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The Relationship between Intellectual Capital and Banks' Productivity in Pakistan

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Abstract

The performance of banks has been widely researched using accounting ratios, Tobin's Q and market returns and less emphasis has been given to productivity measures. The productivity growth of banks is captured through Malmquist Productivity Index (MPI). The study then investigates the impact of intellectual capital on the productivity of banks in Pakistan. Value-added The intellectual Coefficient (VAIC) approach is employed to examine the intellectual capital of banks. Data is obtained from annual reports of 20 banks listed on the Pakistan Stock Exchange for 10 years (2007-2016). The panel corrected standard error approach is used for estimating the panel regression model. The findings provide evidence that the VAIC, human capital efficiency (HCE) and structural capital efficiency (SCE) has a positive impact on productivity growth (MPI). On the other hand, capital employed efficiency (CEE) has no significant impact on productivity growth. The VAIC approach may be useful for the banks and policymakers in a knowledge economy to integrate the intellectual capital in the decision-making process. Our results also suggest that banks in Pakistan shall increase spending on intellectual capital particularly on human capital and structural capital to elevate the intellectual capital of banks and subsequently get benefits in terms of increased productivity.

Keywords: Intellectual capital; Value added intellectual coefficient (VAIC); Malmquist productivity Index; Pakistan banking sector

Intellectual capital is considered as an important component of firm value. This recognition of IC in the corporate world encourages firms to spend more on intellectual capital as it is considered as a catalyst for productivity. Intellectual capital signifies knowledge, infrastructure, capacity to innovate, skill set, access to information, and intellectual property. These attributes can bring value to organizations. Hence, the mangers and policymakers consider intellectual capital as vital for market competitiveness and a catalyst for the performance of firms. Sine intellectual capital has implications for the productivity of the firm hence it is also important for both internal and external stakeholders.

Since the banking sector is highly knowledge-intensive, requires a skill set, and involves relationship service. Hence, the banking sector is an epitome of the necessity of intellectual capital. Kamath (2008) argued that surviving in the competitive sector; banks capitalize on intellectual capital in the form of human, structural, and relational capital. The employees' role at various tiers is a manifestation of the intellect of employees (Bontis, Chua Chong Keow, & Richardson, 2000). Hence, in a knowledge-based economy, the skill set of the workforce; there relationship and the structure of the organization enable the banks to gain advantage in a competitive environment.

The banking sector in Pakistan has become more competitive and efficient (Mirza, Bergland, & Khatoon, 2016; Tahir, Shah, & Afridi, 2016). It is evident from an international perspective that banks around the globe are taking maximum advantage of technology and IC to maximize their profits (Alhassan & Asare, 2016; Ozkan, Cakan, & Kayacan, 2017). This trend now is not uncommon in the banking sector of Pakistan. Banking sector of Pakistan has become efficient and is now prioritizing IC over just employing high number of employees to achieve higher goals of profitability. Banks now employ professionals and ones who possess knowledge and capabilities to accomplish the desired outcome of the banks for a targeted period during a calendar year. Banks are vying for gaining maximum shares in the market with IC because banks perceive IC as their long-term intangible assets that have apparently no value on banks' balance sheet but add value to the banks in the form of higher profitability. The mobilization of IC by the banks has intensified competition in the banking sector.

Although studies on the nexus between IC and firm performance have been conducted in Pakistan but most of these studies (Khan, Afzal, Salamat, Khurshid, & Saqib, 2017; Khurshid, Sabir, Imran, Kashif, & Sajid, 2017) focused on the non-banking sector of Pakistan. The importance of IC cannot be ignored in case of the banking industry because of employment of and efficient utilization of IC are now defined as most crucial and pivotal in the success of the banks as compared to other industries operating in the financial system of the economy for reason that banks that are equipped with IC tend to deliver on high quality services backed by banks' continuous training of its human resources, building of its brand, internal system, and processes (Ahuja and Ahuja, 2012). This study attempts to explore that the high quality of services delivered to customers is determined by the IC and not only the physical or tangible assets employed by the banks are crucial. The efficient and effective management of IC therefore becomes of utmost significance for the banks to operate both competitively and efficiently.

