THE MODERATING EFFECT OF HUMAN CAPITAL ON INNOVATION CAPITAL AND FIRM MARKET VALUE RELATIONSHIP: AN APPLICATION ON BIST

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ABSTRACT

In today's world, for wealth creation, capital should be invested in a manner of leading to innovation and human development. This kind of wealth creation, is generally discussed in the concept of intellectual capital (IC). There is a widespread belief in the literature that IC is a phenomenon based on interactions and interdependencies among its components. In this paper, it was investigated the impact of innovation capital (INVC) on firm market value and moderating effect of human capital (HC) on this relation. Experimental models were based on Ohlson (1995) model. INVC and HC were measured by using proxy variables derived from accounting data. This paper concludes that INVC can be considered to be value-relevant to market participants, and HC augments the role of INVC in reinforcing firm's market value. As a managerial implication, managers should consider the interaction between HC and INVC when developing a strategy of utilizing intangible assets for sustainable performance.

Keywords: Innovation Capital, Human Capital, Moderating Effect, Ohlson Model, Value Relevance.

İNSAN SERMAYESİNİN İNOVASYON SERMAYESİ VE FİRMA PİYASA DEĞERİ İLİŞKİSİ ÜZERİNDEKİ ILIMLAŞTIRICI ETKİSİ: BİST ÜZERİNE BİR UYGULAMA

ÖZET

Günümüz dünyasında değer yaratımı için sermayenin, yenilikçiliği ve çalışan gelişimini sağlayacak bir şekilde değerlendirilmesi gerekmektedir. Bu tür değer yaratımı genellikle entelektüel sermaye kavramı içerisinde ele alınmaktadır. Literatürde entelektüel sermayenin, bileşenleri arasındaki etkileşimlere ve karşılıklı bağımlılıklara dayalı bir fenomen olduğuna dair yaygın bir görüş bulunmaktadır. Bu çalışmada, yenilik sermayesinin (YS) firma piyasa değeri üzerindeki etkisi ve insan sermayesinin (IS) ise bu ilişki üzerindeki ılımlaştırıcı etkisi araştırılmıştır. Deneysel modeller Ohlson (1995) modelini temel almaktadırlar. YS ve IS, muhasebe verilerinden türetilen gösterge değişkenler kullanılarak ölçülmüşlerdir. Elde edilen bulgulara göre YS'nin piyasa oyuncularının kararları üzerinde etkisinin olabileceği ve YS'nin firmaların piyasa değerini artırma rolü üzerinde IS'nin güçlendirici bir etkiye sahip olduğu ile ilgili önemli bulgular ortaya koyulmaktadır. Sonuç olarak yöneticiler, sürdürülebilir bir performans için maddi olmayan duran varlık kullanımı ile ilgili stratejiler geliştirirken IS ile YS arasındaki etkileşimi de göz önüne almalıdırlar.

Anahtar Kelimeler: Yenilik Sermayesi, İnsan Sermayesi, Ilımlaştırıcı Etki, Ohlson Modeli, Değer İlişkisi.

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1. Introduction

In today's world where technology develops rapidly, competition becomes more difficult and consumer's expectations constantly change, firms should respond with innovations outputs in order to survive, provide a competitive advantage, and increase their market share (Ince, Imamoglu and Turkcan, 2016). The most important difference that distinguishes today's new world from the past is the fact that knowledge has become the most important factor among production factors (Öğüt, 2009). Therefore, for wealth creation, capital need to be invested in brain power, i.e. human capital, and in the use of technology leading to innovation and rapid product generation (Moore and Craig, 2008). This kind of wealth created based on knowledge and innovation beyond tangible capital within firms is generally discussed in the concept of intellectual capital. Stewart (1998) defines intellectual capital as intellectual materials, such as knowledge, know-how and intellectual property, used to create value. Likewise, Brennan and Connell (2000) briefly define it as knowledge-based equity of organizations. IC is now at the center of value creation activities for modern business world (Hsiao, 2014).

