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Article

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FINANCIAL ECONOMICS | RESEARCH ARTICLE

The relationship between human capital and firm value: Evidence from Indian firms

Garima Sisodia¹, Nemiraja Jادیappa² and Anto Joseph^{3*}

Abstract: The purpose of this paper is to investigate whether human capital affects firm value by following a positive methodological approach. According to the classical theory of economic growth, the output of a country depends on its human and physical capital. At the micro-level, the same theory holds true for firm output. Thus, the human capital of a firm should play a significant role in firm performance and therefore firm valuation. Our results show a positive relationship between human capital and firm value. Human capital creates value; first, by better utilization of current growth opportunities; second, by creating future growth opportunities, and lastly, by reducing the volatility associated with the firm growth rate. Also, we test the size effect on the relationship between human capital and firm value and do not find any differential impact.

Subjects: Economics; Economics; Business, Management and Accounting

Keywords: human capital; firm value; firm growth; firm volatility; firm valuation

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PUBLIC INTEREST STATEMENT

Human capital refers to the intrinsic productive capabilities of human beings. It is the collective measure of the knowledge, education, skills, competencies, and other attributes personified in individuals or groups of individuals which impact their prolific capacity and earning potential to produce goods, services, or ideas in market settings. However, human capital is an intangible asset that is not recorded on a company's balance sheet. In a corporate setting, remarkably, human capital acts as the primary facilitator in augmenting firm productivity and serves as the critical factor in the effective execution of business strategies. Thus, the human capital of a firm should play a significant role in firm performance and, therefore firm valuation. The purpose of this paper is to investigate whether human capital affects firm value by following a positive methodological approach. Our results show a positive relationship between human capital and firm value.

1. Introduction

Human capital refers to the intrinsic productive capabilities of human beings (Eide & Showalter, 2010). It is the collective measure of the knowledge, education, skills, competencies, and other attributes personified in individuals or groups of individuals which impact their prolific capacity and earning potential to produce goods, services, or ideas in market settings. Investment in human capital is of paramount importance for the sustainable development, economic competitiveness, and growth of any nation. Therefore, every nation should have a strong investment in human capital in complementing other investments and policies to boost efficiency and economic advancement. At the micro-level, human capital not only acts as the primary facilitator in augmenting firm productivity but also serves as the critical factor in the effective execution of business strategies (Bontis et al., 2000; Yusuf, 2013). Firms with superior human capital are in a better position to build resources and capabilities (Barney, 1991). Moreover, the extent to which a firm develops and maintains human capital is positively related with the level of firm performance and the long run value creation (Ruiz et al., 2017). Therefore, it is challenging for a firm to create a competitive advantage without an efficient labor force, even though the firm has ample financial resources, advanced technologies, and sophisticated infrastructure.

The existing empirical studies which examine the relationship between human capital and firm value confirm that the investment in human capital can yield better firm performance outcomes (Almeida & Carneiro, 2009; Ballot et al., 2001; Becker & Huselid, 2006; Bowen & Ostroff, 2004; Buller & McEvoy, 2012; Heskett et al., 2003; Khan & Quaddus, 2018; Likert & Bowers, 1969; Mohapatra et al., 2019). Although, existing literature identifies a positive relationship between human capital and firm value, one of the major problems entrenched in the literature is the scarcity of a generally accepted methodological framework to establish the relationship between firm value and human capital. In order to avoid this predicament, the present study trails a positive methodological approach, which grounds research on a fundamental theory from which research hypotheses are later inferred and verified in the context under study. We develop our hypotheses by following the classical economic growth theory, the output of a country depends on two factors; labor and capital. We modify the production function given by Cobb-Douglas and argue that at the micro level, this production function equally applies to firms and hence, the firm's output depends mainly on two inputs, physical capital and human capital (labor).¹ In this framework, the value of the firm should be a function of these two factors. Hence, we try to empirically answer the following four questions.

- (1) Does the human capital affect firm value?
- (2) Does the human capital impact the future growth opportunities of a firm?
- (3) Does the human capital of a firm impact its volatility exposure?
- (4) Does the size effect influence the impact of human capital on firm value?

