SOCY7706: Longitudinal Data Analysis
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Describing Longitudinal Data

Next, we examine some tools that allow us to describe change using longitudinal data. We will use an example from HRS data that focuses on employment and caregiving.

```
. use http://sarkisian.net/socy7706/hrs_hours.dta

. reshape long r@workhours80 r@poorhealth r@married r@totalpar  r@siblog h@childlg
r@allparhelptw, i(hhid pn) j(wave)
(note: j = 1 2 3 4 5 6 7 8 9)

Data                               wide   ->   long
-----------------------------------------------------------------------------
Number of obs.                     6591   ->   59319
Number of variables                  75   ->      20
j variable (9 values)                     ->   wave
xij variables:
r1workhours80 r2workhours80 ... r9workhours80->rworkhours80
r1poorhealth r2poorhealth ... r9poorhealth->   rpoorhealth
      r1married r2married ... r9married   ->   rmarried
   r1totalpar r2totalpar ... r9totalpar   ->   rtotalpar
         r1siblog r2siblog ... r9siblog   ->   rsiblog
      h1childlg h2childlg ... h9childlg   ->   hchildlg
r1allparhelptw r2allparhelptw ... r9allparhelptw->rallparhelptw
-----------------------------------------------------------------------------

. tab wave
       wave |      Freq.     Percent        Cum.
------------+-----------------------------------
          1 |      6,591       11.11       11.11
          2 |      6,591       11.11       22.22
          3 |      6,591       11.11       33.33
          4 |      6,591       11.11       44.44
          5 |      6,591       11.11       55.56
          6 |      6,591       11.11       66.67
          7 |      6,591       11.11       77.78
          8 |      6,591       11.11       88.89
          9 |      6,591       11.11      100.00
------------+-----------------------------------
      Total |     59,319      100.00
```

To keep things simpler for now, we will keep only two time points, but use preserve to return to the full data.

```
. preserve

. keep if wave<3
(46137 observations deleted)
```

Stata provides a number of tools for analyzing panel data. The commands all begin with the prefix xt. To use these commands, we first need to tell Stata that our dataset is a panel dataset. We need to have a variable that identifies the units (for example, a country or person id) and a time variable. To set a dataset as a panel, we need to use xtset command:

```
. xtset hhidpn wave
```

```
       panel variable:  hhidpn (strongly balanced)
        time variable:  wave, 1 to 2
                delta:  1 unit
```

Stata thinks the dataset is strongly balanced, meaning all units are observed at all time points (at the same time and equal number of times). But it is not true – we just have empty rows that were created when we went from wide to long format.

```
. xtdes

  hhidpn:  10003020, 10004010, ..., 99564010                n =       6591
    wave:  1, 2, ..., 2                                     T =          2
           Delta(wave) = 1 unit
           Span(wave)  = 2 periods
           (hhidpn*wave uniquely identifies each observation)

Distribution of T_i:   min      5%     25%       50%       75%     95%     max
                         2       2       2         2         2       2       2

     Freq.  Percent    Cum. |  Pattern
 ---------------------------+---------
     6591    100.00  100.00 |  11
 ---------------------------+---------
     6591    100.00         |  XX
```

Xtdes also thinks all cases are complete. We will now delete those empty records to have a more accurate picture. Note that those rows are not completely empty – time-invariant variables still have values there, but the time-variant ones are empty. So we will only specify time-varying variables in the egen command:

```
. egen miss=rowmiss( rworkhours80 rpoorhealth rmarried rtotalpar rsiblog hchildlg
rallparhelptw)

. tab miss
       miss |      Freq.     Percent        Cum.
------------+-----------------------------------
          0 |     11,327       85.93       85.93
          1 |      1,017        7.72       93.64
          2 |        115        0.87       94.52
          3 |         90        0.68       95.20
          4 |          7        0.05       95.25
          5 |          3        0.02       95.27
          6 |        364        2.76       98.04
          7 |        259        1.96      100.00
------------+-----------------------------------
      Total |     13,182      100.00

. drop if miss==7
(259 observations deleted)

. xtset  hhidpn wave
       panel variable:  hhidpn (unbalanced)
        time variable:  wave, 1 to 2
                delta:  1 unit
```

This is more accurate now, and xtdes also shows that there are missing observations at time 2.

```
. xtdes

  hhidpn:  10003020, 10004010, ..., 99564010                n =       6591
    wave:  1, 2, ..., 2                                     T =          2
           Delta(wave) = 1 unit
           Span(wave)  = 2 periods
           (hhidpn*wave uniquely identifies each observation)

Distribution of T_i:   min      5%     25%       50%       75%     95%     max
                         1       2       2         2         2       2       2

     Freq.  Percent    Cum. |  Pattern
 ---------------------------+---------
     6332     96.07   96.07 |  11
      259      3.93  100.00 |  1.
 ---------------------------+---------
     6591    100.00         |  XX
```

Next, let's examine change in a continuous variable.

```
. xtsum rworkhours80
Variable         |      Mean   Std. Dev.       Min        Max |    Observations
-----------------+--------------------------------------------+----------------
rwork~80 overall |  29.53971   22.79859          0         80 |     N =   12477
         between |             21.33473          0         80 |     n =    6580
         within  |             8.392351  -10.46029   69.53971 | T-bar =  1.8962
```

Here we see overall standard deviation along with between and within standard deviations – between indicates the amount of variation across individuals (cross-sectional variation, or differences among individuals that are stable over time), and within indicates change over time within individuals (temporal variation). Between variation is essentially variation of average values for individuals over time, and within variation is variation in differences between values at each time point and averages for a given individual (i.e. individual's deviation from their own overall mean). That is why the minimum and maximum differ from those for overall and between, and can be negative. Moreover, the way they calculate minimum and maximum is such that these are not just differences from the individual's mean, but such differences plus the overall mean (in this case, 29.5). So the person who has 69.5 (maximum value) in fact only differs from his or her own mean by 69.5-29.5=40 hours. And the minimum value, -10.5, is in fact -10.5-29.5=-40. So it is fairly symmetric, which is what we would expect. Observation column shows that there are 12477 records, 6580 individuals, and an average of 1.8962 time points per person.

