Lehenchuk, Serhii; Zavalii, Tetiana

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Empirical Paper

Serhii Lehenchuk*, Tetiana Zavalii

The impact of customer capital on company's market value: An empirical study from 100 U.S. stock market leaders

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Abstract:
Objective: The aim of the paper is to establish the relationship between the customer capital and the company's market value (MV). Examining this impact seems justified as the topic has been rarely investigated till now.
Methods: The regression analysis was used to achieve the research objective. We analyzed reports of 100 U.S. stock market leaders for 2018, which were prepared in accordance with the requirements of International Financial Reporting Standard 3 «Business Combinations» and included information about customer capital.
Findings: The hypothesis that the customer capital has a direct impact on the company's MV is confirmed by the results of this study.
Practical implication: The proposed regression model (Model 3) can be used for needs of value-based management.
Originality/value: Customer capital as a tool of value-based management is a poorly studied topic in the context of understanding the importance of the role of intangibles in creating value for company.

Keywords: customer capital, goodwill, intangible assets, market value, research and development costs
JEL Classification: D24, E22, G32, L14

1 Introduction

The difference between the market and book value of the company is largely due to its intellectual capital, usually grouped into three components–human, structural, and customer capital. Today, the issue of the impact of components of intellectual capital on the company's market value (MV) remains unresolved, which emphasizes the importance of this work.

In the effective value-based management of intellectual capital and its components for many companies, the main problem is the absence of opportunity for reporting information about intangible assets that would form a transparent analytical base for building current trends. In turn, the company's reporting, compiled in accordance with the requirements of international financial standards, provides an informational basis for the analysis of various types of intangible assets and allows determining the relationship between different indicators.

***Corresponding author: Serhii Lehenchuk,** Department of Information Systems in Management and Accounting, Zhytomyr Polytechnic State University, Zhytomyr, Ukraine. E-mail: legenchyk2014@gmail.com
Tetiana Zavalii, Department of Management and Entrepreneurship, Zhytomyr Polytechnic State University, Zhytomyr, Ukraine. E-mail: zavaliitatyana@gmail.com

The importance of empirical studies on the impact of customer capital on the company's MV increases with the need to identify intangible reserves to build more effective management. Using econometric models built on the basis of available statistical data allows managers to establish the fact of presence and the level of dependence between various economic phenomena in the form of corresponding mathematical equations. Such an analytical assessment of data focuses on specialists on established trends in the past, making it possible to create a transparent resource management policy based on relevant forecasts.

The main motivation of this paper to prove the correlation between the customer capital and the company's MV. The result of studying the impact of customer capital on the MV should be an equation that allows you to understand how much the company's MV will change if the customer capital changes. Previous findings regarding the definition of the reflection features of intangible assets that characterize customer capital (IAcust) in the reporting allow us to confirm the vagueness and «fuzziness» of such data, which entails the need to highlight not one but several factors that contain information about customer relationships and are reflected in the reports. If there are a lot of factors, then we get correspondingly as many parameters (coefficients), with the help of which we can predict the company's MV.

Regression analysis requires a fairly large amount of calculations and verification of a number of hypotheses, but with the advent of appropriate software which simplifies the work of the analyst, free versions of such products can be used. In this study, we use such cross-platform software package as a Gretl: Gnu Regression, Econometrics and Time-series Library («GRETL»), designed for econometric modeling based on statistical data.

2 Literature review

Knowing that customer capital is a component of intellectual capital, we have the opportunity to express how the problem of the impact of intellectual capital on various spheres of company activity is being revealed. The impact of intellectual capital on business organization includes such spheres as innovation, competitive advantage, research and development, business performance, value creation, organizational strategy, and competence and capability [Abdulaali, 2018].

There are researchers whose works are dedicated to the problem of establishing the impact of intangibles on the company's MV, in particular, factors such as *intellectual capital* [Chen et al, 2005; Tseng and Goo, 2005; Maditinos et al, 2011; Khangah et al, 2012; Berzkalne and Zelgalve, 2014; Bchini, 2015; Nimtrakoon, 2015; Nuryaman, 2015; Sardo and Serrasqueiro, 2017; Ahmed et al, 2019; Forte et al, 2019; Mačerinskienė and Survilaitė, 2019], *intangible assets* [Shahman, 2004; Volkov and Garanina, 2008; Behname et al, 2012; Ramirez and Hachiya, 2012; Shih, 2013; Castro, 2014; Jaara and Elkotayni, 2016; Glova and Mrazkova, 2018; Ocak and Findik, 2019; Vasconcelos et al, 2019], and *goodwill* [Chauvin and Hirschey, 1994; Shahman, 2004; Li et al., 2010; Cole, 2012]. Only one article related directly to the main focus of our study explores the relationship between customer capital and the company's MV [Taghieh et al, 2013]. These scholars establish the relationship between intangibles and the company's MV using mathematical models based on the reporting data from companies in different countries.

The problem of measuring the components of intellectual capital is polemic and difficult [Andreeva and Garanina, 2015]. The understanding that customer capital is the one component of intellectual capital in accounting is known as intangible assets leads us to the fact that researchers who devoted their works to the impact of intangible assets on the company's value could also study issues with the similar effect of customer capital (Table 1).