The first question tries to examine the overall impact of the human capital on firm value while the next two explore how exactly the value is created. The last question study whether or not the impact of human capital is uniform across firms. Overall, our results show that it is indeed the case. Firms with better human capital command a better valuation in the market. As we discuss in the next section, human capital adds value either by affecting the growth rate of the firm and/or by affecting the volatility of the cash flows. This directly motivates us to test whether the impact of human capital on firm value is greater for firms with higher growth opportunities, measured as annual sales growth rate. Also, better human capital should lead to better growth opportunities in the future. The first argument addresses the issue of utilizing the current growth opportunities and the second one, creating future growth opportunities. By interacting human capital with the current growth, we show that the valuation impact of human capital is greater for firms with

higher growth opportunities. Therefore, human capital adds value to the firm by better utilizing the current growth opportunities and also by creating higher growth opportunities in the future.

Next, we test the impact of human capital on volatility of firm's growth with the conjecture that value is created when human capital decreases the volatility of firm's growth. To test this, we regress firm volatility on the human capital and find a negative relationship between these two and find that firms with better human capital have lower growth rate volatility, thus adding value to the firm. Concomitantly, value is created when it decreases the volatility associated with its future growth rate. By considering the next five years' growth rate as today's best estimate of future growth rate, we regress the volatility of cash flow for next five years' sales growth rate on current year's human capital. We expect the coefficient to be negative, but our empirical analysis shows a positive coefficient. The interpretation is quite interesting, firms with better human capital tend to take volatile projects in the future. We are not sure about the impact of this result as increased volatility should lead to a rise in the discount rate and hence reduce the firm value. High volatile projects should bear higher return on investment (ROI). A firm with better human capital would be in a better position to convert the upside risk of such volatile projects into higher ROI. But, at the same time better utilization of the projects, as discussed above, may decrease the valuation impact of increasing volatility. Lastly, we examine the impact of the size effect influences the impact of human capital on firm value and find no evidence in support of it. All firms in our study, irrespective of their size have the same impact of human capital. This result could be due to the fact that our sample consists only of National Stock Exchange (NSE) listed firms, which generally have less degree of information asymmetry.

We contribute to the existing literature mainly in two ways. First, we examine the relationship between human capital and firm value by following a positive methodological approach by modifying the classical production function. Next, we contribute to the value relevance analysis (VRA) strand of literature by examining the significance of human capital in the determination of firm value. Thus, we show that whether the value relevance of human capital to the investors and also the role played by the human capital in firms' value creation. The rest of the paper is organized as follows. In the second section, we briefly discuss the theoretical framework and hypothesis development and in the third section, we explain the methodology and data. Results and discussions are in the fourth section and lastly, the conclusions are drawn in the fifth section.

2. Theoretical framework and hypothesis development

We start our discussion with the basic discounted cash flow model for firm valuation. According to this model, the value of a firm is based on its future cash flows, its growth rate and cost of capital as given in Eqn. (1).

$$V_t = CF(1 + g) / (k - g) \quad (1)$$

where, V_t is the value of the firm at time t , CF is future cash flows, g is the growth rate of the cash flows and k is the cash flow discount rate which is determined based upon the volatility of the cash flows. Alternatively, the future cash flows are function of human and physical capital employed by firms. This statement is the firm level equivalent to the classical economic growth theory given by Cobb-Douglas. The theory establish that the output of a country depends on two factors-labor and capital and hence the production function is as follows:

$$Q = aL^bC^c \quad (2)$$

where, Q is the total output, L is the labor input, and C is the capital input. We argue that at the micro level, this production function equally applies to firms and hence, the firm's output depends mainly on two inputs, physical capital and human capital (labor). Thus, the value of the firm should be a function of these two factors. Furthermore, we combine the discounted cash flow firm valuation model with the Cobb-Douglas production function model to find the relationship

between firm value and the human capital by associating human capital of a firm with the magnitude, growth and volatility of cash flows. As we discussed earlier, firm value is a function of future cash flows, growth rate of future cash flows, and the discount rate (Eq. 3). Further, we argue that these three characteristics of the future cash flows are function of human capital (Eq. 4) and hence, firm value is a function of human capital (Eq. 5).

$$V_t = f \left| \begin{array}{c} CF \\ g \\ k \end{array} \right| \quad (3)$$

where, V_t is firm value and CF , g and k represents magnitude, growth and volatility of future cash flows.

$$\left| \begin{array}{c} CF \\ g \\ k \end{array} \right| = g(HC) \quad (4)$$

where, HC is the firm's human capital.

$$V_t = f(g(HC)), \text{ thus } V_t = \psi(HC) \quad (5)$$

where, $\psi(\cdot)$ represents $f(g(\cdot))$.

