How Does Technology Improve the Role of Financial Sector in Economy? An Empirical Analysis of Global Banks Based on Input-Output Model and Knowledge Graph

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The core mission of the modern financial industry is to support the high-quality development of the real economy, and technology, as the primary productivity, is considered a pivotal means to empower the quality and efficiency of financial services to the real economy. However, research on the core issue of how technology can better play this empowering role is limited, with related practices still in the exploratory stage and effective solutions yet to be sufficiently developed. Thus, there is an urgent need for further deepening of relevant theories and empirical research to provide the necessary theoretical guidance and decision support for the practice of technological innovation and business development within the financial industry.

This study innovatively approaches the issue by examining how technology empowers financial services to support the real economy from the perspective of matching technology supply with business demand. We propose a method to measure the impact of financial services on the real economy using input-output models, alongside a novel approach to measure the degree of matching between supply and demand side based on knowledge graph. Using the banking industry as a case study, we empirically test the impact of technology supply-demand matching on the efficacy of financial services to the real economy, analyzing the optimal level of matching necessary to leverage technology effectively in empowering financial services.

Specifically, drawing on OECD's national input-output tables spanning from 2000 to 2020, we employ input-output analysis to calculate indicators such as the pulling and sensitivity of the banking sector, providing a comprehensive measure of commercial banks' role in the economy. Additionally, a knowledge graph network linking global banking business with technology is constructed, using over 152,000 entries of English patent texts in the global banking industry. Employing network analysis methods, the study derives the "degree of technology supply-business demand matching" indicator for banks. We further investigate the mechanism using econometric models, through which technological innovation affects the efficiency of bank services to the real economy with the moderating effect of matching index.

Our findings reveal insights as follows: First, the effect of global banks on various sectors of the economy is higher in middle to high-income countries than other groups with a continuous increasing trend in the past eight years. Second, in terms of the degree of technology supply and business demand matching, developed countries exhibit "deep penetration" while developing countries explore through "comprehensive development", with both earned advantages in areas such as credit assessment and mobile payment. Third, the positive impact of matching between technology and business on the efficiency of bank services to the real economy is significant, while the indicator has an optimal level and also an asymmetric moderating effect on this impact.

The main contributions of our study are: First, it is to our knowledge the first study to measure the quality of technological innovation and its impacts from the view of technology supply-business demand matching, which is an expansion of relevant theories on technology economics and bank management. Second, methodologically, we propose a novel method to measure the supply-demand matching based on knowledge graph, combining unstructured text processing of bank patents and semantic network modeling methods to construct a fine-grained banking network. This work also expands the application field of input-output analysis methods, providing foundational data framework and methodological reference for relevant research. Third, this study has prominent practical guiding value. The research conclusions can effectively guide banks and other financial institutions to optimize the allocation of technological resources oriented towards demand, enhance

financial technology competitiveness, and empower the quality and efficiency of financial services to the real economy.