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Original Article

The Relationship between It Investment and Corporate Financial Performance: An Empirical Study on Chinese Tourism Listed Companies

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Abstract - *Several studies have devoted much effort to investigate the effects of IT investment on business productivity and performance, and currently, researchers generally accept that the effects are positive and significant. However, few studies have focused on the tourism industry in developing countries. This study selects the financial data of Chinese tourism listed companies from 2010 to 2017 to examine the relationship between IT investment and financial performance. The results show that the overall financial performance of tourism-listed companies has a significant positive correlation with IT investment. However, the relationship between profitability, operational and development capabilities, and IT investment is subject to the "IT productivity paradox," which may be related to the hysteresis of IT investment and the strategic orientation of managers. This paper can compensate for some shortcomings in research in the field of tourism and provide some references for IT investment for relevant Chinese tourism companies.*

Keywords **-** *Financial performance, IT investment, Tourism listed company, Panel regression*

I. INTRODUCTION

The informatization characterized by digitalization, networking, and intelligence has flourished, and its position in economic and social development has become increasingly prominent, turning into an important production factor, intangible assets, and social wealth. At the company level, research has also shown that informatization plays an essential role in reducing costs, improving management and decision-making, increasing corporate performance, and creating competitive advantage (Buhalis and Law, 2008; Melián-González and Bulchand-Gidumal, 2016; Oliner and Sichel, 2000). Corporate performance as a direct measure for testing the effect of the implementation of information technology (IT) investment has always been the focus and topic of research.

Many scholars have conducted in-depth research on the relationship between informatization and corporate performance but have not yet formed a unified understanding (Dedrick et al., 2003; Weill, 1992). The relationship between the two can be summarized in two categories: "the IT productivity paradox" and "the IT value-added theory". Gordon (2000) is the proponent of the IT productivity paradox. He analyzed the economic growth of the United States in 1995-1999 and found that in addition to the problems of periodic factors and measurement methods, computer investment has had a near-zero rate of return outside of durable manufacturing. Moreover, in recent years, by filtering this publication bias in the ICT productivity paradox literature, Polák (2017) reached a similar conclusion that the productivity paradox might be reborn after it was refuted. And Acemoglu et al. (2014) also stated prior declarations of the death of the Solow Paradox might have been premature.

However, some studies found that the construction and investment of information technology has a positive effect on the business performance of a company. Lim et al. (2011) concluded, using meta-analysis, that IT investment is positively related to company financial performance. Moreover, before them, Shin (2006) had found that IT improves the financial performance of diversified firms when their strategic direction is oriented more toward related diversification. Bharadwaj (2000) and other scholars also confirmed that information technology could significantly improve performance.

Actually, the current research on the relationship between informatization and performance mainly focuses on certain industries in developed countries. There are few studies involving developing countries, and researches on tourism in developing countries is even less. And because of the different capital market environments in developed countries and developing countries, ICT investment leads to different effects in economic growth and corporate performance, bringing obvious" Digital Gap".(Dewan and Kraemer, 2000; Du and Guo, 2016; Lee et al., 2005) So, considering the difference between the industries, countries and the uncertain effect of IT investment, the tourism industry in China deserves more discussion.

While the role of information technology has been widely confirmed, we found that many Chinese tourism companies with good performance don't pay much attention to IT investment. For one thing, the substitution relationship between capital and labor indicates that Chinese enterprises still use labor more to replace capital. For another, managers thought the effect of IT investment is not significant and enterprises' insufficient order quantity is also difficult to support the operation and maintenance of information equipment. (Zhu and Du, 2018)

Therefore, at the moment, it is particularly important to explore whether the IT investment in tourism brings significant growth in corporate performance. We select this research topic both to make up for the lack of research in the tourism industry and to benefit the Chinese tourism industry. We do so by providing the industry with definitive information to assist in deciding whether tourism companies should invest strategically in IT.

