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**Patience Is Not The Only Virtue: The Relationship Between Time Preferences, Class Attendance And Final Marks**

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Patience is \textbf{not} the only virtue: The relationship between time preference, class attendance and final marks

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Paper presented to HERSLEB, University of Melbourne, December 2012

**Earlier study**

- “Patience is a virtue” but not for first year economics students  
  - Final marks increased with discount rate (impatience)  
  - Paper presented at Australasian Teaching Economics Conference in July 2012  
  - Delegates querying generalisability of results for this and other papers that evaluated T&L interventions

- So what about selectivity bias?  
  - Can we identify it?  
  - Can we correct for it?

**Yes 😊**

- We had population data  
  - We had survey respondent data  
  - We also had non-respondent data

**Data collection**

**Population**  
- Semester one and two 2011  
- Economics 1 students  
- Two metropolitan campuses  
- \(N = 420\)  
- Revised \(N = 412\) (8 students enrolled in both semesters – only first semester enrolment included)

**Sample (n = 163)**  
- In class surveys  
  - 191 completed surveys (46.4%)  
  - 163 surveys with discount rates (39.6%)
Characteristics from student admin data

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>1 = Male</td>
</tr>
<tr>
<td>Outer metropolitan campus</td>
<td>1 = Joondalup</td>
</tr>
<tr>
<td>Degree</td>
<td>1 = Bachelor of Business</td>
</tr>
<tr>
<td>Type of enrolment</td>
<td>1 = Full-time</td>
</tr>
<tr>
<td>Type of student</td>
<td>1 = International</td>
</tr>
<tr>
<td>Finance</td>
<td>1 = Enrolled in or already completed first year Finance unit</td>
</tr>
<tr>
<td>Parents’ education level</td>
<td>1 = University</td>
</tr>
</tbody>
</table>

Characteristics from survey

<table>
<thead>
<tr>
<th>Characteristics from survey</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discount Rate</td>
<td>The annual discount rate implied by the decision to switch (upper bound)</td>
</tr>
<tr>
<td>Parents’ education level</td>
<td>1 = University</td>
</tr>
</tbody>
</table>

Characteristics from tutor records

<table>
<thead>
<tr>
<th>Characteristics from tutor records</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tutorial Attendance</td>
<td>Number of Economics tutorials attended (out of 13) during the semester</td>
</tr>
</tbody>
</table>

Survey

The survey included twenty choice statements:

1. Paid one month from now: $54 □ Paid 7 months from now: $54.36 □
2. Paid one month from now: $54 □ Paid 7 months from now: $56.04 □
3. Paid one month from now: $54 □ Paid 7 months from now: $58.20 □
4. Paid one month from now: $54 □ Paid 7 months from now: $60.24 □
5. Paid one month from now: $54 □ Paid 7 months from now: $62.50 □
6. Paid one month from now: $54 □ Paid 7 months from now: $64.80 □
7. Paid one month from now: $54 □ Paid 7 months from now: $67.08 □
8. Paid one month from now: $54 □ Paid 7 months from now: $69.48 □
9. Paid one month from now: $54 □ Paid 7 months from now: $71.96 □
10. Paid one month from now: $54 □ Paid 7 months from now: $74.44 □
11. Paid one month from now: $54 □ Paid 7 months from now: $76.92 □
12. Paid one month from now: $54 □ Paid 7 months from now: $79.40 □
13. Paid one month from now: $54 □ Paid 7 months from now: $81.88 □
14. Paid one month from now: $54 □ Paid 7 months from now: $84.36 □
15. Paid one month from now: $54 □ Paid 7 months from now: $86.84 □
16. Paid one month from now: $54 □ Paid 7 months from now: $89.32 □
17. Paid one month from now: $54 □ Paid 7 months from now: $91.80 □
18. Paid one month from now: $54 □ Paid 7 months from now: $94.28 □
19. Paid one month from now: $54 □ Paid 7 months from now: $96.76 □
20. Paid one month from now: $54 □ Paid 7 months from now: $99.24 □

Comparison of students who completed the survey (n = 191) with those who didn’t (n = 221)

Students who completed the survey:
- Were slightly older
  - (F = 8.85; p = 0.0031)
- Had higher final mark (55% cf 37%)
  - (F = 60.40; p = 0.000),
- Had higher course average (60% cf 48%)
  - (F = 42.39; p = 0.000),
- Attended more tutorials (on average 10 cf 6)
  - (F = 140.75; p = 0.000)
- Had parents with less education (43% cf 59%)
  - (chi sq = 8.3518; p = 0.004).
Comparison of consistent surveys (n = 163) with inconsistent surveys (n = 28)

Students who completed consistent surveys:
- Had higher final marks (58% cf 42%) – $(F = 18.49; p = 0.000)$
- Had a higher course average (68% cf 48%) – $(F = 24.00; p = 0.000)$
- Lived at an address with a higher socio-economic index (IRISAD) score – $(F = 5.85; p = 0.017)$
- Were more likely to be studying part-time – (chi sq = 3.0927; p = 0.079)
- Were more likely to be domestic students – (chi sq = 8.3288; p = 0.004).

Factors affecting final marks before correcting for selectivity bias

Final marks
- Increase with
  - Discount rate (b = 39.8244)
  - Tutorial attendance (b = 5.4560)
- Decrease with
  - Discount rate x tutorial attendance (b = -3.3876), that is, the positive effect of tutorial attendance on final marks is more than offset by the negative effect of high discount rates

Correcting for selectivity bias

- Omitted variable problem - omitted variable can be proxied by inverse Mills ratio (Heckman 1979)
- The ‘two steps’ but taken together
  - Run the selection (into the sample) equation using probit with all observations to produce the constructed values of the inverse Mills ratio, $\lambda$
  - Run the outcome equation using ordinary least squares where the RHS variables include the constructed values of the inverse Mills ratio, $\lambda$, with the sample observations only
  - $\lambda$ represents the correlation between the unobservables in the selection and outcome equations

Factors affecting selection

Probit model
- n = 381; pseduo $R^2 = 0.1263$; LL = -215.8726
- Age – older students are more likely to submit consistent surveys (b = 0.0319)
- Weighted course average – better (more able) students are more likely to submit consistent surveys (b = 0.0293)

Factors affecting final marks after correction for selectivity bias (substantive model)

OLS model
- n = 381; Wald chi$^2 = 21.67$; LL = -741.7663
- lambda = -18.3601, that is unobserved characteristics that result in some students being less likely to be surveyed also contribute to some students having higher final marks

Final marks
- Increase with
  - Discount rate (b = 25.3955)
  - Tutorial attendance (b = 3.2693)
- Decrease with
  - Discount rate x tutorial attendance (b = -2.1443), that is, the positive effect of tutorial attendance on final marks is more than offset by the negative effect of high discount rates

Much ado about nothing?

<table>
<thead>
<tr>
<th></th>
<th>OLS without correction for selectivity bias</th>
<th>OLS with correction for selectivity bias</th>
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<tr>
<td>Comparison</td>
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<td>Interactive term</td>
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<td>$b = -2.1443$</td>
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Take home message

• Interventions can be evaluated with survey data
• But .. ensure there is a hold-out / control group
• Check for selection bias
  – May change which are the important variables and their sign
  – May change their magnitude
  – May not change anything much