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Introduction to the Special Section on the Interface of Operations, Finance, and Technology (OpsFinTech)

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Recent advances in technology including data analytics and artificial intelligence (AI), distributed ledgers (such as blockchain), cloud computing, and the proliferation of mobile platforms have enabled a more efficient and transparent flow of physical goods, information, and money between individuals, firms, and organizations. These developments have also profoundly altered the connections between operations and finance: they have fueled innovative financial products and services that rely on extensive operational data, they have led to new business models aimed at improving operational performance by alleviating financial frictions, and they have disrupted traditional processes in the delivery of financial services, leading to a wide range of new operational challenges and opportunities.

This special section focuses on the intersection of operations, finance, and technology—an area we call OpsFinTech—and is aimed at stimulating more work on these important topics. The call for papers for the special section was announced in June 2019. Despite the substantial overlap with the unfolding COVID-19 pandemic, this special section received 37 submissions, covering a wide range of applications and research methodologies, including economic modeling, optimization and machine learning, and empirical studies. Four papers were accepted in time to be included in this section, with one more still in the review process and which will potentially be published in a future regular issue.

The accepted papers address diverse research questions and highlight the potential merits—but also some of the pitfalls—that might emerge when fusing operations, finance, and technology. Consistent with the premise that technology could be an important driver for cost reductions, the papers in this special section show how technology can reduce operational costs and inefficiencies associated with supply chain disruptions (Dong et al.

2022a), with information transmission and verification (Lee et al. 2022), and with demand uncertainty (Wang and Xu 2022), while also reducing capital costs. Relatedly, all the papers highlight the role of technology in driving financial inclusion, which could occur through a variety of operational mechanisms: by adopting (government-supported) mobile payment services (Dong et al. 2022a), by giving distant suppliers access to improved financial terms (Dong et al. 2022b), or by complementing and improving trade finance activities (Lee et al. 2022, Wang and Xu 2022). However, the papers also show that to reap the full benefits requires a judicious choice of technology and care in combining it with specific financial or operational innovations, because otherwise these might interact in unintended ways and might not benefit all the parties in the value chain. Below, we briefly comment on each of the four accepted papers.

Dong et al. (2022a) sheds lights on how digital technologies could improve supply chain management while also promoting financial inclusion. The paper theoretically investigates the role of blockchain technology and advance payments as a tool to mitigate disruptions in complex supply networks. Using a game-theoretic model with a three-tier supply chain, the study compares traditional systems with limited visibility to blockchain-enabled systems that offer perfect visibility, and sheds light on how blockchain technology influences operational and financial decisions and profit levels across the different tiers. The findings reveal that the visibility afforded by blockchain technology can improve the financing terms available to deeper tiers in the supply chain and thus enhance their resilience, which in turn can aid manufacturers and the entire supply chain. However, the study also shows that the distribution of gains depends on the specific financing schemes employed. For instance, delegate financing

is beneficial for all tiers only when the tier 2 supplier is severely capital constrained, whereas cross-tier direct financing consistently results in win-win-win outcomes, irrespective of the working capital profiles of the various tiers. These insights offer valuable guidance for firms considering blockchain technology, showing how this can enhance the visibility and resilience of their supply chains, while also fostering financial inclusion benefits for deeper supply tiers.

Dong et al. (2022b) adds to our understanding of the financial and operational challenges in launching mobile payment services (MPS) by examining the government's role as a key stakeholder. The paper empirically tests the premise that government involvement—for example, through the offering of person-to-government or government-to-person payments—could boost the adoption rates and help mobile network operators (MNOs) overcome the high costs and operational hurdles associated with offering MPS. Utilizing a unique proprietary data set with MPS launches in Africa, Asia, and Latin America and a quasi-experimental design, the study finds that government involvement expands the MNO user base and has a greater impact on larger MNOs and on those MNOs offering a more diverse range of payment services. Additionally, government involvement could also lead to improved financial inclusion, either through direct regulation or because more microloans are issued by MNOs offering government-related payment services. These findings provide important lessons regarding the role of public-private partnerships, which could foster gains in technology adoption and in improving payment services to the population.