So this output allows us to decompose the variance in the variable we are describing into variance components -- into within-group and between-group variance (although they are expressed as standard deviations – to get variances, we'd have to square them). That does not explain anything, but it allows us to evaluate whether there is variation in group means (here, person-specific means), and how much of it. That's why it is always a good idea to run this basic model when starting the analyses – it's the null model of our regression analysis. If we find that there is no significant variation across individuals, then there is no need to adjust for the fact that clusters of observations come from the same individuals because all individuals are pretty much the same.

The proportion of variance due to group-level variation in means can be calculated as

$\rho = S^2_{between} / (S^2_{between} + S^2_{within})$

It can be interpreted as the proportion of variance due to differences across individuals. It can also be interpreted as the average correlation between two randomly chosen time points that are in the same unit; therefore, it is also known as intra-class correlation. Here, we get:

```
. di 21.33473^2 / (21.33473^2 + 8.392351^2)
.86599838
```

So 87% of the total variance in hours of work is due to person-specific effects; the rest is due to changes that individuals experience over time.

To examine change in categorical variables, we can use both xttab and xttrans.

```
. xttab rmarried
                  Overall             Between            Within
 rmarried |    Freq.  Percent      Freq.  Percent        Percent
----------+-----------------------------------------------------
        0 |     2662     21.20       1532     23.24          92.13
        1 |     9895     78.80       5300     80.41          97.73
----------+-----------------------------------------------------
    Total |    12557    100.00       6832    103.66          96.47
                                (n = 6591)
```

Here we can see that overall, out of all records in the data, 78.8% indicate that the person is currently married, and 21.2% indicate that the person is currently single. Between percent indicates that 80.41% of all individuals in the data were married at some point during the study (or in this case that means that they were married at either wave 1 or wave 2), and 23.24% of individuals were single at some point during the study period. The total is larger than 100 because any person who experienced both marriage and singlehood over this time period will be counted twice. Within percent indicates that among those individuals that were married at some point, they were married 97.73% of all of their data points, and among those who were single at some point, they were single 92.13% of all of their data points. The total for within is a weighted average – the number of people with at least one 0 multiplied by the proportion of 0s among these people's records + the number of people with at least one 1 multiplied by the proportion of 1s among these people's records, all divided by the total of those with at least one 1 and those with at least one 0. So here:

```
. di (1532*.9213+5300*.9773)/(1532+5300)
.96474262
```

```
. xttrans  rmarried, freq
           |       rmarried
  rmarried |         0          1 |     Total
-----------+----------------------+----------
         0 |     1,130         87 |     1,217
           |     92.85       7.15 |    100.00
-----------+----------------------+----------
         1 |       154      4,595 |     4,749
           |      3.24      96.76 |    100.00
-----------+----------------------+----------
     Total |     1,284      4,682 |     5,966
           |     21.52      78.48 |    100.00
```

Xttrans shows transitions among statuses: so here we see that among those who were married at time point 1, 96.76% were still married at time point 2, while 3.24% were no longer married. Of those who were single at time 1, 92.85% were still single at time 2 and 7.15% were no longer single.

If we have more than 2 time points, xttab and xttrans put them all together. For example, let's go back to all 9 waves.

```
. restore
```

Let's once again get rid of those "empty" observations (with no data for a given wave):

```
. egen miss=rowmiss( rworkhours80 rpoorhealth rmarried rtotalpar rsiblog hchildlg
rallparhelptw)

. tab miss

       miss |      Freq.     Percent        Cum.
------------+-----------------------------------
          0 |     30,546       51.49       51.49
          1 |     15,030       25.34       76.83
          2 |      1,435        2.42       79.25
          3 |        143        0.24       79.49
          4 |          7        0.01       79.50
          5 |          3        0.01       79.51
          6 |      7,512       12.66       92.17
          7 |      4,643        7.83      100.00
------------+-----------------------------------
      Total |     59,319      100.00

. drop if miss==7
(4643 observations deleted)

. xtset  hhidpn wave
       panel variable:  hhidpn (unbalanced)
        time variable:  wave, 1 to 9, but with gaps
                delta:  1 unit
```

Let's save this file:

```
. save hrs_hours_long.dta
```

And now we can describe the data:

```
. xtdes

  hhidpn:  10003020, 10004010, ..., 99564010                  n =       6591
    wave:  1, 2, ..., 9                                       T =          9
           Delta(wave) = 1 unit
           Span(wave)  = 9 periods
           (hhidpn*wave uniquely identifies each observation)

Distribution of T_i:   min      5%     25%       50%       75%     95%     max
                         1       3       9         9         9       9       9

     Freq.  Percent    Cum. |  Pattern
 ---------------------------+-----------
     5540     84.05   84.05 |  111111111
      154      2.34   86.39 |  11.......
      137      2.08   88.47 |  1........
       84      1.27   89.74 |  1111.....
       81      1.23   90.97 |  11111....
       73      1.11   92.08 |  11111111.
       69      1.05   93.13 |  111......
```

```
       55      0.83   93.96 |  1111111..
       49      0.74   94.70 |  111111...
      349      5.30  100.00 | (other patterns)
 ---------------------------+-----------
     6591    100.00         |  XXXXXXXXX

. xtsum rworkhours80 rpoorhealth rmarried rtotalpar rsiblog hchildlg rallparhelptw

Variable         |      Mean   Std. Dev.       Min        Max |    Observations
-----------------+--------------------------------------------+----------------
rwork~80 overall |  19.67817   22.46339          0         80 |     N =   46661
         between |             17.10868          0         80 |     n =    6587
         within  |              15.5263  -48.89326   90.78928 | T-bar =  7.0838
                 |                                            |
rpoorh~h overall |  .2340638   .4234167          0          1 |     N =   47141
         between |             .3401185          0          1 |     n =    6591
         within  |             .2765936  -.6548251   1.122953 | T-bar = 7.15233
                 |                                            |
rmarried overall |  .7463865   .4350836          0          1 |     N =   47115
         between |             .3947182          0          1 |     n =    6591
         within  |             .1958791  -.1425024   1.635275 | T-bar = 7.14838
                 |                                            |
rtotal~r overall |  .8884476   .8662165          0          4 |     N =   46830
         between |             .6585949   .1111111          4 |     n =    6591
         within  |             .6045806  -2.111552   4.138448 | T-bar = 7.10514
                 |                                            |
rsiblog  overall |  1.616775   .6256698          0   3.555348 |     N =   54595
         between |             .6154972          0   3.218876 |     n =    6588
         within  |             .1870047  -.0368364   3.663518 | T-bar = 8.28704
                 |                                            |
hchildlg overall |  1.126299   .5481416          0   2.944439 |     N =   44219
         between |             .5389137          0   2.876082 |     n =    6272
         within  |             .1319155  -.4992974   2.794222 | T-bar = 7.05022
                 |                                            |
rallpa~w overall |  1.652933   4.103339          0   19.23077 |     N =   32727
         between |             2.651108          0   19.23077 |     n =    6588
         within  |             3.228803  -14.14377   18.74695 | T-bar = 4.96767

. for var rpoorhealth rmarried : xttab X

->  xttab rpoorhealth
                  Overall             Between            Within
rpoorhe~h |    Freq.  Percent      Freq.  Percent        Percent
----------+-----------------------------------------------------
        0 |   36107     76.59      5995     90.96          82.10
        1 |   11034     23.41      3285     49.84          50.82
----------+-----------------------------------------------------
    Total |   47141    100.00      9280    140.80          71.02
                               (n = 6591)

->  xttab rmarried
                  Overall             Between            Within
 rmarried |    Freq.  Percent      Freq.  Percent        Percent
----------+-----------------------------------------------------
        0 |   11949     25.36      2404     36.47          70.58
        1 |   35166     74.64      5455     82.76          89.72
----------+-----------------------------------------------------
    Total |   47115    100.00      7859    119.24          83.87
                               (n = 6591)
```

```
. for var rpoorhealth rmarried : xttrans X

->  xttrans rpoorhealth
rpoorhealt |      rpoorhealth
         h |         0          1 |     Total
-----------+----------------------+----------
         0 |     89.35      10.65 |    100.00
         1 |     28.72      71.28 |    100.00
-----------+----------------------+----------
     Total |     76.09      23.91 |    100.00

->  xttrans rmarried
           |       rmarried
  rmarried |         0          1 |     Total
-----------+----------------------+----------
         0 |     95.77       4.23 |    100.00
         1 |      3.49      96.51 |    100.00
-----------+----------------------+----------
     Total |     26.10      73.90 |    100.00
```