In this study, first we examine the marginal impact of human capital on the firm value after controlling for the firm characteristics that are result of the physical capital. Next, we examine the ways through which human capital impacts the three characteristics of future cash flows, viz. magnitude, growth and volatility. We propose that firms with superior human capital will generate cash flows of higher magnitude accompanied with higher growth and lower volatility.

We briefly discuss how human capital can affect these terms and hence firm value. First, we try to find the answer to the question, whether human capital influence the amount of cash flow and the growth associated with it? Various researchers have found a positive association between human capital and firm performance (Andreeva & Garanina, 2016; Becker & Huselid, 2006; Bowen & Ostroff, 2004; Cisneros & Hernandez-Perlines, 2018; Crema & Verbano, 2016; Delgado-Verde et al., 2016; Ghosh & Mondal, 2009; Goh, 2005; X. L. Xu & Liu, 2019; Likert & Bowers, 1969; Molodchik & Jardon, 2017; Phusavat et al., 2011; St-Pierre & Audet, 2011; Ting & Lean, 2009; Xu & Li, 2019; Xu & Wang, 2018, 2019; Yao et al., 2019). Ballot et al. (2001) found a positive impact of human capital on firm performance of French and Swedish firms. Carmeli (2004) extended this line of research to local municipal corporations in Israel and found that local governments with better human capital performed better financially. Almeida and Carneiro (2009) found that the returns of human capital investments, in the Portugal context, to be 8.6%. This line of research clearly establishes a positive association between firms' human capital and performance; and thus, their cash flows. But why should firms with better human capital to be able to generate higher cash flows compared it its peers? Research in strategic human resource management and applied psychology suggests that the investments in human capital are recompensed in the form of low employee turnover rates (Allen et al., 2003), favorable employee attitudes (Tsui et al., 1997), customer satisfaction (Gelade & Ivery, 2003; Koys, 2001), citizenship behaviors (Sun et al., 2007), and increased productivity (Datta et al., 2005; Huselid, 1995). Conti (2005) found that firms which invest more on training of its employees, i.e. investing in enhancing its employees' capabilities, are able to increase the productivity of its employees, which acts as an important source of competitive advantage for firms (Lawler, 2008).

Parham and Heling (2015) analyzed data on 33 Dutch production firms to examine the influence of human capital efficiency on firm performance. The findings show positive and significant association

between human capital efficiency and ROA, ROE, and employee productivity. Kwarbai and Akinpelu (2016) analyzed the relationship between human capital efficiency and firm performance of industrial goods companies listed on the Nigerian Stock Exchange and found that human capital efficiency has a positive and significant association with ROA and earnings per share. Buallay (2017) studied the association between intellectual capital and firm performance of 171 listed firms on the Saudi Stock Exchange and the results show that human capital efficiency has a significant positive effect on firm performance. Likewise, Rahim et al. (2017) examined 55 Malaysian technology firms and proved that human capital efficiency has a significant and positive association with firm performance. Hoang et al. (2018) explored 319 Vietnamese ICT firms to examine the effect of intellectual capital on firm performance and found that human capital and social capital are intensely connected to firm performance. Smriti and Das (2018) analyzed 710 Indian companies to examine the impact of human capital on financial performance. The results indicate that human capital efficiency has a significant impact on firm productivity than employed capital efficiency. Oppong et al. (2019) studied data on 33 insurance companies in Ghana to examine the human capital and its impact on firm performance. The results show that human capital efficiency has a significant effect on the firm performance. Moreover, firms that continuously train their employees will be in a more advantageous position in shaping and utilizing the growth opportunities. Thus, keeping all other things constant, a firm with better human capital should have higher cash flows and be able to grow faster compared to a firm with ordinary human capital.

The next discussion is on whether the volatility in the (value of) firm's human capital affects cash flow volatility? Other things being equal, a firm with a higher employee attrition rate would have higher volatility in its cash flows compared to a firm with less attrition rate. Moreover, firms with better human capital should be able to produce better products, provide better service (Gelade & Ivery, 2003; Koys, 2001), and more predictable in their service offerings to customers; and these should ultimately reduce the cash flow volatility. This is especially true for firms in service sectors and sectors involving skilled labor like information technology where the human capital of the service providers plays an important role in the client's selection (Smriti & Das, 2018; Yao et al., 2019). The traditional finance literature has recognized this important role of human capital, as an important component of management, as it gives a considerable weight for management capabilities in assigning a credit rating to firms (Datta et al., 2005; Huselid, 1995; Lawler, 2008). Thus, we claim that human capital affects the cash flow volatility and hence firm value.