In the past, the IC in relation to banks' financial performance remained the focus of researchers as to know about the firms' performance (Alhassan & Asare, 2016; Makki, Lodhi, & Rahman, 2008; Ozkan et al., 2017; Rehman, Chaudhary, Rehman, & Zahid, 2011). Firms' performance was measured through accounting ratios, Tobin's Q and market returns (ROA, ROE). Recently there has been a growing trend where the focus of researchers is toward productivity measures of the firms or banks. In the case of Pakistan, to the best of our knowledge, there is a paucity of knowledge about the productivity growth of banks in relation to IC and its components. Previous studies (Bharathi, 2010; Rehman, Rehman, Usman, & Asghar, 2012) have examined the relationship between IC and the financial performance of banks in Pakistan. These studies however have multiple weaknesses. For instance, the study of Bharathi (2010) considered only two years of data which is insufficient to capture performance over time and quantify the impact of IC and the financial performance of banks. While our study, in contrast, spans over 10 years, 2007-2016, by considering annual reports of the respective banks to measure the relationship. Another study of Rehman et al., (2012) considered one-year data of Pakistani banks and the models do not contain important determinants like efficiency variables and other bank-specific control variables therefore it is important to add such variables in the model to explore possible implications for the banking sector of Pakistan. Hence, this study attempts to overcome the discrepancies and shortcomings of the previous studies by considering 20 listed banks on Pakistan stock exchange to investigate the nexus between IC and banks' productivity in Pakistan.

Against this backdrop, the objective of this study is to add in the literature on intellectual capital and banks' performance by analysing the outcome of intellectual capital on banks' productivity in Pakistan. The study also attempts to examine which component of intellectual capital drives greater productivity of banks in Pakistan.

The organization of the paper is as follows. In section 2, the related literature is discussed. Section 3 of the study describes the methodology and explains the concept of IC and its components with the financial indicators of firms. Section 3 also describes the data, variables, methodologies employed to measure the relationship and test the hypotheses of the study. Section 4 illustrates the empirical findings. Section 5 concludes and highlights the limitations and future directions of the research.

Literature Review and Hypothesis Development

Technology developments and innovations in new financial products and services have increased the competition in the banking sector. Hence, the circumstances prevailing in the market determine the firms' entrance and retention of their competitive position. It is generally accepted that a bank cannot capture and lead the market by offering all products (Zineldin & Bredenlöw, 2001) rather they are urged to explore new foundations for competition, and they must enhance and maintain the quality and productivity of their products and services (Zineldin, 1996). In competitive conditions, productivity growth is vital for banks operations and processes (Hodgetts, 1998; Nachum, 1999; Sink & Tuttle, 1989) which, in long run, leads to high profitability, lower costs, and growth. Given the importance of banks in the macroeconomic outlook, it is pertinent to explore the productivity of banks.

Banks, regardless of size, are characterized on how efficiently and competitively they engage their scarce resources (physical and financial resources) to grow their productivity and to earn higher profits in the long run. Besides, efficiency and competitiveness the intellectual capital (IC) play an important role in the creation of value for the banks in the banking sector (Alhassan & Asare, 2016; El-Bannany, 2008; Ozkan et al., 2017). According to Pulic (2004), two important capitals that create value addition in companies are capital employed and intellectual capital.

Capital employed includes physical capital and financial capital, whereas IC consists of human and structural capital. The success factors in this age of competition are IC and customer relations which are also considered and defined as driving forces behind the success of the firms and a long-term solution for sustaining a competitive edge over competitors in the banking industry (Kandemir, 2008; Kayacan, 2005; Yalama, 2013). Firms that prioritize IC stay in the market, exercise, and sustain market dominancy and market shares respectively whilst firms failing to do so are ousted by the highly competitive banks. This is a fact in industries like financial, dominated by the banks which add value to themselves by means of intellectual capital, an intangible asset (Shih et al., 2010). Wilg (1997) documented the importance of intellectual capital in relation to a firm performance from the shareholders' perspective and argued that intellectual capital in the form of intangible assets is a vital source in business performance. Since the banking industries provide main functions and interlink the various financial links and business flows and processes which is useful for businesses to manage their day to day activities in the best possible manner.

Over the years the researchers used various methodologies to identify the value of firm and to explore the procedures of creating value of the firm (Pedrini, 2007). The performance and competitive advantage of a firm depends on the firms' acquisition, holding, and its later use of strategic assets (Wernerfelt, 1984). These assets consist of both tangible and intangible nature which may be used by the firms strategically to enhance firms' performance (Riahi-Belkaoui, 2003). Thus, the productive capacity enhancing role of IC is considered vital in services-oriented markets like the banking sector.