According to Chen et al. [2005] the advertising expenditure doesn't have a significant impact on MV. In support of along this line of thought, Sardo and Serrasqueiro [2017] reject the hypothesis that the relational capital has a positive effect on firms' MV. But the results in most articles (Table 1) show that the impact of customer (relational) capital on the company's MV is significant. Tseng and Goo [2005] propose eight useful value-creating paths, one of which is effectively managing the effect of relationship capital on enhancing corporate value. According to the results of Taghieh et al. [2013], relational capital has a significant and positive effect on financial performance and firm value. The authors conclude that customer capital, which is considered as a bridge or catalyst in intellectual capital activities, is the dominant and determining

Table 1. Examples of articles on the impact of customer capital on company's MV

Year of publication	Author/ Authors	Findings/results	
		Regarding all intangible assets	**Regarding customer (relational, relationship) capital**
2005	M.C. Chen, S.J. Cheng, and Y. Hwang	The firms' intellectual capital has a positive impact on MV and financial performance, and may be an indicator for future financial performance	*The object–advertising expenditure.* The authors suggested that companies with greater advertising expenditure tend to have higher market-to-book value ratios, but according to the results of correlation analysis it was found that the coefficient on advertising expenditure is not significant
2005	C.-Y. Tseng and Y.-J.J. Goo	The results generally support the hypothesis regarding the relationship between intellectual capital and corporate value	*The object–relationship capital.* The findings of this study suggest that relationship capital directly influence corporate value
2013	M.B. Taghieh, S. Taghieh, and Z. Poorzamani	It can be concluded that customer capital, which is considered as bridge or catalyst in intellectual capital activities, is the dominant and determining factor to change intellectual capital to the MV, accordingly, the company's business performance	*The object–relational capital.* Based on the results of testing hypotheses, relational capital has significant and positive effect on firm value
2015	B. Bchini	Based on the survey data in Tunisia, the authors find that the link between intellectual capital and value creation is linear and positive in manufacturing companies	*The object–relational capital.* The results of these regressions are presented that the relationship between relational capital and value creation in the Tunisian manufacturing companies is statistically significant
2017	F. Sardo and Z. Serrasqueiro	Concerning firms' MV, the current study shows that human capital and structural capital have higher contribution to firm's MV. Therefore, human capital can be seen as the main driver of firms' future growth and innovativeness	*The object–relational (or customer) capital.* As a result of the regression analysis, it was found that the hypothesis that relational capital has a positive effect on firms' MV was rejected
2018	I. Yilmaz and G. Acar	Amongst the components of multiple factors model, the most influential explanatory variable was capital employed, then comes human capital, and relational capital. Structural capital has the lowest effect on explaining both company's value and performance	*The object–relational capital.* The relational capital has positive and significant effect on M/B ratio

M/B, market to book; MV, market value.

factor to change intellectual capital to the MV, accordingly, the company's business performance. Based on the survey data in Tunisia, Bchini [2015] finds that the link between relational capital and value creation is linear and positive in manufacturing companies. The analysis of Yilmaz and Acar [2018] reveals that relational capital efficiency (RCVA) has a significant positive impact on the market to book (M/B) ratio, which is used for evaluating the MV of companies. Supposedly, the authors' conclusions differ because of the selected data were taken from different countries' reporting.

In this study, research and development (R&D) costs (expenses, expenditures) are also considered as a factor that includes information about customer capital and the level of investment in customer relationships. There are articles devoted to the impact of R&D costs on the company's MV [Chen et al, 2005;

Lantz and Sahut, 2005; Duqi and Torluccio, 2011; Ramirez and Hachiya, 2012; Glova and Mrazkova, 2018; Pazarzi and Sorros, 2018].

From the result of the literature review, we find only one work in which the problem of the impact of customer (relational) capital on the company's MV is investigated [Taghieh et al, 2013]. Therefore, such empirical research becomes necessary for the development of a direction for studying the importance of managing this type of capital.

3 Research design

3.1 Research hypotheses

The hypothesis of this study is the fact that the customer capital has a positive impact on the company's MV. The conditions of such a study are not accurate because if we know the company's MV, then such a value as customer capital is not provided in the companies' reports or other sources.

3.2 Sample selection

To determine the impact of such a component of intellectual capital as customer capital on the company's MV, we selected a sample for our research, which was presented by 100 U.S. stock market leaders. The shares of these companies are publicly traded on US exchanges, in particular on the New York Stock Exchange (NYSE) and on the National Association of Securities Dealers Automated Quotations (NASDAQ). The information about the companies of this sample of and different values of companies' reporting data were taken from the website of «Stock Analysis on Net» [Stock Analysis on Net: 100 U.S. Stock Market Leaders]. The list of these companies is constantly being updated, so it should be noted that for this study, a list was taken that was relevant as of January 10, 2020 (see Appendix 1). To clarify the information (for example, to calculate the residual value of the intangible assets), we additionally used the financial statements from the official websites of companies (mainly the annual report—Form 10-K) and data from other sites that are positioned as providers of financial information [Yahoo Finance; The Wall Street Journal; MarketWatch]. The analyzed reports were compiled in accordance with the requirements of IFRS 3 «Business Combinations» and included information about customer capital. To describe the company's customer capital, we combined «Customer-related intangible assets» (customer lists, customer relations, etc.) and partially «Marketing-related intangible assets» (only trademarks, brands).

