14.64:
Problem Set Two Solutions

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October 16, 2009

Borjas, Problem 2-4

Cindy's reservation wage is the wage she would need to work her first hour. That, is it is her marginal rate of substitution when she is working no hours (L=168). At this point her consumption is only the amount she receives from her great-grandmother: \$630.

MRS $= \frac{C}{L} = \frac{630}{168} = 3.75$.

Her reservation wage is \$3.75.

Borjas, Problem 2-5

This problem asks us to consider riding the bus or driving a car as neither leisure nor work. Thus, the extra time that you spend riding the bus would be spent on either leisure or work if you decide to drive. In equilibrium, you are indifferent between the two, so we'll consider what happens if you spend the extra time as leisure.

No matter what your wage rate, if you drive instead of taking the bus you will save 0.5 hours, 2 times a day, 5 times a week or $0.5 \times 2 \times 5 = 5$ hours for leisure. Since you are indifferent between working and leisure at the optimum you would be willing to pay \$10/hour for additional hours of leisure or \$50 for five hours (where the book is asking us to take a few liberties with the defintion of "on the margin.") The additional relative cost of driving relative to taking the bus is \$60 - \$5 = \$55. So, to drive instead of taking the bus you'd have to pay \$55 to get 5 hours of leisure which you value at \$50. You would decide to take the bus.

However, when your wage rate is \$20, you value those extra 5 hours of leisure at \$100 so you'd prefer to drive, paying \$55 to get those hours of leisure.

Borjas, Problem 2-7

A sudden lump-sum transfer raises some people's lifetime income (very slightly). Since they are richer, they will work less and may retire earlier. Since this transfer is not conditional on working, there is only this lifetime income effect, and no other effect to induce anyone to start working.

In contrast, the earned income tax credit raises the wage for people who are not currently working: a positive substitution effect that will lead some of them to start working. On the other hand, everyone who is currently working chose to work over not working before the EITC. The amount they can earn working has increased or stayed the same while their income from not working stays constant. Thus, no one who worked before will choose not to work after the EITC is implemented.

Borjas, Problem 2-13

No, this does not suggest that children are inferior goods. If we had a randomized experiment where we randomly shocked some people's income and they had fewer children, then we might say that children are inferior goods. However, there are a lot of changes that have gone on in the past 100 years that might have led people to have fewer children that are not directly related to people's incomes. For example: the typical marriage age has increased, better forms of birth control have become available, and there has been an economic switch from farming (where children are productive in their youth) to manufacturing and services in which children can't typically work when they are young. The costs of raising a child in terms of education, health care, and forgone wages have also increased. One can't simply look at the change in incomes and the change in number of children and say that the increase in incomes led women to prefer fewer children.

There is one other concern here which led me to say that we only "might" be able to conclude that children are inferior goods from a randomized experiment. There is a good deal of literature looking at whether there is a "quantity-quality" tradeoff with children. Parents may choose to have fewer children, but invest more of their time and money in these children. As incomes increase, parents may choose to opt for "higher quality" children over having many children. However, in this case parents are choosing different types of children when their income changes. We might say that "low quality" children are an inferior good, but not that children in general are.

B: Analytical Problems

1. (i) Because everyone gets the same lump-sum tax credit no matter how much they work, this policy does not change the effective wage rate and thus there is no substitution effect. There is an income effect, which, since leisure is a normal good, leads women to work less at every hours level.

   (ii) Women who are not working may start working very few hours to get the benefit. For women who are working but already below the poverty line, this policy leads to an income effect which causes them to work less. Women who are between the poverty line and the breakeven face a positive tax rate due to the phase-out. Thus, the return to labor decreases under this policy. These women face both a substitution effect and an income effect which causes them to work less. Women right above the breakeven will, with conventional preferences, reduce their labor supply to get a (small) child allowance. There will be no labor supply effects for women far enough above the breakeven.

   (iii) There are two ways that this question could be interpreted: (1) we could assume that women only get subsidized child care for the hours that they are working or (2) we could assume that, as long as women work some number of positive hours, they get subsidized child care for as many hours as they desire. The first is the more traditional interpretation, but the answer is similar in both cases.

   - Case #1: Because women must pay for child care for every hour they work, before the policy, their effective wage was w-c where c is the cost of child care. The subsidized day care in this policy is cheaper: it costs $c'<c$. Thus, after this policy, the wage for women is effectively $w-c'>w-c$. This higher wage causes both an income effect which reduces labor supply and a substitution effect which increases it. Thus, the labor supply effects for most women are ambiguous. However, women who are currently not working only face a positive substitution effect, so some of them will start working.

