Sources of specialist fee variation

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Introduction

- Aims: Investigate sources of variation in specialist fees.
- Context: Private health care in Australia.
- Large variation in fees contributes to price non-transparency.
- Non-transparency can cause under use, delayed treatment, or dropping off private health insurance.
- Non-transparency also undermines market efficiency.

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- Potential sources of variation:
  1. Patients
  2. Doctors
  3. Specialty
  4. Market and other factors.
- Q: How much does each contribute to the variation in fees?
- Q: Do patient conditions account for most of fee variation?

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Methods

- Claims data (2012–2019) from a large private health insurance fund.
- Unit of analysis: claims made by doctors for an episode of care.
- An episode of care typically involves multiple claims by different doctors.
- Examine two prices: (i) Total Fees charged, (ii) Out-of-Pocket (OOP) payment.
- Total Fees = total doctor fees charged to patient on each claim.
- Total Fees are paid in varying proportion by Medicare, insurer and patient.
- OOP refers to the portion paid by patient.

Two stage Analysis

- Stage 1: Risk adjustment, to adjust for patient risk factors and characteristics.
- Stage 2: Aggregate risk adjusted prices to year-doctor level average prices.
- Compare variation of risk adjusted vs unadjusted prices.
- Decompose total variance of average prices.

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Risk adjustment

- Generalised linear model (GLM): Let p_{ijt} be the price (Total fees/OOP) charged by doctor j for episode i in year t.

$$E[p_{ijt} \mid X_{ijt}] = g(X_{ijt}\beta),$$

  $g(\cdot)$ is the inverse link function.
- Total fees: Identity link + normal distribution.
- OOP: log link + Poisson distribution.
- Patient risk factors & characteristics include:
  1. Age, gender, state of residence.
  2. Elective (0/1), ICU stay (0/1), Same-day stay (0/1), No. diagnoses, No. procedures.
  3. ICD-10 Principal Diagnostic Chapter (19 chapters).
  4. ACHI Blocks 1 & 2 combination (1200+ combinations).
  5. Hospital ID (500+ hospitals).

Stage 2

- Compute risk adjusted price at doctor-year level (doctor j in year t) as:

$$p^a_{jt} = \frac{1}{n_{jt}} \sum_{i \in I_{jt}} (p_{ijt} - \hat{p}_{ijt}),$$

  where $\hat{p}_{ijt} = g(X_{ijt}\hat{\beta})$ is the predicted price, I_{jt} is the set of episodes treated by doctor j in year t, and $n_{jt} = \#I_{jt}$ is the number of episodes treated by j in year t.
- Compute risk adjusted price at doctor-year level as the difference between the average price charged and average predicted price.
- Compare distributions of risk adjusted vs unadjusted prices.
- Estimate variance component models.

Variance components

- 3-level random effects model (specialty, doctor, residual):

$$p^a_{jkt} = \alpha + Z'_{jkt}\,\beta + (s_k + v_j + \epsilon_{jkt}),$$

  where $v_j \sim N(0, \sigma^2_v)$, $s_k \sim N(0, \sigma^2_s)$, $\epsilon_{jkt} \sim N(0, \sigma^2_\epsilon)$
- Assumptions: (i) random effects are uncorrelated, e.g., rules out doctors sorting into specialties.
- Use the intraclass correlations to decompose total variance to specialty- and doctor-specific effects.

$$\rho(specialty) = \frac{\sigma^2_s}{\sigma^2_\epsilon + \sigma^2_s + \sigma^2_v} \qquad \rho(doctor) = \frac{\sigma^2_v}{\sigma^2_\epsilon + \sigma^2_s + \sigma^2_v}$$

- Variance of residual errors: other factors, incl market conditions.