Further, we argue that in order to influence investors' decisions and hence firm value, human capital should affect only the systematic component of the volatility as idiosyncratic volatility is diversifiable at the portfolio level. This line of thought is just an extension of the Capital Asset Pricing Model (CAPM) as discussed by Mayers (1972) and Fama and Schwert (1977) among others. Systematic volatility is defined as the sensitivity of firms' returns to that of market returns. All the factors which affect this sensitivity should affect firm's systematic volatility. We argue that, theoretically, human capital should affect the systematic component of the volatility. A firm with good human capital should be able to innovate in products, strategies, and markets to navigate through bad economic conditions thus reducing their exposures to systematic risk events (Crema & Verbano, 2016; Delgado-Verde et al., 2016; Molodchik & Jardon, 2017).²

Merton (1987) argues that information asymmetry leads to a positive association between stock returns and idiosyncratic volatility under partial diversification. Boehme et al. (2009) and Fu (2009) find supporting empirical evidence for this argument. Therefore, investors are concerned with the unsystematic component of the volatility too (Krebs, 2003, 2003a). Does human capital impact idiosyncratic volatility? Baxter and Jermann (1995) argue that human capital volatility is a part of unsystematic risk as it is highly correlated with the returns of physical assets.³ A firm can have unique and innovative human resource policies or organizational culture, which can create a competitive advantage in terms of superior human capital (Cisneros & Hernandez-Perlines, 2018; Xu & Wang, 2019). In that case, it may lead to reduction in firm-specific risk or idiosyncratic risk as well. It should also affect the unsystematic risk component, as firm-specific human-related problems like employee

unrest, attrition, lack of motivation, etc., affect cash flow volatility. Investors are really concerned about the firm-specific human capital-related problems while making their investment decisions.

Lastly, we examine whether the impact of human capital on firm valuation is affected by firm-specific characters in general and the firm size in particular. In the finance literature, the size effect denotes the differences between big firms and small firms with respect to the degree of information asymmetry, borrowing capacity, market control etc. (X. L. Xu & Liu, 2019; Mohapatra et al., 2019; Nimtrakoon, 2015; Sardo & Serrasqueiro, 2017; Xu & Wang, 2018). Since, human capital is defined as the sum of knowledge, education, skills, competencies, and other attributes that all individuals in a firm collectively possess, its distribution does not, theoretically, depend on firm size (Phusavat et al., 2011; Ting & Lean, 2009; Xu & Li, 2019). The marginal productivity of human capital determines its returns (wages) and returns will eventually determine its distribution. Therefore, the impact of human capital on firm value should be uniform across firms irrespective of their size. But, a higher degree of information asymmetry associated with small firms would impact this relationship adversely as investors will be ignorant about the quality of human resources of small firms (Sanchez-Gutierrez et al., 2016; Xu & Wang, 2018, 2019).

Based on the above discussion, we propose the following hypotheses.

H1: Firms with better human capital would have higher firm value compared to firms with low human capital.

H1a: The firm size influences the impact of human capital on firm value.

H2: The positive relationship between human capital and firm value is greater for firms with high growth opportunities.

H2a: The firms with better human capital will have more growth opportunities in the future.

H3: Firms with better human capital would have a lower cash flow volatility compared to firms with low human capital.

H3a: The firms with better human capital will have lower future cash flow volatility

3. Methodology and data

3.1. Research model

In this section, first we discuss the empirical challenges associated with the above mentioned hypotheses. The most important challenge is that the technical combination of labor and capital is different for different industries⁴ which results in some industries being human capital intensive and others being capital intensive. Econometrically, we can address this issue in two ways. First, we can do our study at the industry level. In that case, we will be exploiting the intra-industry differences in human capital. The second method is to examine firms from all the industries together by controlling for industry differences using industry-fixed effects.⁵ We are addressing this issue by providing for industry-fixed effects (the second procedure) along with year-fixed effects and also by adding a control variable which proxies the capital intensity of the firm. The proxy that we use is tangibility which is defined as the ratio of net-fixed assets to total assets.