II. LITERATURE REVIEW

A. The relationship between IT and corporate performance

Economic theory suggests that the diffusion of new technologies can have a significant impact on economic growth and development, which affects almost all aspects of the economy, including the dynamics of innovation, productivity, growth, firm performance, the development of market structures, and the demand for labor (Kossaï and Piget, 2014). Therefore, it is of great importance for organizations' executives and decision-makers to understand as profoundly as possible how the IT adopted by their companies can be better used and how to use it to produce sustained competitive advantage, growth, and enhanced company financial performance (Devaraj and Kohli, 2003; Gursoy and Swanger, 2007) The constant enhancement concern of enterprise managers for the relationship between IT and corporate performance has also inspired scholars to undertake a lasting, in-depth discussion on this issue.

In recent years, numerous empirical studies have been conducted to verify the relationship between investments in IT and their associated effects on firm performance. However, research has produced contradictory evidence at best that IT investments lead to a significant increase in productivity (Kim et al., 2009). The literature of the last five years and the classic literature cited more than 1,000 are summarized in Table 1. It is seen that related research can generally be classified into two categories: "IT value-added theory" and "IT productivity paradox". Some scholars have made many efforts to overcome this difficult situation through the use of more rigorous research frameworks, such as large sample data sets, the inclusion of additional factors, and adopting a new methodology. This work has led to positive or at least mixed (partly positive) effects (Dedrick et al., 2003; Kim et al., 2009), as shown in Table 1. Gradually, researchers have come to accept that some positive and significant effects (Kim et al., 2009).

Though the current researchers have reached a similar conclusion, there are some differences in research methods and measurement of indicators. Some researchers have used hierarchical regressions by comparing two or more regression models to obtain a more exact relationship between IT and performance (Céspedes-Lorente et al., 2018; Weill, 1992), and two-stage least squares (2SLS) approach and least-squares regressions have also frequently been used (Bharadwaj et al., 1999a; Brynjolfsson and Hitt, 1996; DeStefano et al., 2018; Yunis et al., 2018). As for the measurement of IT, there are also many differences. Timothy et al. (2018) chose to start with broadband infrastructure. Based on ADSL broadband enablement and the cable distance to the local telephone exchange, they used two different databases to study the effects of the impact of IT on firm performance and found substantial and significant effects on revenue. However, Oltean et al. (2014) selected a different approach. They conducted an empirical analysis of some hotel systems that facilitate the operation of the hotel to represent IT, such as front-office information systems and PMS, suggesting that IT has some positive effects. Lim et al. (2011) further identified IT investment as "IT capability", "IT strategy", and "IT spending", finding all three were positively related to firm financial performance, but "IT capability" was not as significant a factor as the other two.

Furthermore, researchers not only study the relationship between IT and performance but also explore some complementary factors that help achieve better performance. Yunis et al. (2018) examined the nature of the relationship between ICT adoption/use and organizational performance in the Lebanese market and proposed that innovation and corporate entrepreneurship are essential catalysts in the ICT–performance relationship. The study by Avci et al. (2011) proposed that different strategic orientations would influence financial performance, and analytical strategic orientation was more appropriate in developing countries. Moreover, Shin (2006) illustrated that IT improved the financial performance of diversified firms when their strategic direction was oriented more toward related diversification.

B. The impact of IT on financial performance in the tourism industry

Regarding research on the relationship between IT and corporate performance, developed countries have always had an absolute advantage because information technology developed earlier and various measurement indicators are relatively mature. Even if recent years have witnessed an increase in studies on IT and performance in developing countries, it is still necessary, due to the different development levels and development stages of different countries (Table 1), to

study the development of specific industries in particular countries. At present, there are very few.

