Check and compare model results

Ayush

In our previous conversation, Suman pointed out that the trendlines of the charts in the word document and the charts that I have generated are not identical. I checked, this is a correct observation. This means that the results of the model that I run is different than what Suman has generated. I am sharing the models for every figure so that Suman can compare mu results and see where I have gone wrong.

Figure 1 - Change in Average Attainment and Inclusivity premium

Model 1 - Populaiton Weighted Linear Model

$$y \sim x\beta_1 + e$$

$$x = \text{Change in space average attainment per annum}$$

$$y = \text{Inclusivity premium W\_Sen per annum}$$

```
mod_pop_weighted_linear <- lm(data = data_as_inclusicve,
                              formula = S_W_Sen_pa ~ d_attain_pa,
                              weights = population)

summary(mod_pop_weighted_linear)
```

```
Call:
lm(formula = S_W_Sen_pa ~ d_attain_pa, data = data_as_inclusicve,
    weights = population)

Weighted Residuals:
```

```
     Min       1Q   Median       3Q      Max
-147.395  -26.764   -5.800    2.643  142.500

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.16108    0.05820   2.768 0.007047 **
d_attain_pa  0.21927    0.05703   3.845 0.000245 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 48.94 on 78 degrees of freedom
Multiple R-squared:  0.1593,    Adjusted R-squared:  0.1486
F-statistic: 14.78 on 1 and 78 DF,  p-value: 0.0002447
```

Coefficients

```
mod_pop_weighted_linear$coefficients
```

```
(Intercept) d_attain_pa
  0.1610805   0.2192676
```

Fitted Values

```
mod_pop_weighted_linear$fitted.values
```

```
        1         2         3         4         5         6         7         8
0.4776986 0.2028102 0.1810962 0.3005042 0.0861038 0.3385131 0.4533353 0.1980129
        9        10        11        12        13        14        15        16
0.2115960 0.5513928 0.3271807 0.3737614 0.4960095 0.2721928 0.2972013 0.4589804
       17        18        19        20        21        22        23        24
0.2028816 0.3199006 0.2310958 0.3630624 0.3008001 0.3595722 0.3431941 0.4137988
       25        26        27        28        29        30        31        32
0.2555279 0.4886912 0.3291715 0.3149080 0.4648590 0.2570273 0.1866555 0.1743033
       33        34        35        36        37        38        39        40
0.2640622 0.3349137 0.2774637 0.4379166 0.5253721 0.5397536 0.4240248 0.1740711
       41        42        43        44        45        46        47        48
0.2700775 0.1872481 0.2914202 0.3241493 0.1580781 0.4446020 0.4257330 0.6090359
       49        50        51        52        53        54        55        56
0.4213393 0.3000070 0.4132532 0.2774661 0.4524426 0.4300959 0.3148208 0.2809728
       57        58        59        60        61        62        63        64
```

```
0.2862010 0.2172545 0.5020440 0.3390018 0.2998565 0.6253128 0.1737874 0.5148998
       65        66        67        68        69        70        71        72
0.2735670 0.4376394 0.2578491 0.2303040 0.2198836 0.3038624 0.2510933 0.5318288
       73        74        75        76        77        78        79        80
0.1554726 0.3303128 0.4002445 0.2092347 0.2248879 0.3344355 0.3513603 0.2690707
attr(,"label")
[1] "Inclusivity premium W_Sen per annum"
attr(,"format.stata")
[1] "%9.0g"
```

Model 2 - Population weighted Quadratic fit

$$y \sim x\beta_1 + x^2\beta_2 + e$$

$$x = \text{Change in space average attainment per annum}$$

$$y = \text{Inclusivity premium W\_Sen per annum}$$

```
mod_pop_weighted_quadratic <- lm(data = data_as_inclusicve,
                                 formula = S_W_Sen_pa ~ d_attain_pa + I(d_attain_pa^2),
                                 weights = population)

summary(mod_pop_weighted_quadratic)
```

```
Call:
lm(formula = S_W_Sen_pa ~ d_attain_pa + I(d_attain_pa^2), data = data_as_inclusicve,
    weights = population)

Weighted Residuals:
     Min       1Q   Median       3Q      Max
-153.413  -27.729   -2.463    7.999  134.364

Coefficients:
                Estimate Std. Error t value Pr(>|t|)
(Intercept)      0.08467    0.09442   0.897   0.3727
d_attain_pa      0.44011    0.22237   1.979   0.0514 .
I(d_attain_pa^2) -0.12691    0.12351  -1.027   0.3074
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 48.92 on 77 degrees of freedom
Multiple R-squared:  0.1707,    Adjusted R-squared:  0.1492
F-statistic: 7.925 on 2 and 77 DF,  p-value: 0.0007419
```