3.3 Variable definition

Problems arise at the stage of understanding the limited information support of customer capital management for the needs of value-based management: the main source of information—the accounting system—does not give a clear answer regarding the amount of company's customer capital. Understanding that the data on customer capital is limited to information about intangible assets that directly characterize relations with customers gives an impetus to identifying new sources of information support. The informational basis for analyzing customer capital of is formed by the corresponding intangible assets, which are divided into those that are directly related to customers and those related to marketing, anyway, we conclude that this does not reflect the real value of customer capital and does not form its general vision. This «fuzziness» of the reported customer capital data suggests that they can be hidden in other lines of reporting.

At first, we combine intangible assets related to customers (customer lists, customer base, order or production backlog, etc.) and related to marketing (trademarks, trade names, brands) in one group—IAcust. It is these intangible assets are the object of this study.

The first variant of the regression model—simple linear regression—consists of the dependent variable (company's MV) and the independent variable (IAcust).

The second variant of the regression model includes more independent variables. In addition to IAcust, this variant includes factors such as other intangible assets, GW, and R&D costs. In authors' opinion, the

proposed factors are added to the model, because they include information about customer capital with a high degree of probability.

First, based on the assumption of the separation of the customer capital into information, reputational, contractual, and personal components, there is a high probability that data on other intangible assets include information about customer capital. For example, the information component of customer capital, which includes Customer relationship management systems, the customer base, is at the intersection with organizational capital, which makes it possible to disperse data on customer capital within other intangible assets.

Second, GW information may obscure information that characterizes the company's customer capital. This is because GW absorbs data on assets that do not meet the recognition criteria for identifiable intangible assets. For example, the business reputation and prestige are directly dependent on the level of customer loyalty, and therefore the relations between the company and its customers will be displayed on the amount of GW. Historically, customer capital has been known as «goodwill»: the propensity of clients to repeat, strengthen, and sustain relationships with an organization [Roberts, 2007]. In historical development one of the first approaches to the understanding of the appearance of GW was purely customer capital concept of GW [Van der Merwe, 1996]. None of the components of GW that give rise to the excess earnings (future intangible value, synergies, reputation, assemblage, and workforce) are closely related to customer relationships. Alternatively, customer relationships are a derivative of the components of GW [Prall, 2019].

Third, the amount of expenses incurred in organizing and conducting special studies related to customer capital is not displayed as the corresponding intangible assets, therefore R&Dcosts may contain information about the customer capital and the company's policy regarding the amount of investment expenses in improving the strategy of cooperation with customers. As a proof, Hulten and Hao [2008] noted that in order for value added to turn into an intangible asset (brand), it is necessary to invest in the development of a product (or service).

The third variant of the regression model—multilinear regression—consists of a dependent variable (MV) and seven independent variables: IAcust, other intangible assets, GW, R&Dcosts, the company's size by its total assets (TA), the intensity of research and development (Int), and financial leverage (FinLev). We supplemented this model with three independent variables that are used to control for industry and other specific features of the company.

3.4 Model

We want to examine the relationships between the company's MV and customer capital using single and multiple regression models. The ordinary least squares method is used to test the hypothesis in this study. This method allows us to establish regularities on the basis of random fluctuations and to build forecasts based on the obtained results. To establish the level of probability of explaining the dependent variable through independent variables, we use the coefficient of determination (R^2). All variants of the regression model are checked for adequacy to sample data (F-test) and the absence of multicollinearity of the independent variables (correlation matrix, coefficients of determination).

4 Empirical results

We hypothesize that customer capital has a direct impact on the company's MV. Following this we test the relation between customer capital and the company's MV using three variants of the regression model (Table 2). The models are the same in the part of the dependent variable, which is represented by the MV, and differ in the number of independent variables.

IAcust are calculated as the sum of such intangibles as brands (brand assets), customer base, customer contracts, customer lists, customer programs, customer relationships, customer-related assets, costs incurred to obtain contracts with customers, loyalty card holders, order backlog, purchasing and payer contracts, trademarks, and trade names. Other intangible assets are calculated as the total intangible assets, minus the total IAcust. GW, research and development costs and TA are

Table 2. The variants of regression models of the impact of customer capital on company's MV

Model 1		**Model 2**		**Model 3**	
Dependent variable					
MV					
Independent variable		**Independent variables**		**Independent variables**	
IAcust	Intangible assets that characterize customer capital	IAcust	Intangible assets that characterize customer capital	IAcust	Intangible assets that characterize customer capital
		IAother	Other intangible assets	IAother	Other intangible assets
		GW	Goodwill	GW	Goodwill
		RD	Research and development costs	RD	Research and development costs
				TA	Total assets
				Int	Research and development intensity
				FinLev	Financial leverage

MV, market value.

taken from annual report (Form 10-K) of analyzed companies. The level of companies' research and development intensity is determined according to results of work of Galindo-Rueda and Verger [2016], who proposed the classification of R&D intensity by industry. FinLev is calculated by dividing the total liabilities by the shareholder equity of the analyzed company.