There is a widespread belief in the literature that intellectual capital (IC) is a phenomenon based on interactions and interdependencies among its components (human, relational, process and innovation capital, following studies that adopt quadruple classification), and therefore; the ability of IC to effectively contribute to value creation depends on the interactions among these components (Bontis, 1999; Cabrita and Bontis, 2008; Huang and Liu, 2005). For example, It is emphasized that human capital, seen as the main source of sustainable competitive advantage, may only have an indirect effect on value of the firms by interacting with the other components, and therefore, human capital is considered to have a moderating effect on the relation between other IC components and the firms' market value (Ferraro and Veltri, 2011). Similarly, Alpkan, Bulut, Gunday, Ulusoy and Kilic (2010) think that in addition to its direct effect on company performance, human capital may also have a facilitator role in the efforts to create an appropriate ground to produce higher organizational performance.

The purposes of this paper are to empirically investigate whether innovation capital is value relevant and whether human capital has a moderating effect on the relationship between innovation capital and firm market value, or not. To test relevant hypotheses, we added innovation capital, measured by using proxy variables, and then interaction term to the Ohlson (1995) valuation model as 'other information'. Unbalanced panel data set with 932 observations, obtained from Borsa Istanbul publicly traded industrial companies between years 2004-2014, have been analyzed applying static panel data estimation technique. In this context, Section 2 provides a literature review of innovation capital and human capital, then moves on to development of hypotheses. Research methods take place in Section 3. Findings of the analysis are presented in Section 4. Finally, conclusion of the study and discussions of the findings are set out in the final section.

2. Literature Review and Theoretical Framework

2.1 Innovation capital

Bellora and Guenther (2013) argue that major economies' transformation from an industry-based structure to a knowledge-based structure increases the significance of innovation. Innovation indicates to the nations' future intellectual wealth (Bontis, 2004), and it is an important factor of sustainable growth for both countries and organizations (Kwan and Chiu, 2015). Hence, innovation capital should not be subject to structural capital, instead it should represent an independent capital structure (Chen, Zhu and Xie, 2004).

Innovation capital can be sometimes referred to as technological capital (Bueno, Salmador, Rodríguez and Martín De Castro, 2006; Khalique, Shaari and Isa, 2011; Ramezan, 2011) and sometimes as renewal capital (Bontis, 2004), and it is defined, in general, as the capacity of organizations to introduce new products and services (Ferraro and Veltri, 2011) and/or to improve existing ones (Koroglu and Eceral, 2015). It consists of development of functions and activities within both an internal and an external process scope related to the products and services that shape different operations of the organization (Ramírez, 2010). Firms' stock of innovation capital is based on information technology, research and development activities, and protection rights (Khalique et al., 2011). It is widened and improved by internal R&D activities and/or transformation of the technologies and knowledge developed by other organizations in a way of reverse engineering, industrial espionage, head-hunting and purchases of licenses, machinery and production equipment (Fernandez, Montes and Vazquez, 2000).

2.2. Human Capital

For companies in today's world, management of human capital might be the only way to succeed (Gavious and Russ, 2009). It ensures a competitive advantage for companies in terms of skills, expertise and willingness to work (McGuirk, Lenihan and Hart, 2015). Moreover, economics scholars know that human capital is the central element of economic growth, whereas management scholars acknowledge that a firm's growth is positively related to human capital quality (McGuirk et al., 2015). Human assets in firms are an organizational accelerator that activate intangible assets and enhances the operational efficiency of tangible assets (Bozbura and Toraman, 2004). It is also regarded as an essential part of innovation (OECD, 2011).

Becker's (1964) human capital theory states that individual knowledge, skills and capabilities are worthful resources and an important factor of economic productivity, and these skills and capabilities can be built through education and experience (Martinez, Zouaghi and Garcia, 2017). Human capital shows the stock of knowledge, talents, creativity, technical skills and experience in organizations (Pasban and Nojedeh, 2016). Moreover, it does not only refer to individual skills and aptitudes, but also to collective ones of workforce (Stewart, 1998). On the other hand, it is not seen as an asset that is legally owned by firms (Stewart, 1998). So, it can also be understood as the knowledge that employees take with them when leaving the firm (Meritum, 2002).