Coefficients

```
mod_pop_weighted_quadratic$coefficients
```

```
     (Intercept)      d_attain_pa I(d_attain_pa^2)
      0.08466915       0.44011311      -0.12690700
```

Fitted Values

```
mod_pop_weighted_quadratic$fitted.values
```

```
         1          2          3          4          5          6
0.45557267 0.16383238 0.12378696 0.31320888 -0.08066238 0.35771073
         7          8          9         10         11         12
0.44582683 0.15519919 0.17932796 0.46597749 0.34524041 0.39216443
        13         14         15         16         17         18
0.46083484 0.27510514 0.30898159 0.44836394 0.16395986 0.33687165
        19         20         21         22         23         24
0.21226399 0.38239990 0.31358481 0.37908379 0.36266385 0.42334280
        25         26         27         28         29         30
0.25069757 0.45894405 0.34748017 0.33097072 0.45082714 0.25295368
        31         32         33         34         35         36
0.13427669 0.11074836 0.26338013 0.35382343 0.28251970 0.43803999
        37         38         39         40         41         42
0.46557807 0.46624066 0.42994942 0.11029833 0.27208829 0.13538516
        43         44         45         46         47         48
0.30144393 0.34178971 0.07861884 0.44157041 0.43099923 0.45413255
        49         50         51         52         53         54
0.42826786 0.31257625 0.42297480 0.28252300 0.44541024 0.43361055
        55         56         57         58         59         60
0.33086647 0.28737461 0.29448742 0.18909205 0.46218124 0.35823321
        61         62         63         64         65         66
0.31238444 0.44761190 0.10974809 0.46440855 0.27705226 0.43788851
        67         68         69         70         71         72
```

```
 0.25418516  0.21096562  0.19357123  0.31744794  0.24395571  0.46601061
         73          74          75          76          77          78
 0.07333001  0.34875482  0.41373519  0.17520322  0.20199633  0.35330179
         79          80
 0.37102798  0.27064399
attr(,"label")
[1] "Inclusivity premium W_Sen per annum"
attr(,"format.stata")
[1] "%9.0g"
```

Model 3 - Unweighted Quadratic fit

$$y \sim x\beta_1 + x^2\beta_2 + e$$

$$x = \text{Change in space average attainment per annum}$$

$$y = \text{Inclusivity premium W\_Sen per annum}$$

```
mod_pop_unweighted_quadratic <- lm(
  data = data_as_inclusicve,
  formula = S_W_Sen_pa ~ d_attain_pa + I(d_attain_pa^2))

summary(mod_pop_unweighted_quadratic)
```

```
Call:
lm(formula = S_W_Sen_pa ~ d_attain_pa + I(d_attain_pa^2), data = data_as_inclusicve)

Residuals:
     Min       1Q   Median       3Q      Max
-0.54490 -0.14325 -0.01076  0.14941  0.69267

Coefficients:
                Estimate Std. Error t value Pr(>|t|)
(Intercept)      0.17359    0.06967   2.492   0.0149 *
d_attain_pa      0.09802    0.17140   0.572   0.5691
I(d_attain_pa^2) -0.01703    0.09091  -0.187   0.8519
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 0.2662 on 77 degrees of freedom
Multiple R-squared:  0.019, Adjusted R-squared:  -0.006477
F-statistic: 0.7458 on 2 and 77 DF,  p-value: 0.4777
```

Coefficients

```
mod_pop_unweighted_quadratic$coefficients
```

```
     (Intercept)      d_attain_pa I(d_attain_pa^2)
      0.17358734       0.09802131      -0.01703310
```

