

Competition, prices, and quality in the market for GP consultations

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Motivation

- Markets for healthcare are idiosyncratic: moral hazard adverse selection, supplier-induced demand, govt intervention
- But market structure, competition still play a role in determining outcomes (prices, quality)
- Australian context interesting to test market forces: unregulated prices, rich GP-level data

Motivation

- In Australia the number of GPs is rising:

GPs in Australia

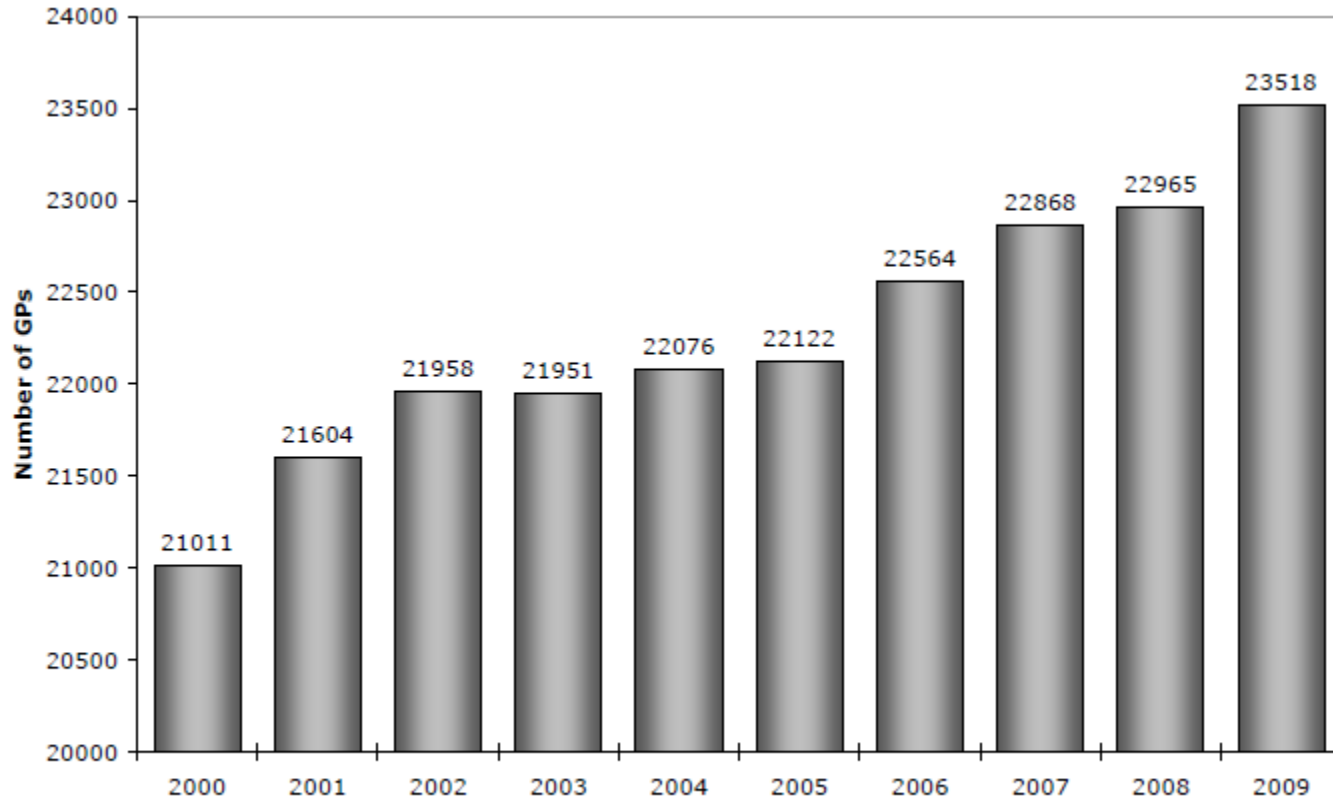


Figure 3.5: Estimated number of GPs in Australia, 30 June, 2000-2009

Motivation

- In Australia the number of GPs is rising.
- But the number of GP *practices* is falling:

GP *practices* in Australia

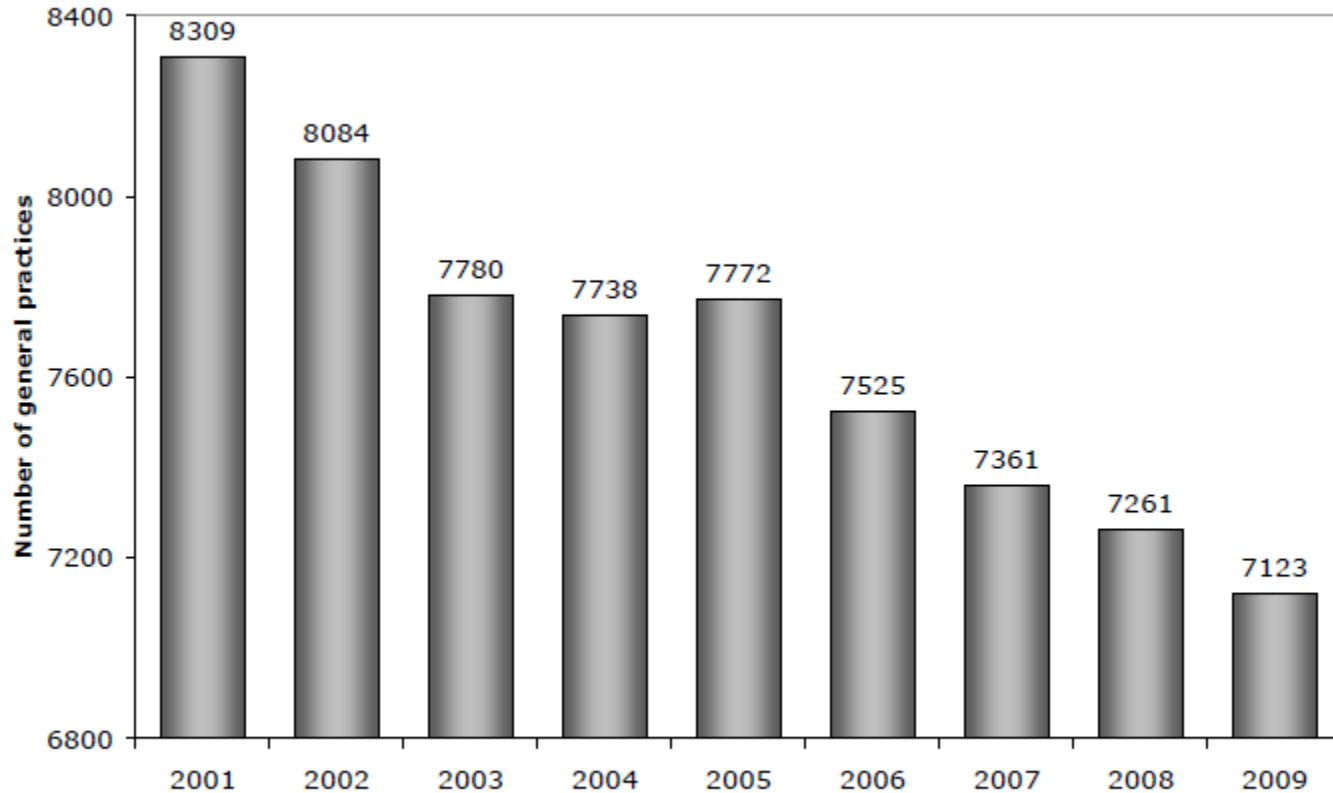


Figure 3.2: Estimated number of practices in Australia, 30 June 2001-2009

Motivation

- In Australia the number of GPs is rising.
- But the number of GP *practices* is falling.
 - Greater concentration in the market
- This trend is also apparent in the UK, USA
- As well as time variation there is also cross-sectional variation in GP density or *localised competition*

