Investigating the Relationship between Intangible Assets and Heterogeneous Firms Listed in Tehran Stock Exchange

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Abstract
This study aimed to investigate the effects of heterogeneity on intangible assets of companies listed on the Tehran Stock Exchange. Hence, the present study sought to see whether there is a significant relationship between the heterogeneity of companies and investments in intangible assets. For this purpose, the metrics companies, human capital and limited funding were used to measure the heterogeneity of firms. The population of this research included all listed companies in Tehran Stock Exchange and sample consisted of 161 companies listed in Tehran Stock Exchange from 2003 to 2012. Multivariate linear regression analysis and ANOVA analysis were used to test the hypothesis. The results indicated a significant and positive relationship between size of the company and human capital investment in intangible assets. Moreover, the results showed that there is no significant relationship between the restrictions on financing and investment in intangible assets. The analysis results showed that there is no significant difference between the amount of investment in intangible assets between group companies, large and small-sized companies, and also there is no significant difference between investment in intangible assets in companies with no restrictions on funding and financing constraints and firms with high and low levels of human capital.

Keywords: Intangible assets, firm heterogeneity, size, restrictions on financing, human capital

Introduction
Intangible assets include assets that are produced or assets that are purchased through the market (Corrado et al., 2006). In general, intangible assets can be classified in four groups. The first group, purchased goodwill, the second group, acquired intangible assets, the third group, intangible assets created by the company and the fourth group is dedicated to research and development. Accounting standards are adopted by guidelines of the first, second and fourth group. Cost of purchased goodwill, intangible assets acquired at fair value at the time of purchase, and research and development costs as well as capital items are recorded in the books. Problem in the accounting process of entering values is guesswork, while the asset is conjectural. In general, there are two main views on accounting for intangible assets. Some experts believe that a high proportion of the market value of equity accounting book value of intangible assets is not recorded in the company's balance and if the assets are not recorded in the balance sheet, it will cause several problems. Moreover, experimental studies have shown a positive relationship between intangible assets and stock prices (Mátolcsy & Wyatt, 2006). According to Arrighetti et al. (2014) regarding the heterogeneity of investment in intangible assets, companies should focus on specific features such as size, organizational structure and studied historical foundation of the intangible asset. Nevertheless, a country has the infrastructure, economic, cultural, social, political circumstances which are different from other countries. Accordingly, the main research question is that: Is there a significant
relationship between intangible assets and heterogeneity of firms listed in Tehran Stock Exchange? In other words, does the heterogeneity affect on the Company's investment in intangible assets?

**Background of study**

With regard to the particular economic, cultural, political and social circumstances and since the impact of heterogeneity on corporate investment in intangible assets is not discussed, this study empirically examines the impact of heterogeneity on the company's investment in intangible assets.

**Literature review**

Castiglonesy and Oranaghi (2003) examined the relationship between human capital and total factor of productivity growth in Spain. The results of their study showed that human capital has a positive and significant impact on total factor of productivity growth.

Villalonga (2004) studied the development of the intangible assets of companies engaged in different industries. His results showed that the rate of growth in different industries with the highest levels found intangible assets such as the insurance industry, medicine, communications), and the lowest levels of intangible assets such as in retail trade and wholesale).

Dogan et al. (2007) examined the relationship between firm size and the timing of the annual report of companies listed in the Istanbul Stock Exchange. Their results showed that the timeliness of reports significantly depends on the size of the company.

Buccellato et al. (2008) investigated the relationship between ownership structure and constraints in financing. Their results showed that companies and public institutional ownership structure of companies have fewer restrictions on financing with foreign ownership, management, and family.

Zhilin and Lin (2008) in a study examined the relationship between EVA and intangible assets of companies. The results of their study by using data on 984 companies listed on the Stock Exchange of China in the period from 1998 to 2002 showed a significant and negative relationship in the economic value of intangible assets.

