ELIT
Economic Laboratory Transition
Research Podgorica

Montenegrin Journal of Economics

For citation:

Uzik, M., Runge, C.A. (2023), “The Shareholder Value Drivers in Digital Age – An Empiric Perspective of Intangible Value, R&D’s and Network Sales”, *Montenegrin Journal of Economics*, Vol. 19, No. 2, pp. 45-55.

The Shareholder Value Drivers in Digital Age – An Empiric Perspective of Intangible Value, R&D’s and Network Sales

MARTIN UZIK[1] (*corresponding author*) and CHRISTOPHER ALEXANDER RUNGE[2]

[1] Professor, Berlin School of Economics and Law, Department of Business and Economics, Berlin, Germany, e-mail: martin.uzik@hwr-berlin.de
[2] PhD student, University of Kosice, Faculty of Economics, Kosice, Slovakia

ARTICLE INFO

Received May 05, 2022
Revised from June 05, 2022
Accepted July 06, 2022
Available online April 15, 2023

JEL classification: G10, G32

DOI: 10.14254/1800-5845/2023.19-2.4

Keywords:

Digitalization,
shareholder value,
intangible assets,
value drivers.

ABSTRACT

Increasing digitization is shifting the focus of value generation to the tertiary sector. The classic economic production factors seem to be fading into the background. The question arises as to whether value-oriented management concepts still have their justification in the digital age. This paper takes up Alfred Rappaport's shareholder value and examines for the period 1997 to 2020 whether the known value drivers still have a significant influence on shareholder value. In addition, new value drivers corresponding to the digital age, such as investments in intangible assets and R&D investments, as well as the affiliation to the group of digital companies are examined for their significance. Using multivariate regression, the relationships between shareholder value as the dependent variable and the independent variables are presented. On the one hand, the classic value drivers according to Rappaport are analyzed. On the other hand, selected digital value drivers such as intangible assets, R&D expenses and network sales are analyzed. This paper examines which of Rappaport's betting drivers still explain shareholder value and tests whether new betting drivers can be identified. For companies in the S&P 500, it was possible to demonstrate that the value drivers according to Rappaport continue to have a significant influence on shareholder value. At the same time, it was also possible to attest significance to the new digital value drivers. However, the explanatory power of the new model is significantly lower than that of the classic value drivers of shareholder value.

INTRODUCTION

In the context of value orientation, the foundations of value-based management were laid as early as 1986 in the work of Alfred Rappaport "*Creating Shareholder Value*" (Bodrow and Bergmann, 2003). Subsequently, the concept of shareholder value shaped the work of authors such as Stern and Stewart as well as Copeland. The basic premise of the shareholder value approach is to align the actions of corporate management with the interests of shareholders. The increasing importance of the tertiary sector, the establishment of new technologies as well as the shift of the production focus from the classical production factors to a new "*fourth production factor*" (Stewart, 1998), recently pose new challenges to science and economy. Intangible assets are the new production factor. The transformation of economies into high-tech infrastructures is now also putting the classic value creation concepts to the test. This also applies to Rappaport's shareholder value concept. Maximizing the long-term value of the company and increasing the return on equity are defined as the primary goals. With seven value enhancement factors, Rappaport lists the possibilities of influencing shareholder value, as this cannot be directly influenced as a result variable. The only way to control shareholder value is to influence input values, i.e., the value drivers (Kinne, 2006). In addition to the value drivers mentioned by Rappaport, the question arises in the new digital age as to which new value drivers influence shareholder value. In principle, intangible assets have always been classified as high-risk investments, which offers an interesting starting point, particularly from a portfolio theory perspective. The higher the risk, the higher the return on these assets, which in turn increases shareholder value. Rappaport divides the individual value drivers into three categories: Growth, Return and Risk. The individual value drivers in these categories are sales growth, investment in fixed assets (capital investment) and investment in current assets (investment in working capital) in the growth category. Within the Return category, operating profit margin and tax payments are identified as value drivers. Finally, the Risk category includes the Total Cost of Capital and the Competitive Advantage Period. In the new digital age, other new value drivers are to be identified that influence shareholder value. For example, investments in intangible assets, R&D investments, membership in the group of innovative companies and the PVGO from Myers' model are identified as value drivers here.

