

INVESTMENTS IN HUMAN CAPITAL IN THE FINNISH STOCK MARKET

JUHA-PEKKA KALLUNKI

*Department of Accounting and Finance,
University of Oulu,
PO Box 4600, FIN-90014 University of Oulu, Finland*

MINNA MARTIKAINEN

*Laurea Polytechnic,
Espoo-Institute
Vanha maantie 9, FIN-02600, Espoo, Finland*

Contact address:

Juha-Pekka Kallunki
Department of Accounting and Finance, University of Oulu,
PO Box 4600, FIN-90014 University of Oulu, Finland

e-mail: juha-pekka.kallunki@oulu.fi
fax. +358 8 553 2906

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Abstract

This paper extends the paper by Ballester et al. (1998) by investigating the proportion of labor costs that represents investments in human capital, and the rate of amortization of this asset in Finland, where all firms are required to report their labor costs in financial reports. Another characteristics of the Finnish data is that high-tech industries such as telecommunication and electronics industry where substantial investments are made in human capital are dominating in the Finnish stock market. The results supports the hypothesis that the estimated proportion of labor expenses that represents investments in human capital is large in Finland. The results also indicate that the estimated ratios of the human capital asset to market value of equity are reasonable related to firm characteristics that are hypothesized to be determinants of the human capital asset ratios.

Key words: Human capital, stock market, labor costs, Ohlson's model

1. Introduction

As pointed out by Amir and Lev (1996), among others, investments in intangible assets such as brand development, research and development or human capital are of crucial importance for firms in the knowledge-based economy. As a consequent, valuation of intangible assets is an important issue from equity holder's point of view, too. There is large body of literature investigating the stock market valuation of firms' investments in intangible assets. Bublitz and Ettredge (1989), for instance, find that the slope coefficient of regressing stock returns on R&D costs is positive suggesting that

stock market values R&D expenditures as an asset rather than a cost. Similar results are reported by Chaucin and Hirschey (1993) and Green, Stark and Thomas (1996), among others. Ballester et al. (1998) use Ohlson's (1995) valuation approach to estimate the proportion of a firm's labor expensive that the market views as an investment in human capital. They find that 16% of all labor-related costs represent investment in human capital, and that the estimates of the ratio of the human capital asset to market value of equity make economic sense.

This paper investigates the proportion of labor costs that represents investments in human capital, and the rate of depreciation of this asset by using the Finnish data. The Finnish data is ideal for the investigation of the proportion of labor costs that represent the investments in human capital, because Finnish firms are required to report labor costs in their published financial statements. Therefore, the Finnish data provides an unique sample of listed firms for which the data required in measuring the investments in human capital all publicly available for all firms. In addition, high-tech industries such as telecommunication and electronics industry, where substantial investments are made in human capital are in a very dominant role in the Finnish stock market. Therefore, a significant proportion of labor costs of the Finnish firms can be assumed to represent investments in human capital.

The paper contributes to the literature that investigates the market valuation of intangible assets, especially the paper by Ballester et al. (1998). While Ballester et al. (1998) investigate the market valuation of firms' labor expenditures in U.S. where some firms voluntarily disclose these costs in their financial reports, the current paper uses the same approach in Finland where firms are obligatorily required to disclose the labor related costs in financial reports.

The rest of the paper is organized as follows. The next section describes the valuation of the human capital in the Ohlson's (1995) framework. The third section provides the data description and preliminary data analysis. The empirical results are offered in the fourth section. The fifth section concludes the paper.

2. Valuing human capital in the Ohlson (1995) framework

In this section, the residual income model is used to estimate the valuation of labor expenditure by the capital markets and to determine the economic amortization rate for the asset human capital.

Earlier studies estimating the value of human capital have mainly been focusing on the value of individual employees to the firm. For instance, Lev and Schwartz (1971) approximated the value of human capital as the present value of earnings of all employees for the remaining active service life. Flamholtz (1971) improved this approach by allowing the possibility of employees' career movements within the firm or the possibility of employees leaving the firm before retirement or death.

Jaggi and Lau (1974) developed a stochastic model that used the groups of employees as the basis for the valuation of human capital. This is because predicting patterns in group behavior is easier than predicting individual behavior. More recently, Rosett (2000) used data from union contracts to estimate labor stock for firms with a relatively large fraction of unionized work

force. In this study firm's labor stock was defined as the present value of the expected cost of compensating employees.