Motivation

- What does theory say?
- Classic theories of competition (eg Cournot competition) suggest more firms \rightarrow price falls closer to marginal cost
- But Australian GP market characterised by vertical (quality) differentiation, horizontal (especially geographical) differentiation, price discrimination
- **Aim:** To model and estimate the relationship between localised competition, and prices and quality of consultations

Related literature

- Substantial literature looking at competition and outcomes in hospital markets (Bloom et al 2010, Gaynor et al 2010, Propper et al 2008)
- But little research in physician markets (Gaynor and Town 2011)
- Two US papers have found higher physician density is associated with lower prices (Bradford and Martin 2000, Schneider et al 2008) with across-area identification.
- Structural models: entry (Schaumans and Verboven 2008), price-cost margin (Gunning and Sickles 2012)
- Johar (2012) uses patient-level data to estimate the effect of patient income on prices. The effect is interacted with an area-level measure of GP density

Related literature

- Previous Australian studies also use area-level data on prices and GP density (McRae 2009, Richardson et al 2006, Savage and Jones 2004).
- But some recent IO papers emphasise the role of **distance measures** of localized competition (Alderighi and Piga 2012, Thomadsen, 2005)
- Theoretical models: Glazer and McGuire (1993), Gravelle (2000) and Brekke et al (2010) all model prices, quality and competition with Hotelling or Salop approaches to horizontal differentiation

Our Contribution

- Develop a model of localised competition and prices in the presence of: price discrimination, vertical differentiation and consumer heterogeneity
- Estimate the effect of localised competition on prices for GP services
 - Using GP-level measures of prices and distance measures of localised competition
 - Taking account of unobserved area-level characteristics using fixed effects

Institutional Framework

In Australian General Practice:

- General Practitioners (GPs) are paid by fee-for-service
- The government pays a fixed rebate (~\$35) per service
- GPs can charge any level of copayment they wish on top of this (average \$10) which cannot be covered by insurance
- When GPs charge zero copayment they 'bulk bill'.
- ~80% of all *consultations* bulk-billed, average bulk-billing rate per GP is 60% (GPs who bulk-bill 100% of consultations do more consultations).
- There is no patient enrollment/lists - patients can choose GPs freely

Model Set-Up

- The model is an extension of the Vickrey-Salop circular city model of monopolistic competition.
- In addition we allow for bulk-billing, price discrimination, vertical differentiation and patient heterogeneity
- Patients demand one consultation and their utility from GP i is:

$$u_i = r - p_i + \alpha q_i - t d_i$$

- Where p_i, q_i, d_i is price, quality, distance. r, α, t are parameters.

Model Set-Up

- Patients are distributed uniformly around the circle of circumference L , there are G GPs and the distance between them is $l=L/G$
- Patient types α , distribution function at each point $F(\alpha;\theta)$, $F'_\theta < 0$; density $f(\alpha;\theta)$
- GPs strategically choose price to non bulk billed patients p , the proportion of patients bulk-billed F^b and quality q for bulk-billed and non bulk billed patients

Model Outcomes

We observe in the data for each GP

a) price charged to non-bulk billed patients: p

b) proportion of patients who are bulk billed: F^b

c) average quality (consultation length) for all patients: \bar{q}

and we can derive

d) average price to all patients: $\bar{p} = (F^b \times 0) + (1 - F^b)p = (1 - F^b)p$

Model Predictions

Fixed ℓ		Exogenous factor							
Case	Endogenous	ℓ	t	m	δ	ϑ	h	K	
$0 < F^b < 1$	F^b	—	—	+	+	?	0	0	
$0 < F^b < 1$	p	?	?	—	?	?	0	0	
$0 < F^b < 1$	\bar{p}	?	?	?	?	?	0	0	
$0 < F^b < 1$	\bar{q}	—	—	?	?	?	0	0	

- Distance between GPs (less localised competition) will *reduce* the bulk-billing rate
- Distance between GPs (less localised competition) will *reduce* quality
- The effect of distance between GPs on price or the average price is indeterminate

Data

MABEL survey:

- Census survey of all Australian doctors in 2008
- Response rate for GPs = 17.65% = 3873 GPs
- Survey is broadly representative of population (Joyce et al 2010)
- For analysis we use 'city' based sample includes only GPs in major cities = 2492 GPs
- Item nonresponse on price variable reduces sample to 2143 GPs, on other variables to 1925
- 380 statistical local areas (pop ~ 35,000) used to attribute characteristics, and for fixed effects

Key variables

Price and quality variables

- F^b : proportion of patients charged no out-of-pocket price
- $\overline{p + m}$: price for non bulk-billed consultations
- \overline{q} : average consultation time

We will estimate models for bulk billing F^b , log price $\ln(p+m)$, log average price $\ln[m + (1-F^b)*p]$ and log consultation time $\ln(q)$

Localised competition measure

- l_{ij} measured by log distance to 3rd closest GP practice (in the population), robustness checks with 1st and 5th closest

Descriptives

Variable	Mean	S.D.	Min	Max
<i>Dependent Variables</i>				
Average price (\$): $(1-F_b) \times (p + m)$	42.297	9.719	32.800	150.000
Bulk-billed (%): F_b	60.029	31.172	0.000	100.000
Price (\$): $p + m$	50.289	11.383	32.800	150.000
Consult time (mins)	16.635	5.460	5.000	60.000
Closest GP Practice (km)	0.703	0.998	0.000	9.434
Third closest GP practice (km)	1.527	1.589	0.003	17.448
Fifth closest GP practice (km)	2.171	1.958	0.067	19.005

Descriptives

Variable	Mean	S.D.	Min	Max
<i>GP and Practice Variables</i>				
Female GP	0.474	0.499	0.000	1.000
Spouse	0.868	0.339	0.000	1.000
Children	0.643	0.479	0.000	1.000
Australian Medical School	0.821	0.384	0.000	1.000
Experience 10-19 years	0.209	0.407	0.000	1.000
Experience 20-29 years	0.368	0.482	0.000	1.000
Experience 30-39 years	0.265	0.442	0.000	1.000
Experience 40+ years	0.089	0.285	0.000	1.000
GP registrar	0.034	0.182	0.000	1.000
Partner or associate	0.454	0.498	0.000	1.000
Practice taxed as company	0.274	0.446	0.000	1.000
Practice size: 2-3 GPs	0.167	0.373	0.000	1.000
Practice size: 4-5 GPs	0.201	0.401	0.000	1.000
Practice size: 6-9 GPs	0.328	0.470	0.000	1.000
Practice size: 10+ GPs	0.162	0.368	0.000	1.000
<i>Area Variables</i>				
Index of advantage/disadvantage	-0.032	0.988	-4.510	2.194
Incentive area	0.228	0.420	0.000	1.000
Median House price (\$'000,000)	55.312	29.231	15.500	302.250
Proportion of residents U15	0.176	0.049	0.025	0.296
Proportion 65+	0.133	0.046	0.017	0.432
Proportion disabled	0.039	0.014	0.004	0.110
Proportion NW Europe	0.081	0.039	0.011	0.269
Proportion SE Europe	0.048	0.042	0.002	0.301
Proportion SE Asia	0.042	0.051	0.000	0.332
Proportion Other	0.097	0.083	0.002	0.496
Popn density (pop/km2) ('000)	2.056	1.640	0.000	8.757

Empirical Models

- First, the linear regression approach, GP j , area r , outcome y_{jr}

$$y_{jr} = \beta_1 GPdist_{jr} + \beta_2 GPchars_{jr} + \beta_3 Areachars_r + v_{jr}$$

- The main endogeneity problem:
 - GPs choose their location *and* pricing behaviour
 - Unobservables may influence both these choices leading to correlation between $GPdist_{jr}$ and v_{ij} , biasing β_1

Empirical Models

- Our strategy: allow for area effects
- Area random effects and fixed effects

$$y_{jr} = \beta_1 GPdist_{jr} + \beta_2 GPchars_{jr} + \beta_3 Areachars_r + \gamma_r + \nu_{jr}$$