The widely used VAIC methodology is employed to quantify banks' IC performance. With this background, the research on linking IC with firms' performance become central. Pulic (2001) introduced an efficacy measure (VAIC). This measure captures a firm's ability to employ intellectual, physical, and financial capital to enhance its performance (Clarke, Seng, & Whiting, 2011). The VAIC represents a true indicator of IC from the stakeholder's viewpoint. VAIC is composed of three components of intellectual capital: i) structural capital efficiency (SCE), ii) human capital efficiency (HCE) and iii) capital employed efficiency (CEE). These indicators are used as tools for assessing firms' performance and efficiency from an IC perspective.

Previous literature has mainly discussed IC in the perspective of disclosure indices (Abeysekera, 2010; Ahmed Haji & Mubaraq, 2012; Asare, Onumah, & Simpson, 2013; Ax & Marton, 2008; Castelo Branco, Delgado, Sousa, & Sa, 2011; Guthrie, Steane, & Farneti, 2009). The other studies (Abdulsalam, Al-Qaheri, & Al-Khayyat, 2011; Clarke et al., 2011; Kamath, 2008; Maditinos, Chatzoudes, Tsairidis, & Theriou, 2011; Makki & Lodhi, 2009) explored the performance and efficiencies of the IC using the VAIC model. Some authors explored the effects of IC on firms' performance e.g. a study (Veltri & Silvestri, 2011) conducted on Italian financial firms using the VAIC approach found a positive association between IC and firm performance and the same results were validated by Phusavat, Comepa, Sitko-Lutek, & Ooi, (2011) for manufacturing firms in Thailand. They used four proxies for firm performance including return on assets and equity, growth in revenues and employee productivity and found a positive relationship with IC. In the case of Pakistan, a study by Khurshid et al., (2017) examined the impact of investment in IC on the financial performance of PSX listed non-financial firms and concluded that IC and its components are significant in determining the financial performance of firms. Similarly, Khan et al., (2017) also found a meaningful association between the intellectual capital and financial performance of non-financial firms in Pakistan.

While exploring the link between intellectual capital and firm performance in the banking sector, the studies by Abdulsalam et al., (2011); Alhassan & Asare, (2016) and Mondal & Ghosh, (2012) used the VAIC approach to analyse the banks' performance focusing on intellectual capital. For example, Alhassan and Asare (2016) used economic measure of banks' performance in relation to IC and the results confirmed the positive association between VAIC and the banks' productivity in Ghana. They concluded that the productivity growth of banks is manifested by efficiency changes rather than technological changes. Further, the study also confirmed that the productivity growth of banks in Ghana is mainly attributed to the components of IC i.e., HCE and CEE. Similarly, Mavridis (2004) examined the IC performance of five banking groups in Japan using quarterly data from 2000 to 2001. Chen Goh (2005) found a stronger impact of HCE of IC to highlight the role of staff knowledge resources on the banks' performance in Malaysia.

The HCE is a key element of IC and it strengthens the various forms of capital (relational capital, structural capital, physical capital, and financial capital) in every firm. Siddique (2016) documented the importance of Human Resource in the context of the banking sector of Pakistan and argued that high-performance work system is important and translates into the human capital efficiency of banks inducing the performance of banks in Pakistan. Further, Latif and Ullah (2016) found that CEE and SCE in the form of collaborative culture and internal service quality have a

direct and positive impact on the banks' performance in Pakistan. Abdulsalam et al., (2011) in a study on Kuwaiti banks found that commercial banks performed better in all efficiency indicators of HCE SCE and CEE. While exploring the impact of IC in relation to banks' performance in the European Union, do Rosário Cabrita & Vaz, (2005) found a nexus between the components of IC (structural and relational capital) and the performance of 53 banks in Portugal. Ozkan et al., (2017) suggested in their study that the Turkish banking sector's IC is influenced by HCE. However, it is also noticed that CEE and SCE have less influence in adding value to bank performance in contrast to HCE. In another study, Yalama and Coskun (2007) found the inconclusive results on the effect of VAIC on the performance of Turkish banks in Turkey. The inconsistency between the results of Yalama and Coskun (2007) and Ozkan et. al., (2017) may be attributed to the differences in the settings and study periods. Mondal and Ghosh (2012) found that firms' performance is mainly driven by IC but varying results between different components of IC and different measures of performance using data of 65 Indian banks for the period 1999 to 2008. In another study by Saengchan (2008) also explored the positive effect of IC on banks' performance. All these findings advocate that improvement in firms' IC enables competitive advantage. This may possibly differentiate banks in terms of performance.