2.3. Research Hypotheses

Innovation is an important factor of sustainable growth for organizations (Kwan and Chiu, 2015). There are studies that find a relationship between innovation capital and firms' financial performance (i.e. Tanideh, 2013). Firms' innovation capital accumulation is mainly based on research and development (R&D) activities (Khalique et al., 2011). It has been found that R&D activities play an important role in the innovative output of companies which means future growth opportunities (Ferraro and Veltri, 2011). It is advocated that firms create more tangible and intangible assets when investing in higher innovation capital (Hsiao, 2014). Accordingly, it can be expected that more innovation capital will improve financial performance, and working on innovation will have a systematic effect on the market values of today's production companies, where information-based production is advantageous. Following above discussion and this reasoning, we formulate the following research hypothesis:

H_1: Higher innovation capital of a firm results in greater effects on its market value in the case of Turkish industrial companies.

Milgrom and Roberts' (1995) complementarities theory suggests that there are synergies among the complementarity factors of a system of mutually enhancing elements (Huang and Liu, 2005). There are many scholars who think that intellectual capital is also formed by the same characteristic (Bontis, 1999; Cabrita and Bontis, 2008; Giuliani, 2013; Huang and Liu, 2005; Kamukama, Ahiauzu and Ntayi, 2010; Starovic and Marr, 2003). To be clear, the ability of intellectual capital to effectively contribute to value creation depends on the interactions and interdependencies among its components (human, relational, process and innovation capital). Particularly, it is emphasized that human capital, seen as the main source of sustainable competitive advantage, may have an indirect effect on value of the firms by interacting with the other components (Ferraro and Veltri, 2011). For example, Thacker and Handscombe (2003) assert that people in the organization and the interrelation between them inevitably play a big part in easing or limiting the organization's innovation process. Similarly, Hitt, Bierman, Shimizu and Kochhar (2001) claim that innovative organizations which have highly skillful and knowledgeable human assets are more likely to create deeper knowledge and higher innovativeness. The above literature leads us to deduce that human capital may play a moderating role in the relationship between innovation capital and firm's market value. In this context, we may argue that high human capital accumulation stimulates the relationship between innovation capital and firm market value, and thus, it may be expected that the bigness or smallness of the human capital will determine the impact level of innovation capital on firm's market value. Following this argumentation, we formulate the following hypothesis:

H_2: The greater human capital in organizations, the stronger the influence of innovation capital on firm's market value in the case of Turkish industrial companies.

3. Research Method

3.1. Proxy variables for innovation and human capital and research sample

R&D is key parameter in innovation capital, and its significant role is widely recognized (Lin, 2014). This significant role comes from the direct and systematic influence of R&D expenditures on firm's market value (Bandeira and Afonso, 2010), as investors consider R&D expenditures to be a value-enhancing activity (Sydler, Haefliger and Pruksa, 2014). On the other hand, today's organizations may not only rely on internal innovation activities, but also try to acquire knowledge and capabilities from other institutions' R&D sources (Lin, 2014). Intangible assets in a company are closely related to innovation activities, and it involves mainly patents, non-patent technology, trademarks and copyrights (Xiangying, Yueyan and Xianhua, 2015). As a result, in order to investigate the effects of the innovation capital on firm value, it has been decided to add the innovation capital to the valuation model with two different proxies based on available financial statement data. The first one of these proxies, supported by previous studies (Shakina and Barajas, 2014; Sydler et al., 2014; Wang and Chang, 2005; Wang, 2008) is research and development expenses realized by the firm with the aim of innovation enhancement, whereas the second one, also supported by previous studies (Ferraro and Veltri, 2011; Shakina and Bykova, 2011; Yu and Zhang, 2008), is intangible assets that include such assets as patents, rights, licenses and royalties that the firm owns.

Formal education is one of the major components of human capital since it assists in the development of skills and augmentable knowledge (Cetindamar, Gupta, Karadeniz and Egrican, 2012). There are studies that find

a direct positive relationship between education and wage and salary level (e.g. Dumont, 2008; Turcotte and Rennison, 2004). These relationships are rational, seeing that more skilled and educated employees demand higher salaries by getting more experience and seniority within the company (Kallunki, Karjalainen and Martikainen, 2005). Moreover, when employees successfully apply their human capital competence to their job, they receive reward, such as salary, benefits, job satisfaction as well as promotion, for their efforts (Pasban and Nojedeh, 2016). As a result, in order to investigate the moderating effect of human capital on the relationship between innovation capital and firm market value, it has been decided to use total personnel expenses per employee as a proxy variable for human capital accumulation. This variable is easily derived from financial statements and is supported by previous studies (Ballester, Livnat and Sinha, 2002; Lajili and Zéghal, 2005; Widener, 2006).

