

Article

The Effects of Changes in Financial Performance on Value Creation in Digital Transformation: A Comparison with Undigitalized Firms

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Abstract: We attempted to analyze the effect of changes in financial performance after digital transformation on firm value creation, compared to undigitalized firms for digitally transformed firms listed in the KOSPI market in Korea. To this end, we conducted an independent sample *t*-test and a multivariate regression analysis for a total of 12,143 firms listed on the KOSDAQ market, from 2011 to 2021. As a result of the empirical analysis of our study, it was confirmed that digitally transformed firms showed differential results in changes in financial performance compared to undigitalized firms. Overall, changes in profitability, stability, and growth are excellent, but in some aspects of activity and productivity, it is confirmed that they are weaker than undigitalized firms. In addition, it was confirmed that there was a difference in the change in the current ratio and the total asset turnover rate in the changes in the financial performance affecting the value creation. Nonetheless, there were insignificant differences in other variables.

Keywords: digital transformation; financial performance; value creation



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1. Introduction

The recent prolonged COVID-19 pandemic has changed our daily lives. Despite the severe recession in the global economy, demand for e-commerce on Facebook, Google, Netflix, and Amazon is on a non-face-to-face basis, and demand is exploding due to a realistic situation where goods can be purchased quickly and easily. Digitally transformed firm is growing at a different level from existing manufacturers, but competition in the Korean e-commerce market is getting worse day by day. The size of the Korean e-commerce market was KRW 161 trillion in 2020, an increase of 19.3% from the previous year. The share in the e-commerce market is in the order of Naver Shopping 17%, Coupang 13%, and eBay Korea 12%.

E-commerce is a business model in which transactions are made through electronic networks, mainly on the Internet, and includes the process of electronically trading products, services, and information. In the past, not only young people but also the baby boomer generation, who were mainly offline consumers, while experiencing the COVID-19 pandemic, joined the ranks. In order to create various growth engines, these rapidly growing digitally transformed firms are also increasing in investments to promote innovation throughout management activities such as R&D, production, procurement, and sales based on e-commerce.

Competition between firms in the e-commerce market, such as Naver and Coupang, which are the first and second largest firms in Korea's market share, is intensifying. Coupang was listed on New York Stock Exchanges in March 2021, and its market capitalization exceeded Naver (KRW 64 trillion) to reach KRW 87 trillion. The strategy was to invest in expanding logistics centers, expanding new businesses, and strengthening productivity

by successfully raising funds through listing. It seems to be focusing on strengthening its business influence by expanding its logistics base by establishing 700,000 pyeong of logistics facilities in seven regions except Seoul by 2025 [1].

In addition, e-commerce firms that have been preparing for IPO on the back of such COVID-19 special cases are in trouble due to the “bad news” of the spread of the pandemic atmosphere. In other words, there is a high concern that value creation may not be evaluated as expected or may be forced to withdraw its listing, as there are predictions that e-commerce growth will slow down due to changes in consumption patterns caused by daily recovery. In other words, starting with Market Kurly in April 2022, major electronic commerce firms such as SSG.com, 11st, and Oasis are rushing to prepare for listing within the end of 2022 or the beginning of 2023. Market Kurly, a firm specializing in early morning delivery, is the closest to the position of the “No. 1 e-commerce listed firm in Korea”. Considering the schedule of applying for a preliminary review to the Korea Stock Exchange March 2022, this firm expects to be listed as early as 2022 and expects the market capitalization to be around KRW 4–6 trillion.

In this regard, the prospect of slowing growth due to daily recovery and the increase in logistics investment are obstacles. Market Kurly’s sales in 2021 rose 64% from 2020 to KRW 1.5614 trillion, but its operating loss was KRW 217.7 billion, up sharply from KRW 116.3 billion in 2021. Due to the nature of early morning delivery, which requires large-scale investment to establish a fresh logistics center, the deficit is bound to increase compared to sales [2].

Shinsegae Group’s integrated online mall, SSG.com, is at the end of 2022. It is preparing for listing early next year. It is considered the most promising player of the year after receiving support from Shinsegae and E-Mart. The market capitalization expected by SSG.com is around KRW 10 trillion. Variables include the overall deficit situation of e-commerce and controversy over split listing. The transaction volume of SGD in 2021 was KRW 5.7174 trillion, a 22% increase from the previous year, the highest ever, but the operating deficit also increased significantly to KRW 107.9 billion. As the new government has announced that it will strictly restrict the listing of its split subsidiaries, the “split listing” of S-Gadcom, a subsidiary of E-Mart, could also be controversial [2].

By comparing the beauty industry and other industries for 15 months before and after the COVID-19 outbreak in Korea, Kim and Ahn found that sales of beauty products decreased offline, but sales through e-commerce decreased insignificantly [3]. In addition, Lim et al. analyzed the market trend of e-commerce services of fresh food and found that e-commerce has exploded in Korea from 2010 to 2021 [4]. Moreover, Lee and Whang analyzed the effects of entering the e-commerce market on the performance of firms and estimated that the sales growth rate of firms in the year of entering the e-commerce market was about 9.5% greater than that of firms that did not engage in e-commerce [5]. Specifically, this study presented the results that the positive effect of e-commerce on corporate performance was greater in export firms with e-commerce transactions than in e-commerce firms for domestic purposes. The results of these preceding studies have indicated that e-commerce could be an important source of corporate performance even in the COVID-19 pandemic situation. Accordingly, we attempted to analyze whether the financial performance and value of e-commerce firms in Korea drive positive differences compared to non-e-commerce firms.

