The impact of fintech on the profitability of state-owned commercial banks in China

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Abstract. Fintech is the innovative use of technology in the design and delivery of financial products and services. This study aims to statistically investigate the fintech and other determinants that affect the profitability of six state-owned commercial banks (SOBs) in China using the data from the 2014-2019 period. Theoretically, fintech serves as a disruption for its banking services through adverse impacts on asset business, liquidity business and intermediary business. Empirically, the result shows that the development of fintech has a negative impact on the profitability of SOBs and the regression results from the OLS estimation, the FGLS estimation, the Prais-Winsten estimation and the FE estimation are compared to ensure the validity of the statistical inference.

1. Introduction
Some of the most recent technological innovations, such as artificial intelligence, big data, cloud computing, blockchain, digital payments and robot advisors, are rapidly reshaping traditional banking industry. After the 2007-2008 global financial crisis, China’s commercial banks have focused on dealing with numerous new regulations and embracing innovative technologies seems to be a distant priority. The upsurge of fintech startups in recent years has undoubtedly accelerated the disruption of traditional banking model [1] and even technology-driven companies have decided to capture the opportunities. However, the state-owned banks (SOBs) seem to be slow in incorporating technologies into their banking products and services [2], while some private banks have actively tried to embed fintech into their daily operation activities to increase efficiency and reduce cost [3]. A few studies [4-6] have been undertaken to understand the effects of fintech on bank profitability across different countries. But there are still mixed results of either positive or negative effect of fintech on bank profitability, particularly in the case of state-owned commercial banks whose profitability may be affected by other important factors simultaneously as well. The precise influence mechanism of fintech on bank profitability remains to be elucidated. The aim of the present study is to identify the impact of fintech on the profitability of China’s SOBs, from both theoretical and empirical perspectives.

2. Theoretical analysis
A theoretical analysis of the impact is carried out in this section and a critical hypothesis is proposed. Historically as technology evolved, the banking industry was reasonably good to integrate those new technologies in order to better serve customers. One of the different characteristics between state-owned banks and private banks is that the former is more regulated by government policies and could be more conservative in carrying out daily operations. After the 2007-2008 financial crisis, global commercial banks are busy dealing with complicated regulations. China’s SOBs can be classified as
systematically important banks [7], the China Banking and Insurance Regulatory Commission (CBIRC) has also strengthened supervision of these banks to improve transmission mechanism of monetary policies and to prevent systematic financial risks. Besides, the agency problems [8], the internal bureaucratic issues, and the inflexible organizational structure associated with large state-owned banks could also affect the banks’ willingness to change the current paradigm.

As compared with private banks, SOBs traditionally have diverse sources of low-cost liquidity so there is a lack of motivation to compete for deposits. It has been shown that fintech has undermined the stability and popularity of bank deposits [9]. For example, in recent years, Chinese people have begun to transfer deposits to online internet money funds, such as Yu’ebao, and this could result in a gradual increase of state-owned banks’ liquidity risks. Meanwhile, the rapid development of third-party payment infrastructure could erode the intermediary business of SOBs. Therefore, it is reasonable to make a hypothesis as follows:

**Hypothesis:** The fintech has a negative impact on the profitability of China’s SOBs.

The above hypothesis was proposed by considering how the liquidity business and the intermediary business of state-owned banks can be affected. Meanwhile, from a traditional asset business perspective, the profitability of state-owned banks depends on the quality of bank assets. Capital adequacy ratio (CAR), cost-to-income ratio (CIR), non-performing loans ratio (NPL) and the level of bank assets (TA) are also key indicators of bank financial health. Therefore, the current statistical model also incorporates these factors to understand the determinants of the bank profitability.

3. Model and data

This study is based on the data collected from the Wind and iFinD database with a selection of six listed state-owned commercial banks in China for the 2014-2019 period. A panel data estimation model is used to explore the determinant factors of state-owned banks’ profitability (measured by ROE), especially the effect of financial technology (FT). ROE is a primary proxy for the level of bank profitability [10] and it measures a bank’s ability to reward its shareholders through the increase in retained earnings and additional paid-in capital. Banks with poor profitability normally face higher funding costs. Considering data availability, the index of FT was constructed using a principal components analysis, which collectively incorporated the volume of third-party payments, the market volume of cloud computing, and the number of internet finance users for the 2014-2019 period. There are several benefits of using panel data analysis, including more degrees of freedom, more data variability and less multicollinearity [11], and it also helps to control heterogeneity of cross-section units [12]. The model is proposed as follows:

\[
ROE_{it} = \beta_0 + \beta_1 FT_t + \beta_2 CAR_{it} + \beta_3 CIR_{it} + \beta_4 NPL_{it} + \beta_5 TA_{it} + u_i + \varepsilon_{it}
\]

As shown in Equation 1, the econometric model indicates that the level of profitability in state-owned commercial banks depends on fintech (FT), capital adequacy ratio (CAR), cost-income ratio (CIR), non-performing loan (NPL), and the natural logarithm of total assets (TA) and \(u_i\) represents the unobserved heterogeneity across individuals. The descriptive statistics of variables are summarized in Table 1.

