Trade Credit Optimization

Kimmo Soramäki

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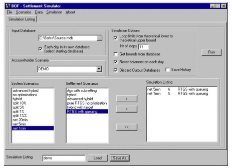
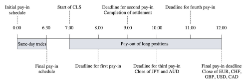
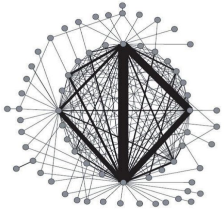
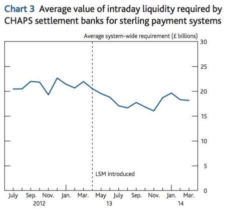
FNA

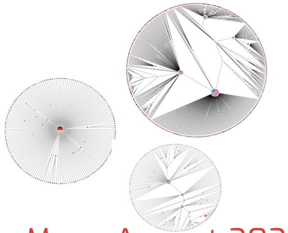
Payment System optimization has resulted in Billions of liquidity savings

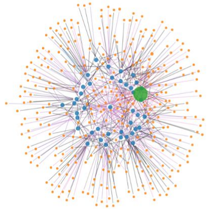












May - August 2022

1999

Bank of Finland developed the first Payment System Simulator to assess **liquidity impact of joining Target**

2002

CLS goes live after a **regulatory approval process**, setting a precedent of the critical role of simulations

2004-2006

FRBNY and U.S. National Laboratories develop Agent Based Model to assess **attacks on critical infrastructure**

2013

Bank of England **introduces new liquidity savings mechanisms** in CHAPS with FNA - £4b collateral savings for members

2018

First **GSIB** optimizes its group payments with FNA

2023-

First **wCBDC simulator**.

A bottom-up approach, focused on design options, adoption, and macro financial impact.

Key Features of the Trade Credit FMI

Objectives

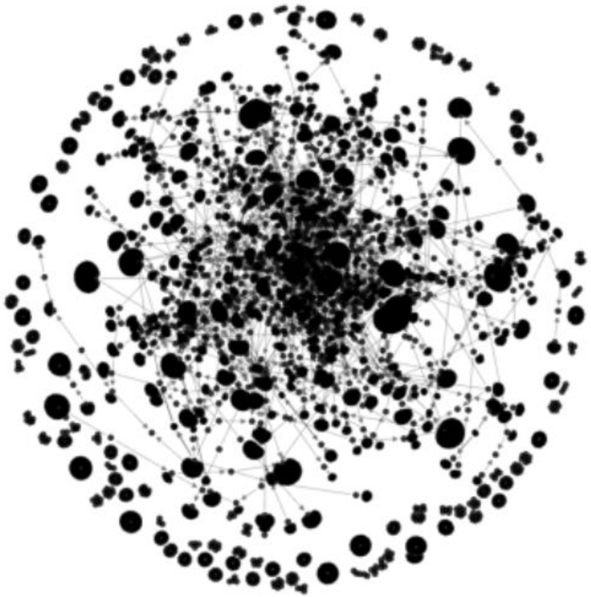
- Save 25%+ of liquidity/operating capital for firms
- Reduce substantially payment delays
- Improve economic efficiency and resiliency
- Significant downstream effects for the economy

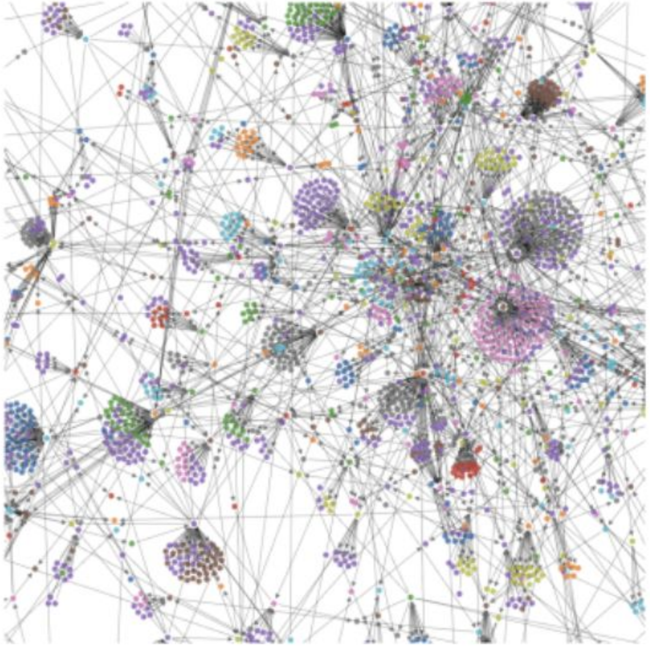
Design questions

- Data access
- Liquidity Saving Mechanism
- Credit Provision & Pricing
- Settlement Mechanisms (smart contracts, de/centralised, synchronization, frequency of Settlement)
- Payment Failure Recovery
- Incentives to join the FMI (banks & firms)
- Regulatory & supervisory handling

-> Phased approach with early wins and full vision achieved in stages

Trade Credit / Receivables are (payment) networks that can be optimized





Using network science / graph theory we can model and optimize these networks

Example:

Trade credit data from Huangdao Zone, Shandon Province, China, sourced from Cui (2021)

8,704 obligations between firms

Network Motifs

Diagram 1. Reciprocal payment flows.

