Does Intellectual Capital Affect Financial Performance and Non-Performing Loans? Evidence From the Banking Sector in Turkey

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Abstract

The purpose of this study is to empirically examine the impact of intellectual capital (VAIC) capacity of 21 Turkish banks on financial performance (ROA) and non-performing loans (NPL) from 2004 to 2020. Panel data technique was used for analysis. The study results suggest that banks' intellectual capital is vital for their profitability, credit risk and competitive advantage. As far as known, this is one of the first empirical researches in Turkey that examines the impact of IC and its components on financial performance and non-performing loans of the Turkish banking sector in the long term.

Keywords: Intellectual Capital, VAIC, Financial Performance, Non-Performing Loans, Banks, Credit Risk

JEL Classification: F31, F41, L25.

Öz - Entelektüel Sermaye Finansal Performansı ve Takipteki Kredileri Etkiler mi? Türk Bankacılık Sektöründen Kanıtlar

Bu çalışmanın amacı, 2004'ten 2020'ye kadar 21 Türk bankasının entelektüel sermaye (VAIC) kapasitesinin finansal performans (ROA) ve takipteki krediler (NPL) üzerindeki etkisini ampirik olarak incelemektir. Analiz için panel veri tekniği kullanılmıştır. Çalışma sonuçları, bankaların entelektüel sermayelerinin karlılık, kredi riski ve rekabet avantajı için hayati önem taşıdığını göstermektedir. Bilindiği kadarıyla bu çalışma, IC ve bileşenlerinin Türk bankacılık sektörünün uzun vadede finansal performansına ve takipteki alacaklarına etkisini inceleyen Türkiye'deki ilk ampirik araştırmalardan biridir.

Anahtar Kelimeler: Entelektüel Sermaye, VAIC, Finansal Performans, Takipteki Krediler, Banka, Kredi Riski.

JEL Sınıflandırması: F31, F41, L25.

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1. Introduction

Intellectual capital (IC) has recently played an important role in the performance of a business. Factors such as the development of technology, globalization, artificial intelligence, robotic production increase the benefits of human resources even more. In this respect, businesses with a good intellectual capital can make a visible difference compared to their competitors or counterparts (Pulic, 2004: 67; Wang, 2011: 244; El-Bannany, 2008: 495). Therefore, enterprises with high intellectual capital levels may be expected to be more efficient and profitable than others.

Their seemingly valuable, rare, inimitable and non-transferable qualities can contribute to the competitive advantage of firms (Barney, 1991: 116). In this way, it is easier to achieve the goal of maximizing the profit of the business owners. Researchers believe that managers should give more importance to the internal knowledge and development of the business during its establishment phases (Edvinsson, 1997: 68). The more the necessary conditions are met during the establishment phase, the easier it can be for the business to gain competitive edge and then turn this advantage into profitability.

Most of the researchers state that information is never-ending, but its effect, from time to time, sways up and down (Mavridis, 2004: 44). This in- formation is considered very important for those, who have a long-term and endless resource to ensure a sustainable economic development. Companies with information will have the most important driving force for production (World Bank, 1999: 20). Businesses become as much valuable as the information they obtain and thus can produce the products required by society. Besides, the information that is obtained can become a basic and dominant economic resource, and perhaps one of the most important competitive advantage factors as well (Mavridis, 2004). In the studies that were carried out, it was revealed that this situation is binding not only to the production sector but also to the banking sector, which is in the service industry (Pulic, 2004).

In recent years, service sectors have also played a dominant and important role in the growth of economies. This effect has increased considerably today, when the financial sector has started to play a more active role in global trade. However, it is known that world economies are moving towards more commercial liberalization and globalization. Being able to compete has become vital for the continuity of businesses. At this point, tangible assets by themselves have become insufficient to ensure the competitiveness of businesses. Consequently, given the fact that banks are composed of intellectual and intangible resources by their nature and play an important role in the value creation process, it has become crucial to investigate

the efficiency of creating value in banking and analyze how well intellectual capital resources are managed.

In the globalizing world and in highly competitive markets, economic value and economic assets include not only the material products produced by businesses, but also the intangible assets of the enterprise, i.e. intellectual capital types (Goldfinger, 1997: 36). As it can be said that intellectual capital can create as much as or even higher value than material assets in terms of value creation. In this period of information, where intellectual capital has become one of the important production and service factors, the impact of intellectual capital on business performance has gained significance for businesses. But at this stage, it is important to measure the intellectual capital correctly, which is considered to be among the intangible fixed assets. Performance measurements for businesses are no longer possible with traditional accounting practices. Therefore, developing new methods that take into account intellectual capital has become an increasing necessity (Mavridis, 2004: 93).

Since Turkey is a developing country and has a history of banking-based crisis, non-performing loans are an important issue. In addition to the 2001 crisis in Turkey, the fact that the 2008 global financial crisis is a banking-based crisis that started in the USA increases the importance of the issue. Finally, the main motivation is the lack of a study on the effect of the intellectual capital capacities of Turkish banks on the non-performing loan ratios. The study period covers the 15-year-long period between 2004 and 2019. The study universe included 3 state and 18 private deposit banks making a total of 21 that are functioning in Turkey and have at least 3 branches with good regional distribution, so as to represent the intellectual capital capacity as good as possible.