Table 1. Literature review summary

Reference	Performance	IT	Control Variables	Statistical Model	Effect	Developing vs. Developed
Literature in the past five years						
DeStefano et al. (2018)	the sales revenue of the firm employment, and TFP	Hardware and software	employment, multi-plant status, and the local loop distance.	two-stage least squares (2SLS) approach	positive	Developed
Yunis et al. (2018)	a seven-item scale based on a questionnaire	ICT adoption and use scale based on a questionnaire	-	Partial least squares regression	positive	Developing
Berné et al. (2015)	market performance and financial performance	The enhancement of relationships via ICT	-	the exploratory factorial analysis	positive	Developing
Céspedes-Lorente et al. (2018)	ROA	IT-level of use (IT use) and ERP	proactive strategy, hr. policies, age, SME, documentation, industry, innovation	hierarchical regressions	partly positive	Developing
Oltean et al. (2014)	turnover for accommodation services, turnover for food services, turnover for other services, market share, the volume of income, and expenditure	applications, standard software, Front-office systems, bookings systems, Hotel management systems, Systems type eXpresSoft, and some specialized sites	-	Pearson correlation analysis	partly positive	Developing
Classic literature cited over 1000 in Google Scholar						
Bharadwaj (2000)	ROA. relative market to book value, sales, growth, risk	IT capability (the rankings of IT leaders)	-	matched sample comparison group/ the Wilcoxon Rank Sum Test	positive	Developed
Devaraj and Kohli(2003)	revenue per day, revenue per admission, mortality	number of reports, disk input-output, CPU time	Medicare, Medicaid, case mix, age, number of employees	Fixed effects model	Partly positive	Developed
Weill (1992)	sales growth, ROA, and two measures of labor productivity	the ratio of IT expenditure divided by total annual sales	size	hierarchical regression	Partly positive	Developed
Bharadwaj et al. (1999b)	Tobin's Q	information technology spending ratio	Five firm-specific and four industry-level control variables	Least-squares regression	positive	developed
Brynjolfsson and Hitt (1996)	ROA, ROE, total shareholder return	IT Stock composed of computer capital and IS labor	capital intensity, debt, market share, sales growth	OLS/LSUR/2SLS	negative	developed

Studies on tourism, most of which focus on the hotel industry in the tourism industry, and the study of the hotel industry is also concentrated in a small number of countries and regions with mature tourism industries. Ham et al. (2005) examined the effect of IT applications on their performance in lodging operations for an upscale hotel in Seoul, Korea, finding positive effects on these operations. Oltean et al. (2014) also focused on the application systems that facilitate the operation of the hotel in Mureú county, Romania, finding that IT has mixed effects on performance, a result consistent with Ham et al. (2005). Gursoy and Swanger (2007) used a self-administered survey questionnaire to investigate the links between the internal strategic factors examined and financial performance from the perspectives of middle and upper managers of hospitality companies. The results of the study confirmed the positive effect of IT on financial performance.

C. corporate performance measures

We also see that some researchers made a special division on performance that they summarized the corporate performance into two aspects: financial performance and strategic performance (Tarutė and Gatautis, 2014). Moreover, financial performance can be measured in two ways: market-based and accounting-based (Lim et al., 2011). Market measures are broad measures of performance, and they can reflect the market's expectations on future firm performance, but they are easily confounded with other factors, such as differences in risk, changes in competition, and changes in the information environment. There also has been some criticism on the accounting measures because they fail to reflect intangible improvements, do not include an adjustment for risk and only track relatively short-term performance. (Bharadwaj et al., 1999a) But accounting measures are very direct measures, and compared with the market measures, the relationship between IT investment and firm financial performance is more significant than market measures. (Lim et al., 2011) Therefore, in this paper, we adopt accounting-based financial performance.

III. DATA AND VARIABLES

According to the industry classification of the China Securities Regulatory Commission, 37 companies in the tourism and hotel industry that have relatively complete data on all accounting and financial variables over the eight years from 2010 to 2017 were selected for the research sample. Considering the representativeness and comparability of the data, the ST company, *ST company, and the companies listing after 2010 or having incomplete data were excluded from the sample. Finally, we selected 14 publicly-traded tourism companies, such as Huatian Hotel Group Co., Ltd., Guangzhou Lingnan Group Holdings Co., Ltd., and Zhang Jia Jie Tourism Group Co., Ltd. All data used in this study are taken from CSMAR financial databases and annual report.

A. Corporate performance measures

There are two standard methods to measure corporate financial performance. One is to choose one representative financial indicator to represent such performance, like return on assets (ROA), Tobin's Q, and primary operational margins (Céspedes-Lorente et al., 2018; Bharadwaj et al., 1999a). The other is to choose diversified financial indicators to use as measures, such as Wole's Credit Scoring (Li, 2009) and Comprehensive Evaluation Method (Chen, 2010). Instead of measuring performance with a single performance indicator, the latter method uses multiple indicators to measure performance from multiple perspectives, which is more authoritative and comprehensive. In this study, we combined these two methods, selecting respectively a single indicator from the four dimensions of profitability, solvency, operational capability, and development capability and also calculating an overall financial performance to measure the corporate performance. A summary of all the critical variables we needed is shown in Table 2.