Hirschey and Weygandt (1985) estimated the market valuation and the amortization rate for advertising and R&D expenditures. They find that advertising and R&D expenditures have a positive impact on a firm's Tobin Q (ratio of market value and replacement cost of assets) suggesting that the market treats these expenditures as intangible capital investments.

The residual income model of valuation can be explicitly incorporated investments in and depreciation of the human capital asset. To enable the process, it is assumed that a firm's market value is given by the present value of its expected dividends. Assuming the clean surplus in accounting, Ohlson (1995) shows that its market value can also be computed as the sum of its reported book value and the infinite sum of discounted residual income as follows:

$$(1) \quad MV_t = BV_t + \sum_{i=1}^{\infty} E \left[\frac{E_{t+i}^R - r_f BV_{t+i-1}}{(1+r_f)^i} \right],$$

where

BV_t = book value (as reported) at time t ,

$E[.]$ = expectations based on information at time t ,

E_t^R = reported earnings for period t and

r_f = cost of equity capital (= risk free interest rate given risk neutrality).

It can be demonstrated that under additional assumptions of risk neutrality and an autoregressive structure on the time series of residual income, the market value (MV) is a function of current book value (BV) and current abnormal earnings (see Ohlson, 1995 and also Myers, 1999) as follows:

$$(2) \quad MV_t = \alpha_1 BV_t + \alpha_2 (E_t^R - r_f BV_{t-1}) + \gamma v_t$$

Abnormal earnings are calculated as current earnings minus the risk free rate times the beginning of period book value. The variable v_t captures information other than that pertaining to abnormal earnings, and α and γ are functions of the risk free rate and the time series properties of abnormal earnings and other information.

Suppose a fraction β (where $0 < \beta < 1$) of the labor expenses (w_t) in each period represents increase in the human capital of the firm. Moreover, it is assumed labor expenses to grow at the certain rate of g percent every year, such that $w_t = (1+g)w_{t-1}$. Further, if the rate of depreciation for this asset is δ (where $0 < \delta < 1$) then the value of the human capital asset at the end of period t (L_t) is given by

$$(3) \quad L_t = \beta w_t + (1-\delta)L_{t-1}$$

After incorporating the value of L_{t-1} , L_t can be written as:

$$(4) \quad L_t = \beta w_t \left[1 + \left(\frac{1-\delta}{1+g} \right) + \left(\frac{1-\delta}{1+g} \right)^2 + \left(\frac{1-\delta}{1+g} \right)^3 + \dots + \left(\frac{1-\delta}{1+g} \right)^t \right]$$

$$= \beta w_t \left(\frac{1+g}{\delta+g} \right)$$

$$\equiv \beta \phi w_t$$

where the second equality is the sum of the series as t approaches infinity and ϕ is defined as $(1+g)/(\delta+g)$. Similarly, for large t ,

$$(5) \quad L_{t-1} = \beta \phi w_{t-1}$$

Reported earnings (E_t^R) are based on a full expensing of labor costs. Alternatively, an accounting system that capitalizes the investment in human capital will report earnings (E_t), which, after making adjustments for additions to and depreciation of the human capital asset, are given by¹

$$(6) \quad E_t = E_t^R + \beta w_t - \delta L_{t-1}$$

The accounting system will show book value of equity that is equal to the full-expensing book value plus the human capital asset L_t . By inserting these adjusted values (under capitalization of some labor costs) of earnings and book values in equation (2) we get:

$$(7) \quad MV_t = \alpha_1(BV_t + L_t) + \alpha_2(E_t^R + \beta w_t - \delta L_{t-1} - r_f(BV_{t-1} + L_{t-1})) + \gamma w_t$$

Equation (7) and equation (2) represent valuation equations which are based on two different accounting systems – one that has full expensing of labor costs, and another that capitalizes some of these costs. Both of these valuation equations will provide the same value if each follows the clean surplus relationship. Moreover, it is assumed that the abnormal earnings follow the Markovian process. However, the two systems may have different valuation consequences if some further assumptions about the earnings generating process are made to obtain less complicated valuation equation.