The first variant of the regression model (Model 1)—simple linear regression—consists of the dependent variable (MV) and the independent variable (IAcust). This model is built by using the cross-platform software package «GRETL», and follows the regression Equation (1.1) stated as follows:

$$\hat{y} = 135010 + 1.46x_1, \quad (1.1)$$

where y—MV (market value);

x_1—IAcust (intangible assets that characterize customer capital).

The failure of Model 1 is caused by a low coefficient of determination (R^2) of value 0.0045. The closer coefficient of determination (R^2) is to 1, the more real the results of using the model will be.

This ratio shows what part of the dependent variable is explained by regressors. The determination coefficient varies in the range of [0, 1] and should be >0.2 [Mačerinskienė and Survilaitė, 2019].

It is inadvisable to use the regression equation of Model 1 for predicting the company's MV due to the lack of links between it and its customer capital. According to the results of the analysis, using a simple linear regression with one factor based on the reporting data of 100 U.S. stock market leaders for 2018, we came to the conclusion that the intangible assets characterizing the customer capital do not affect the company's MV. The problem of the lack of links between these measures can lay in the issue that IAcust does not demonstrate the real size of customer capital.

According to Yilmaz and Acar [2018], the models with multi-factor components present better results in understanding MV. Therefore, the inappropriateness of Model 1 leads to the need to expand the number of factors characterizing customer capital, which hypothetically can make the model more correct for practical users. Though we know the number of companies that don't have IAcust in their reports, we have to take into account that the absence of such reporting data in 35 out of 100 companies does not prove their actual absence. Thus, due to the failure of the single-factor model, we will use regression analysis with other factors that can characterize the customer capital of the company.

In the second variant of the regression model (Model 2) we use the company's MV as a dependent variable, and as independent variables we use IAcust, other intangible assets, GW, and R&D costs.

This model, built using the cross-platform software package «GRETL», follows the regression Equation (1.2):

$$\hat{y} = 65729.5 + 0.71x_1 + 0.42x_2 + 0.11x_3 + 26.79x_4 \quad (1.2)$$

where y—MV (market value);
x_1—IAcust (intangible assets that characterize customer capital);
x_2—IAother (other intangible assets);
x_3—GW (goodwill);
x_4—RD (R&D costs).

According to the t-test results, the constant (const) and the R&D costs (RD, x_4) are recognized as the most significant in the presented regression equation.

Table 3 shows the statistical characteristics of the sample.

Table 3 shows summary statistics for all variables of the analyzed regression model (Model 2), which generally inform about the values from the sample (e.g., minimal, average (mean), and maximum value for each variable). It should be noted that for all independent variables the minimum value is 0, which means in the sample of companies there are companies that do not have reporting data for the selected factors that characterize the customer capital.

In support of the practicability of Model 2, we note that the coefficient of determination (R^2) of that model is 0.4, which is higher than in Model 1 ($R^2 = 0.0045$). This makes it possible to use this equation to predict the company's MV with a probability of 40%.

The presented regression (Model 2) of 40% explains the changes in the company's MV (MV, y). The remaining 60% of the changes in the MV are due to other factors that are not included in the presented equation as independent variables.

According to the results of *F*-test (Fisher test), the proposed regression model (Model 2) is recognized as adequate to sample data, because the comparing (using the cross-platform software package «GRETL») of the observed value of F [4, 95] with the critical value of F [4, 95] shows that $F_{observed}$ is higher than $F_{critical}$ ($F_{critical}$ (2.47)<$F_{observed}$ (15.76) with a probability of error of 0.05, which confirms the basic requirement of this test.

One of the requirements of multiple regression is the lack of highly correlated independent variables. First, we demonstrate the correlation coefficients for the independent variables of Model 2 (Table 4).

The correlation coefficient between GW and IAcust is 0.65, which is the most significant correlation between independent variables in Model 2.

Next, we will construct a correlation matrix to establish the level of the collinearity of the independent variables of Model 2 (Figure 1).

The data from Table 4 and Figure 1 suggest the absence of multicollinearity of the variables of Model 2, due to the lack of correlation coefficients with a value >0.7. There is one negative correlation between GW/IAother, which means that increasing one variable (GW) will decrease another (other intangible assets).

For another variant of testing for multicollinearity, we estimate the regression models, where x_1, x_2, x_3, and x_4 will be dependent variables, and all other factors will be independent variables. Thus we find the coefficients of determination of variables (Table 5).

According to the data of Table 5 the multicollinearity for the selected variables is rejected because all values are <0.7.

The proposed regression equation of Model 2 can be used by managers to predict the company's MV with a probability of 40%. Verification by various tests shows that model is adequate to sample data (F-test) and the multicollinearity for the independent variables is rejected (correlation matrix, coefficients of determination).

Table 3. Summary statistics, using the observations 1–100 (Model 2)

Variable	Mean	Median	Standard deviation	Min	Max
MV	1,40,107	92,998	1.65e + 0.05	26,262	9,56,625
IAcust	3,481	432	7,537	0	45,358
IAother	8,461	1,367	20,395	0	1,38,005
GW	17,092	8,801	21,745	0	1,46,370
RD	2,480	915	3,858	0	21,419

GW, goodwill; IAcust, intangible assets that characterize customer capital; MV, market value; RD, research and development.