It could also be helpful to continue looking at specific transitions, either taking two waves at a time or as sequences of transitions over a number of waves. The latter approach led to a technique called sequence analysis (or social sequence analysis when used in social sciences). If interested, see, for example, “Social Sequence Analysis” book by Benjamin Cornwall (2015). To see some basic sequences, let’s use a special package:

```
. net search sequence
(contacting http://www.stata.com)

33 packages found (Stata Journal and STB listed first)
------------------------------------------------------

st0244 from http://www.stata-journal.com/software/sj12-1
    SJ12-1 st0244.  Scrambled Halton sequences in Mata / Scrambled Halton
    sequences in Mata / by Stanislav Kolenikov, University of Missouri,
    Columbia, USA / Support:  skolenik@gmail.com

st0111 from http://www.stata-journal.com/software/sj6-4
    SJ6-4 st0111.  Sequence analysis with Stata / Sequence analysis with Stata
    / by Christian Brzinsky-Fay, Wissenschaftszentrum Berlin / Ulrich Kohler,
    Wissenschaftszentrum Berlin / Magdalena Luniak, Wissenschaftszentrum
    Berlin / Support:  brzinsky-fay@wz-berlin.de, kohler@wz-berlin.de,

st0103 from http://www.stata-journal.com/software/sj6-2
    SJ6-2 st0103.  Generating Halton sequences using Mata / Generating Halton
    sequences using Mata / by David Drukker, StataCorp / Richard Gates,
    StataCorp / Support:  rgates@stata.com / After installation, type help
    sj_halton

dm55 from http://www.stata.com/stb/stb43
    STB-43 dm55.  Generating sequences and patterns of numeric data. / STB
    insert by R. Mark Esman, Stata Corporation. / Support: mesman@stata.com /
    After installation, see help fill.

dm44 from http://www.stata.com/stb/stb37
    STB-37 dm44.  Sequences of integers. / STB insert by Nicholas J. Cox,
    University of Durham, UK. / Support:  n.j.cox@durham.ac.uk / After
    installation, see help seq.
```

```
sadi from http://teaching.sociology.ul.ie/sadi
    Sequence Analysis Distance Measures / {bf: Brendan Halpin, Dept of
    Sociology, Univer
--Break--
r(1);
```

We will install st0111 from http://www.stata-journal.com/software/sj6-4

```
. sqset rmarried hhidpn wave

Note: Some sequences contains gaps
Consider option -keeplongest-

Note: Some sequences have missings at the end
Consider option -rtrim-

       element variable:  rmarried, 0 to 1, and missings
       identifier variable:  hhidpn, 10003020 to 99564010
       order variable:  wave, 1 to 9

. sqtab

Sequence-Pa |
      ttern |      Freq.     Percent        Cum.
------------+-----------------------------------
  111111111 |      2,283       41.74       41.74
  000000000 |        508        9.29       51.03
        111 |        209        3.82       54.85
          1 |        206        3.77       58.62
         11 |        194        3.55       62.17
      11111 |        165        3.02       65.19
       1111 |        157        2.87       68.06
   11111111 |        155        2.83       70.89
     111111 |        120        2.19       73.08
    1111111 |        117        2.14       75.22
  111111110 |         93        1.70       76.92
         00 |         75        1.37       78.30
          0 |         73        1.33       79.63
  111000000 |         70        1.28       80.91
  111110000 |         62        1.13       82.04
  111111100 |         59        1.08       83.12
  111111000 |         57        1.04       84.17
  110000000 |         54        0.99       85.15
       0000 |         52        0.95       86.10
      00000 |         50        0.91       87.02
  111100000 |         49        0.90       87.91
  100000000 |         48        0.88       88.79
   00000000 |         45        0.82       89.61
        000 |         41        0.75       90.36
    0000000 |         39        0.71       91.08
  011111111 |         36        0.66       91.74
     000000 |         24        0.44       92.17
  000011111 |         22        0.40       92.58
         10 |         11        0.20       92.78
        110 |         11        0.20       92.98
   11111110 |         11        0.20       93.18
…[output omitted]…
  111110110 |          1        0.02       99.98
   11111101 |          1        0.02      100.00
------------+-----------------------------------
      Total |      5,469      100.00
```

While all of these tools are helpful to better understand the nature of change in your data, such analyses rarely directly appear in articles using longitudinal data – typically, tables of descriptive statistics take one of the following approaches, or some combination:

1. Show means (and standard deviations) for each year, or some select years (e.g., the first and last year of the time sequence), or select ages – this approach aims to show how various variables in the study changed over time, but does not target change within individuals.
2. Show means and standard deviations for pooled data (entire long dataset, where units are person-years or country-years, etc.). This does not focus on change over time (either overall or individual) but rather aims at describing the dataset overall.
3. Show averages or frequencies of changes, transitions, or trajectories of individuals.