   - Case #2: Now some working women (those who would buy some child care at the subsidized price when they are not working) face a larger income effect than in Case #1 because they get access to subsidized care for more hours. This extra income effect decreases hours worked. In considering the substitution effect, we have two classes of women: those who would not buy child care for the marginal hour at the subsidized prices if they don't work and those who would still buy child care when taking leisure. Women who would not buy the child care for their marginal hour of leisure face the same positive substitution effect as in Case #1 which would increase their labor supply. They also face the same income effects as in Case #1 due to their increased wage as well as potentially the extra income effect due to subsidized prices of child care that they use during leisure. These income effects decrease their labor supplied. Thus, the effect of this program on their labor supply is indeterminate. Working women who would buy child care for the marginal hour if they aren't working will benefit the same amount from the subsidized

child care whether or not they work an extra hour. Thus, they face no substitution effect and their labor supply will decrease due to the income effect. Women who aren't working without this program only face a substitution effect, so some of these women will work more.

(iv) This is very similar to Case #2 in part (iii). All non-working women who would buy some child care at the subsidized price and all working women face an income effect which reduces labor supply. These women who would buy child care for the marginal hour of leisure if they decide not to work another hour do not face a subsitution effect, so their labor supply will decrease. However, these women who would not buy an hour of child care for the marginal hour of leisure face a positive substitution effect which causes them to work more. For these women, labor supply is indeterminate. Non-working women who would not buy some child care at the subsidized price only face a substitution effect, so their labor supply will increase.

2. Given that the sizes of the subsidized daycare and the child allowance aren't specified, it's a bit difficult to answer this question. However, the answer will depend on two things: (1) how much labor supply changes and (2) how much production of child care during leisure changes. Since we haven't gotten to the home production model in class, I assume that parents enjoy spending time with their children so that during leisure, no child care is purchased. (Other assumptions are fine here as long as you specify what they are.) Thus, the program that reduces home production of child care the least (or increases it the most) will be the one that has the most negative effects on labor supply. Since the question doesn't specify the size of the child allowance or day care subsidy, it's difficult to say which program will have the most negative effects on labor supply. However, since subsidized day care increases labor supply for some women and has ambiguous effects for others whereas the child allowance always decreases labor supply or keeps it constant, we assume that (i) or (ii) will have more negative labor supply effects.

   It's unclear whether (i) or (ii) has more negative labor supply effects. Program (i) leads to an income effect for all women which reduces labor supply while program (ii) only has an income effect for women at or below the breakeven and encourages women not working to work (though only a very small amount). On the other hand, program (ii) leads to a substitution effect which reduces labor supply for women in the phase-out and women right above the breakeven. Depending on the breakeven, the phase-out rate, and the size of the allowance either (i) or (ii) could have more negative effects on labor supply.

   Note that when we get to the home production model in class we will distinguish between three types of time instead of two: work, home production (e.g. taking care of one's kids), and leisure. We'll see different types of graphs, have different answers, and have more machinery with which to answer these questions.

Problem C: Data Analysis

The model we discussed in class gives us a few key predictions that relate to what we would expect to see in the data.

1. Women with higher wages may supply more labor. It's not entirely clear from our model that this should happen because women with higher wages face also face an income effect which causes them to work less. However, if the substitution effect is stronger than the income effect (as it may be for women who don't work many hours), women with higher wages may supply more labor. Thus more educated and older women (who can earn higher wages on average) should supply more labor.

2. Women with more children have higher costs of working – they have to pay for more child care. Thus, we should see women with more children working less.

3. Women with more unearned income should supply less labor, through the income effect. Consequently, unearned income should strongly predict less labor force participation. Women who are married also typically have more income that they did not earn (the income their husbands earned) so non-married women should work more.

The predictions above generally apply to the "intensive" margin as well; hours should move in the same direction. But remember that we're throwing out all of the observations who aren't in the labor force (for them we don't have log hours).

The regressions generally confirmed these predictions. In both types of regressions

- The high school and college dummies lead to significantly more work
- Women who are older work more
- More children leads to significantly less work
- More unearned income leads to less work; not being married leads to more work

However, keep in mind that we are not randomly choosing the independent variables for the women in our sample so we can't take our estimates as causal effects of these variables on labor supply. For example, women who are more career-focused may have fewer children. We would then see that women who have fewer children work more, but these women don't work less because they have fewer children. In fact, it's the other way around.