Table 2. Summary of variables

	Key Issues (Variables)
Corporate performance	
Profitability	Return on equity (ROE)
	Return on asset (ROA)
Solvency	Current ratio (CR)
	Quick ratio (QR)
Operational Capability	Total asset turnover (TAT)
Development Capability	Operating profit growth rate (OPGR)
Overall Financial Performance	SCORE
IT investment and control variables	
IT investment	Hardware (HIT)
	Software (SIT)
	IT investment (IT)
Control variables	Company size (SIZE)
	Debit-equity ratio (DE)
	The proportion of the top ten shareholders (TOP10)

ROE is calculated by dividing the net income by total equity and is an essential indicator of profitability, measuring the income earned by every dollar of shareholders' equity. The higher is the ROE; the greater is the profitability.

$$ROE = \frac{Net\ \text{income}}{Total\ \text{equity}} \quad (1)$$

The current ratio (CR) is the ratio of current assets to current liabilities. It is used to measure the capacity of current assets to repay current liabilities before short-term debt expires. The CR reflects the

company's short-term solvency from the perspective of stocks (Wang and Gu, 2016). The higher is the current ratio; the smaller is the financial risk.

$$CR = \frac{Current\ asset}{Current\ liability} \quad (2)$$

Total asset turnover (TAT) reflects a company's operational capability, which depends on the ratio of operating revenue and total assets. The higher the TAT rate is, the better are the company's sales ability and the efficiency of asset investment.

$$TAT = \frac{Operating\ revenue}{Total\ asset} \quad (3)$$

The operating profit growth rate (OPGR), often used as the proxy of growth capability, is the ratio of the company's operating profit growth in the current year to the total operating profit of the previous year, reflecting the expansion of the company's business scale. If a company's performance declines or loses its ability to grow, the indicator decreases and may even have a negative value (Liu et al., 2017).

$$OPGR = \frac{Icrease\ in\ operating\ profit}{Total\ operating\ profit\ in\ last\ year} \quad (4)$$

The overall financial performance (SCORE) also combines four dimensions of performance (profitability, solvency, operational capability, and development capability). However, given the previous research, profitability and solvency have a stronger correlation with corporate performance, thus adding ROA, quick ratio, and debit-equity ratio (Yu, 2003).

Net income expressed as a percentage of average total assets represents the ability to use assets to generate profit. Many researchers also selected return on assets (ROA) as an indicator to measure company performance. (Jose et al., 1996; Wang, 2002). Compared with ROE, ROA could more adequately reflect the operational efficiency of enterprises and reveal the relationship between capital management and corporate performance.

$$ROA = \frac{Net\ income}{Total\ asset} \quad (5)$$

The quick ratio (QR), computed as quick assets (those easily converted into cash) divided by current liability, is a measure of short-term liquidity of the assets. The quick assets are the balance of the company's current assets minus inventory, mainly including cash, short-term investments, bills receivable, and accounts receivable. Generally, the higher the quick ratio is, the stronger is the company's short-term solvency is, and the more effective is the company's asset management.

$$QR = \frac{Current\ asset - inventory}{Current\ liability} \quad (6)$$

The debt-equity ratio (DE) is also an essential part of solvency, but different from QR and CR, it reflects the long-run solvency. Many studies have shown that it has a close relationship with corporate performance.

$$DE = \frac{Totoal\ debit}{Total\ equity} \quad (7)$$

In this study, we followed Chen (2010) to compute the overall financial performance based on factor analysis. Factor analysis can group several closely related variables into the same class, thus using a few factors that can explain most of the variances among the ratios to describe the relationship between many indicators or factors. (Xiong and Tang, 2019)

Accordingly, a principal component factor analysis was performed using SPSS 19.0. The KMO and Bartlett sphericity test showed that the KMO value was 0.601>0.5 and that the significance level was 0.000 < 0.01%, which indicated that the original data had a significant correlation and that the seven variable indicators were suitable for factor analysis. Based on the principle of eigenvalue>1 and a factor loading $\geqslant$ 0.50(Hair et al., 1998), three common factors were finally extracted from seven financial ratios, and the cumulative variance contribution rate was 86.426%. This result illustrates that three common factors can replace the original indicators for calculation.

