The Real Effect of Accounting for Software Development Costs on Corporate Innovation

Syeda Nusrat Haider and Hai Wu (Presenter)
The Australian National University
Research Questions

Whether the adoption of **SFAS-86** (Accounting for the Costs of Computer Software to Be Sold) affects US public software firms’

- **quantity** of innovation outputs,
- scientific and economic **quality** of innovation, and
- **innovation strategies**

as compared with other high-tech firms?
# Accounting for R&D

<table>
<thead>
<tr>
<th></th>
<th>IAS 38</th>
<th>SFAS-86 (ASC 985-20)</th>
<th>SFAS-2 (ASC 730)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capitalization regime</td>
<td>Capitalization regime</td>
<td>Expense regime</td>
<td></td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Software development</td>
<td>R&amp;D</td>
<td></td>
</tr>
<tr>
<td>Distinguish research and development</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Technical feasibility and probable future economic benefits</td>
<td>Technical feasibility and probable future economic benefits</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>How to establish technical feasibility</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Amortization</td>
<td>Amortization</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
What we know:

<table>
<thead>
<tr>
<th>Pros</th>
<th>Capitalization regime vs Expense regime</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Software capitalisation information helps forecasting future economic benefits (Aboody and Lev, 1998)</td>
</tr>
<tr>
<td></td>
<td>Software capitalisation information helps reduce information asymmetry (Mohd, 2005; Oswald, 2008; Krishnan and Wang, 2014) and firms’ financing costs (Kreß, Eierle and Tsalavoutas, 2019).</td>
</tr>
<tr>
<td></td>
<td>Software capitalisation is associated with lower underinvestment (Dinh et al. 2019).</td>
</tr>
<tr>
<td></td>
<td>Mandated expensing of R&amp;D results in information loss for investors (Wyatt, 2005).</td>
</tr>
<tr>
<td></td>
<td>R&amp;D expensing is associated with reduced R&amp;D investment (Horwitz and Kolodny, 1980; Elliott et al., 1984; Wasley and Linsmeier, 1992).</td>
</tr>
<tr>
<td>Cons</td>
<td>Capitalised development costs in some IFRS countries are not informative (Dinh et al. 2016, Mazzi et al. 2019).</td>
</tr>
<tr>
<td></td>
<td>Experimental evidence shows that managers tend to keep investing in failing projects when R&amp;D capitalisation is allowed (Seybert 2010, 2016).</td>
</tr>
<tr>
<td></td>
<td>Software firms’ earnings quality declined following the adoption of SFAS-86 (Ciftci 2010).</td>
</tr>
<tr>
<td></td>
<td>Software capitalisers’ innovation efficiency decreases relative to expensers following the introduction of SFAS-86 (Li 2012).</td>
</tr>
</tbody>
</table>

As prior studies focus on the economic consequences of R&D capitalization, we provide evidence on the effect of accounting for software development on firms’ creation of scientific values.
## Innovation characteristics

<table>
<thead>
<tr>
<th>Patent quantity</th>
<th>Patent quality</th>
<th>Innovation strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total patent count:</strong> # of new patents applied in a year</td>
<td><strong>Average citation:</strong> Average citation received from new patents</td>
<td><strong>Explorative patents:</strong> % of new patents citing mainly unknown knowledge</td>
</tr>
<tr>
<td><strong>Total citation count:</strong> # of citation received from new patents</td>
<td><strong>Patent Generality:</strong> How widely are new patents cited by different tech. classes</td>
<td><strong>Exploitative patents:</strong> % of new patents citing mainly known knowledge</td>
</tr>
<tr>
<td></td>
<td><strong>Patent Originality:</strong> How widely do new patent cite different tech. classes</td>
<td><strong>Patent diversity:</strong> How diverse are new patents’ tech. classes</td>
</tr>
<tr>
<td></td>
<td><strong>Market value of patent:</strong> Economic value of new patents</td>
<td></td>
</tr>
</tbody>
</table>

**Innovation strategies**

- **Explorative patents:**
  - % of new patents citing mainly unknown knowledge

- **Exploitative patents:**
  - % of new patents citing mainly known knowledge

- **Patent Generality:**
  - How widely are new patents cited by different tech. classes

- **Patent Originality:**
  - How widely do new patents cite different tech. classes

- **Patent diversity:**
  - How diverse are new patents’ tech. classes

- **Market value of patent:**
  - Economic value of new patents
Hypotheses – information asymmetry and financing cost

SFAS-86:
Information about expected R&D success

Reduce information asymmetry

Decrease cost of capital

Greater access to funds

Increase innovation quantity
Decrease innovation quality
More explorative patents
Hypotheses – managerial myopia

- SFAS-86: Less conservative accounting for software development
- Reduce downward pressure on reported earnings
- Managers report software capitalization opportunistically.
- Lower market pressure on managers to focus on short-term earnings
- Increase Innovation quantity
- Increase innovation quality
- More explorative patents
- Reduced innovation quality

Managers report software capitalization opportunistically.
Hypotheses – the Learning effect

Financial reporting affects managers’ information set as they assimilate new information to comply with new accounting standards.

SFAS-86 requires managers to learn about the feasibility and value of the underlying investment which reduce uncertainty in investment decision, ensure continuous monitoring of the project and evaluate existing and new knowledge.

- Innovation Quantity?
- Increase Innovation Quality
- More Explorative Patents
- More Exploitative Patents
Research Design

• We compare changes in innovation characteristics following the adoption of SFAS-86 between software firms and other high-tech firms.