My log file is below


```
  log type:  text
 opened on:  15 Oct 2009, 16:45:12

. use marcps08.dta, clear

.
.
. /* Creating dummies
> Notes: I do not create dummies for each number of children aged 6 through 18 though that
was ambiguous.
> No one has missing labor force status, education, race, marital status, or number of children.
> child6to18 isn't exactly precise since more than 9 children 0 to 18 was binned.
> I let employed be a dummy for whether an individual is employed. It equals 0 if either the
person is unemployed or not in the labor force.
> */
.
. gen employed = (labforcestat<=3)

. gen lfp = (labforcestat!=7)

. gen hsg = (educ>=39)

. gen clg = (educ>=43)

. gen nonwhite = (race>=2)

. gen nonmarried = (marstat>=4)

. gen child6to18 = child18 - child6

.
. summ

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
labforcestat |     65449    2.798591     2.67957         0          7
      hrswk |     65449    27.14002    18.83053         0         99
       age |     65449    40.55115    12.87564        18         65
      race |     65449     1.30549    .6264213         1          3
    marstat |     65449    3.234687    2.633814         1          7
-------------+--------------------------------------------------------
      educ |     65449    40.30062    2.603799        31         46
```

```
    child6 |    65449    .276704   .6111722        0        5
   child18 |    65449   .9075922   1.139617        0        9
 unearninc |    65449   13656.09   31240.31   -20760   951434
  employed |    65449   .7120048   .4528323        0        1
-------------+--------------------------------------------------------
       lfp |    65449   .7154426   .4512068        0        1
       hsg |    65449   .8807316   .3241066        0        1
       clg |    65449   .2842824   .4510754        0        1
  nonwhite |    65449   .2153738   .4110846        0        1
 nonmarried |    65449   .4246971   .4943007        0        1
-------------+--------------------------------------------------------
child6to18 |    65449   .6308882   .9452934        0        8

.
. ***************************************
. * Regressions
. ***************************************
. * Note loghrswk is missing for anyone who works no hours
. gen loghrswk = log(hrswk)
(17080 missing values generated)

. gen age2 = age^2

.
. reg lfp age age2 nonwhite hsg clg child6 child6to18 nonmarried unearninc

      Source |       SS       df       MS              Number of obs =   65449
-------------+------------------------------           F(  9, 65439) =  775.46
       Model |  1284.11173     9  142.679082            Prob > F      =  0.0000
    Residual |  12040.2905 65439   .18399258            R-squared     =  0.0964
-------------+------------------------------           Adj R-squared =  0.0962
       Total |  13324.4022 65448  .203587615            Root MSE      =  .42894

------------------------------------------------------------------------------
         lfp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .0417036    .000939    44.41   0.000     .0398631    .0435441
        age2 |  -.0005447   .0000114   -47.62   0.000    -.0005671   -.0005223
    nonwhite |  -.0220793   .0041314    -5.34   0.000    -.0301768   -.0139817
         hsg |   .2125939   .0053666    39.61   0.000     .2020753    .2231124
         clg |   .0864554   .0038954    22.19   0.000     .0788203    .0940904
      child6 |  -.0937308    .002988   -31.37   0.000    -.0995873   -.0878743
```

```
 child6to18 |   -.022732   .0019285   -11.79   0.000    -.0265118   -.0189522
 nonmarried |   .0489348   .0038237    12.80   0.000     .0414405    .0564292
 unearninc |  -6.92e-07   5.50e-08   -12.57   0.000    -8.00e-07   -5.84e-07
      _cons |   -.167819    .018486    -9.08   0.000    -.2040516   -.1315863
------------------------------------------------------------------------------

. reg loghrswk age age2 nonwhite hsg clg child6 child6to18 nonmarried unearninc

      Source |       SS       df       MS              Number of obs =   48369
-------------+------------------------------           F(  9, 48359) =  374.63
       Model |  621.063213     9  69.0070237            Prob > F      =  0.0000
    Residual |  8907.78036 48359  .184201087            R-squared     =  0.0652
-------------+------------------------------           Adj R-squared =  0.0650
       Total |  9528.84357 48368  .197007186            Root MSE      =  .42919

------------------------------------------------------------------------------
    loghrswk |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .0513817   .0011626    44.20   0.000      .049103    .0536604
        age2 |  -.0005931   .0000143   -41.54   0.000    -.0006211   -.0005651
    nonwhite |   .0425147   .0048541     8.76   0.000     .0330006    .0520287
         hsg |    .055631   .0073877     7.53   0.000      .041151     .070111
         clg |   .0287075   .0043548     6.59   0.000      .020172    .0372431
      child6 |  -.0424713   .0037058   -11.46   0.000    -.0497347   -.0352078
 child6to18 |  -.0595579   .0022833   -26.08   0.000    -.0640333   -.0550825
 nonmarried |   .0462105   .0044177    10.46   0.000     .0375517    .0548692
  unearninc |  -8.51e-07   6.42e-08   -13.25   0.000    -9.77e-07   -7.25e-07
      _cons |   2.482733   .0230863   107.54   0.000     2.437484    2.527983
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Fall 2009