

Do Intangible Assets Still Matter for Firm Performance? Evidence from Korean Firm-Level Data*

Nyeong Seon Son

As digital transformation accelerates, intangible assets have become increasingly important. In Korea, however, their accumulation has decelerated since the mid-2010s. This study examines whether this trend reflects a weakening link between intangible investment and firm growth. Using firm-level data, we find that even during the period of decelerated accumulation, intangible investment continues to improve sales and labor productivity and increase firms' participation in export markets. These results suggest that the deceleration in intangible asset accumulation in Korea does not stem from diminishing returns to intangible investment.

Keywords: Intangible Assets, Firm Growth, Digital Transformation

JEL Classification: E22, D24, O47

Nyeong Seon Son, Research Fellow, Department of Digital Policy Research, Korea Information Society Development Institute, 18, Jeongtong-ro, Deoksaneup, Jincheon-gun, Chungcheongbuk-do, 27872, Republic of Korea. (Tel): +82-43-531-4180.

E-mail: nsson@kisdi.re.kr.

The author would like to thank the editor and an anonymous referee for their helpful comments and suggestions, which significantly improved the paper.

[**Seoul Journal of Economics** 2026, Vol. 39, No. 3]

DOI: 10.22904/sje.2026.39.3.001

* This paper expands and complements the content of Chapter 4, "The Status of Korean Firms' Intangible Assets and the Impact of Intangible Assets on Firm Performance," from Investment in Intangible Assets and Economic Growth: Global Trends and Policy Implications (KIEP Policy Analyses 24-07). All results have been reviewed and approved to ensure that no confidential information is disclosed.

I. Introduction

As digital transformation progresses, firms are reshaping their growth strategies. Although the limitations of input-driven growth have long been acknowledged, the spread of digitalization has made the shift toward a new growth paradigm an urgent, unavoidable task rather than a discretionary choice. In particular, advances in artificial intelligence have transformed digitalization from an abstract notion into a concrete operating environment for firms. With technological progress and innovation becoming indispensable for corporate growth and survival, the importance of intangible assets has increased as a result.

Intangible assets include research and development, knowledge, and brand capital, all of which are core inputs in the development of new products and services. They also play a central role in enhancing firm productivity and securing competitive advantage through technological innovation and the accumulation of proprietary capabilities. These characteristics are further accentuated by the acceleration of digital transformation, as the digital environment itself is tightly intertwined with various components of intangible capital.

Numerous studies have documented the significant contribution of intangible assets to economic development (Corrado et al., 2018; Haskel and Westlake, 2017). Similar patterns are observed at the macroeconomic and firm levels, where the accumulation of various types of intangible assets has been found to exert a positive influence on firm value and financial performance.¹ Moreover, from the perspective of global value chains, a growing body of evidence highlights the critical role that intangible assets play in firms' participation in global value chains and in expanding the value-added they capture (OECD, 2013; Jona-Lasinio et al., 2016; Dedrick et al., 2010).

As the economic importance of intangible assets has grown, a broad shift toward intangible-intensive economic structures has been documented across major economies (Corrado et al., 2018, Haskel and Westlake, 2017). Similarly, expanding awareness of digital transformation in Korea has increased interest in the role of intangible assets.

¹ These findings have been documented in various countries, including the United States (Hulten and Hao, 2008), Japan (Miyagawa and Kim, 2008), the United Kingdom (Marrano and Haskel, 2006), and Finland (Jalava et al., 2007).

Reflecting this interest, several studies examine how intangible assets relate to firm performance in Korea. Park et al. (2007) analyze the impact of intangible assets on corporate competitiveness from the perspective of industry excess profits. Yi (2008) documents an increasing contribution of intangible capital to growth and underscores the need for growth strategies based on investment in intangible assets. Choi (2019) investigates the effect of intangible assets on firm productivity and confirms a positive relationship between the two. At the industry level, Son et al. (2019) show that more active investment in intangible assets is associated with greater participation in global value chains. Kwon et al. (2020) provide evidence that intangible assets positively affect firm value in the KOSDAQ market, while Chung (2021) finds that investment in intangible assets has a positive effect on firms' sales growth. Other studies have focused on the effects of specific components of intangible assets. Sung et al. (2011) verify that e-business systems improve firm performance, and Mun et al. (2014) show that internet use leads to different outcomes in firms' productivity and sales.² Overall, these studies provide evidence that intangible assets contribute positively to firm performance in the Korean context.

Despite this consistent evidence of positive effects, firm-level data from Korean manufacturing and service sectors reveal that intangible asset accumulation has decelerated. According to data from the Survey of Business Activities for 2006–2023,³ the absolute level of intangible assets has continued to increase (Figure 1). However, since the mid-2010s, growth in both total and intangible assets has slowed, with the slowdown being more pronounced for intangible assets.⁴ Consequently,

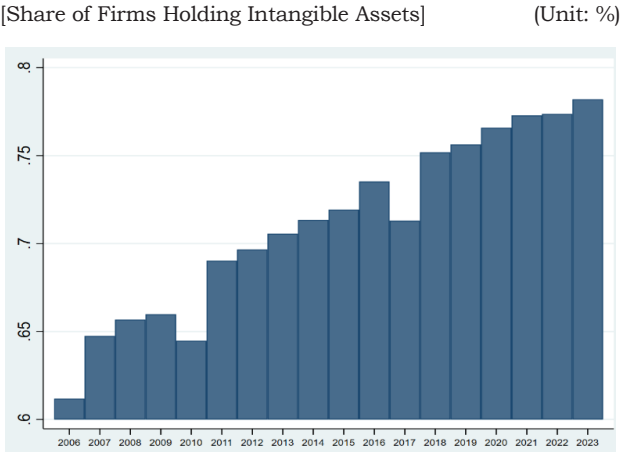
² Investment in research and development (R&D), a component of intangible assets, has been extensively examined in prior studies (Lee et al., 2009; Rhee and Pyo, 2015; Son et al., 2015). The Survey of Business Activities used in this study provides information on firms' intangible assets and R&D expenditures. In our analysis, we use the book value of intangible assets as a key variable to assess their overall impact on firm performance, with a focus on the total stock of firms' intangible assets.