Except for the Competitive Advantage Period, all other value drivers are examined empirically in terms of their influence on shareholder value.

1. LITERATURE REVIEW

The development of companies' business models and the increasing focus on intangible capital as a key value driver justify the need for a discussion. The question arises whether the value drivers mentioned by Rappaport are still valid. On the one hand, the empirical studies carried out here were unable to produce a satisfactory value for the validity of Rappaport's value drivers. On the other hand, it can be seen not only in the "empirical anomalies" identified in the course of this work, but also in various scientific studies (Aboody and Lev, 1998), that shareholder value is certainly influenced by individual components of intangible capital. For example, the work of Heiens, Leach and McGrath (2007), as well as that of Nakano (2007), specifically examines the influence of intangible assets on shareholder value. It is not only the authors of these scientific contributions who are confronted with the problem of quantifying intangibles. Most empirical studies focus on research and development expenditures to obtain a quantifiable measure of intangible capital (Chan et al., 2001; Lev and Sougiannis, 1996). Here, the literature finds a significant positive impact of R&D expenditures on shareholder value. In this context, Nakano emphasizes: "While R&D investments reduce current-year earnings, they build the R&D capability of the organization for the future. Accumulated R&D capability can be expected to create future earnings, which relates to shareholders' value." (Nakano, 2007) Heiens, Leach and McGrath (2007) conclude that advertising, goodwill, and R&D spending do not have a significant impact on shareholder value. "Instead, only intangible assets other than goodwill, which include the value of patents, copyrights, licenses, and trademarks, have a positive impact on shareholder value."

Innovation is becoming increasingly important, as simple product improvements no longer protect against product substitutes. The quintessence of the current global development is that companies should devote themselves to product enhancement and new product development much more than in the past. This development is further accelerated by ongoing technological change and increasingly defines research and development as a new value driver of corporate success (Brodbeck et al., 2002). If the investments in R&D lead to success, then the innovations can be transformed into physical assets through patents or through "first-mover" advantages (Lev, 2001). The valuation of innovation as the output of research and development is only possible indirectly, for example by determining the share of sales from new products in total sales. As an additive correction variable, the value of patents developed or acquired in a year can also be added (Stewart, 1998).

$$Innovation\ indicator\ A = \frac{R\&D\ Expenditure}{Total\ Sales} \qquad (1)$$

Innovations must always be viewed with an uncertainty equivalent, as they cannot be planned ex ante. In a broader sense, expenditure on research and development can be assumed to be an estimator of a company's ability to innovate. This relationship is often assumed in the literature, and a mostly positive assumed influence on shareholder value has also been empirically proven. For example, the relationship between investments and returns in R&D and property, plant and equipment were analyzed. The result showed that each $1 investment in R&D yields an eightfold higher return than a comparable investment in tangible fixed assets. Aboody and Lev, studying 83 chemical companies over a 25-year period, found an average pre-tax return on investment in R&D of 25.9% compared to 15% on average for traditional investment measures (Aboody and Lev, 1998). Investment in property, plant and equipment has remained at a constant level of $110 billion in the U.S. since 1982 through the mid-1990s. In contrast, investment in computers and telecommunications by U.S. companies increased from $49 billion in 1982 to $86.2 billion in 1987 and to $112 billion in 1991, exceeding the level of investment in property, plant, and equipment for the first time that year (Stewart, 1998). R&D expenditure in Germany increased from EUR 26,971 million in 1990 to EUR 44,870 million in 2002 (Esser and Hackenberger, 2004).