In particular, the Markovian process assumes that the expected abnormal earnings in the current period are equal to abnormal earnings in the prior period times a persistence coefficient. This particular coefficient is assumed to be less than one. Under full expensing of labor costs book value is consistently understated. Moreover, book value will be more grossly understated to the extent that the investment in human capital grows over time. Therefore, under full expensing, abnormal earnings are actually expected to increase period by period, instead of declining as assumed by the Markovian process. The accounting system that is based on capitalization of some labor costs is likely to generate abnormal earnings that better fit the underlying Markovian assumptions for valuation process. This holds, at least until the human capital asset stops growing.

The application of the valuation equation that is based on a partial capitalization of labor expenses for a subset of firms that experienced a positive growth in labor expenses is described. Such firms can be assumed to be at the stage where the investment in human capital is growing.

Assuming that the dynamics of the human capital asset can be described as in equations (3) and (4). After substituting in the values of L_t and L_{t-1} and some manipulation the equation (7) can be written as follows:

$$(8) \quad MV_t = \alpha_1 BV_t + \alpha_2 (E^R_{t-1} - r_f BV_{t-1}) + (\alpha_1 \beta \phi + \alpha_2 \beta) w_t - (\alpha_2 \delta \beta \phi + r_f \alpha_2 \beta \phi) w_{t-1} + \gamma w_t \\ \equiv A'_0 + A_1 BV_t + A_2 (E^R_{t-1} - r_f BV_{t-1}) + A_3 w_t + A_4 w_{t-1},$$

where,

$$A'_0 \equiv \gamma w_t,$$

$$A_1 \equiv \alpha_1,$$

$$A_2 \equiv \alpha_2,$$

$$A_3 \equiv (\alpha_1 \beta \phi + \alpha_2 \beta) = (A_1 \beta \phi + A_2 \beta),$$

$$A_4 \equiv -A_2 \beta \phi [\delta + r_f] \text{ and}$$

$$\phi \equiv (1+g)/(\delta+g).$$

The parameters of interest in the above relationship are A_1 , A_2 , β (the investment portion of labor expenditures) and δ (the amortization rate for human capital). Although the above relationship is linear in the dependent variables, it is not linear in these parameters. Therefore, the nonlinear regression technique to estimate the regression model is used. In the following section, the empirical estimation of the above equation is described.

3. Research design

3.1. Helsinki Stock Exchange

Helsinki Stock Exchange (HSE), which is the only stock market in Finland, has undergone major changes in 1990's. Deep recession period in the Finnish economy in the beginning of the 1990's crashed stock prices and the trading volume of stocks until the middle of the 1990's. However, the liberalization process of money markets, the abolishment of the foreign ownership restrictions and better business conditions paved the way for the increase in stock prices and the trading volume since the middle of the 1990's. In addition, the success of Nokia and the other listed Finnish high-tech firms in their business operations significantly increased the market values of these firms since the middle of 1990's. High-tech industry is in a dominating role in the HSE and in the Finnish economy as a whole. To illustrate, telecommunication and electronics industry represented 42.3 per cent and 31.1 per cent of the annual turnover and the year-end market value of HSE in 1997, respectively. The fact that the high-tech industry is in the dominant role in the HSE is interesting from the current paper's point of view, because significant investments in human capital are typical for high-tech firms.

Despite the development of the Finnish stock market, the HSE has remained as a small market comprised, for the most part, of infrequently traded stocks. Table 1 compares the key statistics of the HSE in 1995 to those of the leading European stock markets, London Stock Exchange and the Deutsche Börse. As can be seen, the number of listed firms in London was about 30 times higher than the corresponding figure for Helsinki. However, when interpreting these figures, it should also be noted that the stock markets in U.K. and Germany are the major stock markets in Europe and that many of the European stock markets are close to the HSE in their size.

(Insert Table 1 about here)

3.2 Sample selection

The sample consists of all 21 Finnish industrial firms for which the necessary data are available for a 10-year period from 1990 to 1999. Therefore, the total number of firm-year observations equals 210. Accounting figures are retrieved from the data base maintained by ETLA (Research Institute of the Finnish Economy). Market values of equity are retrieved from the database provided by the HSE. The deep recession period in the HSE before the middle of 1990's decreased stock prices, and consequently, market values of equity. As a result, for 109 firm-year observations out of 210, the market value of equity is less than the book value of equity, i.e. the ratio of market to book equity is less one.

