Cream skimming, hospital transfers and capacity pressure

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Cream-skimming: Selecting profitable patients, transfer non-profitable patients to others.

Q: Do private hospitals cream-skim?

Common complaints about private hospitals:
- Selectively admit patients.
- Transfer complex cases to public hospitals.
- Divert low-cost patients from public to private hospitals.
Introduction

Cream-skimming: Selecting profitable patients, transfer non-profitable patients to others.

Q: Do private hospitals cream-skim?

Common complaints about private hospitals:

- Selectively admit patients.
- Transfer complex cases to public hospitals.
- Divert low-cost patients from public to private hospitals.
Background

- Australia has a mixed public-private health care system.
- Doctors are allowed to practice in both public and private sectors (dual practice).
- **Dual practice doctors** have incentives to divert easy to treat patients from public hospitals to private practice (Barros and Olivella 2005; Biglaiser and Ma 2007)—cherry picking.
- Private hospitals can charge any prices.
- Public hospitals also provide private patient care.
- Private patient treatments funded by: (i) private hospital insurance, (ii) Medicare, (iii) OOP.
Medibank will not pay for the cost of being readmitted with an unexpected or preventable condition within 28 days of discharge.

“...the deals may prompt private hospitals to **cherry pick** healthier patients and procedures that result in fewer complications so they do not face additional costs...” (AMA VP)
Hospital transfers: Patients transferred from one hospital to another during single episode of care.

Australia’s mixed private-public system allows opportunities for selecting patients.

$H_0$: transfers not related to profit or cost.

$H_1$: transfers to max. profit or min. cost (cream skimming).

Administrative data on hospital admission episodes in Victoria.

**BIG** data theme: 24m admitted patient records, 32GB data file.
Why focus on transfers?

- Although small as proportion of all admissions, transfer patterns should reflect cream skimming if it is practiced by hospitals.
- Other notions of cream skimming:
  - Over servicing to extract revenue (Ellis 1998, JHE).
  - Under servicing / withholding care to high-cost patients (Levaggi 2002).
Why focus on capacity?

- Previous work (Cheng et al 2015) found $\text{Prob}(\text{PRV-PUB})$ increases with patient severity, but $\text{Prob}(\text{PUB-PRV})$ is the opposite.
- Identification issue: Findings consistent with cream skimming, but also consistent with appropriate clinical practice.
- Capacity pressure is related to costs but unrelated to clinical practice.
- Hospital max. profits by providing standardised care (to easy to treat patients), rather than non-standardised care (to difficult to treat patients).
- When facing capacity pressure, profit max hospitals have incentives to provide more standardised care and less non-standardised care.
Why do we care?

- Broader context: Role of private sector in financing and provision of health care.
- Implications on “efficiency” and “quality” of private vs public hospitals (Barros and Siciliani 2012; Barbetta et al. 2007; Herr 2008; Marini et al. 2008)
- Policy questions:
  - Should we subsidize private health insurance?
  - How much should Medicare pay for private treatments?
  - Should we restrict dual practice?
Methods

- Two-level approach:
  - **L1** Whether to transfer.
  - **L2** Destination (private or public), given transfer.

- **L1 questions**
  1. Are ‘difficult’ patients more likely to be transferred?
  2. Do ‘difficult’ patients tend to get transferred when the hospitals are ‘busy’?

- **L2 questions**: Conditional on transfer, are there differences between PRV-PUB vs PUB-PRV transfers?
Transfers are identified using separation codes in data.

Measure ‘easy’ or ‘difficult’ to treat patients using:

1. Charlson comorbidity index;
2. DRG classes—4th digit of DRG code: A, B, C or Z.

Capacity is not observed in data. Hence can’t observe if hospitals are capacity constrained.

Approx. capacity as max. weekly count of patients that could be accommodated.
Let $Y_h^*$ denote real capacity (unobserved).

Assume max. utilisation is $Y_h = \delta Y_h^*$, $\delta \in (0, 1]$.

To compute $Y_h$, first compute weekly utilisation ($U_{ht}$) as ‘stock’ of patients for week $t$: number of patients admitted prior to the week and remain in the hospital (i.e., not discharged) at the end of the week, and patients admitted during the week (whether discharged during the week or not).

$Y_h$ is max. weekly number of patients a hospital has ever accommodated in a given year, $Y_t = \max\{U_{h,1}, \ldots, U_{h,52}\}$.

Capacity utilisation rate at week $t$: $R_{ht} = U_{ht} / Y_h$. Note: $R_{ht} \in (0, 1]$.

We say hospital $h$ is facing capacity pressure if $R_{ht} \geq R^*$, $0 < R^* < 1$. 

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Hospital administrative data from Victorian Admitted Episodes Dataset 2000/01–2011/12, ∼ 24m records.

Exclude:
1. same-day episodes.
2. episodes in DRGs (3-digit) with fewer than 5,000 admissions during data period.
3. patients who died during data period.
4. age < 18 and age > 100 years.
5. patients from rural areas.
6. episodes involving 4 or more transfers.

