIs for entity and market performance; ad-hoc analyses to inform regulation, supervision, esp. Impact Assessments, Stress Tests and Stress Simulations

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Data giants in finance - reshaping the industry?

Heli Koski, ETLA/Aalto University

Data driven financial stability: opportunities and challenges in big data

December 3, 2019

The Big Read Cryptocurrencies

+ Add to myFT

Facebook's full-frontal assault on finance

Digital currency plan has already garnered a backlash, but may still be hugely disruptive

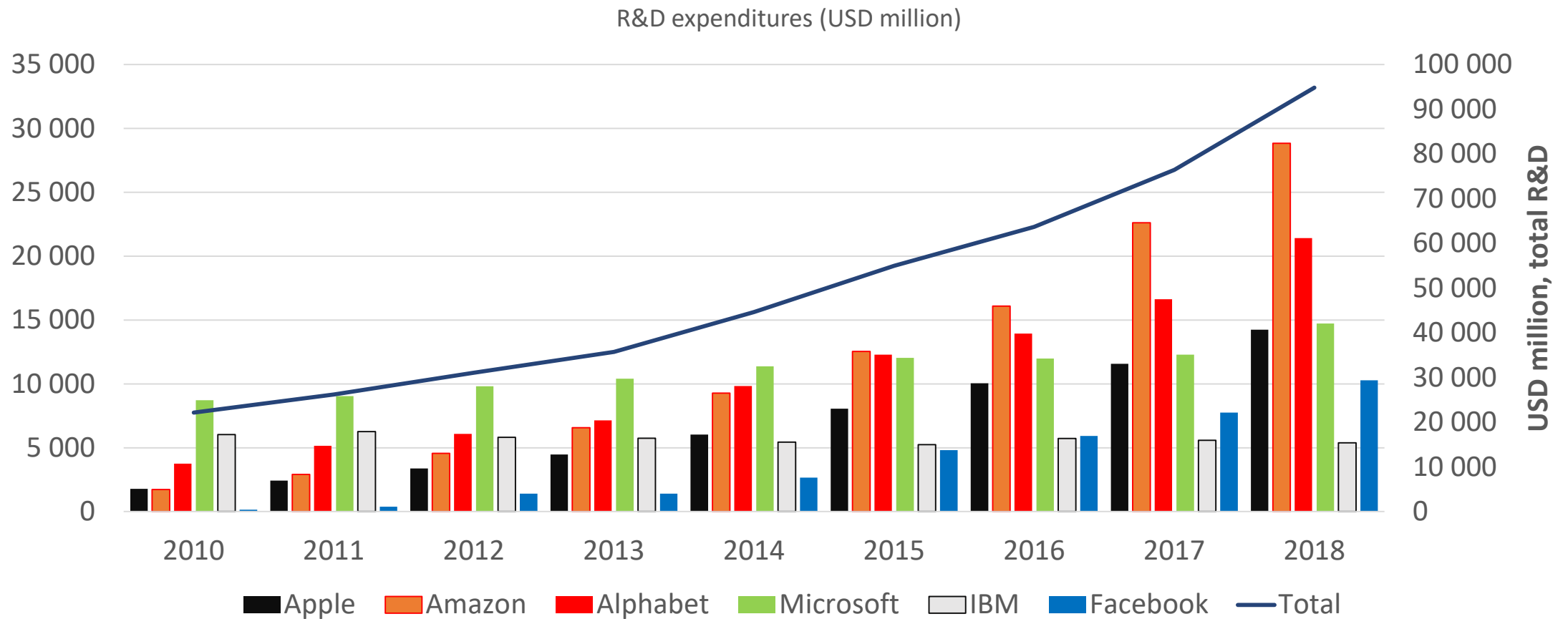


Outline

- Fintech innovation of data giants
- Acquisitions of innovative start-ups
- Data giants in financial services markets – entry and competition