Pontuch (2011) explored the financing constraints and competition in the product market. He said that in a recession when funding of company decreases, the constraints are encountered to access to foreign funds. He added that the cash flow of competitive industries is sensitive to economic fluctuations. In this industry, companies that are experiencing financial constraints are entitled to the benefit of the more unusual.

Kang and Gary (2011) reported the intangible assets of companies engaged in research. Their results indicated that factors such as the risks associated with economic policies and the legal system, industry and market value to book value of intangible assets affect the level of disclosure. Niculita et al. (2012) in their study investigated the role of intangible assets of companies engaged in corporate success. They concluded that the intangible assets of companies are one of the main factors in their success.

Regarding the studies done in Iran, Salehi (2002) investigated the effects of human capital on economic growth in Iran. His research showed that human capital has a positive and significant impact on economic growth in the sectors of industry, agriculture and services.

Hashi (2006) examined the role of corporations in determining the appropriateness of financial reporting. The appropriateness of financial reporting is measured according to the type and content of the audit report and the audit report in terms of the reduction. Results of this study, by using data on 143 companies listed in Tehran Stock Exchange from 1998 to 2004 indicated a significant relationship between the utility of financial reporting and company size (the amount of assets, sales and capital).
Methodology
This study is a quasi-experimental research which is targeted as applied research. The library method, books, magazines and specialized Persian and Latin sites are used to collect the data. The required information is collected through software. Also, companies devise 2 processor version and the official website of the Stock Exchange. Finally, the data were analyzed by using Excel software version 2007 and SPSS software version 20 and Eviews 7.
The listed companies in Tehran Stock Exchange included the study sample. Statistical sampling was not used in this study and the following conditions are used for the selection of companies:

a. The company's fiscal year should end in March each year.
b. The fiscal year of company should not change during the years 2003 to 2012.
c. The financial information required to extract the required data should be available.
d. Component of banks and financial institutions (investment companies, financial intermediation, holding and leasing companies) are not as different financial disclosure and corporate governance structures.
e. Companies should be listed in Tehran Stock Exchange by the end of fiscal year 2012.
According to the study, the above conditions are met and examined about the 161 companies from 2003 to 2012.

Research Hypotheses
The main hypothesis: There is a significant difference between the amount of investment in intangible assets and companies in Tehran Stock Exchange.

Sub-hypotheses
The first sub-hypothesis: Willing to invest in intangible assets is different in large and small companies.
The second sub-hypothesis: Companies having more human capital are more willing to invest in intangible assets.
The third sub-hypothesis: Willing to invest in intangible assets in companies with limited financing is different from other companies.

Variables of the study
a. Size of company: The natural logarithm of total sales companies.
b. Human Capital companies: In this study, the ability of the company to be used as a measure of human capital.
c. Restrictions on financing: in order to clear companies' limited financing, the financing constraint index, Kaplan and Zingales (1997) (KZ) native was used by Tehrani and Hesarzadeh (2009).
d. Investment in intangible assets: The ratio of intangible assets to total assets of the company to measure the amount of investment in intangible assets. The criteria used in this study as a benchmark for measuring the intensity of investment in intangible assets.
f. Life Company: Life company refers to the number of years that is passed since the company was founded.
g. The short-term liquidity to total assets: Short-term liquidity to the company's ability to fulfill financial obligations which refer to maturity (Foster, 1986).
h. Profitability: Profitability refers to the ability of the company's profits.
i. Heterogeneity of companies: The heterogeneity is the specific characteristics of different companies. The most important of these are the large or small companies, companies with complex organizational structure and the constraints on financing companies.
Regression model
In this study, the regression model is used to measure the variables used in the study and to test the research hypotheses.