Estimating sample: ∼ 4.9m obs., transfers ∼ 5%.

Note: Both public and private hospitals provide care to all DRGs in sample.

Note capacity measure is constructed using all data.
Sample divided into two subsets:

1. Patients first admitted as private (initial private admissions).
2. Patients first admitted as public (initial public admissions).

Key variables: patient severity/complexity & capacity pressure.

Capacity pressure (CAPP): $R_{ht}$ normal, high, very high.

- For public hospitals: $[0 \rightarrow 0.88 \rightarrow 0.93 \rightarrow 1]$.
- For private hospitals: $[0 \rightarrow 0.80 \rightarrow 0.90 \rightarrow 1]$.

‘High’ and ‘Very High’ correspond to 70th and 85th percentiles of utilisation rate for each hospital type.
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L1: Prob of transfer

- Patient severity/complexity is measured by Charlson index and DRG classes.
- Charlson index (CH): CH0 (0); CH1 (1,2); CH2 (3+).
- DRG Class: CL0 (C, Z); CLA (A); CLB (B).
- Estimating equation

\[
E(TR | X) = G(\beta_s CH + \beta_c CAPP + \beta_{sc} CH \times CAPP + X\beta).
\]

- \( G \): linear FE or Logit.
- Marginal effects of interest:

\[
\frac{\Delta G}{\Delta CH}, \frac{\Delta G}{\Delta CAPP}, \frac{\Delta^2 G}{\Delta CH \Delta CAPP}.
\]

- Hypothesis tests: Do changes in capacity pressure affect the prob of transfer of severe/complex patients?

\[
H_0 : \frac{\Delta^2 G}{\Delta CH \Delta CAPP}_{|CH2, CAPP_{k+1}} = \frac{\Delta^2 G}{\Delta CH \Delta CAPP}_{|CH2, CAPP_k}
\]
L1: Probit of transfer

- Patient severity/complexity is measured by Charlson index and DRG classes.
- Charlson index (CH): CH0 (0); CH1 (1,2); CH2 (3+).
- DRG Class: CL0 (C, Z); CLA (A); CLB (B).
- Estimating equation

\[ E(TR | X) = G(\beta_s CH + \beta_c CAPP + \beta_{sc} CH \times CAPP + X\beta). \]

\( G \): linear FE or Logit.

- Marginal effects of interest:
  \[ \frac{\Delta G}{\Delta CH}, \frac{\Delta G}{\Delta CAPP}, \frac{\Delta^2 G}{\Delta CH \Delta CAPP}. \]

- Hypothesis tests: Do changes in capacity pressure affect the prob of transfer of severe/complex patients?

\[ H_0 : \frac{\Delta^2 G}{\Delta CH \Delta CAPP|_{CH2, CAPP_{k+1}}} = \frac{\Delta^2 G}{\Delta CH \Delta CAPP|_{CH2, CAPP_k}} \]

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L2: Transfer destination (public or private) given transfer

- Is transfer destination affected by
  1. patient severity/complexity?
  2. capacity pressure?

- Estimating equation

\[
E(D \mid TR = 1, X) = F(\beta_s CH + \beta_c CAPP + \beta_{sc} CH \times CAPP + X \beta).
\]

D = PRV or PUB

- Cream skimming, if present, would be reflected in transfer destination of severe/complex patients.

- Cream skimming is not expected to affect destination choice whether hospitals face capacity pressure.
## Results

### Marginal effects, Prob(Transfer | X)

<table>
<thead>
<tr>
<th>Dep = Transfer (0, 1)</th>
<th>Init PRV Adm</th>
<th>Init PUB Adm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FEs</td>
<td>logit</td>
</tr>
<tr>
<td><strong>Charlson index (Ref= CH0)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH1 (Charlson = 1, 2)</td>
<td>0.0092**</td>
<td>0.0079**</td>
</tr>
<tr>
<td></td>
<td>0.0005</td>
<td>0.0004</td>
</tr>
<tr>
<td>CH2 (Charlson = 3+)</td>
<td>0.0262**</td>
<td>0.0178**</td>
</tr>
<tr>
<td></td>
<td>0.0007</td>
<td>0.0007</td>
</tr>
<tr>
<td><strong>CAP Pressure (Ref= Normal)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>0.0002</td>
<td>0.0020**</td>
</tr>
<tr>
<td></td>
<td>0.0003</td>
<td>0.0003</td>
</tr>
<tr>
<td>Very High</td>
<td>0.0005</td>
<td>0.0047**</td>
</tr>
<tr>
<td></td>
<td>0.0004</td>
<td>0.0003</td>
</tr>
<tr>
<td><strong>Interaction: Charlson × CAP Pressure</strong></td>
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<td></td>
</tr>
<tr>
<td>CH1 × high</td>
<td>0.0029**</td>
<td>0.0008</td>
</tr>
<tr>
<td></td>
<td>0.0009</td>
<td>0.0008</td>
</tr>
<tr>
<td>CH1 × very high</td>
<td>0.0038**</td>
<td>0.0007</td>
</tr>
<tr>
<td></td>
<td>0.0009</td>
<td>0.0008</td>
</tr>
<tr>
<td>CH2 × high</td>
<td>0.0034*</td>
<td>0.0007</td>
</tr>
<tr>
<td></td>
<td>0.0016</td>
<td>0.0015</td>
</tr>
<tr>
<td>CH2 × very high</td>
<td>0.0114***</td>
<td>0.0037*</td>
</tr>
<tr>
<td></td>
<td>0.0016</td>
<td>0.0015</td>
</tr>
</tbody>
</table>

