Premature Apprenticeship Terminations: An Economic Analysis
(Donata Bessey and Uschi Backes-Gellner)

Conference on Economics of Education, Firm Behavior, and Training Policies
University of Zurich, June 26, 2008
Motivation (1)

- Scarcity of apprenticeship places in CH and GER
- 20 – 25 % of all apprenticeship contracts terminated before completion - not necessarily dropouts
- An early termination can lead to…
  - Changing
  - Upgrading
  - Dropping out (risky!)
- Importance of dropouts: 10 – 23 % of youths with an early termination stop any educational attainment afterwards (different data sets, CH, D)
Motivation (2)

• Problematic: Dropout behavior (changers: bad match, even efficient)
• Higher level of education => higher income, lower risk of unemployment

<table>
<thead>
<tr>
<th></th>
<th>Without appr.</th>
<th>Apprenticeship</th>
<th>University degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unempl. rate</td>
<td>26.3 %</td>
<td>9.9 %</td>
<td>4.5 %</td>
</tr>
</tbody>
</table>

Source: Arbeitsmarkt in Zahlen 2003

• Reasons for this (at least at first sight) irrational behavior? Really irrational to drop out?
• Oreopoulos (2005): dropping out difficult to explain with the standard human capital model
Research Question

• Focus of this work:
  • dropout determinants as compared to changers and upgraders
  • Policy implications (for firms and teachers): How can dropouts be avoided?
• Previous research on the topic from an economic perspective: none (up to my knowledge)
• New about our approach: clear-cut background, new data set
Plan of Talk

• Theoretical Considerations
• The Data Set, Descriptive Statistics
• Estimation Results
• Conclusion
Theory (1): Human Capital

- Rational individuals decide over their investment in education using discounted costs and earnings streams
- **Dropouts** from a human-capital (rational) point of view: 
  \[(NPV < 0) \Rightarrow \text{dropping out is rational!}\]
- Data set allows for an analysis based on this approach (using proxies for costs, benefits, time preference)
- We analyze the decision to **continue** an apprenticeship
Theory (2): Regional Labor Markets

- Extreme regional differences in patterns of behavior - reason?
- Model by Wheeler (2001): stronger incentives to invest in human capital in thicker labor markets (better matches => higher wages)
- We incorporate a regional weighting factor for the benefits in the classical HC model, but not for the costs
- Implicitly: matching argument, but still static model
Theory (3): Summary

The “standard” model for any investment (e.g., in human capital)

\[
NPV = \int_t^T R_t e^{-ri} dt - \int_0^t C_i e^{-ri} dt
\]

=> include a weighting factor \( \mu \) in \([0,1]\) that captures local labor market conditions for benefits:

\[
\text{apprenticeship} = \begin{cases} 
0 & \text{if } \int_0^t C_i e^{-ri} dt > \mu \int_t^T R_t e^{-ri} dt \\
1 & \text{if } \int_0^t C_i e^{-ri} dt \leq \mu \int_t^T R_t e^{-ri} dt
\end{cases}
\]

• Incentives to invest in general
• Importance of labor market thickness (extreme case: \( \mu = 0 \)
Testable Hypotheses

• Incentives to complete an apprenticeship:
  • Incentives to complete ↑ when costs lower, benefits higher, patience of individual higher
  • Incentives ↑ in thicker labor markets
The BiBB Data Set (1)

- Questionnaire and survey realized by BiBB in 2000/2001 („Vertragslösungen 2002 – Strukturen und Gründe“)
- \( n = 1,557 \)
- 7 chambers of commerce and industry (IHK),
  6 chambers of crafts (HWK)
- Regional provenance: IHKs Kiel, Leipzig, Mittlerer Niederrhein, Freiburg, Frankfurt/Oder, Darmstadt, Augsburg
- HWKs Rostock, Osnabrück, Aachen, Ostthüringen, Flensburg, Karlsruhe

=> Allows to include regional characteristics!
The Chamber Districts
The BiBB Data Set (2)