The second challenge is associated with the measurement of human capital of a firm as it is an intangible asset that is not prone to exact measurement. The important and measurable aspects of human capital, like years of experience, formal education, skill set, etc., are not available for most of the firms. Given this limitation, empirical studies in labor economy have used various measures which

are assumed to be highly correlated with the human capital of a firm (Ghosh & Mondal, 2009; Goh, 2005; Opong et al., 2019; Smriti & Das, 2018; Ting & Lean, 2009). The most frequently used measure is employee training expenses, both flow as well as stock measure. The intuition is that the firms which spend more on employee training would continually build employee capabilities. Training expenditure along with research and development expenses would give an idea about knowledge creation and distribution in a given firm. The next important measure is the total labor expense; this is based on the assumption that wage depends on the marginal productivity of the labor. Therefore, higher labor expenses are a result of higher productivity and thus better the human capital. In the US context, Fama and Schwert (1977) have used this measure. In this study, we use total employee compensation as a ratio of sales to proxy the human capital.⁶ There is an inherent drawback with this measure. They indicate the level of human capital only when the labor is freely mobile across industries but, in most of the cases, labor skills are industry-specific and movable only within the industry. Furthermore, within the industry, firms can only attract the best talent with the best compensation. Thus, intra industry differences in employee compensation proxy the differences in their human capital. However, directly exploiting this volatility makes our study industry-specific. Nevertheless, we are taking care of this aspect econometrically by using industry fixed effect. The base equation for the estimation is given in equation (6):

$$Y_{jit} = \alpha_i + \beta_1 HC_Ratio_{jit} + \beta_2 Size_{jit} + \beta_3 Firm_Growth_{jit} + \beta_4 ROA_{jit} + \beta_5 Leverage_{jit} + \beta_6 Cash_Ratio_{jit} + \beta_7 R\&D_Dummy_{ji} + \beta_8 Turnover_{jit} + \beta_9 DPR_{jit} + \beta_{10} Tangibility + \varepsilon_{jit} \quad (6)$$

where, Y_{jit} for the base model is the Tobin's Q for "jth" firm belonging to "ith" industry in the year "t" and it is calculated as the ratio of the sum of Market Capitalization and Total Debt to Total Assets. HC_Ratio is the ratio of total employee compensation to firm sales. It is our main independent variable, the impact of which on the dependent variable is examined. The following control variables are used in the model and taken from the previous literature (Alipour, 2012; Dženopoljac et al., 2016; Firer & Williams, 2003; Forte et al., 2017; X. L. Xu & Liu, 2019; ; Lu & Huang, 2009; Ma et al., 2017; Mohapatra et al., 2019; Mondal & Ghosh, 2012; Nadeem et al., 2019; Nimtrakoon, 2015; Sardo & Serrasqueiro, 2017; Xu & Wang, 2018, 2019; Xu et al., 2017; Yang, 2014). Size is the log of firm sales, Firm_Growth is annual sales growth rate, ROA is EBIT/Total assets, Leverage is total debt/total assets, Cash_Ratio is cash and short term investments/total assets, R&D_Dummy is a dummy variable which takes value one if research and development expenses is positive and otherwise zero, Turnover is total share turnover/market capitalization, DPR is dividends paid/total assets and Tangibility is net fixed assets/total assets.

We also extend our model to examine the impact of human capital on future growth, contemporaneous volatility and the future volatility. These dependent variables are defined as; Future_Growth is the average of the firm growth for the next 4 years, Volatility is the coefficient of variation calculated as ratio between five year moving average volatility and five year moving average mean of the firm growth and Future_Volatility is the average of the volatility for the next four years.

3.2. Data

We examine our hypotheses by using the sample of all NSE listed non-financial Indian firms derived from the Prowess database for the period 2001–2019. We start from the year 2001 since uniform data on stock prices is available for the majority of firms only from 2001. As per Table 1, firms in our sample spend on an average 10% of their sales revenue on employee compensation. There is wide volatility among the firms as the range is very wide and SD is 9.4%. Average Tobin's Q for our sample firms is 0.854, highest being 2.366 and the lowest being 0.271. Future volatility has the lowest number of firm-year observations (19,709) since it requires 4-year averaging of 5-year rolling window coefficients of variance. The future growth and contemporary volatility have also lesser number of observation due to same reason. There are a total of 1,862 firms out of which at least 14,236 observations for have been considered for final estimation. All the variables have

Table 1. Summary statistics. Tobin's Q is (Market cap+total debt)/Total assets, HC_Ratio is the ratio of total employee compensation to firm sales, Size is the log of firm sales, Firm_Growth is annual sales growth rate, ROA is EBIT/Total assets, Leverage is Total Debt/Total assets, Cash_Ratio is cash and short-term investments/total assets, Turnover is total share turnover/market capitalization, DPR is dividends paid/total assets, Tangibility is net fixed assets/Total assets, Future_Growth is the average of the firm growth for the next 4 years, Volatility is the coefficient of variation calculated as ratio between 5 year moving average volatility and 5 year moving average mean of the firm growth and Future_Volatility is the average of the volatility for the next 4 years