The study contributes to the literature. This study investigates the effect of intellectual capital on non-performing loans, different from existing studies, as the original value of this study. Analysis results provide us evidence that intellectual capital efficiency reduces NPL ratios (NPLL) in Turkish commercial banks. Research findings also show that non-performing loans (NPLL) in the Turkish banking sector are mostly affected by the human capital efficiency coefficient (HCE). This result provides important information as it shows that Turkish banks can reduce their credit risks by paying more attention to employing expert and experienced personnel. In this study, it will be very useful to emphasize the positive effect of the potential of human capital efficiency coefficient (HCE) to reduce non-performing loans and to recommend that decision makers and bank managers make investments in this direction.

2. Theorical Background, literature review and hypothesis

According to the resource-based theory, a firm's resources are human resources, organizational resources, and tangible or intangible resources (Barney, 1991: 102). Based on this theory, researchers suggest that intangible assets, also known as intellectual capital (IC), are factors that make a difference in firm performance (Edvinsson & Malone, 1997: 15). Information-based intangible assets are considered as critical factors in generating a sustainable competitive advantage that is necessary for the acquisition of superior business performance (Barney, 1991: 100). Bontis et al. (2015: 47) also argues that benefiting from intangible assets is the key to the well-being of a firm. Pulic (2004, 2000) introduced a model known as the VAIC that measures the intellectual efficiency of a firm in the current information economy. According to Pulic (2000: 714), it is about physical/financial, structural and human capital, which create value for model firms.

Similarly Reed, Lubatkin and Srinivasan (2006) state that IC provides the most important competitive advantage for businesses and is a source of value, because it is difficult to imitate and substitute. But they claim that physical capital can be general, easily imitated, substituted and easily purchased. Therefore, it is only the IC that deserves to be viewed as a strategic resource to allow a firm to create added value. This point of view is also consistent with the views of authors such as Wang (2013). Based on the IC-based theory developed by Reed et al. (2006), IC and its components are expected to be positive with the organizational financial performance of banks, which sees IC as the most important strategic asset of companies playing a critical role in creating and maintaining competitive advantage of enterprises.

In studies on the relationship between the effectiveness of intellectual capital and financial performance of financial institutions, VAIC and its components (CEE, HCE and SCE) are used as an indicator of intellectual capital efficiency. On the other hand, return on assets (ROA), return on equity (ROE) are used as an indicator of financial performance, while non-performing loan ratios (NPL) are used as the basic indicator of banks' credit risk (Lee & Hsieh, 2013; Meles et al., 2016; Us, 2020).

Empirical studies conducted in the USA show that credit growth may later lead to an increase in credit losses. He found that the past average loan growth of certain sizes of US banks in the period 1984–1987 was significantly positively associated with the growth rate of non-performing loans (Singh et al., 2015; Santos and Netto, 2020).

Since a bank's recent peak in credit losses, they have seen credit standards loosen and more lending as time has passed. Similar results have been obtained in some other developed countries. In fact, these results are evidence in favor of the "corporate memory hypothesis", meaning that credit workers' ability to recognize potential credit issues may over time erode. This leads to a decrease in loan standards and an increase in lending volume. As a result, along with loan growth, non-performing loans also tend to increase. But in banks with a higher IC this trend is expected to occur less frequently. When it comes to intellectual capital in terms of banks, we see the financial function to be one of the most important determinants of a bank's value (Ting & Lean, 2009). Various studies in the banking sector have often shown a significant positive link between intellectual capital and financial performance (Pulic, 2004; Bontis & Fitz-enz, 2002; Mavridis, 2004; Goh, 2005; El-Bannany, 2008; Karacan and Ergin, 2011; Mondal, 2012; Curado et al., 2014; Singh et al., 2015; Özkan et al., 2017; Oppong: 2019; Ekim, Acar, & Uçan, 2019; Ayaydın, Pilatin and Barut, 2021).

Besides the positive relationship, some studies found no significant relationship between VAIC and the performance of financial institutions in different countries (Joshi et. al. 2013; Özkan et. al. 2017). For example, in the linear regression using a sample of 40 Australian financial companies over the period 2006-2008, he found no relationship between VAIC and its components, namely HCE, SCE and ROA (Joshi et. al., 2013). As mentioned above, many studies in the literature demonstrate that there is a positive relationship between financial performance indicators and VAIC, while few studies reveal a negative relationship between non-performing loans and VAIC (Wang, Lu and Wang, 2013; Curado et al., 2014; Meles et al., 2016). On the other hand, it is not easy to evaluate the contribution of intellectual capital components to business performance. In most of the studies, although there was a positive relationship between intellectual capital and financial performance, there were some different results in terms of intellectual capital components. For example, the studies in India (Tripathy, Gil-Alana, & Sahoo, 2015; Maji & Goswami, 2016) found a positive and significant relationship between relational capital (CEE) and financial performance, while Rehman, Chaudhary, Rehman and Zahid (2011) and Latif, Malik and Aslam, (2012) found that there is no significant link between structural capital and the performance of banks in Pakistan. A study by Ting and Lean (2009) on the Malaysian banking sector revealed that there was no significant relationship between structural capital and financial performance. In another study, Zou and Huan (2011), on the contrary, show that there is an important relationship for the

banks in China. Puntillo (2009) argues that the relationship in Italian banks is limited at best. Obviously, it is not correct to make a generalization that all the components of intellectual capital have a positive effect on the financial performance of banks. Because there may be special situations in some countries and certain banking sectors, where this is not the case.

