Work-Related Ability as Source of Information Advantages of Training Employers

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Motivation

- Investment in transferable skills generates information advantage about employee ability or training content (Katz and Ziderman 1990, Chang and Wang 1995, Acemoglu and Pischke 1998)
- Information advantage drives wedge between able employees’ wage and their outside wage offers
  → Return for training investments
  → The most productive trainees can be retained – they are “locked-in”
Motivation

• Many examples of employer-sponsored general training: MBA courses, language and IT courses, apprenticeship training

• Most of these training courses end with a certificate

• Especially marked certificates issued by an external institution allow outside firms to infer training participants´ abilities (Arcidiacono et al. 2010)
Open empirical questions

• What is the source of information advantage given training contents are public knowledge and training achievements are documented by certificates?

• Do training firms have the discretion power to select most able employees?
Empirical approach

- Distinguish between cognitive and work-related ability as sources of employee productivity
- Use German apprenticeship system as framework of certified and transparent general training
- Compare relative ability of apprenticeship graduates in comparison to homogeneous peer group
Contribution

• Derive hypotheses on two-period model with two ability dimensions that nests symmetric and asymmetric employer learning (Schönberg 2007)

• Develop two new signals on ability in addition to established measures AFQT, schooling, library card (Kahn 2014):
  – mark in final occupation certificate (public) signal on cognitive ability
  – bonus voluntarily paid by training firm (private) signal on work-related ability

• Show that ability dimensions are orthogonal
Model

- First period: training firm learns about two ability dimensions
- Second period: skilled employee decides whether to stay at training firm or move to another employer
- Trained employee stays if inside higher than outside wage offer plus disutility shock incurred during training
- Disutility shock not observable for employers
Model

- Outside firms offer wages depending on observable ability, a-priori distribution of unobservable ability, and selectivity.
- Unobservable ability is indicated by noisy signal.
- Training firm makes counteroffer if outside wage is lower than productivity.
- Competition reduces profits to zero.
- The lower the risk that able apprentices leave training firm the higher the wedge between inside wage and productivity.
Hypotheses

• Symmetric employer learning
  → Entry wage determinants are equal for movers and stayers
  → No adverse selection of movers based on ability measures

• Asymmetric employer learning
  → Adverse selection of movers
  → The public signal (cognitive skills) stronger influences entry earnings for movers than for stayers
  → The private information (work-related skills) influences entry earnings for stayers only
Institution

German dual apprenticeship training system

- Defines transferable and visible skills
- Investments by training firms
- Externally monitored and marked final certificates from the chambers of commerce and craft
- Apprentices perform similar tasks
- Within one region and occupation: apprentices graduate at the same day, after the final exam
- Apprenticeship graduates can leave at no cost
Two types of information on apprenticeship graduates’ ability

Cognitive ability:

– final examination marks from external institutions with no economic interest (chambers properly assess ability as public administration duty)
– marks known to all labour market actors
– training contents tailor-made for occupational demands
– differences between marks given occupation and employer is indicator of cognitive ability
Two types of information

Work-related ability:

– captures work-related ability
– earnings bonus at the end of apprenticeship
– bonus is difference from minimum wage paid to apprentice in employer, occupation and year cell
– voluntarily paid by employer
– mainly paid during last months of apprenticeship period
Bonus determined from earnings variation within an establishment/occupation/graduation year cell.

Establishment/occupation/graduation year cell with at least five apprentices over the entire training period. Regular apprenticeships only, wage between 50% and 200% of occupational mean LIAB longitudinal version 2.0 1999-2006.
Two types of information

– bonus known to recipients because collective bargaining apprentice earnings acts as focal wage or bonus is made transparent
– bonus not known to outside firms because complete wage structure not revealed (Waldman, 1987) and bonus small in absolute terms (about 20€ per month on average)
– no need for strategic use of bonus in contrast to observable indicators of work-related ability (e.g. promotions)
– reasons for voluntary bonus: gift exchange, retention signal, motivation device
Data

• Saarland Panel: SIAB (social security records) of apprenticeship graduates between 1999 and 2005 in the federal state of Saarland linked to administrative records of chambers of crafts and industry and commerce

• Entire population of apprenticeship graduates

• Information from chambers: marks in final certificate, training occupation, school leaving qualification, regular graduate (graduation repeaters)
Data