In this situation, it is also considered to be a very important research task to examine the financial performance of e-commerce firms and the relationship between value creation. Nonetheless, research on changes in financial performance and value creation of e-commerce firms in Korea is still insufficient. Therefore, our study attempted to identify whether there is a difference in the average of changes in financial performance and value creation between e-commerce and non-e-commerce firms. Second, we would like to verify whether there is a difference in the changes in financial performance affecting value creation between e-commerce firms and non-e-commerce firms. We expected that the potential results of the current study would justify the government’s discriminatory support for e-commerce firms and would provide a logical basis for policies that foster them as national strategic projects in the future.

2. Literature Review and Hypothesis Development

2.1. Digitally Transformed Firms

E-commerce refers to economic activities related to the purchase and sale of products and services, e-learning, marketing, and service provision through computer networks [6]. Such e-commerce is often confused with e-business. Some view the term commerce as describing only transactions made between firms and consumers. Using this definition of commerce, the term e-commerce would be quite narrow. Due to this complexity, quite a few people are using the terms e-commerce and e-business interchangeably [7,8]. In this paper, e-commerce and e-business are exchanged.

There are many concepts of e-commerce. If all activities are digital, it can be said to be pure e-commerce. Without digital, this cannot be called e-commerce. If some tasks are processed digitally, it can be said that partial e-commerce is being conducted. For example, purchasing a computer from Interpark's website or purchasing a book from Amazon is partial e-commerce, because the product is physically delivered. However, purchasing e-books or software products at Interpark is pure e-commerce, because ordering, processing, and shipping to buyers are all digital. Many firms can be divided into two or more classification units [9]. According to Turban et al., firms with purely physical organizations are called traditional (or old-economy) firms or "Brick-and-Brick" [8], but organizations engaged only in e-commerce are considered virtual (pure) firms. Firms that use the Internet for business and commerce, such as Amazon, Yes24 and Interpark, are called "Internet-pure firms" or "click-and-click". Firms that use the Internet as an addition to their core businesses, such as E-Mart dotcom, are called "Brick-and-Click". Some "Internet-pure firms" expand to incorporate traditional corporate trading methods into their businesses. For example, Amazon.com has been expanded to include the storage and distribution of products to facilitate Internet commerce.

Recently, many scholars have argued that corporate Digital Transformation goes through three stages: Digitalization, Digitalization, and Digital Transformation [10–16]. The first step, digitization, refers to a change from an analog form to a digital form [10]. It is mainly defined as the conversion of analog information into digital information in a firm's computer system for the purpose of 'digitalization of information' until the early 2000s. The second step, digitalization, represents the use of digital technology to change a firm's business model and provide new revenue and value-generating opportunities [10,17]. This is a process of moving to a digital business, reflecting the digitalization of work processes, ordering, and production methods by firms for the purpose of operating innovation and efficiency until the early 2010s. The third step, digital transformation, refers to the achievement of customer-led strategic business innovations that require organizational change, as well as the implementation of digital technologies [10,18].

2.2. Changes in Financial Performance and Value Creation

Kim, Chun, and Lee studied value creation evaluation and investment by financial ratio by dividing corporate activities into sales and financial activities for 1625 listed firms from 2001 to 2003 [19]. As a result of the study, it was concluded that the financial variables affecting value creation are the gross margin of sales, the turnover rate of operating assets, financial leverage, and sales variables.

Lee, Woo, and Ryu compared the differences in profitability, stability, growth, activity, and productivity by selecting 94 venture firms registered in the KOSDAQ market from 1995 to 1998 [20]. As a result of the analysis, venture firms were found to be better in the case of total asset return, net return on equity capital, and growth index, and these indicators showed significant differences between the two groups. In addition, the debt ratio of venture firms was lower than that of general firms, but the risk of short-term debt repayment due to lack of liquidity was higher for venture firms than that of general firms.

Kim and Kim analyzed the differences in changes in financial performance by industry, focusing on US listed firms, by dividing the Internet industry into Internet infrastructure, software and programming, and Internet service industries [21]. The Internet infrastruc-

ture industry showed much higher liquidity and growth factors, and the software and programming industries showed significant differences in profitability factors compared to other industries. In addition, the Internet service industry was disadvantageous in low profitability and liquidity due to uncertainty in the profit model of the industry, which is in its early stages.

Lee, Moon, and Kim empirically analyzed changes in financial performance by dividing the software industry by size, venture firm type, R&D, and operating profit level [22]. As a result of empirical analysis, in order for government policies on the software industry to be effective, it is necessary to focus on internal profitability rather than external growth, which is a policy implementation method, and small software firms need M&A. However, venture employment and R&D policies were found to be ineffective.

Cho selected and studied 51 firms that distinguished between blue chip and non-blue chip groups among venture firms registered in the KOSDAQ market to verify which of the changes in financial performance of venture firms are the determinant of blue chip or non-blue chip venture firms [23]. As a result of the verification, the factors that determine blue chip or non-blue chip venture firms showed a significant difference only in interest costs and the total return on assets before corporate tax reduction.

Meanwhile, Sim analyzed the investment propensity of foreigners by verifying the relationship between foreign ownership interests and changes in financial performance, changes in financial performance, and value creation invested in listed firms for six years from 1995 to 2000 [24]. As a result of the study, foreign shares showed a statistically significant positive (+) relationship with ROE and growth rate, and a negative (−) relationship with R&D expenses and the debt ratio. In addition, before the International Monetary Fund (hereinafter referred to as IMF) situation in Korea in 1997, foreign shares were statistically significant with R&D, ROE, liquidity ratio, and firm size, and after the IMF, they showed statistically significant values in debt ratio, sales growth, and firm size, indicating changes in changes in financial performance on value creation before and after the IMF.

An and Ha analyzed the relationship between the financial performance and corporate value of Korean exporters after the global financial crisis and found that the total asset return, total asset turnover, and equity return had a positive effect on corporate value only in the export firm group [25]. In particular, this study showed that the liquidity ratio had a positive effect on the export business group and a negative effect on the non-export business group. It was also found that the total asset growth rate had a positive effect on both groups. Oh and Kim compared the financial performance of firms in the healthcare industry, which have emerged as new business items since the COVID-19 pandemic, with those in the non-healthcare industry [26]. As a result of this study, the healthcare industry was superior to the non-healthcare industry in terms of corporate value and net return on the equity capital of profitability, stability, and growth.