Productivity is an important measure of performance, which could be explained in connection to the IC in the context of services firms such as banking firms. Meanwhile, the researchers are now focusing on economic measures of productivity and efficiency instead of profitability ratios. There is a paucity of knowledge on the effects of IC on economic measures of performance (productivity) and non-existent in the case Pakistan. To the best of our knowledge, in developing countries context, only Alhassan and Asare (2016) have attempted to explore the association between VAIC and productivity of Ghanaian banks while other studies like Chen, Liu, & Kweh, (2014) studied the effects of VAIC on the productivity of insurance firms.

The significance of IC in relation to the firms' performance is evident from the above review of literature underlining the strategic importance of knowledge resources. The relationship between VAIC and economic measure of performance in emerging markets is very rare and in case Pakistan it is non-existent. This study attempts to fill this research gap by an empirical exercise by linking IC to the productivity of banks in Pakistan. In the following study, it is expected that VAIC and its components would positively influence the bank's productivity. Therefore, the following hypotheses are to be tested.

H_1: VAIC and banks' productivity are positively related.

H_2: HCE and banks' productivity are positively related.

H_3: SCE and banks' productivity are positively related.

H_4: CEE and banks' productivity are positively related.

IC along with other assets is important in the value creation of a firm. According to An et.al., (2011), a modern competitive world, the business environment lies in the IC of the firm and not in the physical capital. From the previous studies, there is evidence that the performance of a firm is affected significantly due to IC VAIC and its components like HCE, SCE, and CEE (Makki & Lodhi, 2009; Rehman et, al., 2012; Khan et, al., 2012; Rehman et, al., 2011; Bharathi, 2010; Ozkan et, al., 2016). Moreover, we also find evidence from the previous studies that IC has also an important impact on the productivity of the banks (Alhassan & Asare, 2016; Ahangar, 2011; Chen et, al, 2014).

Research Methodology

This section consists of three-stage strategy employed in testing the hypotheses proposed for the study. The first stage describes the calculation of VAIC proposed by Pulic (2001). The second stage explains the Malmquist Productivity Index (MPI) and its components that are technical change (TECHCH) and efficiency change (EFFCH). The third stage involves the regression analysis for which the dependent variable is productivity (MPI) and its sub-elements (TECHCH and EFFCH) while the independent variables are IC (VAIC) and its components (HCE, SCE, CEE). The regression models presented by equations 7 and 8 are used to test the impact of IC on the productivity of banks in Pakistan.

Estimation of Intellectual Capital of Banks (*using VAIC*)

IC has remained the topic of discussion for researcher to find methods to define firms' value and to understand the process mechanism of value creation (Pedrini, 2007). The estimation

of IC has always been a call into question to the researchers and they have defined it in various ways that is why there is not a widely accepted definition of IC nevertheless it can be construed as an intangible asset of a firm which is not clearly shown on the balance sheet of the firms however it positively influence the performance or productivity of the firm (Kayacan, 2005; Mondal & Ghosh, 2012).

Various approaches are used by different authors to quantify the IC of firms, for example, balanced scorecard (Kaplan & Norton, 1996), IC services IC-index (Roos, Edvinsson, & Dragonetti, 1997), and economic value added (Stewart & Ruckdeschel, 1998) but the most widely used measure is value-added intellectual coefficient (Karacan & Ergin, 2011; Ante Pulic, 1998, 2004; Yalama & Coskun, 2007) however this measure has been severely criticized and challenged the validity of the VAIC method as a measure of IC (Iazzolino & Laise, 2013; Ståhle, Ståhle, & Aho, 2011) but still this measure is used in the literature (Alhassan & Asare, 2016; Ozkan et al., 2017) based on Pulic (2000) reasoning that whether and how much of value is created by the traditional indicators or methods and its suitability in the context of a knowledge economy remained doubtful.

This study uses VAIC and its components CEE_i, HCE_i and SCE_i as independent variables. This study adopts the methodology of Ozkan et. al., (2017); Yalama (2013) and Ante Pulic, (1998, 2004) to calculate VAIC as follows:

$$VAIC_{it} = CEE_{it} + HCE_{it} + SCE_{it} \quad (1)$$

Where $i\ and\ t$ denotes bank and time period (year).

In order to calculate the components of $VAIC_i$, the total value-added (VA_i) created by banks needs to be calculated. Total value added VA_i is calculated in the related literature (Alipour, 2012; Ozkan et al., 2017; Ante Pulic, 2004) as follows:

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

In equation (2), VA_i is the total value added created by the bank i. OP_i refers to the operating profit of the bank i; EC_i refers to the employment cost of the bank i, and A_i refers to the amortization and depreciation of the bank i.