| N                     | 1.94m | 2.93m |

Significance levels: †: 10%, *: 5%, **: 1%
Hypothesis testing

\( H_0: \text{Prob}(\text{TR} | \text{CAPP} v \text{high}@ \text{CH}, X) - \text{Prob}(\text{TR} | \text{CAPP} \text{high}@ \text{CH}, X) = 0 \)

<table>
<thead>
<tr>
<th>Capacity Pressure</th>
<th>Init PRV Adm</th>
<th>Init PUB Adm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FEs</td>
<td>logit</td>
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<tr>
<td></td>
<td>p-val</td>
<td>p-val</td>
</tr>
<tr>
<td>vh-high vs high@ CH0</td>
<td>0.0000 0.909</td>
<td>0.0026 0.000</td>
</tr>
<tr>
<td></td>
<td>0.0003 0.0003</td>
<td>0.0004 0.0004</td>
</tr>
<tr>
<td>vh-high vs high@ CH1</td>
<td>0.0009 0.267</td>
<td>0.0025 0.000</td>
</tr>
<tr>
<td></td>
<td>0.0008 0.0007</td>
<td>0.0008 0.0007</td>
</tr>
<tr>
<td>vh-high vs high@ CH2</td>
<td>0.0079 0.000</td>
<td>0.0056 0.000</td>
</tr>
<tr>
<td></td>
<td>0.0014 0.0013</td>
<td>0.0014 0.0011</td>
</tr>
</tbody>
</table>

\[ (b_{vh} - b_h)/se \]
**Marginal effects, Prob (D | transfer)**

**Dep = Transfer dest. (1= cross type)**

<table>
<thead>
<tr>
<th></th>
<th>Pr(PRV-PUB</th>
<th>Init PRV)</th>
<th>Fe</th>
<th>logit</th>
<th>Pr(PUB-PRV</th>
<th>Init PUB)</th>
<th>Fe</th>
<th>logit</th>
</tr>
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<tr>
<td><strong>Charlson index (Ref= CH0)</strong></td>
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<tr>
<td>CH1 (Charlson = 1, 2)</td>
<td>0.0121**</td>
<td>0.0175**</td>
<td>0.0031</td>
<td>0.0040</td>
<td>0.0027</td>
<td>0.0101</td>
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<tr>
<td>CH2 (Charlson = 3+)</td>
<td>0.0237**</td>
<td>0.0298**</td>
<td>0.0045</td>
<td>0.0046</td>
<td>0.0037</td>
<td>0.0171</td>
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</tr>
<tr>
<td><strong>CAP Pressure (Ref= Normal)</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>-0.0088**</td>
<td>-0.0077†</td>
<td>0.0028</td>
<td>0.0039</td>
<td>0.0024</td>
<td>0.0146</td>
<td></td>
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</tr>
<tr>
<td>Very high</td>
<td>-0.0115**</td>
<td>-0.0026</td>
<td>0.0030</td>
<td>0.0052</td>
<td>0.0023</td>
<td>0.0155</td>
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<tr>
<td>Interaction: Charlson×CAP Press</td>
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<td></td>
</tr>
<tr>
<td>CH1×High</td>
<td>-0.0111†</td>
<td>-0.0144*</td>
<td>0.0067</td>
<td>0.0066</td>
<td>0.0054</td>
<td>0.0091</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH1×Very high</td>
<td>-0.0135*</td>
<td>-0.0113</td>
<td>0.0066</td>
<td>0.0081</td>
<td>0.0050</td>
<td>0.0105</td>
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<tr>
<td>CH2×High</td>
<td>-0.0089</td>
<td>-0.0085</td>
<td>0.0099</td>
<td>0.0126</td>
<td>0.0083</td>
<td>0.0120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH2×Very high</td>
<td>0.0005</td>
<td>0.0066</td>
<td>0.0096</td>
<td>0.0139</td>
<td>0.0077</td>
<td>0.0150</td>
<td></td>
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</tr>
<tr>
<td>N</td>
<td>61,356</td>
<td>61,294</td>
<td>187,826</td>
<td>187,468</td>
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</tbody>
</table>

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Discussion

- We investigate cream skimming by examining hospital transfers.
- We analyze hospital transfers in two levels:
  - **L1** Whether to transfer;
  - **L2** Transfer destination (public or private), given transfer.
- Main findings:
  1. Prob transfer of severe/complex patients increases when hospitals face capacity pressure, and the increase is much stronger for private than public hospitals.
- Further work: nested logit estimation, robustness checks.