2.3. Hypothesis Development

Prior studies have presented that the e-commerce market may be a success factor even in the situation of the COVID-19 pandemic [3–5]. The COVID-19 has brought uncertainty and great changes in our society. Due to the prolonged pandemic, there are more opportunities for non-face-to-face transactions, and day by day, we are entering a familiar situation. Due to these changes in reality, the demand for e-commerce is exploding. Demand is exploding due to a realistic situation where goods can be purchased quickly and easily on the premise of non-face-to-face, and the size of the Korean e-commerce market also increased 19.3% year-on-year to KRW 161 trillion in 2020. In addition, the reality is that competition between digitally transformed firms is intensifying day by day. As a result, despite the high demand, many digitally transformed firms are in the red. Recently, the social demand for face-to-face transactions has increased and uncertainties about the bizarre future e-commerce market have been increasing.

Under these uncertainties, national interest and support for Korea's digitally transformed firms seem to be needed, and for this, it is necessary to first understand the characteristics

of Korea's digitally transformed firms. Through this, it will be possible to derive prospects and implications for the e-commerce market in the future and seek strategies to expand stable profit generation and support the digitally transformed firm. Kim and Ahn presented the results that the beauty industry in Korea insignificantly decrease in sales through e-commerce even after the COVID-19 outbreak [3]. In addition, Lim et al. suggested that electronic transactions of fresh food in Korea exploded from 2010 to 2021 [4]. Moreover, Lee and Whang showed the effects of entering the e-commerce market on corporate performance through a survey [5]. The results estimated that the per capita sales growth rate of firms in the current year of entering the e-commerce market was about 9.5% greater than that of the hypothetical case where e-commerce would not have been conducted. In addition, they found that the positive effect of e-commerce on corporate performance was greater in e-commerce exporters than in e-commerce firms for domestic demand [5].

From this point of view, the following hypotheses were developed to examine the difference between changes in financial performance and value creation in digital transformed factors and the relevance of changes in financial performance to value creation.

H1. *There is a difference in the average of changes in financial performance and value creation in digitally transformed firms and undigitalized firms.*

H1-1. *There is a difference in the average profitability between digitally transformed firms and undigitalized firms.*

H1-2. *There is a difference in the average stability between Digitally transformed firms and undigitalized firms.*

H1-3. *There is a difference in the average growth potential between digitally transformed firms and undigitalized firms.*

H1-4. *There is a difference in the average of activity between digitally transformed firms and undigitalized firms.*

H1-5. *There is a difference in the average productivity between digitally transformed firms and undigitalized firms.*

H1-6. *There is a difference in the average value creation between digitally transformed firms and undigitalized firms.*

H2. *There is a difference in changes in financial performance that affect value creation between digitally transformed firms and undigitalized firms.*

3. Research Design

3.1. Sample and Data

According to Bloomberg and Verhoef et al., we considered digitally transformed firms to be firms in the third step of digital transformation [10,19]. In other words, we operationally defined digitally transformed firms as firms that have achieved business innovation through diversification of customers' Internet services and diversification of public communication groups by applying cloud computing, artificial intelligence, and data analytics on a digital infrastructure and system basis. According to this definition, we limited digitally transformed firms from the KISVALUE database to firms with 19 industrial codes, including digital native enterprise, digital converted e-travel services, e-wholesale, publishing, telecommunications, e-learning, game and system software providers, and digital content firms.

The sample target firms for empirical research were limited to those that could obtain financial data from the KISVALUE program of NICE evaluation information among those registered and traded in the KOSDAQ market for 11 years from 2011 to 2021. In addition, the Financial Supervisory Service's electronic disclosure system searched the business report of the sample firm and selected a firm that meets the following conditions among the firms that can obtain data. The unit of analysis is a firm's financial year.

3.1.1. Firms Falling under Financial Institutions and Industries Other Than Real Estate

This is to secure the homogeneity of the firms to be analyzed and to secure an appropriate number of firms, because financial institutions such as banks, securities, insurance, and real estate-related institutions have different business characteristics from those of general firms, and the composition items in the financial statements are also different. In addition, financial institutions and real estate-related institutions were excluded from the sample firms because the meaning of financial institutions and real estate-related institutions may be different from that of general firms even if they are the same account subjects. In fact, the number of excluded firms was only 66 in the real estate industry, which is very small compared to 12,143 in the total number of firms selected. In addition, in the case of real estate firms, they do not belong to digitally transformed firms and are excluded from the sample for comparison. Thus, including them is not a problem at all in identifying the financial performance of digitally transformed firms and has no significant impact on the overall sample. However, this was excluded to obtain robustness to the results of our study.

3.1.2. A Firm That is a Settlement of Accounts in December and Has Not Changed Its Settlement Date

Most Korean firms adopt the settlement date of 31 December, and if the disclosure time of accounting information is different, it is easily affected by external economic conditions in addition to accounting information. Therefore, it was excluded from the sample firm to remove the timing effect due to the difference in evaluation time.

In fact, the Korean government allows firms to select the settlement date according to the Commercial Act. Currently, about 1.6% of firms listed on the KOSDAQ choose and use the settlement date other than the end of December. In particular, many of Korean financial institutions were choosing March and June, not the end of December, and some entertainment firms are also choosing the settlement date at the end of March or the end of June. If the timing of disclosure of accounting information is different, it is easily affected by external economic conditions in addition to accounting information, so it was excluded from the sample firm to remove the timing effect due to differences in evaluation timing.