³ The statistics exclude observations with measurement errors in key variables, such as total and intangible assets. In addition, assets are deflated using the Producer Price Index, and observations for which the relevant price index is unavailable are dropped. These excluded observations account for less than 1% of the full sample.

⁴ Among the firms included in Figure 1, the mean year-on-year growth rate of

the ratio of intangible to total assets has trended downward, raising the question of whether the well-documented benefits of intangible assets continue to hold under a prolonged slowdown in their accumulation.^{5,6,7}

However, existing firm-level evidence on the performance effects of



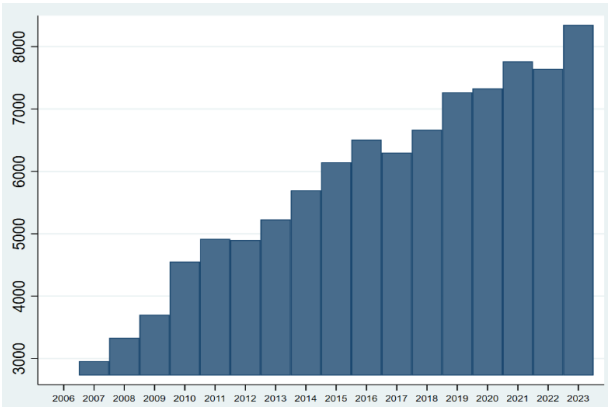
total assets decreased from 8.7% over the period 2006–2014 to 4.8% over 2015–2023, while the mean year-on-year growth rate of intangible assets decreased more sharply, from 12.1% to 5.9% over the same subperiods.

⁵ The Survey of Business Activities covers firms with paid-in capital of at least KRW 300 million and 50 or more employees. Therefore, the statistics used in this study should be interpreted as trends among medium-sized and large firms rather than as a comprehensive measure of all Korean firms. In addition, the intangible asset variable follows accounting-based recognition criteria and therefore does not fully correspond to the broader concept of intangible capital used in international statistics, such as the intangible investment measures of the WIPO. Direct comparison with such statistics is limited. Nevertheless, because the survey includes major corporations that account for a substantial share of corporate investment, it provides reliable evidence on the evolution of accounting-recognized intangible assets among economically significant Korean firms.

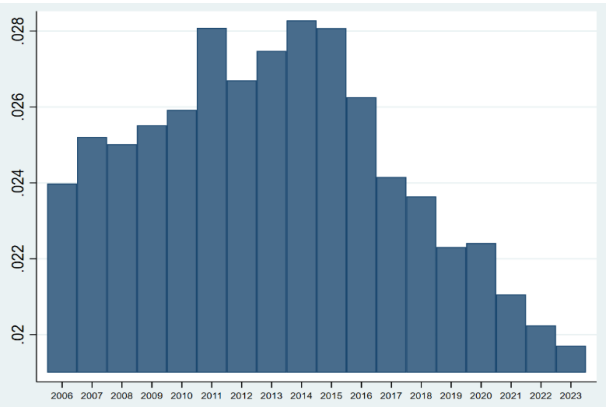
⁶ Agriculture, forestry and fishing, financial and insurance activities, and human health and social work activities are excluded from the analysis.

⁷ As total assets in the Survey of Business Activities include not only tangible and intangible assets but also cash and cash equivalents, inventories, and other assets, we additionally compare firms’ tangible and intangible assets alone to obtain a more accurate picture. This comparison reveals a similar pattern, and the results are reported in Figure A1 in the Appendix.

[Amount of Intangible Assets] (Unit: million KRW)



[Ratio of Intangible Assets to Total Assets] (Unit: %)



Note: The share of firms holding intangible assets denotes the proportion of sample firms in each year that report positive intangible assets. The amount of intangible assets refers to the average stock of intangible assets held by firms, and the ratio of intangible assets to total assets represents the average share of intangible assets in firms' total assets. Statistics are computed based on firms in manufacturing and service sectors with non-missing values for key variables used in the analysis, such as firm age and total assets.

FIGURE 1
TREND IN INTANGIBLE ASSET HOLDINGS AMONG KOREAN FIRMS

intangible assets is largely confined to periods before 2020. Since the deceleration in intangible asset accumulation became discernible only around the mid-2010s, studies based on pre-2020 data provide limited evidence on the longer-term implications of this shift—a window too narrow to assess whether the slowdown has altered the relationship between intangible assets and firm performance. By extending the analysis through 2023, this study examines whether such a relationship remains robust during a period in which the deceleration in intangible asset accumulation has persisted.

Building on this background, this study investigates the relationship between firms' intangible assets and performance using data from the Survey of Business Activities provided by the Ministry of Data and Statistics. Rather than explaining the causes of the deceleration, the study asks: given that intangible asset accumulation has decelerated, do intangible assets remain positively associated with firm performance? Answering this question is a necessary step toward understanding the implications of the observed trend.