Global supply chains are fueled by trade finance, an area where significant technology-enabled innovations have emerged recently. Lee et al. (2022) examines a novel type of bank-intermediated trade finance, dynamic trade finance (DTF), under which banks dynamically adjust loan interests as an order passes through different steps in the trade process. By considering a multistage trade process with uncertain processing time, the paper reveals that the value of DTF lies in its ability to reduce transactional deadweight loss and screening. The paper also highlights that the interaction between the DTF contract and technology is nuanced: on the one hand, technologies that reduce information transmission and verification cost and those that enable automatic execution (such as blockchain and smart contract) complement DTF; on the other hand, technologies that segment customers more efficiently (such as advanced data analytics) could substitute DTF. These results help business and financial professionals better understand how the underlying trade process and the involved information frictions affect the design and deployment of contract innovations and FinTech in trade finance.

Also in the context of trade finance, Wang and Xu (2022) delves into the role of smart contracts in enhancing supply chain efficiency. Utilizing a two-stage game-theoretic model, the study examines how smart contracts can mitigate both operational risks, such as demand uncertainty, and financial risks related to credit and liquidity. The research finds that the effectiveness of smart contracts is highly dependent on the structure of trade finance, including both preshipment and postshipment financing schemes. In a traditional trade finance model that uses purchase order financing and factoring, smart contracts can correct supplier overpricing behaviors caused by commitment frictions, thereby improving overall supply chain efficiency. However, when alternative financing methods are used, such as buyer direct financing for preshipment or invoice trading for postshipment, smart contracts can have unintended consequences. For instance, smart contracts may discourage retailers from offering buyer direct financing, hurting the supplier and reducing overall supply chain profits. Similarly, the flexibility of invoice trading can lead to commitment traps that reduce supplier profits. The study concludes that these dilemmas can be resolved by adopting smart contracts in conjunction with traditional factoring methods. The findings offer valuable insights for managers on when and how to implement smart contracts in different trade finance settings, emphasizing that smart contracts do not universally benefit all supply chain parties.

We hope this special section further stimulates the community's interest in exploring the interface of operations, finance, and technology as a dynamic nexus. Building on the themes emerging from this special section, we envision more work that examines how technologies such as AI or blockchain could act as catalysts for operational and financial innovation, and how to harness the full potential of the interactions and avoid pitfalls.

An area where we believe more work is warranted is in channeling such technology-driven operational and financial innovation to address some of the most pressing challenges of our time. Technology could be pivotal in helping design novel insurance contracts or mobilize and target new streams of capital (e.g., emerging from sustainable finance initiatives or payments for ecosystem services) in order to stimulate operational innovations that reduce environmental footprints or help cope with new risks emerging from climate change. Novel FinTech solutions, AI, and digital platforms could drive significant changes in the energy, transportation, and agriculture sectors and help build more sustainable business models, and they could empower and engage smallholder producers and make goods and services widely available in underserved populations around the world. On this front, more academic research is needed to better understand the designs and processes that would most effectively achieve such profound

transformations while ensuring an equitable sharing of the gains among various stakeholders.

More research effort is also needed to advance our understanding of how to best enable the “supply chain” for technology and how to manage new financial or operational risks emanating from technology. Novel financing schemes, organizational structures, and operational processes may be needed to efficiently develop the next generation of disruptive technologies, as seen in the case of OpenAI. The increasing penetration of technologies in business will bring new challenges, from new types of supply chain disruptions to cybersecurity threats or compliance, regulatory, or reputational risks. Technology-driven automation may require substantial changes in workflow, project management, task assignment, or workforce training, with a view toward balancing the benefits of the technology with costs such as overreliance, substituting rather than complementing human work, or exacerbating skills gaps. Research aimed at better understanding and managing these challenges is essential for sustained economic growth, and our community is uniquely positioned to bring new qualitative and quantitative insights in this direction.

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