- SIAB longitudinal data:
  Individual level: age, nationality, start and apprenticeship graduation day, earnings
  Employer level: number of employees and apprentices, earnings level, sector
- All spells start on 1 January or when status changes
- All spells are on day basis and linked to firm identifier and employment/unemployment status
- Earnings: 50% – 200% of occupational mean only
- Training termination close to chamber information on exam dates only
Cell definition

At least two apprentices within an establishment/ occupation/ graduation year
  - No missings
  - Graduates who immediately move (< 30 days) to another employer and who stay

Key variables:
  - Log earnings deviation from cell minimum = earnings bonus
  - Average mark in final exam (multiplied by -1, between -5 and -1)
  - Log earnings in first full-time employment spell after graduation
Descriptive statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mover</th>
<th>Stayer</th>
<th>t-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marks (work-related ability)</td>
<td>-3.01</td>
<td>-2.82</td>
<td>5.92</td>
</tr>
<tr>
<td>Log earnings bonus during training (cognitive ability)</td>
<td>0.500</td>
<td>0.638</td>
<td>4.25</td>
</tr>
<tr>
<td>Log earnings at first full-time employment</td>
<td>3.942</td>
<td>4.109</td>
<td>7.91</td>
</tr>
</tbody>
</table>
# Probability to move

<table>
<thead>
<tr>
<th></th>
<th>Cells with movers only</th>
<th>all</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earnings bonus</td>
<td>-0.084*** (5.34)</td>
<td>-0.142*** (5.20)</td>
</tr>
<tr>
<td>(work-related ability)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marks</td>
<td>-0.053*** (3.21)</td>
<td>-0.098*** (3.12)</td>
</tr>
<tr>
<td>(cognitive ability)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controls</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Cell Fixed Effects</td>
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<td>Yes</td>
</tr>
<tr>
<td>Pseudo R square</td>
<td>0.11</td>
<td>0.26</td>
</tr>
<tr>
<td>Observations</td>
<td>2320</td>
<td>2320</td>
</tr>
</tbody>
</table>

Dependent variable: dummy, mover (1) and stayer (0); Probit regression; non-displayed variables: gender, school certificate (Abi, Realschule, unknown), age, nationality, number of employees, average apprenticeship earnings, year-occupation and sector dummies; standard errors clustered on establishment-level, *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$; Source: Saarlandpanel 1997-2005.
Determinants of first full-time skilled employment log earnings

<table>
<thead>
<tr>
<th></th>
<th>Stayers</th>
<th>Movers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log earnings bonus</td>
<td>0.027***</td>
<td>0.011*</td>
</tr>
<tr>
<td>(work-related ability)</td>
<td>(4.84)</td>
<td>(2.12)</td>
</tr>
<tr>
<td>Marks</td>
<td>0.025***</td>
<td>0.019***</td>
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<tr>
<td>(cognitive ability)</td>
<td>(4.66)</td>
<td>(3.52)</td>
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<tr>
<td>Controls</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
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<td>3384</td>
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<tr>
<td>R-sq</td>
<td>0.60</td>
<td>0.65</td>
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</tbody>
</table>

Dependent variable: log earnings; OLS regression; non-displayed variables: gender, school certificate (Abi, Realschule, unknown), age, nationality, number of employees, average apprenticeship earnings, year- occupation and sector dummies; standard errors clustered on establishment-level, *** p < 0.01; ** p < 0.05; * p < 0.1; Source: Saarpanel 1997-2005.
Main Findings

• Moving apprenticeship graduates receive a lower bonus at the end of training and worse marks at final apprenticeship examination than stayers

→ adverse selection of moving apprenticeship graduates with respect to cognitive and work-related ability
Main Findings

• Cognitive ability (marks at final examination) is public signal and has a stronger impact on entry earnings of movers than of stayers

• Same pattern for alternative signal on cognitive ability, schooling level (not reported)

• Work-related ability (bonus payment by training firm) is private information and has only impact on entry wages of stayers but not for movers
Determinants of log earnings – separate control for earnings bonus and mark