Variable	Obs	Mean	Std. Dev.	Min	Max
TOBIN_Q	29,776	0.854	0.533	0.271	2.366
HC_Ratio	35,095	0.100	0.094	0.009	0.419
Size	35,195	6.826	1.958	2.991	10.245
Firm_Growth	33,129	0.126	0.308	-0.428	0.879
ROA	35,674	0.069	0.068	-0.076	0.204
Leverage	33,763	0.336	0.206	0.022	0.780
Cash_Ratio	35,744	0.227	0.286	0.000	0.796
Turnover	31,756	6.176	10.319	0.000	39.560
DPR	27,369	0.582	0.793	0.000	2.689
Tangibility	35,559	0.324	0.192	0.026	0.688
Future Growth	27,238	0.149	0.190	-0.163	0.619
Volatility	25,336	1.227	3.065	-6.384	8.445
Future Volatility	19,709	1.212	2.941	-6.331	7.941

been winsorized at 5%. We follow the CMIE industrial classification for classifying firms into various industry groups. In total, we have firms belonging to 136 industries.

4. Results and Discussion

This section presents the results of the empirical models used to examine the impact of human capital on firm value, growth opportunities and volatility. The result in [Table 2](#) supports out first hypothesis that firm value and firm human capital are positively associated. The HC_Ratio coefficient is positive and significant at the 1% level. This finding is in line with the results from previous studies (X. L. Xu & Liu, 2019; Nimtrakoon, 2015; Oppong et al., 2019; Parham & Heling, 2015; Smriti & Das, 2018; Tran & Vo, 2018; Xu & Li, 2019). Among the control variables, size, firm growth, ROA, leverage, turnover ratio and DPR have positive and significant coefficients. The tangibility coefficient is negative and significant. Cash ratio and R&D Dummy coefficients are not significant. Overall, these variables explain about 17% of the volatility in Tobin's Q. In column number three, we have examined the influence of the size effect by including an interaction dummy (product of HC_Ratio and firm size). Remarkably, the significance level of HC_Ratio is lost and the interaction term is significant. This shows that the smaller firms are not in a position to leverage their human capital to enhance their firm value. In other words, the benefits of human capital accrue only when the firms grow bigger.

In [Table 3](#), we present the results for H2 and H2a hypotheses which examine the source of value addition. The second column examines whether the impact is the same for high and low growth firms. This differential impact is captured in Growth*HC variable which is an interaction term. As both the coefficients, i.e. HC_Ratio and Growth*HC are positive and significant, it implies that the positive impact of human capital on firm value is positive in general for all the firms but the magnitude of the impact is greater for growth-oriented firms. The finding is in line with the results in the extant literature (X. L. Xu & Liu, 2019; Nimtrakoon, 2015; Sardo & Serrasqueiro, 2017; Xu & Wang, 2018). This result shows the contemporaneous relationship, whereas the results presented

Table 2. Impact of human capital on firm value. The dependent variable Tobin's Q is (Market cap+total debt)/Total assets, HC_Ratio is the ratio of total employee compensation to firm sales, Size is the log of firm sales, Firm_Growth is the annual sales growth rate, ROA is EBIT/ Total assets, Leverage is Total Debt/Total assets, Cash_Ratio is cash and short term investments/total assets, R&D_Dummy is a dummy variable which takes value one if R&D expenditure is positive and otherwise zero, Turnover is total share turnover/market capitalization, DPR is dividends paid/total assets, Tangibility is net fixed assets/total assets. Size_HC is the interaction term. The regression is run using fixed effects model. *** denotes significance at 1% and ** denotes significance at 5%, and * denotes significant at 10%

Variables	Tobin's Q (without size effect)	Tobin's Q (with size effect)
HC_Ratio	0.840***	-0.080
Size*HC		0.173***
Size	0.124***	0.109***
Firm_Growth	0.063***	0.065***
ROA	2.458***	2.483***
Leverage	0.240***	0.250***
Cash_Ratio	0.004	0.004
R&D_Dummy	0.013	0.011
Turnover	0.006***	0.006***
DPR	0.079***	0.080***
Tangibility	-0.186***	-0.196***
Constant	-0.453***	-0.367***
Observations	21,795	21,795
R-squared	0.171	0.172
No. of firm_code	1,862	1,862
Year FE	Yes	Yes
Industry FE	Yes	Yes

in column 3 shows present (human capital) and future (growth) relationship. Here the dependent variable is the future growth, which is the next five years moving average of firm sales growth rate. The main independent variable is HC_Ratio which is positive and significant. It shows that the firms which have better human capital today would grow faster in the future. This is a very important result as it tells how human capital adds value to firms.

