Data - SD2011

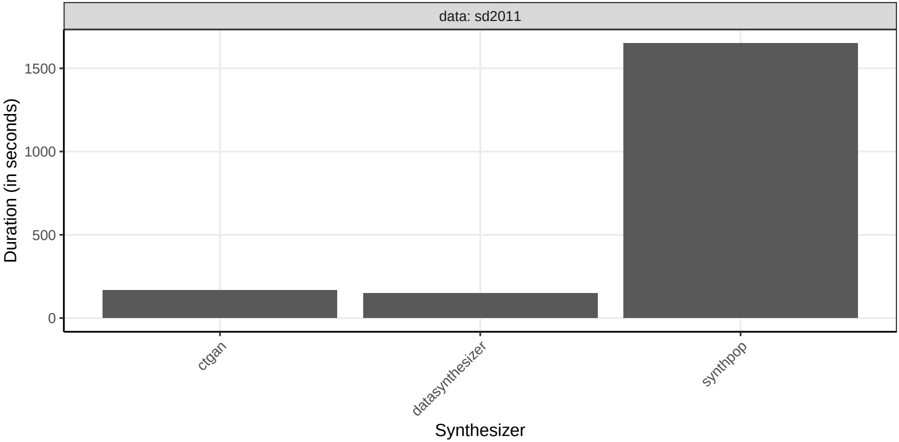
```
’data.frame’:   5000 obs. of  35 variables:
 $ sex       : Factor w/ 2 levels "MALE","FEMALE": 2 1 2 2 2 1 2 1 2 2 ...
 $ age       : num  57 20 18 78 54 20 39 39 43 63 ...
 $ agegr     : Factor w/ 6 levels "16-24","25-34",..: 4 1 1 6 4 1 3 3 3 5 ...
 $ placesize : Factor w/ 6 levels "URBAN 500,000 AND OVER",..: 3 6 1 6 3 3 6 3 6 5 ...
 $ region    : Factor w/ 16 levels "Dolnoslaskie",..: 5 10 7 10 16 12 15 5 13 1 ...
 $ edu       : Factor w/ 4 levels "PRIMARY/NO EDUCATION",..: 2 2 2 1 2 3 3 3 3 3 ...
 $ eduspec   : Factor w/ 27 levels "agriculture, forestry, fishing",..: 19 25 25 25 1 25 4 22 20 25 ...
 $ socprof   : Factor w/ 9 levels "EMPLOYED IN PRIVATE SECTOR",..: 6 7 7 6 3 7 2 1 2 6 ...

...

 $ nofriend  : num  6 4 20 0 6 10 0 4 1 25 ...
 $ smoke     : Factor w/ 2 levels "YES","NO": 2 2 2 2 1 2 2 2 1 1 ...
 $ nociga    : num  NA NA NA NA 20 NA NA NA 30 15 ...
 $ alcabuse  : Factor w/ 2 levels "YES","NO": 2 2 2 2 2 2 2 2 2 2 ...
 $ alcsol    : Factor w/ 2 levels "YES","NO": 2 2 2 2 2 2 2 2 2 2 ...
 $ workab    : Factor w/ 2 levels "YES","NO": 2 2 NA 2 2 2 2 2 2 2 ...
 $ wkabdur   : Factor w/ 32 levels "0","1","10","11",..: NA NA NA NA NA NA NA NA NA NA ...
 $ wkabint   : Factor w/ 3 levels "YES, TO EU COUNTRY",..: 3 3 3 3 3 3 3 3 3 3 ...
 $ wkabintdur: Factor w/ 5 levels "LESS THAN 1 YEAR",..: NA NA NA NA NA NA NA NA NA NA ...
 $ emcc      : Factor w/ 17 levels "AUSTRIA","BELGIUM",..: NA NA NA NA NA NA NA NA NA NA ...
 $ englang   : Factor w/ 3 levels "ACTIVE","PASSIVE",..: 3 1 1 3 3 1 2 3 3 3 ...
 $ height    : num  170 187 165 160 158 165 168 171 167 155 ...
 $ weight    : num  89 82 50 78 50 65 68 86 54 65 ...
 $ bmi       : num  30.8 23.4 18.4 30.5 20 ...
```

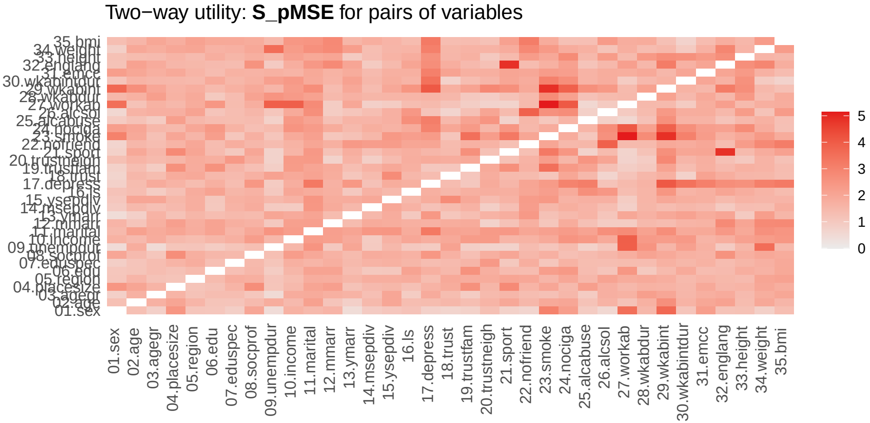
Efficiency

Figure 1:



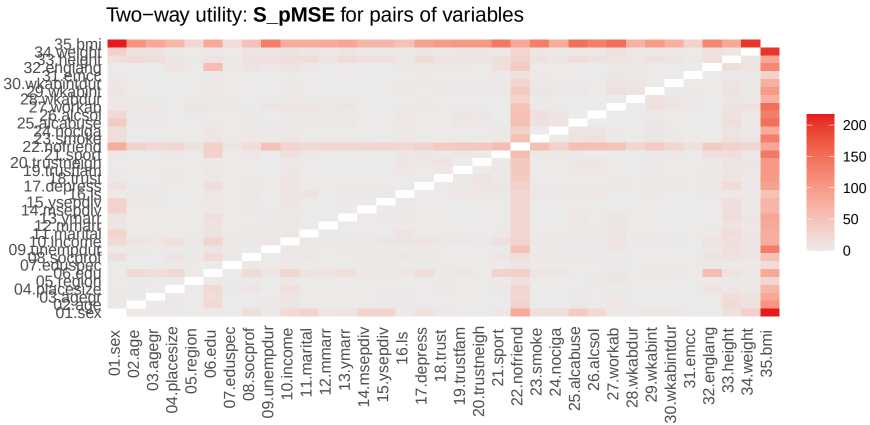
Synthpop utility - two-way utility

Figure 2:



DataSynthesizer utility - two-way utility

Figure 3:



Kolmogorov-Smirnov statistic for full data set

DataSynthesizer

```
> utility_measure <- utility.gen(sds_list, df_ods, print.stats = "all", nperms = 3)
> utility_measure$SPECKS
     D
0.6964
```

Synthpop

```
> utility_measure$SPECKS
     D
0.2346
```

Kolmogorov-Smirnov statistic for each variable

DataSynthesizer

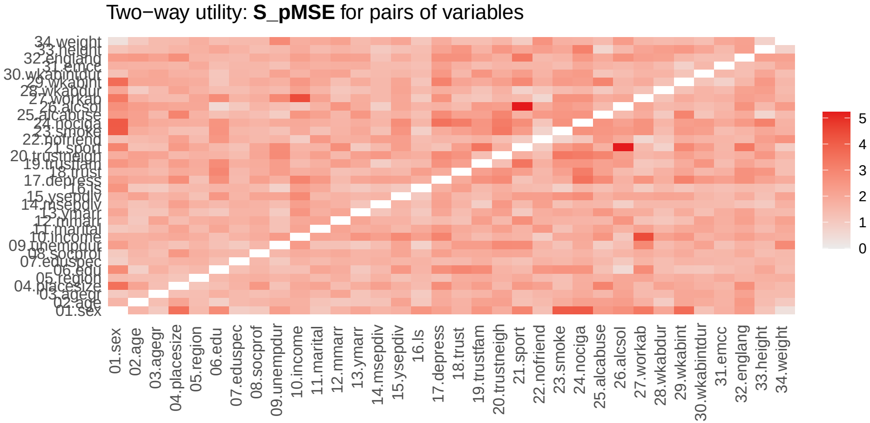
```
> df_compare$tab.utility[,4]
       sex        age      agegr  placesize     region        edu    eduspec    socprof
    0.0064     0.0114     0.0084     0.0104     0.0200     0.0066     0.0158     0.0130
  unempdur     income    marital      mmarr      ymarr    msepdiv    ysepdiv         ls
    0.0038     0.0340     0.0070     0.0092     0.0160     0.0048     0.0044     0.0124
   depress      trust   trustfam trustneigh      sport   nofriend      smoke     nociga
    0.0102     0.0114     0.0014     0.0074     0.0022     0.1762     0.0010     0.0048
  alcabuse     alcsol     workab    wkabdur    wkabint wkabintdur       emcc    englang
    0.0028     0.0012     0.0088     0.0040     0.0064     0.0030     0.0046     0.0064
    height     weight        bmi
    0.0788     0.0470     0.3056
```

Synthpop

```
> df_compare$tab.utility[,4]
       sex        age      agegr  placesize     region        edu    eduspec    socprof
    0.0048     0.0172     0.0090     0.0184     0.0230     0.0090     0.0212     0.0156
  unempdur     income    marital      mmarr      ymarr    msepdiv    ysepdiv         ls
    0.0060     0.0216     0.0094     0.0112     0.0064     0.0034     0.0072     0.0076
   depress      trust   trustfam trustneigh      sport   nofriend      smoke     nociga
    0.0060     0.0094     0.0032     0.0052     0.0028     0.0152     0.0138     0.0146
  alcabuse     alcsol     workab    wkabdur    wkabint wkabintdur       emcc    englang
    0.0026     0.0004     0.0068     0.0022     0.0054     0.0030     0.0062     0.0102
    height     weight        bmi
    0.0108     0.0116     0.0092
```

