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: Imtest
## 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>
datamatrix <- datamatrix[datamatrix[,9]!= 0,]</pre>
datamatrix <- datamatrix[datamatrix[,9]!= 9999999,]</pre>
```

```
incomeadjust <- function(data.m = datamatrix, sampq = TRUE){</pre>
  AdjInc <- c(rep(NA, nrow(data.m)))
 data.m <- cbind(data.m, AdjInc)</pre>
 for (i in 1:nrow(datamatrix)){
    year <- as.numeric(data.m[i,1])</pre>
    income <- as.numeric(data.m[i,9])</pre>
    if (year == 2004){
      AdjustedIncome <- income * 1.25
      data.m[i,10] = round(AdjustedIncome)
    if (year == 2014){
      AdjustedIncome <- income
      data.m[i,10] = round(AdjustedIncome)
 if (sampq == TRUE){
 top <- head(data.m, n=15)</pre>
 bottom<- tail(data.m, n=15)
  sample <- rbind(top,bottom)</pre>
 row.names(sample) <- NULL</pre>
 return(sample)
 if (sampq == FALSE){
   return(data.m)
incomeadjust(datamatrix, TRUE)
         YEAR REGION AGE SEX RACE EDUC99 EMPSTAT HRSWORK INCWAGE Adjinc
                            2 100
##
   [1,] 2004
                   11 59
                                        13
                                                 10
                                                          2
                                                              60000 75000
   [2,] 2004
                   11 49
                            1 100
                                        10
                                                 10
                                                         20
                                                              32000 40000
```

```
[3,] 2004
                                   100
                                                                40
                                                                     30000
##
                     11
                          42
                               2
                                             15
                                                      10
                                                                             37500
##
    [4,] 2004
                     11
                          68
                               2
                                   100
                                             15
                                                      10
                                                                20
                                                                      18000
                                                                              22500
    [5,]
          2004
                          42
                               2
                                   100
                                             10
                                                      10
                                                               24
                                                                     30000
                                                                             37500
##
                     11
##
    [6,]
          2004
                     11
                          45
                               1
                                   100
                                             13
                                                      10
                                                                33
                                                                     50000
                                                                              62500
    [7,]
          2004
                          20
                                   100
                                             10
                                                                0
                                                                     15000
                                                                              18750
##
                     11
                               1
                                                      30
    [8,]
          2004
                     11
                          19
                                   100
                                             10
                                                      10
                                                               44
                                                                     18000
                                                                              22500
##
                               1
                          18
##
    [9,] 2004
                     11
                               2
                                   100
                                              8
                                                      10
                                                               20
                                                                     10000
                                                                              12500
   [10,]
          2004
                          59
                                   100
                                              8
                                                      10
                                                               25
                                                                     20285
##
                     11
                               2
                                                                              25356
   [11,]
##
          2004
                     11
                          74
                               1
                                   100
                                             15
                                                      10
                                                                26
                                                                     19000
                                                                              23750
##
   [12,]
          2004
                     11
                          73
                               2
                                   100
                                             14
                                                      10
                                                               32
                                                                     24250
                                                                              30312
   [13,]
                          71
                               2
                                                                0
                                                                       5270
                                                                               6588
          2004
                     11
                                   802
                                             11
                                                      32
   [14,]
          2004
                          47
                               2
                                   802
                                             17
                                                      10
                                                               30
                                                                     20900
                                                                              26125
##
                     11
   [15,]
          2004
                          36
                                                                     26048
                                                                              32560
##
                     11
                               1
                                   100
                                             10
                                                      10
                                                               19
##
   [16,] 2014
                     42
                          58
                               1
                                   651
                                             11
                                                      10
                                                               40
                                                                     50000
                                                                              50000
   [17,] 2014
                     42
                          30
                               2
                                   652
                                             16
                                                      10
                                                               40
                                                                     25000
                                                                              25000
   [18,] 2014
                     42
                         30
                                   652
                                             13
                                                                0
                                                                       5000
                                                                               5000
##
                                                      12
                               1
   [19,] 2014
##
                     42
                          48
                               1
                                   651
                                             10
                                                      10
                                                               50
                                                                     43160
                                                                              43160
   [20,] 2014
                     42
                          42
                                                                     55120
##
                               2
                                   651
                                             10
                                                      10
                                                               80
                                                                             55120
   [21,] 2014
                     42
                          35
                               1
                                   802
                                             10
                                                      10
                                                               40
                                                                     24000
                                                                              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
                          26
##
                     42
                                   651
                                             10
                                                      10
                                                               15
                                                                     18000
                                                                              18000
                               1
   [25,] 2014
                     42
                          24
                               2
                                   651
                                             17
                                                      10
                                                               40
                                                                     60000
                                                                              60000
##
   [26,]
          2014
                     42
                          26
                                   652
                                             10
                                                      10
                                                               32
                                                                     39000
                                                                              39000
                               1
   [27,]
                     42
                          20
                                                      30
                                                                 0
                                                                       3480
                                                                               3480
##
          2014
                               1
                                   652
                                             10
##
   [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
                                                                     10300
                                                                             10300
                                             11
                                                      10
                                                                19
```

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, to adjust 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