Examples:

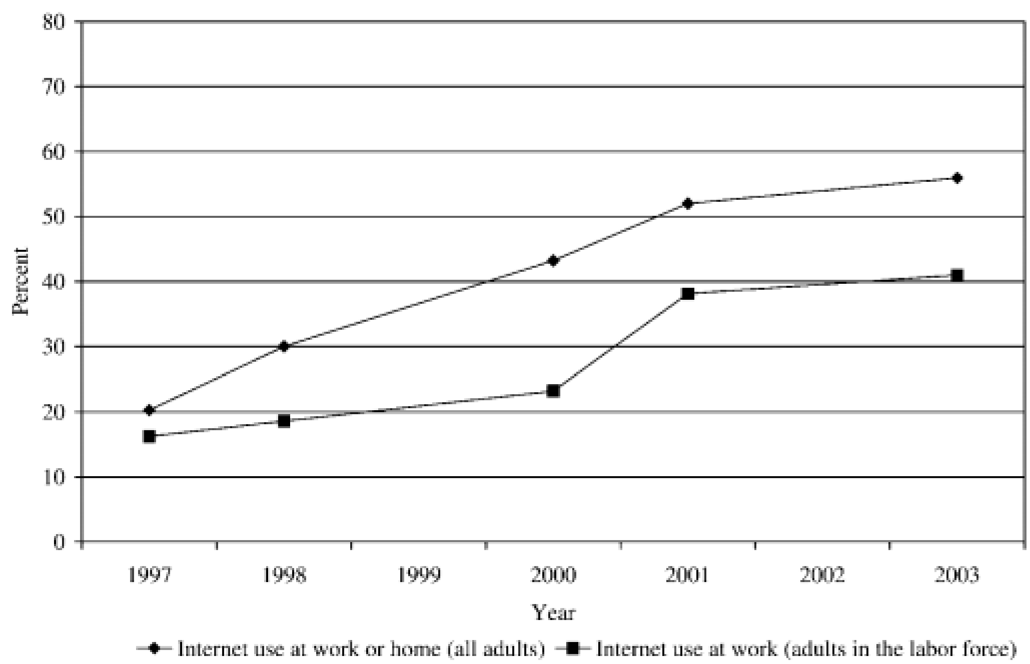


Figure 1. Internet Use, 1997 to 2003

Source: Current Population Survey Internet and Computer Use Supplements, 1997, 2000, 2001, and 2003.

From: DiMaggio, Paul, and Bart Bonikowski. 2008. “Make Money Surfing the Web? The Impact of Internet Use on the Earnings of U.S. Workers.” *American Sociological Review* 73: 227–250.

Table 1. Descriptive Statistics for Dependent and Explanatory Measures, 1970 to 2010

Measures	Overall Mean	Overall (SD)	1970 Mean	1970 (SD)	1980 Mean	1980 (SD)	1990 Mean	1990 (SD)	2000 Mean	2000 (SD)	2010 Mean	2010 (SD)
White Homicide Rate	4.3	(2.7)	4.4	(2.8)	6.1	(3.5)	4.6	(2.2)	3.3	(1.5)	2.9	(1.4)
Black Homicide Rate	31.1	(15.8)	42.2	(16.0)	35.2	(14.1)	36.0	(15.3)	21.5	(9.9)	20.4	(10.0)
B-W Index of Dissimilarity	64.5	(12.5)	75.8	(9.5)	68.0	(10.1)	63.5	(10.9)	59.6	(10.8)	55.4	(10.4)
Black Measures												
Poverty[a]	27.6	(7.5)	30.1	(8.8)	26.8	(5.1)	28.8	(7.9)	24.6	(6.3)	27.7	(7.5)
Unemployment[a]	12.2	(5.0)	7.6	(2.9)	11.8	(4.1)	13.0	(4.1)	11.2	(2.7)	17.3	(5.1)
Single-Parent Families[a]	53.5	(13.1)	37.6	(6.3)	49.0	(7.7)	57.1	(8.6)	60.3	(9.7)	63.7	(12.6)
High Income	9.6	(5.7)	3.8	(2.6)	7.6	(3.0)	10.1	(4.5)	13.7	(5.0)	12.7	(6.0)
Manufacturing	16.5	(9.8)	22.9	(10.7)	22.6	(10.4)	15.6	(7.4)	12.7	(5.9)	8.8	(4.4)
Residential Instability	25.2	(8.3)	14.6	(4.6)	27.7	(7.2)	28.4	(6.7)	26.5	(5.2)	28.6	(7.5)
Young Men	9.2	(2.5)	9.5	(2.9)	11.1	(3.5)	8.7	(1.7)	8.1	(1.1)	8.8	(1.6)
Foreign-Born Pop.	3.6	(5.6)	0.5	(0.8)	2.1	(2.6)	3.1	(4.4)	4.6	(6.2)	7.5	(7.9)
White Measures												
Poverty[b]	8.0	(2.3)	8.3	(2.2)	7.4	(1.5)	7.5	(2.0)	7.1	(1.8)	9.8	(2.8)
Unemployment[b]	5.3	(2.5)	3.7	(1.3)	5.1	(1.7)	4.6	(1.1)	4.2	(0.9)	9.0	(2.5)
Single-Parent Families[b]	17.7	(5.5)	10.9	(2.2)	15.0	(2.3)	17.6	(2.6)	20.7	(3.4)	24.1	(4.5)
High Income	27.1	(9.6)	16.2	(4.1)	23.5	(5.2)	29.0	(7.6)	34.2	(7.9)	32.8	(8.7)
Manufacturing	16.8	(8.6)	23.8	(9.7)	20.8	(8.4)	16.3	(6.3)	13.1	(5.5)	10.3	(4.2)
Residential Instability	19.0	(5.7)	12.6	(3.5)	23.7	(5.7)	20.5	(4.9)	18.6	(3.8)	19.3	(3.9)
Young Men	7.6	(1.7)	8.9	(2.0)	9.3	(1.1)	7.0	(0.9)	6.3	(0.8)	6.4	(0.8)
Foreign-Born Pop.	3.2	(2.6)	1.8	(1.3)	3.7	(2.7)	3.1	(2.5)	3.4	(2.7)	3.9	(3.1)
Overall Measures												
Percent Black	12.7	(9.7)	10.8	(8.7)	12.0	(9.4)	12.5	(9.6)	13.7	(10.2)	14.5	(10.3)
Incarceration Rate	283.4	(190.0)	93.7	(31.4)	138.9	(62.0)	294.1	(115.1)	446.1	(176.5)	444.4	(149.0)
Police per Capita	194.3	(74.3)	157.4	(47.8)	182.6	(63.2)	192.3	(74.1)	218.9	(80.3)	220.2	(82.3)
N	515	515	103	103	103	103	103	103	103	103	103	103