Fintech innovation of data giants

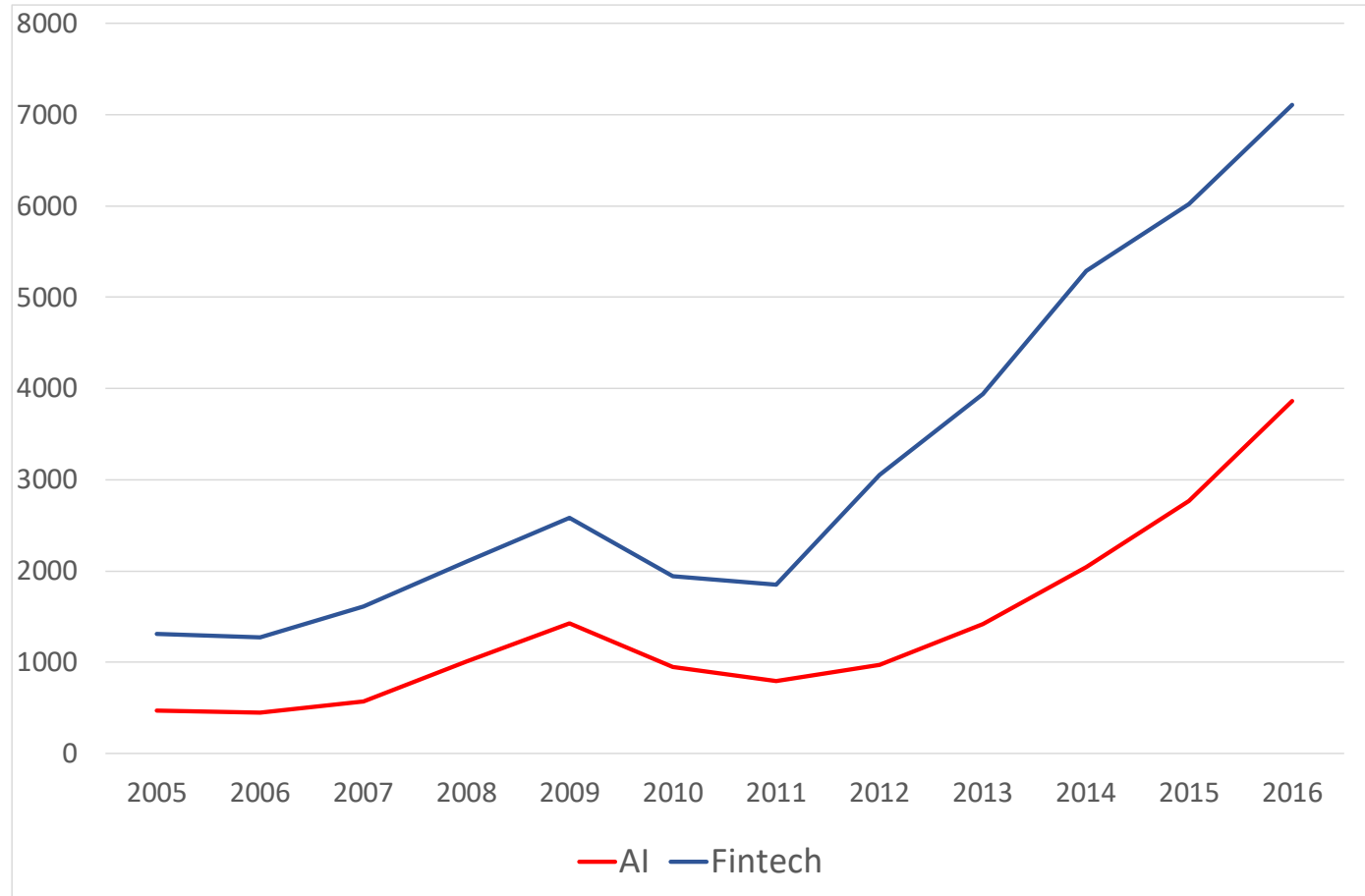
R&D expenditures of data giants: 2010-2018