2.1. Hypothesis Development

Pulic (2004) put the important role of IC efficiency in corporate success in the Australian banking sector to the fore. It has proven that banks that invest more and spend more on IC perform better financially than banks that invest & spend less. Similar results have been obtained in similar studies conducted in different countries. Goh (2005) found in his study that besides the positive impact of VAIC on financial performance, the efficiency of human capital use (HCE) in terms of VAIC components significantly increased an institution's financial performance. In addition to this, the author found that domestic banks are less likely to invest in IC efficiency than foreign banks. Futhermore, most studies have stated that the most important component of VAIC is HC. Therefore, HC should strongly influence corporate performance (Goh, 2005).

In some studies, Chen et al. (2005) have found a positive and significant relationship between ROA and relational capital (CEE). Chan (2009) assessed the impact of VAIC on corporate performance, proving that CEE is positive in all performance measurements, including efficiency.

According to the study of Latif, Malik and Aslam (2012) that evaluated the relationship between structural capital (SCE) and firm performance, it was revealed that SCE and operating performance are highly correlated. Similarly, Bontis, Janoševi´c and Dženopoljac (2015) results are the same. As can be understood from these studies, different results can be obtained in different studies in varying countries.

On the other hand, companies with higher intellectual capital are expected to have low non-performing credit ratios, which are important indicators of credit risk in proportion to their high financial performance. In studies conducted, it was determined that there is a negative relationship between intellectual capital and credit risk (Agusman, Monroe, Gasbarro and Zumwalt, 2008).

From this point of view, the topic was investigated, by analyzing the relationship of a bank's intellectual capital capacity and the components that make up it (CEE, HCE, SCE) with the ratio of commonly used return on assets (ROA) and the ratio of non-performing loans to total loans (NPLL).

In this study, it is estimated that there is a positive relationship between VAIC and ROA, and a negative relationship between NPLL, which can represent the intellectual capital coefficient of Turkish banks as best as possible. Therefore, we assume the hypotheses in

Table 1: Hypotheses of the Study

Hypotheses
$H_{1a.}$ Banks' VAIC has a significant positive effect on ROA.
$H_{1b.}$ Banks' CEE has a significant positive effect on ROA.
$H_{1c.}$ Banks' HCE has a significant positive effect on ROA.
$H_{1d.}$ Banks' SCE has a significant positive effect on ROA.
$H_{2a.}$ Banks' VAIC has a significant negative effect on NPLL.
$H_{2b.}$ Banks' CEE has a significant negative effect on NPLL.
$H_{2c.}$ Banks' HCE has a significant negative effect on NPLL.
$H_{2d.}$ Banks' SCE has a significant negative effect on NPLL.

3. The Data and Methodology

In this section, detailed information will be given about the variables used in data, sample and empirical analysis. There are a total of 34 banks in the Turkish banking system, including state bank and private bank. 3 of the deposits banks are state-owned commercial banks, 9 are domestic privately-owned deposit banks, 1 is United Fund Bank transferred to Savings Deposit Fund, 16 are private banks with foreign capital established in Turkey, 5 are foreign capital funded banks that opened a branch office in Turkey.

3.1. The Data

In the study, dataset belonging to 3 state-owned commercial banks operating in Turkey, 8 private deposit banks and 10 foreign-owned commercial banks established in Turkey was used with a total of 21 banks. The study was made based on the annual data of the banks in the period of 2004-2020. There are 34 deposit banks in Turkey, however 9 of which were not included in the study, as the number of branches they had in Turkey was less than 3. Because in order to measure the effect of intellectual capital more accurately, a sample with higher representation function is expected. The remaining 4 banks were excluded from the study due to

the lack of data for the years 2004-2020. However, the total assets of this data set correspond to 93% of the banking sector's total. In terms of the number of employees, this ratio is around 98%. 21 of the banks that operated in Turkey in the years 2004-2020 are made up of the deposit banks that constituted the scope of this study. In order to test the hypotheses of the research, a large sample of banks belonging to a time period covering 2004-2020 has been used. Put more specifically; the intellectual capital efficiency, data related to the calculation of dependent and independent variables were taken from the database of the Banks Association of Turkey and Banking Regulation and Supervision Agency that included information on bank balance sheets.

3.2. Method

Panel data; individuals, countries, firms, households, such as units of horizontal cross-section observations are brought together in a certain period of time (Baltagi, 1999). In statistical analysis, data can be divided into three classes: Time, horizontal-cross-section, and hash data consisting of a combination of these two data types. If the same sectional unit is tracked over time, this type of mixed data is called panel data (Narendrathan, 1982). In panel data analysis, coefficients take different values for different units at different time periods. In this case, the estimated number of parameters exceeds the number of observations used, meaning that the model cannot be estimated.