In addition, in this study, the timing effect is controlled by using dummy variables, but if the settlement date is different from each other, the number of dummy variables required is too large, so sample firms whose settlement date is not December every year are excluded. In addition, firms whose settlement date was changed during the analysis target period were excluded from the sample for the same reason.

3.1.3. An Enterprise with Appropriate Audit Opinions during the Accounting Period to Be Analyzed

Firms that have been classified as non-appropriate firms during the accounting period to be analyzed are likely to report distorted financial data, and problems with the adequacy of data may arise. In addition, it was excluded from the sample firm because of the lack of continuity of financial data compared to normal corporate conditions in general.

In addition, in order to increase the homogeneity of all variables, firms whose audit opinions were not appropriate during the accounting period to be analyzed were excluded from the sample firms to increase the reliability of the data.

A total of 12,143 sample firms meet the above conditions, and the finally selected results are shown in Table 1. In addition, sample firms are evenly distributed in 41 industries, so there seems to be no bias in the sampling process.

3.2. Variable Selection and Analytics

In this study, Tobin's Q, a proxy for value creation used in studies such as Sim and Kim [24,27], was selected as the value creation variable, and a total of 10 changes in financial performance, two each representing profitability, stability, growth, activity, and productivity, were used in previous studies (e.g., [5,26]).

Table 1. Sampling Procedure.

Criteria	Sample Number	Total
Total Listed Firm on October 2022	1581 × 11	17,391
- An Accounting Review of Non-Qualified Opinion	(276 × 11)	(3036)
- A Closing Date of Non December	(26 × 11)	(286)
- Exclude financial and real estate business	(83 × 11)	(913)
- Data Error	(1013)	(1013)
Final Sample	12,143	12,143

Notes: Data source is from KISVALUE data of NICE (2022). During our research period, firms that added Internet transactions to the existing business scope were excluded from the empirical analysis.

3.2.1. Value Creation (Tobin's Q)

In this study, Tobin Q is used as a proxy variable for value creation. Tobin Q is calculated by dividing the sum of the market value of equity capital and the market value of liabilities by the substitution cost of assets. The market value of equity is calculated by multiplying the number of common shares issued by the year-end closing price and the number of preferred shares issued by the year-end closing price, and the market value of the liability is calculated by subtracting the current asset from the current liability and the estimated market value of the fixed liability adjusted for maturity. However, in Korea, evaluation information related to the substitution cost of assets is not provided, and it is difficult to provide accurate substitution cost, so this study uses the ratio of market value to book value used in many Korean and foreign studies [25,27].

3.2.2. Profitability Ratio

- Net return on total assets

The net return on total assets was defined as net income/total assets as the ratio that measures how much profit the total capital invested in an entity ultimately generates.

- Net return on equity

The net return on equity capital was defined as net income/equity capital as the ratio of how much profit was obtained for KRW 1 of equity capital invested by the owner of the firm.

3.2.3. Stability Ratio

- Current ratio

The current ratio was defined as current assets/current liabilities as a measure of the short-term solvency of the sample firm as a representative stability ratio, and all previous foreign studies used this definition.

- Debt ratio

The debt ratio is a leverage ratio that is traditionally commonly used in practice and is defined as total debt/equity capital as a ratio representing the relationship between the equity capital of the sample firm and other capital based on the book value.

3.2.4. Growth Rate

- Total asset growth rate

The growth rate of total assets represents how much the entity's total assets increased from the end of the previous term regardless of the source of financing, and was defined as (current total assets – total assets)/total assets.

- Sales growth rate

The sales growth rate represents the external growth of the firm and was defined as (current sales-electric sales)/electric sales.

3.2.5. Activity Ratio

- Total asset turnover

The total asset turnover is the ratio that measures the overall efficiency of the asset and is defined as sales/total assets.

- Capital turnover

The turnover rate of equity capital was defined as sales/equity capital as the ratio that removed the influence of financial assets unrelated to business activities from the turnover rate of total assets.

3.2.6. Productivity Ratio

- Percentage increase in sales per employee

The sales growth rate per employee represents how much sales per employee increased, and was defined as the sales growth rate/number of employees.

- Capital intensity chart

Capital intensity refers to the ratio of how much total capital was generated per employee, and was defined as total capital/number of employees.

3.2.7. Analytical Techniques

The sample firms selected for empirical research were analyzed as follows.

First, a basic statistical analysis was conducted to verify the relationship between changes in financial performance and value creation of the digitally transformed form, and then a correlation analysis was conducted. Second, in order to clarify the relationship between changes in financial performance and value creation, we pooled the entire sample and examined the profitability, stability, growth, activity, and productivity of the digitally transformed group that we looked through it. Third, multivariate analysis was conducted to verify what variables affect value creation and whether there is a difference between digitally transformed form and nondigitally transformed form, and this statistical analysis used the SPSS 22.0 statistical package.

4. Analysis and Results

4.1. Descriptive Analysis

Table 2 is the descriptive statistics for 12,143 total firms that meet the sample selection conditions of this study for 11 years from 2011 to 2021. First, the average of the digitalization dummy variables was 0.146, indicating that 14.6% of the total firms were engaged in digital transformation. Next, the average value creation was found to be 2.134, exceeding the book value. In addition, the average of the total asset net return and the net return on equity capital is 0.004 and 0.618, which are low but show positive values. The average flow rate is 3.605, which exceeds 300%, showing a very high flow rate. On the other hand, the debt ratio is relatively low at 84.1%. The average of the total asset growth rate and sales growth rate are also positive at 0.170 and 0.246, respectively. In addition, the total asset turnover and equity turnover are 7.321 and 1.549, respectively. The growth rate of sales per employee is also 0.003, showing a very small value but positive value. As shown in the above results, despite the difficult financial crisis such as COVID-19, the overall figure is not very good, but it shows a positive value.

Table 3 is the result of a correlation analysis by pooling the entire sample for 11 years from 2011 to 2021 to verify the relationship between the changes in financial performance and value creation of the digitally transformed form.