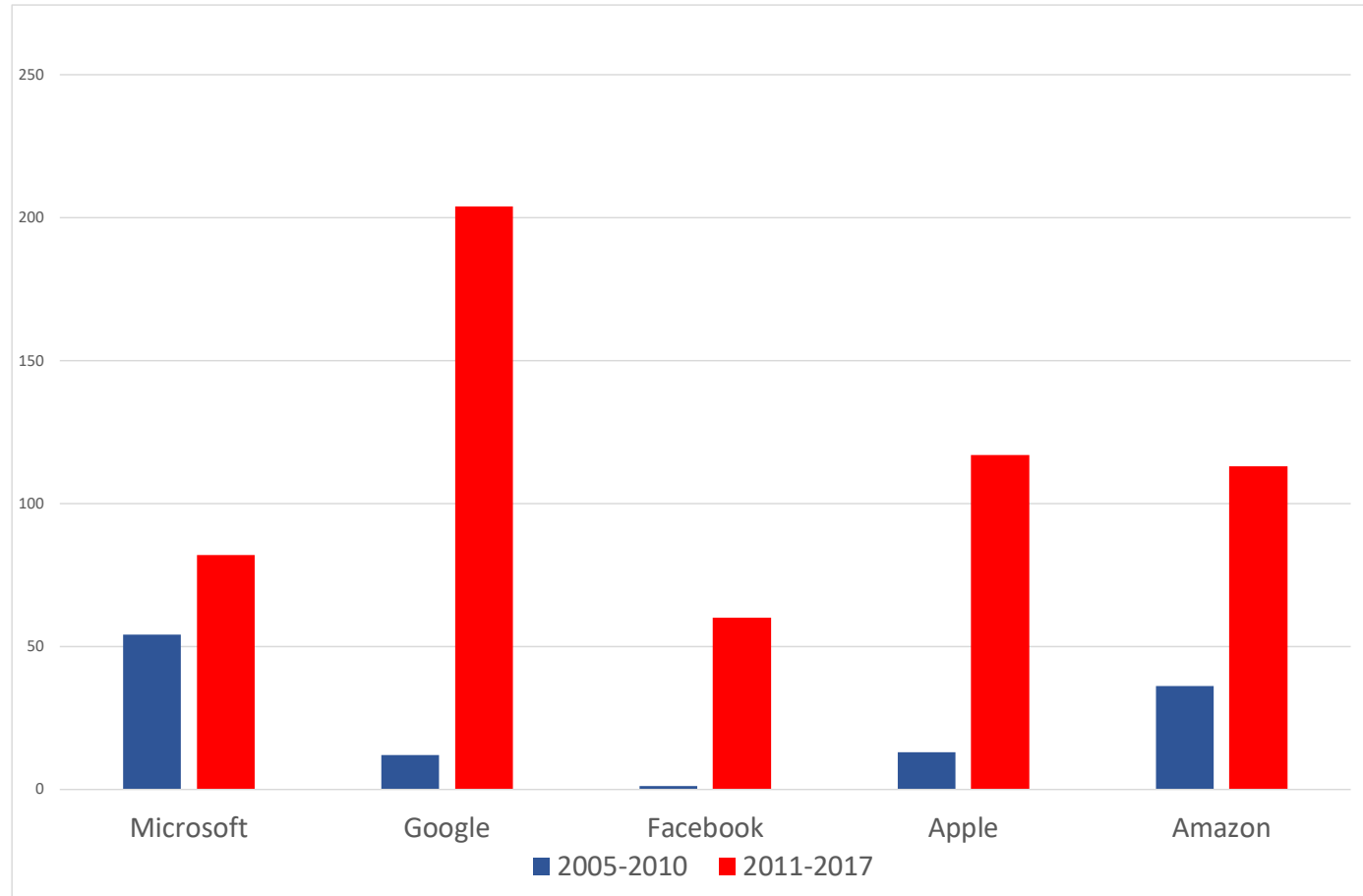
Patented innovation – competition for the market

- Patent provides its holder right to exclude others from making, using or selling invention for limited period of time, typically 20 years.
- **Competition for the market:** patents used for supporting creation of or firm's entry to new markets; to secure that firm will have the freedom to commercially exploit its ideas in new, expanding market areas.
- Patent portfolios; also power to potentially block follow-on innovation.
- Uncertain how markets will evolve; increased patenting in a technology field signals firms' expectations on future importance of these markets.

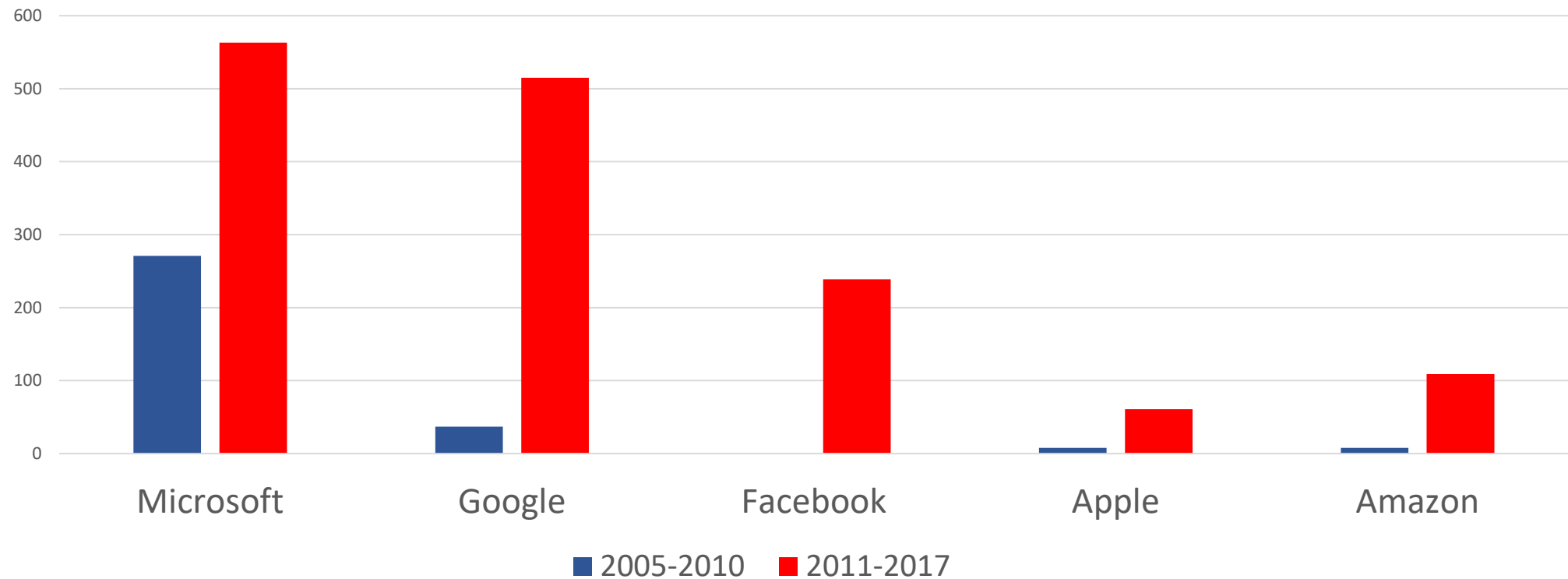
Total number of AI and fintech patent applications filed with the USPTO: 2005-2016



