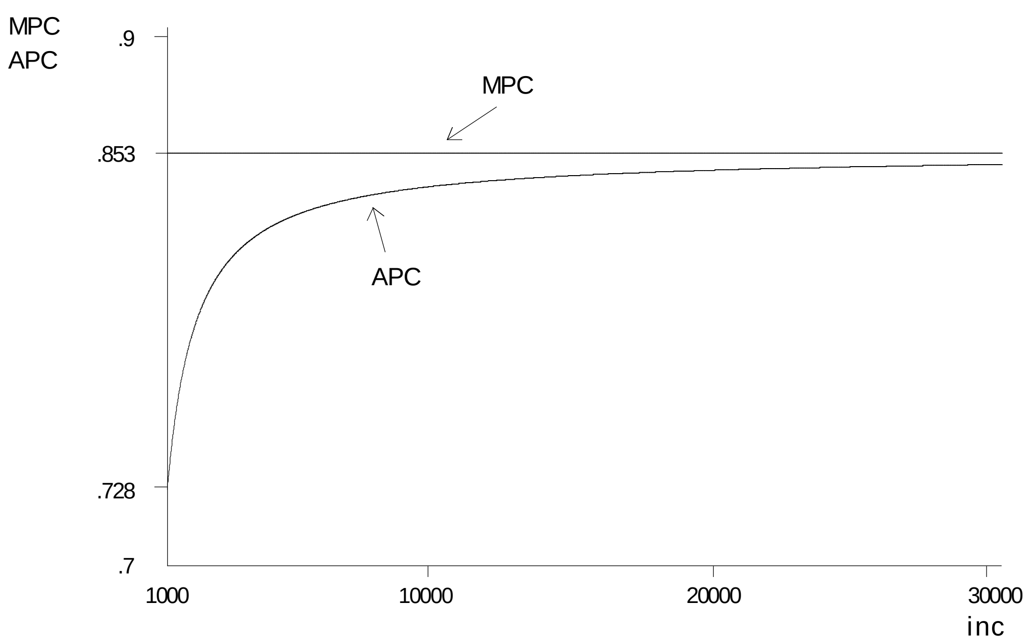
EE325: Solution for the practice questions (midterm exam)

Chapter 2

2.5 (i) The intercept implies that when *inc* = 0, *cons* is predicted to be negative \$124.84. This, of course, cannot be true, and reflects the fact that this consumption function might be a poor predictor of consumption at very low-income levels. On the other hand, on an annual basis, \$124.84 is not so far from zero.

(ii) Just plug 30,000 into the equation: $\widehat{cons}$ = –124.84 + .853(30,000) = 25,465.16 dollars.

(iii) The MPC and the APC are shown in the following graph. Even though the intercept is negative, the smallest APC in the sample is positive. The graph starts at an annual income level of \$1,000 (in 1970 dollars).



2.6 (i) Yes. If living closer to an incinerator depresses housing prices, then being farther away increases housing prices.

(ii) If the city chooses to locate the incinerator in an area away from more expensive neighborhoods, then log(*dist*) is positively correlated with housing quality. This would violate SLR.4, and OLS estimation is biased.

(iii) Size of the house, number of bathrooms, size of the lot, age of the home, and quality of the neighborhood (including school quality), are just a handful of factors. As mentioned in part (ii), these could certainly be correlated with *dist* [and log(*dist*)].

2.11 – See the homework solution

Chapter 3

3.1 (i) *hsperc* is defined so that the smaller it is, the lower the student's standing in high school. Everything else equal, the worse the student's standing in high school, the lower his/her expected college GPA.

(ii) Just plug these values into the equation

$$\widehat{colgpa} = 1.392 - .0135(20) + .00148(1050) = 2.676.$$

(iii) The difference between A and B is simply 140 times the coefficient on *sat*, because *hsperc* is the same for both students. So A is predicted to have a score .00148(140) $\approx$ .207 higher.

(iv) With *hsperc* fixed, $\Delta\widehat{colgpa} = .00148\Delta sat$. Now, we want to find Δsat such that $\Delta\widehat{colgpa} = .5$, so $.5 = .00148(\Delta sat)$ or $\Delta sat = .5/(.00148) \approx 338$. Perhaps not surprisingly, a large ceteris paribus difference in SAT score – almost two and one-half standard deviations – is needed to obtain a predicted difference in college GPA or a half a point.

3.2 (i) Yes. Because of budget constraints, it makes sense that, the more siblings there are in a family, the less education any one child in the family has. To find the increase in the number of siblings that reduces predicted education by one year, we solve $1 = .094(\Delta sibs)$, so $\Delta sibs = 1/.094 \approx 10.6$.

(ii) Holding *sibs* and *feduc* fixed, one more year of the mother's education implies .131 years more of predicted education. So if a mother has four more years of education, her son is predicted to have about a half a year (.524) more years of education.

(iii) Since the number of siblings is the same, but *meduc* and *feduc* are both different, the coefficients on *meduc* and *feduc* both need to be accounted for. The predicted difference in education between B and A is .131(4) + .210(4) = 1.364.

