Finanziato dall'Unione europea NextGenerationEU
Ministero dell'Università e della Ricerca
Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA
Università Bocconi MILANO

Smart CBDC for Decentralized Corporate Finance

Fintech Lab
Baffi Centre
Università Bocconi

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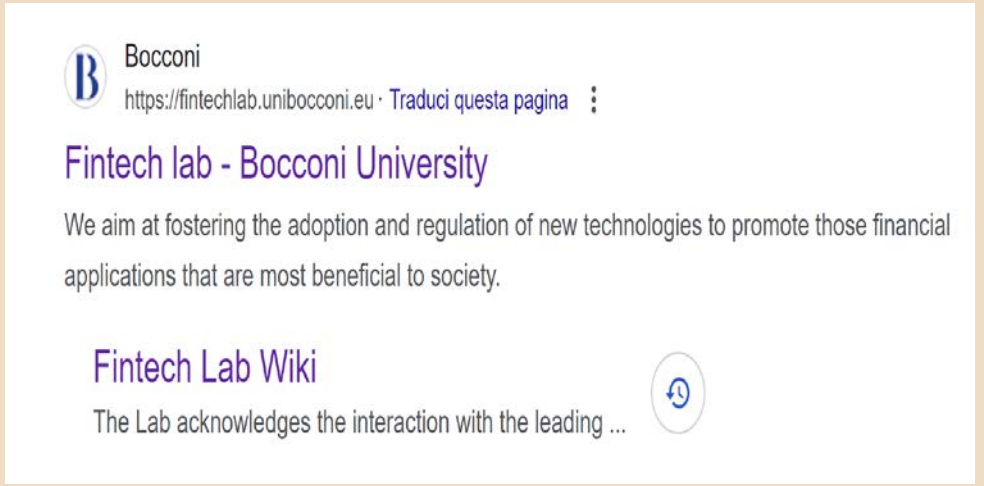
BAFFI CENTRE ON ECONOMICS, FINANCE AND REGULATION

MUSA MULTILAYERED URBAN SUSTAINABILITY ACTION

Bocconi ecosystem,

collaboration network,

coordinated effort.



[Musa Spoke 4 Bocconi WP Fintech]

SDA Bocconi SCHOOL OF MANAGEMENT

IGIER INNOCENZO GASPARINI INSTITUTE FOR ECONOMIC RESEARCH

Project funded by
MUR- Prin 2022- Prot. 20227TCX5W,
Next Generation EU.

Finanziato dall'Unione europea NextGenerationEU

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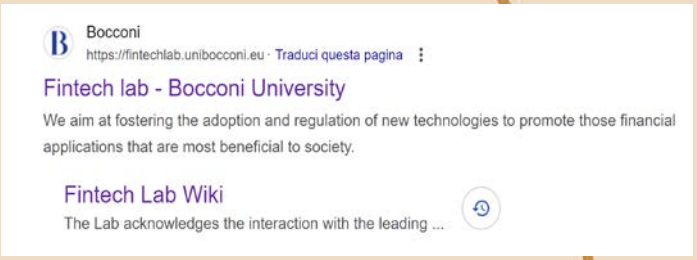

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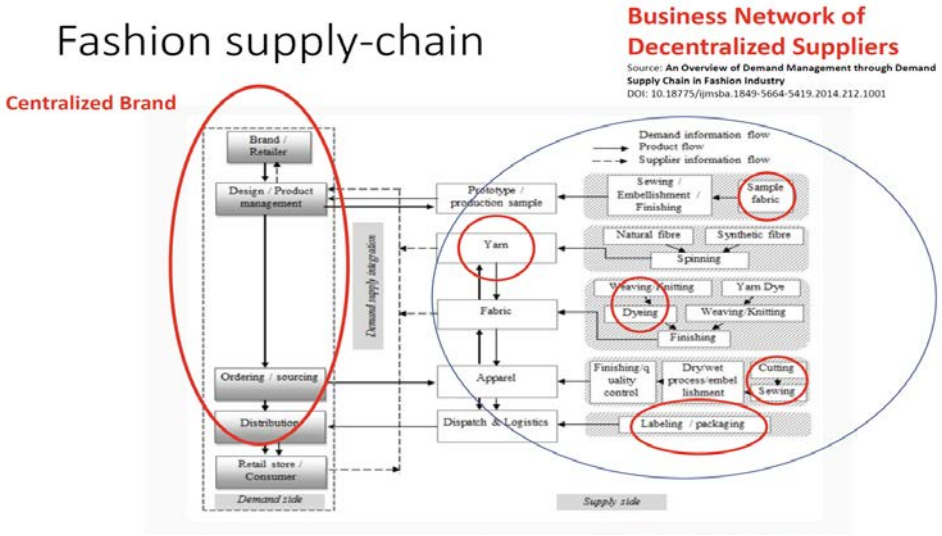
MUSA MULTILAYERED URBAN SUSTAINABILITY ACTION