```
testdata <- incomeadjust(datamatrix, TRUE)

logVarf <- function(data.m = testdata){
   logInc <- c(rep(NA, nrow(data.m)))
   data.m <- cbind(data.m, logInc)

for (i in 1:nrow(data.m)){</pre>
```

```
rowIncomeLog <- log(data.m[i,10])</pre>
    data.m[i,11] <- rowIncomeLog</pre>
  ## return(datamatrix) Commenting out so it doesn't actually return this
  return(data.m)
logVarf(testdata)
          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
                        42
                             2
                               100
                                                  10
                                                           40
                                                                30000
                                                                       37500
                   11
                                         15
##
    [4,] 2004
                   11
                        68
                             2
                                100
                                                  10
                                                           20
                                                                18000
                                                                        22500
                                         15
    [5,] 2004
                             2
                                                           24
                                                                30000
##
                   11
                        42
                                100
                                         10
                                                  10
                                                                        37500
##
    [6,] 2004
                   11
                        45
                             1 100
                                         13
                                                  10
                                                           33
                                                                50000
                                                                        62500
##
    [7,] 2004
                   11
                        20
                             1 100
                                         10
                                                  30
                                                           0
                                                                15000
                                                                       18750
##
    [8,] 2004
                   11
                        19
                             1 100
                                         10
                                                  10
                                                           44
                                                                18000
                                                                        22500
    [9,] 2004
##
                   11
                        18
                                100
                                          8
                                                  10
                                                           20
                                                                10000
                                                                        12500
##
  [10,] 2004
                        59
                               100
                                          8
                                                  10
                                                                20285
                   11
                             2
                                                           25
                                                                        25356
  [11,] 2004
                   11
                        74
                                100
                                         15
                                                  10
                                                           26
                                                                19000
                                                                        23750
## [12,] 2004
                       73
                                                                24250
                   11
                             2 100
                                         14
                                                  10
                                                           32
                                                                        30312
   [13,] 2004
                   11
                        71
                             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
                                651
                                                                50000
                                                                       50000
##
                   42
                        58
                                                  10
                                                           40
                             1
                                         11
  [17,] 2014
                   42
                        30
                                                  10
                                                           40
                                                                25000
                                                                        25000
##
                             2
                                652
                                         16
  [18,] 2014
                   42
                        30
                                652
                                         13
                                                  12
                                                           0
                                                                 5000
                                                                         5000
                             1
  [19,] 2014
                   42
                        48
                             1
                                651
                                         10
                                                  10
                                                           50
                                                                43160
                                                                       43160
## [20,] 2014
                   42
                        42
                             2
                                651
                                                                55120
                                                                        55120
                                         10
                                                  10
                                                           80
## [21,] 2014
                                                                24000
                   42
                        35
                             1
                                802
                                         10
                                                  10
                                                           40
                                                                        24000
## [22,] 2014
                   42
                                804
                                                                14000
                        50
                                         10
                                                  10
                                                           40
                                                                       14000
## [23,] 2014
                   42
                        39
                             1
                                651
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                                                  10
                                                           40
                                                                27000
                                                                       27000
## [24,] 2014
                   42
                        26
                                                                18000
                             1
                                651
                                         10
                                                  10
                                                           15
                                                                       18000
## [25,] 2014
                   42
                        24
                             2
                                651
                                         17
                                                  10
                                                           40
                                                                60000
                                                                        60000
  [26,] 2014
                   42
                        26
                                652
                                         10
                                                  10
                                                           32
                                                                39000
                                                                        39000
## [27,] 2014
                        20
                                                  30
                                                                 3480
                   42
                                652
                                         10
                                                           0
                                                                         3480
                             1
  [28,] 2014
                             2
                   42
                        36
                                100
                                         13
                                                  21
                                                           0
                                                                55300
                                                                        55300
##
  [29,] 2014
                   42
                        47
                                807
                                         10
                                                  32
                                                           0
                                                                35000
                                                                        35000
                             1
##
   [30,] 2014
                   42
                        21
                             2 807
                                         11
                                                  10
                                                           19
                                                                10300
                                                                       10300
##
             logInc
    [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(testdata)

