Devil in the Details
How urgency and costs influence the effects of cost-sharing on healthcare service consumption patterns

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Michael Berger¹, Eva Six², Thomas Czypionka³,⁴

1) Department of Health Economics – Centre for Public Health, Medical University of Vienna
2) Research Institute Economics of Inequality, Vienna University of Economics and Business
3) Institute for Advanced Studies, Vienna
4) London School of Economics and Political Science, Houghton Street, London, WC2A 2AE, UK
Motivation

Cost-sharing schemes are a **common pillar** in the financing of numerous healthcare systems

- Influence and steer **patient behaviour** by internalizing part of costs
- Instrument to generate **revenue**

→ **Dual role** in healthcare policy

**Imperative** for policy makers to have a thorough understanding of the mechanisms behind the effects of cost-sharing

- Knowledge healthcare service-specific price elasticity is crucial for **policy makers** in connection with the dual role of cost-sharing
- Possibility to steer **patient behaviour** along the **best-practice path**
Background

Effects of cost-sharing (desired or undesired) well-documented and extensively discussed in the literature (cf. Kiil & Houlberg, 2014)

• Previous studies often take a macro-perspective (e.g. Schreyögg & Grabka, 2010; Jakobsson & Svensson, 2016) or target specific healthcare sectors (Ellis et al., 2017)

Few studies differentiate between specific healthcare services

• Duarte (2012) is the work related the closest to our study (to the best of our knowledge)
• Empirical investigation of price elasticities in the Chilean private insurance market
• Main findings
  • Consumers’ price elasticities vary by healthcare service
  • Consumers are more sensitive in their demand for elective procedures than for acute care
Our study in a nutshell

Analysis of the demand reaction of **11 different healthcare services** to a reduction in the co-insurance rate from 20% to 10% at beginning of Q2-2016 in Austria

- Near universal healthcare coverage
- Publicly-financed social health insurance (SHI) system with **multiple sickness funds**
- Quasi-experimental study design

We add to the literature by

- **Formulating an intuitive framework** to derive hypotheses that can be empirically tested and that may also aid policy makers in predicting policy effects
- Backed by previous empirical findings (e.g. Duarte, 2012)
- **Empirically test** the direct impact of changes to a cost-sharing regime by estimating the price elasticity of a variety of healthcare services
Data

We utilize a longitudinal pseudonymised patient-level dataset

- **Routine data on outpatient healthcare service consumption**
- **Dataset covers all insurees from three sickness funds**
- **Covered period: Q2-2015 to Q2-2017**
- **1,035,177 patients with 2,370,463 healthcare service contacts**

Outpatient service catalogues differ between sickness funds

- **11 comparable healthcare services analysed in our study**

Patient-level data on sex, age and healthcare service consumption (burden of disease) + district socio-economic status composite measure as additional controls
Methods
Healthcare service classification

Classification of services along **two** dimensions

- **Urgency**
- **Cost**

We expect to see the strongest reaction to price changes in healthcare services that are **deferrable and comparatively expensive**

<table>
<thead>
<tr>
<th></th>
<th>Deferrable</th>
<th>Mix</th>
<th>Urgent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High Cost</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Routine EEG</td>
<td></td>
<td>Electromyography</td>
<td>Sonography of the thyroid and parathyroid gland</td>
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<tr>
<td>Routine ECG</td>
<td></td>
<td>Sonography of the intracranial vessels</td>
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<td></td>
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<td>Blood gas analysis</td>
<td></td>
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<tr>
<td><strong>Low Cost</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incident-light microscopy</td>
<td></td>
<td></td>
<td>Nystagmus inspection</td>
</tr>
<tr>
<td>Uroflowmetry</td>
<td></td>
<td></td>
<td>Removal of foreign bodies from the cornea, sclera or conjunctiva</td>
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<tr>
<td>Cerumen removal</td>
<td></td>
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</tr>
</tbody>
</table>

Table: Classification matrix of the 11 healthcare services in the outpatient sector according to cost and urgency
Methods
Combining Matching and Difference-in-difference

Two-stage estimation procedure (see Everding & Marcus, 2020)

(I) Matching stage via entropy balancing

- Multivariate reweighting method that matches covariate distribution on the 1st and 2nd moment → increases comparability of treatment and control group
- Stata package ebalance (Hainmueller & Xu, 2013)
- Balancing weights w.r.t. sex, age, socio-economic status and burden of disease

(II) Regression stage via weighted-generalised linear model with Poisson distribution

$log(Y_{i,t}) = \alpha_{i,t} + \beta_t \text{post}_t + \gamma_i \text{treat}_i + \delta_{i,t} (\text{post}_t \cdot \text{treat}_i) + \theta_i C_i \varepsilon_{i,t}$

$Y$ ... healthcare consumption, $C$ ... time-fixed controls
$\delta$ ... interaction term, i.e. effect of co-insurance rate reduction
Methods
Sensitivity analysis

Validity of DiD estimation depends crucially on shared pre-trends
  • Visual and formal pre-trend analysis (Angrist & Pischke, 2008)

Plausibility that change in the co-insurance rate is the cause of the shift in demand
  • Placebo regression with “treatment” signalled two quarters prior to actual treatment
Pre- and post-intervention trends

Note
Routine electroencephalography (AAS10), Removal of foreign bodies from the cornea, sclera or conjunctiva (BZ540), Cerumen removal (CA540), Nystagmus inspection (CE510), Routine electrocardiogram (DE510), Sonography of the intracranial vessels (EA510), Uroflowmetry (JR510), Sonography of the thyroid and parathyroid gland (KC510), Electromyography (PF520), Incident-light microscopy (QZ510), Blood gas analysis (ZX530).