Setting the stage

- *Business networks* lie at the heart of corporate Europe industrial organization.
- *Supply-chain finance* plays a pivotal role for EU integration and stability.
- Digital integration between trade-finance instruments and global capital market solutions is a key competition factor.



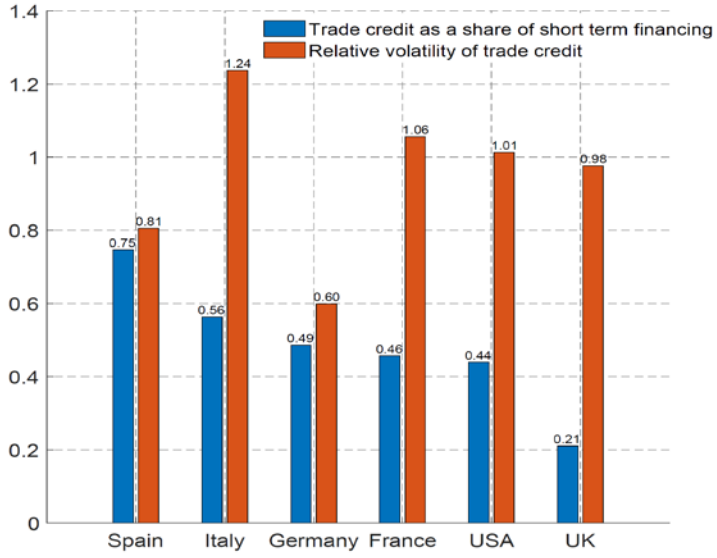
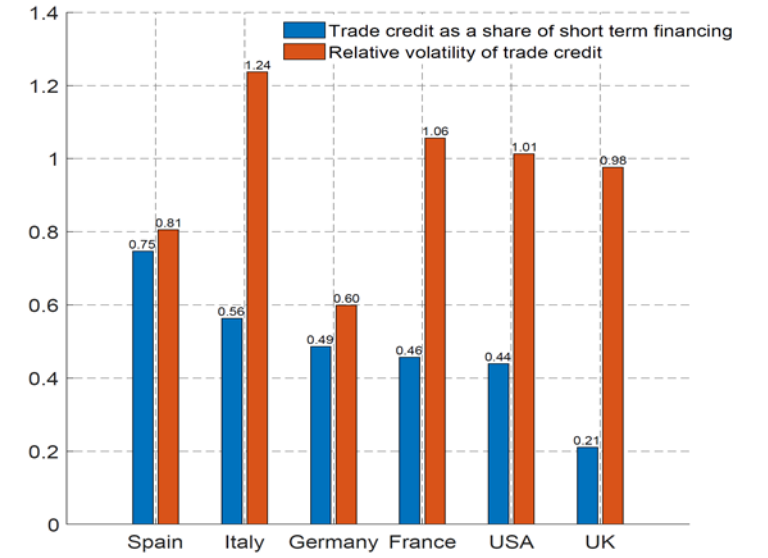


Figure 1: Relative size and volatility of trade credit

From: L. Bocola G. Bornstein (2024) Macroeconomics of Trade Credit

Setting the stage: B2B payments technologies and supply-chain finance

- The largest share of payments is B2B. 53% of global payments 125 trillion. (Credit Suisse estimate 2022).
- Asset receivables account for the largest share of short-term funding of SME worldwide and for European firms (Boissay and Gropp 2007, Bocola and Bornstein 2022).
- Payment-chain disruptions play an important role in explaining the co-movement between productivity slowdowns and worsening of credit conditions observed during financial crises. (Bigio 2023)



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- Smart contracts may improve tradability and reduce of commitment frictions of accounting receivables.
- Technological innovation might affect the endogenous balance between trade-credit instruments and money in B2B transactions.
- Implementation of a smart-contract money requires the definition and management of a complex technological stack. We will call it generically a 'platform'. (Smart-CBDC herafter)

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Main research and policy issues:

i. Which motivations (if any) support a smart-contract enabled CBDC?

ii. Which are the features that might determine its success or failure, with specific focus on welfare improvements and adoption?