potExpf <- function(data.m = testdata){

  potExp <- c(rep(NA, nrow(data.m)))
  YrsOfSch <- c(rep(NA, nrow(data.m)))
  data.m <- cbind(data.m, potExp, YrsOfSch)

for (i in 1:nrow(data.m)){</pre>
```

```
indAge = as.numeric(data.m[i,3])
indEduCode = as.numeric(data.m[i,6])
if (indEduCode < 6){</pre>
  indYrsOfSch = 9
  indPotExp = indAge - indYrsOfSch - 5
  data.m[i,12] = indPotExp
  data.m[i,13] = indYrsOfSch
if (indEduCode == 6){
 indYrsOfSch = 10
 indPotExp = indAge - indYrsOfSch - 5
 data.m[i,12] = indPotExp
 data.m[i,13] = indYrsOfSch
}
if (indEduCode == 7){
  indYrsOfSch = 11
  indPotExp = indAge - indYrsOfSch - 5
  data.m[i,12] = indPotExp
  data.m[i,13] = indYrsOfSch
if (indEduCode == 8){
 indYrsOfSch = 12
  indPotExp = indAge - indYrsOfSch - 5
 data.m[i,12] = indPotExp
 data.m[i,13] = indYrsOfSch
}
if (indEduCode == 9){
  indYrsOfSch = 13
  indPotExp = indAge - indYrsOfSch - 5
  data.m[i,12] = indPotExp
  data.m[i,13] = indYrsOfSch
if (indEduCode == 10){
  indYrsOfSch = 13
```

```
indPotExp = indAge - indYrsOfSch - 5
  data.m[i,12] = indPotExp
  data.m[i,13] = indYrsOfSch
if (indEduCode == 11){
  indYrsOfSch = 14
  indPotExp = indAge - indYrsOfSch - 5
  data.m[i,12] = indPotExp
  data.m[i,13] = indYrsOfSch
}
if (indEduCode == 12){
  indYrsOfSch = 15
  indPotExp = indAge - indYrsOfSch - 5
  data.m[i,12] = indPotExp
  data.m[i,13] = indYrsOfSch
if (indEduCode == 13){
  indYrsOfSch = 15
  indPotExp = indAge - indYrsOfSch - 5
  data.m[i,12] = indPotExp
  data.m[i,13] = indYrsOfSch
if (indEduCode == 14){
  indYrsOfSch = 15
  indPotExp = indAge - indYrsOfSch - 5
  data.m[i,12] = indPotExp
  data.m[i,13] = indYrsOfSch
if (indEduCode == 15){
  indYrsOfSch = 17
  indPotExp = indAge - indYrsOfSch - 5
  data.m[i,12] = indPotExp
  data.m[i,13] = indYrsOfSch
```

```
if (indEduCode == 16){
     indYrsOfSch = 19
     indPotExp = indAge - indYrsOfSch - 5
     data.m[i,12] = indPotExp
     data.m[i,13] = indYrsOfSch
   if (indEduCode == 17){
     indYrsOfSch = 19
     indPotExp = indAge - indYrsOfSch - 5
     data.m[i,12] = indPotExp
     data.m[i,13] = indYrsOfSch
   if (indEduCode == 18){
     indYrsOfSch = 22
     indPotExp = indAge - indYrsOfSch - 5
     data.m[i,12] = indPotExp
     data.m[i,13] = indYrsOfSch
  ## return(datamatrix) Commenting out so it doesn't actually return this
 return(data.m)
potExpf(sample)
        YEAR REGION AGE SEX RACE EDUC99 EMPSTAT HRSWORK INCWAGE Adjinc
##
   [1,] 2004
                 11 59
                        2 100
                                                         60000 75000
                                    13
                                            10
                                                    2
   [2,] 2004
                         1 100
                                            10
                                                         32000 40000
##
                 11 49
                                    10
                                                    20
##
   [3,] 2004
                 11 42
                         2 100
                                    15
                                            10
                                                    40
                                                         30000 37500
##
   [4,] 2004
                 11 68
                         2 100
                                    15
                                            10
                                                    20
                                                         18000 22500
   [5,] 2004
                 11 42
                                                         30000 37500
                        2 100
                                    10
                                            10
                                                    24
##
   [6,] 2004
                 11 45
                         1 100
                                    13
                                            10
                                                    33
                                                         50000 62500
   [7,] 2004
                 11 20
##
                         1 100
                                    10
                                            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
                        2 100
                                     8
                                            10
                                                    25
                                                         20285 25356
## [11,] 2004
                 11 74 1 100
                                    15
                                            10
                                                         19000 23750
```