Note: Results are unweighted.
[a]Measures comprise the Black Disadvantage Index.
[b]Measures comprise the White Disadvantage Index.

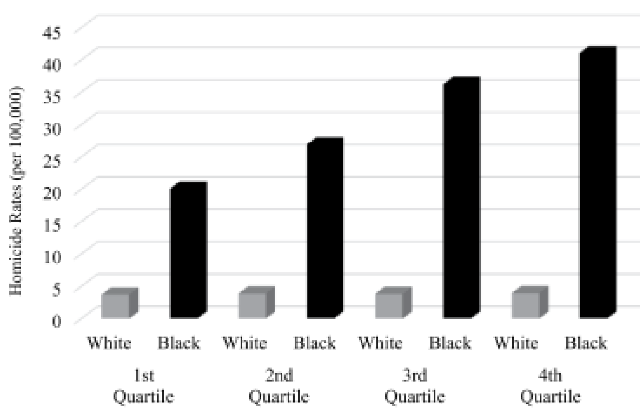


Figure 1. Black and White Homicide Rates across Different Levels of Segregation, 1970 to 2010
Note: The analysis includes 103 MSAs. Homicide rates are weighted by the size of the respective populations. The dissimilarity range for each quartile is as follows: 1st (29.1 to 56.3); 2nd (56.3 to 65.1); 3rd (65.2 to 73.6); and 4th (73.8 to 91.5).

From: Light, Michael T. and Julia T. Thomas. 2019. "Segregation and Violence Reconsidered: Do Whites Benefit from Residential Segregation?" *American Sociological Review*, 84(4): 690–725.

Table 1. Health Problems by Gender at Age 40 and 50 among All Individuals and among Married Individuals

	Age 40				Age 50				
	Total		Married		Total		Married		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Range
Women									
Chronic Conditions	.56	.88	.51	.81	1.17	1.28	1.02	1.16	[0, 7]
Self-Rated Health	2.32	1.01	2.20	.97	2.58	1.06	2.43	.99	[1, 5]
Physical Functioning	48.32	8.76	47.55	7.88	51.29	10.88	50.04	9.92	[33.4, 88.8]
Men									
Chronic Conditions	.43	.73	.39	.68	.98	1.13	.89	1.07	[0, 7]
Self-Rated Health	2.24	.96	2.18	.93	2.49	1.03	2.35	.96	[1, 5]
Physical Functioning	47.00	6.73	46.83	6.57	49.57	9.00	48.67	8.01	[32.8, 88.4]

Note: Range represents observed range across both waves. Self-rated health and physical functioning are reverse coded so that higher values indicate worse health for all variables in the analysis. The theoretical range for physical function is 1-excellent to 100-poor.

Table 3. Individual-Level Descriptive Statistics (For Person-Years in Full Sample and Married Subsample)

	Total		Married		
	Mean	SD	Mean	SD	Range
Age (years)	45.8	4.8	45.8	4.8	[39, 55]
Household income ($k)	75.1	74.9	95.2	80.5	[0, 498]
Education (years)	13.5	2.5	13.7	2.6	[0, 20]
Duration in state of residence (years)	9.1	2.4	9.1	2.3	[0, 10]
Men	46.3%		46.9%		
Non-white	19.3%		12.8%		
Married	64.1%		100%		
Have children	80.8%		88.7%		
Have health insurance	84.9%		91.0%		
Divorced during period	10.1%		7.9%		
N (person-years)	6,754		4,336		

From: Homan, Patricia. 2019. "Structural Sexism and Health in the United States: A New Perspective on Health Inequality and the Gender System." *American Sociological Review*, 84(3): 486–516.

Table 1. Average Mobility Patterns by Years of Potential Experience and Sex

	4 Years of Potential Experience					8 Years of Potential Experience					12 Years of Potential Experience				
	Men		Women		Sex Diff.	Men		Women		Sex Diff.	Men		Women		Sex Diff.
	Mean	SD	Mean	SD		Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Cumulative Employer Changes															
All	2.83	1.76	2.65	1.57	**	4.86	2.80	4.41	2.37	***	6.39	3.55	5.74	2.99	***
Layoffs	.99	.97	.70	.74	***	1.61	1.46	1.13	1.08	***	2.09	1.83	1.52	1.35	***
Discharges	.19	.39	.13	.32	***	.30	.56	.22	.46	***	.36	.63	.29	.59	**
Family-related	.03	.14	.20	.36	***	.05	.19	.39	.53	***	.06	.22	.54	.63	***
Other	1.81	1.25	1.83	1.21		3.05	1.95	3.00	1.81		4.08	2.54	3.90	2.30	*
Tenure (years)	2.10	1.48	2.03	1.38		3.39	2.34	3.25	2.21		4.55	3.20	4.45	3.03	
Percent time employed	85.40	15.50	76.50	20.40	***	87.50	13.40	75.80	19.40	***	88.30	12.70	75.10	18.90	***
Employment gaps (≥ 8 weeks)	1.34	1.14	1.64	1.22	***	2.03	1.77	2.89	2.07	***	2.52	2.25	4.06	2.82	***

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$ (two-tailed tests).

