1 Function Approximation Warmup

1.1 Exploring and downloading the data

```
rm(list=ls())
                         # Clear the workspace
set.seed(20866)
library(ggplot2)
library(sandwich)
library(car)
library(xtable)
library(aod)
library(systemfit)
## Loading required package: Matrix
## Loading required package:
## Loading required package:
## Attaching package: 'zoo'
##
## The following objects are masked from 'package:base':
##
##
      as.Date, as.Date.numeric
library(MASS)
library(stargazer)
## Please cite as:
##
## Hlavac, Marek (2014). stargazer: LaTeX code and ASCII text for
well-formatted regression and summary statistics tables.
## R package version 5.1. http://CRAN.R-project.org/package=stargazer
setwd("/Users/Tony/Downloads")
data <- read.csv("cps_00005.csv")</pre>
datamatrix <- as.matrix(read.csv("cps_00005.csv"))</pre>
datamatrix <- datamatrix[,-5:-8]</pre>
datamatrix <- datamatrix[,-2:-3]</pre>
AdjInc <- c(rep(NA, nrow(datamatrix)))</pre>
datamatrix <- cbind(datamatrix, AdjInc)</pre>
datamatrix <- datamatrix[datamatrix[,9]!= 0,]</pre>
datamatrix <- datamatrix[datamatrix[,9]!= 9999999,]</pre>
```

```
incomeadjust <- function(data.m = datamatrix){</pre>
  for (i in 1:nrow(datamatrix)){
    year <- as.numeric(datamatrix[i,1])</pre>
    income <- as.numeric(datamatrix[i,9])</pre>
    if (year == 2004){
      AdjustedIncome <- income * 1.25
      datamatrix[i,10] = round(AdjustedIncome)
    if (year == 2014){
      AdjustedIncome <- income
      datamatrix[i,10] = round(AdjustedIncome)
  top <- head(datamatrix, n=15)</pre>
  bottom<- tail(datamatrix, n=15)
  sample <- rbind(top,bottom)</pre>
  row.names(sample) <- NULL</pre>
  return(sample)
incomeadjust(datamatrix)
##
         YEAR REGION AGE SEX RACE EDUC99 EMPSTAT HRSWORK INCWAGE Adjinc
##
    [1,] 2004
                  11 59
                           2 100
                                       13
                                               10
                                                        2
                                                             60000 75000
    [2,] 2004
##
                  11 49
                           1 100
                                       10
                                               10
                                                        20
                                                             32000 40000
##
    [3,] 2004
                  11 42
                           2 100
                                       15
                                               10
                                                       40
                                                             30000 37500
    [4,] 2004
                           2 100
                                                        20
##
                  11
                      68
                                       15
                                               10
                                                             18000 22500
##
   [5,] 2004
                  11 42
                          2 100
                                       10
                                               10
                                                       24
                                                             30000 37500
##
    [6,] 2004
                  11 45
                          1 100
                                       13
                                               10
                                                       33
                                                             50000 62500
                                       10
##
    [7,] 2004
                  11 20
                          1 100
                                               30
                                                        0
                                                             15000 18750
##
    [8,] 2004
                  11 19
                          1 100
                                       10
                                               10
                                                             18000 22500
```

```
100
                                             8
                                                              20
##
    [9,] 2004
                     11
                         18
                               2
                                                     10
                                                                    10000
                                                                            12500
##
   [10,] 2004
                     11
                         59
                               2
                                  100
                                             8
                                                     10
                                                              25
                                                                    20285
                                                                            25356
                                                              26
   [11,] 2004
                         74
                                  100
                                            15
                                                     10
                                                                    19000
                     11
                               1
                                                                            23750
   [12,] 2004
                     11
                         73
                               2
                                  100
                                            14
                                                     10
                                                              32
                                                                    24250
                                                                            30312
   [13,] 2004
                         71
                               2
                                  802
                                                     32
                                                               0
                                                                     5270
                                                                             6588
##
                     11
                                            11
                                                                            26125
   [14,] 2004
                     11
                         47
                               2
                                  802
                                            17
                                                     10
                                                                    20900
##
                                                              30
##
   [15,] 2004
                     11
                         36
                               1
                                  100
                                            10
                                                     10
                                                              19
                                                                    26048
                                                                            32560
   [16,]
                         58
                                                                    50000
##
          2014
                     42
                               1
                                  651
                                            11
                                                     10
                                                              40
                                                                            50000
##
   [17,]
          2014
                     42
                         30
                               2
                                  652
                                            16
                                                     10
                                                              40
                                                                    25000
                                                                            25000
##
   [18,] 2014
                    42
                         30
                               1
                                  652
                                            13
                                                     12
                                                               0
                                                                     5000
                                                                             5000
   [19,] 2014
                     42
                         48
                                                                    43160
                               1
                                  651
                                            10