As shown in the table, the digitalization status dummy variable is insignificant from the value creation variable, but shows a positive correlation. The profitability variable, the net return on total assets and the net return on equity, shows a significant positive (+) correlation at the 1% significance level. In addition, the flow ratio, total asset growth

rate, and capital intensity variables also show a significant positive relationship at the 1% significance level.

Table 2. Result for descriptive statistics.

Sample Number = 12,143	Digitalization Dummy	y1	x11	x12	x21	x22
Mean	0.146	2.134	0.004	0.618	3.605	0.841
Median	0.000	1.476	0.028	0.634	1.830	0.568
Std. Deviation	0.353	3.322	0.183	0.264	14.703	2.657
Min	0.000	0.020	−5.034	−10.613	0.011	−160.751
Max	1.000	196.965	3.342	0.999	1335.731	91.616
	x31	x32	x41	x42	x51	x52
Mean	0.170	0.246	7.321	1.549	0.003	698,269,158.932
Median	0.067	0.053	1.456	1.093	0.000	334,511,527.174
Std. Deviation	0.606	3.022	323.723	3.344	0.045	1,762,420,535.854
Min	(0.885)	(0.999)	0.158	(212.140)	(0.103)	(1,162,933,206.897)
Max	22.499	169.054	35,334.956	126.068	2.374	43,460,151,000.000

Source: KISVALUE data of NICE (2022). Notes: 1. Digitalization Dummy: Digitalized Firm coded as 1, Undigitalized Firm as 0; Dummy; Y₁ = Tobin Q; X₁₁ = Net Income to Total Asset Ratio; X₁₂ = Net Income to Total Stockholders' Equity; X₂₁ = Current Ratio; X₂₂ = Debt Ratio; X₃₁ = Growth Rate of Total Assets; X₃₂ = Increase Rate of Sales; X₄₁ = Total Asset Turn Over Rate; X₄₂ = The Turn Over Rate of Net Worth; X₅₁ = Increase Rate of Sales by Employee; X₅₂ = Capital Intensity.

On the other hand, the dependent variable value creation showed a significant positive correlation at the 1% significance level with the equity capital net return, current ratio, total asset growth rate, total asset growth rate, and total asset turnover rate. On the other hand, the net return on total assets, the debt ratio, and the turnover rate of equity capital show a significant negative correlation at the 1% significance level.

In addition, the correlation coefficient value is higher than 0.6 in sales growth rate and liquidity ratio, equity capital turnover rate and sales growth rate, per employee sales growth rate, liquidity ratio, and total asset turnover rate. In general, when the correlation coefficient is 0.6 or more, the problem of multicollinearity may be serious. To solve this problem, in this study, conclusions were drawn using a regression equation by a model that removed or considered variables.

Table 3. Result for correlation coefficient analysis.

Sample Number = 12,143	Digitalization Dummy	y1	x11	x12	x21	x22	x31	x32	x41	x42	x51
y1	0.008 (0.399)										
x11	0.029 *** (0.001)	−0.142 *** (0.000)									
x12	0.036 *** (0.000)	0.062 *** (0.000)	0.340 *** (0.000)								
x21	0.032 *** (0.000)	0.036 *** (0.000)	0.011 (0.212)	0.160 *** (0.000)							
x22	−0.012 (0.181)	−0.033 *** (0.000)	−0.063 *** (0.000)	−0.197 *** (0.000)	−0.043 *** (0.000)						
x31	0.032 *** (0.000)	0.038 *** (0.000)	0.081 *** (0.000)	−0.023 ** (0.012)	0.048 *** (0.000)	−0.015 * (0.098)					
x32	−0.006 (0.491)	−0.004 (0.684)	0.006 (0.539)	−0.026 *** (0.004)	0.001 (0.917)	0.018 ** (0.045)	0.167 *** (0.000)				
x41	−0.004 (0.685)	0.021 ** (0.021)	−0.015 * (0.095)	0.010 (0.281)	0.046 *** (0.000)	−0.004 (0.682)	0.127 *** (0.000)	0.000 (0.984)			
x42	−0.011 (0.239)	−0.058 *** (0.000)	0.022 ** (0.014)	−0.187 *** (0.000)	−0.049 *** (0.000)	0.828 *** (0.000)	−0.018 * (0.052)	0.042 *** (0.000)	−0.009 (0.334)		
x51	−0.007 (0.459)	−0.001 (0.918)	−0.009 (0.317)	−0.019 ** (0.036)	0.000 (0.987)	0.015 (0.105)	0.136 *** (0.000)	0.861 *** (0.000)	−0.001 (0.885)	0.032 *** (0.000)	
x52	0.025 *** (0.005)	−0.014 (0.119)	0.045 *** (0.000)	0.168 *** (0.000)	0.340 *** (0.000)	−0.049 *** (0.000)	−0.011 (0.245)	−0.010 (0.269)	0.031 *** (0.001)	−0.073 *** (0.000)	0.002 (0.856)

Source: KISVALUE data of NICE (2022). Notes: 1. p: *** < 0.01, ** < 0.05 and * < 0.10; 2. The Explanation for the Remaining Variables is the as Table 2.

4.2. Differences between Digitally Transformed Firms and Undigitalized Firms

Table 4 is the result of analyzing the average difference between changes in financial performance and value creation between the digitally transformed firm group and the undigitalized firm group. First, we examined whether there is a difference in the average between the net return on total assets and the net return on equity capital, which represents profitability. As shown in Table 4, the gross asset net return of the digitally transformed firm group was 0.017, which was higher than the average of 0.002 of the undigitalized firm group, and the difference in the average was statistically significant at the 1% significance level.