Number of fintech patent applications filed by data giants with the USPTO, 2005-2010 vs. 2011-2017



Number of AI patent applications filed by data giants with the USPTO: 2005-2010 vs. 2011-2017

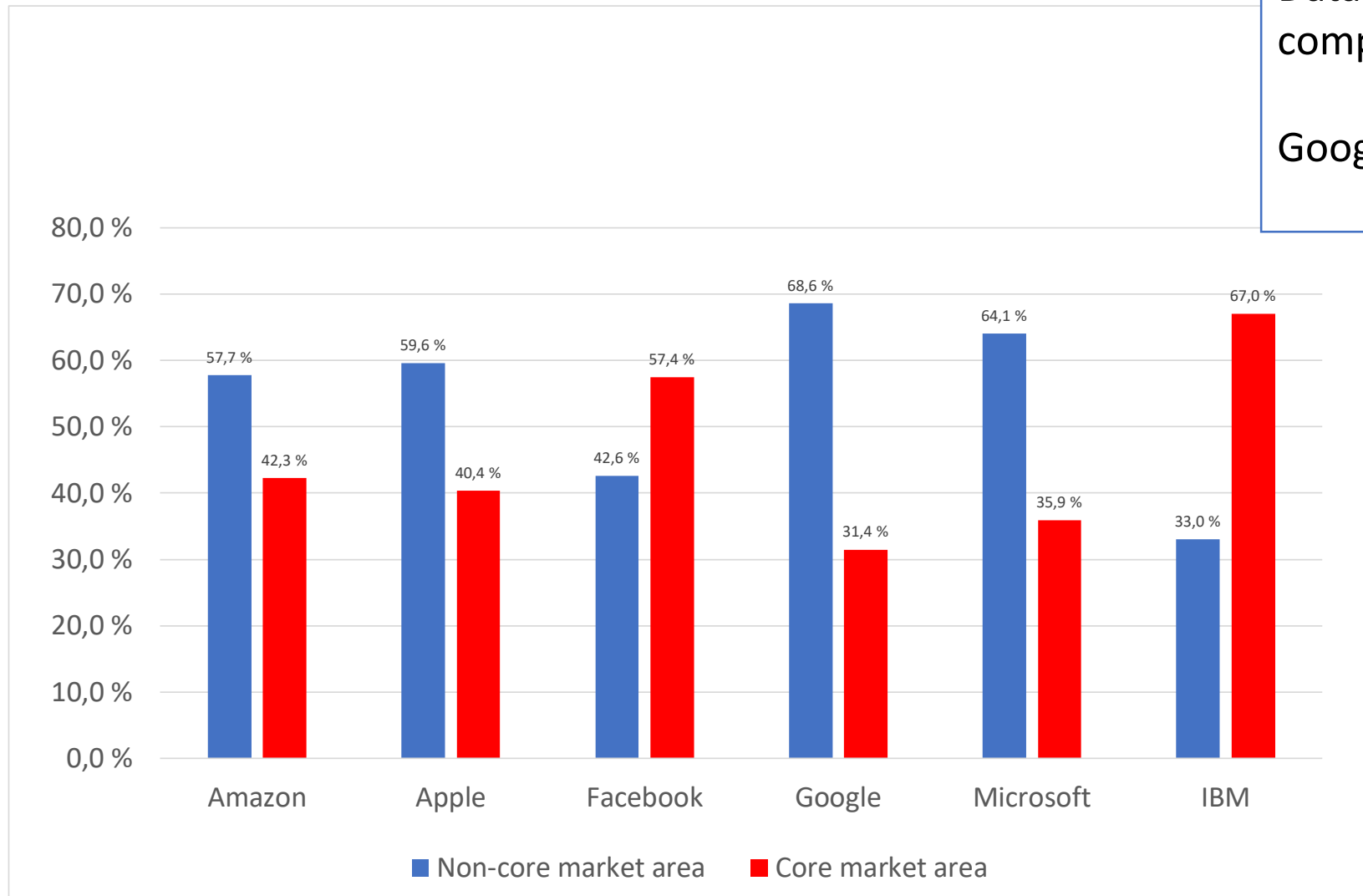