Questions include…

• current status
• firm-level reasons (overtime work, clash with boss/colleagues, low quality of in-firm training…)
• job-related reasons (wrong idea, bad prospects…)
• school-related reasons (bad teaching quality, clash with teachers, exam nerves…)
• personal reasons (health problems, financial distress, relocation…)
• timing (year of apprenticeship)
• type of school-leaving diploma, native tongue, occupation chosen
• firm size
• Former work with the data set: only descriptive statistics
Descriptives (1)

Timing of contract termination

- 31% before appr.
- 32%
- 24%
- 8%
- 1%
- 4%

Legend:
- probation
- later 1st year
- 2nd year
- 3rd year
- 4th year
- before appr.
Descriptives (2)

Destination of terminating youths

- Changers: 72%
- Upgraders: 7%
- Dropouts: 21%
Descriptives (3)

**Destination by timing of termination**

- **Changers**
- **Upgraders**
- **Dropouts**

- Probation time
- Later 1st year
- 2nd year
- 3rd year
- 4th year
Descriptives (4)

Destination by type of school-leaving diploma

- **Nomech**
- **Haupt**
- **Real**
- **Fachabi**
- **Abili**

Legend:
- **changers**
- **upgraders**
- **dropouts**
Premature Terminations, Donata Bessey and Uschi Backes-Gellner

Descriptives (5)

Destinations by Region of Origin

- Kiel
- Leipzig
- Mitt. Niederrhein
- Freiburg
- Frankfurt/Oder
- Darmstadt
- Augsburg
- Rostock
- Osnabrück
- Karlsruhe
- Ostthüringen
- Aachen

Legend:
- dropouts
- aufsteiger
- wechsler
Upshot of descriptive evidence, implications for estimation strategy

• Timing and prior level of schooling
• Regional differences – Model by Wheeler (2001): better matches in bigger labor markets => more investment in human capital
• Proxies for costs, benefits, time horizon
• Add more (non-monetary) cost- and benefit-related variables:
  • girls in male occupations and vice versa
  • opportunity costs of an apprenticeship (wages for unskilled)
  • regional information
Estimation strategy

• We estimate a logit/probit model for the following baseline equation...

\[ \text{dropout}_{ij} = \beta_1 x_{ij} + \beta_2 x_i + \beta_3 x_j + u_{ij} \]

• \(ij\): individual-and regional-level characteristics (benefits)
• \(i\): individual-level characteristics (schooling)
• \(j\): regional-level characteristics (labor market)
• error term \(u\): we adjust for clustering on regions
• NB: not efficient estimation strategy but results handier to interpret
• The **control groups** are changers/changers and upgraders/bankruptcy victims
Estimation strategy (2)

Assumption: apprentices in bankrupt firms can be treated as “successful” apprentices and hence provide a third control group

<table>
<thead>
<tr>
<th></th>
<th>Bankruptcy victims</th>
<th>Entire sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>dropouts</td>
<td>0.0963</td>
<td>0.2112</td>
</tr>
<tr>
<td>changers</td>
<td>0.8464</td>
<td>0.7160</td>
</tr>
<tr>
<td>upgraders</td>
<td>0.0500</td>
<td>0.0728</td>
</tr>
<tr>
<td>n</td>
<td>280</td>
<td>1676</td>
</tr>
</tbody>
</table>
Empirical Results (1)