Hsu et. al. (2016) analyze the impact of brand architectures on firm value. Despite evidence of increasing adoption of brand architecture strategies beyond the Brand House (BH) (e.g., Boeing and IBM) and House of Brands (HOB) (e.g., P&G with Tide and Cheer) and the recognition that these strategies vary widely in practice, there is still a need for research on how financial markets value the full range of brand architecture strategies pursued by firms. Hsu et. al. (2016) replicate and extend Rao et al.'s (Journal of Marketing, 68(4), 126-141, 2004) research on brand portfolio strategy and firm performance by varying the research methodology. To examine the risk profiles of five different strategies, Hsu et. al. (2016) developed a brand-relevant conceptualization of the sources of idiosyncratic risk that can be exacerbated or controlled by brand architecture strategy: Brand reputation risk, brand dilution risk, brand cannibalization risk, and brand stretch risk. Hsu et. al. (2016) show superior model performance results using the extended five-part architecture categorization and conclude with implications for practice. The authors show that the risk-return tradeoffs for sub-branding, endorsed branding, and the BH-HOB hybrids are significantly different from what conventional wisdom suggests. The research confirms that the seemingly subtle differences in brand architecture strategy matter in practice. The strengths and weaknesses of the different brand architectures manifest themselves in significantly different risk-return profiles. To assess the significance of the results, the authors simulate portfolio development. In January 1996, $1000 is invested in each of five portfolios of firms with different brand architectures. By December 2006, the investment in sub-branded firms triples to $3640; the same $1000 investment in BH firms increases to $1820 by the end of 2006. In contrast, the $1000 investment in HOB increases by 50% to $1540, and for endorsed branding and BH-HOB hybrids, there is only an insignificant increase to $1240 and $1140. This pattern of risks and returns along the architecture continuum is not linear; risk/reward tradeoffs do not manifest in an orderly fashion, moving from BH to HOB with increasing distance from the corporate brand.

Kambara, K. M. (2010) examines how customer satisfaction and its instability affect capital market reputation and shareholder returns. A sample from the American Customer Satisfaction Index database of 76 publicly traded companies from 2001 to 2007 was used to test the model. The model consisted of a set of hypothesized relationships, where:

- the instability of customer satisfaction is negatively related to the level of customer satisfaction:
- customer satisfaction is positively related to capital market reputation; and
- capital market reputation is positively related to shareholder value.

Structural equation modeling using the partial least squares (PLS) algorithm supported the hypotheses. The results are of importance and relevance to brand management and the emerging field of branding as they explore the potential negative consequences of customer satisfaction instability, develop a theory on the relationship between customer satisfaction in product markets and capital market reputation, and introduce a new measure of capital market reputation.

C. Kirk et. al. (2012) base their analysis on the efficient markets' hypothesis, which states that a company's stock price reflects investors' perceptions of the current and future earnings potential of all its assets, both tangible and intangible. Brand equity can be considered an intangible corporate asset, and research suggests that brand equity influences stock prices. However, the effect of brand on consumers is different from its effect on corporate buyers. C. Kirk et. al (2012) find that brand value estimates are significantly associated with stock prices beyond book value and earnings information. However, this relationship is affected by the industry affiliation of the firms, and although the association of brand value and stock prices is significant for consumer firms, it is not significant for industrial firms. The associations between brand value and stock prices are significant on both a contemporaneous basis and on a lagged one-year basis, suggesting that brand value changes have a persistent effect on firm valuation.

Technological development also increasingly favored the possibilities of speech and sentiment analysis. However, it should be noted that the analysis of the information and the form of its communication was the focus, because of the verification of whether the communication was correct or false and how false communication affected the reputation. For example, Craig and Brennan (2012) studied the influence of the language used in the context of corporate communication and corporate reputation. This paper proposes a taxonomy to help more clearly situate research on aspects of the relationship between corporate reputation and corporate responsibility reporting. Using DICTION 5.0 software, the authors analyze the content of CEO letters from 23 U.S. firms with high reputations and 23 U.S. firms with low reputations. The results suggest that firm size and name recognition each have a positive influence on the extent to which corporate reputation is associated with language choice in CEO letters. These results, which differ from those of Geppert and Lawrence (2008), highlight the need for caution when making claims about the effects on corporate reputation.