State of the art

- Programmable money solutions that improve trade-credit financial solutions are under investigation of public and private players.

NTT Digital Collaborates with Amazon and StraitsX to Showcase Tokenized Accounts Payable Use Case Using Digital Wallets at

NTT Digital amazon straitsX

THE CENTRAL BANK OF BRAZIL
DREX TRADE FINANCE PROJECT PARTICIPANTS

inter | Chainlink | Microsoft | 7COMm

The program:
A Sustainable Digital Development Model for European Business Networks

In the *Institute for Economic Policy @Bocconi* Report 'A Europe fit for the Digital Age' we discuss the potential deriving from consolidation of new *decentralized governance models*.

- ***Decentralization as a Driver of Growth***:

  Promote Web 3.0 platforms leveraging Blockchain and Distributed Ledger Technologies (B&DLT) to decentralize digital services, breaking the link between centralization and digitalization while increasing supply chain resilience.

- ***Regulatory Framework for Decentralized Organizations*** that extends the Italian Civil Law 'Contratto di rete'

  Establish a European legal framework to govern decentralized organizations, ensuring transparency, accountability, and compliance with competition laws while facilitating value-chain integration.

- ***Fostering Digital Sustainability and Resilience***:

  Create public databases to monitor value chains, implement sustainability metrics, and support decentralized systems for green transitions, reinforcing the EU's competitive edge in digital governance.

Our proposal

Include in the European CBDC infrastructure a unique centralized platform enabling smart contracts (Smart-CBDC herafter) to target B2B and in particular trade-credit related applications.

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Key takeaways

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- Bundling the pure cash-like solution for consumers and a smart-CBDC dedicated to B2B might promote adoption and financial inclusion of Micro Small Medium Enerprises (26 millions in EU)

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- Bundling the pure cash-like solution for consumers and a smart-CBDC dedicated to B2B might promote adoption and financial inclusion of Micro Small Medium Enerprises (26 millions in EU)
- An open finance approach: core operations are managed by the public provider would preserve interoperability and singleness of money while private operators may add services leaving space for competition and technological improvement.

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- An open finance approach: core operations are managed by the public provider would preserve interoperability and singleness of money while private operators may add services leaving space for competition and technological improvement.
- A centralized enabler of trade-related conditional payments would expand ECB oversight and bring additional monetary and financial stability policy tools.

Digital Innovation – Platform Economics

- EU lags behind in the Web 2.0 economy—no European company among the world's top 10 tech firms and among DMA European gatekeepers.
- Web 2.0 shares many features of bilateral markets of credit card payment systems: platform economics. See Rochet and Tirole (2004):

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➢ Emergence of externalities: Networking effects imply that your utility has implications on that of the others.

➢ Bundling or complementarity among services: good and services offered offered by an infrastructure are bundled when use of one might require the adoption of another.

➢ Lock-in: Provision of services through the infrastructure may harm competition reducing the possibility of users to switch freely among service providers.

➢ Standardization and interoperability: adoption of a specific infrastructure requires the definition of uniform technology standards that foster exchange of goods and services.

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- Web 3.0 and decentralized organizations. Blockchain & Distributed Ledger Technologies (B&DLT) create the conditions for exploiting network effects without requiring vertical integration and hierarchical control.

Toward a European Model of Digital Sovereignty

Business networks, as currently organized, are usually created by bilateral contracts between corporations. They have two main drawbacks:

- Fragility, i.e. they vulnerable to exogenous shocks (Capponi, Stiglitz et al. 2024)
- Financially weak, network structure generates an underinvestment an externality (Garlappi et al. 2022)

Solutions to milden the problem:

- Fragility → New regulation fostering adoption of decentralized governance to improve resilience.
- Financial weakness → Well-integrated capital-friendly ecosystems integrated with digital asset markets.

