Self-governance in complex financial systems

Alexey Lobanov, Ph. D., FRM

Director Banking Regulation Department Bank of Russia

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Outline

- 1. Goal functions and architecture of financial systems
- 2. Key features of distributed financial systems
- 3. Self-regulation in financial systems and in nature
- 4. Amending existing rules and producing new ones: a task for artificial intelligence?
- 5. Recent trends in direct participation in lawmaking: citizens' initiative referendum (RIC) by "yellow vests" in France

Goal functions of financial systems









Investment / Saving

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Goal functions of financial systems

Question for discussion

Are there any other goal or secondary functions performed by financial systems?

- ü Price discovery?
- **ü** Risk sharing?

...

Architecture of financial systems



Centralized financial system

- § A single trusted entity keeps complete information on all transactions
- **§** Intermediary-client relationship
- S Client account as a primary legal concept Example: central depositaries, central counterparties

Decentralized financial system

- S Different records together provide complete information on transactions
- § Intermediary-client relationship
- **§** Client account as a primary legal concept

Example: hierarchical ledgers (central depositary records assets only of banks and brokers, which, in turn, keep records of end-investors)

Architecture of financial systems

Distributed financial system

- **§** Each member (node) keeps complete record of past transactions
- S Each new transactions is verified by members based on consensus (e. g. proof-ofwork, proof-of-stake)
- **§** Record of past transactions are kept as immutable sequence of blocks
- S Open (i. e. permissionless) access to the system to ensure tamper-proof and censorship-resistant network (?)

Architecture of financial systems



Source: Tannenbaum (2011), p. 2

Financial system vs financial network

"There is considerable confusion in the literature between a computer network and a distributed system. The key distinction is that in a distributed system, a collection of independent computers appears to its users as a single coherent system. Usually, it has a single model or paradigm that it presents to the users. Often a layer of software on top of the operating system, called *middleware*, is responsible for implementing this model.

In a computer network, this coherence, model, and software are absent. Users are exposed to the actual machines, without any attempt by the system to make the machines look and act in a coherent way.

In effect, a distributed system is a software system built on top of a network. The software gives it a high degree of cohesiveness and transparency. *Thus, the distinction between a network and a distributed system lies with the software (especially the operating system), rather than with the hardware."*

Distributed financial systems



Smart contracts

- Computer code designed to automatically execute contractual duties upon the occurrence of a trigger event
- "Add-on" to a distributed financial system beyond its primary function as a keeper of records
- **ü** Automatic and unstoppable execution of contracts in data format
- ü Excise of human discretion
- ü No ex-post review of contractual duties after contract formation
- ü Immutable after execution due to blockchain structure

Source: Paech (2017)

Distributed financial systems



Unwarranted emergence

- L Herd behavior and flash crashes
- L Impossibility of administrative "stays" on execution of transactions in case of high volatility or insolvency
- Increased leverage in financial system due to false perception of zero credit risk
- L Interaction with third parties

Decentralised autonomous organisation (DAO)

Smart contracts can be combined with one another in a distributed network (DAO), operating without human intervention, creating a complex, evolving ecosystem of interacting agents linked by rules that are

- ü Pre-determined
- ü Hard-wired
- ü Self-enforcing

Source: Paech (2017)

Distributed financial systems

Risk management issues

- **ü** Common risk management mechanisms in financial systems:
 - Ø DVP
 - *Ø* Offsetting and close-out netting agreements
 - Ø Collateral
 - Ø Multilateral clearing of exposures
 - Ø Hedging with derivatives
- DVP, offsetting, and netting reduce gross bank credit exposure to risk from derivatives transactions by 75 82 percent (BIS 2016, 2017), hence capital is required for only 18 24 percent (!)

Risk management across different asset classes require (Paech 2017)

- L Very complex sets of smart contracts and corresponding blockchain systems or
- L Capital adequacy requirements based on gross basis (obviously unaffordable)

How credible execution of goal functions in distributed financial system can be ensured?