According to Miller and Modigliani (1961), the value of growth opportunities corresponds to the difference between the return on future investments and the cost of capital, which must be exceeded. Myers (1977) specifies this idea and defines tangible assets as units of production capacity. In contrast, Myers considers intangible assets as expansion options of current production capacity. The sum of these option values equals the present value of growth options (PVGO). Investments in future opportunities, which Myers (1977) refers to as PVGO, contribute to a large extent to shareholder value. In his empirical work, Myers finds PVGO ratios of 66% to the market value of equity, which ranged from 36.5% to 87.1%. Not to be neglected in this context is volatility, which increases the value of options and thus PVGO, leading to higher shareholder value Brealey et al. (2010). Myers and Turnbull (1977) extend the concept to include two key areas. First, the authors refer to the distributions to shareholders, which depends on the endogenous availability of projects. Second, they define assets that depend on future discretionary investments by the firm. They distinguish between existing assets as tangible, non-discretionary sunk costs, while future investments are referred to as intangible, discretionary investments. The authors include all variable expenses, such as research and development costs, among discretionary investments. They also point out that real assets prevent the creation of shareholder value that is independent of corporate strategy. In contrast, real growth options can generate positive net present value in the future. In general, the PVGO studies by Amram and Kulatilaka (2000) and Manyika et al (2018), show the value driver potential of growth options. EUR.

2. EMPIRICAL ANALYSIS

2.1 Data

The sample to be examined comprises companies from the S&P 500 Index. The relevant data are drawn from the EIKON database for the period from 1997 to 2020 and thus take into account a period of 24 years.

2.2 Methodology

A multivariate regression analysis is used to test the relevance of the value drivers. Two regressions are analyzed as part of the empirical evaluation. The first examines the influence of the value drivers named by Rappaport on shareholder value and presents the following functional relationship:

$$\ln\left(\frac{P_t}{P_{t-1}}\right) = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 \quad (2)$$

Where

$x_1 = ln\left(\frac{Sales_t}{Sales_{t-1}}\right)$ Growth in sales

$x_2 = ln\left(\frac{Assets_t}{Assets_{t-1}}\right)$ Investment in fixed assets

$x_3 = ln\left(\frac{Working\ Capital_t}{Working\ Capital_{t-1}}\right)$ Investment in current assets

$x_4 = \left(\frac{\frac{EBITDA_t}{Sales_t}}{\frac{EBITDA_{t-1}}{Sales_{t-1}}}\right)$ Operating profit margin

$x_5 = ln\left(\frac{Tax\ Payment_t}{Tax\ Payment_{t-1}}\right)$ Tax payments

$x_6 = ln\left(\frac{CAPM_t}{CAPM_{t-1}}\right)$ Cost of capital

The second regression tests the influence of the new value drivers in the digital age. The regression relationship is shown as follows:

$$\ln\left(\frac{P_t}{P_{t-1}}\right) = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 \quad (3)$$

Where

$x_1 = ln\left(\frac{Intangible\ Assets_t}{Intangible\ Assets_{t-1}}\right)$ Investment in intangible assets

$x_2 = ln\left(\frac{R\&D_t}{R\&D_{t-1}}\right)$ Investment in research and development

$x_3 = \frac{PVGO_t}{PVGO_{t-1}}$ Share of growth options

$x_4 = ln\left(\frac{\frac{Sales_t^2 - Sales_t}{Sales_t}}{\frac{Sales_{t-1}^2 - Sales_{t-1}}{Sales_{t-1}}}\right)$ Growth in network sales

$x_5 = digital\ company$ Affiliation with digital companies

Due to their nature, most of the variables are already understandable from the presentation above. In the following, we will only discuss the growth options, network revenues and the affiliation to digital companies and the calculation of these variables.

Schwartz and Moon (2000) have already shown that revenue growth can be a leading indicator of value creation. Market valuation can be explained by revenue growth. Rajgopal et al. (2003) focuses on sales growth and introduces the concept of network sales. This uses Safferstone et al. (1999) explanation of positive network effects and the associated exponential effects of sales growth.

$$Network\ Sales_t = \frac{Sales_t^2 - Sales_t}{Sales_t} \quad (4)$$

The affiliation to the group of digital companies is defined based on the TRBC (Thomson Reuters Business Sector Code) "Software & IT Services" "Technology Equipment" and "Telecommunications Services". Extended to this group of companies is Amazon, which is a tech company, but is listed as a retailer. This variable is included in the regression as a dummy variable.