Acquisitions of innovative start-ups

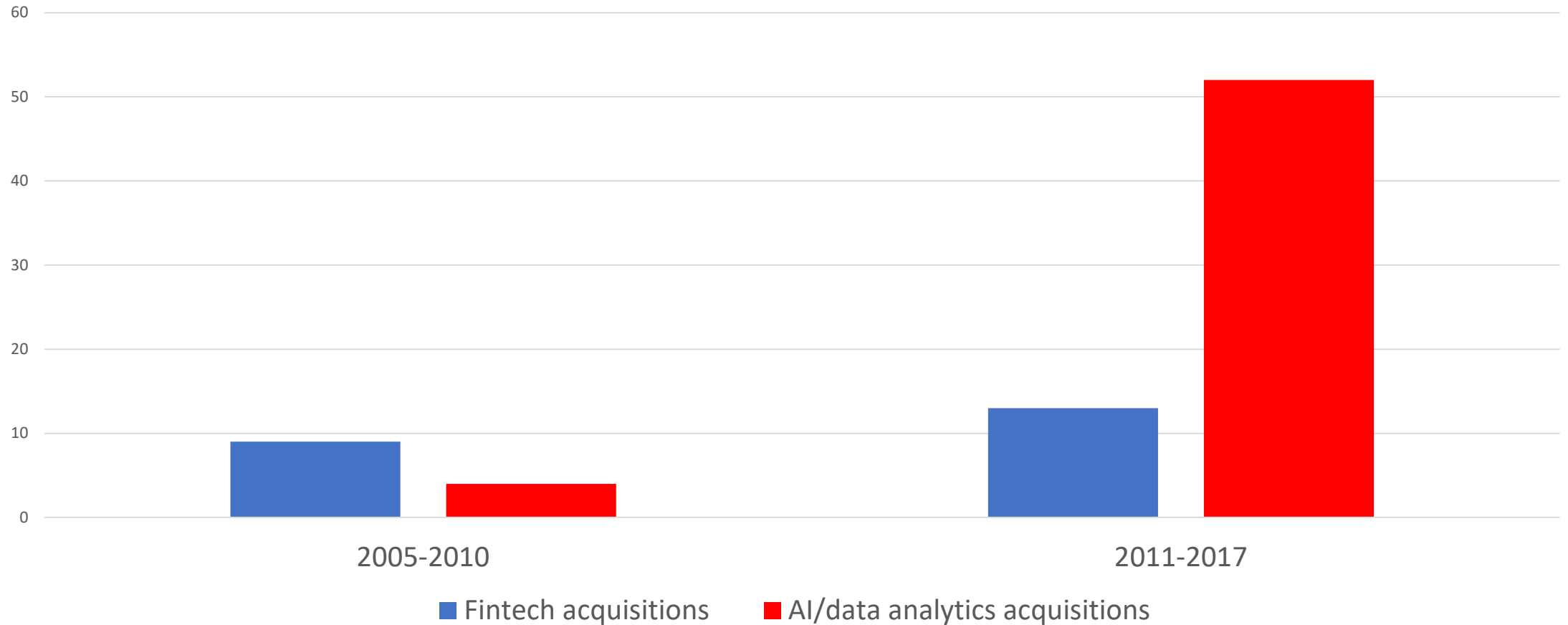
Data giants' acquisitions: core vs. non-core market areas, 2005-2017

Data giants acquired over 700 companies 2005-2018.