- Area random effects with area-Mundlak adjustment terms

$$y_{jr} = \beta_1 GPdist_{jr} + \beta_2 GPchars_{jr} + \beta_3 Areachars_{ij} + \lambda_1 \overline{GPdist_r} + \lambda_2 \overline{GPchars_r} + \gamma_r + \nu_{jr}$$

Empirical Models

- We also estimate an adapted tobit model

$$\ln L = \sum_{j=1}^N \left\{ F_j^b \left[-\ln \sigma + \ln \phi \left(\frac{\ln \left[(p_j + m) / m \right] - X_j \beta}{\sigma} \right) \right] + (1 - F_j^b) \ln \left[1 - \Phi \left(\frac{X_j \beta}{\sigma} \right) \right] \right\}$$

- We use the same covariates X_{jr} as in the linear models
- We also estimate an area-Mundlak effects version, but not area fixed effects

Key results – linear models

Dependent Variable	OLS		R.E.		Mundlak		F.E.	
	Marg eff	S.E.	Marg ef	S.E.	Marg e	S.E.	Marg eff	S.E.
Log price = $\ln(p+m)$	0.017	0.007 **	0.015	0.007 **	0.014	0.009 *	0.013	0.009
Bulk billing rate = F^b	-2.853	0.809 ***	-2.889	0.767 ***	-3.130	0.923 ***	-3.056	0.884 ***
Log average price = $\ln[m + (1-F^b) \cdot p]$	0.016	0.005 ***	0.016	0.005 ***	0.017	0.006 ***	0.016	0.006 ***
Log of consult time = $\ln(q)$	-0.004	0.007	-0.005	0.008	-0.012	0.011	-0.014	0.011

Key results – incl tobit

Dependent Variable	OLS		R.E.		Mundlak		F.E.		Tobit		Tobit with Mundlak	
	Marg eff	S.E.	Marg ef	S.E.	Marg e	S.E.	Marg eff	S.E.	Marg eff	S.E.	Marg eff	S.E.
Log price = $\ln(p+m)$	0.017	0.007 **	0.015	0.007 **	0.014	0.009 *	0.013	0.009	0.015	0.004 ***	0.017	0.005 ***
Bulk billing rate = F^b	-2.853	0.809 ***	-2.889	0.767 ***	-3.130	0.923 ***	-3.056	0.884 ***	-3.000	0.837 ***	-3.328	0.955 ***
Log average price = $\ln[m + (1-F^b) \cdot (p)]$	0.016	0.005 ***	0.016	0.005 ***	0.017	0.006 ***	0.016	0.006 ***	0.020	0.006 ***	0.022	0.006 ***
Log of consult time = $\ln(q)$	-0.004	0.007	-0.005	0.008	-0.012	0.011	-0.014	0.011	N/A		N/A	

Interaction terms

	OLS		R.E.		Mundlak		F.E.	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Dep Var: log price = ln(p+m)								
ln(3rd closest GP pr)	0.017	0.007 ***	0.017	0.007 ***	0.021	0.009 **	0.021	0.009 ***
x SEIFA adv/disadv	0.002	0.008	0.004	0.007	0.016	0.009 *	0.018	0.008 **
Dep Var: bulk billing rate = F^b								
ln(3rd closest GP pr)	-3.080	0.879 ***	-3.268	0.835 ***	-3.930	1.018 ***	-4.026	1.034 ***
x SEIFA adv/disadv	-0.620	0.790	-0.967	0.716	-1.876	0.793 **	-2.244	0.779 ***
Dep Var: log average price = ln[m+ (1-F^B)*(p)]								
ln(3rd closest GP pr)	0.016	0.006 ***	0.017	0.006 ***	0.021	0.007 ***	0.021	0.007 ***
x SEIFA adv/disadv	0.001	0.005	0.004	0.005	0.010	0.005 **	0.013	0.005 **
Dep var: log consult time = ln(q)								
ln(3rd closest GP pr)	-0.005	0.007	-0.006	0.007	-0.017	0.011	-0.019	0.010 *
x SEIFA adv/disadv	-0.001	0.008	-0.003	0.008	-0.011	0.011	-0.012	0.011