Sample overview

Admission Year	No. patients	No. doctors	No. hospitals	No. episodes	No. claims
2012	425,573	21,056	547	750,847	1,915,381
2013	430,232	21,570	535	768,286	1,968,227
2014	433,324	22,370	544	780,848	2,005,512
2015	434,984	23,179	585	794,588	2,031,705
2016	426,499	24,034	607	799,664	2,030,065
2017	417,092	25,239	673	792,330	2,027,961
2018	404,730	25,367	677	766,411	1,983,978
2019	399,692	25,086	590	759,139	1,971,715
All years	1,658,347	41,934	778	6,212,113	15,934,544

Total Fees and OOP per claim

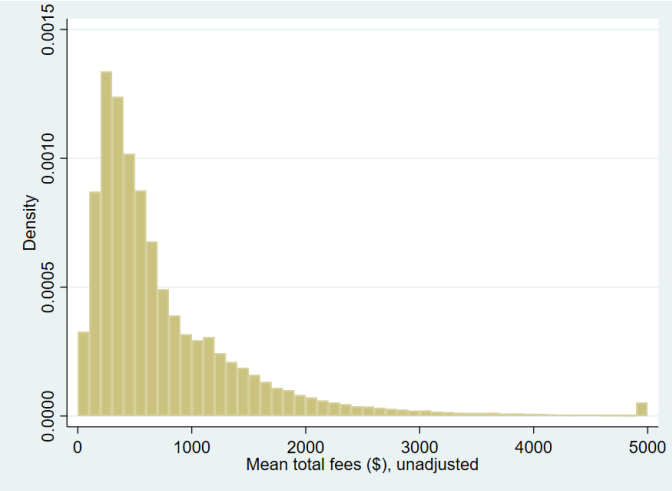
Year	Total Fees		Out of Pocket		Prop
	Mean($)	s.d.	Mean($)	s.d.	no OOP
2012	588.4	786.8	85.5	473	0.737
2013	594.9	820.7	85.5	529	0.746
2014	600.8	807.6	88.0	525	0.741
2015	607.6	824.5	95.0	549	0.721
2016	612.8	830.5	97.3	521	0.707
2017	612.8	830.0	97.2	541	0.708
2018	620.5	860.2	102.0	580	0.703
2019	630.2	859.0	104.6	581	0.720
All years	608.6	827.9	94.4	541	0.723

Total Fees and OOP by episode of care

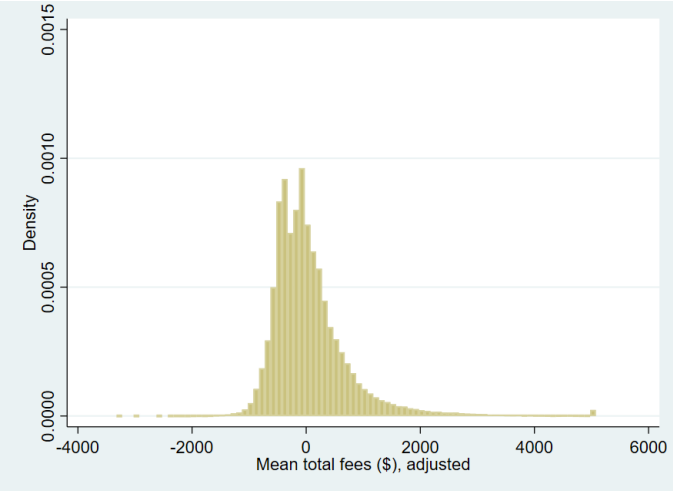
Year	Total Fees		Out of Pocket		Prop
	Mean($)	s.d.	Mean($)	s.d.	no OOP*
2012	1,610	2,257	234	832	0.538
2013	1,638	2,289	235	913	0.544
2014	1,655	2,311	243	874	0.540
2015	1,673	2,360	262	906	0.520
2016	1,682	2,395	267	904	0.500
2017	1,699	2,409	270	905	0.496
2018	1,731	2,476	285	990	0.488
2019	1,764	2,485	293	954	0.515
All years	1,681	2,374	261	911	0.518

*proportion of episodes paying no OOP each year.

