Distributed Ledger Technologies and market infrastructure

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Since 2000, FinTech investments has grown dramatically

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Companies</th>
<th>Total Funding</th>
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<tbody>
<tr>
<td>2005</td>
<td>~1,600</td>
<td>$5.5B</td>
</tr>
<tr>
<td>2010</td>
<td>~3,000</td>
<td>$15.3B</td>
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<tr>
<td>Today</td>
<td>&gt;8,800</td>
<td>&gt;$100.2B</td>
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Visualization based on ~1,800 FinTechs receiving the highest amount of private funding. Dataset mapped with Quil and allowed to cluster based on similar products, technologies, customers etc.

1) Data based on over 8,800 companies which were discovered across over 4 data sources. Total funding based on date of funding. Total companies based on founding year. Data as of November 2016.

Source: Fintech Control Tower, Expand, November 2016
ECB approach: Assessing impact of FinTech / DLT on central bank roles
The future of Eurosystem market infrastructures

Keeping pace with technological advance and changing needs of users

Consolidation of TARGET2 and T2S
Improve efficiency, cut down operational costs, easier access to services via harmonised interface, etc.

TARGET Instant Payment Settlement
Ensure efficiency and market integration in the settlement of instant payments (operating hours up to 24/7/365)

Eurosystem collateral management system
Further harmonisation of the Eurosystem’s collateralisation techniques and procedures
Hammer (DLT) looking for a nail (Eurosysteem market infrastructures)?

- Eurosysteem operates two of the world’s largest market infrastructure services (TARGET2 and TARGET2-Securities)
- New projects have been launched (TARGET Instant Payments Settlement) and additional initiatives are being assessed
- DLT cannot be the solution at this stage of development but benefit of possible future use is being explored
Experimental work with DLT

**ECB/Bank of Japan cooperation:** In December 2016, joint research project launched to study the possible use of DLT for market infrastructure.

**ESCB / Eurosystem work:** Cooperation and joint work to better understand opportunities and challenges of DLT.

**Central Bank Digital Currency / Digital Base Money**

"The ECB will continue to provide banknotes."
(Yves Mersch, ECB Board member, 04/2017)
Financial market integration efforts must not be jeopardised by new technologies.

Coordinated efforts are necessary to harmonise potentially DLT-enabled business processes at the industry level and with public authorities; DLT-Task Force (ECB Secretariat / chaired by + composed of market participants); first findings published in September 2017.

E.g. assessing impact on oversight framework.
Central bank money

Deposits at central bank accounts

Banknotes

Coins

Distributed ledger technology (DLT) / blockchain?

Project Stella

CBDC*

CBDC

* Central Bank Digital Currency
Objective
Deepen understanding of DLT
Not geared towards replacing existing central bank services with DLT-based solutions

Use case
In-depth experiments on whether specific liquidity-saving mechanisms of TARGET2 and BOJ-NET could be run on DLT
Assessment of performance (efficiency) and availability (safety)

Test set-up
In-house test environment / cloud computing services
Hyperledger v0.6.1
Main findings (1)

Performance

Current performance needs of RTGS system (ca. 10-70 requests per seconds - RPS) can be processed without difficulty

Non-negligible trade-off between traffic and performance when RPS increased up to 250

Latency stayed at around 0.6 seconds when nodes were 4-65

Liquidity-saving mechanisms (smart contract) not a major factor for latency (adding 0.01-0.02 sec.)
Main findings (2)

Performance (ctd.)

DLT performance is affected by distance between nodes

Scenario 1 (“concentrated”)

Scenario 2 (“dispersed”)

[Scenario 1] quorum required to achieve consensus was close together: negligible impact on latency

[Scenario 2] if quorum is dispersed: higher impact on latency (up to 0.3 seconds)

(RTT = round trip time
12 ms = distance Frankfurt/Rome, Tokyo/Osaka
228 ms = stance Frankfurt Tokyo)
Main findings (3)

Availability

DLT solutions were found to be resilient to the failure of individual network nodes.

As long as the number of nodes required by the consensus algorithm (3 out of 4 nodes) was operational, availability was not affected.

Validating nodes mostly recovered in less than 30 seconds.

Certificate authority could become a single point of failure.
Main findings (4)

Availability (ctd.)

DLT solutions were found to be resilient to incorrectly formatted messages.
Latency remained between 0.5 and 1 second.

- Percentage of incorrectly formatted transactions
- Latency remains between 0.5 and 1 second for different transaction rates.

10 transactions per second
100 transactions per second
Thank you! Questions?