Model (5) \[ \text{INTANG}_{i,t} = \beta_0 + \beta_1 \text{SIZE}_{i,t} + \beta_2 \text{AGE}_{i,t} + \beta_3 \text{QR}_{i,t} + \beta_4 \text{ROA}_{i,t} + \varepsilon \]
Model (6) \[ \text{INTANG}_{i,t} = \beta_0 + \beta_1 \text{HC}_{i,t} + \beta_2 \text{AGE}_{i,t} + \beta_3 \text{QR}_{i,t} + \beta_4 \text{ROA}_{i,t} + \varepsilon \]
Model (7) \[ \text{INTANG}_{i,t} = \beta_0 + \beta_1 \text{FC}_{i,t} + \beta_2 \text{AGE}_{i,t} + \beta_3 \text{QR}_{i,t} + \beta_4 \text{ROA}_{i,t} + \varepsilon \]

In which:
- INTANG: is the variable investment in intangible assets.
- SIZE: is the size of the company.
- HC: is the human capital.
- FC: are the restrictions on financing.
- AGE: is the life company.
- QR: is the ratio of short-term liquidity to total assets.
- ROA: is the company's profitability.
- \( \varepsilon \): is the remaining amount of regression models.

Findings of the study
Descriptive Statistics
Table 1 shows the calculated descriptive statistics including mean, standard deviation, maximum and minimum human capital variables, firm size, restrictions on financing, investment in intangible assets, life companies, short-term liquidity to total assets, and profitability for the years studied. According to Table 1, the variable short-term liquidity to total assets variable with the highest and lowest levels of investment in intangible assets is scattered among the variables. Statistics relating to restrictions on the financing of the variable indicates that almost half of the surveyed companies listed in Tehran Stock Exchange are limited in its financing. This suggests a high degree of financing constraints on companies accepted in the Tehran Stock Exchange. Statistics relating to the variable investment in intangible assets suggests that the companies accepted in the Tehran Stock Exchange have invested a mean less than 1% of their assets in intangible assets. One reason for this low level of investment in intangible assets by the company may be due to the fact that there are probably a lot of companies that are not recorded intangible assets. Moreover, the average short-term liquidity to total assets ratio (ANI) indicates that companies have the appropriate level of liquidity. The data relating to profitability variable suggests that in some of the surveyed companies corporations have gained loss and their mean is about 14.71% of its total assets profit interest.

Table 1. Descriptive statistics of variables

<table>
<thead>
<tr>
<th>Variable name</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>HC</td>
<td>-0.6196</td>
<td>0.5339</td>
<td>0.0099</td>
<td>0.2416</td>
</tr>
<tr>
<td>Size</td>
<td>7.6530</td>
<td>18.7711</td>
<td>13.2662</td>
<td>1.2890</td>
</tr>
<tr>
<td>FC</td>
<td>0</td>
<td>1</td>
<td>0.51</td>
<td>0.50</td>
</tr>
<tr>
<td>Intang</td>
<td>0</td>
<td>0.3094</td>
<td>0.0070</td>
<td>0.0205</td>
</tr>
<tr>
<td>Age</td>
<td>1</td>
<td>60</td>
<td>31.8900</td>
<td>12.9190</td>
</tr>
<tr>
<td>QR</td>
<td>0.0150</td>
<td>488.9449</td>
<td>2.1271</td>
<td>17.9144</td>
</tr>
<tr>
<td>ROA</td>
<td>-0.1912</td>
<td>6.0238</td>
<td>0.1471</td>
<td>0.2651</td>
</tr>
</tbody>
</table>
Table 2. Reliability testing results of the variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Test statistic (Sig.)</th>
<th>Test statistic (Sig.)</th>
<th>Test statistic (Sig.)</th>
<th>Test statistic (Sig.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HC</td>
<td>-36.6150 (0.00005)</td>
<td>-21.6028 (0.00005)</td>
<td>1097.64 (0.00005)</td>
<td>1442.52 (0.00005)</td>
</tr>
<tr>
<td>Size</td>
<td>-36.3373 (0.00005)</td>
<td>-19.2787 (0.00005)</td>
<td>1000.33 (0.00005)</td>
<td>1231.57 (0.00005)</td>
</tr>
<tr>
<td>FC</td>
<td>639.015 (0.00005)</td>
<td>-11.8964 (0.00005)</td>
<td>639.015 (0.00005)</td>
<td>780.931 (0.00005)</td>
</tr>
<tr>
<td>Intang</td>
<td>928.267 (0.00005)</td>
<td>-24.9378 (0.00005)</td>
<td>928.267 (0.00005)</td>
<td>1116.20 (0.00005)</td>
</tr>
<tr>
<td>Age</td>
<td>1038.53 (0.00005)</td>
<td>-20.1457 (0.00005)</td>
<td>1038.53 (0.00005)</td>
<td>1272.38 (0.00005)</td>
</tr>
<tr>
<td>QR</td>
<td>1006.32 (0.00005)</td>
<td>-23.6213 (0.00005)</td>
<td>1006.32 (0.00005)</td>
<td>1130.40 (0.00005)</td>
</tr>
<tr>
<td>ROA</td>
<td>953.646 (0.00005)</td>
<td>-17.8730 (0.00005)</td>
<td>953.646 (0.00005)</td>
<td>1111.01 (0.00005)</td>
</tr>
</tbody>
</table>

