

**Doctors, Hospitals, Pharmaceuticals**

Graded satisfactory (4% of course grade) or unsatisfactory (0% of grade).

Satisfactory means a serious attempt made to answer the questions. Your answers need not be lengthy. No credit for late assignments. Academic honesty is required.

**Questions 4 to 6 use Stata and dataset ass5s25.dta.**

**1.** Consider a college graduate aged 22 deciding whether to become a G.P. Retirement is at age 62. All dollar figures given below are given in real dollars.

If she becomes a G.P. then annual income is -\$40,000 (the cost of Med school) for each of years 1 to 4; \$80,000 for each of years 5 to 8 (resident's income) and \$240,000 for each of years 9 to 40.

Alternatively, she can immediately get a job, beginning at \$60,000 in year 1 and rising by \$2,000 each year to \$138,000 in year 40.

**(a)** Give the difference in income (G.P. income – non-G.P. income) in years 1-10 and in year 40.

**(b)** Show that without discounting total lifetime income as a G.P. will be \$3,880,000 higher than if she is not a G.P.

**(c)** Now consider discounting. The present discounted value of the investment in G.P. training compared to no training is

$$PDV = Y_1/(1+r) + Y_2/(1+r)^2 + \dots + Y_{40}/(1+r)^{40},$$

where  $Y_1$  is **net return** in year 1 (here -\$20,000 - \$30,000 = -\$50,000),  $Y_2$  is **net return** in year 2 (here \$51,000 and so on). The PDV varies with the discount rate. It can be shown that

Discount rate $r$	.00	.05	.10	.15	.20
PDV	3,880,000	1,169,918	348,352	48,384	-74,900

What approximately is the internal rate of return to investing in training to become a G.P.?  
(The internal rate of return is that discount rate for which an investment just breaks even.)

**(d)** Optional. Use a spreadsheet such as Excel to calculate the PDV's in part c.

**2.** Suppose a hospital has constant marginal costs (equal to average cost). It can act as a monopolist in pricing to private patients. But it also must treat Medicaid patients at a reimbursement rate that is less than marginal cost.

**(a)** Will the hospital necessarily go out of business? Provide a verbal explanation.

**(b)** Now use appropriate diagrams to explain your answer.

**3.** Consider a drug company with patented drug that behaves as a profit-maximizing monopolist. It can be shown that the profit-maximizing output for a monopolist is a point on the demand curve where  $MR = P \times (1 + 1/\eta)$  where  $\eta$  is the price elasticity of demand (which is negative) and price is the amount received by the drug company. Recall that at a profit max  $MR = MC$ .

**(a)** Suppose that the price elasticity of demand for a drug is -1.5. How much more than marginal cost of production will the monopolist sell the drug for?

**(b)** Why do drug companies spend so much money on advertising?

**(c)** Why does the government permit drug companies to be a monopolist?

**(d)** On appropriate diagrams show how the drug company may price differently in two different markets (such as two different countries) even when MC is the same (and constant) in the two markets.

**Questions 4 to 6 reproduce a study that looked at the pricing trends for 58 anticancer drugs approved in the U.S. by the FDA between 1995 and 2013.**

The following data comes from the article David Howard, Pater Bah, Ernst Berndt and Rena Conti (2015), “Pricing in the Market for Anticancer Drugs”, *Journal of Economic Perspectives*, Winter 2015, pages 139-162.

Background: Anticancer drug spending was \$37 billion in the U.S. in 2013. The launch prices of new branded drugs have increased substantially over time. This paper investigates this issue.

Dataset:           ass5s25.dta

Key variables: lyg     = Life-years gained  
                  price   = Drug price at launch per treatment-episode 2012 \$1000's  
                  plyg   = Price per life-year gained 2012 \$1000's  
                  time   = Approval date since 1995 in years"  
                  year   = Approval date (year)

Other variables: Give Stata command describe

In answering the following questions be sure to answer in the correct units:

- in some places I want answers in dollars (whereas prices are in thousands of dollars)
- and in some places I want answers in percentages (and not proportions).

**4. Consider the relationship between drug prices and life years saved.**

**(a)** Read in Stata dataset **ass5s25.dta** and give commands **describe** and **summarize** to initially inspect the data.

**(b)** Give a scatterplot with regression line of drug prices against life year saved.

**graph twoway (scatter price lyg) (lfit price lyg, lc(black) lw(thick))**

**(c)** Fit this relationship using command regress. Use option vce(robust).

By how much do drug prices rise per life year saved? Give your answer in dollars.

Does this amount seem reasonable? Explain.

**(d)** Give a scatterplot with regression line of log drug prices against log life year saved.

**(e)** Fit this relationship using command regress. Use option vce(robust).

What is the elasticity of drug price with respect to life year saved.

**(f)** Would you expect this elasticity to be approximately one?

**(g)** Test whether or not it equals one at significance level 0.05.

**5. Consider the relationship between drug prices per life-year saved and year of approval.**

**(a)** Give a scatterplot with regression line of drug price per life year saved against year.

**(b)** Fit this relationship using command regress.

By how much do drug prices per life-year saved rise per year?

**(c)** Give a scatterplot with regression line of log drug price per life year saved against year.

**(d)** Fit this relationship using command regress.

What is the annual percentage increase in drug prices per life-year saved rise per year?

Does this amount seem reasonable? Explain.

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6. Consider other variables that may influence the determination of drug prices per life-year saved.

All models have log of drug prices per life-year saved as dependent variable and continue to include an intercept and the year of approval as regressors.

(a) Add as regressor a variable that measures unpleasant side effects: the rate of gastrointestinal complications.

(b) Is the effect large? Explain.

Is it statistically significant at level 0.05?

Does it have the expected sign?

(c) The variable **gi** was set equal to 0 if data were unavailable.

Instead run the previous regression using only observations with **gi** > 0.

(For general regression of y on x the command is regress y x if x > 0).

Does this make much difference to your results in (b)?

(d) Now consider the role of competition. Variable **lncomp** is the natural logarithm of the number of drugs previously approved for the same tumor site. Add as a regressor (along with year and an intercept).

(e) Is the effect large? Explain.

Is it statistically significant at level 0.05?

Does it have the expected sign?

(f) Give two key conclusions from your analysis in these three questions.