Following the calculation of the total VA_i, the components of $VAIC_i$ (CEE_i, HCE_i , SCE_i) are calculated as follows. The first component of $VAIC_i$ is CEE_i is calculated as follows:

$$CEE_i = \frac{VA_i}{CE_i} \quad (3)$$

Where, CE_i is the capital employed (book value of assets) of the bank i; in other words, equity value of the bank i. So, HCE_i and SCE_i are calculated as follows:

$$HCE_i = \frac{VA_i}{HC_i} \quad (4)$$

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

$$SCE_i = \frac{SC_i}{VA_i} \quad (6)$$

In equations (4) to (6), HC_i refers to the personnel expenses of the bank i and SC_i refers to the difference between VA_i and HC_i.

Measuring Malmquist Productivity Index (MPI)

The productivity of banks is estimated through MPI which was proposed by Fare et.al., (1994). The MPI gauge productivity changes between the current technology period and the previous technology period. The MPI records the variations in output relative to variations in input with respect to time. This productivity measure is a composition of technology changes and efficiency changes. The technology changes may be reflected through improvements in performance associated with the launch of new financial products and innovations whereas efficiency changes may be attributed to the capability of unproductive banks to “catch-up” with best practice ones. When the productivity index takes values greater than 1 implies growth in productivity between periods two subsequent periods whereas when MPI take values less than 1 indicate productivity decays.

The intermediation approach has been followed in the estimation of bank productivity assuming banks as financial intermediaries. This method considers inputs (deposits, fixed assets,

and expenditure on employees/staff) employed by banks to generate output (investment, loans, advances, fees and wages).

Empirical model

This study adopts the empirical model of Lu, Wang, & Kweh, (2014) and Alhassan and Asare (2016) and estimate the regression model given below;

$$MPI_{i,t}(EFFCH_{i,t}; TECHCH_{i,t}) = \beta_1 VAIC_{i,t} + \beta_2 CRL5_{i,t} + \beta_3 SIZE_{i,t} + \mu_i + \emptyset_{i,t} \quad (7)$$

$$MPI_{i,t}(EFFCH_{i,t}; TECHCH_{i,t}) = \gamma_1 HCE_{i,t} + \gamma_2 SCE + \gamma_3 CEE + \gamma_4 CRL_{i,t} + \gamma_5 SIZE_{i,t} + \zeta_i + \vartheta_{i,t} \quad (8)$$

Where i is bank and t is year. MPI refer to productivity of banks; EFFCH is efficiency changes which refer to the capacity enhancement of banks with best practices whereas TECHCH means technical change brought up in as a result of improvements in performance due to new products and innovations. VAIC, HCE, SCE and CEE are independent variables. CRL5 is five big banks loan concentration ratio indicating market concentration and SIZE is log of total assets. ζ_i and $\vartheta_{i,t}$ are the time variant error terms in the model.

The input and output variables are listed in Table 1. It shows that deposits have the highest average mean, standard deviation and maximum value during the period under study whereas Fees and commission has the lowest mean value.

Table 1. *Input and Output Variables (Rupees in, 000)*

Output variables	**Mean**	**SD**	**Min**	**Max**
Investment	170392815	217390035	3829354	1344404771
Loan & advances	183489764	174322866	4587904	790593327
Fees and commission	2862050	3637131.683	6975	18652985
Input variables				
Fixed assets	10556078	10060096.52	187589	39298927
Deposits	327157659	353376354	9465000	1885959026
Staff expenses	4969239	5287964.368	178000	27234174

Source: Author's estimation from research data.

Data Analysis and Results

According to the State Bank of Pakistan, there are 34 banks in Pakistan and only 20 banks are listed on Pakistan Stock Exchange (PSX) in 2016. The study used the data for the 20 listed banks. These banks capture 83% of the gross loans and advances and 92% of the deposits of all banking sector (see Appendix A1 for the list of banks included in the sample and their details on loans and deposits). The sample also includes large as well as small banks to take into account the scale of operation of the banks. The study spans over the period 2007-2016 and considers annual reports published by the respective banks and supplemented by the acquisition of relevant information from the official website of the State Bank of Pakistan.