Results from a probit model, marginal effects, clustering-robust S.E.s

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boy in female job</td>
<td>-0.016</td>
<td>-0.027</td>
<td>0.068</td>
</tr>
<tr>
<td></td>
<td>[0.020]</td>
<td>[0.031]</td>
<td>[0.049]</td>
</tr>
<tr>
<td>Girl in male job</td>
<td>0.057*</td>
<td>0.063*</td>
<td>0.061</td>
</tr>
<tr>
<td></td>
<td>[0.030]</td>
<td>[0.033]</td>
<td>-0.084</td>
</tr>
<tr>
<td>Exam nerves</td>
<td>0.129*</td>
<td>0.132*</td>
<td>0.327***</td>
</tr>
<tr>
<td></td>
<td>[0.086]</td>
<td>[0.087]</td>
<td>[0.048]</td>
</tr>
<tr>
<td>Financial distress</td>
<td>0.178***</td>
<td>0.184***</td>
<td>0.272***</td>
</tr>
<tr>
<td></td>
<td>[0.056]</td>
<td>[0.052]</td>
<td>[0.042]</td>
</tr>
<tr>
<td>Bad prospects</td>
<td>-0.045</td>
<td>-0.041</td>
<td>0.066</td>
</tr>
<tr>
<td></td>
<td>[0.06]</td>
<td>[0.07]</td>
<td>[0.219]</td>
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<tr>
<td>Bad income prospects</td>
<td>0.058</td>
<td>0.063</td>
<td>0.278***</td>
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<tr>
<td></td>
<td>[0.048]</td>
<td>[0.05]</td>
<td>[0.096]</td>
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<tr>
<td>Bad career prospects</td>
<td>-0.051</td>
<td>-0.056</td>
<td>-0.055</td>
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<tr>
<td></td>
<td>[0.052]</td>
<td>[0.062]</td>
<td>[0.177]</td>
</tr>
<tr>
<td>Regional unemployment rate</td>
<td>2.087***</td>
<td>2.358***</td>
<td>0.162</td>
</tr>
<tr>
<td></td>
<td>[0.417]</td>
<td>[0.425]</td>
<td>[1.066]</td>
</tr>
<tr>
<td>Percentage in out-of-firm training</td>
<td>-0.434***</td>
<td>-0.493***</td>
<td>-0.011</td>
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<tr>
<td></td>
<td>[0.091]</td>
<td>[0.091]</td>
<td>[0.334]</td>
</tr>
<tr>
<td>Population density</td>
<td>-0.014</td>
<td>-0.013</td>
<td>-0.104</td>
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<tr>
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<td>[0.023]</td>
<td>[0.024]</td>
<td>[0.064]</td>
</tr>
<tr>
<td>Supply-demand ratio on the apprentice market</td>
<td>-0.676***</td>
<td>-0.085***</td>
<td>-0.125**</td>
</tr>
<tr>
<td></td>
<td>[0.023]</td>
<td>[0.025]</td>
<td>[0.060]</td>
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<tr>
<td>Transport smoothness</td>
<td>0.031</td>
<td>0.031*</td>
<td>0.108</td>
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<tr>
<td></td>
<td>[0.019]</td>
<td>[0.019]</td>
<td>[0.040]**</td>
</tr>
<tr>
<td>Migration background</td>
<td>0.063</td>
<td>0.068</td>
<td>0.043</td>
</tr>
<tr>
<td></td>
<td>[0.049]</td>
<td>[0.053]</td>
<td>[0.101]</td>
</tr>
<tr>
<td>Female</td>
<td>-0.067***</td>
<td>-0.08***</td>
<td>0.071</td>
</tr>
<tr>
<td></td>
<td>[0.016]</td>
<td>[0.019]</td>
<td>[0.055]</td>
</tr>
</tbody>
</table>

n: 1556
LogL: -702.47268, -684.25346, -313.59713
Pseudo $R^2$: 0.1131, 0.1053, 0.1959
Controls in all models: firm size, field, year, schooling
### Empirical Results (2)