The parameters of the human capital valuation model are estimated for each of the 21 sample firms in non-linear time-series regressions. These estimates are then used to calculate the ratios of the human capital asset to market value of equity for the sample that consists of 210 firm-year observations. The economic relevance of the resulting human capital asset ratios is then tested by using both the total sample of 210 firm-year observations, and a sub-sample of the 109 firm-year observations for which the market value of equity exceeds the book value of equity. This way, the parameters of the valuation model are estimated by using the maximum sample size, and validity of the results of testing the economic relevance of the estimated human capital asset ratios is

enhanced by using both a sub-sample in which the market value of equity is greater than the book value and the total sample.

3.3 Methods and preliminary data analysis

Following Ballester et al. (1998), this paper uses the Ohlson (1995) framework to estimate the proportion of labor costs that represents investments in human capital and the rate of amortization of this asset. The following regression model is estimated (see Ballester et al. 1999):

$$(9) \quad \frac{MV_t}{BV_{t-1}} = A_0 + A_1 \frac{BV_t}{BV_{t-1}} + A_2 \frac{E_t}{BV_{t-1}} + A_3 \frac{w_t}{BV_{t-1}} + A_4 \frac{w_{t-1}}{BV_{t-1}},$$

where MV_t is the market value of equity in the end of the year t, BV_{t-1} is the book value of equity in the end of year t-1, E_t is earnings for the year t, w_t is extent of the labor costs in year t, w_{t-1} is extent of the labor costs in year t-1. In addition, the following non-linear dependencies exist between the slopes ($A_0 - A_4$) of the model:

$$A_0 \equiv \alpha_0,$$

$$A_1 \equiv \alpha_1,$$

$$A_2 \equiv \alpha_2,$$

$$A_3 \equiv \alpha_1 \beta \phi + \alpha_2 \beta,$$

$$A_4 \equiv -\alpha_2 \beta \phi (\delta + r_f),$$

$$\text{and } \phi \equiv \frac{1+g}{\delta+g}.$$

The average growth rate in labor expenses (g) is calculated as the average growth rate over the entire time-series from 1990 to 1999.² The risk-free interest rate equals to 7.0%. The parameters of the model (9) are estimated by using the non-linear estimation procedure. The parameters β and δ are restricted to fall between zero and 0.5. The estimated parameters are used to calculate the value of the human capital for each firm- year observation in the sample period as follows:

$$(10) \quad HU_L = \beta \delta w_t$$

The economic significance of the estimated parameters and the resulting ratio of the human capital asset to market value of equity is tested by regressing the ratio of the human capital asset to market value of equity (HU/MV) on the following firm characteristics (see Ballester et al. 1998):

1. **Average salary** (the ratio of labor expense to the number of employees). It is hypothesized that firms that employ quality and skilled labor are likely to invest more in training and developing their human capital. Therefore, this type of firms should have higher ratios of human capital to market value. It is hypothesized that there exists a positive relationship between average salary and the human capital asset. This is because a skilled labor force commands higher salaries.
2. **Labor intensity** (the ratio of labor expense to sales). It is hypothesized that there exists positive relation between the ratio of labor expense to sales and human capital. This is because labor intensive firms are assumed to invest intensively in retention and training of personal.

3. **Operating uncertainty** (the standard deviation of the return on equity measured over the sample period). It is hypothesized that there exists positive relationship between operating uncertainty, measured by the standard deviation of the return on equity, and the ratio of human capital to market value. This is because firms are expected to make larger investments in human capital in order to prepare employees to fast changes in business environment.
4. **Profitability** (return on asset). It is hypothesized that profitable firms do not need to make investments in human capital. Therefore the negative relation is expected to exist between investments in human capital and profitability measured by the return on assets (income before extraordinary items divided by total assets)
5. **Growth** (the average growth rate of sales during the sample period). It is hypothesized to exist the negative relation between the growth and the investment in human capital. This is because it is expected a growing firm to need to have all its available resources to sustain its growth, and no extra assets are assumed to have to be used in human capital investments.
6. **Size** (the log of total assets). It is hypothesized that there would exist a negative relation between size of firm and investments in human capital. This is because it is assumed that larger firms do not need to have employees to carry out more than limited amount of tasks.

The ratio of the human capital asset to market value of equity (HU/MV) is regressed on the firm characteristics by using both the total sample of all 210 firm-year observations and the sub-sample of 101 firm-year observations for which the book value of equity exceeds the market value of equity.