**Static reliability of variables**

In order to ensure non-spurious regression model is discussed to investigate the static variables. The results of the reliability parameters by using this test are presented in Table 4-3. According to these tables, all the independent variables, dependent and significant control of the unit root tests Levin, Lin and Chu, Dickey-Fuller and Phillips Perron adjusted smaller than 0.05, which indicates that the parameters are valid.

**Inferential statistics**

Table 3 shows the results of the first research hypothesis testing. According to this table, Chow test results indicate that the combined model and panel data (fixed effects model or random effects model) should be used to test the first hypothesis.

Given the amount of data to test the model F listed in Table 3 that is equal to 23.3302 indicates that the significance of the applied model is 95%. Moreover, according to the statistics presented in Table 3, Durbin Watson is 1.9332 in the companies.

**Table 3. Results of the first research hypothesis testing by regression analysis**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficients</th>
<th>Standard error</th>
<th>T-statistics</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.0077</td>
<td>0.0053</td>
<td>-1.4425</td>
<td>0.1493</td>
</tr>
<tr>
<td>Size</td>
<td>0.0011</td>
<td>0.0003</td>
<td>3.0488</td>
<td>0.0023</td>
</tr>
<tr>
<td>Age</td>
<td>-0.0001</td>
<td>5-10 × 3.87</td>
<td>-2.7079</td>
<td>0.068</td>
</tr>
<tr>
<td>QR</td>
<td>5-10 × 1.08</td>
<td>5-10 × 2.79</td>
<td>0.3862</td>
<td>0.6994</td>
</tr>
<tr>
<td>ROA</td>
<td>0.0162</td>
<td>0.0018</td>
<td>8.6480</td>
<td>0.00005</td>
</tr>
<tr>
<td>R2</td>
<td>R2adj1</td>
<td>Watson statistic camera</td>
<td>F statistics</td>
<td>Significance level</td>
</tr>
<tr>
<td>0.0549</td>
<td>0.0525</td>
<td>1.9332</td>
<td>23.3302</td>
<td>0.00005</td>
</tr>
<tr>
<td>Chow test</td>
<td>0.4813</td>
<td>0.8879</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The existence of serial correlation in the regression analysis did not show a disturbing element. Also, according to the coefficient of determination adjusted for the expected rate of 25.5% of variations of investments in intangible assets is for the variables, firm size, firm age, firm
profitability and short-term liquidity to total assets. Table 3 shows the coefficients of the regression model are used to test the research hypotheses and significance level. According to this table the variables significantly are related to firm size indicates a significant and positive correlation between the size of companies and investments in intangible assets. The results also show that the control variables show a significant and negative relationship between Life and investments in intangible assets but a significant and positive relationship between profitability and investment in intangible assets. However, there is no statistically significant relationship between the variable short-term liquidity to total assets and investments in intangible assets.