In the paper, proxy variables for innovation and human capital, which are obtained from accounting data and used mainly in previous studies are needed. Therefore, the companies which are publicly traded in Borsa İstanbul Industrial Index (XUSIN) between 2004 and 2014, and whose balance sheet and income statement data can be accessed reliably and completely are included in research sample. According to the data set used, it is determined that research will be conducted by panel data analysis methods. Because of the fact that some firms in research sample do not have any data for certain years, the dataset is unbalanced panel. The data relating to variables were obtained from Public Disclosure Platform and Borsa Istanbul official websites. Starting research sample consists of 1,360 firm-year observations. After subtracting missing data observations, we obtain 948 observations. Consistent with prior literature (Wang, 2008), research sample is restricted to firms which have positive book value; consequently, 932 samples have remained. While keeping as much information as possible in the dataset, in order to mitigate the influence of outliers on statistical inference, all variables are winsorized (by year) at the 5th and 95th percentiles.

Table 1: Descriptive Statistics and Correlations

Variables	Mean	St. Deviation	1	2	3	4	5
1. MVPS	6.975	10.061	-				
2. BVPS	5.689	6.930	0.574*	-			
3. AEPS	0.036	1.868	0.309*	0.059	-		
4. IAPS	0.166	0.324	0.382*	0.320*	0.139*	-	
5. RDPS	0.032	0.070	0.203*	0.260*	0.002	0.280*	-
6. PEPE	44.46	29.522	0.293*	0.175*	0.165*	0.124*	0.061

*Variable definitions: Where MVPS is the closing price of firm's share at the last official release of the annual reports in year t+1; BVPS is firm's book value per share; AEPS is firm's abnormal earnings per share; IAPS is firm's intangible assets per share; RDPS is firm's research and development expenditures per share; PEPE is firm's personnel expenses per employee. Asterisk * indicate that significance at the 5 per cent level. All variables are winsorized at the 5th and 95th percentiles to avoid the influence of outliers on statistical inference. PEPE is decreased by a factor 1.000 for reporting issues.*

Table 1 reports descriptive statistics and correlations of variables. In the research sample period, mean market value per share is 6.975 ($SD = 10.061$); mean book value per share is 5.689 ($SD = 6.930$); mean abnormal earnings per share is 0.036 ($SD = 1.868$); mean intangible assets per share is 0.166 ($SD = 0.324$); mean research and development expenses per share is 0.032 ($SD = 0.070$); and mean personnel expenses per employee is 44.46 ($SD = 29.522$). Table 1 also reports correlation matrix results among variables. Table 1 reveals that dependent variable, i.e. stock value, is positively and significantly correlated with all of the independent variables, as expected. Moreover, we have utilized variance inflation factor (VIF) to avoid multicollinearity problem among the independent variables, and according to findings (untabulated), there is no serious collinearity problem among the variables in regression models. As a result, it has been decided that the dataset is suitable for regression analysis.

3.2. Models and Estimation

In accounting and finance literature, studies in which an empirical relation between market values (or changes in values) and particular accounting numbers are investigated for the purpose of assessing the use of those numbers in an accounting standard are called value-relevance studies (Holthausen and Watts, 2001). In studies examining the value relevance of any accounting numbers, it is necessary to use a valuation model that associates firm value with the firm characteristics that investors value (Barth, 2000). The major valuation model utilized in

these studies is Ohlson (1995) valuation model (OM) which is suggested as a benchmark model relating to how to determine value of an organization by utilizing accounting numbers. OM have become a leading model used by many authors in value relevance research due to the fact that it provides a direct link between market value of an asset and its accounting numbers (Barth, 2000; Eloff and de Villiers, 2015).