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- A digital model fit for Europe. From fragmentation to governance decentralization: (Web 3.0) a technological opportunity to build resilient, inclusive digital infrastructures rooted in European business networks. (see IEP Report: Rules that Empower Chapter 4)

Italian Civil Law 'contratto di rete' ←→ Decentralized Autonomous Organization

Digital Innovation – Policy gap

Italian Civil Law 'contratto di rete' ←→ Decentralized Autonomous Organization

A dedicated EU legal framework to:

- Recognize decentralized and other hybrid organizations alternative to corporations
- Support scope-based collaborations (e.g., via updated EEIG or new "28th regime")
- Align smart contract legal enforceability with EU law
- Legal Decentralized Organizations: Italian Business Network Contract Law (Contratto di Rete) provides a civil law enforcement of a multilateral agreement thus creating a legal decentralized organization.
- MUSA PNRR Documentation on the Decentralized Financial Network

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International Trends on Digitalization of Supply Chains: Corning, Emerson, Leonardo LEAP, OpenES

REPLY

B-Ledger – A DIGITAL PLATFORM FOR DATA-DRIVEN COLLABORATIVE BUSINESS NETWORKS

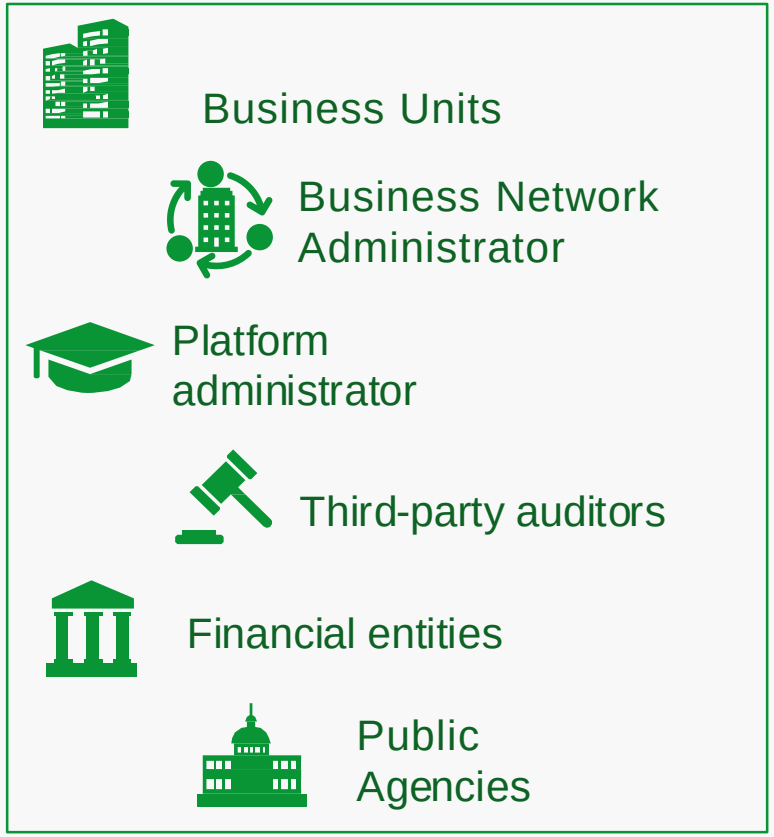
PROCESS DESCRIPTION

March 15, 2026

Bocconi

PLATFORM PLAYERS

Below are some of the potential stakeholders who may participate in the platform. During the analysis phase, we will determine which of these to activate for PoC