In studies with Panel data, different models can be obtained by making different assumptions about the properties of error terms and the variability of coefficients. Models obtained by different assumptions are "fixed-effect" and "incidental-effect" model. The choice between" fixed-effect "and" random-effect " models is made by the hauman test. If there is no correlation between ei and X, the random effects model, if there is a correlation between ei and X, the constant effects model will be appropriate. For this reason, panel data with fixed effect were used as it is more suitable in this study (Baltagi, 1999). Finally, Hausman test was performed to choose between the fixed effects model and the random effects model, and it was decided that it would be more effective to make predictions with the fixed effects model according to the results of Hausman test. After model selection, locally best invariant tests of Bhargava, Franzini and Narendrathan (1982), Durbin-Watson and Baltagi and Wu (1999) was used for autocorrelation in models, and the Pesaran (2004) test was performed for heteroscedasticity. There was no probability value in the locally best invariant tests of Bhargava et al. (1982) and Baltagi and Wu (1999), the fact that the statistical value is less than 2 strengthens the possibility that there may be

autocorrelation. In the Pesaran (2004) test, the probability value being less than 5% indicates that there is a variance problem. In this context, when the models are examined, it is determined that the probability of autocorrelation is high in all models except Model 1 and Model 2, and the heteroscedasticity problem is detected in all models.

As the models have autocorrelation & heteroscedasticity problem in general, Driscoll and Kraay (1998) fixed effects model estimator that is an estimator resistant to autocorrelation and heteroscedasticity was used to make estimations on models.

3.3. Dependent Variables

In the research, the return on assets (ROA) of the most used assets from traditional performance criteria was used to show the financial performance of banks. This variable is widely used in the financial literature to measure the financial performance of banks (Ting & Lean, 2009; Joshi et al., 2013; Yalama, 2013). ROA is calculated by dividing the net profit (loss) in the current year by the average total asset (at the end of the year + at the at the beginning/2).

Non-performing loan ratio, which is one of the most important indicators of banks' credit risks, has been taken as an indicator of credit quality, as in a few other similar studies (Wang et al., 2013: Curado et al., 2014: Meles et al., 2016; Us, 2020). In this study, unlike existing studies, non-performing loans are also added to the model and the effect of intellectual capital on non-performing loans is examined. The non-performing loans variable, which is defined as the NPLL variable, was calculated by dividing non-performing loans by total loans (gross). NPLL is a risk indicator for loans extended by banks.

3.4. Independent Variables

The VAIC methodology developed by Ante Pulic (2004) is considered as the basis of measurement for independent variables in this study. VAIC is the model designed to enable management, shareholders and other relevant stakeholders to effectively monitor and evaluate the effectiveness of VA (Value Added) by a firm's total resources and each major resource component. Although there are different classifications according to the literature, intellectual capital consists of three main variables: Relational Capital, Human Capital and Structural Capital (Ting and Lean, 2009: 591). In fact, companies with higher VAIC value signify that they create a higher value with all their available resources, namely IC, HC, structural capital and physical capital use (Mondal, 2015: 520).

The following equation expresses the VAIC relationship mathematically: The components of the VAIC model were used as independent variables in this study. VAIC is calculated as follows (Pulic, 2004: Yalama, 2013):

$$VAIC_i = CEE_i + HCE_i + SCE_i \quad (1)$$

In the Equation (1), VAICi corresponds to Intellectual coefficient added value of bank i, CEEi corresponds to the participation capital efficiency coefficient of the bank i: HCEi corresponds to the i Bank's human capital efficiency coefficient, SCEi corresponds to the structural capital efficiency coefficient of the bank i. To calculate these variables, the total added value created by banks VAi should be calculated. Total VAi is calculated as follows.

$$VA_i = OP_i + EC_i + A_i \quad (2)$$

In the equation (2), VAi refers to the added value created by bank i: OPi refers to the bank's operating profit: ECi gives the bank's employment cost, Ai indicates the depreciation and amortization of the bank.

After the calculation of total VAi, VAICi (CEEi, HCEi and SCEi) components are calculated.

CEEi as the first component of VAICi is calculated as follows:

$$CEE_i = VA_i / CE_i \quad (3)$$

In the equation (3), CEi refers to the used capital (book value of assets) of the bank i: In other words, the equity value of the bank is HCEi and SCEi, and it is calculated as follows.

$$HCE_i = VA_i / HC_i \quad (4)$$

In the equation (4), HCEi shows the efficiency coefficient for bank i: VAi shows VA for bank i: and HCi shows the total salary and salary costs of firm i.

$$SC_i = VA_i - HC_i \quad (5)$$

In the equations (5) and (6), HCi refers to the bank's personnel expenses and SCi refers to the difference between VAi and HCi.

$$SCE_i = SC_i / VA_i \quad (6)$$

3.5. Control Variables

As in other studies in the literature (Mondal and Ghosh, 2012: Yalama, 2013: Özkan et al., 2017) bank size (LNTA = Total Assets) and leverage (LEV = Ratio of Long Term Debt to Total Assets) are included in the regression models (Models 2, 4, 6 and 8) as control variables. Leverage is a risk indicator for banks' long-term debt. In addition, dummy variables (State and Private) were used to show the impact of bank types on the bank's profitability. In models 2,4, 6, and 8, state banks take the value of 1 and otherwise they take 0; in the other dummy variable, private banks take 1, otherwise they take 0 according to the classification of the Banking Regulation and Supervision Agency (BDDK).

3.6. Research Models

Models 1 and 2 in Table 2 examine the relationship between ROA, which is the financial performance measurement of banks, and VAIC: Models 3 and 4 examine the relationship between CEE, HCE and SCE, which are ROA and VAIC components. Models 5 and 6 examine NPLL and VAIC as indicators for credit risk of banks; Models 7 and 8 examine the relationship between credit risk and VAIC components CEE, HCE and SCE. In addition, control variables are included in Models 2, 4 6 and 8.