Empirical Estimation

Table 2**.** *Summary Statistics (2007-2016)*

Variables	Mean	SD	Min	Max
Intellectual capital efficiency (VAIC)	3.112	1.792	-6.209	6.836
Capital employed efficiency (CEE)	0.209	0.172	-0.812	0.507
Human capital efficiency (HCE)	2.29	1.492	-2.579	5.706
Structural capital efficiency (SCE)	0.612	0.908	-6.352	5.679
Concentration (CRL5)	0.582	0.029	0.541	0.623
Bank size (Rupees in million)	440,000.00	449,000.00	16,500.00	2,510,000.00

Source: Author's estimation from research data.

Table 2 shows the descriptive statistics. IC efficiency (VAIC) during the period under study has the mean value of 3.112 with a standard deviation of 1.792, whereas its minimum and maximum value is -6.209 and 6.836 respectively. CEE has a mean value of 0.209 with a standard deviation of 0.172, whereas its minimum and maximum value is -0.812 and 0.507 respectively. HCE has a mean value of 2.290 with a standard deviation of 1.492, whereas its minimum and maximum value is -2.579 and 5.706 respectively. SCE has a mean value of 0.612 with a standard deviation of 0.908, whereas its minimum and maximum value is -6.352 and 5.679 respectively. Bank loan concentration has a mean average value of 0.582 which means 58 % of loan concentration in the market is covered by the top 5 banks of Pakistan in terms of loans whereas its minimum and maximum value is 0.541 and 0.623 respectively. As far as bank size is concerned the mean average value of all 20 banks during the period under study is 444,000,000 with a standard deviation of 449,000,000. The minimum and maximum value is 16,500,000 and 2,510,000,000 respectively.

Table 3. *Bank Productivity Indices*

	MPI	EFFCH	TECHCH	PECH	SECH
2007/2008	0.815***	0.925	0.884***	1.073***	0.862***
2008/2009	1.3677***	0.954	1.491***	0.901***	1.083
2009/2010	1.135	1.346***	0.867***	1.167	1.160***
2010/2011	1.287***	0.919***	1.407***	0 .936***	0.983
2011/2012	1.113***	1.067	1.042***	1.021	1.063
2012/2013	0.962	0.875***	1.102***	1.053	0.864***
2013/2014	1.117***	0.904***	1.245***	0.989	0.949
2014/2015	1.1391***	1.367***	0.871***	1.054	1.299***
2015/2016	1.003	0.775***	1.441***	0.959	0.812***
2007/2016	1.105***	1.015	1.150***	1.017	1.008

Notes: MPI, Malmquist productivity index; EFFCH, efficiency change; TECHCH, technical change, ***Denotes that indices are significantly different from one at 1 per cent.

Table 3 shows the results related to MPI and its components change over the period. As from the above table, it is observed that the average growth in productivity is about 10.5 percent. This growth in productivity was largely driven by technical change over the period by 15.0 percent while a slight growth of 1.5 percent is also contributed by efficiency change. Though the percentage of efficiency change is less as compared to a technical change that is 1.5 and 15.0 respectively, it implies that banks in Pakistan are abler to utilize their resources to improve their technical capabilities in more efficient way as compared to their efficiency changes, though there is not a decline in efficiency change. The results indicate that the upward shift in technical change is due to the innovative investments in technology in the banking sector of Pakistan over the period.

Table 4 *Intellectual Capital and Bank Productivity*

	MPI	EFFCH	TECHCH	VAIC	SCE	CEE	HCE	CRL5	SIZE
MPI	1								
EFFCH	0.598***	1							
TECHCH	0.317***	-0.511***	1						
VAIC	0.251***	0.107	0.217***	1					
SCE	0.108	0.039	0.077	0.421***	1				
CEE	0.148**	0.077	0.123*	0.673***	-0.172**	1			
HCE	0.219***	0.095	0.200***	0.867***	-0.083	0.797***	1		
CRL5	0.040	-0.063	0.008	-0.217***	0.072	-0.292***	-0.271***	1	
SIZE	0.093	0.015	0.225***	0.460***	0.048	0.337***	0.485***	-0.313*	1

Notes: MPI, Malmquist productivity index; EFFCH, efficiency change; TECHCH, technical change; CEE, capital employed efficiency; HCE, human capital efficiency; SCE, structural capital efficiency; VAIC= intellectual efficiency; CRL5= 5bank loan concentration ratio; SIZE= natural logarithm of total assets. *, **, ***Denotes significance at 10, 5 and 1 percent respectively.

