Cost and Benefit of Apprenticeship Training –
A Comparison of Germany and Switzerland

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Outline

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2. Data and Sample Selection
3. Descriptive Statistics
4. The Matching-Approach
5. Results
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   b) Treatment Effects on Swiss Firms
6. Discussion and Conclusions
7. Further Research
Concept of the Cost-Benefit-Surveys

• No direct analyses of costs and benefits possible
  – usually no explicit cost unit for app. training in cost accountings

  – Development of a first concept of cost-benefit-surveys
  – Definitions: Gross Costs, Benefits, Net Costs

• Complex questionnaire to calculate the costs and benefits

• Interview partners are personnel managers or managers in charge for apprenticeship training
Gross Costs

- costs for the apprentices
  - apprentices wages
  - social benefits
  - voluntary social benefits

- costs for the trainers
  - full-time trainer
  - part-time trainer
  - external trainer

- initial and material costs
  - working place (tools, materials for practicing)
  - company training centre
  - internal class

- miscellaneous costs
  - teaching material/media
  - dues (e.g., test fees)
  - work and protection cloth
  - external training
  - administration

Cost and Benefit of Apprenticeship Training
Benefits

- Benefits achieved by the apprentices are calculated by the times apprentices perform productive work

  - Calculation of days at workplace (less vocational school days, vacation days, sick days etc.)

  - Calculation of productive work (I and II)
    - Productive work I: work, that otherwise would be carried out by unskilled workers
    - Productive work II: work, that otherwise would be carried out by skilled workers

  => Weighted by the relative productivity compared to an average skilled worker

  - valued at wages
Cost and Benefit of Apprenticeship Training

Net Costs

Gross Costs

- Benefits

= Net Costs
Data and Sample Selection

- Merge of two surveys with the reference year 2000
  - For Switzerland see Schweri et al. (2003)
  - For Germany see Beicht et al. (2004)

- Focus on apprenticeship programs that last three years

- \( n = 3296 \) firms
  - 1825 German
  - 1471 Swiss

- All results presented are weighted by sampling weights that account for the stratified sample
Descriptive Statistics I

Comparison of Gross Costs, Benefits and Net Costs

![Bar chart comparing gross costs, benefits, and net costs for Germany and Switzerland.](chart.png)
Possible Reasons for the Differences in Net Costs

- **Structural variables** (e.g. industry, firm size or training profession)

- **Parameters of net costs**
  - Wages
  - Parameters concerning the VET system
    - Days in vocational school
    - Other external courses
    - Vacation days
  - Time allocation at the workplace
    - Productive time I (work, that otherwise would be carried out by unskilled workers)
    - Productive time II (work, that otherwise would be carried out by skilled workers)
    - Non-productive time (e.g. practicing time)
### OLS-Regressions with Structural Variables I

<table>
<thead>
<tr>
<th>Dep. variable: net costs of training</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>German firm</td>
<td>8440.79</td>
<td>8419.92</td>
<td>8451.60</td>
<td>8393.03</td>
<td>8430.11</td>
</tr>
<tr>
<td></td>
<td>(341.24)</td>
<td>(348.12)</td>
<td>(354.40)</td>
<td>(363.59)</td>
<td>(364.93)</td>
</tr>
</tbody>
</table>

**Independent Variables:**

1. Dummy German firm
2. (1) + firm size
3. (2) + industry
4. (3) + training profession
5. (4) + dummies for training centre and full-time trainers
Wages

- Employees` Wages: German skilled and unskilled worker earn between 60% and 70% of Swiss employees
- Apprentices` Wages: In GER and CH almost similar
- Larger difference between apprentices-wages and wages for skilled (unskilled) workers in Switzerland
### Parameters concerning the VET system

<table>
<thead>
<tr>
<th></th>
<th>Germany</th>
<th>Switzerland</th>
<th>Diff. GER-CH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>days of absence</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>vocational school</td>
<td>61.8</td>
<td>50.6</td>
<td>11.1</td>
</tr>
<tr>
<td>external courses</td>
<td>9.0</td>
<td>6.6</td>
<td>2.4</td>
</tr>
<tr>
<td>internships</td>
<td>3.6</td>
<td>2.3</td>
<td>1.3</td>
</tr>
<tr>
<td>vacation days</td>
<td>27.3</td>
<td>26.5</td>
<td>0.8</td>
</tr>
<tr>
<td>sick days</td>
<td>9.1</td>
<td>5.8</td>
<td>3.3</td>
</tr>
<tr>
<td><strong>total days of absence</strong></td>
<td>109.4</td>
<td>92.2</td>
<td>17.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>at the workplace</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>138.2</td>
<td>156.2</td>
<td>-18.0</td>
</tr>
<tr>
<td><strong>at the company training center</strong></td>
<td>1.8</td>
<td>0.5</td>
<td>1.3</td>
</tr>
<tr>
<td><strong>in internal courses</strong></td>
<td>2.7</td>
<td>1.9</td>
<td>0.7</td>
</tr>
<tr>
<td><strong>total</strong></td>
<td>250</td>
<td>250</td>
<td>0</td>
</tr>
</tbody>
</table>
Descriptive Statistics V

Productive vs. Unproductive Times

- Germany: 57% unproduktive times, 43% produktive times
- Switzerland: 17% unproduktive times, 83% produktive times

Cost and Benefit of Apprenticeship Training
The Matching-Approach

• OLS-Estimation impossible as the parameters of interest are part of the net costs by construction

• Basic idea was to estimate the costs and benefits of German (Swiss) firms if they face “Swiss” (“German”) attributes concerning certain parameters

• Basic literature on matching:
  – Rubin (1974)
  – Rosenbaum and Rubin (1983)
  – Abadie et al. (2004)

