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

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Abstract

- **Research Question:** We investigate how the alignment between banks' technological innovation and national Fintech strategies impacts their ability to serve the real economy.
- **Index Construction:** Covering 1,638 listed banks across 43 countries, we develop a matching index to measure the alignment between banks' innovations and national strategic goals. Specifically, we analyzed the occurrence of strategy-consistent terms in patent texts.
- **Index Features:** The index shows relatively high levels in Europe (e.g., Italy), Asia (e.g., Japan), and the Americas (e.g., the United States), with faster growth rate in similar regions, taking Belgium, China and Canada as examples.
- **Empirical Findings:** Innovation quality, indicated by a higher matching degree in patents, significantly enhances banks' driving capacity in the national economy, while merely increasing patent quantity has limited impact. This highlights the critical role of strategic alignment in innovation.

Keywords:
bank innovation, matching index, real economy, patent text analysis

Motivations

- **Commercial Trends in the Banking Sector:** Commercial banks have significantly increased their R&D investments, indicating a rapid growth in technologies developed in-house by banks.

Chart 1. Global Growth of FinTech Investment and Financing Activities[1]

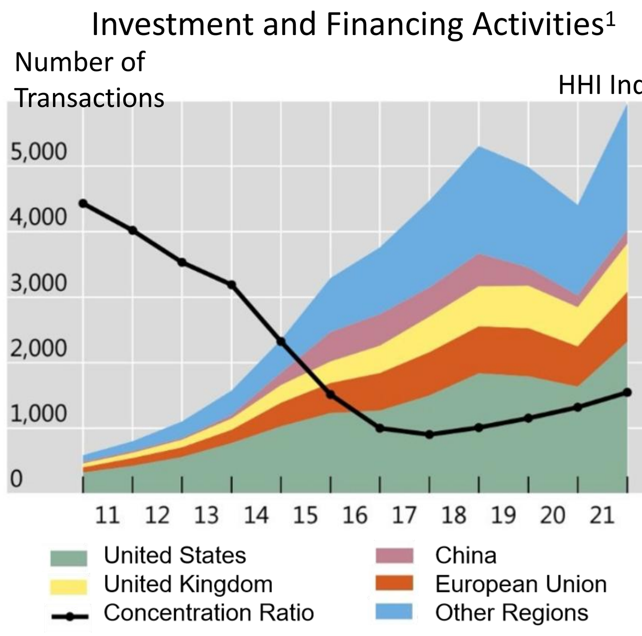
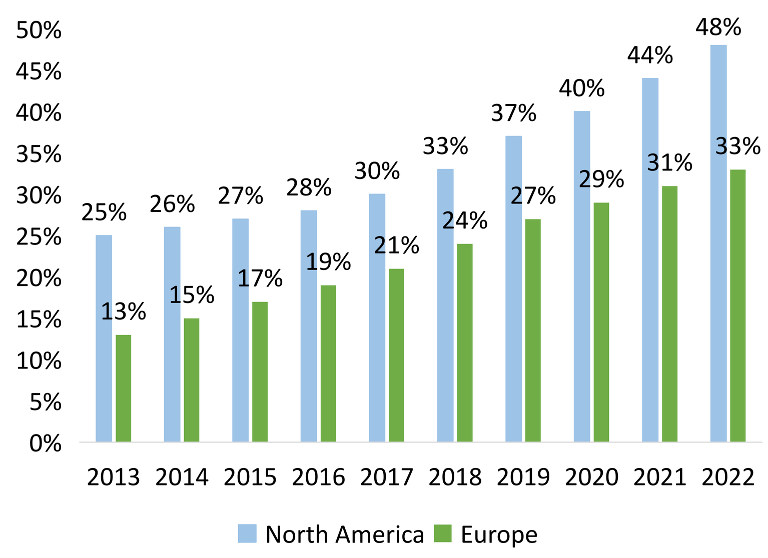


Chart 2. The Proportion of New Technology Investment in Banks' IT Expenditures[2]



- **Practical Challenges:** Earlier industry surveys conducted by our team indicated that many patents are filed to meet KPIs but fail to generate practical benefits. Despite increased investments, concerns remain that patent quantity does not equate to quality or practical value.
- **Economic Research Gap:** While current studies often rely on patent quantity, R&D expenditures, or patent NLP analysis to assess innovation, these measures lack directionality. A rarely considered yet critical perspective is the alignment between technological supply and business needs, which provides a clearer sense of innovation's practical relevance (Jaffe et al., 1993; Hall et al., 2005).