Ohlson (1995) characterizes firm market value as a linear function of book value of equity, future abnormal earnings present value, and "*other information*" rather than abnormal earnings that affects future abnormal earnings. OM linear valuation function is shown as follows:

$$p_t = bv_t + \alpha_1 X_t^a + \alpha_2 v_t$$

Where p_t is stock value at time t; bv_t is book value at time; X_t^a is abnormal earnings at time *t;* and v_t is information other than abnormal earnings at time t. Abnormal earnings is calculated as follows:

$$X_t^a = X_t - r_f . bv_{t-1}$$

Where r_f is cost of equity capital (= risk-free interest rate in the default risk-free environment). OM can be modified for testing value relevance of accounting numbers by enabling econometric panel data analysis, as follows:

$$MVPS_{it} = \beta_0 + \beta_1 BVPS_{it} + \beta_2 \text{AEPS}_{it} + \varepsilon_{it} \tag{1}$$

Where $MVPS_{it}$ is the closing price of firm *i*'s stock at the last official release of the annual financial reports in year *t+1* (Because, annual financial reports in year t don't become publicly available until release date in year t+1, i.e. March or April.); $BVPS_{it}$ is firm *i*'s book value per share in year *t*; AEPS_{it} is firm *i*'s abnormal earnings per share in year *t;* β_0 is constant term*;* β_1 and β_2 are slope coefficients; and ε_{it} is error term.

As seen in the model (1), researchers generally simplify OM linear valuation function, by assuming that the effects of unspecified other information are entirely absorbed by the constant and/or error term in order to make the model more appropriate for econometric analysis. However, some researchers argue that removal of other information from the model may weaken the fit of OM (Al-Hares, AbuGhazaleh and Haddad, 2011; Ota, 2000). Hence, studies that utilize various accounting numbers in exchange for v_t in the model are widely seen in OM literature (Barth, Beaver, Hand and Landsman, 1999; Dechow, Hutton and Sloan, 1999). For example, Mondal and Ghosh (2013) utilize intellectual capital in exchange for v_t by asserting that investments in intangibles are associated with higher future earnings and stock returns. For these reasons, proxies of innovation capital are added into OM as 'other information', and thus whether innovation capital has any meaningful information on firm market value, i.e. value relevant or not is investigated. Extended OM to test H₁ hypothesis comes up as follows:

$$MVPS_{i,t} = \beta_0 + \beta_1 BVPS_{it} + \beta_2 \text{AEPS}_{it} + \beta_3 IAPS_{it} + \beta_4 RDPS_{it} + \varepsilon_{it} \tag{2}$$

Where $IAPS_{it}$ is firm i's intangible assets per share at time *t*; $RDPS_{it}$ is firm i's research and development expenditures per share at time *t*.

Afterwards, in order to investigate whether human capital has a moderating effect on the relationship between innovation capital and firm market value, proxy of human capital and interaction terms are added to model (2). Interaction models to test H₂ hypothesis come up as follows:

$$MVPS_{i,t} = \beta_0 + \beta_1 BVPS_{it} + \beta_2 \text{AEPS}_{it} + \beta_3 IAPS_{it} + \beta_4 RDPS_{it} + \beta_5 PEPE_{it} + \varepsilon_{it} \tag{3}$$

$$MVPS_{i,t} = \beta_0 + \beta_1 BVPS_{it} + \beta_2 \text{AEPS}_{it} + \beta_3 IAPS_{it} + \beta_4 RDPS_{it} + \beta_5 PEPE_{it} + \\ \beta_6 IAPS * PEPE_{it} + \varepsilon_{it} \tag{4}$$

$$MVPS_{i,t} = \beta_0 + \beta_1 BVPS_{it} + \beta_2 \text{AEPS}_{it} + \beta_3 IAPS_{it} + \beta_4 RDPS_{it} + \beta_5 PEPE_{it} + \\ \beta_6 RDPS * PEPE_{it} + \varepsilon_{it} \tag{5}$$

$$MVPS_{i,t} = \beta_0 + \beta_1 BVPS_{it} + \beta_2 \text{AEPS}_{it} + \beta_3 IAPS_{it} + \beta_4 RDPS_{it} + \beta_5 PEPE_{it} + \\ \beta_6 IAPS * PEPE_{it} + \beta_7 RDPS * PEPE_{it} + \varepsilon_{it} \tag{6}$$

Where $PEPE_{it}$ is firm i's personnel expenses per employee at time *t,* personnel expenses include all types of related expenses; wages, salaries, bonuses, employee insurance and other employee benefits. Model (4) has been obtained by adding the interaction term formed via multiplication of IAPS and PEPE to Model (3). Model (5) has been obtained by adding the interaction term formed via multiplication of RDPS and PEPE to Model (3). Model (6) has been obtained by adding the interaction term formed via multiplication of RDPS and PEPE to Model (4).