Table 4 indicates the results of the second hypothesis testing. According to this table, Chow test results indicate that the combined model and panel data (fixed effects model or random effects model) should be used to test the second hypothesis. According to the amount of data to test the model F listed in Table 4 which is equivalent to 22.3675, the significance of the model is 95%. Moreover, according to the statistics presented in Table 5 Watson camera at all times is 1.9367. The existence of serial correlation in the regression analysis did not show a disturbing element. Also, according to the adjusted coefficient of determination, it can be predicted that the rate of 5.04% of variations of investments in intangible assets is for human capital variables, life companies, corporate profitability and short-term liquidity to total assets.

Table 5 shows the coefficients of the regression model to test the hypothesis and the significance level. According to this table, the significant level of human capital variables shows a positive and significant relationship between human capital and investments in intangible assets of the company. The results also show that the control variables have a significant and negative relationship with the life of companies and investments in intangible assets and there is a significant and positive relationship between profitability and investment in intangible assets. However, there is no statistically significant relationship between the variable short-term liquidity to total assets and investments in intangible assets.

Table 4. Results of the second hypothesis testing by regression analysis

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficients</th>
<th>Standard error</th>
<th>T-statistics</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.0079</td>
<td>0.0013</td>
<td>5.8243</td>
<td>0.00005</td>
</tr>
<tr>
<td>Size</td>
<td>0.0049</td>
<td>0.0020</td>
<td>2.3737</td>
<td>0.0177</td>
</tr>
<tr>
<td>Age</td>
<td>-0.0001</td>
<td>5-10 × 3.87</td>
<td>-2.7738</td>
<td>0.0056</td>
</tr>
<tr>
<td>QR</td>
<td>6-10 × 6.01</td>
<td>5-10 × 2.79</td>
<td>0.2151</td>
<td>0.8297</td>
</tr>
<tr>
<td>ROA</td>
<td>0.0162</td>
<td>0.0018</td>
<td>8.6271</td>
<td>0.00005</td>
</tr>
<tr>
<td>R2</td>
<td>R2adj</td>
<td>Watson statistic camera</td>
<td>F statistics</td>
<td>Significance level</td>
</tr>
<tr>
<td>0.0549</td>
<td>0.0504</td>
<td>1.9367</td>
<td>22.3675</td>
<td>0.00005</td>
</tr>
<tr>
<td>Chow test</td>
<td>0.4655</td>
<td>Significance level</td>
<td>0.8982</td>
<td></td>
</tr>
</tbody>
</table>

Table 5 presents the results of the third research hypothesis testing. According to this table, Chow test results demonstrate that the combined model and panel data (fixed effects model or random effects model) should be used to test the third hypothesis. With respect to the amount of data to test the model F listed in Table 5 that is equal to 20.8872 indicates the significance of the model used in 95%. Moreover, according to the statistics presented in Table 5 Watson camera at all times is 1.9368. The existence of serial correlation in the regression analysis did not show a disturbing element. Also, according to the adjusted coefficient of determination can be predicted that the rate of 4.71 percent of variations of investments in intangible assets is for the variables restrictions on financing, corporate life, corporate profitability and short-term liquidity to total assets.
Table 5. Results of the third research hypothesis testing by regression analysis

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficients</th>
<th>Standard error</th>
<th>T-statistics</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.0081</td>
<td>0.0014</td>
<td>5.5579</td>
<td>0.00005</td>
</tr>
<tr>
<td>Size</td>
<td>-8.32 * 10^-5</td>
<td>0.0010</td>
<td>-0.0830</td>
<td>0.9339</td>
</tr>
<tr>
<td>Age</td>
<td>-0.0001</td>
<td>5-10 × 3.88</td>
<td>-2.8285</td>
<td>0.0047</td>
</tr>
<tr>
<td>QR</td>
<td>6-10 × 7.78</td>
<td>5-10 × 2.80</td>
<td>0.2783</td>
<td>0.7808</td>
</tr>
<tr>
<td>ROA</td>
<td>0.0162</td>
<td>0.0018</td>
<td>8.5985</td>
<td>0.00005</td>
</tr>
</tbody>
</table>