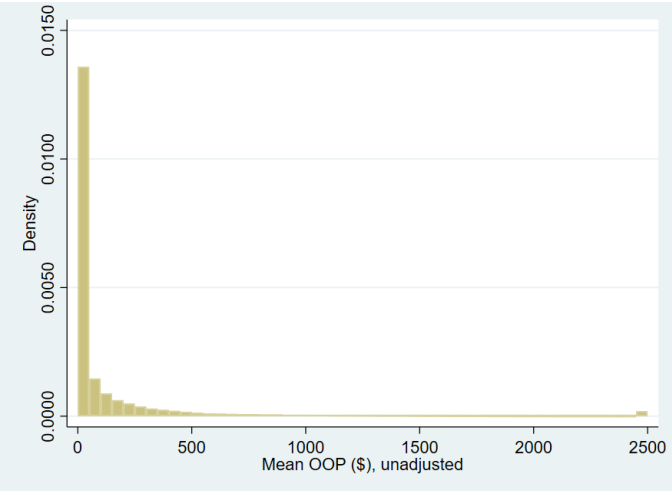
Distributions of risk adjusted and unadjusted prices



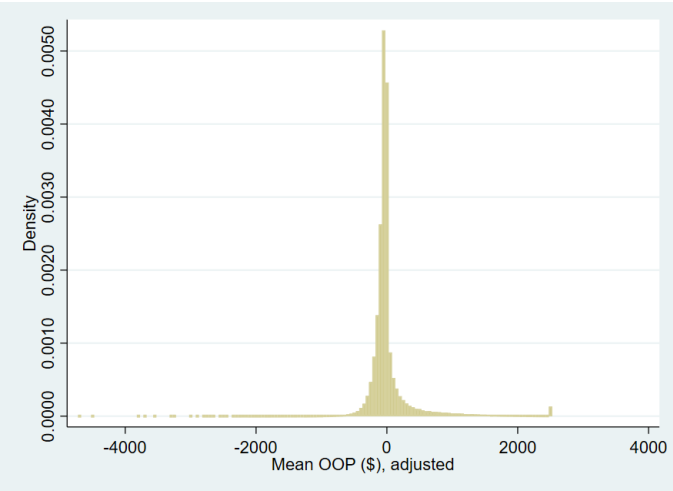
(a) Unadjusted Total Fees



(b) Risk adjusted Total Fees



(c) Unadjusted OOP



(d) Risk adjusted OOP

Dispersion of risk adjusted vs unadjusted prices

	Unadjusted	Adjusted	Ratio (A/U)
Total fees			
Mean ($)	779.2	73.9	
Median ($)	522.2	-71.1	
Variance	687,698.8	581,864.8	0.846
Interquartile range ($)	687.5	676.6	0.984
p90th-10th percentile range ($)	1,458.2	1,379.5	0.946
OOP			
Mean ($)	167.2	39.0	
Median ($)	5.5	-33.5	
Variance	292,229.6	236,770.7	0.810
Interquartile range ($)	98.0	89.4	0.912
p90th-10th percentile range ($)	410.5	402.6	0.981
No. of specialists		37,602	
No. of obs.		177,918	

Variance decomposition

	Total fees			OOP		
	Coeff.	s.e.	p-val	Coeff.	s.e.	p-val
Three-level RE model						
$\hat{\sigma}_s$	187.51	10.84	<0.001	33.67	2.44	<0.001
$\hat{\sigma}_v$	643.98	2.60	<0.001	415.55	1.73	<0.001
$\hat{\sigma}_\epsilon$	340.87	0.64	<0.001	248.85	0.47	<0.001
$\rho(specialty)$		0.062			0.005	
$\rho(doctor)$		0.733			0.733	
No. obs.		177,663			177,573	
No. doctors		37,553			37,513	

Note: Also included in estimation but not shown are year & state dummies.

Summary of results

- Main findings:
  1. Accounting for patient risk factors reduced price variance 15–20%.
  2. The role of patient risk factors varies substantially across specialties.
  3. Decomposition of risk adjusted price suggests doctor-specific factors account for more than 70% of variation.
- Patient characteristics not dominant factors in specialist pricing.
- Doctor-level variation accounts for most of the price variation.
- Other sources of variation, including doctor specialty, account for far less.
- Understanding doctor-level variation will be key for improving price transparency.