Different competition measures

Dep Var: log average price = $\ln[m + (1-F^B) * (p)]$	OLS		R.E.		Mundlak		F.E.	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
ln(closest GP pr)	0.006	0.003 **	0.005	0.003 *	0.005	0.003 *	0.005	0.003
ln(3rd closest GP pr)	0.016	0.005 ***	0.016	0.005 ***	0.017	0.006 ***	0.016	0.006 ***
ln(5th closest GP pr)	0.022	0.007 ***	0.023	0.007 ***	0.028	0.009 ***	0.028	0.009 ***

Results Summary

The tobit model with Mundlak area effects predicts:

- 1.5km (1 S.D.) fall in distance to 3rd nearest GP practice:
→ \$0.91 (10%) fall in average price
- Move a GP from bottom 10% to top 10% of GP density
(2.9 km to 0.6 km to 3rd nearest GP)
→ \$2.18 (18%) fall in average price, 7.7 %-point increase in proportion bulk-billed
- The effect may be substantially larger in socio-economically advantaged areas

Discussion

- Our results broadly align with the predictions of theory model
- less localised competition (greater distance) reduces bulk-billing
- Our results broadly align with existing literature on GP density and prices
- But we use a new (improved) way of measuring localised competition competition (Alderighi and Piga 2012, Thomadsen 2005)
- We find a suggestion of an interaction between localised competition and local SES in determining prices (Johar 2012)

Discussion - Policy

- Trend of rising concentration in Australian General Practice
- Good reasons from theory to suggest effects on prices and quality
- Our empirical results provide evidence of (relatively) small effects in a cross-section
- Rising concentration could lead to higher prices and lower quality in Australian General Practice

Endogeneity

Nash equilibrium profit with given number of GPs

is $\pi^*(\ell; \delta, t, m, h, \theta)$ where $\ell = L/G$ is competition measure.

With free entry $\ell = L/G$ is determined by

$$\pi^*(\ell; \delta, t, m, h, \theta) = K$$

where K is fixed cost (net of amenity benefits)