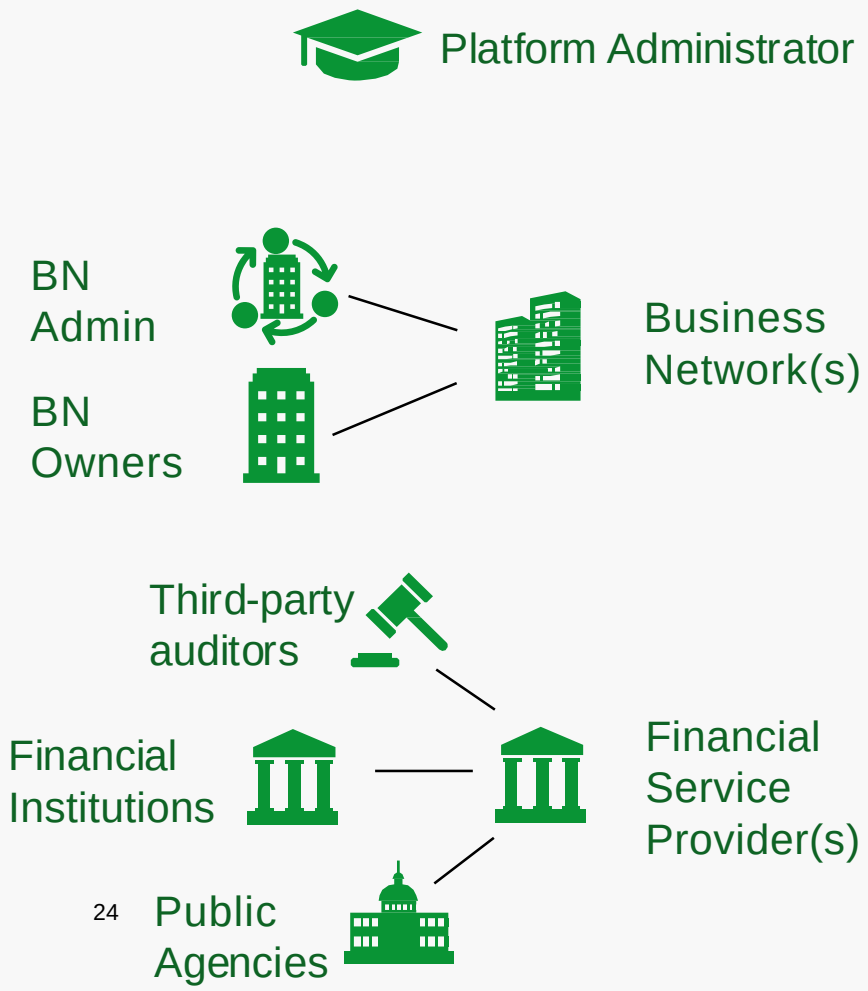


- **Business Units (BUs):** Corporations, SMEs and startups using the platform to enhance data sharing with business network partners.
- **Business Network Administrators (BNAs):** The entity that is delegated by the network participants to the relevant administrative tasks for the network.
- **Platform Administrator:** Responsible for maintaining the platform's integrity, managing onboarding process.
- **External Auditors:** External entities that provide independent validation of the data shared on the platform.
- **Financial Entities:** Banks, insurers, and investment firms that use the platform to verify data and assess sustainability metrics for green financial products or other initiatives
- **Governmental Agencies**: frequently visiting users, auditing reported compliance data by querying records on the platform.

Each of these actors has the ability to **either participate** in or **view information** within a **business network** in which they are registered as participants.

PLATFORM FUNCTIONAL ROLES

Based on the platform stakeholders defined in the previous slide, we define the list of platform user roles as follows:



- **Platform Administrator:** A platform-based admin role with ability to ensure platform's integrity, managing onboarding and other administrative processes.
- **Business Network:** Group of network main users of the platform who have to go through rigorous onboarding procedure before accessing platform's services.
  - **Business Network Administrators (BNA):** A network-based role assigned to BUs in business networks to handle admin tasks in a particular network.
  - **Network Network Owners (BNO):** A network-based role refers to BUs who are members of a network.
- **Financial Service Providers:** Another user role of the platform whose main activities are verifying and/or auditing data. Based on the entities, their functionalities are slightly different:
  - **External Auditors:** Enforcing and supporting data truthfulness and overall quality.
  - **Financial Entities:** Verifying data and assess sustainability metrics for green financial products or other initiatives.
  - **Governmental Agencies**: auditing reported compliance data by querying records on the platform.

A new financial architecture

Above and beyond traditional supply-chain finance products, it is worth recalling the possibility to leverage on digitalization of asset markets to promote private funding of a decentralized organization through token distributions

- Stakeholder rights are shaped by security-token payoff beyond traditional equity- and debt- corporate model.
- On-chain management of collateral may support new forms of securitization
- Decentralized forms of peer-to-peer insurance
- Decentralized funding of pubic-private partnerships

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Manager of the payment system is the gatekeeper of the Web 3.0 financial architecture

Potential gatekeepers: E-Payments

- (Dollar-backed) regulated stablecoins
- Each bank issues standardized stablecoins backed by ring-fenced reserves at the Central Bank (e.g. JPM Coin)
- Commercial bank money tokens represent bank deposits with interoperability (e.g. CBMT)

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Berg, Keil, Martini, and Puri (2024): '*a key benefit and thus a potential motive behind launching CBDCs is to enhance payment autonomy, which may involve ensuring the adoption of fiat money in digital payments and reducing reliance on non-bank payment providers, especially foreign ones*.'