The x-axes depict the number of (weighted) cases, the y-axes is the time dimension in quarters.

Figure: Pre-and post-intervention trends of the treatment and the weighted control group for the 11 healthcare services in the four quarters before and after the intervention (reduction of the co-insurance rate).
Results

Pre-trend analysis

- 7 out of 11 healthcare services pass formal test for shared pre-trend
- Only 2 healthcare services show also well-behaved visual patterns
- Most pre-trends too volatile for DiD estimation
- Substantial variation in the number of observations as potential culprit

DiD framework only suitable for two healthcare services

- Routine electrocardiogram (DE510)
- Electromyography (PZ520)
Results
Routine electrocardiogram (DE510)

Routine electrocardiogram

- **Low urgency, relatively high cost**
- **Small positive effect on demand (+1.4%)**
- **Effect statistically significant**

<table>
<thead>
<tr>
<th>Healthcare service</th>
<th>Routine electrocardiogram (DE510)</th>
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<tr>
<td>Regression Method</td>
<td>Generalised Poisson Regression</td>
</tr>
<tr>
<td>Matching Method</td>
<td>Raw</td>
</tr>
<tr>
<td>Additional controls</td>
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</tr>
<tr>
<td>Time</td>
<td>0.0716*** (0.0012)</td>
</tr>
<tr>
<td>Treatment</td>
<td>0.0427*** (0.0018)</td>
</tr>
<tr>
<td>Time*Treatment</td>
<td>0.0180*** (0.0021)</td>
</tr>
<tr>
<td>N</td>
<td>737,399</td>
</tr>
<tr>
<td>N (treated)</td>
<td>248,123</td>
</tr>
<tr>
<td>Log-Pseudolikelihood</td>
<td>-892,657.277</td>
</tr>
</tbody>
</table>

*p < 0.1, ** p < 0.05, ***p < 0.01
Heteroskedasticity robust standard errors in parentheses (clustered at the patient level)
# Results

## Electromyography (PZ520)

### Electromyography

- **Mixed urgency, relatively high cost**
- **Minuscule positive effect on demand (+0.12%)**
- **Effect statistically not significant**
  - **Considerably smaller sample size**

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<th>N (treated)</th>
<th>Log-Pseudolikelihood</th>
</tr>
</thead>
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<tr>
<td></td>
<td>0.0320*** (0.0036)</td>
<td>0.0165*** (0.0071)</td>
<td>0.0036 (0.0087)</td>
<td>31,927</td>
<td>5,884</td>
<td>-34,107.755</td>
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<tr>
<td></td>
<td>0.0348*** (0.0038)</td>
<td>0.0189*** (0.0071)</td>
<td>0.0012 (0.0088)</td>
<td>31,927</td>
<td>5,884</td>
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<tr>
<td></td>
<td>0.0345*** (0.0038)</td>
<td>0.0215*** (0.0072)</td>
<td>0.0003 (0.0088)</td>
<td>31,927</td>
<td>5,884</td>
<td>-34,259.48</td>
</tr>
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*p < 0.1, ** p < 0.05, ***p < 0.01

Heteroskedasticity robust standard errors in parentheses (clustered at the patient level)
Results

Another service narrowly fails formal test, but is visually well-behaved

- Sonography of the thyroid and parathyroid gland (KC510): Mixed urgency, high cost
- DiD result: demand increases by 2.7% in reaction to co-insurance reduction

Additional hints are found in the pre-trend graphs

- Routine EEG (AA510): Low urgency, high cost
- Pre-trend pattern suggests that patients postponed healthcare service consumption from Q1-2016 to Q2-2016

DiD regressions for remaining services yield insignificant or paradox results

- Reasons: group-specific seasonal patterns or spikes in consumption despite matching
Discussion

Results show that even minor changes to co-insurance cause reactions in demand

• Effect is not very pronounced given the small change of costs for patients (max. €6)
• Possibly stronger reaction if moving to or from zero cost-sharing (change to status-quo)

Results are in line with expectations derived from classification of healthcare services
Limitations

Comparability of treatment and control group

• Different patterns in healthcare consumption trends for some healthcare services
• Lack of data on patient characteristics reduces matching accuracy
  • Socio-economic status only derived from district characteristics
• Different levels of healthcare consumption between treatment and control group

Difference in remuneration between sickness funds for physicians could exacerbate outcome differences due to supplier-induced demand

• Physicians (unknowingly) react to price differentials (cf. Coey, 2015)
• Potential contributor to the difference in levels of healthcare service consumption between treatment and control group
Limitations

Set of healthcare services *chosen due to comparability in definitions across* sickness funds and may not be ideal

- The most expensive service in the sample is only €60
- Small price change likely contributes to weak findings
- Arguably idiosyncratic healthcare services

Regional differences *in healthcare consumption due to medical practice variation* additional potential source for distortion (cf. Berger & Czypionka, 2021)

- Number of cases often not large enough to allow sub-sample analysis
Conclusion

We find evidence in our empirical analysis that the demand reactions of different healthcare services to changes in cost-sharing vary along the dimension of urgency and cost

- Strongest reaction in expensive and deferrable services in the sample

Relevant insights for policy makers concerning dual role of cost-sharing

- Different demand reaction can be used for specific steering of patient behaviour and patient flows
- Postponement effects

Concerns about the quality of the data limits the strength of the results

- Unexplained differences in the consumption patterns – sample not well-behaved
- Lack of suitable control variables for better matching
References

- Berger, M., Czypionka, T., 2021. Regional medical practice variation in high-cost healthcare services: Evidence from diagnostic imaging in Austria. Eur J Health Econ. 22, 917-929