Next, we examine the impact of human capital on the other source of value addition, i.e. growth volatility. The results are presented in [Table 4](#).

In [Table 4](#), the second column shows how firm volatility and human capital are associated. When we regress firm volatility against the HC_ratio, we obtain a negative and significant coefficient. This implies that firms with better human capital had a significantly lower level of volatility. This result is very important for valuation as investors use volatility computed from the past data as the best estimate of future volatility. Therefore, human capital by influencing the cash flow volatility would influence firm value. In the third column, we analyze the impact of today's human capital on future cash flow volatility. Again future cash flow volatility is captured using the five years moving coefficient of volatility. The result shows that HC_ratio is negative and significant. It indicates that firms with better human capital should have less volatility in their future growth for a given level of growth opportunities.

5. Summary and conclusions

According to the classical growth theory, human capital is one of the important inputs for production. Firm value is derived from its output growth and volatility which implies a direct

Table 3. The impact of human capital on growth opportunities. The dependent variable is Tobin's Q and Future Growth. Tobin's Q is (Market cap+total debt)/Total assets and Future Growth is the average of the firm growth for the next 4 years. HC_Ratio is the ratio of total employee compensation to firm sales, Size is the log of firm sales, Firm_Growth is the annual sales growth rate, ROA is EBIT/Total assets, Leverage is Total Debt/Total assets, Cash_Ratio is Cash and short term investments/total assets, R&D_Dummy is a dummy variable which takes value one if R&D expenditure is positive and otherwise zero, Turnover is total share turnover / market capitalization, DPR is Dividends paid/total assets, Tangibility is net fixed assets/total assets. Growth_HC is an interaction term which is the product of firm growth and HC_Ratio. The regression is run using fixed effects model. *** denotes significance at 1%, ** denotes significance at 5%, and * denotes significance at 10%

Variable	Tobins_Q	Future Growth
HC_Ratio	0.840***	0.384***
Growth*HC	0.330***	
Size	0.124***	-0.124***
Firm_Growth	0.037***	0.009**
ROA	2.462***	-0.079***
Leverage	0.241***	-0.020**
Cash_Ratio	0.003	-0.044***
R&D_Dummy	0.013	0.004
Turnover	0.006***	0.001***
DPR	0.079***	0.005***
Tangibility	-0.188***	-0.005
Constant	-0.450***	1.010***
Observations	21,795	17,044
R-squared	0.171	0.364
No. of firm_code	1,862	1,862
Year FE	Yes	Yes
Industry FE	Yes	Yes

relationship between firm value and human capital. In this study, we have examined the impact of human capital on firm value by using a positive methodological approach. We tested our first hypothesis that firm value and firm human capital are positively associated and found that the HC_Ratio coefficient is positive and significant. This finding is in line with the results from previous studies (X. L. Xu & Liu, 2019; Nimtrakoon, 2015; Opong et al., 2019; Parham & Heling, 2015; Smriti & Das, 2018; Tran & Vo, 2018; Xu & Li, 2019). We also examined the influence of the size effect by including an interaction dummy, the HC_Ratio is insignificant but the interaction term is significant. This indicates that the benefits of human capital accrue only when the firms grow bigger so that smaller firms are not in a position to leverage their human capital to enhance their firm value.

Next, we tested the second level of hypotheses which examine the source of value addition. The differential impact for high and low growth firms is captured by Growth*HC variable which is an interaction term. The results indicate that magnitude of impact is greater for growth-oriented firms. Further, we examined the present (human capital) and future (growth) relationship, the main independent variable is HC_Ratio which is positive and significant. This shows that firms which have better human capital today would grow faster in the future and it tells how human capital adds value to firms. Subsequently, we tested the third level of hypotheses to examine the impact of human capital on the growth volatility, we obtain a negative and significant coefficient. This implies that firms with better human capital had a significantly lower level of volatility. Again, we analyzed the impact of current human capital on future cash flow volatility and found that HC_Ratio is negative