A limited level of interoperability might contribute further to the (re-)fragmentation of the European Economic Area.

What theory says: advantages deriving from a unified ledger

- Regulated Liability Network (2022): an infrastructure to deliver an interoperable network of all facets of the sovereign currency system: central bank money, commercial bank money, and e-money.
- A **Unified Ledger** (BIS 2023) brings together:
  - Regulated Liabilities
    - Central bank money (CBDC)
    - Tokenised deposits
  - Tokenised assets

All components reside on a single platform for real-time automation that ideally achieves technical, legal and financial finality and creates a trusted environment (exclusion is a credible threat as in B&P 2022).

Unified ledger and trade credit: a priori estimate of benefits

Boldrini, Croce, Nguyen, Parfenov, Tebaldi, 2025: R&D-intensive firms face high risk premiums due to supply chain shocks, reducing innovation and growth.

Model Insight:

Firms must pre-pay royalties to innovators → leads to costly, uncollateralized intra-period borrowing
Financing costs rise with shock risk → depresses R&D and long-term growth.

Blockchain Counterfactual:

Real-time production + payment data via blockchain enables resource reallocation and reduces credit frictions easing pressure on working capital

An upper bound on the benefits: platform adoption worthwhile if reallocation cost < 1.6% of GDP.

CBDC adoption: basic framework

We follow Ahnert, Hoffmann, Monnet (2022) and discuss the tradeoff between privacy and efficiency

Key Insights:

- Sellers prefer online distribution for better matching.
- Digital payments reveal information to banks; cash ensures anonymity.
- Walled Garden Risk: Platforms use data advantages to block competition.

CBDC with data-sharing defeats walled gardens. Sellers gain from both privacy and competitive financing.

CBDC adoption: privacy of Business vs Consumer users

Privacy concerns for business activities are qualitatively different with respect to those of consumers and households. Functional separation between (non-financial) business and consumer users may help contemperating ‘unified ledger’ and ‘privacy concerns’ objectives.

We may assume that retail CBDC use can be segmented between B (?zero holding limit?) and C users.

For B users:

- We may assume compliance w.r.t. KYC/AML for business users. E-invoicing already identifies uniquely customers and suppliers.
- Zero Knowledge Proofs can be used to reduce the need to disclose sensitive data to other business network participants

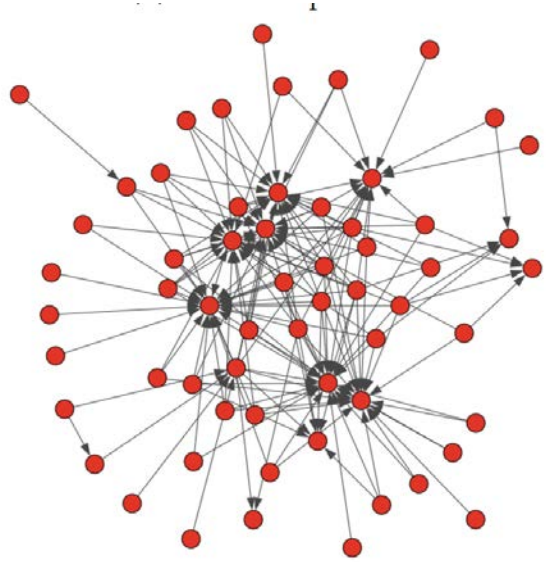
CBDC adoption: Bundling B and C users‘ instruments may be efficient and popular

Approximately 26.1 million small and medium-sized enterprises (SMEs) in EU in 2024:

- 210,170 were medium-sized firms that had 50 to 249 employers.
- 1.38 million enterprises were small firms with between 10 and 49 employees.

The contribution of SMEs (99.8 percent active business) to EU:

- produce almost 52 percent of total value added in the EU.
- 90 million employed by SMEs (e.g. Germany, SMEs employed 18.3 million people)



Unified ledger and expansion of factoring services

Bottazzi, Gopalakrishna, Tebaldi 2024 analyze the impact of a 2014 Italian securitization reform easing factoring access for suppliers that enabled banks to more efficiently purchase receivables.