In terms of net return on equity capital, the digitally transformed firm group was 0.641, showing a relatively stable value of 0.615 on average, and the difference in average was statistically significant at the 1% significance level. Therefore, these results are the result of adopting hypothesis 1-1 that there will be a difference in the average profitability between digitally transformed firm and undigitalized firms.

Next, the results of verifying whether there is a difference in the average between the digitally transformed firm group and the undigitalized firm group for the liquidity ratio and debt ratio indicating stability were examined. First, in the case of the flow ratio, the average of the digitally transformed firm group was 4.731 which was higher than the average of 3.412 of the undigitalized firm group, and the debt ratio was low, indicating a relatively stable value, but it was not statistically significant. Hypothesis 1-2 was therefore rejected.

In the case of the debt ratio, the digitally transformed firm's debt is low, but it does not show statistically significant results. As a result, in the case of the current ratio, the difference in the average stability between digitally transformed firms and undigitalized firms was statistically significant, while the debt ratio was not statistically significant.

Next, the results of verifying whether there is an average difference between the total asset growth rate and the sales growth rate indicating growth potential are as follows. First, in the case of the total asset growth rate, the average of the digitally transformed firm group was 0.217, and the average of the undigitalized firms was 0.162, which was statistically high, showing a significant difference at the 1% significance level.

On the other hand, the average sales growth rate was 0.200 in the digitally transformed firm group, which was lower than the average of 0.253 in the undigitalized firm group, but did not show statistically significant results. Therefore, in the case of growth potential, hypothesis 1-3 that there is a difference in the average of growth potential between digitally transformed firm and undigitalized firms could be partially adopted.

Next, the analysis results of the average difference between the total asset turnover rate and the equity capital turnover rate indicating activity are as follows. As shown in Table 4, the average of the total asset turnover was 4.438 in the digitally transformed firm group, while the average of the undigitalized firm group was 7.814, indicating that the total asset turnover of undigitalized firms was higher, but it was not statistically flexible. On the other hand, the turnover rate of equity capital was 1.463, which was lower than that of undigitalized firms with an average of 1.564, but the difference was not statistically significant.

In the case of activity, H1-4 was rejected that there was a difference in the average of activity between digitally transformed firm and undigitalized firms because both variables were not statistically significant.

Next, it was verified whether there is an average difference in sales growth rate per employee and capital intensity, which show productivity between digitally transformed firm and undigitalized firms.

The growth rate of sales per employee was 0.002 in the digitally transformed firm group, while the undigitalized firm group showed a higher average of 0.003, but it was not statistically significant. On the other hand, while the capital intensity of the undigitalized firm group was KRW 670 million, the capital intensity of digitally transformed firms was about KRW 800 million. In addition, the *t*-test results, which show the difference in the mean, also show a significant positive difference at the 10% level. Therefore, H1-5 was partially adopted.

Finally, as a result of verifying whether there is an average difference in value creation between the digitally transformed firm and the undigitalized firm group, the average value creation of the deictically transformed firm group was 2.195, which was higher than the average of 2.123 non-electronic commerce firms, but it was not statistically significant. Therefore, H1-6 was rejected.

Table 4. Results of difference between descriptive statistics and mean.

Classification			Sample Number	Mean	Standard Deviation	t Value (Significance)
Profitability	Net Income to Total Asset Ratio	Digitalized firms	1775	0.017	0.162	3.194 ***
		Undigitalized firms	10,368	0.002	0.187	(0.001)
	Net Income to Total Stockholders' Equity Current Ratio	Digitalized firms	1775	0.641	0.263	3.927 ***
		Undigitalized firms	10,368	0.615	0.264	(0.001)
Stability	Debt Ratio	Digitalized firms	1775	4.731	34.074	1.625
		Undigitalized firms	10,368	3.412	7.367	(0.104)
	Growth Rate of Total Assets	Digitalized firms	1775	0.855	2.691	−1.338
		Undigitalized firms	10,368	0.217	0.845	(0.181)
Growth	Increase Rate of Sales	Digitalized firms	1775	0.162	0.554	2.646 ***
		Undigitalized firms	10,368	0.162	0.554	(0.008)
Activity	Total Asset Turn Over Rate	Digitalized firms	1775	0.200	1.805	−0.689
		Undigitalized firms	10,368	0.253	3.184	(0.491)
	The Turn Over Rate of Net Worth	Digitalized firms	1775	4.438	29.488	−0.406
		Undigitalized firms	10,368	7.814	350.127	(0.685)
Productivity	Increase Rate of Sales by Employee	Digitalized firms	1775	1.463	2.630	−1.177
		Undigitalized firms	10,368	1.564	3.452	(0.239)
	Capital Intensity	Digitalized firms	1775	0.002	0.029	−0.740
		Undigitalized firms	10,368	0.003	0.047	(0.459)
Firm Value	Tobin Q	Digitalized firms	1775	805,629,836	3,178,825,611	1.640 *
		Undigitalized firms	10,368	679,889,027	1,380,753,201	(0.051)
			1775	2.195	2.187	1.158
			10,368	2.123	3.479	(0.247)

Source: KISVALUE data of NICE (2022). Notes: 1. p : *** < 0.01 and * < 0.10; 2. The Explanation for the Remaining Variables is the same as Table 2; 3. In our study, because the size of sample was 12,143, we assumed that the sample mean follows normality. In addition, the results of the Mann-Whitney test, a nonparametric test, were similar to those presented in our study.

4.3. Results of Multivariate Regression Analysis

Table 5 shows the results of multivariate regression analysis of the effects of changes in financial performance on value creation for the entire sample. Multicollinearity on the correlation between some variables in analysis of problems in the table in order to control the panel a all variables, including in the Empirical Analysis, and panel b some eliminating variables, the Verification and analysis. The analysis does not look backward from elimination and removal after a big difference.