In order to test the hypotheses, six different econometric panel data regression analyses (model 1 to 6) have been applied to a sample of XUSIN firms from 2004 to 2014. Before starting the regression analyses, for the purpose of determining which panel data estimation technique is more suitable to the data set, it has been run model specification tests for pooled vs. fixed effects, pooled vs. random effects and random vs. fixed effects techniques by means of F (Chow), Breusch-Pagan Lagrange Multiplier and Hausman tests, respectively. According to the results (untabulated), it has been decided to utilize fixed effects estimation technique (Hereafter FE). Later, time dummies redundancy tests have been conducted to decide whether two-way or one-way FE could be used. According to the findings (untabulated), it has been decided that time dummies are needed in the models. In addition, time dummies also help to reduce the omitted variable bias. Finally, proxy variables of innovation and human capital, before forming interaction terms, are centered (mean=0) in order to minimize the effects of any multicollinearity among them, following Aiken and West (1991).

It is thought that noncompliance with regression assumptions on regression residuals may lead to biased statistical inferences (Hoechle, 2007); therefore, estimates have been made using Rogers clustered standard errors which produces consistent results under heteroscedasticity and autocorrelation problems. Results of two-way fixed-effect regression analyses of Model (1) and (6) are reported in Table 2.

4. Findings

According to Model 1 (OM) analysis results in Table 2, F-value of the model is 6.85 (P-value<.01) meaning that the validity of model can't be rejected. The adjusted R^2 of the model is 0.719. The coefficients of BVPS (β_1=0.435, P<.01) and AEPS (β_2=1.950, P<.01) are significantly positive at the 0.01 level of significance, as expected. These findings indicate that OM is suitable for the Turkish industrial companies' valuation. Secondly, the analysis results of Model (2), which is acquired by the involvement of proxies of innovation capital in OM, are displayed in Table 2. F-value of Model (2) is 6.33 (P<.01), meaning that Model (2) has a statistically significant predictive capability, with an adjusted-R^2 value of 0.737. It is observed that the coefficients of BVPS (β_1=0.325, P<.05) and AEPS (β_2=1.710, P<.01) are significantly positive again. The coefficient of IAPS in Model (2) is significantly positive (β_3=10.822, P<.01) at the 0.01 level of significance, whereas the coefficient of RDPS in Model (2) is negative and insignificant (β_4=-12.458, P>.10). These results partially supports Hypothesis 1, which proposes that higher innovation capital of a firm results in greater effects on its market value in the case of Turkish industrial companies. Second F-statistic in Table 2 (ΔF-value) provides a statistic which tests whether inclusion of any variables in a particular model is statistically significant or not. Thus, ΔF-value of the Model (2) is 3.84 (P<.01) indicating that the change of 0.018 in adjusted-R^2, owing to the inclusion of proxies of innovation capital in Model (1), is statistically significant. These findings reveal the incremental explanatory power of innovation capital on firm market value.