The concept of growth options can be traced back to Myers (1977). Myers decomposes the stock price into its components, the Present Value of Existing Asset (PVEA) and the Present Value of Growth Opportunities (PVGO).

$$S_t = PVEA_t + PVGO_t \qquad (5)$$

The PVEA captures the static enterprise value component in which, under the assumption of full distribution and no growth, the earnings per share of the company are recognized at present value.

$$S_t = \frac{eps_t}{{r_t}^{EK}} + PVGO_t \qquad (6)$$

The difference between the two components lies in the options for future investments. Entrepreneurial flexibility is represented by the PVGO. The future room for maneuver is concretized over time by the resolution of uncertainties. This represents the value-based justification for capturing action flexibilities in the share price. The PVGO is not explicitly modeled. It is determined recursively on the share price and the PVEA.

$$PVGO_t = S_t - \frac{eps_t}{{r_t}^{EK}} \qquad (7)$$

3. RESULTS

All input variables were calculated for the 500 companies in the S&P500. In order to make a meaningful comparison between the classic value drivers according to Rappaport and the value drivers identified here in the digital age, all data sets must be complete. Because few companies report information on intangibles as well as R&D expenses, and furthermore the study period of 24 years is a long time series in which new companies were included in the S&P500, not all data sets are complete. After cleaning up the sample, 127 companies remain in the study sample. 42 companies can be assigned to the digital sector. A panel data set with 3048 individual complete data records was analyzed as part of the statistical evaluations.

Table 1. Regression of the classical value driver according to Rappaport.

ANOVA[a]								
Model		Sum of Squares	df	Mean Square	F	Sig.	Adjusted R Square	Durbin-Watson
1	Regression	68.744	6	11.457	103.785	.000[b]	0.168	1.637
	Residual	335.711	3041	0.110				
	Total	404.455	3047					
a. Dependent Variable: ln(Pt/Pt-1)								
b. Predictors: (Constant), ln(CAPMt/CAPMt-1), ln(TAXt/TAXt-1), ln(Assett/Assett-1), ln(WCt/WCt-1), ln(EBITDA-Salest/EBITDA-Salest-1), ln(Salest/Salest-1)								
Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	0.095	0.007		14.580	0.000		
	ln(Salest/Salest-1)	0.095	0.035	0.056	2.731	0.006	0.643	1.556
	ln(Assett/Assett-1)	-0.026	0.030	-0.018	-0.876	0.381	0.677	1.477
	ln(WCt/WCt-1)	0.040	0.009	0.075	4.467	0.000	0.980	1.020

	ln(EBITDA-Salest/EBITDA-Salest-1)	0.043	0.013	0.056	3.231	0.001	0.921	1.086
	ln(TAXt/TAXt-1)	0.025	0.009	0.050	2.843	0.005	0.880	1.136
	ln(CAPMt/CAPM t-1)	-0.478	0.021	-0.384	-23.154	0.000	0.992	1.008
a. Dependent Variable: ln(Pt/Pt-1)								

Source: own

The regression of Rappaport's classic value drivers shows sufficient explanatory power with an R squared of 16.8%. It should be noted that the corona year 2020 was retained in the analyses. With the exception of investment in fixed assets, all variables are highly significant. The signs of the coefficients are also in line with the literature definition, with the exception of investment in fixed assets. The CAPM cost of equity has a negative sign, which is consistent with the literature view that as the cost of capital increases, shareholder value decreases and vice versa.

Table 2. Regression of the digital value drivers of shareholder value.

ANOVA[a]								
Model		Sum of Squares	df	Mean Square	F	Sig.	Adjusted R Square	Durbin-Watson
1	Regression	11.405	5	2.281	17.653	.000[b]	0.027	1.393
	Residual	393.050	3042	0.129				
	Total	404.455	3047					
a. Dependent Variable: ln(Pt/Pt-1)								
b. Predictors: (Constant), ln(NetworkSalest/NetworkSalest-1), ln(PVGOt/PVGOt-1), Dummy Digital, ln(IAt/IAt-1), ln(R&Dt/R&Dt-1)								
Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	0.077	0.008		9.245	0.000		
	Dummy Digital	0.032	0.014	0.041	2.283	0.022	0.982	1.018
	ln(IAt/IAt-1)	0.032	0.013	0.047	2.510	0.012	0.928	1.078
	ln(R&Dt/R&Dt -1)	-0.074	0.032	-0.051	-2.352	0.019	0.684	1.461
	ln(PVGOt/PVGOt-1)	0.048	0.006	0.142	7.940	0.000	0.999	1.001
	ln(NetworkSalest/NetworkSalest-1)	0.110	0.037	0.066	3.002	0.003	0.670	1.493
a. Dependent Variable: ln(Pt/Pt-1)								