First of all, panel a, the results of net income to total assets ratio is unexpectedly value creation to show significant well the relevance of (−) from 1 percent significance level. On the other hand, variable net income and current ratio and total assets of equity growth variable is a significant amount shows the relevance of (+) from 1 percent significance level. On the other hand, equity capital ratio and capital intensity indicate relevant significant negative (−) in the parameter is 1 percent significance level. These results are panel b also appeared equally.

Table 6 shows the results of multivariate regression analysis of examining the difference between two groups on the effects of changes in financial performance on value creation. Panel A and Panel B are the results of multivariate regression analysis for the digitally transformed form group, and Panel C and Panel D are the results of multivariate regression analysis for the undigitalized firm group.

Table 5. This is a table. Tables should be placed in the main text near to the first time they are cited.

Classification	Panel A (Sample Number = 12,143)		Panel B (Sample Number = 12,143)	
	Regression Variables	t Value (Significance)	Regression Variables	t Value (Significance)
Constant	1.227	14.333 *** (0.000)	1.122	13.984 *** (0.000)
X ₁₁ (Net Income to Total Asset Ratio)	−3.333	−19.077 *** (0.000)	−3.418	−19.813 *** (0.000)
X ₁₂ (Net Income to Total Stockholders' Equity)	1.540	12.412 *** (0.000)	1.621	13.329 *** (0.000)
X ₂₁ (Current Ratio)	0.006	2.824 *** (0.005)	0.006	2.807 *** (0.005)
X ₂₂ (Debt Ratio)	0.024	1.190 (0.234)		
X ₃₁ (Growth Rate of Total Assets)	0.290	5.772 *** (0.000)	0.295	5.903 *** (0.000)
X ₃₂ (Increase Rate of Sales)	−0.007	−0.376 (0.707)		
X ₄₁ (Total Asset Turn Over Rate)	0.000	1.106 (0.269)	0.000	1.103 (0.270)
X ₄₂ (The Turn Over Rate of Net Worth)	−0.047	−2.916 *** (0.004)		
X ₅₁ (Increase Rate of Sales by Employee)	−0.035	−0.027 (0.978)	−0.551	−0.825 (0.409)
X ₅₂ (Capital Intensity)	−7.151 × 10 ^{−11}	−3.972 *** (0.000)	−6.819 × 10 ^{−11}	−3.792 *** (0.000)
F-Value	50.001 (0.000) ***		69.460 (0.000) ***	
Modified R ²	0.039		0.038	

Source: KISVALUE Data of NICE (2022). Notes: 1. *p*: *** < 0.01; 2. The Explanation for the Remaining Variables is the as Table 2.

First, the variable representing the total asset return showed a significant negative relationship at the 1% significance level in both four models. These results are the same as the correlation analysis results. On the other hand, the net return on equity capital excluding liabilities consistently showed a significant positive relationship at the 1% significance level in all four models. These results indicate that the net return of firms with a high net equity capital ratio excluding debt has a positive effect on value creation.

Next, the debt ratio showed a negative relationship with value creation in the digitally transformed form group, but was not statistically significant. On the other hand, in the undigitalized firm group, the higher the debt ratio, the more positive the value creation was, and statistically, there was a difference between the two business groups, showing significant results at the 1% significance level.

The total asset growth rate variable showed a significant positive relationship at the 1% significance level in both business groups. On the other hand, the sales growth rate showed a positive relationship in both groups, but was not statistically significant.

Next, the activity variables are as follows. First, the total asset turnover rate had a positive effect on value creation in both groups, but was not statistically significant. In addition, the turnover rate of equity capital showed a positive relationship in the digitally transformed form group, but was not statistically significant. On the other hand, in the undigitalized firm group, a significant negative relationship was shown at the 1% significance level.

Finally, in the productivity variable, the sales growth rate per employee did not show statistically significant results. On the other hand, the capital intensity variable consistently showed a significant negative relationship at the 1% significance level in both groups.

Table 6. Results of Multivariate Regression Analysis II.

Classification	Digitally Transformed Firms (N of Cases = 1775)				Undigitalized Firms (N of Cases = 10,368)			
	Panel A		Panel B		Panel C		Panel D	
	Regression Variables	t Value (Sig.)	Regression Variables	t Value (Sig.)	Regression Variables	t Value (Sig.)	Regression Variables	t Value (Sig.)
Constant	1.533	9.926 *** (0.000)	1.525	9.885 *** (0.000)	1.218	12.599 *** (0.000)	1.118	12.316 *** (0.000)
X ₁₁	−1.657	−4.610 *** (0.000)	−1.654	−4.619 *** (0.000)	−3.516	−18.077 *** (0.000)	−3.625	−18.828 *** (0.000)
X ₁₂	1.148	5.307 *** (0.000)	1.153	5.335 *** (0.000)	1.406	9.689 *** (0.000)	1.471	10.326 *** (0.000)
X ₂₁	0.000	−0.163 (0.870)	−8.772 × 10 ^{−5}	−0.051 (0.959)	0.029	6.006 *** (0.000)	0.029	6.048 *** (0.000)
X ₂₂	−0.067	−2.299 ** (0.022)	−0.067	−2.323 ** (0.020)	0.061	2.548 ** (0.011)		
X ₃₁	0.222	3.254 *** (0.001)	0.212	3.150 *** (0.002)	0.313	5.005 *** (0.000)	0.316	5.073 *** (0.000)
X ₃₂	−0.088	−1.166 (0.244)			−0.003	−0.151 (0.880)		
X ₄₁	0.001	0.262 (0.793)			7.043 × 10 ^{−5}	0.729 (0.466)	7.184 × 10 ^{−5}	0.743 (0.458)
X ₄₂	0.011	0.418 (0.676)	0.011	0.405 (0.686)	−0.069	−3.697 *** (0.000)		
X ₅₁	2.706	0.571 (0.568)	−2.309	−1.138 (0.255)	0.049	0.035 (0.972)	−0.278	−0.388 (0.698)
X ₅₂	−6.103 × 10 ^{−11}	−2.344 ** (0.019)	−5.677 × 10 ^{−11}	−3.069 *** (0.002)	−6.683 × 10 ^{−11}	−2.695 *** (0.007)	−6.144 × 10 ^{−11}	−2.481 ** (0.013)
F-Value	6.181 (0.000) ***		7.554 (0.000) ***		48.973 (0.001) ***		67.749 (0.001) ***	
Modified R ²	0.028		0.029		0.044		0.043	

Source: KISVALUE Data of NICE (2022). Notes: 1. p : *** < 0.01 and ** < 0.05; 2. The Explanation for the Remaining Variables is the as Table 2; 3. The problem of multicollinearity occurred between some variables of Panel A. Accordingly, empirical analysis was conducted by removing some variables from Panel B.