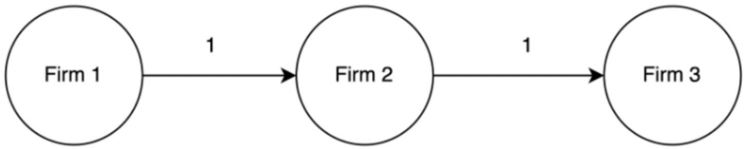


Diagram 2. Chain payment flows.

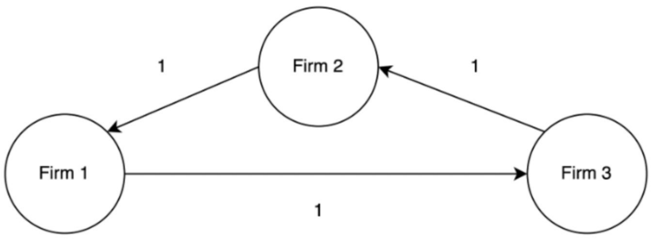


Diagram 3. Cyclical payment flows.

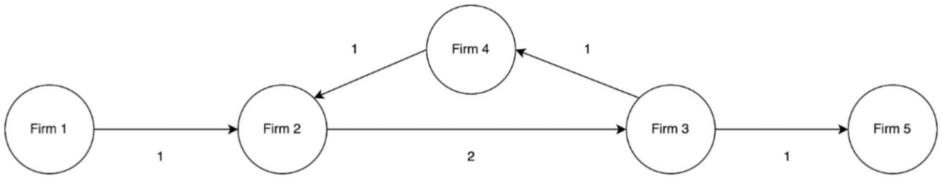


Diagram 4. Integrated payment flows. Source: Fleischman, et al. (2020)

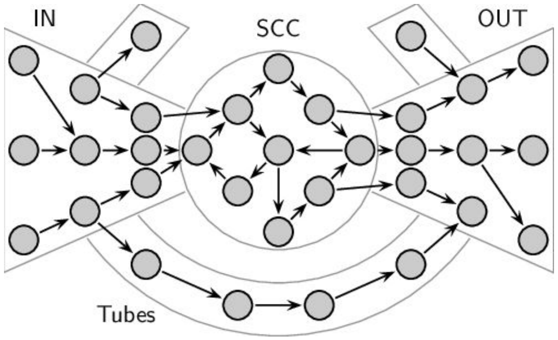


Diagram 5: Generalized bow-tie network

Basic idea of resequencing and positive impact on liquidity

Example: We have two obligations: A to C of value 10 and C to B of value 10.
And two orders to settle these.

Original order: C —10→ B and A —10→ C **Credit need: 20**

Balances:

A		-10
B	10	
C	-10	0

Resequenced order: A —10→ C and C —10→ B **Credit need: 10**

Balances:

A	-10	
B		10
C	10	0

50% Reduction of credit need using Resequencing

Until now impossible to solve for large systems

Using brute force to find the sequence of payments which minimises liquidity is impossible

A sequence of 2 payments results in 2! = 2 possible sequences

A sequence of 20 payments results in 20! = 2.4 * 10^18 possible sequences

= Three quintillion four hundred quadrillion

A sequence of 200 payments results in more sequences than there are atoms in the universe

Quantum computing can solve up 120 payments (McMahon et al. 2022)

FNA Re-sequence algorithm based on Graph Optimization works in a real-time environments with up to 25 million payments in 10 minutes,

Large potential liquidity savings

Huangdao Zone Credit network

Baseline	CNY 1.61 Billion
Optimal sequence with FNA:	CNY 1.09 Billion

This is a **32%** liquidity saving, significant in relative terms—and potentially significant in absolute terms if extrapolated across a region or an economy.

CHIPS interbank payment system (US)

Baseline	USD 195 Billion
CHIPS algorithms	USD 68 Billion
Optimal sequence with FNA	USD 53 Billion

This is a **22%** saving to CHIPS algorithm and **73%** saving to Baseline