                                                     10
                                                              50
                                                                            43160
  [20,] 2014
                    42
                         42
                               2
                                            10
                                                     10
                                                              80
                                                                    55120
                                                                            55120
##
                                  651
  [21,] 2014
                    42
                         35
                                                                    24000
##
                               1
                                  802
                                            10
                                                     10
                                                              40
                                                                            24000
##
   [22,] 2014
                    42
                         50
                               1
                                  804
                                            10
                                                     10
                                                              40
                                                                    14000
                                                                            14000
   [23,] 2014
                     42
                         39
                               1
                                  651
                                            15
                                                     10
                                                              40
                                                                    27000
                                                                            27000
   [24,] 2014
                     42
                         26
                                                                    18000
##
                                  651
                                            10
                                                     10
                                                              15
                                                                            18000
                               1
   [25,] 2014
##
                     42
                         24
                               2
                                  651
                                            17
                                                     10
                                                              40
                                                                    60000
                                                                            60000
                         26
   [26,] 2014
                     42
                                                              32
                                                                    39000
##
                               1
                                  652
                                            10
                                                     10
                                                                            39000
## [27,] 2014
                     42
                         20
                               1
                                  652
                                            10
                                                     30
                                                               0
                                                                     3480
                                                                             3480
##
  [28,] 2014
                     42
                         36
                               2
                                  100
                                            13
                                                     21
                                                               0
                                                                    55300
                                                                            55300
## [29,] 2014
                     42
                         47
                               1
                                  807
                                            10
                                                     32
                                                               0
                                                                    35000
                                                                            35000
## [30,] 2014
                     42
                         21
                               2
                                  807
                                            11
                                                     10
                                                              19
                                                                    10300
                                                                           10300
```

To find the CPI, I used the Bureau of Labor Statistics CPI Inflation Calculator, which told me that a dollar in 2004 has the same buying power as 1.25in2014. Therefore, toadjust 2004 income to its 2014 equivalent, I wrote a function that multiplied all 2004 income.

1.2 Make a new variable that is log wage income in your data

```
sample <- incomeadjust(datamatrix)
logVar <- c(rep(NA, nrow(sample)))
sample <- cbind(sample, logVar)

logVarf <- function(data.m = sample){
  for (i in 1:nrow(sample)){
    rowIncomeLog <- log(sample[i,10])
    sample[i,11] <- rowIncomeLog
}</pre>
```

```
## return(datamatrix) Commenting out so it doesn't actually return this
  return(sample)
}
logVarf(sample)
         YEAR REGION AGE SEX RACE EDUC99 EMPSTAT HRSWORK INCWAGE AdjInc
##
    [1,] 2004
                    11
                        59
                              2
                                 100
                                          13
                                                   10
                                                             2
                                                                 60000
                                                                        75000
##
    [2,] 2004
                    11
                        49
                              1
                                 100
                                          10
                                                   10
                                                            20
                                                                 32000
                                                                         40000
##
    [3,] 2004
                    11
                        42
                             2
                                 100
                                          15
                                                   10
                                                            40
                                                                 30000
                                                                         37500
##
                              2 100
    [4,] 2004
                    11
                        68
                                          15
                                                   10
                                                            20
                                                                 18000
                                                                         22500
    [5,] 2004
                             2 100
                                          10
                                                   10
                                                            24
                                                                 30000
                                                                         37500
##
                    11
                        42
    [6,] 2004
                                 100
                                                                 50000
##
                    11
                        45
                              1
                                          13
                                                   10
                                                            33
                                                                         62500
    [7,] 2004
##
                    11
                        20
                             1
                                 100
                                          10
                                                   30
                                                            0
                                                                 15000