```
## [12,] 2004
                       73
                             2 100
                                                  10
                                                           32
                                                                 24250 30312
                   11
                                          14
## [13,] 2004
                   11
                        71
                             2
                                802
                                                  32
                                                            0
                                                                  5270
                                                                         6588
                                          11
## [14,] 2004
                                                                 20900
                        47
                             2
                                802
                                                                        26125
                    11
                                          17
                                                  10
                                                           30
## [15,] 2004
                    11
                        36
                                 100
                                          10
                                                  10
                                                           19
                                                                 26048
                                                                        32560
## [16,] 2014
                   42
                        58
                                 651
                                                           40
                                                                 50000
                                                                        50000
                             1
                                          11
                                                  10
##
   [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
                                 651
                                                  10
                                                                 43160
                                                                        43160
                        48
                             1
                                          10
                                                           50
## [20,] 2014
                                                  10
                   42
                        42
                             2
                                 651
                                          10
                                                           80
                                                                 55120
                                                                        55120
## [21,] 2014
                   42
                        35
                             1
                                802
                                          10
                                                  10
                                                           40
                                                                 24000
                                                                        24000
## [22,] 2014
                   42
                        50
                                 804
                                                           40
                                                                 14000
                             1
                                          10
                                                  10
                                                                        14000
## [23,] 2014
                   42
                        39
                                 651
                                                  10
                                                           40
                                                                 27000
                                                                        27000
                             1
                                          15
## [24,] 2014
                        26
                                                                 18000
                   42
                             1
                                 651
                                          10
                                                  10
                                                           15
                                                                        18000
## [25,] 2014
                   42
                        24
                             2
                                651
                                          17
                                                  10
                                                           40
                                                                 60000
                                                                        60000
##
  [26,] 2014
                   42
                        26
                             1
                                 652
                                          10
                                                  10
                                                           32
                                                                 39000
                                                                        39000
  [27,] 2014
                        20
                                 652
                                          10
                                                  30
                                                            0
                                                                  3480
                                                                         3480
##
                   42
                             1
##
   [28,] 2014
                   42
                        36
                             2
                                100
                                          13
                                                  21
                                                            0
                                                                 55300
                                                                        55300
   [29,] 2014
                   42
                        47
                                807
                                                                 35000
##
                             1
                                          10
                                                  32
                                                            0
                                                                        35000
##
   [30,] 2014
                   42
                        21
                             2
                                807
                                          11
                                                  10
                                                           19
                                                                 10300
                                                                        10300
##
             logInc potExp YrsOfSch
##
    [1,] 11.225243
                         39
                                   15
                                   13
##
    [2,] 10.596635
                         31
##
    [3,] 10.532096
                         20
                                   17
##
    [4,] 10.021271
                         46
                                   17
    [5,] 10.532096
                         24
                                   13
##
##
    [6,] 11.042922
                         25
                                   15
##
    [7,] 9.838949
                          2
                                   13
##
    [8,] 10.021271
                          1
                                   13
##
    [9,] 9.433484
                          1
                                   12
## [10,] 10.140771
                         42
                                   12
  [11,] 10.075338
                         52
                                   17
  [12,] 10.319299
##
                         53
                                   15
## [13,] 8.793005
                         52
                                   14
## [14,] 10.170648
                         23
                                   19
## [15,] 10.390840
                         18
                                   13
## [16,] 10.819778
                         39
                                   14
## [17,] 10.126631
                         6
                                   19
## [18,] 8.517193
                         10
                                   15
## [19,] 10.672669
                         30
                                   13
## [20,] 10.917268
                         24
                                   13
## [21,] 10.085809
                         17
                                   13
## [22,] 9.546813
                         32
                                   13
## [23,] 10.203592
                         17
                                   17
## [24,] 9.798127
                          8
                                   13
## [25,] 11.002100
                                   19
                          0
```

```
## [26,] 10.571317 8 13

## [27,] 8.154788 2 13

## [28,] 10.920528 16 15

## [29,] 10.463103 29 13

## [30,] 9.239899 2 14
```

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

```
library(stargazer)

regData <- incomeadjust(datamatrix, FALSE)
regData <- logVarf(regData)
regData <- potExpf(regData)</pre>
```