Table 2. Percentage Distribution of Cumulative Employer Changes by Years of Potential Experience and Sex

Cumulative Employer Changes	Years of Potential Experience: 1		4		8		12	
	Men	Women	Men	Women	Men	Women	Men	Women
0	40.9	43.2	12.5	13.2	5.8	6.0	2.9	3.7
1	35.1	33.2	20.5	21.0	11.1	12.4	8.6	8.2
2	16.6	16.9	18.6	20.5	12.5	13.2	9.4	10.0
3	5.8	4.7	16.9	16.3	13.1	14.6	10.1	11.8
4	1.2	1.8	12.0	11.8	13.3	11.8	10.1	10.7
5	.2	.1	7.3	7.4	9.6	11.5	9.1	10.7
6	.0	.0	4.8	4.3	8.9	8.0	9.2	8.9
7	.1		3.2	2.6	5.6	7.1	8.0	7.9
8			1.8	1.4	4.3	5.0	5.8	7.2
9			1.0	.8	4.7	3.0	5.6	4.8
10			.4	.2	2.7	2.7	3.4	4.5
11			.5	.3	2.4	1.3	3.8	2.8
12+			.4	.4	6.2	3.6	14.1	8.9

From: Fuller, Sylvia. 2008. "Job Mobility and Wage Trajectories for Men and Women in the United States." *American Sociological Review* 73: 158–183.

Let's look at similar descriptive stats and graphs for our data.
Pooled means (only for time-varying variables):

```
. mean rworkhours80 rpoorhealth rmarried rtotalpar rsiblog hchildlg rallparhelptw

Mean estimation                   Number of obs   =     30,546

--------------------------------------------------------------
              |       Mean   Std. Err.     [95% Conf. Interval]
--------------+-----------------------------------------------
 rworkhours80 |   23.16339   .1316364      22.90538    23.42141
  rpoorhealth |   .2183592   .0023638       .213726    .2229924
     rmarried |   .8119885   .0022356      .8076066    .8163704
    rtotalpar |   1.270019   .0044539      1.261289    1.278749
      rsiblog |   1.676201   .0035233      1.669295    1.683107
     hchildlg |   1.121192   .0031265      1.115064    1.127321
rallparhelptw |   1.620912     .02321      1.575419    1.666404
--------------------------------------------------------------
```

Time-specific means (we could then decide which waves to report):

```
.  mean rworkhours80 rpoorhealth rmarried rtotalpar rsiblog hchildlg rallparhelptw,
over(wave)
Mean estimation                     Number of obs   =     30,546

            1: wave = 1
            2: wave = 2
            3: wave = 3
            4: wave = 4
            5: wave = 5
            6: wave = 6
            7: wave = 7
            8: wave = 8
            9: wave = 9
---------------------------------------------------------------
         Over |       Mean   Std. Err.     [95% Conf. Interval]
--------------+------------------------------------------------
rworkhours80  |
            1 |   30.61686   .2907706      30.04694    31.18679
            2 |   28.20681   .3175137      27.58447    28.82915
            3 |   25.67603   .3440231      25.00173    26.35033
            4 |    23.1508   .3639189      22.43751     23.8641
            5 |   20.20652   .3977902      19.42684    20.98621
            6 |   16.09536   .4030355       15.3054    16.88533
            7 |   13.44678   .4264197      12.61098    14.28258
            8 |   11.57035   .4698255      10.64947    12.49123
            9 |   9.932146     .50947      8.933563    10.93073
--------------+------------------------------------------------
rpoorhealth   |
            1 |   .1954613   .0051042      .1854568    .2054658
            2 |   .1988658   .0054884      .1881083    .2096233
            3 |   .2022571    .005976      .1905439    .2139703
            4 |   .2434294   .0068561      .2299911    .2568677
            5 |   .2226708   .0073329      .2082981    .2370435
            6 |   .2274583   .0080763      .2116284    .2432882
            7 |    .246778   .0094216      .2283112    .2652448
            8 |   .2493719   .0108468      .2281117     .270632
            9 |   .2765055   .0130316      .2509631    .3020479
--------------+------------------------------------------------
rmarried      |
            1 |   .8189498   .0049563      .8092353    .8286643
            2 |   .8200378   .0052823      .8096843    .8303913
            3 |   .8012835   .0059366      .7896475    .8129194
            4 |    .803011    .006354      .7905568    .8154651
            5 |    .810559   .0069067      .7970216    .8240964
            6 |   .8181818    .007431      .8036168    .8327468
            7 |   .8128878   .0085227       .796183    .8295927
            8 |   .8121859   .0097917      .7929939     .831378
            9 |   .7989822   .0116765      .7760957    .8218686
--------------+------------------------------------------------
rtotalpar     |
            1 |   1.606427   .0098604        1.5871    1.625754
            2 |   1.405104   .0111955       1.38316    1.427048
            3 |   1.285904   .0117704      1.262833    1.308974
            4 |   1.215106   .0120179       1.19155    1.238661
            5 |    1.15528   .0127173      1.130353    1.180206
            6 |   1.036364   .0131864      1.010518     1.06221
            7 |   .9923628   .0144016       .964135    1.020591
            8 |    .923995   .0157687      .8930877    .9549023
            9 |   .8710772   .0172318      .8373021    .9048523
--------------+------------------------------------------------
```

```
rsiblog       |
            1 |   1.673055   .0081439      1.657092    1.689017
            2 |   1.680897   .0086198      1.664002    1.697792
            3 |   1.691382   .0091705      1.673407    1.709356
            4 |   1.666379   .0096965      1.647374    1.685385
            5 |   1.678038   .0106761      1.657112    1.698963
            6 |   1.680657   .0116672      1.657788    1.703525
            7 |   1.678899   .0131027      1.653217    1.704581
            8 |   1.656552    .014932      1.627284    1.685819
            9 |   1.652234   .0177086      1.617525    1.686944
--------------+-------------------------------------------------
hchildlg      |
            1 |   1.107862   .0070198      1.094103    1.121621
            2 |   1.118057   .0074358      1.103482    1.132631
            3 |   1.109619   .0081834      1.093579    1.125659
            4 |   1.124737   .0087356      1.107614    1.141859
            5 |   1.131209   .0096739      1.112248     1.15017
            6 |   1.129443   .0106084       1.10865    1.150236
            7 |   1.140981   .0119127      1.117632     1.16433
            8 |   1.136373   .0136879      1.109544    1.163202
            9 |    1.13422   .0158981      1.103059    1.165381
--------------+-------------------------------------------------
rallparhelptw |
            1 |   .6292256   .0373714       .555976    .7024751
            2 |   1.228155   .0464493      1.137113    1.319198
            3 |   1.584609   .0566464      1.473579    1.695638
            4 |   1.896702   .0668625      1.765648    2.027755
            5 |   1.763599   .0711459       1.62415    1.903048
            6 |   2.296546   .0912181      2.117755    2.475338
            7 |   2.563283   .1127419      2.342304    2.784261
            8 |    2.68663   .1313707      2.429138    2.944122
            9 |    2.63579   .1508951      2.340029     2.93155
----------------------------------------------------------------
```