Fitted Values

```
mod_pop_unweighted_quadratic$fitted.values
```

```
        1         2         3         4         5         6         7         8
0.2796128 0.1916252 0.1823932 0.2290284 0.1380782 0.2417532 0.2739769 0.1896143
        9        10        11        12        13        14        15        16
0.1952657 0.2941003 0.2380664 0.2526390 0.2835718 0.2188850 0.2278743 0.2753202
       17        18        19        20        21        22        23        24
0.1916550 0.2356500 0.2031502 0.2494279 0.2291315 0.2483628 0.2432496 0.2639359
       25        26        27        28        29        30        31        32
0.2126488 0.2820180 0.2387207 0.2339711 0.2766951 0.2132179 0.1847887 0.1794365
       33        34        35        36        37        38        39        40
0.2158670 0.2405921 0.2208165 0.2701928 0.2894244 0.2920681 0.2666392 0.1793349
       41        42        43        44        45        46        47        48
0.2181044 0.1850427 0.2258357 0.2370648 0.1722419 0.2718542 0.2670835 0.3027502
       49        50        51        52        53        54        55        56
0.2659364 0.2288552 0.2637896 0.2208174 0.2737624 0.2682090 0.2339416 0.2220915
       57        58        59        60        61        62        63        64
0.2239749 0.1975814 0.2848245 0.2419102 0.2288027 0.3047665 0.1792106 0.2874072
       65        66        67        68        69        70        71        72
0.2193905 0.2701232 0.2135292 0.2028353 0.1986496 0.2301939 0.2109562 0.2906294
       73        74        75        76        77        78        79        80
0.1710692 0.2390945 0.2602386 0.1942926 0.2006694 0.2404371 0.2458228 0.2177317
attr(,"label")
[1] "Inclusivity premium W_Sen per annum"
attr(,"format.stata")
[1] "%9.0g"
```

Figure 2 - Shared prosperity premiums and inclusivity premiums across 25 countries

Model 1 - Population weighted quadratic fit

$$y \sim x\beta_1 + x^2\beta_2 + e$$

$$y = \text{Shared Prosperity premium}$$

$$x = \text{Inclusivity premium W\_Sen per annum}$$

```
mod_pop_weighted_quadratic <- lm(data = data_as_inclusicve,
                                 formula = inc_shr_pre ~ S_W_Sen_pa + I(S_W_Sen_pa^2),
                                 weights = population)

summary(mod_pop_weighted_quadratic)
```

```
Call:
lm(formula = inc_shr_pre ~ S_W_Sen_pa + I(S_W_Sen_pa^2), data = data_as_inclusicve,
    weights = population)

Weighted Residuals:
    Min      1Q  Median      3Q     Max
-706.98  -78.55   11.69   73.03  579.31

Coefficients:
                Estimate Std. Error t value Pr(>|t|)
(Intercept)      -0.5584     0.3741  -1.492 0.146756
S_W_Sen_pa        7.5398     2.0309   3.713 0.000903 ***
I(S_W_Sen_pa^2)  -8.5345     3.0323  -2.815 0.008840 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 231.7 on 28 degrees of freedom
  (49 observations deleted due to missingness)
Multiple R-squared:  0.3706,    Adjusted R-squared:  0.3257
F-statistic: 8.245 on 2 and 28 DF,  p-value: 0.00153
```

Coefficients

```
mod_pop_weighted_quadratic$coefficients
```

```
  (Intercept)      S_W_Sen_pa I(S_W_Sen_pa^2)
    -0.558405        7.539821       -8.534525
```

Fitted Values

```
mod_pop_weighted_quadratic$fitted.values
```

```
         2          3         10         12         17         18         19
 0.7260370  0.4441301  1.0852061  1.0919719  0.6700632  1.1022290  1.0510412
        22         26         28         33         35         37         40
-0.3081209  0.4067919  0.9030806  1.0751325  0.8496990 -1.3852627  0.3841332
        43         45         46         49         55         56         57
 0.4396107  0.3128376  0.1136184  0.4416763 -0.1969818  1.0962047  0.9096854
        58         59         62         63         69         74         75
 0.7618826  0.4323717 -0.7970009  0.1416580  0.6466220 -1.8724190 -0.7025790
        76         77         80
 1.0773048  0.3664820  0.1974839
attr(,"format.stata")
[1] "%9.0g"
```

Model 2 - Unweighted quadratic fit

$$y \sim x\beta_1 + x^2\beta_2 + e$$

$$y = \text{Shared Prosperity premium}$$

$$x = \text{Inclusivity premium W\_Sen per annum}$$

```
mod_pop_unweighted_quadratic <- lm(data = data_as_inclusicve,
                                   formula = inc_shr_pre ~ S_W_Sen_pa + I(S_W_Sen_pa^2))

summary(mod_pop_unweighted_quadratic)
```

```
Call:
lm(formula = inc_shr_pre ~ S_W_Sen_pa + I(S_W_Sen_pa^2), data = data_as_inclusicve)

Residuals:
     Min       1Q   Median       3Q      Max
-2.38041 -0.99832  0.00523  0.68779  3.00689

Coefficients:
               Estimate Std. Error t value Pr(>|t|)
(Intercept)     -0.1290     0.4631  -0.279   0.7826
S_W_Sen_pa       5.5927     2.6037   2.148   0.0405 *
I(S_W_Sen_pa^2) -6.7744     2.9500  -2.296   0.0293 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.374 on 28 degrees of freedom
  (49 observations deleted due to missingness)
Multiple R-squared:  0.1585,    Adjusted R-squared:  0.0984
F-statistic: 2.637 on 2 and 28 DF,  p-value: 0.08927
```

