Intellectual Capital Investments: Evidence from Panel VAR Analysis

Iuliia Naidenova
Petr Parshakov

The research is carried out in the framework of "Science Foundation HSE" program, grant № 13-05-0021
Intellectual capital (IC)

- Human capital (HC)
- Structural capital (SC)
- Relational capital (RC)

Literature review. Theory

1. IC components helps company to gain competitive advantage and **contribute to performance** (Chang and Hiesh, 2011; Huang and Wu, 2010; Carbita et al., 2006; Kamukama et al., 2010; Bontis et al., 2000; Tseng and Goo, 2005; Díez et al., 2010)

2. IC components are **interrelated** (Chang and Hiesh, 2011; Huang and Wu, 2010; Carbita et al., 2006; Kamukama et al., 2010; Bontis et al., 2000; Tseng and Goo, 2005)

3. possible **delay between the impacts** of one intellectual component on performance or others components (Tseng and Goo, 2005; Kaplan and Norton, 1992; Chen et al., 2004).

4. + **earnings** are the determinant of investments (Love and Zicchino, 2006; Eklund, 2010)
1. Influence of intellectual capital components on company performance – mixed results (Bontis et al., 2000; Carbita et al., 2006).

2. IC components are interrelated (Chang and Hiesh, 2011; Huang and Wu, 2010; Carbita et al., 2006; Kamukama et al., 2010; Bontis et al., 2000; Tseng and Goo, 2005).

3. Models with delay by 1 or 2 periods had been tested – confirmed (Tseng and Goo, 2005).

4. earnings are the determinant of investments in IC – no research
The aim of this study is to analyze a dynamic relationship between IC components and economic profit, with a special emphasis on industry specific effects in pharmaceutical, retail, steel, telecommunications, and service sectors.
Relationship between IC components and economic profit

INPUT

ΔTA
ΔRC
ΔHC
ΔSC

OUTPUT

Company performance

INPUT

National Research University Higher School of Economics - Perm
### Methodology. IC proxy indicators

<table>
<thead>
<tr>
<th>Category</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Human capital (HC)</strong></td>
<td>- Number of employees (Scandia Navigator, 1997; Гаранина, 2009; Sullivan, 2000; Wang, Chang, 2005; Zickgraf, Merton et al., 2007)</td>
</tr>
<tr>
<td><strong>Structural capital (SC)</strong></td>
<td>- Intangible assets (Shakina, 2011; Shakina, Barajas Alonso, 2012)</td>
</tr>
<tr>
<td><strong>Relational capital (RC)</strong></td>
<td>- Excess of accounts receivable over accounts payable</td>
</tr>
</tbody>
</table>
Methodology. Company performance measurement

- **NOPAT**
  - one of the traditional performance measures
  - could be derived directly from a company’s reports

- **EVA**
  - Reflects company value creation
  - Available for unlisted companies
Data

- Compustat database
- American companies
- Pharmaceutical, retail, steel, telecommunications, and service industries
- For 2001 to 2010
## Data

<table>
<thead>
<tr>
<th>Industry</th>
<th>N</th>
<th>HC/TA</th>
<th>SC/TA</th>
<th>RC/TA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmaceutical</td>
<td>1035</td>
<td>0.09</td>
<td>10.47</td>
<td>-7.20</td>
</tr>
<tr>
<td>Retail</td>
<td>1080</td>
<td>0.06</td>
<td>1.82</td>
<td>-1.68</td>
</tr>
<tr>
<td>Services</td>
<td>1222</td>
<td>0.36</td>
<td>6.82</td>
<td>-6.85</td>
</tr>
<tr>
<td>Steel industry</td>
<td>390</td>
<td>0.02</td>
<td>0.28</td>
<td>-0.50</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>1727</td>
<td>0.04</td>
<td>3.33</td>
<td>-1.19</td>
</tr>
</tbody>
</table>

A comparison of industries on the relative size of intellectual capital component
Methodology

- panel vector auto regression (pVAR)
Methodology

• PVAR of a second order

\[ z_{i,t} = \alpha + \beta_1 \cdot z_{i,t-1} + \beta_2 \cdot z_{i,t-2} + f_i + e_{it} \]

• \( Z_{it} \) is a vector of \{NOPAT (or EVA), hc, rc, sc, control variables\}
• \( f_i \) is a company’s individual features
• \( hc \) is the increase in the number of employees
• \( rc \) is the increase of the difference between accounts receivable and accounts payable
• \( sc \) is the increase in the value of intangible assets
• NOPAT is the net operating profit
• EVA
Methodology

• impulse-response function (IRF)

• orthogonal IRF (Choleski decomposition)
  it permits to focus on how a shocked variable (e.g. human capital) impacts another variable (e.g. EVA) keeping other shocks (e.g. capital expenditures, structural and relational capital and their lags) constant

• fixed effects, Helmert procedure
• GMM, but GMM = 2SLS (in this case)
• bootstrap confidence intervals
## An example of IRFs

**Impulse responses for 2 lag VAR of eva hc sc rc capex**

Errors are 5% on each side generated by Monte Carlo with 500 reps

### IFRs for telecommunications
Results

- **Pharmaceuticals** – investments in HC and tangible resources gain a positive return after a five years and more
- **Retail**, SC doesn’t matter for NOPAT and decreases EVA
- **Telecommunications**, HC(-1) and SC(-2) contribute to the creation of EVA. In this case, the most important roles are played by investments in human capital of the previous year, and, as for structural capital, investments from the two previous years
- In the **steel** industry, investments in HC(!) play the most significant role
- Value creation in companies providing **consulting and educational services** is a less definite process
- **Performance** influence on IC investments in services, steel and retail
- Interdependence of **IC components** exists in retain, steel and telecom industries
Conclusions

1. Investments in IC can give a positive return over the course of six years.
2. Return on intellectual capital is frequently close to zero or even is negative for a long period.
3. Management generally takes into consideration company performance when making investment decisions on capital expenditures, but not always when deal with intellectual capital.
4. Significant difference between the influence of investments on operating profit and on economic profit.
5. Influence of capital expenditures on EVA is significant.
7. Models of intellectual capital outputs should be dynamic.