• Treatment Group:
  Identify software firms from Hall and MacGarvie (2010)
  130 public software firms

• Control Group
  223 other high-tech public firms
  Matched to treatment based on several common firm characteristics

• Alternative Control Group
  Private and government software entities matched on similar patenting activities
Timeline and empirical model

Pre SFAS-86 period: 1981 to 1985
Post SFAS-86 adoption period: 1987 to 1991

\[
\text{INNOVATION}_{it} = \alpha_0 + \beta_1 \text{TREAT}_{t} \times \text{POST}_{t} + \beta_2 \text{SIZE}_{it} + \beta_3 \text{ROA}_{it} + \beta_4 \text{CAPEX}_{it} \\
+ \beta_5 \text{TANGIBLES}_{it} + \beta_6 \text{R&D}_{it} + \beta_7 \text{CASH}_{it} + \beta_8 \text{LEVERAGE}_{it} \\
+ \beta_9 \text{TOBINQ} + \beta_{10} \text{FOLLOW}_{it} + \text{Firm-fixed Effects} \\
+ \text{Year-fixed Effects} + \varepsilon_{it}
\]
Sample

• Data sources:
  • Patent and citation data come from the National Bureau of Economic Research database
  • Data on the economic value of patents come from Kogan et al. (2017)
  • Data on software firm classification come from Hall and MacGarvie (2010)
  • Financial data are collected from the CRSP/COMPUSTAT merged dataset.
  • Data on analyst following come from the I/B/E/S database.

• To be included in the sample, we require:
  • Non-missing total assets
  • Firms have at least one patent application in the pre-SFAS-86 period
  • Observations not from 1986

• The final sample has 10,195 firm-year observation. The matched sample contains 2,039 firm-year observations.
Average patenting activity by year (N=10,195)

<table>
<thead>
<tr>
<th>Year</th>
<th>Software Firms (N=1,177)</th>
<th>Other high-tech Firms (N=9,018)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Patent</td>
<td>Citations</td>
</tr>
<tr>
<td>1981</td>
<td>42.17</td>
<td>378.66</td>
</tr>
<tr>
<td>1982</td>
<td>43.13</td>
<td>404.19</td>
</tr>
<tr>
<td>1983</td>
<td>39.96</td>
<td>375.06</td>
</tr>
<tr>
<td>1984</td>
<td>40.92</td>
<td>369.46</td>
</tr>
<tr>
<td>1985</td>
<td>44.37</td>
<td>406.35</td>
</tr>
<tr>
<td>1987</td>
<td>58.84</td>
<td>488.08</td>
</tr>
<tr>
<td>1988</td>
<td>66.70</td>
<td>539.11</td>
</tr>
<tr>
<td>1989</td>
<td>69.13</td>
<td>526.25</td>
</tr>
<tr>
<td>1990</td>
<td>74.78</td>
<td>490.17</td>
</tr>
<tr>
<td>1991</td>
<td>42.17</td>
<td>378.66</td>
</tr>
</tbody>
</table>
Main results

Compared to other public high-tech firms, public software firms’

- patent and citation
- average citation, patents’ generality and originality
- monetary value
- explorative patents
- patents’ portfolio diversity

in the post SFAS-86 adoption period from the pre-SFAS-86 period.
Public vs private software entities

Consistent with main result, compared to private software entities, public software firms’
- innovation quantity increases
- innovation scientific quality increases
- produce more explorative patents
in the post SFAS-86 adoption period from the pre-SFAS-86 period

Other robustness tests:
- Falsification tests: adoption of SFAS-86 does not affect capital expenditure, the number of employees, tangible assets, M&A, leverage and profitability.
- No sign of pre-SFAS86 differences between the treatment and control groups.
The role of financially constrained firms

- We expect that SFAS-86 brings greater benefit to financially constrained firms by reducing the cost of capital, and consequently, fostering innovation.

- We use the KZ-index (Kaplan-Zingales Index) as a proxy to measure financial constraints.

- We find evidence consistent with the expectation on analyses of total citations, average citations, patent generality and explorative patents.
Software capitalization and meeting performance targets

• SFAS-86 may provide opportunities for managers to use software capitalization to meet performance target.

• We predict that innovation activities of software firms that just meet or beat earnings targets are less benefited post SFAS-86 adoption.

• $\text{MEET} = 1$ if the firm $i$’s earnings change between year $t$ and $t-1$ lies within the interval $[0, 0.005]$ or zero otherwise.

• We find results confirming this prediction in analyses of innovation quantity, innovation scientific quality, and patent diversity.
Short-term earnings pressure from analysts

- Financial analysts can create market pressure on managers, which encourages them to be more myopic with innovation investment.

- SFAS-65 may alleviate this effect.

- We find that the effects of SFAS-86 on software firms’ innovation activities are stronger for firms with high analyst coverage.
Contributions

• This study extends research on accounting for intangible to focus the impact of accounting standards on firms’ technology and scientific development. Innovation characteristics have significant social implications.

• Standards requiring R&D capitalization, such as IAS-38 and SFAS-86, may be associated with real economic and scientific benefits generated from greater innovation quantity, quality, and novelty.

• This study suggests that standard setters may take scientific benefits of accounting standard of intangible into consideration when evaluate the benefits and costs of such standards.
Conclusion and limitations

• Public software firms’ innovation quantity, scientific quality, explorative patents and patent diversity increases while the monetary value decreases following the adoption of SFAS-86.

• Endogeneity issue: the estimated effects can be biased by the overall software boom in the late 1980s.

• Potential generalisability issue.
  – The event occurs almost 30 years ago.
  – SFAS-86 governs a specific class of technology innovation. It is able to provide specific guidelines on testing technical feasibility.

• Difficult to test the learning effect.
Thank you
and
Comments welcome