3.3 (i) If adults trade off sleep for work, more work implies less sleep (other things equal), so $\beta_1 < 0$.

(ii) The signs of β_2 and β_3 are not obvious, at least to me. One could argue that more educated people like to get more out of life, and so, other things equal, they sleep less (β_2 < 0). The relationship between sleeping and age is more complicated than this model suggests, and economists are not in the best position to judge such things.

(iii) Since *totwrk* is in minutes, we must convert five hours into minutes: Δ*totwrk* = 5(60) = 300. Then *sleep* is predicted to fall by .148(300) = 44.4 minutes. For a week, 45 minutes less sleep is not an overwhelming change.

(iv) More education implies less predicted time sleeping, but the effect is quite small. If we assume the difference between college and high school is four years, the college graduate sleeps about 45 minutes less per week, other things equal.

(v) Not surprisingly, the three explanatory variables explain only about 11.3% of the variation in *sleep*. One important factor in the error term is general health. Another is marital status and whether the person has children. Health (however we measure that), marital status, and number and ages of children would generally be correlated with *totwrk*. (For example, less healthy people would tend to work less.)

Appendix A

A.10 (i) The value 45.6 is the intercept in the equation, so it literally means that if *class* = 0, then the *score* is 45.6. Of course, *class* = 0 can never happen. And values close to zero would rarely if ever occur, except in very small schools. So, by itself, 45.6 is not of much interest. But it must be accounted for to use the equation to obtain *score* for sensible values of *class*.

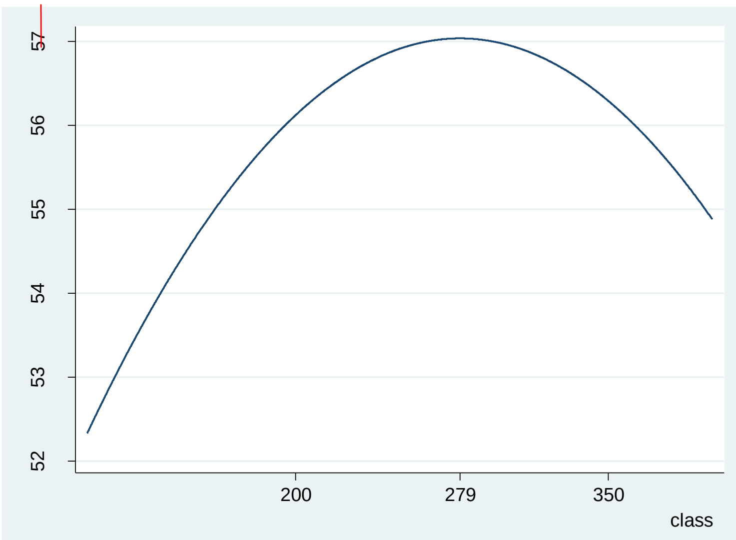
(ii) We use calculus to obtain the optimal class size:

$$class^* = .082/[2(.000147)] \approx 278.91.$$

Rounded to the nearest integer, the optimal class size is 279 students. When we plug this into the equation for *score*, we get the largest achievable score:

$$score^* = 45.6 + .082(279) - .000147(279^2) \approx 57.04\,.$$

(iii) The following graph shows the solution rounded to the nearest integer:



(iv) It is not at all realistic to think that a student's score is determined only by the size of his or her graduating class. For one thing, that would imply that all students graduating in the same year from the same high school would have the same score. A student's ability, motivation, classes taken, family background, and many other factors – including some that are totally random, such as not feeling well while taking the test – would come into play. In fact, it is safe to say that, realistically, the size of the graduating class would have a small effect, if any effect at all. Multiple regression analysis allows for many observed factors to affect a variable like *score*, and it also recognizes that there are unobserved factors that are important and that we can never directly account for.

Appendix B

B.8 The weights for the two-, three-, and four-credit courses are 2/9, 3/9, and 4/9, respectively. Let Y_j be the grade in the j^{th} course, j = 1, 2, and 3, and let X be the overall grade point average. Then $X = (2/9)Y_1 + (3/9)Y_2 + (4/9)Y_3$ and the expected value is $E(X) = (2/9)E(Y_1) + (3/9)E(Y_2) + (4/9)E(Y_3) = (2/9)(3.5) + (3/9)(3.0) + (4/9)(3.0) = (7 + 9 + 12)/9 \approx 3.11$.

B.10 (i) $E(GPA|SAT = 800) = .70 + .002(800) = 2.3$. Similarly, $E(GPA|SAT = 1{,}400) = .70 + .002(1400) = 3.5$. The difference in expected GPAs is substantial, but the difference in SAT scores is also rather large.

(ii) Following the hint, we use the law of iterated expectations. Since $E(GPA|SAT) = .70 + .002\ SAT$, the (unconditional) expected value of *GPA* is $.70 + .002\ E(SAT) = .70 + .002(1100) = 2.9$.

(iii) If a student's SAT score is 1,100, this does not mean he or she will have the GPA 2.9, found in part(ii). The GPA of 2.9 is the average GPA calculated when the average SAT score is 1,100. GPA is influenced by other variables.