As a preliminary data analysis, Table 2 reports descriptive statistics and correlations of the variables used in the empirical analysis for the sub-sample.³ The correlation coefficient matrix indicate that none of the correlations are especially high. The estimated human capital asset ratio is significantly correlated with sales growth, standard deviation of the return on equity ratio and the return on asset ratio. The signs of these correlation coefficients are also as predicted by the theory. Hence, the preliminary results indicate that the estimated human capital asset ratios seem to be related to economic characteristics of firm in reasonable sense.

4. Empirical results

Panel 1 of Table 3 reports the parameter estimates of the model (9) and the resulting human capital asset ratios for the total sample 210 firm-year observations. The average and mean values of the estimated earnings coefficient, α_2 , equal 4.4 and 1.5, respectively. In addition, most of the estimated earnings coefficient are positive, as predicted. The estimated proportion of labor costs that represents investments in human capital, β , has a mean of 0.286, and a median of 0.307. These estimates are substantially larger than those reported by Ballester et al. (1998) for the sample of US firms. These findings support the hypothesis that, because the Finnish firms are obligatorily required to report their labor cost in financial statements, and because the high-tech firms have a dominating role in the Finnish stock market, the proportion of labor costs that is related to investment in human capital is likely to be high. However, it should be noted that the results are based on relatively small sample from time period, when stock market was volatile in Finland.

The estimated rate of depreciation of human capital, δ , has a mean of 0.111 and a median of 0.000. These estimates are clearly smaller than those reported in previous studies. For instance, Hirschey and Weygandt (1985) report a depreciation rate of 10 to 20% for R&D costs and Ballester et al. (1998) report an average depreciation rate of 34% for human capital.

The estimates of the ratios of the human capital asset to the market value of equity (HU/MV) reported in Panel 1 of Table 3 are very high if compared to corresponding ratios reported in previous studies. This is at least partly caused by the fact that the market value of equities of the Finnish firms were low before the middle of 1990's due to recession period in the Finnish stock market. Consequently, denominator of the human capital asset ratio is low for many firms leading to the high values of the ratios. For this reason, Panel 2 of Table 3 reports the estimated human capital asset ratios for a sub-sample of firms for which the market value of equity exceeds the book value of equity. The ratios of the estimated human capital asset to market value of equity based on the sub-sample are still high, but clearly less than those based on the total sample. All in all, the results indicate that the human capital represents significant role in the market value of the Finnish firms.

(Insert Table 3 about here)

Table 4 reports the results of the regressing the ratio of the estimated human capital asset to the market value of equity (HU/MV) on the firm characteristics. Again, the result are based both on the sub-sample of firms for which the market value of equity

exceeds the book value and the total sample. The estimated parameters of the model (9) reported in Table 3 are used to calculate the estimates of the human capital asset ratio. Regressions are based on the pooled data. The results indicate that, except for the variable measuring the size of the firm, the signs of the slopes are as predicted for the sub-sample. Statistically significant slopes are reported for sales growth, standard deviation of the return on equity ratio and the return on asset ratio. For the total sample, the estimated slope coefficient is statistically significant only for the return on asset ratio. In addition, the adjusted R^2 is much smaller for the total sample than for the sub-sample. It therefore seems, that the estimated human capital asset ratios are economically more relevant when the estimated values of the ratio are not hampered by the very low market value of equity⁴.

As a whole, the results of regressing the ratio of the estimated human capital asset to the market value of equity on the firm characteristics indicate the estimated human capital asset make economic sense. However, it should be noticed that, even in the sub-sample of firms with market value of equity exceeding the book value, some of the independent variables remain statistically insignificant and the adjusted R^2 is relatively small (0.126).

(Insert Table 4 about here)

5. Conclusions

This paper applies the Ohlson's (1995) framework to estimate the proportion of labor costs that represents investments in human capital, and the rate of depreciation of

this asset by using data from Finland where all listed firms are required to report labor costs in financial statements and where high-tech firms have a dominant role in the stock market. The results indicate the estimated proportion of labor costs that represents investments in human capital is high in Finland as compared to US (see Ballester et al. 1998). However, it should be noted that these results should be interpreted with some degree of caution, because the available sample size used in the study is relatively small and the research period for which the necessary data is available was volatile in the Finnish stock market.