Table 2: Research Models

Models
Model 1: $ROA_{i,t} = a_0 + \beta_1 VAIC_{i,t} + u_{i,t}$
Model 2: $ROA_{i,t} = a_0 + \beta_1 VAIC_{i,t} + \beta_2 LEV_{i,t} + \beta_3 LNTA_{i,t} + \beta_5 DummyState_{i,t} + \beta_6 DummyPrivate_{i,t} + u_{i,t}$
Model 3: $ROA_{i,t} = a_0 + \beta_1 CEE_{i,t} + \beta_2 HCE_{i,} + + \beta_3 SCE_{i+} u_{i,t}$
Model 4: $ROA_{i,t} = a_0 + \beta_1 CEE_{i,t} + \beta_2 HCE_{i,} + \beta_3 SCE_i + \beta_4 LEV_{i,t} + \beta_5 LNTA_{i,t} + \beta_7 DummyState_{i,t} + \beta_8 DummyPrivate_{i,t} + u_{i,t}$
Model 5: $NPLL_{i,t} = a_0 + \beta_1 VAIC_{i,t} + u_{i,t}$
Model 6: $NPLL_{i,t} = a_0 + \beta_1 VAIC_{i,t} + \beta_2 LEV_{i,t} + \beta_3 LNTA_{i,t} + \beta_4 DummyState_{i,t} + \beta_5 DummyPrivate_{i,t} + u_{i,t}$
Model 7: $NPLL_{i,t} = a_0 + \beta_1 CEE_{i,t} + \beta_2 HCE_{i,} + + \beta_3 SCE_{i+} u_{i,t}$
Model 8: $NPLL_{i,t} = a_0 + \beta_1 CEE_{i,t} + \beta_2 HCE_{i,} + + \beta_3 SCE_i + \beta_4 LEV_{i,t} + \beta_5 LNTA_{i,t} + \beta_6 DummyState_{i,t} + \beta_7 DummyPrivate_{i,t} + u_{i,}$

4. Analysis and Results

The aim of this study is to investigate the effect of IC efficiency on the financial performance of Turkish commercial banks with the VAIC methodology measured with subcomponents such as CEE, HCE and SCE and non-performing loans(NPL) from 2004 to 2020.

Table 3 displays explanotary statistics belonging to the dependent variables for the period 2004-2020; ROA, VAIC and independent variables; financial performance consisting of CEE, HCE, SCE, LEV, LNTA, NPLL; and some variables depending on bank characteristics. The hypothesis results tested vai the hypotheses in Table 1 are given in Table 9.

Table 3: Descriptive Statistics of Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	357	1.337	1.332	-12.554	4.501
VAİC	357	4.077	3.059	0.008	28.093
CEE	357	2.916	1.563	-5.802	9.120
HCE	357	0.003	0.001	-0.0125	0.021
SCE	357	2.425	1.264	-4.783	8.236
LEV	357	0.487	0.599	-5.946	5.016
LNTA	357	12.032	8.644	0	54.221
NPLL	357	23.665	1.788	19.007	27.009

According to Table 3 results, the average was ROA 1.337, NPLL 4.077, VAIC 2.916, CEE 0.003, HCE 2.425, SCE 0.487,LEV 12.037, LNTA 23.665. The maximum and minimum values are NPLL 4.501, -12.554, ROA 28.093, 0.008, VAIC 9.120, -5.802, CEE 0.021, -0.0125, HCE 8.236, -4.473, SCE 5.016, -5.946, LEV 54.221, 0, LNTA 27.009, 19.007.

Table 4: Correlation Matrix

	ROA	VAIC	CEE	HCE	SCE	LEV	LNTA	NPLL
ROA	1.0000							
VAİC	0.6909	1.0000						
CEE	0.8064	0.4992	1.0000					
HCE	0.7750	0.9255	0.5584	1.0000				
SCE	0.1756	0.6495	0.1290	0.3131	1.0000			
LEV	-0.1238	-0.1473	-0.1007	-0.1847	0.0012	1.0000		
LNTA	0.3369	0.5968	0.1183	0.6102	0.2720	-0.1002	1.0000	
NPLL	-0.0451	-0.0752	-0.0019	-0.0793	-0.0296	-0.0489	-0.005	1.0000

According to Table 4 data, it was determined that all variables except ROA, NPLL and LEV are positively related, all variables except VAIC and NPLL and LEV are positively related, all variables except CEE and NPLL and LEV are positively related, all variables except HCE and NPLL and LEV are positively related, SCE and all variables expect NPLL are positively related. The non-performing loans were found to be negatively correlated with VAIC and all other variables.

Stability of the variables was examined by Im Pesaran and Shin (2003) panel unit root test and the results are given in Table 5.

Table 5: IPS Unit Root Test Results

Değişkenler	Katsayı
ROA	-3.842***
VAIC	-3.400***
CEE	-3.199***
HCE	-2.647***
SCE	-4.451***
LEV	-1.789*
LNTA	-3.589***
NPLL	-3.256***

Note:***, * * Indicates the stationarity of variables at 1% and 10% significance level, respectively.

According to the results of Table 5, all variables are stationary at their level of value, e.g. the unit is rootless. Choosing the right model and autocorrelation and changing variance states of the selected models are summarized in Table 6.