5. Discussion

5.1. Summary of Research Results

The purpose of our study was to examine the difference in financial performance and value creation through comparison between digitally transformed and undigitalized firms in Korea, and to verify the difference between value creation and changes in financial performance variables. To verify this, we examined the difference between changes in financial performance and value creation in 1775 firms and 10,368 undigitalized firms among firms registered in the KOSDAQ market for 11 years from 2011 to 2022, when international accounting standards were mandatory in Korea.

5.2. Research Implications

Through this study, several results were found as follows. First, as a result of conducting a t -test to verify whether there is a difference in changes in financial performance between digitally transformed firms and undigitalized firms, the average of digitally transformed firm groups was consistently high in the case of profitability indicators, and statistically significant differences were also found. These results are seen as a result of reflecting the situation of COVID-19. Next, in the case of the stability index, the digitally transformed firm group had a high flow ratio and the debt ratio was low, but it was not statistically significant. In the case of growth indicators, the average of the digitally transformed firm group was significantly higher at the 1% significance level. On the other hand, the sales growth rate did not show a significant difference between groups. In addition, in the case of activity indicators, the average of the undigitalized firm group was high in both the equity capital turnover rate and the total asset turnover rate, but there was no statistically significant difference. In the productivity index, the average of the undigitalized firm group was high in sales growth per employee, but it was not statistically

significant. On the other hand, in terms of capital intensity, the average of the digitally transformed firm group was high, and there was a statistically significant difference.

Second, in order to analyze the effect of changes in financial performance on value creation, multivariate regression analysis was performed by dividing the entire sample into digitally transformed firms and undigitalized firms. First, as a result of regression analysis on the entire sample, the total asset net return variable showed a significant negative relationship with the value creation variable, contrary to expectations. On the other hand, the net return on equity, the current ratio variable, and the total asset growth rate variable showed a significant positive relationship. On the other hand, the capital turnover rate and capital intensity variables showed a significant negative relationship. As a result of the analysis by classification between groups, first, the total asset return variable showed a significant negative relationship in all four models of the two groups. These results are the same as the result of correlation analysis. On the other hand, the net return on equity capital excluding liabilities consistently showed a significant positive relationship in all four models. These results indicate that the net return of firms with a high net equity capital ratio excluding debt has a positive effect on value creation.

Next, the debt ratio showed a negative relationship with value creation in the digitally transformed firm group, but was not statistically significant. On the other hand, in the undigitalized firm group, the higher the debt ratio, the more positive the value creation was, and statistically significant results were shown, showing a difference between the two business groups. This result seems to be a relatively low need for capital procurement in the sense that many facility assets are not required due to the nature of the digitally transformed business group, and undigitalized firms are increasing their corporate value through external capital procurement.

The total asset growth rate variable showed a significant positive relationship in both business groups. On the other hand, the sales growth rate showed a positive relationship in both groups, but was not statistically significant. Next, looking at the activity variable, the total asset turnover had a positive effect on value creation in both groups, but was not statistically significant. In addition, the turnover rate of equity capital showed a positive relationship in the digitally transformed firm group, but was insignificant. On the other hand, the undigitalized firm group showed a significant negative relationship at the 1% significance level.

Finally, in the productivity variable, the sales growth rate per employee did not show statistically significant results. On the other hand, the capital intensity variable consistently showed a significant negative relationship at the 1% significance level in both groups.

In the above results, we confirmed that the digitally transformed firm showed differential results in changes in financial performance compared to undigitalized firms, and overall, it was confirmed that profitability, stability, and growth were excellent, but vulnerable to undigitalized firms in some areas of activity and productivity. In addition, we confirmed that the financial performance variables affecting the value creation showed differences in the current ratio and the total asset turnover rate, and other variables showed the same results.

As a result of our study, we first confirmed that despite excessive competition due to the explosive increase in digitally transformed firms due to the prolonged COVID-19, the profitability of digitally transformed firms in Korea was superior to that of undigitalized firms. These results indicated that the digitally transformed firms could have stably generated profits despite the external environmental impact, such as the COVID-19 pandemic, and that the possibility of growth in these firms may be high in the future. In addition, growth is superior to undigitalized firms, and this situation is expected to continue for the time being. Second, in relation to corporate value, the lower the debt ratio, the higher the firm value in the undigitalized firms, but the higher the debt ratio, the weaker the debt leverage effect in the digitally transformed firms.

5.3. Research Limitations and Future Study Directions

In our study, in order to increase the difficulty of sampling and the transparency of financial data, only KOSDAQ-listed firms among digitally transformed firms were studied. In future studies, it is believed that more robust results can be produced if research is conducted including the digitally transformed form of the KOSPI market by expanding this. In addition, we did not compare firms that were always non-digital to those that were always digital. Further research may investigate the differences of these two groups with respect to firm value creation.

In addition, our study suffers from the consistency of the results. For this reason, we judged that the abnormal situation of COVID-19 pandemic greatly influenced our research results. In the future, if this situation ends and the results of the study are derived except for this period, we could judge that more robust research results would be presented.

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