Micro-Estimate Insight:

Factoring expands supplier networks and efficiently redistributes liquidity.
Financing access and trade volume increase by easing factoring conditions

Empirical Test results:

- More distressed suppliers extend ↑ 18.6% more factoring to large customers post-reform.
- Safer suppliers extend ↑ 9% more factoring to small customers

Capital Structure Implications:

- Lower leverage (higher A/E) from Q1 to Q3 → ↑ 0.92% reliance on factoring (median value 7.7%)

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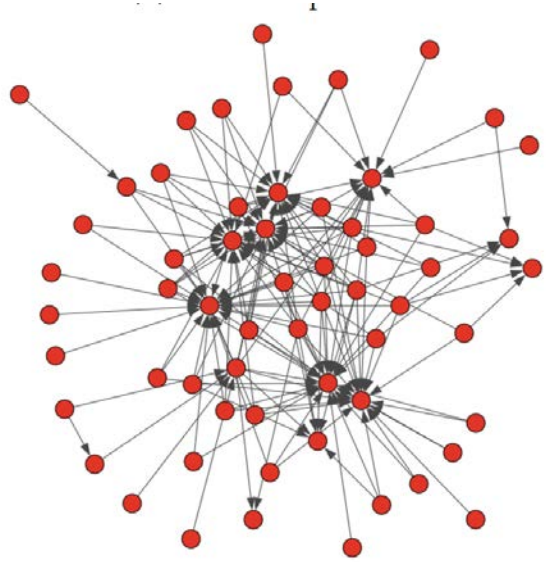

Conditional micro-payment B2B services would ease working capital constraints for SME!

Optimal design of smart contract and DLT for trade credit

Trade credit is often costly and risky due to delivery/payment mismatches and fraud risk. Suppliers, especially SMEs, face limited access to working capital. With a Unified Ledger:

- Blockchain for Deep-Tier Financing (Dong, Qiu & Xu, 2023): facilitates delegate and direct financing across supply chains. Cross-tier direct financing always boosts performance.
- Smart Contracts in Trade Finance (Wang & Xu, 2023): gains with buyer direct financing and invoice trading and securitization.
- Benefits from financing a business network organization managed through decentralized governance is under investigation (Green DAOs C.T., Croce et al. in preparation)

Macroeconomic and financial stability relevance of the new financial architecture.

Trade-credit channels are wel known to be important channels of distress propagation A supplier of a distressed customer has 50% more probability to default (Jacobson Von Schvedin 2015)

A standardized common rulebook for CBDC enhanced B2B Conditional Payment would complement the traditional roles of the central bank supervisory role

- Stabilizing Financial Shocks: prevents cascading liquidity crises by injecting trade-credit liquidity during financial shocks, mitigating disruptions in supplier-customer networks.

- Enhancing the Credit Multiplier: optimizes the complementary relationship between regulated and non-regulated liabilities, ensuring the smooth functioning of credit supply chains during financial stress.

Smart-CBDC, the technological stack

For each transaction, the unique ledger infrastructure should grant multiple functions, like: granting settlement, promoting tradability, improving commitment among the counterparties, improving contract enforcement.

A 'shell model' to be the subject of a mechanism design approach

- The core functionalities (settlement?) would be centralized and publicly managed and developed that are to be maintained to guarantee interoperability and execution safety during crises

- Non-core functionalities: oracle verification, legal contract enforcement, monitoring of creditworthiness, provision of other financial and operational services, should be delegated to commercial players.

Smart-CBDC, the technological stack: core Smart Contracts

A tentative list:

- **Payment Commitment Settlement Contract** Locks payment funds and releases them upon condition verification.
- **Factoring/Receivables Assignment** Contract Registers assignment of receivables. Defines payment redirection from buyer to financier.
- **Penalty or Default Contract** Monitors deadlines and conditions.
- **Delivery Confirmation Contract** Triggers payment or further actions once delivery (digital) is confirmed by both parties.
- **Multi-party Escrow Contract** Holds funds or assets until a multiparty (digital) condition is met (e.g., buyer, seller, platform).

Smart-CBDC, the technological stack: non-core Smart Contracts

A tentative list:

- **Oracle Validation** Contract Interfaces with external systems (e.g., logistics, IoT, financial APIs)

- **Tokenization Contract** Converts receivables, inventory, or commitments into tradable digital tokens.

- **Reputation/Score** Update Contract Updates on-chain or off-chain credit scores or reputation metrics based on contract performance.

Thank you!

For any further question and comments write to:

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