This study differs from the existing literature in three main respects. First, it examines the impact of intangible assets on a broad set of performance indicators, including sales, productivity, and export status. While prior studies have largely focused on outcomes such as sales growth or firm value, this study also considers firms' international activities. While intangible assets have been found to foster participation in global value chains (Jona-Lasinio et al., 2016; Son et al., 2019), evidence from Korean firm-level data remains scarce. Second, by estimating the relationship over the full 2006–2023 period and separately for the pre- and post-2015 periods, this study examines whether the association between intangible assets and firm growth changed following the slowdown in intangible asset accumulation. Third, leveraging the panel nature of the data, the analysis considers short-term one-year and medium-term three-year growth rates to examine whether the association between intangible assets and firm performance differs across time horizons.

II. Data and Variables

To analyze the current state of Korean firms' intangible asset holdings and their impact on firm performance, this study draws on the Survey of Business Activities conducted by the Ministry of Data and

Statistics. The survey has been administered annually since 2006 and covers firms in all industries with paid-in capital of at least KRW 300 million and 50 or more employees. It contains detailed information on firms' financial structure, employment, sales, and management-related characteristics. In particular, it provides data on firms' asset holdings, including intangible assets, as well as their overseas activities, such as export values, making it well suited to the objectives of the study. The sample period spans 2006–2023.⁸

To examine the relationship between firm performance and intangible assets using this panel dataset, this study adopts an autoregressive dynamic panel model that draws on the existing literature on firm growth (Canarella and Miller, 2018; Chung, 2021). The baseline specification is given by the following equation:

$$gr_{i,j,\Delta t} = \alpha + \rho gr_{i,j,\Delta t-1} + \beta shareofintan_{i,j,t} + \gamma X_{i,j,t} + \mu_j + \theta_t + \delta_i + \varepsilon_{i,j,t} \quad (1)$$

i , j , and t denote firms, industries, and years, respectively. The dependent variable $gr_{i,j,\Delta t}$ represents the growth rate of a given firm performance indicator. For performance measures, the analysis uses sales and labor productivity and constructs one-year and three-year growth rates. Labor productivity is defined as sales divided by employment, and all growth rates are computed as log differences. The one-year and three-year horizons allow us to compare the effects of intangible asset holdings from short-term and medium-term perspectives. $gr_{i,j,\Delta t-1}$ denotes the lagged growth rate and is included to control for the persistence of firm growth.

The variable $shareofintan_{i,j,t}$ measures the ratio of intangible assets to total assets for firm i in industry j at time t . Given that the absolute level of intangible assets held by Korean firms has been increasing while their relative share in total assets has decelerated, focusing on this ratio provides a more appropriate lens through which to assess how the structure of firms' assets affects growth. The vector $X_{i,j,t}$ contains control variables such as total assets, employment, debt ratio,

⁸ In the Survey of Business Activities, intangible assets are reported as a stock variable based on values drawn from the administrative data submitted by each firm and thus correspond to accounting intangibles. Accounting intangibles include items such as development costs and goodwill (Choi, 2019).

and firm age.⁹ Total assets and employment proxy for firm size, while debt ratio and age are standard controls in the empirical analyses of firm growth (Evans, 1987; Lang et al., 1996). Debt ratio is computed as the ratio of total liabilities to total assets. Total assets, intangible assets, and sales are deflated to the two-digit industry level using the Producer Price Index from the Bank of Korea, and the control variables enter the regression in logarithms. The regressions also include two-digit industry fixed effects (μ_j) and year fixed effects (θ_t), and the coefficients are estimated using a fixed-effects model.

In addition to the preceding analysis, this study examines whether intangible assets influence firms' export activities by estimating a probit model for the export decision. Export behavior is incorporated into the analysis in light of evidence that intangible assets affect participation in global value chains and because exporting constitutes a key channel for firm growth in Korea. The model is specified as follows:

$$dumexp_{i,j,t+\delta} = \alpha + \beta shareofintan_{i,j,t} + \gamma X_{i,j,t} + \mu_j + \theta_t + \varepsilon_{i,j,t} \quad (2)$$

The variable $dumexp_{i,j,t+\delta}$ indicates whether firm i engages in export activities at time $t + \delta$. It takes the value of 1 if the firm records positive export revenues, and 0 otherwise. In this study, exporting is defined as having a strictly positive amount of merchandise exports. A limitation of the data is that export values in the Survey of Business Activities are based on customs trade statistics, which do not capture exports of services. Consequently, the analysis of export activity should be interpreted primarily in the context of manufacturing firms, for which goods exports constitute the dominant component of international sales.

III. Empirical Results

Table 1 reports summary statistics for the firms included in the analysis. Given that the growth regressions are estimated using one-year and three-year horizons, the descriptive statistics are presented separately for each regression sample.¹⁰

⁹ These are standard firm-level controls used to account for firm characteristics in empirical analyses (Chung, 2021; Chun et al., 2021).

¹⁰ In constructing the regression sample, firms in the top 1% of the growth-rate

TABLE 1
DESCRIPTIVE STATISTICS

Panel A. 1-Year Horizon

	Obs	Mean	Standard deviation
Dependent variables			
1-year sales growth	146,328	0.020	0.231
1-year labor productivity growth	146,328	0.036	0.308
Export status 1-year ahead	146,328	0.505	0.500
Explanatory variables			
Share of intangible assets in total assets	146,328	0.022	0.069
log(total asset)	146,328	10.509	1.500
log(emp)	146,328	4.968	1.027
log(debt ratio)	146,328	-0.854	0.731
log(age)	146,328	2.981	0.590

Panel B. 3-Year Horizon

	Obs	Mean	Standard deviation
Dependent variables			
3-year sales growth	113,792	0.082	0.389
3-year labor productivity growth	113,792	0.077	0.402
Export status 3-year ahead	113,792	0.526	0.499
Explanatory variables			
Share of intangible assets in total assets	113,792	0.022	0.067
log(total asset)	113,792	10.535	1.491
log(emp)	113,792	5.026	1.008
log(debt ratio)	113,792	-0.877	0.714
log(age)	113,792	2.975	0.588

Notes: This table reports summary statistics for the firms included in the regressions using the 2006–2023 waves of the Survey of Business Activities. The dependent variables are the growth rates between t and $t + 1$ and between t and $t + 3$, respectively. Export status indicates whether a firm is engaged in export activities at $t + 1$ or $t + 3$.