                                                                         18750
##
    [8,] 2004
                    11
                        19
                                 100
                                          10
                                                   10
                                                                 18000
                                                                         22500
                             1
                                                            44
    [9,] 2004
##
                    11
                        18
                             2
                                 100
                                           8
                                                   10
                                                            20
                                                                 10000
                                                                         12500
## [10,] 2004
                             2
                                           8
                                                                 20285
                                                                         25356
                    11
                        59
                                 100
                                                   10
                                                            25
   [11,] 2004
##
                    11
                        74
                             1
                                 100
                                          15
                                                   10
                                                            26
                                                                 19000
                                                                         23750
  [12,] 2004
                    11
                        73
                             2 100
                                          14
                                                   10
                                                            32
                                                                 24250
                                                                         30312
##
  [13,] 2004
                    11
                        71
                             2
                                 802
                                          11
                                                   32
                                                            0
                                                                  5270
                                                                          6588
   [14,] 2004
                    11
                        47
                                 802
                                          17
                                                   10
                                                            30
                                                                 20900
                                                                         26125
  [15,] 2004
                    11
                        36
                                 100
                                                   10
                                                                 26048
##
                             1
                                          10
                                                            19
                                                                         32560
  [16,] 2014
                    42
                        58
                             1
                                 651
                                          11
                                                   10
                                                            40
                                                                 50000
                                                                         50000
  [17,] 2014
                             2
                                                                 25000
##
                   42
                        30
                                 652
                                          16
                                                   10
                                                            40
                                                                         25000
   [18,] 2014
                   42
                        30
                             1
                                 652
                                          13
                                                   12
                                                            0
                                                                  5000
                                                                          5000
## [19,] 2014
                   42
                        48
                                 651
                                          10
                                                   10
                                                            50
                                                                 43160
                                                                        43160
                             1
## [20,] 2014
                    42
                        42
                                 651
                                          10
                                                   10
                                                            80
                                                                 55120
                                                                         55120
  [21,] 2014
                    42
                        35
                                 802
                                                                 24000
                                                                         24000
##
                                          10
                                                   10
                                                            40
                              1
   [22,] 2014
                    42
                        50
                                 804
                                                   10
                                                            40
                                                                 14000
                                                                         14000
##
                             1
                                          10
   [23,] 2014
##
                    42
                        39
                             1
                                 651
                                          15
                                                   10
                                                            40
                                                                 27000
                                                                         27000
##
  [24,] 2014
                   42
                        26
                             1
                                 651
                                          10
                                                   10
                                                            15
                                                                 18000
                                                                         18000
  [25,] 2014
##
                    42
                        24
                             2
                                 651
                                                                 60000
                                                                         60000
                                          17
                                                   10
                                                            40
   [26,] 2014
##
                   42
                        26
                             1
                                 652
                                          10
                                                   10
                                                            32
                                                                 39000
                                                                         39000
   [27,] 2014
                    42
                                 652
                                                   30
                                                            0
                                                                  3480
                        20
                             1
                                          10
                                                                          3480
##
   [28,] 2014
                    42
                        36
                             2 100
                                          13
