**Suggested Answers**
**Problem Set 2**
**Economics 40565**

**Bill Evans**
**Fall 2007**

1. Between 1971 and now, obesity rates among adults have doubled. The obesity rate in the UK stood at about 23% in 2005, which is a rate much lower than in the US but it is three times the value just twenty years ago. Similar changes have occurred in Australia where the obesity rates are now around 21%. Even the obesity rate in France has doubled from 6 to 12 percent over the past 29 years. On a percentage basis, the change in obesity has been similar in many other countries to what the US has experienced.

2. If 'super-sized meals are to blame for the rise on obesity, we would expect to see a large increase in calories at lunch and dinner. Looking at table 3, we see a small increase in calories at lunch for both men and women but a larger decline in calories at dinner, so roughly, there is little change in lunch/dinner calories at all. Nearly all the change in calories consumed is coming from an increase in snack food consumption.

3. As smoking rates fell from 37 to 22 percent, that means 15 percent of the population is at risk of gaining weight. Assume that all of the difference in obesity rates between former and current smokers is due to their quitting smoking, then smoking cessation increases the chance of being obese by 6 percentage points or 0.06. Therefore, we would expect obesity rates to increase by (0.15)(0.06) = 0.009 or 9 tenths of one percentage point. Since obesity increased by 16 percentage points, the fall in smoking can explain AT MOST 0.009/0.16 or 5.6 percent of the rise in obesity.

4. In class, we demonstrated that $d\sigma_1/dh = p\beta U(Y,\sigma_2)/ U_{\sigma\sigma}(Y,\sigma_1) < 0$

   $d(d\sigma_1/dh)/dp = \beta U(Y,\sigma_2)/ U_{\sigma\sigma}(Y,\sigma_1) < 0$. Recall that p is the probability one survives until the next period and since $d\sigma_1/dh < 0$, increasing survival probabilities will generate larger negative behavioral changes. This means that we should expect to find greater behavioral changes generated from changes in the HIV incidence rate in areas with greater overall survival probabilities.

5. The graph for this question is at the end of the answer key. Let P be the probability of death and R be driver risk taking. The "cost" of risk taking is a greater chance of death so the demand for risk taking is negatively sloped with respect to risk. At the same time, the "supply" curve indicates that greater risk taking will mechanically produce a greater probability of death. Therefore, the equilibrium level of P and R is given at point a. A change in occupant safety generated by air bags will initially shift down the supply curve – for any level of R, P is now lower. Without any behavioral response, the market equilibrium would be point b. However, the increase in car safety may encourage more risk taking on the part of drivers. This is represented by a shift out in the demand for risk taking. Holding risk level constant, drivers are now willing to take more risks. The new equilibrium in the market is point c.

6. One way to test this would be to examine whether there is greater risk taking after states adopted mandatory safety belt use laws. Laws greatly increased belt usage and made drivers much safer in a crash. You could estimate a difference in difference model and measure risk taking directly by looking at average speeds or running red lights. Alternatively, you could measure indirect measures of risk taking like pedestrian fatalities.

7. Let Y be income and since utility is linear in income, U=Y and utility without playing the lottery is Y. A lottery player pays $1 for a ticket. They have a 1 in 1000 chance of winning $500. If they purchase a ticket, $E(U) = (0.999)(Y-1) + (0.001)(Y-1+500) = Y - 1 + .001(\$500) = Y - 1 + 0.5 = Y - 0.5$. In this case, $U = Y > E(U) = Y - 0.5$, so, this person would not play the lottery.

8. Let the probabilities of drawing a red, black or yellow ball be labeled as R, B and Y, respectively. The choice of gamble A over B implies that

$RU(100) + (1-R)U(0) > BU(100) + (1-B)U(0)$.

Assuming that U(0)=0, the choice of Gamble A implies that R>B or that people exopect there are more red balls than black balls in the urn.

The choice of Gamble D over C implies that

$(B+Y)U(100) + (1-B-Y)U(100) > (R+Y)U(100) + (1-R-Y)U(100)$

And again, assuming U(0)=0, then this implies that $(B+Y)U(100) > (R+Y)U(100)$ or $(B+Y) > (R+Y)$ or B>R. The choice of Gamble D over C means that the participant believes there are more Blacks balls than red balls in the urn, which is inconsistent with the choice of option A over B above.

9. Utility when income is certain: $U(25) = 25^{0.5} = 5$
Utility when income is uncertain: $E(U) = .5U(36) + .5U(16) = .5(6) + .5(4) = 5$.
Betsy is indifferent between the two jobs. Notice that the job with the risky income has higher expected income than the original situation $[0.5(36) + 0.5(16)] = 26$.