- **ü** Applying pre-defined rules in a consistent and credible way
 - Ø Reaching agreement (consensus) in finite time (!)
 - Ø Tolerating / identifying faults and opportunistic / malicious behavior
 - **Ø** Disciplining untrustworthy members (i.e. cheating)
 - Ø Dealing with unwarranted emergence in complex systems
- **ü** Amending existing rules and making new ones under the internal governance procedures

Can distributed financial systems provide greater financial stability?

"A polycentric financial system is thus not one without regulations, but one in which the regulations are created *endogenously by the actors*, rather than exogenously by a government regulator.



How are these endogenous regulations created? *The most interesting and important institution in this regard is the interbank clearinghouse*. These are institutional questions, and institutional questions demand institutional answers."

Source: Salter and Tarko (2017), p. 26

When self-governance may emerge?

	Sociological Approach	Economic Approach	Political Approach
Characteristics required for successful self-governance	Dense social ties	 ü Small groups (low cost of communication) ü Homogenous agents ü Low discount rates (threat of a "lost" future is meaningful) 	 ü Delegation ü Low tax rates ü Government encourages sharing of information

Source: Stringham and Boettke (2014), p. 9

Self-regulation in nature: an example



Dictyostelium discoideum (slime mold)

Chemical "smart contract"

Amoeba living in soil and capable of transition from a collection of unicellular organisms into a multicellular "slug"

Starvation initiates a biochemical machinery allowing for cell adhesion to attract neighboring cells to a central location

The slug is about 2–4 mm long, composed of up to 100,000 cells, and is capable of movement by producing a cellulose sheath in its anterior cells through which the slug moves toward light, heat, and humidity

Source: Wikipedia

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A task for artificial intelligence?

"Keeping in mind that irrelevant or outdated traditions are difficult to change once in place, we should take advantage of this period of time to create governance models that have lasting core tenets where change is a key tenet (*establish a tradition to be able to amend traditions-* oxymoron I know)."

Laird (2018)

Recent developments

- Improving decision-making models by AI models (e. g. genetic optimization algorithms)
- Ø "Deep" machine learning based on unstructured "big" data

Amending and making rules



"Le RIC": Citizens' initiative referendum

- " Right to propose law?
- Right to demand to abrogate a law?
- Right to revoke elected officials?
- Right to modify a Constitution?
- Right to approve or disapprove of treaties?

Source: Le Monde (2018)

References

- Baldwin, R., Cave, M., Lodge, M. (2012). Understanding regulation: Theory, strategy, and practice, 2nd Edition, Oxford University Press.
- Bank for International Settlements (2016), OTC derivatives statistics at end-June 2016, 16 November (<u>https://www.bis.org/publ/otc_hy1611.pdf</u>)
- Bank for International Settlements (2017), OTC derivatives statistics at end-December 2017, 3 May (<u>https://www.bis.org/publ/otc_hy1805.pdf</u>).
- 4. Holland, J. H. (1998). Emergence: From Chaos to Order. Oxford University Press.
- 5. Laird, S. (2018). Blockchain Governance: How decentralized do we need to be? April 23rd (<u>https://www.blockstate.co/blog/blockchain-governance-how-decentralized-do-we-need-to-be</u>)
- Paech, P. (2017). The Governance of Blockchain Financial Networks. Modern Law Review, V. 80 (6), p. 1073–1110.
- Référendum d'initiative citoyenne: 6 questions sur une mesure populaire chez les «gilets jaunes», Le Mond, 16 December 2018 (<u>https://www.lemonde.fr/les-decodeurs/article/2018/12/16/six-questions-</u> <u>sur-le-ric-referendum-d-initiative-citoyenne-qui-seduit-les-gilets-jaunes_5398368_4355770.html</u>)
- 8. Salter, A. W., Tarko, V. (2017). Governing the Financial System: A Theory of Financial Resilience. Mercatus working paper, George Mason University.
- 9. Stringham, E., Boettke, P. (2014). Self-Governance in the Emergence of Financial Markets.
- 10. Tannebaum, A. S. (2010). Computer networks, 5th edition, Prentice Hall, Indian International Ed.

QUESTIONS???