Methods and Materials

- **Keyword Extraction**: Use a large language model (LLM) to identify and extract a total of 258 fintech terms from multilingual documents issued by governments and international organizations.
- **Patent Analysis**: Analyze patent texts from 1,683 listed banks worldwide (2000–2024) and compute 258-dimensional annual vectors representing the frequency of fintech-related terms for each country, so that we could capture the alignment between banking innovation and global fintech goals.
- **Explanatory Variable - Matching Index**: Calculate the Euclidean distances of the vectors, normalized by patent count, to derive the matching index.
- **Dependent Variable - Banking Performance Assessment**: Leverage OECD input-output tables to compute the influence and sensitivity coefficients of the banking sector, reflecting the sector's economic interdependencies and its ability to contribute to real economic growth.

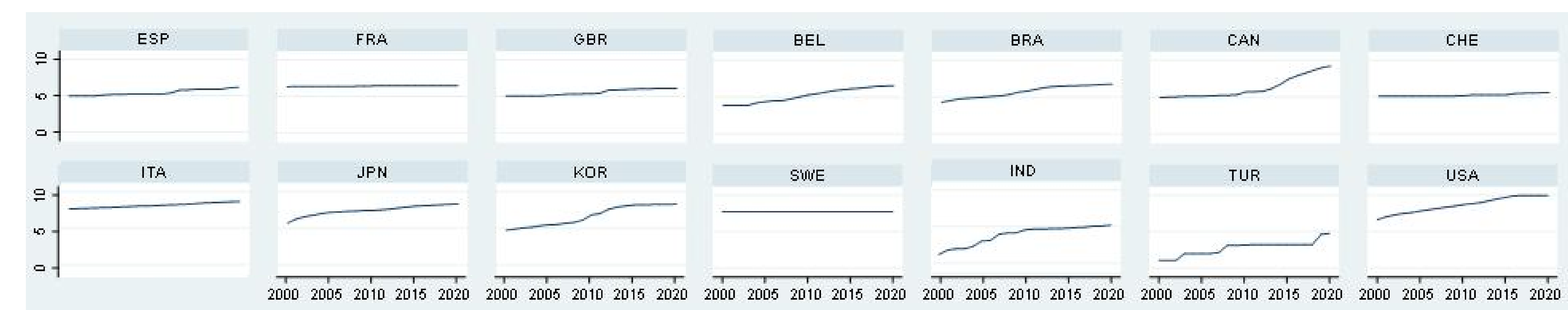
Table 1. Examples of Global Fintech Strategy Documents

	Country or Global Organizations	Publishing Authority	Full Name of Documents
1	World Bank Group	World Bank Group	Fintech and the future of finance flagship technical note: Global patterns of fintech activity and enabling factors
2	World Economic Forum	World Economic Forum	Beyond fintech: A pragmatic assessment of disruptive potential in financial services
3	European Union	European Parliament	Financial technology (FinTech): Prospects and challenges for the EU
4	China (Asia)	People's Bank of China	China's Fintech Development Plan for 2022-2025
4	Nigeria (Africa)	Department for Business & Trade	Recommendations for the implementation of the national fintech strategy in Nigeria

Major Results

The chart below illustrates the match ratio for 43 countries, reflecting the degree to which bank patent development aligns with national fintech development needs.

Chart 3. Match ration distribution across 43 nations



For the influence coefficient, the model is as follows:

$$Influence_{i,t} = \beta_0 + \beta_1 Matchratio_{i,t} + \beta_2 Macro_{i,t} + \beta_3 Industry_{i,t} + \mu_{i,t} + \epsilon_{i,t}$$

For the sensitivity coefficient, the model is as follows:

$$Response_{i,t} = \alpha_0 + \alpha_1 Matchratio_{i,t} + \alpha_2 Macro_{i,t} + \alpha_2 Industry_{i,t} + \sigma_{i,t} + \varepsilon_{i,t}$$

Our multivariate regression analysis shows that:

- A higher match ratio between bank innovation and national fintech priorities strengthens the banking sector's capacity to support the real economy. This finding underscores fintech's crucial role in enhancing banks' contributions to economic development.
- In the heterogeneity analysis, we find that the match ratio has a more significant impact on the banking sector's ability to serve the real economy in countries with higher private credit ratios, greater stock market trading volumes, and higher bank concentration. Additionally, the impact is stronger in countries with lower government intervention and stronger entrepreneurial and innovation cultures.

Contributions

Our findings indicate that the alignment between banks' innovations and national strategies significantly enhances their ability to serve the real economy. The results suggest that the quality of banking technology innovation in a country is not solely determined by the quantity of patents, but by its strategic alignment with national priorities. Key contributions of this study include:

- **Shifting the Focus:** With in-house technology development by banks becoming a major trend, we shift the focus from competition with FinTech companies to recognizing banks as key contributors to national FinTech goals.
- **Novel Supply-Demand Matching Perspective:** We introduce a new perspective that assesses the quality of banking sector innovations through their alignment with national fintech strategies.
- **Empirical Evidence:** We provide evidence that underscores the importance of strategic alignment in enhancing banks' ability to serve the real economy.

This study provides a comprehensive understanding of how commercial banks' technological innovations can be aligned to serve national interests and boost economic performance.

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