If utility is now $U=Y^{0.9}$, utility of the original job is now $25^{0.9} = 18.11$ and expected utility is $EU = 0.5(36^{0.9}) + 0.5(16^{0.9}) = 18.64$ so she now take job #2.

10. $EU_{wo} = (1-P)U[Y] + PU[0]$

11. $EU_w = (1-P)U[Y(1-\theta P)] + PU[Y\theta(1-P)]$

$d\, EU_w/d\theta = -(1-P)YPU'[Y(1-\theta P)] + PY(1-P)U'[Y\theta(1-P)] = 0$

Rewrite as $(1-P)YPU'[Y(1-\theta P)] = PY(1-P)U'[Y\theta(1-P)]$

The terms (1-P)YP can be cancelled from each side, leaving $U'[Y(1-\theta P)] = U'[Y\theta(1-P)]$ which means marginal utilities in the good and bad states of the world are equal, which implies that income in the good and bad states of the work are equal, or

$Y(1-\theta P)= Y\theta(1-P)$

Solving for θ, one gets that θ=1, which means that workers should fully insure.

12. $EU_w = (1-P)U[Y(1-k\theta P)] + PU[Yk\theta(1-P)] = (1-P)\ln[Y(1-k\theta P)] + P\ln[Yk\theta(1-P)]$

$d\ EU_w/d\theta = -(1-P)kYP/[Y(1-k\theta P)] + PYk(1-P)/[Yk\theta(1-P)] = 0$

In the first term, the Y's cancel in the numerator and denominator. In the second term, the Yk(1-P) cancel in the numerator and denominator.

$d\ EU_w/d\theta = -(1-P)kP/[(1-k\theta P)] + P/\theta = 0$

Rewrite as $P/\theta = (1-P)KP/[(1-k\theta P)]$

Solving for $\theta$, we get $\theta=1/k$ and since $k>1$, workers should have less than full insurance.

13. $E(U)_{\text{w/out insurance}} = 0.99U(\$50{,}000) + 0.01U(\$50{,}000-\$20{,}000) = 0.99(50000^{0.5}) + 0.01(30000^{0.5}) = 223.103$

With insurance, the person will pay a premium PREM for insurance and therefore, income in the "good" state is Y-PREM. If a health shock occurs, the person will experience a loss L but receive a payment of L from the insurance company to cover these expenses. As a result, income in the "bad" state is also Y-Prem-L+L = Y-PREM. Therefore, utility with insurance is U(Y-PREM) $=(Y\text{-}PREM)^{0.5.}$ A person will continue to pay for insurance so long as $E(U)_{\text{w/insurance}} >= E(U)_{\text{w/out insurance}}$. Therefore, the most a person would pay is the point is the PREM that reduces utility with insurance to the point where where $E(U)_{\text{w/insurance}} = E(U)_{\text{w/out Insurance}}$

$E(U)_{\text{w/insurance}} = (Y\text{-}PREM)^{0.5} = E(U)_{\text{w/out insurance}} = 223.103$. Squaring both sides produces

$Y\text{-}PREM = 223.103^2$ so $PREM = Y-223.103^2 = \$50{,}000 – 223.102^2 = \$225.15$

When $U=Y^{0.1}$, then $E(U)_{\text{w/out insurance}} = 0.99(50000^{0.1}) + 0.01(30000^{0.1}) = 2.949$

$E(U)_{\text{w/insurance}} = (Y\text{-}PREM)^{0.1} = E(U)_{\text{w/out insurance}} = 2.949$. Raising both sides by a factor of 10 generates $Y\text{-}PREM = 2.949^{10}$ and $PREM = Y – 2.949^{10} = 50{,}000 – 49{,}751 = \$249$

14. With insurance expected utility is $EU_w = (1-p)U(W-\alpha_1) + pU(W-d+\alpha_2)$ and with zero expected profits, we know that $(1-p)/p = \alpha_2/\alpha_1$. This means that $\alpha_2 = [\alpha_1(1-p)/p]$. Substituting this into expected utility, we see that

$EU_w = (1-p)U(W-\alpha_1) + pU(W-d+ [\alpha_1(1-p)/p])$

Differentiating expected utility with respect to $\alpha_1$ we get

$dEU_w/d\alpha_1 = -(1-p)U'(W-\alpha_1) + p[(1-p)/p]U'(W-d+ [\alpha_1(1-p)/p]) = 0$

Which means that

$(1-p)U'(W-\alpha_1) = p[(1-p)/p]U'(W-d+ [\alpha_1(1-p)/p])$

And canceling all the terms out in front of the marginal utilities

$U'(W-\alpha_1) = U'(W-d+ [\alpha_1(1-p)/p])$

Since marginal utilities in the good and the bad state of the world are equal, it must mean that income in the good and bad states of the world are equal.