| Variable | Obs. | Mean  | Std. Dev. | Min   | Max   |
|----------|------|-------|-----------|-------|-------|
| ROE      | 36   | 14.0331 | 2.6191   | 10.3700 | 19.8000 |
| FT       | 36   | 11.1088 | 0.6792   | 10.0596 | 11.8722 |
| CAR      | 36   | 14.2895 | 1.6572   | 9.5600  | 17.5200 |
| CIR      | 36   | 33.2314 | 10.8338  | 23.2800 | 66.4700 |
| NPL      | 36   | 1.3983  | 0.3692   | 0.6400  | 2.3900  |
| TA       | 36   | 11.9476 | 0.4776   | 11.0459 | 12.6152 |
4. Empirical analysis

The regression analysis is shown in Table 2. The results from the OLS estimation, the fixed-effects estimation and the random-effects estimation are summarized. The $R^2$-squared values indicate that the independent variables collectively explain the dependent variable well. It can be seen from the regression results that $FT$ generally negatively affect $ROE$ under different methods. However, some diagnostics tests must be conducted to draw any statistically reliable conclusions.

| Test method | Results |
|-------------|---------|
| $F$-test | $F(5,25) = 10.12$; Prob > $F = 0.0000$ |
| LM-test | $chibar2(01) = 16.93$; Prob > $chibar2 = 0.0000$ |
| Pesaran CD test (under FE) | $Pr = 0.0611$; Value = 0.491 (off-diagonal elements) |
| Breusch-Pagan LM test (under FE) | $ch2(15) = 32.446$; Pr = 0.0056 |
| Modified Wald test | $ch2(6) = 27.07$; Prob > $ch2 = 0.0001$ |
| Test for autocorrelation | $F(1,5) = 66.195$; Prob > $F = 0.0005$ |
| Arellano’s Wald test | Sargan-Hansen statistic = 25.626; P-value = 0.0000 |
| Hausman test (panel-robust) | $F(5,5) = 1523.40$; Prob > $F = 0.0000$ |
4.2. **Comparison of estimators**

The results from tests suggest that the presence of panel-level heteroskedasticity, serial correlation and cross-sectional dependence are highly likely, techniques that are robust to violations of regression assumptions are therefore needed in this case. The FGLS estimator (which is consistent but not fully efficient when disturbance terms are not independent and identically distributed [16]), Prais-Winsten estimator with panel-corrected standard errors (PCSE), and the FE estimator with Driscoll-Kraay standard errors (DK) [18] are therefore evaluated and cross-compared. The results are summarized in Table 4. Overall, it is evident that there is a significant negative relationship between ROE and fintech under each technique.

|                | OLS       | FE Robust | FGLS    | PCSE    | DK        |
|----------------|-----------|-----------|---------|---------|-----------|
| FT             | -3.5895***| -1.7517   | -3.5110***| -3.3455***| -1.7517*  |
|                | (0.3862)  | (0.9201)  | (0.0573) | (0.2571) | (0.4838)  |
| CAR            | -0.2163   | -0.3691   | -0.4247***| -0.3965*  | -0.3691   |
|                | (0.2299)  | (0.2734)  | (0.0243) | (0.1673) | (0.2415)  |
| CIR            | 0.0185    | -0.0452   | -0.0120  | -0.0367  | -0.0452   |
|                | (0.0324)  | (0.0263)  | (0.0065) | (0.0297) | (0.0284)  |
| NPL            | -1.2451   | -1.9789   | -1.9685***| -1.8565***| -1.9789   |
|                | (0.6630)  | (0.8509)  | (0.0728) | (0.4911) | (0.9285)  |
| TA             | 3.1696*** | -4.2153   | 3.2453***| 2.5711** | -4.2153   |
|                | (0.6123)  | (5.8825)  | (0.1363) | (0.7831) | (2.9014)  |
| Cons.          | 20.2554***| 93.3980   | 23.4610***| 30.1866***| 93.3980    |
|                | (6.6218)  | (56.6831) | (1.1487) | (8.6405) | (26.5145) |
| N              | 36        | 36        | 36      | 36      | 36        |
| $R^2$          | 0.844     | 0.933     | N/A     | 0.990   | 0.933     |

Standard errors in parentheses (* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$)

5. **Conclusions**

The present study empirically tested the impact of fintech on the profitability of six state-owned commercial banks in China for the period 2014-2019. A static panel model was used to describe this impact. Different estimators for regression coefficients were compared and different types of standard errors were also evaluated. It has been shown that the choice of standard errors is crucial for the validity of the statistical results. Panel regressions with heteroskedasticity, serial correlation and cross-sectional dependence were performed to allow for an improvement in accuracy of the statistical estimation. The findings of the multivariate panel regressions suggest that fintech has a negative impact on the profitability of SOBs. It is implied that the development of fintech is currently still a disruption for SOBs and a reasonable approach to tackle this impact could be to accelerate reform and to embrace fintech strategically to create new profitable business opportunities.

It should be noted that the current research conclusions are solely based on the analysis of the data from the 2014-2019 period. Due to the rapid development of advanced technologies, it is highly likely that any potential new disruptive technologies might significantly affect the banking industry to an unknown extent in the future. It is therefore worthwhile to pay continued attention to the evolving fintech-banking relationship.

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