Source: own

In the regression of the digital value drivers, the R square drops significantly to only 2.7%. Compared to the classic value drivers according to Rappaport, the digital value drivers do not appear to be very significant. Nevertheless, all digital value drivers used are highly significant. With the exception of investments in R&D, the digital value drivers also have correct signs. Spending in R&D exists negatively affects shareholder value. A 1% increase in R&D spending leads to a 0.074% decrease in shareholder value.

Table 3. Regression of the digital value drivers of the Sharehodler Value with time-shift, part1.

		Model	*1 to 1*			*t shift + 1 Year*		
		R	.168a			.099a		
		R Square	0.028			0.010		
		Adjusted R Square	0.027			0.008		
		Std. Error of the Estimate	0.359			0.366		
		Durbin-Watson	1.393			1.356		
ANOVA	Sum of Squares	Regression	11.405			3.852		
		Residual	393.050			391.068		
		Total	404.455			394.920		
	df	Regression	5			5		
		Residual	3042			2915		
		Total	3047			2920		
	Mean Square	Regression	2.281			0.770		
		Residual	0.129			0.134		
		F	17.653			5.742		
		Sig.	.000b			.000b		
Coefficients	Unstan-dard-ized Coefficients		B	Sig.	VIF	B	Sig.	VIF
		(Constant)	0.077	0.000		0.092	0.000	
		Dummy Digital	0.032	0.022	1.018	0.044	0.002	1.018
		In(IAt/IAt-1)	0.032	0.012	1.078	-0.041	0.002	1.076
		In(R&Dt/RDt-1)	-0.074	0.019	1.461	-0.071	0.031	1.440
		In(PVGOt/PVGOt-1)	0.048	0.000	1.001	0.011	0.078	1.001
		In(NetworkSalest/ NetworkSalest-1)	0.110	0.003	1.493	0.012	0.746	1.471
a. Dependent Variable: In(Pt/Pt-1)								
b. Predictors: (Constant), In(NetworkSalest/NetworkSalest-1), In(PVGOt/PVGOt-1), Dummy Digital, In(IAt/IAt-1), In(R&Dt/R&Dt-1)								

Source: own

Table 4. Regression of the digital value drivers of the Sharehodler Value with time-shift, part2.

		Model	**t shift + 2 Year**	**t shift + 3 Year**
		R	.111a	.069a
		R Square	0.012	0.005
		Adjusted R Square	0.010	0.003
		Std. Error of the Estimate	0.361	0.346
		Durbin-Watson	1.351	1.255
ANOVA	Sum of Squares	Regression	4.513	1.523
		Residual	363.982	317.691
		Total	368.495	319.214

	df	Regression	5			5		
		Residual	2788			2661		
		Total	2793			2666		
	Mean Square	Regression	0.903			0.305		
		Residual	0.131			0.119		
		F	6.913			2.552		
		Sig.	.000b			.026b		
Coefficients	Unstan-dard-ized Coeffi-cients		B	Sig.	VIF	B	Sig.	VIF
		(Constant)	0.088	0.000		0.081	0.000	
		Dummy Digital	0.028	0.059	1.018	-0.001	0.927	1.017
		In(IAt/IAt-1)	-0.049	0.000	1.075	0.030	0.017	1.074
		In(R&Dt/R&Dt-1)	-0.015	0.653	1.439	-0.049	0.121	1.444
		In(PVGOt/PVGOt-1)	-0.025	0.000	1.001	-0.010	0.108	1.001
		In(NetworkSalest/ NetworkSalest-1)	0.068	0.074	1.471	0.061	0.096	1.476
a. Dependent Variable: In(Pt/Pt-1)								
b. Predictors: (Constant), In(NetworkSalest/NetworkSalest-1), In(PVGOt/PVGOt-1), Dummy Digital, In(IAt/IAt-1), In(R&Dt/R&Dt-1)								