<table>
<thead>
<tr>
<th></th>
<th>Stayers</th>
<th>Movers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log earnings bonus</td>
<td>0.011* (2.12)</td>
<td>0.008 (0.82)</td>
</tr>
<tr>
<td>(work-related ability)</td>
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<tr>
<td>Marks</td>
<td>0.019*** (3.53)</td>
<td>0.043*** (3.93)</td>
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<td>(cognitive ability)</td>
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<tr>
<td>Controls</td>
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<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>3384</td>
<td>3384</td>
</tr>
<tr>
<td>R-sq</td>
<td>0.65</td>
<td>0.65</td>
</tr>
</tbody>
</table>

Dependent variable: log earnings; OLS regression; non-displayed variables: gender, school certificate (Abi, Realschule, unknown), age, nationality, number of employees, average apprenticeship earnings, year-occupation and sector dummies; standard errors clustered on establishment-level, *** p < 0.01; ** p < 0.05; * p < 0.1; Source: Saarpanel 1997-2005.
Main Findings

• Earnings bonus and marks are orthogonal
• Impact of ability indicators on earnings does not change if we leave out other determinants (DeVaro and Waldman, 2012)
• Both ability indicators measure different dimensions of productivity
Conclusions

- Training firms have no information advantage about cognitive skills
- They have an information advantage about work-related ability
- The information advantage is a pre-requirement of
  - the possibility to pay able graduates a wage above the market wage but below productivity
  - possibility to invest in transparent and visible training with certificates
Conclusions

- These results are robust if we reduce the sample of apprenticeship movers to those who leave training firms with strong (20%/50%) reductions in retention rate (Von Wachter and Bender 2006)
- Determinants of earnings in second year after apprenticeship graduation are very similar to first year (coefficients of marks even increase)
Thanks for your attention

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Sample selection

- Graduating apprentices: 20,701
- ~ last apprenticeship spell in IEB in the same year as graduation according to chambers: 15,340
- ~ age below 30 and earnings between 50% and 200% of occupational mean: 13,597
- ~ with minimum cell size: 5,813
- ~ and without missings: 7,792
Pairwise correlation to marks

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>Mover</th>
<th>Stayer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earnings bonus during training</td>
<td>0.215</td>
<td>0.191</td>
<td>0.228</td>
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<tr>
<td>Log earnings at first full-time employment</td>
<td>0.134</td>
<td>0.146</td>
<td>0.119</td>
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<tr>
<td>Observations</td>
<td>4097</td>
<td>1642</td>
<td>2455</td>
</tr>
</tbody>
</table>
Determinants of log earnings of employer movers– cells with demand shocks only

<table>
<thead>
<tr>
<th></th>
<th>Retention rate 20% below average</th>
<th>Retention rate 50% below average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log earnings bonus</td>
<td>0.009 (0.12)</td>
<td>0.020 (0.49)</td>
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<tr>
<td>(private information)</td>
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<tr>
<td>Grades</td>
<td>0.112 (1.18)</td>
<td>0.089* (1.74)</td>
</tr>
<tr>
<td>(public information)</td>
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<tr>
<td>Controls</td>
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<td>Observations</td>
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<tr>
<td>R-sq</td>
<td>0.56</td>
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Dependent variable: log earnings; OLS regression; non-displayed variables: gender, school certificate (Abi, Realschule, unknown), age, nationality, number of employees, average apprenticeship earnings, year- occupation and sector dummies; standard errors clustered on establishment-level, *** p < 0.01; ** p < 0.05; * p < 0.1; Source: Saarpanel 1997-2005.
### Determinants of log earnings - second year

<table>
<thead>
<tr>
<th></th>
<th>Stayers</th>
<th>Movers</th>
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</thead>
<tbody>
<tr>
<td>Log earnings bonus</td>
<td>0.009 (0.12)</td>
<td>0.007 (0.68)</td>
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<tr>
<td>(private information)</td>
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</tr>
<tr>
<td>Grades</td>
<td>0.021*** (2.73)</td>
<td>0.061*** (5.59)</td>
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<tr>
<td>(public information)</td>
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<tr>
<td>Controls</td>
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<td>Yes</td>
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<tr>
<td>Observations</td>
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<td>1916</td>
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<tr>
<td>R-sq</td>
<td>0.52</td>
<td>0.38</td>
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</table>

Dependent variable: log earnings; OLS regression; non-displayed variables: gender, school certificate (Abi, Realschule, unknown), age, nationality, number of employees, average apprenticeship earnings, year- occupation and sector dummies; standard errors clustered on establishment-level, ** p < 0.01; * p < 0.1; Source: Saarpanel 1997-2005.