                                                   21
                                                            0
                                                                 55300
                                                                         55300
   [29,] 2014
                    42
                                 807
##
                        47
                             1
                                          10
                                                   32
                                                            0
                                                                 35000
                                                                         35000
##
   [30,] 2014
                    42
                        21
                              2
                                 807
                                          11
                                                   10
                                                            19
                                                                 10300
                                                                         10300
##
             logVar
    [1,] 11.225243
##
##
    [2,] 10.596635
##
    [3,] 10.532096
##
    [4,] 10.021271
##
    [5,] 10.532096
    [6,] 11.042922
```

```
## [7,] 9.838949
## [8,] 10.021271
## [9,] 9.433484
## [10,] 10.140771
## [11,] 10.075338
## [12,] 10.319299
## [13,] 8.793005
## [14,] 10.170648
## [15,] 10.390840
## [16,] 10.819778
## [17,] 10.126631
## [18,] 8.517193
## [19,] 10.672669
## [20,] 10.917268
## [21,] 10.085809
## [22,] 9.546813
## [23,] 10.203592
## [24,] 9.798127
## [25,] 11.002100
## [26,] 10.571317
## [27,] 8.154788
## [28,] 10.920528
## [29,] 10.463103
## [30,] 9.239899
```

1.3 Construct "potential experience", which will be "Age - years of schooling - 5"

```
sample <- logVarf(sample)
potExp <- c(rep(NA, nrow(sample)))
sample <- cbind(sample, potExp)

potExpf <- function(data.m = sample){
  for (i in 1:nrow(sample)){
    indAge = as.numeric(sample[i,3])
    indEduCode = as.numeric(sample[i,6])

  if (indEduCode < 6){
    indYrsOfSch = 9
    indPotExp = indAge - indYrsOfSch - 5
    sample[i,12] = indPotExp</pre>
```

```
if (indEduCode == 6){
  indYrsOfSch = 10
  indPotExp = indAge - indYrsOfSch - 5
  sample[i,12] = indPotExp
if (indEduCode == 7){
  indYrsOfSch = 11
  indPotExp = indAge - indYrsOfSch - 5
  sample[i,12] = indPotExp
if (indEduCode == 8){
  indYrsOfSch = 12
  indPotExp = indAge - indYrsOfSch - 5
  sample[i,12] = indPotExp
if (indEduCode == 9){
  indYrsOfSch = 13
  indPotExp = indAge - indYrsOfSch - 5
  sample[i,12] = indPotExp
if (indEduCode == 10){
  indYrsOfSch = 13
  indPotExp = indAge - indYrsOfSch - 5
  sample[i,12] = indPotExp
if (indEduCode == 11){
  indYrsOfSch = 14
  indPotExp = indAge - indYrsOfSch - 5
  sample[i,12] = indPotExp
if (indEduCode == 12){
```

```
indYrsOfSch = 15
  indPotExp = indAge - indYrsOfSch - 5
  sample[i,12] = indPotExp
if (indEduCode == 13){
 indYrsOfSch = 15
  indPotExp = indAge - indYrsOfSch - 5
  sample[i,12] = indPotExp
if (indEduCode == 14){
  indYrsOfSch = 15
  indPotExp = indAge - indYrsOfSch - 5
  sample[i,12] = indPotExp
if (indEduCode == 15){
  indYrsOfSch = 17
  indPotExp = indAge - indYrsOfSch - 5
  sample[i,12] = indPotExp
if (indEduCode == 16){
  indYrsOfSch = 19
  indPotExp = indAge - indYrsOfSch - 5
  sample[i,12] = indPotExp
if (indEduCode == 17){
  indYrsOfSch = 19
  indPotExp = indAge - indYrsOfSch - 5
  sample[i,12] = indPotExp
if (indEduCode == 18){
  indYrsOfSch = 22
  indPotExp = indAge - indYrsOfSch - 5
  sample[i,12] = indPotExp
```

```
## return(datamatrix) Commenting out so it doesn't actually return this
  return(sample)
potExpf(sample)
         YEAR REGION AGE SEX RACE EDUC99 EMPSTAT HRSWORK INCWAGE AdjInc
##
                                100
                                                                60000
                                                                        75000
##
    [1,] 2004
                   11
                        59
                             2
                                         13
                                                  10
                                                            2
                                                                32000
##
    [2,] 2004
                    11
                        49
                             1
                                100
                                         10
                                                  10
                                                           20
                                                                        40000
##
    [3,] 2004
                    11
                        42
                             2
                                100
                                         15
                                                  10
                                                           40
                                                                30000
                                                                        37500
##
    [4,] 2004
                        68
                             2
                                100
                                                           20
                                                                18000
                                                                        22500
                    11
                                         15
                                                  10
##
    [5,] 2004
                        42
                             2
                                100
                                         10
                                                  10
                                                           24
                                                                30000
                                                                        37500
                   11
    [6,] 2004
##
                   11
                        45
                             1
                                100
                                         13
                                                  10
                                                           33
                                                                50000
                                                                        62500
                                         10
##
    [7,] 2004
                   11
                        20
                             1 100
                                                  30
                                                           0
                                                                15000
                                                                        18750
##
    [8,] 2004
                    11
                        19
                             1 100
                                         10
                                                  10
                                                           44
                                                                18000 22500
##
    [9,] 2004
                    11
                        18
                             2
                               100
                                          8
                                                  10
                                                           20
                                                                10000
                                                                       12500
## [10,] 2004
                    11
                        59
                                100
                                          8
                                                  10
                                                           25
                                                                20285
                                                                        25356
  [11,] 2004
                       74
                                100
                                                                19000
##
                   11
                             1
                                         15
                                                  10
                                                           26
                                                                        23750
## [12,] 2004
                   11
                        73
                                100
                                         14
                                                  10
                                                           32
                                                                24250
                                                                        30312
## [13,] 2004
                        71
                   11
                             2
                                802