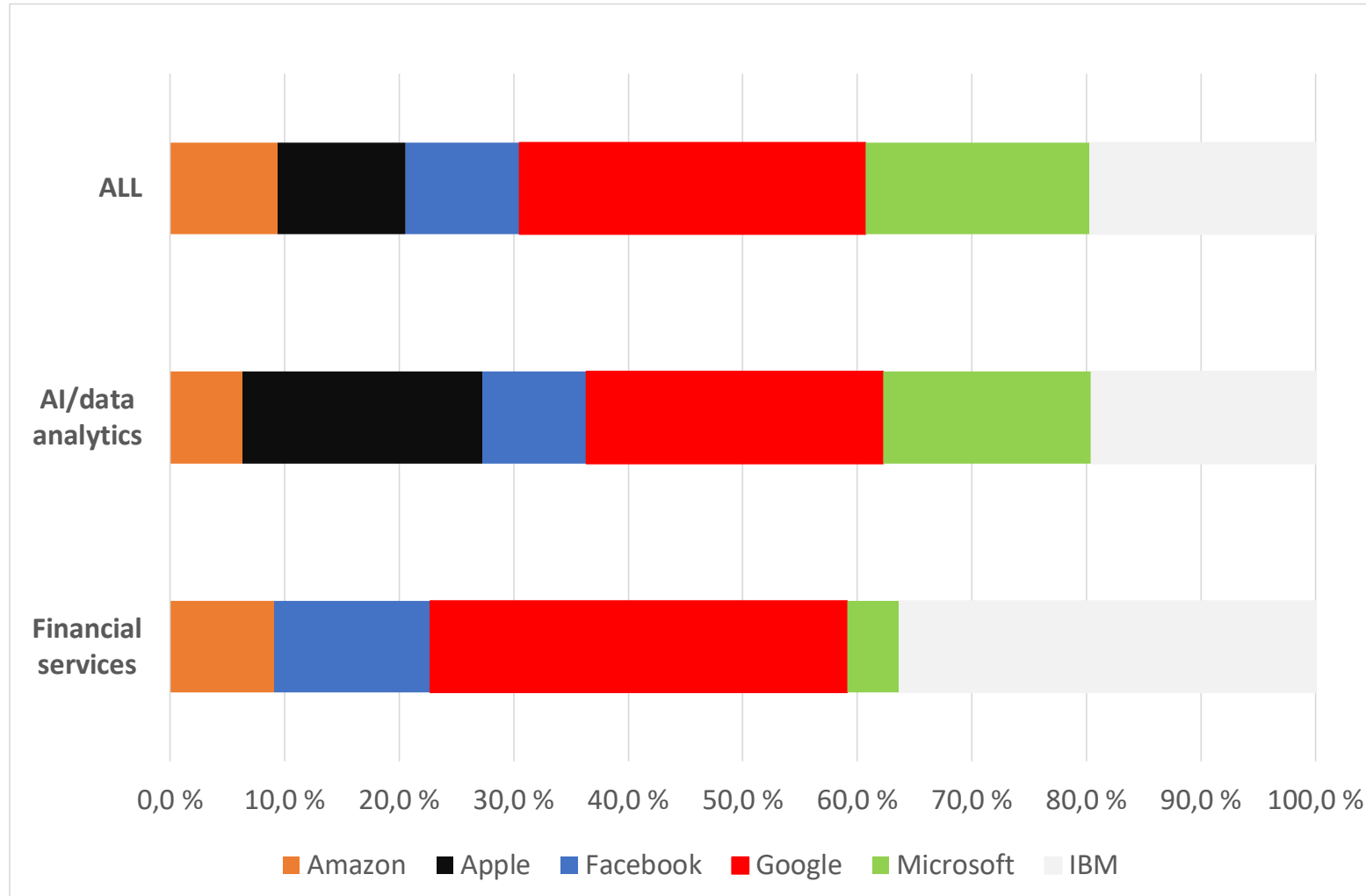
Google: 200+ acquisitions.



Data giants' fintech and AI acquisitions: 2005-2010 vs. 2011-2017



Percentage shares of acquired companies among data giants: 2005-2017



Examples of GAFA buyouts

- 2012: Google bought TxVia offering an advanced payments processing technology for emerging payments and other transactions in financial services.
- 2013: Facebook bought Onavo developing mobile applications that assist its users in managing their finance, entertainment, social networking, and privacy (price: USD 120 million).
- 2016: Amazon bought Emvantage offering online payment gateway platform compatible with credit card, debit card, and net banking.

Data giants' acquisitions: efficiency gains vs. antitrust concerns

- Fintech acquisitions: data giants' access to new technologies and tacit knowledge, enable specialization. If data giants are better at exploiting technologies of innovative start-ups
→ efficiency gains; increased innovation and overall welfare.