For the one-year growth rates, average sales growth is 2.0 percent, while average labor productivity growth is 3.6 percent. One year after the baseline period, 50.5 percent of firms in the sample are active in export markets. Over the three-year horizon, average growth in sales and labor productivity reaches 8.2 and 7.7 percent, respectively, and the share of firms participating in export markets three years after the baseline is 52.6 percent.

Turning to the explanatory variables in the one-year sample, the average ratio of intangible assets to total assets is 2.2 percent. The mean log total assets and log employment are 10.509 and 4.968, corresponding to approximately KRW 36.6 billion in total assets and 144 employees when exponentiated. The mean log debt ratio and log firm age are -0.854 and 2.981, implying an average debt ratio of 42.6 percent and an average firm age of 19.7 years. The relatively high average age reflects the fact that the survey covers larger, more established firms. The descriptive statistics for the three-year sample are broadly similar, but firms are somewhat larger on average, which is consistent with the higher survival probability of larger firms.¹¹

Tables 2 and 3 report the fixed-effects regression results for the growth rates of sales and labor productivity, respectively. The estimates in Columns (1) and (2), which use one-year growth rates as the dependent variables, show that a higher ratio of intangible assets to total assets within a firm is associated with faster growth in both sales and labor productivity. The lagged growth term enters with a negative coefficient, indicating mean reversion in firm growth. Total assets also exhibit a negative coefficient, suggesting that larger firms have more difficulty sustaining high growth rates.

Similar to total assets, employment has a negative coefficient in the sales growth regression but a positive coefficient in the labor productivity regression. Given that labor productivity is defined as sales per employee, this may indicate the tendency of larger firms to experience lower employment growth relative to sales growth, so weaker growth in the denominator (employment) contributes to higher growth

distribution are excluded because their high growth rates may reflect temporary shocks and unduly influence the estimation results.

¹¹ In the three-year analysis sample, inclusion of a firm implies that it has operated continuously for three years from the baseline year t , that is, it is a surviving firm over that period.

TABLE 2
REGRESSION RESULTS: SALES GROWTH

	1-year	1-year	3-year	3-year
Share of intangible assets	0.128*** (0.025)	0.132*** (0.025)	0.180*** (0.060)	0.248*** (0.060)
Growth _{t-1}	-0.069*** (0.004)	-0.064*** (0.004)	-0.286*** (0.006)	-0.244*** (0.006)
log(total asset)		-0.050*** (0.003)		-0.233*** (0.007)
log(emp)		-0.024*** (0.003)		-0.153*** (0.007)
log(debt ratio)		0.024*** (0.002)		0.001 (0.005)
log(age)		-0.023*** (0.004)		-0.019** (0.007)
Constant	-0.074*** (0.020)	0.687*** (0.037)	-0.078 (0.048)	3.318*** (0.087)
R-sq	0.039	0.048	0.087	0.156
Obs	146,328	146,328	113,792	113,792

Note: The dependent variables are defined as the growth rates between $t + 3$ and t and between $t + 1$ and t , while the explanatory variables are measured at time t . The regressions include year fixed effects and two-digit industry fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Figures in parentheses denote standard errors clustered at the firm level.

in labor productivity. The debt ratio enters positively, implying that growth strategies financed through higher leverage can have favorable effects on short-run firm expansion. Firm age has a negative coefficient, confirming that younger firms tend to grow faster than older firms, consistent with the literature on firm growth.

The three-year growth results are broadly similar to the one-year findings. The ratio of intangible assets to total assets exerts a positive and statistically significant effect on firm growth, and the coefficients on the other explanatory variables display patterns that closely resemble those observed in the one-year regressions.¹²

¹² As a robustness check, we estimated system GMM specifications for sales

TABLE 3
REGRESSION RESULTS: LABOR PRODUCTIVITY GROWTH

	1-year	1-year	3-year	3-year
Share of intangible assets	0.190*** (0.030)	0.195*** (0.031)	0.359*** (0.056)	0.379*** (0.054)
Growth _{t-1}	-0.278*** (0.003)	-0.200*** (0.003)	-0.418*** (0.004)	-0.292*** (0.005)
log(total asset)		-0.142*** (0.004)		-0.294*** (0.007)
log(emp)		0.308*** (0.006)		0.461*** (0.009)
log(debt ratio)		0.029*** (0.003)		0.012** (0.005)
log(age)		-0.016*** (0.005)		-0.008 (0.007)
Constant	-0.026 (0.028)	0.013 (0.048)	0.085* (0.048)	0.968*** (0.088)
R-sq	0.094	0.159	0.130	0.216
Obs	146,328	146,328	113,792	113,792

Note: The dependent variables are defined as the growth rates between $t + 3$ and t and between $t + 1$ and , while the explanatory variables are measured at time t . The regressions include year fixed effects and two-digit industry fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Figures in parentheses denote standard errors clustered at the firm level.