Source: own

If the assumption is made that the selected digital value drivers in Intangible Assets, R&D, PVGO and Network Sales influence a time lag until the realization of the added value and thus the shareholder value, the model must be adjusted. This is done by shifting the variable shareholder value by a certain time period. In the following, the time shifts of the shareholder value of 1, 2 and 3 years are tested. Thus, the digital value drivers should explain the shareholder value in the respective year (1 to 1) as well as with a corresponding delay. When shifted over time, the digital variables explain shareholder value in subsequent years. For example, the digital value drivers of the year 2000 explain the shareholder value of the year 2001 at a time lag t + 1. The results show that as the time lag increases, the R square decreases and that some digital value drivers lose their significant influence on shareholder value. For example, R&D expenses, which are no longer significant after a shift of 2 years. At a shift of 3 years, the variable belonging to the digital companies loses its significance. The growth options have a negative impact on shareholder value from a shift of 2 and 3 years.

CONCLUSION

This paper examined the significance of the shareholder value approach and its value drivers. For the period from 1997 to 2020, it was essentially possible to confirm the significant influence of the value drivers examined on shareholder value, with the exception of investments in fixed assets. The classic value drivers according to Alfred Rappaport thus continue to exist in the digital age. The newly identified digital value drivers, such as investments in intangible assets, investments in R&D, investments in the growth options of the companies, network sales and the affiliation with digital companies are also significant value drivers. However, the explanatory power in terms of the corrected R square is not high. Shifting the influence of digital value drivers on shareholder value over time did not improve the explanatory power. The work confirms the validity of the shareholder value approach, but at the same time provides new starting points for corporate management with the new digital value drivers. It remains to be seen what influence the crises, such as the bursting of the dot-com bubble and the corona pandemic, will have on the results.

REFERENCES

Aboody, D., Lev, B. (1998) 'The Value Relevance of Intangibles: The Case of Software Capitalization', *Journal of Accounting Research*, No. 36, p. 161-191. doi: 10.2307/2491312

Amram, M., Kulatilaka, N. (2000), "Strategy and Shareholder Value Creation: the Real Options Frontier", *Journal of Applied Corporate Finance*, Vol. 13, No. 2, pp. 15–28. doi: 10.1111/j.1745-6622.2000.tb00051.x

Berndt, R. ed. (2006), "Success Factor Innovation", *Challenges to Management*, Vol. 12, (German and English Ed., Springer, Dordrecht (in German).

Bodrow, W., Bergmann, P. (2003), *Knowledge Valuation in Companies: Accounting of Intellectual Capital*, E. Schmidt, Berlin (in German).

Brealey, R.A., Myers, S.C., Allen, F. (2010), *Principles of corporate finance*, 10th ed., McGraw-Hill Irwin, New York.

Brodbeck, H., Savioz, P., Lichtenhaller, E. (2002), "How to become an "innovation champion": Ways to systematically increase the capacity for radical innovation", *New Management*, No. 5, pp. 56-64 (in German).

Chan, L.K.C., Lakonishok, J., Sougiannis, T. (2001), "The Stock Market Valuation of Research and Development Expenditures", *The Journal of Finance*, Vol. 56, No. 6, pp. 2431–2456. doi: 10.1111/0022-1082.00411

Craig, R.J., Brennan, N.M. (2012), "An exploration of the relationship between language choice in CEO letters to shareholders and corporate reputation", *Accounting Forum*, Vol. 36, No. 3, pp. 166–177. doi: 10.1016/j.accfor.2012.02.004

Esser, M., Hackenberger, J. (2004), "Accounting of Intangible Assets of Fixed Assets under IFRS and U.S. GAAP", *Capital Markets Accounting*, Vol. 10, pp. 402-414 (in German).

Geppert, J., Lawrence, J.E. (2008), "Predicting Firm Reputation Through Content Analysis of Shareholders' Letter", *Corporate Reputation Review*, Vol. 11, No. 4, pp. 285–307. doi: 10.1057/crr.2008.32

Gstraunthaler, T. (2006), "The valuation and accounting of intangible assets according to IAS 38 in the revised version of March 31, 2004 and its effects" in Matzler, K. (ed.), *Intangible Assets: Handbook of intangible assets*, Schmidt, Berlin (in German).