After obtaining the extracted factors and corresponding factor score, we computed SCORE by multiplying the corresponding factor score by the weight of each factor respectively and then summing them up. The specific calculation formula is as follows:

$$SCORE = \sum_{i=1}^{k} W_i \times S_i \quad (8)$$

where scores are the overall financial performance of the *i*th tourism listed company; S_i is the corresponding factor score of the *i*th tourism listed company, and W_i is the weight of the variation explained by each factor divided by the variation explained by all factors:

$$W_i = (E_i \Big/ \sum_{i=1}^{k} E_i) \times 100 \quad (9)$$

where W_i is the weight of the ith tourism listed company, E_i is the variation explained by the *i*th factor, and k is the number of factors.

B. IT investment

The explanatory variable we selected in this study is information technology investment. IT investment is an indicator that is hard to measure. As early as 2001, the National Informatization Evaluation Center of China announced the evaluation indicators and systems for informatization. However, many indicators are difficult to measure and cannot be fully covered in original research. Although the National Information Evaluation Center has published a list of the top 500 Chinese enterprises that have engaged in informatization since 2003, the evaluation ended in 2008 because measuring a company's overall informatization is complex.

There are also other methods to measure IT investment. For example, Daveri and Maliranta (2007) adopted the evaluation of employee age, education level, and labor cost. Lin (2007) adopted the hardware

investment as information technology investment for the correlation coefficient between information technology hardware investment and comprehensive information technology investment (including software investment and human capital investment) is around 0.75 ~ 0.8, etc. Besides these, there are also a few studies using questionnaires, but the questionnaire survey is subjectively affected, and the recovery rate is not high. For example, (Wang et al., 2006; Wang et al., 2007) conducted surveys on enterprises' informatization and corporate performance in 11 cities in Zhejiang, China; 1.800 copies were distributed, but only 800 complete questionnaires were obtained.

Accordingly, in this study, we measured the hardware equipment and software system following Li and Wu (2008)'s method. The data for the hardware equipment comes from the ending balance of electronic equipment and computer equipment within fixed assets in the annual report, and the software data comes from the software system in intangible assets. At the same time, taking into account the impact of the size of the company, IT investment was divided by the operating income of the year (Weill, 1992), that is:

$$IT_i = (HIT_i + SIT_i) / Inc_i \quad (10)$$

where HIT_i is the year-end book value of the hardware of the *i*th tourism-listed company, $SIT_i$is the year-end book value of the software of the *i*th tourism-listed company, and *Inci*represents, the operating revenue of the *i*th tourism-listed company.

C. Control variable

To enhance the accuracy of the model and remove the influence of other factors that may correlate with corporate performance, we selected the company size (SIZE), the debt-equity (DE) ratio, and the shareholding ratio of the top 10 shareholders (TOP10) as the control variables.

The company size is a common factor affecting corporate performance. Fan (2018) discovered that large-scale companies have economies of scale, can carry out professional divisions of labor, hire senior experts, can significantly improve efficiency, and obtain higher profitability with sufficient capital, mature technology, advanced equipment, industrial monopolies, and more policy support; thus, SIZE is a vital control variable for performance research. The size of the company is computed by taking the logarithm of the total assets, that is:

$$SIZE = LN(company's\ total\ assets) \quad (11)$$

As the debt-equity ratio (DE) affects the level of corporate performance(Wang and Xu, 2017), DE was also taken into account. At the same time, the concentration of ownership is closely related to the management behavior of the company, which finally affects the company's performance. Therefore, the shareholding ratio of the top 10 shareholders (TOP 10) was selected as the control variable.

IV. METHODOLOGY AND RESULTS

A. Descriptive statistical analysis

Table 3 summarizes the data of ROE, CR, TAT, OPGR, SCORE, IT, SIZE, DE, and TOP 10 for all samples between 2010 and 2017. One can see from the standard deviation that CR is the most volatile, valued from -1.129 to 4.331; TAT also fluctuates, ranging from -1.577 to 2.988, indicating that CR and TAT vary greatly between companies and years. Also, compared with CR, ROE, TAT, OPGR, the standard deviation of SCORE is smaller, showing that the overall performance indicator is more stable than a single financial indicator.