Table 4. Correlation coefficients for independent variables of Model 2 using the observations 1–100

IAcust	IAother	GW	RD	Variables
1.0000	0.3239	0.6493	0.0127	**IAcust**
	1.0000	0.6346	−0.0696	**IAother**
		1.0000	0.0985	**GW**
			1.0000	**RD**

GW, goodwill; IAcust, intangible assets that characterize customer capital; RD, research and development.

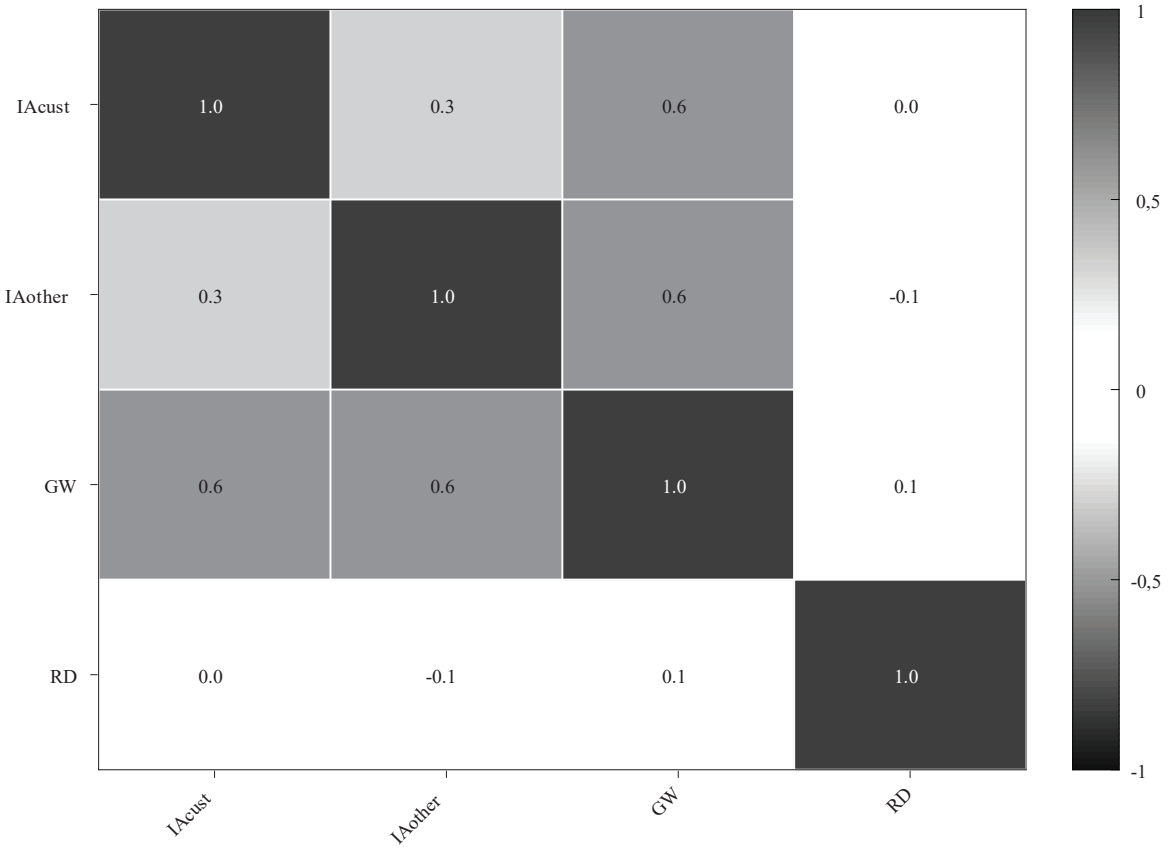

Figure 1. Correlation matrix of Model 2. GW, goodwill; IAcust, intangible assets that characterize customer capital.

Understanding that about 60% of changes in MV are due to other factors that are not included in the presented equation (Model 2) as independent variables, we expand the number or the independent variables to increase the probability of predicting MV.

In the third variant of the regression model (Model 3) we use the company's MV as a dependent variable while IAcust, other intangible assets (IAother), GW, R&D costs (RD), the company's size by its TA, the Int, and FinLev as independent variables.

Now add to Model 2 such independent variables as the company's size, the Int, and FinLev, which are used to control the industry and other specific features of the company. We assume that the added factors have a significant effect on the company's MV .

In particular, the size of the company is a very important indicator that directly affects the MV of the company. The reporting makes it possible to see the size of the company as TA, but in calculations we use the natural logarithm of TA at the end of period to reduce the dispersion of data and simplify their processing.

Table 5. Coefficients of determination

R^2	IAcust	0.44
	IAother	0.44
	GW	0.64
	RD	0.05

GW, goodwill; IAcust, intangible assets that characterize customer capital; RD, research and development.

Using the findings of the work of Galindo-Rueda and Verger [2016, p. 14], who classified companies by its average weighted levels of R&D costsand the specifics of the company's activities into levels, we divide 100 U.S. stock market leaders in accordance with this taxonomy (high, middle, or low R&D intensity). These authors relate the ratio of R&D intensity to value added within an industry.

FinLev is a ratio calculated by dividing the company's total liabilities with the company's shareholder equity. The information about this ratio is necessary for investors to understand the level of possible risks.