Table 4 shows the correlation matrix between the dependant variable 'MPI' and independent variables VAIC, SCE, CEE, HCE, and control variables CRL5 and SIZE. As SCE, CEE and HCE are the components of VAIC, so the correlation between VAIC and its components should be higher. The correlation matrix shows that efficiency change (EFFCH) has a positive association with MPI at a significance level of 1 percent. Furthermore, the correlation matrix shows that technical efficiency (TECHCH) has also a positive relationship with MPI at a significance level of 1 percent. VAIC has also a positive association with MPI at 1 percent significance level. HCE has a positive association with MPI at 1 percent significance level while CEE has a positive association with MPI at 5 percent level of significance. Whereas SCE, 5 bank loan concentration ratio (CRL5), and bank size (SIZE) has also a positive association but statistically insignificant correlation with MPI. SCE is negatively associated with capital employed efficiency at 5 percent significance and SCE is also negatively associated with HCE but has statistically insignificant correlation. On the other hand, capital employed efficiency is positively associated at 1 percent significance with HCE.

Table 5. *Impact of Intellectual Capital and its Components on Bank Productivity*

Dep Var	**MPI**	**EFFCH**	**TECHCH**	**MPI**	**EFFCH**	**TECHCH**
Constant	-0.086	1.906***	-1.305***	-0.066	1.914***	-1.282***
	(0.520)	(0.419)	(0.465)	(0.517)	(0.425)	(0.463)
VAIC	0.043***	0.029***	0.026***			
	(0.0130)	(0.00834)	(0.0127)			
CEE				-0.040	0.033	-0.166
				(0.187)	(0.086)	(0.169)
HCE				0.052**	0.031**	0.060***
				(0.022)	(0.013)	(0.021)
SCE				0.040*	0.025**	0.048***
				(0.023)	(0.011)	(0.021)
CRL5	1.266*	-0.784	1.429***	1.243*	-0.762	1.333***
	(0.685)	(0.622)	(0.403)	(0.720)	(0.643)	(0.402)
SIZE	0.016	-0.027*	0.081***	0.016	-0.028	0.083***
	(0.015)	(0.016)	(0.017)	(0.016)	(0.017)	(0.019)
R^2	0.210	0.191	0.185	0.225	0.198	0.195
Wald x^2 (5)	32.750	20.580	51.600	34.150	21.230	65.470
Prob > x^2	0.000	0.000	0	0.0000	0.0007	0.0000
Banks	20	20	20	20	20	20
Observations	180	180	180	180	180	180

Notes: MPI, Malmquist productivity index; EFFCH, efficiency change; TECHCH, technical change; VAIC= intellectual efficiency; , CEE, capital employed efficiency; HCE, human capital efficiency; SCE, structural capital efficiency; CRL5= 5bank loan concentration ratio; SIZE= natural logarithm of total assets. *, **, ***Denotes significance at 10, 5 and 1 per cent respectively. Standard errors are in parenthesis.

Table 5 shows the relationship between the dependent variable and the independent variables. According to the model estimated for this study, the dependent variable is MPI whereas VAIC is taken as an independent variable. CRL5 refers to 5 largest banks loan concentration ratio and SIZE is the natural logarithm of total assets. CRL5 and SIZE are taken as control variables.

From the regression analysis, the results revealed that the IC coefficient (VAIC) has a positive impact on overall productivity growth at 1 percent significance level. Further, the parts of MPI i.e., EFFCH and TECHCH, are also being positively influenced by VAIC at a significance level of 1 percent. From R2 value, it is concluded that in the case of MPI, 21.0 percent variation is explained by independent variables. In the case of EFFCH and TECHCH 19.1 percent and 18.5 variations are explained by independent variables respectively. Table V further presents the relationship between banks' productivity and the components of IC which are HCE, SCE, and CEE. CRL5 refers to 5 bank loan concentration ratio and SIZE is the natural logarithm of total assets. CRL5 and SIZE are taken as control variables.