Table 3 also shows the results of the Pearson correlation coefficient test applied to the data. From Table 3, it can be seen that the current ratio (CR) and the overall financial performance (SCORE) are significantly positively correlated with the company's IT investment. The total asset turnover rate (TAT) is significantly negatively correlated with IT. ROE and OPGR, however, have no significant correlation with IT, which shows that the more a company invests in IT, the stronger a company's overall income ability is, the slower the asset turnover rate is.

B. Panel regression tests

To examine the relationship between corporate performance and the IT investment of tourism-listed companies, we use panel balance data from 14 tourism-listed companies from 2010 to 2017 for panel regression testing. According to Chen (2010), panel data methods can control the heterogeneity of individual firms, reduce problems associated with multiple collinearities and estimated bias, and specify time-varying relationships between related variables and independent variables. The built regression model is as follows:

$$ROE = \alpha_{10} + \beta_{11} IT + \beta_{12} SIZE + \beta_{13} DE + \beta_{14} TOP10 + \varepsilon_1$$

$$CR = \alpha_{20} + \beta_{21} IT + \beta_{22} SIZE + \beta_{23} DE + \beta_{24} TOP10 + \varepsilon_2$$

$$TAT = \alpha_{30} + \beta_{31} IT + \beta_{32} SIZE + \beta_{33} DE + \beta_{34} TOP10 + \varepsilon_3$$

$$OPGR = \alpha_{40} + \beta_{41} IT + \beta_{42} SIZE + \beta_{43} DE + \beta_{44} TOP10 + \varepsilon_4$$

$$SCORE = \alpha_{50} + \beta_{51} IT + \beta_{52} SIZE + \beta_{53} DE + \beta_{54} TOP10 + \varepsilon_5$$

Three conventional linear panel regression models are considered in this study: the pooled ordinary least square model (OLS), the fixed effects model, and the random-effects model. The OLS method estimates that all cross-sections share a universal constant; that is, there is no difference in the estimated cross-section. The fixed effect method regards this constant as a specific part, and the difference between the fixed-effect method and the random effect method is the relationship between the unobservable effect of the individual and the independent variable (Chen, 2010).

Before the regression analysis, it is necessary to determine which model is most suitable. In this study, the F test and the Hausman test are used to determine the final model.

Table 3: Descriptive statistics of variables and Pearson's correlation coefficients

	ROE	CR	TAT	OPER	SCORE	IT	SIZE	DE	TOP 10
Panel A: Descriptive statistics of variables									
Mean	0.019	0.110	-0.003	0.045	-2.08 e-07	-1.75 e-07	1.29 e-01	-0.151	-3.61 e-07
Standard deviation	0.754	1.071	1.021	0.963	0.504	1	0.899	0.313	1
Minimum	-7.617	-1.129	-1.157	-1.181	-0.806	-0.379	-1.793	-0.672	-2.073
Maximum	0.656	4.331	2.988	7.772	2.872	7.146	2.33	1.033	3.419
Panel B: Pearson's correlation coefficients									
IT	0.038	0.357***	-0.232**	-0.041	0.197**	1	-	-	-
SIZE	0.225**	0.159*	0.192**	-0.231**	-0.052	-0.164*	1	-	-
DE	-0.430***	-0.644***	-0.208**	0.270***	-0.444***	-0.154	0.156	1	-
TOP 10	0.200**	0.066	0.381***	-0.173*	0.060	0.186**	0.337***	-0.110	1

Note: **Significance at the 10% level. **Significance at the 5% level. ***Significance at the 1% level*

Table 4. Results of F-test and Hausman specification test

	F-statistic[p-value]	Hausman specification test [p-value]	Test result
ROE	3.22(0.0005) ***	37.13(0.0000) ***	Fixed effects
CR	5.59(0.0000) ***	9.52(0.0493) **	Fixed effects
TAT	20.91(0.0000) ***	7.02(0.1346)	Random effects
OPGR	2.76(0.0024) ***	17.89(0.0013) ***	Fixed effects
SCORE	5.59(0.0000) ***	30.42(0.0000) ***	Fixed effects