Table 6. Model Selection and Summary of Model Test Specifications

	F Test		Breusch-Pagan LM Test		Hausman Test		Selected Model	Specification Tests	
	C	P	C	P	C	P		Autocorrelation Test	Variable Variance Test
M.1	170.16	0.000	34.32	0.000	4.16	0.041	F.E.	2.145	15.557***
M.2	43.00	0.000	24.06	0.000	3.69	0.087	F.E.	2.159	11.758***
M.3	386.79	0.000	105.09	0.000	16.65	0.000	F.E.	1.549	10.410***
M.4	203.48	0.000	81.047	0.000	42.71	0.000	F.E.	1.557	9.257***
M.5	6.52	0.000	10.36	0.000	3.58	0.001	F.E.	0.984	3.150***
M.6	6.33	0.000	14.26	0.000	4.65	0.007	F.E.	1.102	1.508***
M.7	6.54	0.000	28.25	0.000	5.32	0.054	F.E.	0.998	2.185***
M.8	6.17	0.000	101.21	0.000	5.68	0.058	F.E.	1.598	5.248***

Note: C= Coefficient, P= p value, F.E. = Fixed effect model, ***,**,* Indicates that models and variables are significant at 1%, 5% and 10% significance level, respectively.

In the study, F-test was performed in order to determine whether it can be predicted with the pooled model or with the fixed effects model. According to the results of this test, the basic hypothesis was rejected for all models and it was determined that the model should be estimated with constant effects. Then, Breusch-Pagan LM test was performed to determine whether it can be predicted with the pooled model or the fixed effects model. According to the result of this test, the basic hypothesis was rejected for all models and it was determined that the model should be estimated by random effects.

Finally, Hausman test was performed to choose between the fixed effects model and the random effects model, and it was decided that it would be more effective to make predictions with the fixed effects model according to the results of Hausman test.

After model selection, locally best invariant tests of Bhargava, Franzini and Narendrathan (1982), Durbin-Watson and Baltagi and Wu (1999) was used for autocorrelation in models, and the Pesaran (2004) test was performed for heteroscedasticity. There was no probability value in the locally best invariant tests of Bhargava et al. (1982) and Baltagi and Wu (1999), the fact that the statistical value is less than 2 strengthens the possibility that there may be autocorrelation. In the Pesaran (2004) test, the probability value being less than 5% indicates that there is a variance problem.

In this context, when the models are examined, it is determined that the probability of autocorrelation is high in all models except Model 1 and Model 2, and the heteroscedasticity problem is detected in all models.

As the models have autocorrelation & heteroscedasticity problem in general, Driscoll and Kraay (1998) fixed effects model estimator that is an estimator resistant to autocorrelation and heteroscedasticity was used to make estimations on models.

Table 7. Model Results

Dependent Variable: ROA	Model 1	Model 2	Model 3	Model 4
VAIC	0.713*** [0.063]	0.703*** [0.083]	-	-
CEE	-	-	362.931*** [27.992]	419.773*** [44.092]
HCE	-	-	0.812*** [0.095]	0.726*** [0.113]
SCE	-	-	-0.112* [0.059]	-0.100*** [0.043]
LEV	-	-0.004 [0.003]	-	-0.003 [0.003]
LNTA	-	-0.068 [0.123]	-	0.151 [0.107]
NPLL	-	-0.020 [0.017]		-0.135 [0.012]
Dummy State	-	-0.045 [0.978]	-	-0.970 [0.125]
Dummy Private	-	0.122* [0.015]	-	0.289* [0.158]
C	-0.700*** [0.226]	0.994 [2.978]	-1.659*** [0.220]	-5.354* [2.564]
Prob.	0.000	0.000	0.000	0.000
R^2	0.38	0.39	0.81	0.82

Note: ***,**,* Indicates that models and variables are significant at 1%, 5% and 10% significance level, respectively.

Firstly, does IC efficiency affect banks' financial performance positively? If so, which of the subcomponents has a greater impact? In Table 7, the estimated results of these questions are given for the models that are brought together for panel data and are based on Hypothesis H1a, H1b, H1c and H1d.

According to the results of Model 1: it was determined that there is a positive and significant relationship between the intellectual capital (VAIC) and financial performance (ROA) of banks. This finding supports the results of studies such as Mavridis (2004), El-Bannay (2008). In Model 2, control variables were added to the model and it was determined that there was a positive and significant relationship between the intellectual capital (VAIC) and financial performance (ROA) of banks as in Model 1. On the other hand, as in the study by Özkan et al. (2017), it was detected that the leverage and bank size variables added to the model did not significantly affect the financial performance. In addition, private ownership, which turned to be unrelated in the Meles et al. (2016) study, among the variables that wereadded as a puppet variable was found to affect financial performance positively in Turkish banks in this study. In the study of Singh et al. (2015), similarly with this study, private ownership was found to be related to state and private ownership (ROA), but private ownership was found to be more relevant and significant. In Model 3, the relationship of intellectual capital components, CEE, SCE and HCE with financial performance is examined. Accordingly, the participation efficiency coefficient (CEE) was found to have the most positive and significant relationship, human capital coefficient (HCE) to have a positive and sigificant relationship, whereas the banks' structural capital efficiency coefficient (SCE) had negative relationship. In Model 4, control variables were added to the model and results similar to Model 3 were obtained. These findings support the study of Özkan et al. (2017). On the other hand, it was determined that the leverage and bank size variables added to the model did not significantly affect financial performance.