Means of time-invariant variables:

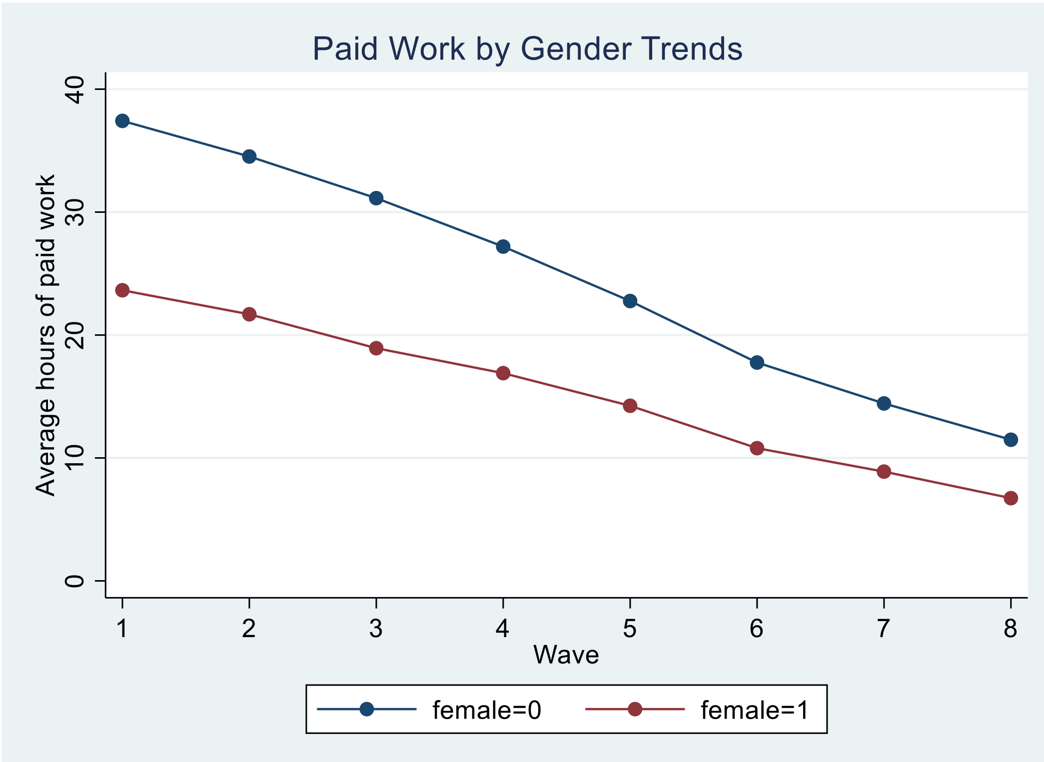
```
. mean raedyrs female age white black latino otherrace minority if wave==1

Mean estimation                   Number of obs   =      6,588
--------------------------------------------------------------
             |       Mean   Std. Err.     [95% Conf. Interval]
-------------+------------------------------------------------
     raedyrs |   12.27277   .0389866      12.19634     12.3492
      female |   .4845173   .0061577      .4724462    .4965884
         age |   55.45835   .0381301       55.3836    55.53309
       white |   .7328476   .0054518      .7221602     .743535
       black |    .153309   .0044392      .1446068    .1620113
      latino |   .0910747    .003545      .0841253    .0980241
   otherrace |   .0227687   .0018379      .0191658    .0263716
    minority |   .2671524   .0054518       .256465    .2778398
--------------------------------------------------------------
```