                                         11
                                                  32
                                                            0
                                                                 5270
                                                                         6588
## [14,] 2004
                   11
                        47
                             2
                                802
                                         17
                                                  10
                                                           30
                                                                20900
                                                                        26125
## [15,] 2004
                   11
                        36
                             1 100
                                         10
                                                  10
                                                           19
                                                                26048
                                                                        32560
## [16,] 2014
                   42
                        58
                                651
                                         11
                                                  10
                                                           40
                                                                50000
                                                                        50000
                             1
## [17,] 2014
                        30
                                652
                                                                25000
                                                                        25000
                   42
                             2
                                         16
                                                  10
                                                           40
## [18,] 2014
                   42
                        30
                                652
                                                            0
                                                                 5000
                                                                         5000
                             1
                                         13
                                                  12
## [19,] 2014
                   42
                        48
                             1
                                651
                                         10
                                                  10
                                                           50
                                                                43160
                                                                       43160
## [20,] 2014
                   42
                        42
                             2
                                651
                                         10
                                                  10
                                                           80
                                                                55120
                                                                        55120
## [21,] 2014
                   42
                        35
                                802
                                                                24000
                                                                        24000
                             1
                                         10
                                                  10
                                                           40
## [22,] 2014
                   42
                        50
                             1
                                804
                                         10
                                                  10
                                                           40
                                                                14000
                                                                        14000
## [23,] 2014
                                                                27000 27000
                   42
                        39
                                651
                                         15
                                                  10
                                                           40
## [24,] 2014
                   42
                        26
                             1
                                651
                                         10
                                                  10
                                                           15
                                                                18000
                                                                       18000
## [25,] 2014
                        24
                   42
                             2
                                651
                                         17
                                                  10
                                                           40
                                                                60000
                                                                        60000
## [26,] 2014
                   42
                        26
                             1
                                652
                                         10
                                                  10
                                                           32
                                                                39000
                                                                        39000
## [27,] 2014
                   42
                        20
                                652
                                         10
                                                  30
                                                            0
                                                                  3480
                                                                         3480
## [28,] 2014
                        36
                             2
                                100
                                                  21
                                                                55300
                                                                        55300
                   42
                                         13
                                                            0
##
  [29,] 2014
                   42
                        47
                             1
                                807
                                         10
                                                  32
                                                            0
                                                                35000
                                                                        35000
##
  [30,] 2014
                   42
                       21
                                807
                                                  10
                                                           19
                                                                10300
                                                                       10300
                             2
                                         11
             logVar potExp
##
##
    [1,] 11.225243
                         39
    [2,] 10.596635
                         31
```

```
##
    [3,] 10.532096
                       20
##
    [4,] 10.021271
                       46
   [5,] 10.532096
##
                       24
   [6,] 11.042922
                       25
##
    [7,] 9.838949
                        2
##
    [8,] 10.021271
                        1
##
   [9,] 9.433484
                        1
## [10,] 10.140771
                       42
## [11,] 10.075338
                       52
## [12,] 10.319299
                       53
## [13,] 8.793005
                       52
## [14,] 10.170648
                       23
## [15,] 10.390840
                       18
## [16,] 10.819778
                       39
## [17,] 10.126631
                        6
## [18,] 8.517193
                       10
## [19,] 10.672669
                       30
## [20,] 10.917268
                       24
## [21,] 10.085809
                       17
## [22,] 9.546813
                       32
## [23,] 10.203592
                       17
## [24,] 9.798127
                        8
## [25,] 11.002100
                        0
## [26,] 10.571317
                        8
## [27,] 8.154788
                        2
## [28,] 10.920528
                       16
## [29,] 10.463103
                       29
## [30,] 9.239899
```

1.4 Make a table comparing the following regressions for 2014 and 2014