Table 5 shows the coefficients of the regression model to test the third hypothesis of this study also indicates a significant level. According to this table, the variables significantly related to financing constraints indicate that there is no statistically significant relationship between the restrictions on corporate finance and investment in intangible assets. The results also show that the control variables associated with the life of companies and investments in intangible assets and there is a significant and negative relationship between profitability and investment, but there is a significant and positive relationship in intangible assets. However, there is no statistically significant relationship between the variable short-term liquidity to total assets and investments in intangible assets.

**Single-factor analysis of variance to test the research hypotheses**

In Tables 6 to 10 indicate the single-factor ANOVA results (as an additional test) to check the hypotheses of the study. In this regard, Table 7 shows the Leuven results of homogeneous data and Kolmogorov–Smirnov test to check the normality of the data. According to this table, KS test results indicate normality of the data used for single-factor ANOVA. In Table 6, the results of the three hypotheses are proposed for Leuven. According to this table, the significance level calculated for Leuven for the second and third research hypothesis is greater than 5% which indicates homogeneity of variance for analysis of variance and the significance level calculated for the Leuven for first hypothesis is smaller than 5% which indicates heterogeneity of variance for analysis of variance.

**Table 6. Results of the Kolmogorov-Smirnov test during the test**

<table>
<thead>
<tr>
<th>Loon Test</th>
<th>Hypothesis</th>
<th>F statistics</th>
<th>DF1</th>
<th>DF2</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>13.762</td>
<td>1</td>
<td>1608</td>
<td>0.00005</td>
<td></td>
</tr>
<tr>
<td>Second</td>
<td>2.554</td>
<td>1</td>
<td>1608</td>
<td>0.110</td>
<td></td>
</tr>
<tr>
<td>Third</td>
<td>0.020</td>
<td>1</td>
<td>1608</td>
<td>0.889</td>
<td></td>
</tr>
<tr>
<td>Ks Test</td>
<td>Z statistics</td>
<td>1.712</td>
<td>Significance level</td>
<td>0.251</td>
<td></td>
</tr>
</tbody>
</table>

Results of ANOVA analysis to test the research hypotheses are presented in Table 7.

**Table 7. Results of ANOVA analysis to test the research hypotheses**

<table>
<thead>
<tr>
<th>Sources of change</th>
<th>Sum of squares</th>
<th>Degrees of freedom</th>
<th>Mean square</th>
<th>F statistics</th>
<th>Significance level</th>
<th>Size effect</th>
<th>Statistical power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test</td>
<td>0.005</td>
<td>1</td>
<td>0.005</td>
<td>12.436</td>
<td>0.00005</td>
<td>0.008</td>
<td>0.941</td>
</tr>
<tr>
<td>The main effect of group</td>
<td>0.676</td>
<td>1608</td>
<td>0.0001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual error</td>
<td>0.682</td>
<td>1609</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
As can be seen, there is a significant difference between the mean values of investments in intangible assets in companies with big size to small size companies. The calculated statistical power suggests this difference is statistically significant (maximum statistical power is number one).

Due to the difference of the amount of investment in intangible assets in large and small companies descriptive statistics of the variable investment in intangible assets is presented in two groups in Table 8.

Table 8. Results of descriptive statistics of investment in intangible assets in large and small companies

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big Firms</td>
<td>0.009023</td>
<td>0.022258</td>
</tr>
<tr>
<td>Small Firms</td>
<td>0.005397</td>
<td>0.018988</td>
</tr>
</tbody>
</table>

The results of a single-factor ANOVA for the second hypothesis are given in Table 9. As can be seen, there is a significant difference between the mean values of investment in intangible assets in companies with high levels of human capital and the companies with low levels of human capital. The calculated data can indicate a statistically acceptable accuracy of the prediction.