Table 4 presents the regression results for firms’ export participation. Similar to the growth rate regressions, the share of intangible assets is statistically significant in the one-year and three-year specifications, indicating that firms with a higher ratio of intangible assets to total assets are more likely to engage in export activities in subsequent periods. Total assets, employment, and firm age all enter with positive coefficients, implying that larger and more established firms have a higher probability of entering or remaining in export markets. Contrary

growth and labor productivity growth using the full sample period. The results are consistent with the main findings, confirming a positive relationship between intangible assets and firm performance. (See Table A1 in the Appendix.)

TABLE 4
REGRESSION RESULTS: EXPORT STATUS

	1-year	1-year	3-year	3-year
Share of intangible assets	0.079*** (0.023)	0.147*** (0.026)	0.056** (0.026)	0.100*** (0.031)
log(total asset)		0.118*** (0.002)		0.120*** (0.002)
log(emp)		0.018*** (0.002)		0.020*** (0.003)
log(debt ratio)		-0.014*** (0.002)		-0.017*** (0.003)
log(age)		0.022*** (0.003)		0.014*** (0.003)
R-sq	0.307	0.362	0.315	0.369
Obs	146,328	146,328	113,792	113,792

Note: The dependent variables are export status at $t + 3$ and $t + 1$. The explanatory variables are measured at time t . The regressions include year fixed effects and two-digit industry fixed effects. Reported coefficients correspond to marginal effects from probit estimations. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Figures in parentheses denote standard errors clustered at the firm level.

to the growth regressions, the debt ratio has a negative coefficient, suggesting that short-term leverage-based financing strategies do not play a major role in facilitating export participation.

These results confirm that firms' investment in intangible assets continues to exert a positive influence on growth and export activity in Korea. However, as shown in Figure 1, the ratio of intangible assets to total assets increased steadily until around 2014 but started to decline thereafter. If this pattern were tied to diminishing returns from intangible-based growth strategies, one might expect the growth effects of intangible assets to weaken or disappear in the post-2014 period. To examine this possibility, this study splits the sample into two subperiods: 2006–2014 (earlier period) and 2015–2023 (later period). The regressions then are re-estimated separately for each sub-sample.

Table 5 reports the estimation results for 2006–2014, while Table 6 presents the results for 2015–2023. Across both subperiods, the share of intangible assets in total assets remains positively and

TABLE 5
REGRESSION RESULTS: EARLIER PERIOD

	1-year sales growth	3-year sales growth	1-year labor productivity growth	3-year labor productivity growth	1-year export status	3-year export status
Share of intangible assets	0.210*** (0.047)	0.320*** (0.087)	0.245*** (0.062)	0.492*** (0.087)	0.236*** (0.036)	0.127*** (0.041)
Growth _{t-1}	-0.111*** (0.006)	-0.273*** (0.007)	-0.215*** (0.005)	-0.273*** (0.006)		
log (total asset)	-0.084*** (0.006)	-0.312*** (0.011)	-0.204*** (0.008)	-0.345*** (0.011)	0.099*** (0.003)	0.108*** (0.003)
log (emp)	-0.028*** (0.005)	-0.211*** (0.010)	0.463*** (0.012)	0.545*** (0.014)	0.019*** (0.004)	0.018*** (0.004)
log (debt ratio)	0.043*** (0.005)	0.029*** (0.008)	0.049*** (0.006)	0.033*** (0.008)	-0.019*** (0.004)	-0.018*** (0.004)
log(age)	-0.017*** (0.006)	-0.005 (0.010)	-0.018** (0.008)	0.004 (0.010)	0.031*** (0.004)	0.017*** (0.004)
Constant	1.035*** (0.075)	4.286*** (0.135)	-0.225** (0.100)	0.759*** (0.134)		
R-sq	0.084	0.202	0.227	0.245	0.299	0.327
Obs	65,381	59,581	65,381	59,581	65,283	59,581

Note: The results are based on the sample for the period 2006–2014. The number of observations for the one-year export status regressions decreases because, in certain industries, the export dummy takes the same value for all firms; thus, those industries are dropped from the probit estimation. The regressions include year fixed effects and two-digit industry fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Figures in parentheses denote standard errors clustered at the firm level.

significantly associated with firm growth, indicating that the growth-enhancing effects of intangible assets persist over time. Moreover, for most specifications, the estimated coefficients for the later period are larger than those for the earlier period, suggesting that the impact of intangible assets on growth has strengthened in recent years. By contrast, in the later period, the effect of intangible assets on export participation appears to be limited. Given that export values

TABLE 6
REGRESSION RESULTS: LATER PERIOD

	1-year sales growth	3-year sales growth	1-year labor productivity growth	3-year labor productivity growth	1-year export status	3-year export status
Share of intangible assets	0.219*** (0.043)	0.324*** (0.096)	0.303*** (0.054)	0.451*** (0.093)	0.017 (0.037)	0.052 (0.045)
Growth _{<i>t</i>-1}	-0.105*** (0.006)	-0.414*** (0.009)	-0.179*** (0.005)	-0.342*** (0.008)		
log (total asset)	-0.065*** (0.005)	-0.269*** (0.013)	-0.175*** (0.007)	-0.342*** (0.014)	0.140*** (0.003)	0.138*** (0.003)
log(emp)	-0.054*** (0.005)	-0.162*** (0.010)	0.419*** (0.010)	0.594*** (0.015)	0.017*** (0.003)	0.019*** (0.004)
log (debt ratio)	0.030*** (0.004)	-0.010 (0.008)	0.036*** (0.005)	-0.002 (0.009)	-0.004 (0.003)	-0.011*** (0.004)
log(age)	-0.028*** (0.007)	-0.023** (0.009)	-0.024*** (0.008)	-0.030*** (0.010)	0.019*** (0.004)	0.014*** (0.005)
Constant	1.031*** (0.071)	3.848*** (0.152)	-0.168* (0.088)	0.965*** (0.171)		
R-sq	0.049	0.169	0.183	0.281	0.418	0.420
Obs	80,947	54,211	80,947	54,211	80,947	54,211

Note: The results are based on the sample for the period 2015–2023. The regressions include year fixed effects and two-digit industry fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Figures in parentheses denote standard errors clustered at the firm level.

in the Survey of Business Activities primarily reflect manufacturing exports, this result is best interpreted as indicating that the influence of intangible investment on manufacturing exports has weakened. Although the present study cannot examine this issue directly due to data limitations, the growing importance of service exports in the context of digital transformation suggests that analyzing the relationship between intangible investment and service export performance represents an important avenue for future research.