Coefficients

```
mod_pop_unweighted_quadratic$coefficients
```

```
   (Intercept)      S_W_Sen_pa I(S_W_Sen_pa^2)
    -0.1290357       5.5926741      -6.7744146
```

Fitted Values

```
mod_pop_unweighted_quadratic$fitted.values
```

```
         2          3         10         12         17         18         19
 0.8001182  0.6027927  1.0221250  0.9913635  0.7615677  1.0250171  1.0069686
        22         26         28         33         35         37         40
-0.2632905  0.3515480  0.7972068  0.9704648  0.8835103 -1.1705253  0.5600089
        43         45         46         49         55         56         57
 0.3802629  0.5089136  0.3649478  0.6010471  0.1379020  1.0249577  0.9226591
        58         59         62         63         69         74         75
 0.8245760  0.5944246 -0.3064299  0.3853026  0.7453105 -1.1135776 -0.2361327
```

```
        76          77          80
 1.0191777  0.5473832  0.4257444
attr(,"format.stata")
[1] "%9.0g"
```

Figure 3 - Inclusivity premiums and absolute changes in the MPIs

Model 1 - Population weighted quadratic fit

$$y \sim x\beta_1 + x^2\beta_2 + e$$

$$y = \text{Absolute change per annum in M0}$$

$$x = \text{Inclusivity premium W\_Sen per annum}$$

```r
mod_pop_weighted_quadratic <- lm(data = data_as_inclusicve,
                                 formula = abs_M0_33_pa ~ S_W_Sen_pa + I(S_W_Sen_pa^2),
                                 weights = population)

summary(mod_pop_weighted_quadratic)
```

```
Call:
lm(formula = abs_M0_33_pa ~ S_W_Sen_pa + I(S_W_Sen_pa^2), data = data_as_inclusicve,
    weights = population)

Weighted Residuals:
    Min      1Q  Median      3Q     Max
-8.0742 -0.3495  0.1456  0.4395  4.1306

Coefficients:
                 Estimate Std. Error t value Pr(>|t|)
(Intercept)     -0.008031   0.001236  -6.497 7.32e-09 ***
S_W_Sen_pa       0.010287   0.006576   1.564   0.1218
I(S_W_Sen_pa^2) -0.025348   0.011113  -2.281   0.0253 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.358 on 77 degrees of freedom
```

```
Multiple R-squared:  0.0771,    Adjusted R-squared:  0.05313
F-statistic: 3.216 on 2 and 77 DF,  p-value: 0.04555
```

Coefficients

```
mod_pop_weighted_quadratic$coefficients
```

```
    (Intercept)      S_W_Sen_pa I(S_W_Sen_pa^2)
   -0.008031233     0.010286868    -0.025348074
```

Fitted Values

```
mod_pop_weighted_quadratic$fitted.values
```

```
           1            2            3            4            5            6
-0.012544205 -0.007006842 -0.007027820 -0.009733234 -0.007884579 -0.010361288
           7            8            9           10           11           12
-0.012358396 -0.011017246 -0.007196652 -0.007887711 -0.009145713 -0.008983040
          13           14           15           16           17           18
-0.010027161 -0.007354082 -0.007088258 -0.007107688 -0.006991581 -0.008165001
          19           20           21           22           23           24
-0.007619890 -0.009477552 -0.007552723 -0.017565442 -0.007640051 -0.007626040
          25           26           27           28           29           30
-0.008213116 -0.013979905 -0.007222996 -0.010909203 -0.008795392 -0.007206598
          31           32           33           34           35           36
-0.006997209 -0.007219740 -0.009265579 -0.007001551 -0.007095416 -0.007066767
          37           38           39           40           41           42
-0.022377203 -0.008053365 -0.007173060 -0.007056611 -0.009602713 -0.007007460
          43           44           45           46           47           48
-0.013800179 -0.011177665 -0.007098674 -0.007253004 -0.011379620 -0.008969426
          49           50           51           52           53           54
-0.007028868 -0.006989704 -0.009853237 -0.007104540 -0.015387448 -0.012725590
          55           56           57           58           59           60
-0.007573584 -0.008037105 -0.007178617 -0.007023714 -0.007032946 -0.007040680
          61           62           63           64           65           66
-0.007189649 -0.008369579 -0.007228440 -0.008690668 -0.014439579 -0.008146910
          67           68           69           70           71           72
-0.007322537 -0.008159008 -0.006988669 -0.007127413 -0.007167795 -0.007766091
          73           74           75           76           77           78
-0.008724315 -0.010128685 -0.008232740 -0.007808548 -0.007066272 -0.006998608
```

```
          79           80
-0.007071712 -0.007182132
attr(,"label")
[1] "Absolute change per annum in M0"
attr(,"format.stata")
[1] "%9.0g"
```