• Regarded parameters:
  – Wages of apprentices, skilled and unskilled workers and non-wage labour costs
  – Parameters related to the VET system (e.g. days spend in vocational school)
  – Allocation of tasks to apprentices at the workplace
The Matching-Approach II

Intention of matching in general:
• Estimation of direction and size of a treatment effect

• Each member of the treatment group is assigned to one or more members of the control group

• The estimated effects are:

\[
ATE_i = E\left[ Y_i(1) - Y_i(0) \right]
\]

\[
ATT_i = E\left[ Y_i(1) - Y_i(0) \mid D_i = 1 \right]
\]

\[
ATC_i = E\left[ Y_i(1) - Y_i(0) \mid D_i = 0 \right]
\]

• D is the treatment indicator; \( D = 1 \) if the firm is situated in Germany
The Matching-Approach III

- **Empirical Strategy:**
  1. Matching of the parameters with large differences in the descriptive statistics
  2. Use of the estimated parameters to re-calculate the cost model

- **Nearest neighbour matching** (Abadie et al. (2004))

- **Matching parameters:**
  - Number of employee
  - Industrial sector
  - Training profession
  - Dummies for training centre and full-time trainers
## Results

### Effects of treatment on costs and benefits for German firms

<table>
<thead>
<tr>
<th>Treatment</th>
<th>ΔCosts</th>
<th>ΔBenefits</th>
<th>ΔNet Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wages</td>
<td>2214</td>
<td>3340</td>
<td>-1126</td>
</tr>
<tr>
<td>VET-system</td>
<td>326</td>
<td>869</td>
<td>-543</td>
</tr>
<tr>
<td>Allocation of tasks to apprentices</td>
<td>-69</td>
<td>2865</td>
<td>-2934</td>
</tr>
</tbody>
</table>

Change in € compared to original values
## Results II

**Effects of treatment on costs and benefits for German firms II**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Costs</th>
<th>Benefits</th>
<th>Net Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>15536</td>
<td>8008</td>
<td>7528</td>
</tr>
<tr>
<td>Wages</td>
<td>17750</td>
<td>12148</td>
<td>6402</td>
</tr>
<tr>
<td>Wages &amp; VET-system</td>
<td>18205</td>
<td>12679</td>
<td>5526</td>
</tr>
<tr>
<td>Wages &amp; VET-system &amp; Task-allocation</td>
<td>18066</td>
<td>17132</td>
<td>934</td>
</tr>
</tbody>
</table>

Absolute values in €

- Dummy “German firm” is still significant in OLS-Regressions
# Results III

## Effects of treatment on costs and benefits for Swiss firms

<table>
<thead>
<tr>
<th>Treatment</th>
<th>ΔCosts</th>
<th>ΔBenefits</th>
<th>ΔNet Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wages</td>
<td>-1852</td>
<td>-5841</td>
<td>3989</td>
</tr>
<tr>
<td>VET-system</td>
<td>-455</td>
<td>-2306</td>
<td>1851</td>
</tr>
<tr>
<td>Allocation of tasks to apprentices</td>
<td>-111</td>
<td>-5998</td>
<td>5887</td>
</tr>
</tbody>
</table>

Change in € compared to original values
### Results IV

**Effects of treatment on costs and benefits for Swiss firms II**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Costs</th>
<th>Benefits</th>
<th>Net Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>18131</td>
<td>19044</td>
<td>-913</td>
</tr>
<tr>
<td>Wages</td>
<td>16279</td>
<td>13202</td>
<td>3077</td>
</tr>
<tr>
<td>Wages &amp; VET-system</td>
<td>15971</td>
<td>11620</td>
<td>4351</td>
</tr>
<tr>
<td>Wages &amp; VET-system &amp; Task-allocation</td>
<td>15924</td>
<td>8006</td>
<td>7918</td>
</tr>
</tbody>
</table>

Absolute values in €

- Dummy “German firm” is not significant in OLS-Regressions
Discussion and Conclusion

• The above mentioned parameters are at large responsible for the difference in net costs between Germany and Switzerland.

• The only parameter firms can actually influence is the time allocation at the working place.

• The larger difference between apprentices-wages and wages for skilled (unskilled) workers is an incentive for Swiss firms to substitute skilled (unskilled) worker by apprentices.

• There is no evidence (in our data) that apprenticeship training in Germany is of higher quality.

• The labour market in Germany is more regulated so opportunity costs might be higher.

• German apprentices stay in their training firms more often (more than 50% in GER, 36% in CH).
Further Research - Investment- vs. Production-Model

- German firms train their apprentices more investment oriented than Swiss firms
  - A variety of ratings/items and factors of our dataset operationalise the investment and production motive
  - First results of probit-regressions confirm the hypothesis
    - Dependent variable: Country Dummy
    - Control variables: Firm size, industry, training profession, training centre, full-time trainers, school performance

⇒ Swiss firms are significantly more satisfied with the cost-benefit-ratio of the own apprenticeship training than German firms

⇒ German firms tend to train apprentices significantly more in order to save costs of recruitment and to qualify them as skilled workers for their firm
Cost and Benefit of Apprenticeship Training

FULL COST vs. DIRECT/ VARIABLE COST APPROCH

Gross Costs

- costs for the apprentices
  - apprentices wages
  - social benefits
  - voluntary social benefits

- costs for the trainers
  - full-time trainer
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- miscellaneous costs
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  - dues (e.g. test fees)
  - work and protection cloth
  - external training
  - administration
  - part-time trainer

Additional costs of apprenticeship training: DIRECT COSTS, VARIABLE COST APPROCH
FULL COST APPROCH