The results indicate that the growth effects of firms' investment in intangible assets are statistically significant in both periods. In

other words, the decline in the relative share of intangible assets in the total assets of Korean firms since 2015 cannot be attributed to a disappearance of the growth benefits associated with intangible investment. If anything, the evidence suggests that the impact of intangible assets on growth has remained robust and may have even strengthened over time. This finding, in turn, implies that the decline in intangible intensity is likely driven less by firms' deliberate choice and more by structural constraints that hinder investment in intangible assets, such as financing frictions and institutional barriers. Therefore, devising policies and institutional arrangements that can promote and support firms' investment in intangible assets remains an economically important task.

IV. Robustness Check

To assess the robustness of the main findings, this study conducts two additional sets of robustness checks. First, the sample is split into manufacturing and service sectors, and the analysis is repeated separately for each group. This allows us to determine whether the effects identified in the baseline results are driven by a particular sector or are broadly present across the entire economy. Second, the regressions are re-estimated using five-year growth rates and export status as dependent variables. This longer-horizon analysis is designed to verify whether the growth-enhancing effects of intangible assets persist over an extended period and continue to influence firms' performance and export behavior in the long run.

A. Industry Heterogeneity

To verify that the results are not specific to an industry, the sample is split into manufacturing and service sectors, and the analysis is repeated separately for each group.

Tables 7 and 8 show the results of the manufacturing and service sectors, respectively. Overall, the effects of intangible assets on sales and productivity growth are statistically significant in both sectors, indicating that the growth-enhancing role of intangible assets is not confined to a single sector.

An intriguing pattern is observed: in the manufacturing sector, the coefficient on the share of intangible assets is larger in the earlier

TABLE 7
ROBUSTNESS CHECK: MANUFACTURING SECTOR

Panel A. Full Sample

	1-year sales growth	3-year sales growth	1-year labor productivity growth	3-year labor productivity growth	1-year export status	3-year export status
Share of intangible assets	0.243*** (0.046)	0.594*** (0.114)	0.244*** (0.053)	0.624*** (0.111)	0.282*** (0.050)	0.285*** (0.056)
R-sq	0.059	0.176	0.168	0.228	0.172	0.167
Obs	81,027	64,036	81,027	64,036	81,027	64,036

Panel B. Earlier Period (2006–2014)

	1-year sales growth	3-year sales growth	1-year labor productivity growth	3-year labor productivity growth	1-year export status	3-year export status
Share of intangible assets	0.458*** (0.091)	0.803*** (0.182)	0.381*** (0.096)	0.736*** (0.170)	0.336*** (0.071)	0.338*** (0.075)
R-sq	0.099	0.223	0.229	0.261	0.136	0.152
Obs	38,176	34,990	38,176	34,990	38,176	34,990

Panel C. Later Period (2015–2023)

	1-year sales growth	3-year sales growth	1-year labor productivity growth	3-year labor productivity growth	1-year export status	3-year export status
Share of intangible assets	0.231** (0.083)	0.594*** (0.224)	0.226** (0.096)	0.586*** (0.216)	0.220*** (0.071)	0.208** (0.084)
R-sq	0.054	0.177	0.190	0.289	0.182	0.168
Obs	42,851	29,046	42,851	29,046	42,851	29,046

Note: The results are based on firms in the manufacturing sector only. All regressions include the full set of control variables used in the main analysis, as well as industry and year fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Figures in parentheses denote standard errors clustered at the firm level.

TABLE 8
ROBUSTNESS CHECK: SERVICE SECTOR

Panel A. Full Sample						
	1-year sales growth	3-year sales growth	1-year labor productivity growth	3-year labor productivity growth	1-year export status	3-year export status
Share of intangible assets	0.097*** (0.030)	0.121* (0.068)	0.168*** (0.038)	0.266*** (0.059)	0.018 (0.017)	−0.014 (0.020)
R-sq	0.043	0.131	0.162	0.212	0.262	0.269
Obs	65,301	49,756	65,301	49,756	65,301	49,756
Panel B. Earlier Period (2006–2014)						
	1-year sales growth	3-year sales growth	1-year labor productivity growth	3-year labor productivity growth	1-year export status	3-year export status
Share of intangible assets	0.087* (0.052)	0.106 (0.089)	0.183** (0.078)	0.369*** (0.096)	0.065*** (0.021)	−0.010 (0.027)
R-sq	0.068	0.168	0.244	0.234	0.192	0.225
Obs	27,205	24,591	27,205	24,591	27,107	24,591
Panel C. Later Period (2015–2023)						
	1-year sales growth	3-year sales growth	1-year labor productivity growth	3-year labor productivity growth	1-year export status	3-year export status
Share of intangible assets	0.216*** (0.050)	0.223** (0.094)	0.317*** (0.063)	0.401*** (0.096)	−0.061** (0.025)	−0.030 (0.031)
R-sq	0.052	0.164	0.183	0.277	0.315	0.317
Obs	38,096	25,165	38,096	25,165	38,096	25,165

Note: The results are based on firms in the service sector only. All regressions include the full set of control variables used in the main analysis, as well as industry and year fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Figures in parentheses denote standard errors clustered at the firm level.

period, whereas in the service sector, the growth effect of intangible intensity is stronger in the later period. This finding is consistent with the view that accelerated digital transformation has amplified the contribution of intangible assets to growth in the service sector. For export status, the impact of intangible assets is particularly pronounced in manufacturing, which is a natural finding given that the export data in the Survey of Business Activities mainly capture goods exports.