A graph of means of work hours over time by gender:

```
. reg rworkhours80 i.female##i.wave

      Source |       SS           df       MS      Number of obs   =    46,661
-------------+----------------------------------   F(17, 46643)    =    580.49
       Model |  4111549.35        17  241855.844   Prob > F        =    0.0000
    Residual |  19433266.7    46,643  416.638439   R-squared       =    0.1746
-------------+----------------------------------   Adj R-squared   =    0.1743
```

```
       Total |    23544816    46,660  504.603859   Root MSE        =    20.412

------------------------------------------------------------------------------
rworkhours80 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    1.female |  -13.77821   .5047102   -27.30   0.000    -14.76745   -12.78897
             |
        wave |
          2  |  -2.897701   .5115941    -5.66   0.000    -3.900433   -1.894969
          3  |   -6.28488   .5194919   -12.10   0.000    -7.303092   -5.266668
          4  |  -10.22427   .5278551   -19.37   0.000    -11.25887   -9.189664
          5  |  -14.65338   .5361013   -27.33   0.000    -15.70415   -13.60261
          6  |   -19.6585   .5421223   -36.26   0.000    -20.72107   -18.59593
          7  |  -22.98268   .5511448   -41.70   0.000    -24.06293   -21.90242
          8  |  -25.93671   .5614959   -46.19   0.000    -27.03725   -24.83617
          9  |  -27.23357   .5705184   -47.73   0.000    -28.35179   -26.11534
             |
 female#wave |
        1 2  |   .9457776   .7320558     1.29   0.196    -.4890627    2.380618
        1 3  |   1.572734   .7425156     2.12   0.034     .1173924    3.028075
        1 4  |   3.481562   .7532003     4.62   0.000     2.005278    4.957846
        1 5  |    5.25893   .7644375     6.88   0.000     3.760621    6.757239
        1 6  |   6.813259   .7722584     8.82   0.000     5.299621    8.326897
        1 7  |    8.23079   .7824995    10.52   0.000      6.69708    9.764501
        1 8  |   9.026886   .7952218    11.35   0.000      7.46824    10.58553
        1 9  |   9.106228   .8059588    11.30   0.000     7.526536    10.68592
             |
       _cons |   37.42107   .3516128   106.43   0.000      36.7319    38.11023
------------------------------------------------------------------------------

. margins, at(wave=(1(1)8) female=(0 1))

Adjusted predictions                            Number of obs     =     46,661
Model VCE    : OLS

Expression   : Linear prediction, predict()

1._at        : female          =           0
               wave            =           1

2._at        : female          =           0
               wave            =           2

3._at        : female          =           0
               wave            =           3

4._at        : female          =           0
               wave            =           4

5._at        : female          =           0
               wave            =           5

6._at        : female          =           0
               wave            =           6

7._at        : female          =           0
               wave            =           7

8._at        : female          =           0
               wave            =           8

9._at        : female          =           1
```

```
               wave            =           1

10._at       : female          =           1
               wave            =           2

11._at       : female          =           1
               wave            =           3

12._at       : female          =           1
               wave            =           4

13._at       : female          =           1
               wave            =           5

14._at       : female          =           1
               wave            =           6

15._at       : female          =           1
               wave            =           7

16._at       : female          =           1
               wave            =           8

------------------------------------------------------------------------------
             |            Delta-method
             |     Margin   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         _at |
          1  |   37.42107   .3516128   106.43   0.000      36.7319    38.11023
          2  |   34.52337    .371614    92.90   0.000       33.795    35.25174
          3  |   31.13619   .3824137    81.42   0.000     30.38665    31.88572
          4  |    27.1968   .3936997    69.08   0.000     26.42514    27.96846
          5  |   22.76769   .4046887    56.26   0.000     21.97449    23.56088
          6  |   17.76257   .4126318    43.05   0.000      16.9538    18.57133
          7  |   14.43839   .4244161    34.02   0.000     13.60653    15.27025
          8  |   11.48436   .4377739    26.23   0.000     10.62632     12.3424
          9  |   23.64286   .3620785    65.30   0.000     22.93318    24.35254
         10  |   21.69093   .3782544    57.34   0.000     20.94955    22.43232
         11  |   18.93071   .3877586    48.82   0.000      18.1707    19.69072
         12  |   16.90015    .396962    42.57   0.000      16.1221     17.6782
         13  |   14.24841   .4072582    34.99   0.000     13.45018    15.04664
         14  |   10.79761   .4139875    26.08   0.000     9.986193    11.60904
         15  |   8.890971    .421241    21.11   0.000     8.065332     9.71661
         16  |   6.733036   .4312764    15.61   0.000     5.887728    7.578344
------------------------------------------------------------------------------

. marginsplot, noci ytitle("Average hours of paid work") xtitle("Wave") title("Paid
Work by Gender Trends")

  Variables that uniquely identify margins: wave female
```



Examining the nature of changes wave to wave:

```
. gen diff_hours=d.rworkhours80
(16,141 missing values generated)

. mean diff_hours, over(wave)
Mean estimation                    Number of obs   =     38,535

            2: wave = 2
            3: wave = 3
            4: wave = 4
            5: wave = 5
            6: wave = 6
            7: wave = 7
            8: wave = 8
            9: wave = 9
--------------------------------------------------------------
        Over |       Mean   Std. Err.     [95% Conf. Interval]
-------------+------------------------------------------------
diff_hours   |
           2 |  -2.818721   .2218065     -3.253468   -2.383975
           3 |  -3.307249   .2321794     -3.762327   -2.852172
           4 |  -3.213501   .2324172     -3.669044   -2.757957
           5 |  -3.753209   .2310037     -4.205982   -3.300436
           6 |  -4.402008   .2398089     -4.872039   -3.931976
           7 |  -2.631661   .2151473     -3.053355   -2.209967
           8 |   -2.50271   .1999011     -2.894522   -2.110899
           9 |  -1.550472   .1853217     -1.913708   -1.187237
--------------------------------------------------------------

. gen diff_hours_cat=(diff_hours>0) if diff_hours<.
(16,141 missing values generated)
```

```
. replace diff_hours_cat=-1 if diff_hours<0
(9,729 real changes made)

. tab diff_hours_cat, m

diff_hours_ |
        cat |      Freq.     Percent        Cum.
------------+-----------------------------------
         -1 |      9,729       17.79       17.79
          0 |     22,835       41.76       59.56
          1 |      5,971       10.92       70.48
          . |     16,141       29.52      100.00
------------+-----------------------------------
      Total |     54,676      100.00

. tab diff_hours_cat wave, col

+-------------------+
| Key               |
|-------------------|
|     frequency     |
| column percentage |
+-------------------+

diff_hours |                                 wave
      _cat |         2          3          4          5          6          7 |     Total
-----------+------------------------------------------------------------------+----------
        -1 |     1,704      1,622      1,421      1,320      1,245        946 |     9,729
           |     28.90      30.15      27.88      27.33      27.17      21.09 |     25.25
-----------+------------------------------------------------------------------+----------
         0 |     2,922      2,739      2,741      2,782      2,752      2,968 |    22,835
           |     49.55      50.91      53.79      57.60      60.06      66.18 |     59.26
-----------+------------------------------------------------------------------+----------
         1 |     1,271      1,019        934        728        585        571 |     5,971
           |     21.55      18.94      18.33      15.07      12.77      12.73 |     15.50
-----------+------------------------------------------------------------------+----------
     Total |     5,897      5,380      5,096      4,830      4,582      4,485 |    38,535
           |    100.00     100.00     100.00     100.00     100.00     100.00 |    100.00


diff_hours |         wave
      _cat |         8          9 |     Total
-----------+----------------------+----------
        -1 |       823        648 |     9,729
           |     19.40      16.11 |     25.25
-----------+----------------------+----------
         0 |     2,969      2,962 |    22,835
           |     69.97      73.64 |     59.26
-----------+----------------------+----------
         1 |       451        412 |     5,971
           |     10.63      10.24 |     15.50
-----------+----------------------+----------
     Total |     4,243      4,022 |    38,535
           |    100.00     100.00 |    100.00
```