This model, built using the cross-platform software package «GRETL», follows regression Equation (1.3):

$$\hat{y} = -794438 + 0.24x_1 - 0.9x_2 - 1.45x_3 + 19.55x_4 + 80992.2x_5 + 12414,4x_6 - 21.51x_7 \quad (1.3)$$

where y—MV (market value);

x_1—IAcust (intangible assets that characterize customer capital);

x_2—IAother (other intangible assets);

x_3—GW (goodwill);

x_4—RD (R&D costs);

x_5—TA (logarithm of total assets);

x_6—Int (research and development intensity—high, middle, or low);

x_7—FinLev (financial leverage)

According to the *t*-test results, the constant (const), R&D costs (RD, x_4) and the TA are recognized as the most significant in the presented regression equation.

Table 6 shows the statistical characteristics of the sample.

The difference between Model 2 and Model 3 is the addition of three control variables (TA (log), Int, FinLev) in Model 3. The Table 6 shows summary statistics, which generally inform about the values from the sample (e.g., minimal, average (mean) and maximum value for each variable).

According to the calculations in the cross-platform software package «GRETL», the coefficient of determination (R^2) of Model 3 is 0.52, which is higher than in Model 1 ($R^2 = 0.0045$) and higher than in Model 2 ($R^2 = 0.4$). This makes it possible to use this equation to predict the company's MV with a probability of 52%.

According to the results of *F*-test (Fisher test), the proposed regression model (Model 3) is recognized as adequate to sample data, because the comparing (using the cross-platform software package «GRETL») the observed value of *F* [7, 92] with the critical value of *F* [7, 92] shows that $F_{observed}$ is higher than $F_{critical}$ ($F_{critical}$ (2.11)<$F_{observed}$ (14.09) with a probability of error of 0.05, which meets the basic requirement of this test.

Next we check the correlation coefficients of the independent variables of Model 3 (Table 7).

The correlation coefficient between GW and IAcust is 0.65, which is the most significant correlation between independent variables in Model 3 (similar to Model 2). The correlation matrix, which establishes the level of the collinearity of the independent variables of Model 3, is shown in Figure 2.

Similar to Model 2, the data from Table 7 and Figure 2 suggest the absence of multicollinearity of the variables of Model 3, which is due to the lack of correlation coefficients with a value >0.7. There are some negative correlation values which mean that increasing of one variable will decrease another (e.g., IAcust/Int, IAother/RD, FinLev/TA).

For another variant of testing for multicollinearity, we estimate the regression models, where x_1, x_2, x_3, x_4, x_5, x_6, and x_7 will be dependent variables, and all other factors will be independent variables. Thus we find the coefficients of determination of variables (Table 8).

According to the data of Table 8 the multicollinearity for the selected variables is rejected because all values are <0.7.

Table 6. Summary statistics, using the observations 1–100 (Model 3)

Variable	Mean	Median	Standard deviation	Min	Max
MV	1,40,107	92,998	1.65e+0.05	26,262	9,56,625
IAcust	3,481	432	7,537	0	45,358
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GW	17,092	8,801	21,745	0	1,46,370
RD	2,480	915	3,858	0	21,419
TA (log)	10.95	10.93	0.96	8.55	13.18
Int	1.92	2.00	0.88	1.00	3.00
FinLev	14.53	1.69	85.12	–8.03	805.6

FinLev, financial leverage; GW, goodwill; IAcust, intangible assets that characterize customer capital; MV, market value; RD, research and development; TA, total assets.

Table 7. Correlation coefficients for independent variables of Model 3, using the observations 1–100

IAcust	IAother	GW	RD	TA	Int	FinLev	Variables
1.0000	0.3239	0.6493	0.0127	0.3903	–0.0998	–0.0621	**IAcust**
	1.0000	0.6346	–0.0696	0.4128	–0.0884	–0.0571	**IAother**
		1.0000	0.0985	0.5850	0.0021	–0.0962	**GW**
			1.0000	0.3290	0.4661	0.0176	**RD**
				1.0000	–0.0794	–0.1267	**TA**
					1.0000	–0.0585	**Int**
						1.0000	**FinLev**

FinLev, financial leverage; GW, goodwill; IAcust, intangible assets that characterize customer capital; Int, intensity of research and development; RD, research and development; TA, total assets.

Model 3 can be used by managers to predict the company's MV with a probability of 52%, which is higher than in Model 1 and in Model 2. Verification by various tests shows that model is adequate to sample data (*F*-test) and the multicollinearity for the independent variables is rejected (correlation matrix, coefficients of determination).

The proposed variants of regression models prove that the customer capital as intangible assets characterized customer capital (the sum of «Customer-related intangible assets», and partially «Marketing-related intangible assets») has a direct impact on the company's MV, but the values of this impact are insignificant.

It should be noted that with an increase in the number of factors in the regression equation, the value of the impact of the customer capital on the company's MV decreases. The regression coefficient of the customer capital in Model 1 equals 1.46 (1 factor), in Model 2—0.71 (4 factors), in Model 3—0.24 (7 factors). This coefficient describes the relationships between customer capital and the company's MV. The positive sign indicates that as customer capital increases, the company's MV also increases.