$$\ell = \ell(\delta, t, m, h, K, \theta)$$

Endogeneity bias in estimation of effect of ℓ if variables

affecting p, \bar{q}, F^b directly and via ℓ are omitted from regression

Variable	OLS		R.E.		Mundlak		F.E.	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
ln(3rd closest GP pr)	0.016	0.005 ***	0.016	0.005 ***	0.017	0.006 ***	0.016	0.006 ***
Female GP	0.043	0.009 ***	0.042	0.009 ***	0.041	0.010 ***	0.042	0.010 ***
Spouse	0.010	0.012	0.013	0.012	0.015	0.013	0.014	0.013
Children	0.004	0.010	0.005	0.009	0.009	0.010	0.013	0.010
Australian Medical School	0.069	0.011 ***	0.070	0.011 ***	0.069	0.012 ***	0.072	0.012 ***
Experience 10-19 years	0.031	0.019	0.029	0.019	0.024	0.021	0.024	0.021
Experience 20-29 years	0.020	0.018	0.017	0.017	0.015	0.018	0.013	0.019
Experience 30-39 years	0.020	0.020	0.023	0.019	0.025	0.021	0.025	0.021
Experience 40+ years	-0.025	0.020	-0.022	0.020	-0.015	0.022	-0.015	0.022
Registrar	-0.004	0.023	0.000	0.022	0.006	0.023	0.005	0.024
Partner or associate	0.037	0.010 ***	0.035	0.010 ***	0.031	0.011 ***	0.031	0.011 ***
Company	0.013	0.009	0.011	0.009	0.009	0.010	0.010	0.010
Practice size: 2-3 GPs	-0.009	0.016	-0.010	0.016	-0.011	0.016	-0.012	0.016
Practice size: 4-5 GPs	0.019	0.015	0.022	0.015	0.030	0.016 *	0.031	0.017 *
Practice size: 6-9 GPs	0.028	0.015 *	0.022	0.014	0.016	0.016	0.017	0.016
Practice size: 10+ GPs	0.022	0.017	0.014	0.017	0.003	0.018	-0.005	0.019
SEIFA adv/disadv	0.045	0.013 ***	0.049	0.012 ***	0.046	0.013 ***		
Incentive Area	0.035	0.015 **	0.034	0.016 **	0.032	0.016 *		
Median house price	0.001	0.000 ***	0.001	0.000 **	0.001	0.000 **		
Percentage U15	-0.490	0.163 ***	-0.397	0.173 **	-0.380	0.173 **		
Percentage 65+	0.350	0.207 *	0.364	0.201 *	0.389	0.196 **		
Percentage disabled	-1.290	0.766 *	-1.179	0.730	-1.266	0.736 *		
Percentage NW Europe	0.015	0.186	-0.020	0.188	-0.044	0.196		
Percentage SE Europe	-0.588	0.175 ***	-0.502	0.160 ***	-0.488	0.162 ***		
Percentage SE Asia	0.280	0.192	0.198	0.205	0.200	0.204		
Percentage Other	-0.027	0.115	0.012	0.121	0.012	0.116		
Pop per km2	0.002	0.005	0.002	0.005	0.001	0.005		
State dummies	Yes		Yes		No		No	
Local area random effects	No		Yes		Yes		No	
Local area averages	No		No		Yes		No	
Local Area FE's	No		No		Yes		Yes	
Obs	1925		1925		1925		1925	
R2	0.298		0.296		0.306		0.069	

Dependent variable: log price = ln(m + p)					
weighted by the bulk billing rate			Tobit with Mundlak		
Variable	Tobit		Mundlak		
	Coeff.	S.E.	Coeff.	S.E.	
ln(3rd closest GP pr)	0.046	0.013 ***	0.051	0.015 ***	
Female GP	0.097	0.020 ***	0.095	0.022 ***	
Spouse	0.040	0.027	0.049	0.028 *	
Children	0.005	0.022	0.014	0.022	
Australian Medical School	0.193	0.030 ***	0.195	0.033 ***	
Experience 10-19 years	0.061	0.044	0.061	0.046	
Experience 20-29 years	0.038	0.042	0.042	0.043	
Experience 30-39 years	0.039	0.046	0.059	0.048	
Experience 40+ years	-0.071	0.050	-0.025	0.052	
Registrar	-0.008	0.056	0.014	0.056	
Partner or associate	0.092	0.022 ***	0.074	0.024 ***	
Company	0.029	0.021	0.020	0.023	
Practice size: 2-3 GPs	-0.004	0.037	-0.003	0.039	
Practice size: 4-5 GPs	0.062	0.035 *	0.087	0.038 **	
Practice size: 6-9 GPs	0.071	0.032 **	0.046	0.035	
Practice size: 10+ GPs	0.051	0.039	0.005	0.040	
SEIFA adv/disadv	0.126	0.026 ***	0.119	0.026 ***	
Incentive Area	0.089	0.034 ***	0.087	0.035 **	
Median house price	0.001	0.001 **	0.001	0.001 **	
Percentage U15	-1.172	0.352 ***	-1.176	0.368 ***	
Percentage 65+	0.991	0.442 **	1.112	0.427 ***	
Percentage disabled	-3.487	1.573 **	-3.945	1.553 **	
Percentage NW Europe	-0.252	0.423	-0.345	0.429	
Percentage SE Europe	-1.507	0.488 ***	-1.418	0.485 ***	
Percentage SE Asia	0.296	0.449	0.263	0.444	
Percentage Other	-0.081	0.277	-0.062	0.270	
Pop per km2	0.006	0.010	0.003	0.010	
State dummies	Yes		Yes		
Local area random effects	No		No		
Local area averages	No		Yes		
Local Area FE's	No		No		
Obs	1925		1925		
Pseudo - R2	0.298		0.296		