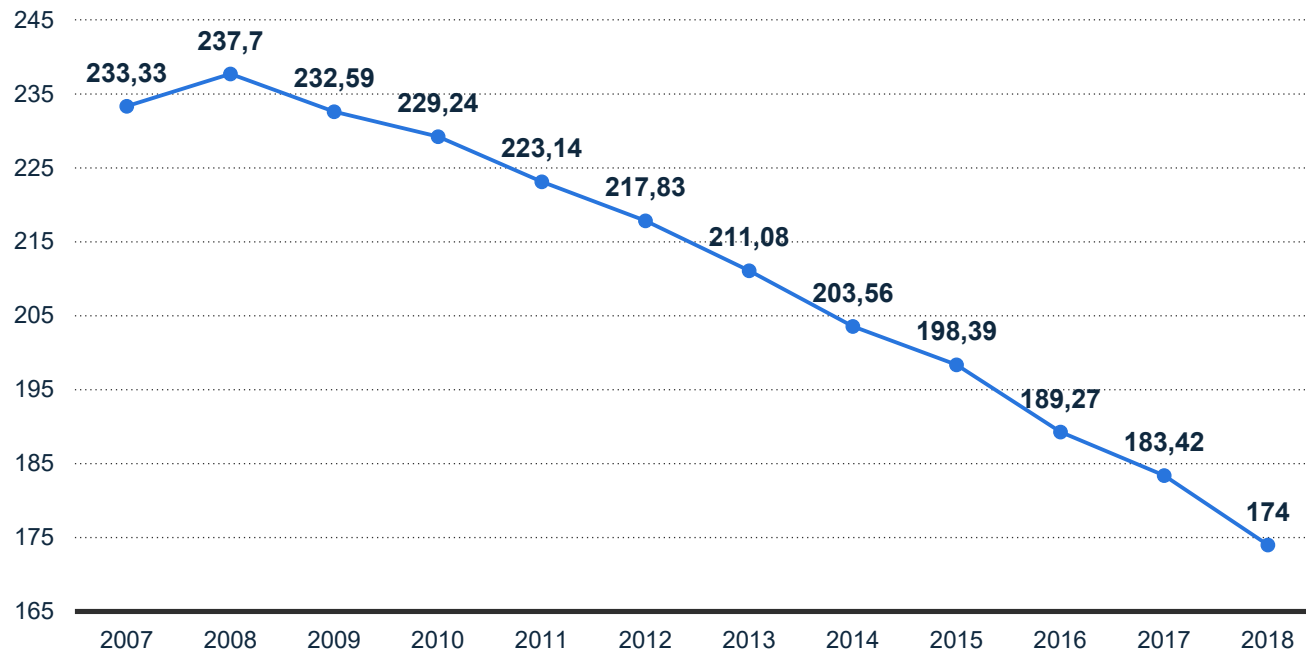
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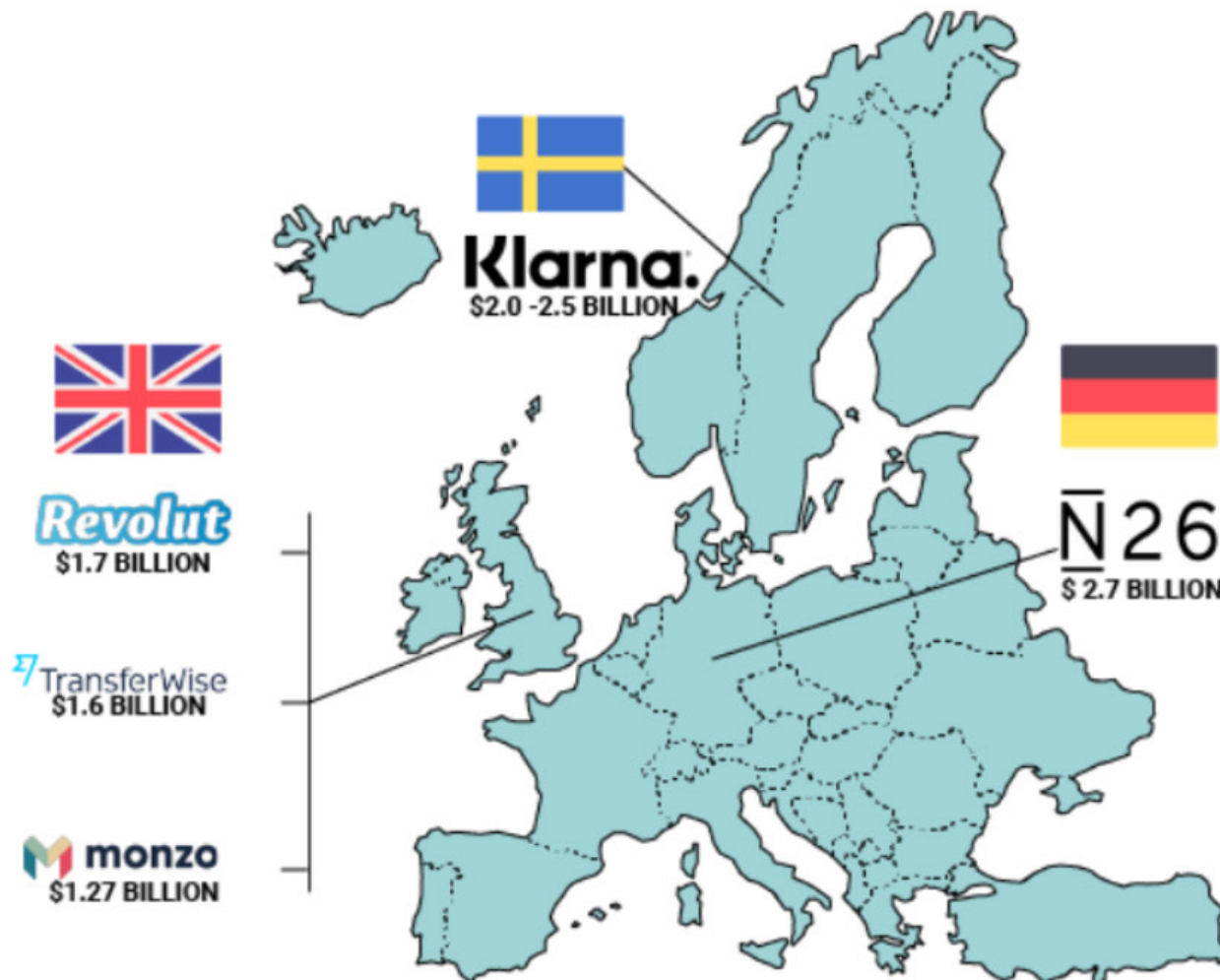
- Killer acquisitions: data giants acquire innovative fintechs to pre-empt future competition (arising from start-ups' innovation).
→ Decreased competition; barriers to entry; antitrust concerns.

