Written Exam at the Department of Economics winter 2018-19

Course name

Final Exam

January 9th 2019

(3-hour closed book exam)

Answers only in English.

This exam question consists of 5 pages in total

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- You cheat at an exam, if during the exam, you:
- Make use of exam aids that are not allowed
- Communicate with or otherwise receive help from other people
- Copy other people's texts without making use of quotation marks and source referencing, so that it may appear to be your own text
- Use the ideas or thoughts of others without making use of source referencing, so it may appear to be your own idea or your thoughts
- Or if you otherwise violate the rules that apply to the exam

Inequalities in waiting times for health care

Question 1. Describe briefly the main traits of Beveridge health care.

Question 2. How can waiting lists (compared to pricing) motivate optimal allocation of health care?

A recent paper, Moscelli et al. (2018), study patient-level UK hospital-episode data to test whether hospital and procedure choices affect socio-economic inequalities in waiting times for non-acute heart procedures.

Particularly, for high versus low-income patients, the authors study differential waiting times for two particular revasculization procedures: (1) bypass operations (coronary artery bypass grafting, CABG, surgery) and (2) angioplasty (percutaneous coronary intervention, PCI).

To some extent CABG (that requires open-chest surgery), and PCI (less invasive) are substitutable. Still, the risk of short-run complication is particularly higher for CABG, however, the post-procedure health improvements are also potentially larger.

For each of the procedures, the main objective is to estimate the following regression:

$$w_{ij} = h_j + \beta'_1 y_{ij} + \beta'_2 s_{ij} + \beta'_3 x_{ij} + \varepsilon_{ij} \qquad \text{Equation (1)}$$

Where $w_{ij} = \ln(W_{ij})$ and W_{ij} is the waiting time (days) of patient i in hospital j, $W_{ij} > 0$. y_{ij} is a vector of dummy variables measuring socio-economic status. To construct this measure, the authors do not have access to individual income records. Instead, socio-economic status is approximated by the income deprivation of the area where the individual resides (specifically, the authors assign to each patient i, the proportion of people aged 18-59 living in low-income households in their residential area). Particularly, the authors split the income deprivation distribution into five quintiles with the highest indicating the least deprived areas (the reference category). s_{ij} is a vector consisting of severity related controls (age, gender, secondary diagnoses, previous emergency room admissions and co-morbidities). x_{ij} is a vector of non-severity controls, such as month of admission. h_j is a vector of hospital fixed effects. It controls for waiting times differences across hospitals, which arise from unobserved differences in supply and demand side factors. ε_{ij} is an idiosyncratic error.

Question 3. What is the interpretation of the sign of β_1?

Ordinary least squares estimates of $\beta_1$are provided in Table 1.

Question 4. Given Table 1, how did inequality in waiting times for revasculization procedures evolve over time?

Table 1. Parameter estimates of β_1

	CAGB						PCI				
Year	2002	2004	2006	2008	2010		2002	2004	2006	2008	2010
$\boldsymbol{\beta_1}$											
1st inc. quintile	0.29	.17	.16	.07	0.09		.42	.23	.17	.11	.14
2nd inc. quintile	0.21	.10	.15	.07	0.09		.34	.20	.16	.10	.12
3rd inc. quintile	0.15	.13	.08	.05	.07		.24	.11	.12	.10	.10
4th inc. quintile	0.02	.05	.03	.03	.03		.11	.05	.07	.05	.05
5th inc. quintile (richest)	Ref. cat.	Ref. cat.	Ref. cat.	Ref. cat.	Ref. cat.		Ref. cat.	Ref. cat.	Ref. cat.	Ref. cat.	Ref. cat.
Number patients	14654	14074	11536	11829	8888		16095	24355	26772	25399	23759
Number of hospitals offering treatment	32	34	32	34	32		37	44	60	73	83
Average waiting times (days)	153.5	98.3	65.9	57.8	50.4		89.8	83.7	52.5	37.4	39.2

Notes: Estimates of Equation 1 for each of the years 2002, 2004, 2006, 2008 and 2010. Each regression controls for hospital fixed effects, measures of severity and non-severity. The 5th income quintile (the richest) is the reference category. All estimates are statistically significant. The table also shows the number of patients that were treated each year, the number of hospitals that offered the specific treatments and the average waiting times.