Note: **, **, and *** indicate that the null hypothesis can be rejected at the 10%, 5%, and 1% levels, respectively.*

First, the F-test is used to determine whether the pooled ordinary least square model (OLS) is more suitable than the fixed-effect model. The original hypothesis of the test is that all constants are equal. If the null hypothesis is rejected, the fixed-effect model should be selected and if the null hypothesis cannot be rejected, select OLS. The Hausman test is used to judge which of the fixed effects model and the random-effects model is more appropriate. The null hypothesis of the Hausman test is that the estimated coefficients under the fixed effect are consistent with the estimated coefficients under the random effect, and the coefficients of random effects are the most efficient. The alternative hypothesis is that the coefficients estimated under the random effect are inconsistent, but the estimated coefficients of the fixed effect are still consistent. Therefore, when rejecting the null hypothesis, the fixed-effect model should be selected, and the random effect model should be selected when the original hypothesis cannot be rejected. Based on this theoretical basis, the F test and the Hausman test were performed, and the results obtained are shown in Table 4.

When performing the Hausman specification test, we find that the value of TAT is not significant, in which case the random effects model should be selected for TAT panel regression. However, for ROE, CR, OPGR, SCORE, the fixed effects model is more suitable.

C. Empirical results

The results of the panel regression tests are shown in Table 5. It can be seen from Table 5 that there is a negative correlation between ROE and IT, and it is significant at the level of 5%, indicating that with the increase of IT investment, the profitability of a company's per-unit equity declines, which is consistent with the theory of productivity paradox. The regression results on ROE further suggest that for tourism enterprises, the application of new technology requires a learning and diffusion process, and it does not produce a satisfactory performance result in the short term. (Sun et al., 2010) Many empirical types of research also have confirmed that a 1-3 years lag period exists.(Devaraj and Kohli, 2003; Brynjolfsson et al., 1994)

Table 5 also summarizes the relationship between CR and IT. Test results reveal that IT has a positive effect on CR, which supports the correlation coefficient and significance level in Table 3. And these effects are statistically significant, showing that the greater is the IT investment, the higher is the CR, and the stronger is the company's short-term solvency. The adjustment R^2 is 0.6213, indicating that the explanatory power (the value of adjusted R^2) of IT on CR is as high as 62%. This value is greater than 0.3, and the model can explain the independent variable well.

IT, as shown in Table 5, has a significantly negative correlation with TAT, the ratio of operating revenue, and total assets. Just as does the ROE, IT investment does not have a significant impact on revenue in a short time because it takes time for information.

Table 5. Results of panel regression test

	(12) ROE	(13) CR	(14) TAT	(15) OPGR	(16) SCORE
IT	-0.286** (-2.70)	0.632*** (6.35)	-0.239** (-2.85)	0.248 (1.61)	0.249*** (3.75)
SIZE	0.467*** (3.63)	0.318** (2.63)	-0.304** (-3.04)	-0.483* (-2.55)	-0.186* (-2.31)
DE	-2.291*** (-7.84)	-1.881*** (-6.85)	0.128 (0.55)	2.230*** (5.40)	0.134 (0.73)
TOP10	0.305** (3.11)	-0.482*** (-5.23)	0.236** (3.03)	-0.377* (-2.31)	-0.236*** (-3.84)
Constant	-0.387*** (-5.27)	-0.214** (-3.10)	0.0558 (0.24)	0.442*** (4.21)	0.0441 (0.96)
Model statistics					
N	112	112	112	111	112
Number of Companies	14	14	14	14	14
R^2*-between*	0.4403	0.6213	0.1933	0.2860	0.2581

Note: **Significance at the 10% level, **Significance at the 5% level, ***Significance at the 1% level*

Systems and equipment to integrate into business operations. And IT investment will also increase the stock of assets, thus decreasing TAT. The low adjusted R^2 of the random effects model implies that the goodness-of-fit for the regression equation is relatively weak; in fact, IT can only explain 19% of TAT.

The operating profit growth rate (OPGR) is positively related to IT but not significant. With the rapid development of the tourism industry, the external development environment has undergone major changes. The annual fluctuation of the operating net interest rate is also extensive; so, there is no significant relationship between them. However, we can see that OPGR is significantly negatively correlated with SIZE, indicating that large companies do not mean strong development capabilities. The overall adjusted R^2 is 0.2860, and IT can explain 29% of it.