Data giants in financial services markets – entry and competition

Digital disruption in financial markets

Number of bank branches (1000s) in Europe





FINTECH UNICORNS IN EUROPE

Source: <https://fintechnews.ch/fintech/a-snapshot-of-the-europes-fintech-unicorns/25253/>

Financial ecosystem with data giants

- Large technology firms' payment platforms
 - i) Online third-party payment infrastructures (e.g., Apple Pay, Google Pay)
 - ii) Payment systems proprietary to large tech companies (e.g. Alipay, WePay)
- Insurance products and money market funds available on data giants' platforms
- Fintech credit provision
- We haven't yet seen large tech companies to enter to traditional banking & financial services still generate only small part of their revenues globally, but big tech is looking for new market areas to enter...

Pros and cons of data giants' market entry

- Data giants' market entry to finance raises questions on efficiency, competition and data regulation.
- Concerns on data giants' market power and anti-competitive behavior.
- But also, data giants' innovation means new services/products & they may increase efficiency and enhance financial inclusion by serving clients that wouldn't be served by incumbents, e.g., due to lack of required documents
 - For instance, SMEs in developing economies may not get loans from incumbent banks as they don't have audited financial statements.

Data giants – value creation in finance

- Extraction of rents via data: e.g., price discrimination (e.g., using data to identify consumer's willingness to pay for insurance).
- Data giants' technologies to understand customer needs/behavior
 - Google: "Methods, systems, and media for personalizing computerized services based on *mood and/or behavior information* from multiple data sources"
 - Amazon: "Method for using *customer attributes* to select a service representative"; "Determining *user interest* from non-explicit cues"
 - Facebook: "Systems and methods for estimating *user attention*"
 - Apple: "Inferring *user mood* based on user and group characteristic data"
- Customer experience: using user data to offer personalized services (incl. digital assistance, offers, recommendations)

More liberal market entry – more competition?

- Traditional approach of competition authorities may not suit well to large technology companies in financial markets.
- Lowering barriers to market entry generally fosters competition.
- BUT in case of data giants their **large size** and **control over various digital platforms** (social media, e-commerce etc.) and **massive amounts of user data** may enable them to use their market power also in finance.

Data giants in finance – anti-competitive behavior?

- **Exclusionary practices**

- E.g., exclusion of potential competitors via increasing user switching costs; self-preferencing (favoring own products, making competing financial companies access to client via their platforms more expensive); killer acquisitions.

- **Abuse of dominant position**

- Data concentration; debate on when data available to dominant firm but not to competitors is regarded as abuse of dominant position.
- Other anticompetitive practices, e.g., provision of privileged data access to own subsidiaries, algorithmic collusion (i.e., exchanging commercially sensitive information, e.g., on prices or costs).

Data giants' entry to new areas in finance continues...

- June 2019: Amazon launched a credit card for underbanked shoppers.
- August 2019: Apple's credit card introduction.
- November 2019: Facebook's announcement of its new payments system, Facebook Pay.
- November 2019: Google told it will begin to offer checking accounts in the US in 2020.



Silicon Valley giants are after your data, not your money



Satoshi Kambayashi



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