Discussion

The estimated results of the study show that VAIC has a positive relationship with the productivity growth MPI and its other proxies (EFFCH and TECHCH). The results affirm all hypotheses of the study except the fourth hypothesis. The results are duly supported by the literature like Asare (2016); Bollen et. al., (2005) and Chen et. al., (2014). This implies that IC and its sub-components (HCE, SCE, and CEE) underscores banks' productivity both technically and efficiently. This infers that banks are technically sound and efficiently increasing their productivity by transforming inputs into outputs. This underpins the importance of the IC of banks in enhancing effective and technical abilities to accelerate their productivity and consistently raise profits. The bank market concentration has a positive and significant impact on the overall productivity of banks which implies that if market concentration leads to higher productivity which supports the relative market hypothesis. This means that that only firms with large market shares and well-differentiated products can exercise market power and earn higher profits (Rhoades, 1985; Shepherd, 1983), this is the case in Pakistan as on average 58% of the assets (loans) are captured by the 5 large banks. These banks have the potential to offer differentiated products and have the capacity to lead the market and earn considerable profits. Further, the size of the banks is positively related to the technical change and negatively related to the efficiency change which implies that large banks are technically sound than the smaller banks but less efficient as compared to the smaller banks. Moreover, the results revealed that human capital efficiency has a positive effect on bank productivity and efficiency changes. Since, the employees are the important resources of the banks, thus spending on human capital enhances productivity. This spending may be in the account of the training and particular skills required by the banking sector. This implies that well trained and trained employees tend to enhance the productivity of the banking sector in a cost-effective manner. Further, the results reveal that structural efficiency significantly improves banks' productivity which implies that banks branch network, building infrastructure, ATMs and 24/7 customer service allow banks to accelerate their productivity. Appendix A2 shows the increase in the branch network of banks since 1980. For the capital employed efficiency, the study does not find any significant impact on the productivity of banks. The possible explanation for this result could be the minimum capital requirement by the central bank of Pakistan which is uniform for all banks operating in Pakistan.

Conclusion

This study has been undertaken to examine the impact of IC on the productivity of the 20 banks that are listed in Pakistan Stock Exchange (PSX) over a period of 10 years, from 2007 to 2016. For the purpose of getting results, this study has undergone through three different stages and these are as follows;

In the first stage, VAIC and its components for all the 20 banks that are listed in PSX were calculated by the given formulas of VAIC, HCE, SCE, and CEE for the period of 10 years i.e. 2007-2016.

In the second stage, regression analysis is estimated for the first model under which the dependent variable MPI is regressed on the independent variable Value-Added Intellectual Coefficient (VAIC). For this model CRL5 which is 5 bank loan concentration ratio and SIZE which is the natural logarithm of total assets were taken as a control variable.

In the final stage i.e. third stage, again regression analysis is estimated but this time it is for the second statistical model under which dependent variable MPI is regressed on independent variables which are the components of value-added IC (VAIC) that are HCE, CEE, and SCE. CRL5 and SIZE were also taken as the control variables in this model.

From the bank productivity indices from 2007 to 2016 as presented in Table III, it can be clearly seen that the overall productivity growth (MPI) is significant at 1 percent significance level. There are some years in between which are not significant in terms of productivity growth like 2009/2010, 2012/2013 and 2015/2016. In terms of efficiency change (EFFCH), the overall result shows that it is positive but not statistically significant. As far as technical efficiency (TECHCH) is concerned, the overall data that is taken for the study shows positive as well as significant at 1 percent level of significance. In 2007/2008, as its value is less than 1 so productivity growth recorded a decline of 18.5 percent. While in 2008/2009 the productivity growth showed an upward incline at 36.77 percent. There was another decline in productivity growth (MPI) which is recorded in 2012/2013 and it was of 3.8 percent.

According to the correlation analysis, the highest correlation recorded between the dependent variables MPI (including its components) and independent variables VAIC, HCE, SCE, and CEE remains at 0.867 at a 1 percent significance level resulted between VAIC and HCE.

Limitations and Suggestions

This study only used value-added intellectual coefficient (VAIC) out of many other measurements of IC irrespective of that the resulted value of IC from the selected method might not be a precise one.

Data for this study was taken only from the banks that are incorporated in Pakistan. Twenty (20) banks were taken for a period of 10 years from 2007 to 2016. For further studies, data could include samples from other countries as well as time period so as to expand the research area and have a better picture regarding IC and productivity of banks in Pakistan and with the World. Especially in the case of Pakistan further studies are needed to be done as no research has yet been done on IC and bank productivity. From the past, there is evidence of the studies conducted on IC and its impact on performance using different financial ratios but productivity measures are non-existent.

So from the results concluded in this study, it should be kept in mind that the banks in Pakistan should also focus and invest in capital employed of the bank so as to have better overall growth in the productivity of the bank. Though it can be observed that IC (VAIC) is positive and also significant to productivity growth (MPI) as well as to its components like efficiency change (EFFCH) and technical change (TECHCCH), policymakers and investors should invest more in capital employed of the bank as CEE is one of the component of value-added intellectual coefficient (VAIC). If CEE is improved, then it would have an overall impact on productivity growth as well as on its components.

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