Finally, a regression analysis of the comprehensive performance indicators (SCORE) of tourism enterprises reveals a slightly different result from individual financial indicators. The correlation coefficient between SCORE and IT is 0.2491, which is significant at the level of 1%. This result confirms the conclusions drawn from Table 3. The reason for the difference from the above three indicators is that the overall corporate performance (SCORE) not only considers the company's profitability but also considers solvency, operational capability, and development capability. Although the effect of a profit increase may not be significant, IT investment improves the overall performance by acting on many aspects of the company. The results in Table 5 also show the relationship between the comprehensive performance indicator (SCORE) and the concentration of ownership (TOP 10); that is, the excessive shareholding of the top 10 shareholders hurts the company's performance. From the results of adjusting R^2, the explanatory power is relatively weak, at 26%.

V. DISCUSSION AND CONCLUSION

This study examines the impact of IT investments on the corporate financial performance of tourism-listed companies in China. IT investments are measured by the hardware and software spending data from their annual report. Corporate financial performance is measured in one of two ways—individual performance indicators by four dimensions and comprehensive financial indicators. Four individual indicators (ROE, CR, TAT, OPGR) respectively represent corporate profitability, solvency, operational capability, and development capability, whereas the comprehensive financial indicators are the comprehensive scores which are obtained by principal component analysis of seven indicators (ROA, ROE, CR, QR, DE, TAT, OPGR) from four dimensions. The effects of IT on corporate financial performance in Chinese tourism-listed companies are then verified via the panel regression test.

The results of the panel regression test suggest that information technology investment has a significant negative impact on the profitability of enterprises, indicating that for tourism companies, investment in information technology seems like a negative productivity factor and that too much investment in IT may reduce these companies' profitability. The results of the regression of operational capability show a similar conclusion. With the increase in investment, the turnover efficiency of capital becomes worse. Also, IT investments do not have any significant impact on the company's development capability.

There are several possible explanations for the three individual indicators. The first possibility is the time lag of IT investment; much investment in IT equipment cannot produce immediate effects, as it takes time for the personnel to learn to integrate it into the company's production and operational processes.

Second, there may be some ineffective IT investments in the tourism industry. IT spending does not necessarily imply the usage of IT. Especially for this period in China, information technology has changed the way traditional travel service companies provide services; trying to catch up with the trend, some companies spend large amounts of money to buy new systems and equipment, but these investments may not be very significant in practice. The third possibility relates to the managers' strategic orientation. It is more sensible for these managers to be more analytical when developing and implementing decisions in uncertain business environments in developing countries (Avci et al., 2011).

However, we can see that solvency and comprehensive performance are significantly positive with IT investments. The results imply that tourism-listed companies can enjoy better solvency and overall performance with more IT investments. For solvency, CR is measured by current assets divided by current liabilities, and IT spending brings short-term financial fluctuations, increases the liquid assets of a company, which means having more assets for conversion to cash to repay corporate debt. Such repayments benefit attempts to achieve solvency. For comprehensive financial performance, the SCORE is obtained by principal component analysis. The influence level of different indicators on SCORE is different. Some indicators (such as ROE, TAT, etc.) affected by hysteresis have a relatively small impact, and some (CR) not affected by hysteresis have a relatively large impact, resulting in a positive impact on the comprehensive financial performance. The results suggest that IT investment will make the overall financial performance of the year better by acting on all aspects of the company's operations and management.

Finally, there are some limitations. The data used in this study is the financial data of 14 tourism-listed companies from 2010 to 2017. The number of samples is relatively small, which might have an impact on the results of the empirical test. And in this paper, we adopt financial data based on accounting. It usually represents the short-term operational results but not the long-term results (Bharadwaj et al., 1999b). However, faced with the domestic condition that recording data on IT are deficient, the accounting measure is still a relatively effective method to study the relationship between IT investment and corporate performance.

Also, there are many factors deserving discussion that has been omitted from this paper, for instance, the effects of software and hardware on performance, how the IT investment influences financial performance, and whether there is a real-time lag or specific time lag associated with IT engagement.

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