Results from a probit model, marginal effects, clustering-robust S.E.s

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</thead>
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<tr>
<td>financialincentive</td>
<td>0.281</td>
<td>0.324*</td>
<td>0.074</td>
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<tr>
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<td>[0.195]</td>
<td>[0.382]</td>
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<tr>
<td>msg</td>
<td>0.052</td>
<td>0.057</td>
<td>-0.018</td>
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<tr>
<td></td>
<td>[0.069]</td>
<td>[0.075]</td>
<td>[0.121]</td>
</tr>
<tr>
<td>female</td>
<td>-0.031</td>
<td>-0.038</td>
<td>0.115</td>
</tr>
<tr>
<td></td>
<td>[0.030]</td>
<td>[0.034]</td>
<td>[0.085]</td>
</tr>
<tr>
<td>boygirlsjob</td>
<td>-0.007</td>
<td>-0.016</td>
<td>0.055</td>
</tr>
<tr>
<td></td>
<td>[0.033]</td>
<td>[0.036]</td>
<td>[0.063]</td>
</tr>
<tr>
<td>girlboysjob</td>
<td>0.077*</td>
<td>0.088*</td>
<td>-0.016</td>
</tr>
<tr>
<td></td>
<td>[0.045]</td>
<td>[0.047]</td>
<td>[0.086]</td>
</tr>
<tr>
<td>badprospects</td>
<td>-0.026</td>
<td>-0.039</td>
<td>-0.247</td>
</tr>
<tr>
<td></td>
<td>[0.065]</td>
<td>[0.072]</td>
<td>[0.180]</td>
</tr>
<tr>
<td>badincomeprospects</td>
<td>0.113*</td>
<td>0.109*</td>
<td></td>
</tr>
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<td></td>
<td>[0.061]</td>
<td>[0.065]</td>
<td></td>
</tr>
<tr>
<td>badcareerpros</td>
<td>-0.059</td>
<td>-0.05</td>
<td>0.360**</td>
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<tr>
<td></td>
<td>[0.074]</td>
<td>[0.090]</td>
<td>[0.145]</td>
</tr>
<tr>
<td>examnerves</td>
<td>0.105</td>
<td>0.107</td>
<td>0.412***</td>
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<tr>
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<td>[0.092]</td>
<td>[0.089]</td>
<td>[0.072]</td>
</tr>
<tr>
<td>findstress</td>
<td>0.266***</td>
<td>0.280***</td>
<td>0.341***</td>
</tr>
<tr>
<td></td>
<td>[0.075]</td>
<td>[0.078]</td>
<td>[0.038]</td>
</tr>
<tr>
<td>percbeh2</td>
<td>-0.428***</td>
<td>-0.476***</td>
<td>0.122</td>
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<tr>
<td></td>
<td>[0.163]</td>
<td>[0.164]</td>
<td>[0.457]</td>
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<tr>
<td>labmarket2001</td>
<td>0.01</td>
<td>0.014</td>
<td>-0.207***</td>
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<td></td>
<td>[0.029]</td>
<td>[0.030]</td>
<td>[0.073]</td>
</tr>
<tr>
<td>supdem2001</td>
<td>-0.130***</td>
<td>-0.140***</td>
<td>-0.282***</td>
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<tr>
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<td>[0.030]</td>
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<td>accpop</td>
<td>0.019</td>
<td>0.02</td>
<td>0.188***</td>
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<td>[0.024]</td>
<td>[0.060]</td>
</tr>
<tr>
<td>unempl01</td>
<td>2.002***</td>
<td>2.241***</td>
<td>0.56</td>
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<tr>
<td></td>
<td>[0.508]</td>
<td>[0.582]</td>
<td>[1.633]</td>
</tr>
</tbody>
</table>

| n        | 876        | 809        | 343        |
| LogL     | -401.69866 | -393.66299 | -189.47774 |
| Pseudo $R^2$ | 0.1263   | 0.1166   | 0.2013    |
Sensitivity Analysis

• Estimate a multinomial model for the different paths and use (again) the bankruptcy victims as a control group
• Results do not change
• Still To Do: take time into account
Summary

• Analysis using human capital theory with a spatial component
• Evidence for importance of short-term (non-monetary) cost of an apprenticeship and local labor market situation
• Decision to drop out: from an individual’s point of view rational in a short-term perspective (but probably not in the long run)
• Tentative Policy Implications
  • Regional level: mobility
  • Individual level: case management
Thank you for your attention