Question 5. Given the papers from the health economics course, discuss whether outcomes of local populations are empirically suitable for assessing dimensions of local hospital quality (hint: you may highlight the overall findings from these papers).

Box 1.
Patient choice of hospital may modify the results in Table 1.
Equation 2 is a (probit) model to predict whether the patient chooses surgery at the geographically nearest hospital

$$n_{ij} = I\left(z_{ij}\gamma'_0 + \gamma'_1 y_{ij} + \gamma'_2 s_{ij} + \gamma'_3 x_{ij} + v_{ij} > 0\right),\ n_{ij} = \{0,1\} \qquad \text{Equation (2)}$$

n_{ij} is an indicator that equals 1 if the patient chooses surgery at the closest hospital and 0 if the patient bypasses the nearest hospital. z_{ij} measures the km-distance between the two closest hospitals faced by individual i, who received treatment at hospital j.
To adjust for patient for patient choice of hospital in Equation (1), predictions from Equation (2) can be included as regressor.

Question 6. Under which identifying assumption would an estimation of Equation (1), that includes the predicted choice of hospital as describe in Box 1, provide consistent estimates of β_1?

Table 2 presents the predicted gradient (inequality) in waiting times from an "unadjusted model" without controlling for whether the patient chose the closest hospital and an "adjusted model" that takes into account, whether the patient chose the closest hospital.

Table 2. Differences in the estimates of overall waiting time inequalities (in days) with and without adjusting for selection into hospitals.

Year	Procedure	%Bypassing local hospital	Predicted days waiting - Unadjusted model		Predicted days waiting - Adjusted Model		Difference in estimates between unadjusted and adjusted waiting time gradient	
		A	B	C	D	E	F	G
			1st income quintile	5th income quintile	1st income quintile	5th income quintile	Absolute	Relative
2002	CABG	35.9%	188.9	140.7	165.2	122.4	-5.37	-11.0%
2003	CABG	40.4%	127.5	101.0	108.5	85.2	-3.17	-12.0%
2004	CABG	39.0%	109.2	92.3	92.1	77.3	-2.07	-12.1%
2005	CABG	34.9%	70.6	61.7	67.1	58.4	-0.25	-2.7%
2006	CABG	35.3%	73.7	62.6	71.2	60.4	-0.30	-2.7%
2007	CABG	36.0%	68.7	60.6	62.8	55.2	-0.51	-6.8%
2008	CABG	34.8%	60.7	56.6	56.2	51.9	0.29	5.6%
2009	CABG	33.0%	52.5	48.6	48.6	44.9	-0.20	-7.0%
2010	CABG	31.3%	53.9	49.1	52.7	48.1	-0.23	-3.8%
2002	PCI	35.4%	114.2	74.8	114.5	122.4	0.17	0.3%
2003	PCI	36.7%	111.8	81.5	106.1	85.2	-2.13	-7.1%
2004	PCI	34.3%	96.0	76.2	92.1	77.3	-1.15	-5.4%
2005	PCI	40.4%	61.5	52.2	59.5	58.4	-0.31	-3.1%
2006	PCI	44.0%	56.9	48.1	56.0	60.4	-0.26	-3.9%
2007	PCI	41.7%	48.7	41.2	46.6	55.2	-0.27	-3.5%
2008	PCI	40.6%	39.1	35.0	37.8	51.9	-0.09	-1.8%
2009	PCI	35.6%	41.6	36.8	38.7	44.9	-0.34	-6.0%
2010	PCI	36.3%	42.1	36.6	40.2	48.1	-0.26	-3.7%

Notes: F=(D-E)-(B-C), G=((D-E)-(B-C))/(B-C)

Question 7. Explain briefly the results in Columns B-F of Table 2. To what extent did patient hospital-choice affect the inequalities in waiting times (Column G)?

Question 8. Which theoretical mechanisms could explain the results from Question 7? Relate your answer to predictions from the Grossman model.

Question 9. Outline policies implemented in the past decades to tackle excessive waiting (hint: you may distinguish between policies targeted at the demand and supply side of health care respectively), and given the information in Table 1 and 2, discuss whether you think any of these policies have been particularly successful.

While questions 1-9 study socio-economic inequalities in waiting times and the role of choice of hospitals, the questions do not consider unequal health outcomes as such. One such outcome could be mortality.

Question 10. Given the papers from the health economics course, discuss briefly the determinants of inequality in mortality/life-expectancy?