Model 2 - Unweighted quadratic fit

$$y \sim x\beta_1 + x^2\beta_2 + e$$

$$y = \text{Absolute change per annum in M0}$$

$$x = \text{Inclusivity premium W\_Sen per annum}$$

```
mod_pop_unweighted_quadratic <- lm(data = data_as_inclusicve,
                                   formula = abs_M0_33_pa ~ S_W_Sen_pa + I(S_W_Sen_pa^2))

summary(mod_pop_unweighted_quadratic)
```

```
Call:
lm(formula = abs_M0_33_pa ~ S_W_Sen_pa + I(S_W_Sen_pa^2), data = data_as_inclusicve)

Residuals:
       Min         1Q     Median         3Q        Max
-0.0183730 -0.0047761  0.0008922  0.0054779  0.0130179

Coefficients:
                 Estimate Std. Error t value Pr(>|t|)
(Intercept)     -0.008506   0.001000  -8.506 1.08e-12 ***
S_W_Sen_pa       0.013983   0.005555   2.517  0.01390 *
I(S_W_Sen_pa^2) -0.024370   0.007978  -3.055  0.00309 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.006622 on 77 degrees of freedom
Multiple R-squared:  0.1087,    Adjusted R-squared:  0.08551
F-statistic: 4.693 on 2 and 77 DF,  p-value: 0.01193
```

Coefficients

```
mod_pop_unweighted_quadratic$coefficients
```

```
  (Intercept)      S_W_Sen_pa I(S_W_Sen_pa^2)
-0.008506046     0.013983118    -0.024370265
```

Fitted Values

```
mod_pop_unweighted_quadratic$fitted.values
```

```
           1            2            3            4            5            6
-0.013930779 -0.006577771 -0.006873914 -0.010658961 -0.008304488 -0.011408930
           7            8            9           10           11           12
-0.009951683 -0.008914371 -0.006501387 -0.006766211 -0.009941311 -0.007442187
          13           14           15           16           17           18
-0.011011821 -0.007516661 -0.006510942 -0.007069358 -0.006624462 -0.006921966
          19           20           21           22           23           24
-0.006633571 -0.010348886 -0.006604293 -0.014197850 -0.007956111 -0.006636348
          25           26           27           28           29           30
-0.006950381 -0.011244965 -0.007292916 -0.008832523 -0.007317107 -0.006502211
          31           32           33           34           35           36
-0.006761204 -0.007287048 -0.007635215 -0.006589415 -0.006508812 -0.006519461
          37           38           39           40           41           42
-0.018278817 -0.008536085 -0.007200582 -0.006952104 -0.010501066 -0.006805893
          43           44           45           46           47           48
-0.011099979 -0.012364706 -0.007049913 -0.007346152 -0.012598503 -0.007433022
          49           50           51           52           53           54
-0.006877031 -0.006636582 -0.010803458 -0.007062614 -0.012391755 -0.010241372
          55           56           57           58           59           60
-0.007857862 -0.006848291 -0.006500442 -0.006552295 -0.006888915 -0.006910529
          61           62           63           64           65           66
-0.006500933 -0.008956530 -0.007302686 -0.007248556 -0.011617369 -0.006911376
          67           68           69           70           71           72
-0.007464676 -0.008678266 -0.006646184 -0.006502539 -0.006500249 -0.006703279
          73           74           75           76           77           78
-0.009413242 -0.011132905 -0.008776422 -0.006724799 -0.006975850 -0.006597299
          79           80
-0.006517181 -0.007217764
attr(,"label")
[1] "Absolute change per annum in M0"
```

```
attr(,"format.stata")
[1] "%9.0g"
```