Table 4. The impact of human capital on firm volatility. **Firm_Volatility:** Coefficient of volatility of annual sales growth rate, **Future_Volatility:** rolling Coefficient of volatility of annual sales growth rate with a rolling window of five. **HC_Ratio** is the ratio of total employee compensation to firm sales, **Size** is the log of firm sales, **Firm_Growth** is annual sales growth rate, **ROA** is EBIT/Total assets, **Leverage** is Total Debt/Total assets, **Cash_Ratio** is Cash and short term investments/total assets, **R&D_Dummy** is a dummy variable which takes value one if R&D expense is positive and otherwise zero, **Turnover** is total share turnover/market capitalization, **DPR** is Dividends paid/total assets, **Tangibility** is net fixed assets/total assets. The regression is run using fixed effects model. *** denotes significance at 1%, ** denotes significance at 5%, and *denotes significance at 10%

Variables	Firm_volatility (Contemporaneous)	Future_volatility
HC_Ratio	-3.902***	-0.939**
Size	0.249***	0.071
Firm_Growth	0.184**	0.359***
ROA	-3.168***	0.089
Leverage	-0.481**	0.110
Cash_Ratio	-0.244**	-0.258***
R&D_Dummy	-0.065	0.349***
Turnover	-0.001	-0.001
DPR	-0.014	-0.064
Tangibility	0.218	0.127
Constant	0.318	0.672*
Observations	17,773	14,236
R-squared	0.009	0.004
No. of firm_code	1,862	1,862
Year FE	Yes	Yes
Industry FE	Yes	Yes

and significant, indicates that firms with better human capital should have less volatility in their future growth for a given level of growth opportunities.

The findings of the present study propose several possible regulatory, managerial as well as theoretical implications in today's knowledge-based world. First, as the study examines the relationship between human capital and firm value, the results highlight the significance of preserving and maintaining the quality and efficiency of human capital in enhancing value of firms. As human capital is defined as the sum of knowledge, education, skills, competencies, and other attributes that all individuals in a firm collectively possess, the results further endorse the impact of continuous training and development in an organization to enhance the knowledge and sharpen skill sets of employees and thus improve employee performance. Managers should pay specific attention to improve human capital by providing appropriate practices opportunities and tools that would warrant that knowledge is competently acquired, created, shared, applied and documented. For this purpose, a firm would have clear knowledge implementing strategy with the help of proper information systems, training, job rotation, compensation policies, job design and so on. Second, it indicates the need to achieve sustainable growth by companies so that they can leverage the use of human capital and optimize the value of firms. Third, the results show the importance of having better human capital to minimize the current and the future cash flow volatility of firms and thus maximize the firm value. This urge the managers to use collective practices to identify and maintain associations with the external business environment to form successful partnerships. This would help to acquire new talents by way of network of partners and

such a strategy would help to maintain better human capital and reduce future volatility of the firm. Fourth, the results of the study would help the prospective investors while selecting companies to their portfolio by evaluating the value creation capability of human capital of various firms. Finally, the results of current study suggest the policymakers to design and introduce programs that inspire the development of human capital at national level by training and developing employees and nurturing managerial awareness on the significance of human capital and firm value association and thus the overall development of the nation. Hence, policymakers should take measures which focus on synchronous execution of practices and measures to enhance productivity, quality, efficiency, competitiveness of human capital as a whole and sustainable growth of firms.

Even though, the study extensively examines the association between human capital and firm value, the present study has its own limitations. First, the study largely focuses on one dimension of the intellectual capital, i.e., human capital, however it ignores the other main two dimensions like structural capital and relational capital. Therefore, further research would extend our work by undertaking a more comprehensive analysis to examine the role of intellectual capital in enhancing firm value by incorporating the other dimensions of intellectual capital, such as structural capital and relational capital. Second, it is also imperative to comprehend how human capital efficiency can be enhanced and what factors need to be considered to manage these intangible assets efficiently and thus increase the firm value. Third, future research would cogitate other macro- and micro-environmental factors like gross domestic product, organizational culture, etc., while modelling the relationship between human capital and firm value. Finally, studies would be conducted in other countries or regions to generalize the results of the present study. Hence, future research on this matter seems warranted.

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Notes

1. This denotes the supply-side capacity of the firm.
2. Our argument is that covariance of stock return with that of market return is moderated by the human capital and thus, firms with a better human capital would be less sensitive to changes in the market.
3. Hedging this human capital volatility involves huge short positions in the physical assets which leads to foreign investors holding a lesser proportion of the portfolio than what the standard portfolio theory would suggest them to hold.
4. a and b parameters in equation (1)
5. The Hausman Test was rejected at 1% significance level, hence fixed effects model is more appropriate than random effects model.
6. It includes training and welfare expenses of the employees.

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