B. Five-Year Horizon Analysis

The preceding one-year and three-year analyses shed light on the short- and medium-term effects of intangible intensity on firm outcomes. Building on this, the study constructs five-year growth rates for sales and labor productivity, as well as a five-year-ahead export indicator defined by the difference between outcomes at and . This additional analysis allows to assess whether the influence of intangible assets remains significant over a longer horizon.

Table 9 summarizes the five-year regression results. In most specifications, the share of intangible assets in total assets remains statistically significant for firms' growth and export status, indicating that the influence of intangible investment persists even over a longer horizon. One notable difference from the main findings is that, whereas the baseline one- and three-year regressions show that intangible intensity had minimal impact on export participation in the later period, the five-year results indicate that the export effect of intangible assets becomes insignificant in the earlier period. Given that the export data primarily capture manufacturing, where the link between intangible assets and exporting is stronger, the weaker significance in some subperiods is likely due to the rising share of services in the sample. The distinct dynamics of services may attenuate the observed relationship between export status and intangible intensity.

V. Conclusion

This study uses firm-level data from the Ministry of Data and Statistics' Survey of Business Activities for the period 2006–2023 to document trends in Korean firms' intangible asset holdings and examine how these assets are associated with firm growth and participation in export markets. In particular, it highlights the deceleration in

TABLE 9
ROBUSTNESS CHECK: 5-YEAR HORIZON ANALYSIS

Panel A. Full Sample			
	5-year sales growth	5-year labor productivity growth	5-year export status
Share of intangible assets	0.288*** (0.085)	0.395*** (0.077)	0.070** (0.035)
R-sq	0.230	0.213	0.389
Obs	88,221	88,221	88,221
Panel B. Earlier Period (2006–2014)			
	5-year sales growth	5-year labor productivity growth	5-year export status
Share of intangible assets	0.234** (0.091)	0.381*** (0.094)	0.054 (0.045)
R-sq	0.268	0.259	0.374
Obs	55,656	55,656	55,656
Panel C. Later Period (2015–2023)			
	5-year sales growth	5-year labor productivity growth	5-year export status
Share of intangible assets	0.407*** (0.120)	0.514*** (0.124)	0.097* (0.057)
R-sq	0.149	0.206	0.418
Obs	32,565	32,565	32,565

Note: The results are based on regressions where the dependent variables are defined over a five-year horizon. All regressions include the full set of control variables used in the main analysis, as well as industry and year fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Figures in parentheses denote standard errors clustered at the firm level.

intangible asset accumulation since the mid-2010s and examines whether intangible assets continue to influence firm growth and export participation during deceleration of intangible asset accumulation.

The empirical results show that a higher ratio of intangible assets to total assets is associated with faster growth in sales and labor productivity. Especially in manufacturing, an increase in intangible intensity is associated with a higher probability of participating in export markets, consistent with the idea that intangible assets facilitate firms' integration into global value chains. The positive association between intangible assets and firm growth is observed in the pre- and post-2015 subperiods, indicating that the decline in intangible intensity in Korea cannot be attributed to a disappearance of the link between intangible assets and firm growth. The findings are corroborated by robustness checks based on five-year horizons and separate analyses for manufacturing and service sectors, which show that the positive relationship between intangible investment and firm performance is stable across time spans and sectors.¹³

In the context of ongoing digital transformation, where the value of intangible assets is receiving increasing attention, the findings of this study underscore that intangible assets continue to play a crucial role in shaping firms' competitiveness in Korea, even as their share in total assets has been declining. However, the analysis does not pinpoint the underlying reasons for the decelerated accumulation of intangible assets relative to total assets. Addressing this gap by investigating the determinants of firms' intangible investment behavior in Korea remains an important task for future research.

(Submitted Feb 4, 2026; revised Sep 8, 2026; accepted Sep 9, 2026)

References

- Canarella, G., and Miller, S. M. "The determinants of growth in the U.S. information and communication technology (ICT) industry: A firm-level analysis", *Economic Modelling* 70(2018): 259-271.

¹³ Despite the additional robustness checks, the possibility that some endogeneity concerns remain in the analysis cannot be entirely ruled out.