Table 9. Single-factor analysis of variance to test the second hypothesis

<table>
<thead>
<tr>
<th>Sources of change</th>
<th>Sum of squares</th>
<th>Degrees of freedom</th>
<th>Mean square</th>
<th>F statistics</th>
<th>Significance level</th>
<th>Size effect</th>
<th>Statistical power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test</td>
<td>0.001</td>
<td>1</td>
<td>0.001</td>
<td>2.043</td>
<td>0.153</td>
<td>0.001</td>
<td>0.298</td>
</tr>
<tr>
<td>Main effect of group</td>
<td>0.681</td>
<td>1608</td>
<td>0.0001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual error</td>
<td>0.682</td>
<td>1609</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 10 demonstrates a single-factor ANOVA results for the third research hypothesis testing. Accordingly, there is a significant difference between the mean values of investments in intangible assets in companies with financing constraints and companies without restrictions on the financing. The calculated data can indicate a statistically acceptable accuracy of the prediction.

Table 10. Single-factor analysis of variance to test the third hypothesis

<table>
<thead>
<tr>
<th>Sources of change</th>
<th>Sum of squares</th>
<th>Degrees of freedom</th>
<th>Mean square</th>
<th>F statistics</th>
<th>Significance level</th>
<th>Size effect</th>
<th>Statistical power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test</td>
<td>5.759 * 10-6</td>
<td>1</td>
<td>5.759 * 10-6</td>
<td>1.014</td>
<td>0.907</td>
<td>0.0001</td>
<td>0.052</td>
</tr>
<tr>
<td>Main effect of group</td>
<td>0.682</td>
<td>1608</td>
<td>0.0001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual error</td>
<td>0.682</td>
<td>1609</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Conclusion

The main objective of this research was to investigate the effects of heterogeneity on investment in intangible assets in companies listed on the Tehran Stock Exchange. Due to the fact that in today's competitive world, intangible assets play an essential role and the heterogeneity factor influences the decisions of companies, corporate executives and therefore, the relationship between investment in intangible assets and heterogeneity of companies listed in Tehran Stock Exchange should be demonstrated. For this purpose, measure of the size of enterprises, human capital and limited funding were used to measure the heterogeneity of firms. The population of this research was 161 companies listed in Tehran Stock Exchange which were studied from 2003 to 2012. Multivariate linear regression analysis and ANOVA analysis were used to test the research.
hypotheses. The results of the study showed a significant and positive relationship between firm size and human capital investment in intangible assets.

The results of this study are consistent with the findings of Arrighetti et al (2014). Moreover, the results showed no significant relationship between restrictions on finance and investment in intangible assets. Also, analysis of variance showed a significant difference between the investment in intangible assets in large and small companies but there is no significant difference in the rate of investment in intangible assets in companies without restrictions on funding and financing constraints and firms with high and low levels of human capital.

**Limitations of the study**

In this study, there are limitations that may affect the results and findings:

- The most important limitation refers to the specific characteristics of quasi-experimental research in the social sciences. In other words, many of the political, economic, social circumstances of Iran (particularly the country and preparing financial statements adjusted for inflation), education and experience of corporate executives on findings of research that cannot be controlled by researcher. As a result, the findings should be used according to the situation.
- Due to the fact that this study is conducted on the planar companies with restrictions on the financing that are not divided, therefore, results should be observed with caution.

**Suggestions for future research**

- It is suggested to conduct a similar study to assess the effect of other measures of heterogeneity of companies (E.g., organizational complexity of companies) on their investment in intangible assets and the results to be compared with the findings of the present study.
- Given that banks and financial institutions (investment companies, financial intermediaries and leasing) are excluded from the sample in this study, it is suggested to conduct future research on the impact of heterogeneity corporate investment in intangible assets to examine the group of companies.
- The nonlinear relationship between firm heterogeneity and the amount of its investment in intangible assets to be reviewed and analyzed in Tehran Stock Exchange.

**References**