Table 8. Model Results

Dependent Variable: NPLL	Model 5	Model 6	Model 7	Model 8
VAIC	-0.444*** [0.264]	-0.430** [0.153]	-	-
CEE	-	-	155.366 [105.3016]	80.526 [110.761]
HCE	-	-	-0.705*** [0.340]	-0.660** [0.258]
SCE	-	-	-0.242 [0.267]	-0.234 [0.268]
LEV	-	-0.022 [0.023]	-	-0.022 [0.023]
LNTA	-	-0.266 [0.186]	-	-0.213 [0.195]
Dummy Devlet	-	0.131 [3.237]	-	0.873 [3.308]
Dummy Özel	-	-0.520 [1.069]	-	-0.473 [1.612]
C	5.374*** [0.771]	12.335* [4.757]	5.544*** [0.503]	11.150** [4.965]
Prob.	0.032**	0.038**	0.014**	0.062*
R^2	0.007	0.008	0.009	0.016

Note: ***,**,* Indicates that models and variables are significant at 1%, 5% and 10% significance level, respectively.

Secondly, does IC efficiency positively affect banks' non-performing loans? If so, which of the subcomponents has a greater impact? In Table 8, the estimated results of these questions are given for the models that are brought together for panel data and are based on Hypothesis H2a, H2b, H2c and H2d.

Table 9. Summary of Hypothesis Results

Hypotheses	Acceptance / Reject
H1a. Banks' VAIC has a significant positive effect on ROA.	**Acceptance**
H1b. Banks' CEE has a significant positive effect on ROA.	**Acceptance**
H1c. Banks' HCE has a significant positive effect on ROA.	**Acceptance**
H1d. Banks' SCE has a significant positive effect on ROA.	**Reject**
H2a. Banks' VAIC has a significant negative effect on NPLL.	**Acceptance**
H2b. Banks' CEE has a significant negative effect on NPLL.	**Reject**
H2c. Banks' HCE has a significant negative effect on NPLL.	**Acceptance**
H2d. Banks' SCE has a significant negative effect on NPLL.	**Reject**

When Table 8 is analyzed, it was found that the increase in intellectual capital in Model 5 caused a decrease in the non-performing loan ratios in accordance with the studies in the literature (Wang, 2013: Curado et al., 2014: Meles et al., 2016). Control variables were added to the model in Model 6 (LEV, LNTA to and Ownership) and Model 1 was confirmed as the result. However, control variables were found to be statistically insignificant. In Model 7, intellectual capital components (CEE, SCE and HCE) were added to the model and it was determined that only the human capital (HCE) coefficient significantly and statistically negatively affected non-performing loans. Model 7 was confirmed in model 8, but control variables were found to be statistically insignificant.

5. Discussion

When the models were examined, the explanatory power of the independent on the dependent variable in models 1, 2, 3 and 4 (R^2) was found to be 38%, 39%, 81% and 82%, respectively, and the explanatory power of model 3 and model 4 on the independent variables was determined to be quite strong. In models 5, 6, 7 and 8, independent variables were determined to have low explanatory power to explain dependent variables. On the other hand, the mean value added intellectual coefficient (VAIC) of the banks during the 2004-2020 period was determined to be 2.916. This rate was determined to be 4.311 for the banks of Ghana in the period of 2000-, -3.762 for the banks of Malaysia in the period of 2012-2016, 4.50 for the banks of the Czech Republic for the 2004-2007 period, 3.50 for Danish banks, 12.50 for

Finnish banks, 1.88 for German banks, 2.85 for Italian banks, 3.58 for Norwegian banks, 3.01 for Polish banks, 2.74 for Spanish banks. In this regard, it can be said that the VAIC mean of banks operating in Turkey is similar to European countries.

This study contains evidence that the level of intellectual capital efficiency has a positive impact on the financial performance of Turkish commercial banks (H_{1a}). However, evidence was revealed by some studies conducted in European countries in regard to a positive, yet statistically insignificant relationship between the financial performance indicator Return on Assets (ROA) and VAIC. Joshi et al. (2013) also found similar findings for financial institutions that operate in Australia. Also, in some other studies (Özkan, 2017), various findings have been presented indicating that ROA is not affected by VAIC. However, in this study, evidence that shows VAIC affects ROA was presented

The results given for Models 3 and 4 in Table 7 display the relationship between the relational capital coefficient (CEE), the human capital coefficient (HCE) and the structural capital coefficient (SCE) and return on assets rate (ROA), all of which are the components of the VAIC. According to the study findings, similar to other studies (Edvinsson & Malone, 1997: Meles et al., 2016), the intellectual capital of the Turkish banking sector seems to be mainly affected by the relational capital efficiency coefficient (CEE) (H_{1b}). It has been determined that the human capital coefficient (HCE) in the banking sector has a positive effect on financial performance (H_{1c}). On the other hand, it has been determined that the human capital efficiency coefficient (HCE) is less effective in creating value in the banking sector than the relational capital coefficient (CEE). Similar to other studies (Edvinsson & Malone, 1997; Meles et al. 2016), it was revealed that the structural capital efficiency coefficient (SCE) does not have a positive effect on the financial performance of banks (H_{1d}). European countries, those in Unlike Özkan (2017) as well as in the study of banking sector in the relational capital coefficient in Turkey (CEE) from human capital efficiency coefficient of the impact on financial performance (HCA) has been found to be higher.