- Choi, K. "Job creation strategy in a knowledge-based economy", *KDI Research Monograph* (No. 2019-12).
- Chun, H. B., Jung, H. J., and Son, N. S. "Global value chains and servicification of manufacturing: Evidence from firm-level data", *Japan and the World Economy* 58(2021): 101074.
- Chung, H. "Asset composition and firm performance in Korea: Effects of intangible assets on firm growth and valuation", *Journal of Industrial Economics and Business* 34(No.5 2021): 1181-1205.
- Corrado, C., Haskel, J., Jona-Lasinio, C., and Iommi, M. "Intangible investment in the EU and US before and since the great recession and its contribution to productivity growth", *Journal of Infrastructure Policy and Development* 2(No.1 2028): 11.
- Dedrick, J., Kraemer, K. L., and Linden, G. "Who profits from innovation in global value chains?: A study of the iPod and notebook PCs", *Industrial and Corporate Change* 19(No.1 2010): 81-116.
- Evans, D. S. "Tests of alternative theories of firm growth", *Journal of Political Economy* 95(No.4 1987): 657-674.
- Haskel, J., and Westlake, S. *Capitalism without capital*. Princeton, NJ: Princeton University Press (2017).
- Hulten, C. R., and Hao, X. "What is a company really worth? Intangible capital and the 'market to book value' puzzle", NBER Working Paper (No.14548 2008).
- Jalava, J., Aulin-Ahmavaara, P., and Alanen, A. "Intangible capital in the Finnish business sector 1975-2005", *ETLA Discussion Papers* (No.1103 2007).
- Jona-Lasinio, C., Manzocchi, S., and Meliciani, V. "Intangible assets and participation in global value chains: An analysis on a sample of European countries", *Rivista di Politica Economica* (July-September 2016): 65-95.
- Kwon, Y. M., Han, Y. H., and Lee, M. W. "The effects of intangible assets on corporate value in the KOSDAQ market", *Korea International Accounting Review* 93(2020): 187-206.
- Lang, L., Ofek, E., and Stulz, R. M. "Leverage, investment, and firm growth", *Journal of Financial Economics* 40(No.1 1996): 3-29.
- Lee, H. Y., Cin, B. C., and Lee, J. C. "Empirical analysis on effects of R&D on corporate value using panel data", *Journal of Industrial Economics and Business* 22(No.1 2009): 435-456.
- Marrano, M. G., and Haskel, J. "How much does the UK invest in intangible assets?", Queen Mary University of London, School of

- Economics and Finance Working Paper (No. 578 2006).
- Ministry of Data and Statistics. Survey of Business Activities (2006-2023), <https://doi.org/10.23333/RN.50149467.V2.1>
- Miyagawa, T., and Kim, Y. "Measuring organization capital in Japan: An empirical assessment using firm-level data", *Seoul Journal of Economics* 21(No.1 2008): 169-193.
- Mun, S. B., Chun, H. B., and Cho, J. H. "The effects of Internet use on productivity and growth at the firm level", *Information Communication Policy* 21(No.3 2014): 53-77.
- OECD. *Knowledge-based capital and upgrading in global value chains. In Supporting Investment in Knowledge Capital, Growth and Innovation* (2013):215-252. OECD Publishing.
- Park, W., Park, S. K., and Lee, C. S. "The relation between intangible resources and sustainability of competitive advantage", *Journal of Industrial Economics and Business* 20(No.6 2007): 2265-2286.
- Rhee, K. H., and Pyo, H. K. "Firm dynamics, resource reallocation and determinants of labor productivity: A panel analysis from the Korean firm level data (2006–2012)", *Journal of Korean Economic Analysis* 21(No.3 2015): 43-114.
- Son, D. H., Han, W. Y., and Jeon, Y. I. "The impact of R&D investment on economic growth and employment", *International Area Studies Review* 19(No.3 2015): 177-194.
- Son, N. S., Chun, H. B., and Jung, H. J. "Intangible investments and participation in global value chain", *Journal of Korean Economic Analysis* 25(No.3 2019): 1-48.
- Sung, N. I., Kim, M. C., and Seo, S. W. "E-business, firm characteristics and firm performance: An empirical analysis of Korean firms", *Journal of Information Technology Applications & Management* 18(No.4 2011): 55-79.
- Yi, S. H. "The impact of knowledge-based intangible capital on economic growth", *Journal of Korean Economy Studies* 22(2008): 137-171.
- Yoon, S. H., Yoon, J. E., Cho, S., Lee, J., Baek, Y., and Son, N. S. "Investment in Intangible Assets and Economic Growth: Global Trends and Policy Implications", *Policy Analyses* 24-07. Sejong: Korea Institute for International Economic Policy, 2024.

Appendix

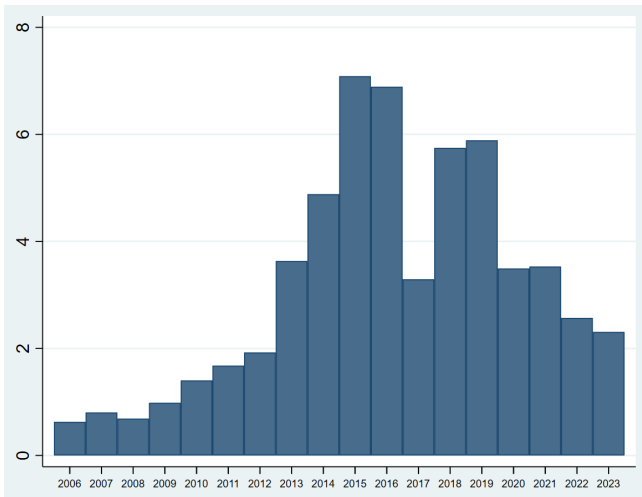


FIGURE A1
RATIO OF INTANGIBLE TO TANGIBLE ASSETS (UNIT: %)

TABLE A1
REGRESSION RESULTS: SYSTEM GMM

	1-year sales growth	3-year sales growth	1-year labor productivity growth	3-year labor productivity growth
Share of intangible assets	0.704 (0.800)	1.152** (0.523)	1.006* (0.514)	1.174* (0.622)
Wald chi ²	74.54	171.87	249.37	175.16
AR1 test (p-value)	0.952	0.044	0.000	0.135
AR2 test (p-value)	0.217	0.069	0.479	0.273
Hansen test (p-value)	0.594	0.621	0.504	0.968
Obs	146,328	113,792	146,328	113,792

Note: The results are based on system GMM estimation. All regressions include the full set of control variables used in the main analysis, as well as industry and year fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Figures in parentheses denote standard errors.