The results of testing whether the estimated parameters and the resulting human capital asset ratios make economic sense indicate that, except for the variable measuring the size of the firm, the signs of the slopes of variables that can be assumed to be economic determinants of the human capital asset ratio are as predicted by theory. Statistically significant slopes are reported for sales growth, standard deviation of the return on equity ratio and the return on asset ratio.

References

Amir, E. and L. Baruch, 1996, 'Value-relevance of Nonfinancial Information: the Wireless Communications Industry', *Journal of Accounting and Economics*, 22, pp. 3-30.

Ballester, M., J. Livnat and N. Sinha (1998), 'Labor costs and investments in human capital' Manuscript.

Bublitz, B. and M. Ettredge (1989), 'The information in discretionary outlays: advertising, research and development', *Accounting Review*, 64, pp. 108-124.

Chaucin, K. W. and M. Hirschey (1993), 'Advertising, R&D expenditures and the market value of the firm', *Financial Management*, 22, pp. 231-258.

Flamholtz, E. (1971) "A Model for Human Resource Valuation: A Stochastic Process with Service Rewards." *The Accounting Review* 46 2: 253-67.

Green, J.P., A.W. Stark and H.M. Thomas (1996), 'UK evidence on the market valuation of research and development expenditures', *Journal of Business Finance and Accounting*, 23 pp. 191-216.

Hirschey, M. and J.J. Weygandt (1985), 'Amortization policy for advertising and research and development expenditures', *Journal of Accounting Research* 23:1, pp. 326-335.

- Jaggi, B. and Hon-Shiang Lau (1974). "Toward a Model for Human Resource Valuation." *The Accounting Review*, 49 2: 321-29.
- Lev B. and A. Schwartz (1971). "On the Use of the Economic Concept of Human Capital in Financial Statements." *The Accounting Review* (January): 103-111.
- Myers, J. N. (1999) "Implementing Residual Income Valuation with Linear Information Dynamics." *The Accounting Review* (January): 1-28.
- Ohlson, J.A. (1995), 'Earnings, book values, and dividends in security valuations', *Contemporary Accounting Research* 11, pp. 661-687.
- Rosett, J.G. (2000). "Equity Risk and the Labor Stock: The Case of Union Contracts," Working Paper, Tulane University.

Footnotes

1. To avoid complicating the analysis deferred taxes are not adjusted to the approach
2. All sample firms have a positive average growth during a sample period.
3. Summary statistics were also calculated by using the total sample of 210 observations. The results were qualitative similar to those reported in Table 3, although some of the significant correlations were now insignificant.
4. Regressions are also re-estimated such that the total sample is split into two sub-samples on the basis of the labor intensiveness ratio. The results (available from the authors) indicate that the adjusted R^2 of the regression model is 0.17 in the sub-sample of firms with high labor intensiveness ratio, whereas the adjusted R^2 is 0.01 in the sub-sample of firms with low labor intensiveness ratio. In addition, the estimated slope coefficients of the average salary and the return on asset ratio are significant in the sub-sample of firms with high labor intensiveness ratio, whereas none of the estimated slopes are significant in the sub-sample of firms with low labor intensiveness ratio.

Table 1.

Summary statistics for Helsinki Stock Exchange, London Stock Exchange and Deutsche Börse in 1995.

	Number of listed firms	Average annual trading volume per firm	Average market value per firm
Helsinki	73	201	467
Deutsche Börse	1622	287	270
London	2265	386	458

Note: All monetary amounts are in millions of ECUs

Table 2
Summary statistics of the variables.

<i>Panel 1: Descriptive statistics</i>				
Variable	Mean	Std. dev.	Minimum	Maximum
Sales growth	0.077	0.050	0.004	0.230
Std Dev ROE	0.162	0.199	0.034	0.820
Average Salary	186.000	47.749	0.000	298.000
ROA	0.138	0.092	-0.090	0.560
Labor/Sales	0.221	0.112	0.000	0.454
Log(Assets)	8.054	1.275	5.136	11.349