Finally, in order to examine whether human capital has a moderating effect on the relationship between innovation capital and firm market value, Model (3), (4), (5) and (6) have been derived, and findings are displayed in Table 2. In spite of minor differences, all four models reveal similar results. It is observed that the coefficients of BVPS, AEPS and IAPS are significantly positive again in all models. On the other hand, the coefficient of RDPS is statistically insignificant in Model (4) and (6), whereas it is only weakly significant and negative (β_4=-13.967, P<.10) in Model (5). The coefficient of PEPE in all models is positive and statistically significant at the 0.10, 0.10, 0.05 and 0.05 levels of significance, respectively. When interaction terms' findings are examined, it is observed that the coefficients of all interaction terms are positive and statistically significant at the 0.10 or 0.05 levels of significance. F-value of Model (4) is 6.11 (P<.01), with an adjusted-R^2 value of 0.745. F-value of Model (5) is 7.50 (P<.01), with an adjusted-R^2 value of 0.746; and F-value of Model (6) is 8.59 (P<.01), with an adjusted-R^2 value of 0.749. Consequently, all there models have a statistically significant predictive capability. ΔF-values of Model (4), (5) and (6), which are statistically significant at the 0.05 significance level, indicate that the changes of 0.006, 0.07 and 0.010 in adjusted-R^2 due to the inclusion of interaction terms in Model (3) are statistically significant. These results supports Hypothesis 2, which proposes that the greater human capital in organizations, the stronger the influence of innovation capital on firm's market value in the case of Turkish industrial companies. Therefore, it can be accepted that human capital plays a positive moderating role in the relationship between innovation capital and firm market value.

Table 2: Results of Two-Way Fixed-Effect Regression Analyses on Firms' Stock Value

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
BVPS	0.435*** (0.140)	0.325** (0.125)	0.311** (0.122)	0.317** (0.135)	0.253** (0.125)	0.2703** (0.135)
AEPS	1.950*** (0.572)	1.710*** (0.579)	1.714*** (0.579)	1.763*** (0.589)	1.697*** (0.596)	1.738*** (0.604)
IAPS	–	10.822*** (4.012)	11.205*** (3.993)	7.620* (4.151)	10.048** (4.018)	7.577* (4.179)
RDPS	–	-12.458 (9.862)	-11.867 (10.327)	-11.199 (10.470)	-13.967* (7.816)	-13.029 (8.558)
PEPE	–	–	0.084* (0.045)	0.076* (0.041)	0.105** (0.043)	0.095** (0.040)
IAPS*PEPE	–	–	–	0.281** (0.123)	–	0.213* (0.113)
RDPS*PEPE	–	–	–	–	1.044** (0.401)	0.829** (0.404)
Time Dummy Variables	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.719	0.737	0.739	0.745	0.746	0.749
F - value	6.85***	6.33***	6.09***	6.11***	7.50***	8.59***
ΔF-value	-	-	-	5.23**	6.78***	4.86***
N	932	932	932	932	932	932

See Table 1 for definitions of all variables. Rogers clustered standard errors (in parentheses). Asterisks ***, **, * indicate that two-tailed significance at the 1, 5 and 10 per cent levels, respectively. Year dummies controlled for but results not reported in all models. All variables are winsorized at the 5th and 95th percentiles to avoid the influence of outliers on statistical inference. PEPE is decreased by a factor 1.000 for reporting issues. All models include an unreported constant term.

Figure 1: Illustration of the Moderating Effects of Personnel Expenses per Employee
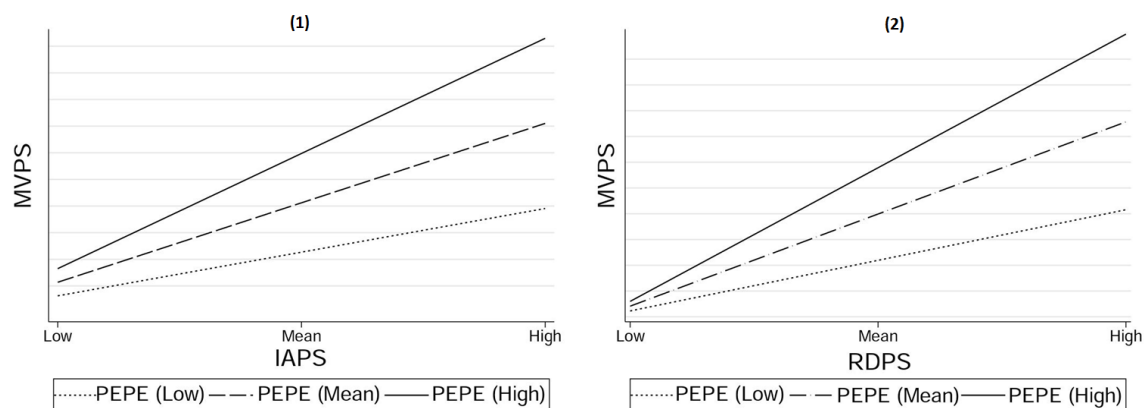
To facilitate interpretation, it is also plotted the moderating effect of human capital in Model (4) and (5) in Figure 1. The first graph in Figure 1 depicts the moderating effect of human capital in Model (4), and the second graph in Figure 1 depicts the moderating effect of human capital in Model (5). In order to create Figure 1, all variables in Model (4), excluding the IAPS and PEPE, and in Model (5), excluding the RDPS and PEPE, have been constrained to sample means. However, IAPS, RDPS and PEPE have taken three different values: average value (mean); average value minus one standard deviation (low); and average value plus one standard deviation (high). In the first graph, the positive effect of IAPS on MVPS is stronger when PEPE is large (one standard deviation above the mean) than when it is small (one standard deviation below the mean), and in the second graph, the positive effect of RDPS on MVPS is stronger when PEPE is large (one standard deviation above the mean) than when it is small (one standard deviation below the mean). As a result, higher levels of PEPE lead to a greater impact of IAPS on MVPS and RDPS on MVPS. Thus, Figure 1 re-supports hypothesis 2.