The following reported similar results for financial institutions in their respective nations: Goh (2005) in Malaysia and Latif et al. (2012) in Pakistan and Özkan et al. (2017) in Turkey. This similarity in Islamic countries is outstanding as opposed to other countries. This similarity can be said to stem from the Islamic school.

It also contains evidence that intellectual capital efficiency, as a main distinguishing feature of the study, reduces the credit risk of Turkish commercial banks, and thus the non-performing loan ratios (NPLL) (H_{2a}). These results share similarities to

previous studies. (Curado et al., 2014: Meles et al., 2016). Results indicate that non-performing loans (NPLL) in the Turkish banking sector are mostly affected by human capital efficiency coefficient (HCE) (H_{2c}). In this case, it can be mentioned that the Turkish banks can lessen their credit risks by paying attention to employing expert and experienced personnel. In the study, there is no evidence that the relational capital coefficient (CCE) positively affects non-performing loans (H_{2b}). Finally, it is understood that the structural capital productivity coefficient (SCE) does not affect non-performing loans positively (H_{2d}).

In parallel with the studies from El-Bannany (2008), HCE can be said to play an important role in decreasing the non-performing loans and in increasing financial performance in the Turkish banking sector. After the 2008 global financial crisis, non-performing loans have gained importance for economies. From this point of efficiency coefficient of human capital in Turkey (HCE) the potential to reduce the NPLs of banks and to highlight the positive impact will be very fruitful to recommend to invest in this direction.

6. Conclusion

In this study, the relationship between the intellectual capital, financial performance and the non-performing loans of 21 private funded and state funded banks operating in Turkey between 2004-2020 were investigated. In the study, intellectual capital was calculated by VAIC method.

The findings of the study show that other studies (Edvinsson and Malone, 1997: Meles et al. 2016) on the contrary shows that the intellectual capital of the Turkish banking sector is mainly influenced by CEE, not HCE.

The regression results show that both CEE and HCE have a positive impact on banks' financial performance. On the other hand, contrary to expectations, CEE had more impact on financial performance compared to HCE. Therefore, banks operating in the Turkish banking sector should use their financial and physical capital, if they want to achieve a higher level of profitability. On the other hand, contrary to previous studies (El-Bannany, 2008), SCE has been found to affect financial performance negatively. This finding is important, in that it shows that banks operating in Turkey do not effectively use the components making up their structural captial. In models where the value added intellectual coefficient (VAIC) and financial performance were examined, it was determined that the intellectual value added coefficient increased financial performance. It was also determined that leverage

(LEV), bank size (LNTA) and non-performing loan ratios (NPLL) did not affect bank performance, whereas private ownership increased financial performance. At this point, it can be said that the state-owned banks in Turkey are less profitable and that this case stems from the fact that the state banks tend to be more active in line with governmental incentives and supports.

In the models that examine the effect of intellectual capital on non-performing loans, it is determined that the increases in intellectual capital (VAIC) decreased the non-performing loan ratios (NPLL). In addition, (HCE) among intellectual capital components being high gives us the result that non-performing loans are reduced. This reveals the importance of intellectual capacity to reduce non-performing loans for the Turkish banking sector. In addition, Turkish banks can reduce their non-performing loans by making them pay more attention to customer relations.

Considering that most of the studies carried out in Turkey on banks traded in Borsa Istanbul (Yalama, 2013), it is seen that this study's scope is more comprehensive. In addition, the fact that there were almost no studies on non-performing loans in the world prior to the 2008 global financial crisis, and the fact that non-performing loans were the subject of studies conducted in just a few countries after the crisis (Meles et al., 2016; Curado et al., 2014) reveals the original value of this study and its contribution for developing the literature.At this point, the study contains evidence that the IC efficiency level positively affects the financial performance and non-performing loans of Turkish commercial banks. The data presents some very positive effects for some agents. First of all, IC can help banks, managers and shareholders achieve their expected profitability target. It then enables policymakers and financial managers to achieve financial stability and sustainability goals. This is due to the fact that banks can achieve a certain profitability and a lower non-performing loan target by increasing their IC capacity. In other words, banks can achieve their profit targets by increasing IC efficiency without incurring additional costs. Considering the crises arising from banking and the stricter rules of Basel III, it can be said that it offers solutions that will improve performance without compromising the financial soundness of the study.

This research provides evidence for a developing country. Similar studies can be done for developed countries and country groups. In this study, insurance companies, which are excluded from the scope and play a key role for the financial sector, can be worked on through studies conducted with companies such as investment partnerships. Also, it is thought that the technology-intensive companies, where in-

tellectual capital is important, being included in future studies and adding variables such as TobinQ, Market Value / Book value, which represent financial performance, to future studies will contribute to the literature. Additionally, empirical tests were performed on a large scale example of Turkey, it is known in such a case that similar studies need to be carried out in different countries for there to be a generalization of results. In order to achieve a more generalizable outcome, more research can be done in different countries to uncover the differences that may exist between different countries, especially with non-performing loans and intellectual capital. This study will shed light on future studies in this regard.

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