All variants of regression models include information about intangible assets that characterized customer capital, but not all can be recommended for practical use. We don't recommend Model 1 as it is rejected for practical use because of its low value of R^2 (0.0045). This statistical measure (R^2) determines the proportion of variance in the dependent variable (company's MV) that can be explained by the independent variable (customer capital). In turn, the coefficient of determination (R^2) in Model 2 is 0.4, which allows managers to use this regression equation to predict the company's MV with a probability of 40%. But the highest probability is ensured by the use of Model 3 in which the coefficient of determination is 0.52.

Various tests conducted by us show that Model 2 and Model 3 are adequate to sample data (*F*-test) and the multicollinearity (for the independent variables) is rejected (correlation matrix, coefficients of determination). Therefore, Model 2 and Model 3 are recommended for practical use.

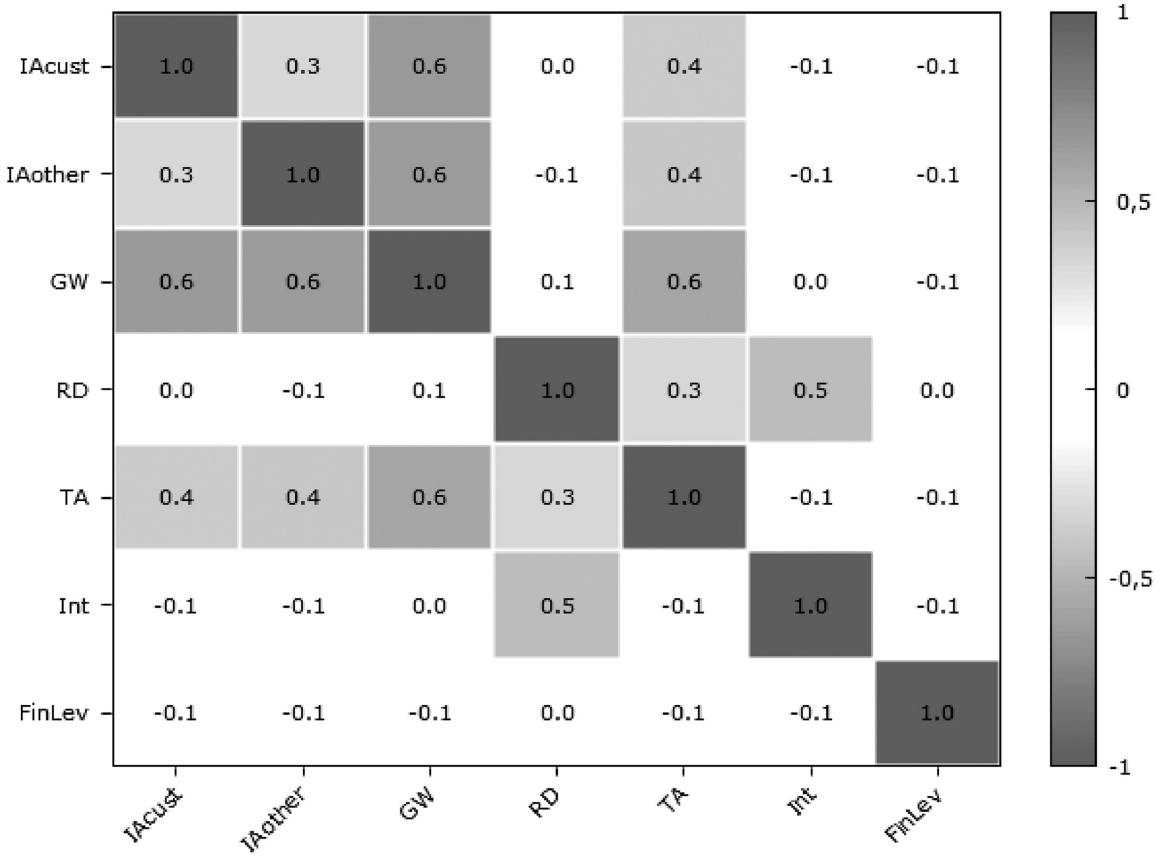

Figure 2. Correlation matrix of Model 3. FinLev, financial leverage; GW, goodwill; IAcust, intangible assets that characterize customer capital; Int, intensity of research & development.

Table 8. Coefficients of determination

R^2	IAcust	0.45
	IAother	0.45
	GW	0.68
	RD	0.40
	TA	0.49
	Int	0.31
	FinLev	0.03

FinLev, financial leverage; GW, goodwill; IAcust, intangible assets that characterize customer capital; Int, intensity of research and development; RD, research and development; TA, total assets.

5 Conclusion

The aim of this paper was to establish the relationship between the customer capital and the company's MV. The hypothesis of this study is the fact that the customer capital has a positive impact on the company's MV. Similar issues were developed in previous research by other authors, in particular, the works of Chen et al. [2005], Tseng and Goo [2005], Taghieh et al. [2013], Bchini [2015], Sardo and Serrasqueiro [2017], and Yilmaz and Acar [2018]. But it is noteworthy that the authors' conclusions are not the same in the context of the impact of customer (or its components) on the value of the company.

The unique aspect of the study was the establishment of the impact of customer capital on the company's MV from two perspectives. The first approach provided that customer capital represented only

IAcust. According to the requirements of IFRS 3 «Business Combinations» we combined «Customer-related intangible assets» (customer lists, customer relations, etc.) and partially «Marketing-related intangible assets» (only trademarks, brands) that constituted the object of this approach (IAcust). In the second approach, the information about customer capital, in addition to the aforementioned intangible assets, could be dispersed to other intangible assets, GW and R&D costs.