5. Conclusion and Discussions

In this paper, panel regression analyses have been performed in order to investigate the impact of the innovation capital on the firm market value and moderating effect of human capital on this relation within the context of Turkish industrial companies. It has been hypothesized that higher innovation capital of a firm results in greater effects on its market value, and the greater human capital in organizations, the stronger the influence of innovation capital on firm's market value. These hypotheses have been developed considering the fact that the most important difference that distinguishes today's new world from the past is the fact that knowledge has become the most important factor among production factors (Öğüt, 2009). Therefore, for wealth creation, capital needs to be invested in human and in the use of technology leading to innovation and rapid product generation (Moore and Craig, 2008). This kind of wealth creation, is generally discussed in the concept of intellectual capital (IC), and there is a widespread belief in the literature that IC is a phenomenon which is based on interactions and interdependencies among its components.

In order to test hypotheses, experimental models have been based on Ohlson (1995) valuation model, the most famous model of the value relevance researches. Innovation and human capital have been measured by using proxy variables derived from the accounting data. This paper concludes that basic accounting variables, i.e. BVPS and AEPS, are value relevant for investors within the Turkish industrial companies context. In order to investigate the impact of the innovation capital on the market value, two different proxy variables have been used for innovation capital. However, different findings have been reached related to the effects of these two proxy variables on market value. It seems that investors only price intangible assets, except for R&D expenditure. On the other hand, we think that intangible assets accounting number is more consistent proxy variable for innovation capital because of the following two reasons: (1) Some companies report that they didn't make any R&D expenses during the financial period, therefore R&D expenses data in Turkey suffers a serious availability problem. (2) R&D expenditure covers only limited portion of innovation investment; that is, it is not equal to actual innovation investment (Xiangying et al., 2015), and outcomes of this investments are usually unpredictable (Ferraro and Veltri, 2011). So this kind of investments may send wrong signals to investors. In the light of these arguments, when hypothesis relating innovation capital is evaluated, the hypothesis, which proposes that higher innovation capital of a firm results in greater effects on its market value, is conditionally, i.e. with the use of intangible assets as proxy variable, supported. Therefore innovation capital can be considered to be value-relevant to market participants due to the significantly positive effect on the market value of firms.

This paper also reveals important findings related to the moderating effect of human capital on the relationship between innovation capital and firm market value. When either intangible assets or R&D expenditures, or both, are used as a proxy variable for innovation capital, human capital augments the role of innovation capital in reinforcing firm's market value. Moreover, it seems that investors only price R&D expenses when it interacts with personnel expenses. These findings support strongly the view that investment in R&D without the support of human capital doesn't increase the market value.

As a managerial implication, managers should understand that the effect of innovation capital on firm market value is a factor which cannot be neglected, and they should consider the interaction between human and innovation capital when developing a strategy of utilizing intangible assets for sustainable performance. However, the findings should be evaluated in terms of Borsa Istanbul publicly traded industrial companies during the research period.

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