Heiens, R.A., Leach, R.T., Mcgrath, L.C. (2007), "The contribution of intangible assets and expenditures to shareholder value", *Journal of Strategic Marketing*, Vol. 15, No. 2-3, pp. 149–159. doi: 10.1080/09652540701319011

Hsu, L., Fournier, S., Srinivasan, S. (2016), "Brand architecture strategy and firm value: how leveraging, separating, and distancing the corporate brand affects risk and returns", *Journal of the Academy of Marketing Science*, Vol. 44, No. 2, pp. 261–280. doi: 10.1007/s11747-014-0422-5

Kambara, K.M. (2010), "Managing brand instability and capital market reputation: Implications for brand governance and marketing strategy", *Journal of Brand Management*, Vol. 17, No. 8, pp. 568–578. doi: 10.1057/bm.2010.21

Kinne, P. (2006), "Intangible Assets - Characteristics of the New Value Drivers" in Berndt, R. (ed.), *Success Factor Innovation* (*Challenges for Management*, Vol. 12, German and English Edition), Springer, Dordrecht, pp. 139-164. http://dx.doi.org/10.1007/3-540-27291-7_9 (in German).

Kirk, C.P., Ray, I., Wilson, B. (2012), "The impact of brand value on firm valuation: The moderating influence of firm type", *Journal of Brand Management*, Vol. 20, No. 6, pp. 488–500. doi: 10.1057/bm.2012.55

Knowledge creation and management: New challenges for managers (2007), Oxford University Press, Oxford, https://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=179907.

Lev, B. (2001), *Intangibles: Management, Measurement, and Reporting*, Brookings Institution Press. http://www.jstor.org/stable/10.7864/j.ctvcj2rf2.

Lev, B., Sougiannis, T. (1996), "The capitalization, amortization, and value-relevance of R&D", *Journal of Accounting and Economics*, Vol. 21, No. 1, pp. 107–138. doi: 10.1016/0165-4101(95)00410-6

Manyika, J. et al. (2018), Superstars. the Dynamics of Firms, Sectors, and Cities Leading The Global Economy. https://www.mckinsey.com/~/media/mckinsey/featured%20insights/innovation/superstars%20the%20Dynaics%20of%20firms%20sectors%20and%20cities%20leading%20the%20global%20economy/mgisuperstarsdiscussion%20paper_oct%202018-v2.pdf (Accessed: 28 April 2022).

Miller, M.H., Modigliani, F. (1961), “Dividend Policy, Growth, and the Valuation of Shares”, *The Journal of Business*, Vol. 34, No. 4, pp. 411–433. http://www.jstor.org/stable/2351143.

Myers, S.C. (1977), “Determinants of corporate borrowing”, *Journal of Financial Economics*, Vol. 5, No. 2, pp. 147–175.

Myers, S.C., Turnbull, S.M. (1977), “Capital Budgeting and the Capital Asset Pricing Model: Good News and Bad News”, *The Journal of Finance*, Vol. 32, No. 2, p. 321. doi: 10.2307/2326764

Nakano, M. (2007), “Corporate finance: intangible assets' effect on shareholders' value” in *Knowledge creation and management: New challenges for managers*, Oxford University Press, Oxford.

Rajgopal, S., Venkatachalam, M., Kotha, S. (2003), “The Value Relevance of Network Advantages: The Case of E-Commerce Firms”, *Journal of Accounting Research*, Vol. 41, No. 1, pp. 135–162. doi: 10.1111/1475-679X.00099

Safferstone, M.J., Shapiro, C., Varian, H.R. (1999), “Information Rules: A Strategic Guide to the Network Economy”, *The Academy of Management Executive* (*1993-2005*), Vol. 13, No. 1, pp. 117–118. http://www.jstor.org/stable/4165527.

Schwartz, E.S., Mark Moon (2000), “Rational Pricing of Internet Companies”, *Financial Analysts Journal*, Vol. 56, No. 3, pp. 62–75.

Stewart, T.A. (1998), *The fourth production factor: Growth and competitive advantages through knowledge management*, Carl Hanser Verlag, Munich, https://d-nb.info/953335348/04 (in German).