The study demonstrates that the first approach (Model 1) is rejected for practical use, which is due to the low value of the coefficient of determination. In turn, the coefficient of determination in the second approach is higher and allows managers to use the regression equation to predict the company's MV with a probability of 40% (Model 2) or 52% (Model 3).

Model 3 (as an extended version of Model 2) demonstrated a higher probability in predicting the company's MV than Model 2, due to the addition of control variables such as the company's size, the Int, and FinLev, which are used to control the industry and other specific features of the company.

The presented regression analysis based on the reporting data of 100 U.S. stock market leaders showed that intangible assets characterizing customer capital have a direct impact on the company's MV, but the values of this impact are insignificant. Therefore, we recommended the impact of customer capital on the company's MV analyzed using different indicators, which may include information about customer capital. Particular attention should be paid to R&D costs, which have a significant impact on the company's MV according to the findings of the regression analysis.

This study has some limitations. One of the limitations of this study is the relevance of the research results can't be applied to all companies, but only to 100 U.S. stock market leaders. These companies are exemplars, which leads them to maintain the most transparent information policy that provides open access to reports that are provided as quickly as possible, which affects their position in the stock markets. Further development of research in this direction may cover other samples of companies, which will reveal general trends and differences in results. The second limitation of this study is taking into account information only for 1 year (2018). Therefore, one of the possible directions for future research could be a comparison of results of identical regression models in dynamics (for example, for the period of 5 years), which allows researchers to identify trend changes in development.

The needs of value-based management require the establishment of relationships between various factors and the company's MV in the form of mathematical models. A priori the intangibles are very important in the process of creating value for companies. The developed models can be used as a guide for managers in the processes of effective management of intellectual capital and its components, which enables seeing links between the company's MV and intangible value drivers.

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Appendix 1

100 U.S. stock market leaders (the list was relevant as of January 10, 2020)

No	Company	No	Company
1	3M Co.	51	Illinois Tool Works Inc.
2	Abbott Laboratories	52	Intel Corp.
3	AbbVie Inc.	53	International Business Machines Corp.
4	Accenture PLC	54	Intuit Inc.
5	Adobe Inc.	55	Intuitive Surgical Inc.
6	Allergan PLC	56	Johnson & Johnson
7	Alphabet Inc.	57	Kimberly-Clark Corp.
8	Altria Group Inc.	58	Kinder Morgan Inc.
9	Amazon.com Inc.	59	Kraft Heinz Co.
10	Amgen Inc.	60	Linde plc
11	Apple Inc.	61	Lockheed Martin Corp.
12	Applied Materials Inc.	62	Lowe's Cos. Inc.
13	AT&T Inc.	63	Marriott International Inc.
14	Automatic Data Processing Inc.	64	McDonald's Corp.
15	Becton, Dickinson & Co.	65	Medtronic PLC
16	Biogen Inc.	66	Merck & Co. Inc.
17	Boeing Co.	67	Microsoft Corp.
18	Booking Holdings Inc.	68	Mondelēz International Inc.
19	Boston Scientific Corp.	69	Netflix Inc.
20	Bristol-Myers Squibb Co.	70	Nike Inc.
21	Broadcom Inc.	71	Northrop Grumman Corp.
22	Caterpillar Inc.	72	NVIDIA Corp.
23	Charter Communications Inc.	73	Occidental Petroleum Corp.
24	Chevron Corp.	74	Oracle Corp.
25	Cisco Systems Inc.	75	PepsiCo Inc.
26	Coca-Cola Co.	76	Pfizer Inc.
27	Colgate-Palmolive Co.	77	Philip Morris International Inc.
28	Comcast Corp.	78	Phillips 66
29	ConocoPhillips	79	Procter & Gamble Co.
30	Costco Wholesale Corp.	80	Qualcomm Inc.
31	CSX Corp.	81	Raytheon Co.
32	CVS Health Corp.	82	Regeneron Pharmaceuticals Inc.
33	Danaher Corp.	83	salesforce.com Inc.
34	Delta Air Lines Inc.	84	Schlumberger Ltd.
35	DuPont de Nemours Inc.	85	Starbucks Corp.
36	Eli Lilly & Co.	86	Stryker Corp.
37	Emerson Electric Co.	87	Target Corp.
38	EOG Resources Inc.	88	Texas Instruments Inc.
39	Estée Lauder Cos. Inc.	89	Thermo Fisher Scientific Inc.
40	Exxon Mobil Corp.	90	TJX Cos. Inc.
41	Facebook Inc.	91	T-Mobile US Inc.
42	FedEx Corp.	92	Union Pacific Corp.
43	Ford Motor Co.	93	United Parcel Service Inc.
44	General Dynamics Corp.	94	United Technologies Corp.
45	General Electric Co.	95	UnitedHealth Group Inc.
46	General Mills Inc.	96	Verizon Communications Inc.
47	General Motors Co.	97	Walgreens Boots Alliance Inc.
48	Gilead Sciences Inc.	98	Walmart Inc.
49	Home Depot Inc.	99	Walt Disney Co.
50	Honeywell International Inc.	100	Zoetis Inc.