<i>Panel 2: Pearson correlation coefficients.</i>						
	Sales growth	Std Dev ROE	Avr. Salary	ROA	Labor/Sales	Log(Assets)
HU/MV	-0.241 (0.015)	0.217 (0.029)	0.055 (0.587)	-0.257 (0.009)	-0.067 (0.507)	-0.024 (0.813)
Sales growth		-0.124 (0.216)	-0.050 (0.623)	0.003 (0.978)	0.207 (0.038)	-0.035 (0.727)
Std Dev ROE			-0.036 (0.721)	0.046 (0.645)	-0.339 (0.001)	-0.171 (0.088)
Average salary				0.209 (0.361)	0.037 (0.712)	0.531 (0.000)
ROA					-0.039 (0.700)	0.216 (0.030)
Labor/Sales						-0.302 (0.002)

Notes:

The results are based on analysing the sub-sample of 101 firm-year observations for which the market value of equity exceed the book value of equity. HU/MV is the ratio of the estimated human capital asset to the market value of equity, Sales growth is the average growth rate of sales during the sample period, Std Rev ROE is the standard deviation of the return on equity measured over the sample period, Average salary is the ratio of labor expense to the number of employees, ROA is the return on asset, Labor/Sales is the ratio of labor expense to sales, and Log(Assets) is the log of total assets.

Table 3
Summary statistics of the parameter estimates.

The estimated model is as follows:

$$\frac{MV_t}{BV_{t-1}} = A_0 + A_1 \frac{BV_t}{BV_{t-1}} + A_2 \frac{E_t}{BV_{t-1}} + A_3 \frac{w_t}{BV_{t-1}} + A_4 \frac{w_{t-1}}{BV_{t-1}},$$

where

$$A_0 \equiv \alpha_0,$$

$$A_1 \equiv \alpha_1,$$

$$A_2 \equiv \alpha_2,$$

$$A_3 \equiv \alpha_1\beta\phi + \alpha_2\beta,$$

$$A_4 \equiv -\alpha_2\beta\phi(\delta + r_f),$$

$$\text{and } \phi \equiv \frac{1+g}{\delta+g}.$$

	N	Mean	Min	10%	25%	50%	75%	90%	Max
<i>Panel 1: Total sample</i>									
α_0	21	-0.511	-8.411	-2.764	-2.148	-0.552	-0.045	2.596	10.474
α_1	21	0.800	-6.528	-0.363	0.290	0.623	1.837	3.400	4.271
α_2	21	4.777	-0.732	-0.198	0.774	1.495	4.718	8.446	43.920
β	21	0.286	0.000	0.007	0.102	0.307	0.500	0.500	0.500
δ	21	0.111	0.000	0.000	0.000	0.000	0.144	0.499	0.500
HU/MV	210	6.297	0.000	0.015	0.176	1.117	2.533	5.640	154.907
<i>Panel 2: Sub-sample</i>									
HU/MV	101	2.329	0.000	0.004	0.053	0.742	1.563	2.757	51.966

Notes:

HU/MV is the ratio of the estimated human capital asset to the market value of equity. Non-linear regressions are based on the time-series data. Total sample refers to the sample of all 210 firm-year observations available. Sub-sample refers to the sample of 101 firm-year observations for which the market value of equity exceed the book value of equity.

Table 4
Results of regressing the estimated human capital asset on the firm characteristics.

Dependent variable	Expected sign	Sub-sample	Total sample
Intercept		1.310 (0.839)	-6.020 (0.589)
Sales growth	-	-34.344 (0.026)	-2.689 (0.073)
Std Dev ROE	+	0.093 (0.032)	0.106 (0.202)
Average Salary	+	0.015 (0.442)	0.020 (0.498)
ROA	-	-0.251 (0.003)	-0.608 (0.001)
Labor/Sales	+	3.862 (0.637)	-12.235 (0.349)
Log(Assets)	-	0.249 (0.757)	2.079 (0.095)
N		101	210
Adj. R ²		0.126	0.056

Notes:

Sub-sample refers to the sample of 101 firm-year observations for which the market value of equity exceed the book value of equity. Total sample refers to the sample of all 210 firm-year observations available. HU/MV is the ratio of the estimated human capital asset to the market value of equity, Sales growth is the average growth rate of sales during the sample period, Std Rev ROE is the standard deviation of the return on equity measured over the sample period, Average salary is the ratio of labor expense to the number of employees, ROA is the return on asset, Labor/Sales is the ratio of labor expense to sales, and Log(Assets) is the log of total assets.

Regressions are based on the pooled data.