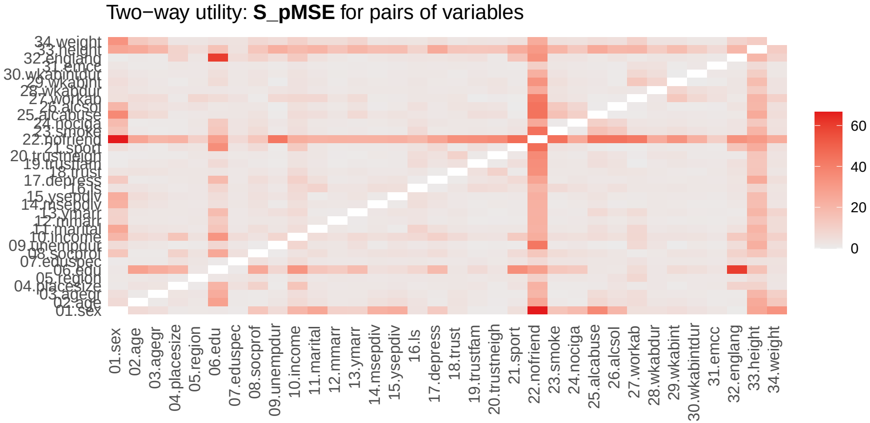
Synthpop utility - two-way utility

Figure 4:



DataSynthesizer utility - two-way utility

Figure 5:



Two−way utility: **S_pMSE** for pairs of variables

Kolmogorov-Smirnov statistic for full data set

DataSynthesizer

```
> utility_measure <- utility.gen(sds_list, df_ods, print.stats = "all", nperms = 3)
> utility_measure$SPECKS
     D
0.5122
```

Synthpop

```
> utility_measure$SPECKS
     D
0.2702
```

Kolmogorov-Smirnov statistic for each variable

DataSynthesizer

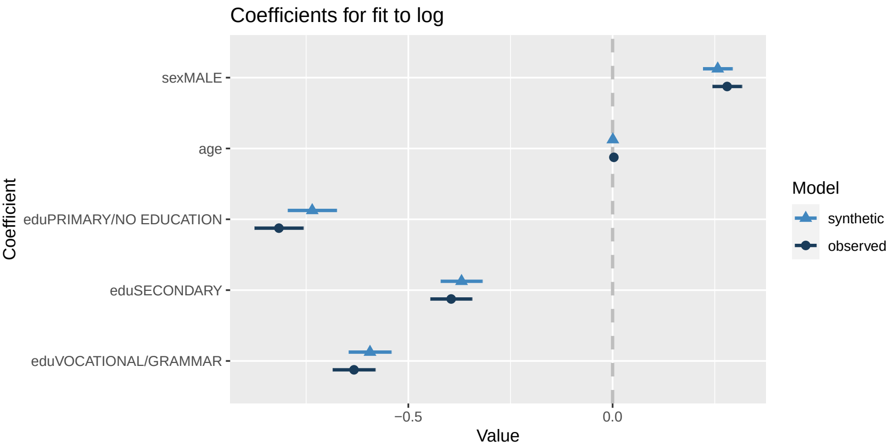
```
> df_compare$tab.utility[,4]
      sex       age     agegr placesize    region       edu   eduspec   socprof
   0.0022    0.0220    0.0172    0.0040    0.0268    0.0088    0.0216    0.0160
 unempdur    income   marital     mmarr     ymarr   msepdiv   ysepdiv        ls
   0.0042    0.0376    0.0088    0.0088    0.0160    0.0038    0.0086    0.0060
  depress     trust  trustfam trustneigh     sport  nofriend     smoke    nociga
   0.0048    0.0026    0.0014    0.0042    0.0036    0.1566    0.0048    0.0076
 alcabuse    alcsol    workab   wkabdur   wkabint wkabintdur      emcc   englang
   0.0018    0.0010    0.0008    0.0040    0.0016    0.0020    0.0036    0.0072
   height    weight
   0.0948    0.0392
```

Synthpop

```
> df_compare$tab.utility[,4]
      sex       age     agegr placesize    region       edu   eduspec   socprof
   0.0108    0.0164    0.0148    0.0122    0.0230    0.0096    0.0150    0.0172
 unempdur    income   marital     mmarr     ymarr   msepdiv   ysepdiv        ls
   0.0142    0.0198    0.0122    0.0112    0.0148    0.0044    0.0062    0.0020
  depress     trust  trustfam trustneigh     sport  nofriend     smoke    nociga
   0.0194    0.0046    0.0068    0.0102    0.0086    0.0036    0.0098    0.0146
 alcabuse    alcsol    workab   wkabdur   wkabint wkabintdur      emcc   englang
   0.0012    0.0010    0.0088    0.0018    0.0036    0.0050    0.0062    0.0122
   height    weight
   0.0110    0.0062
```

Synthpop utility - CIO

Figure 6: DV = log(income)



DataSynthesizer utility - CIO

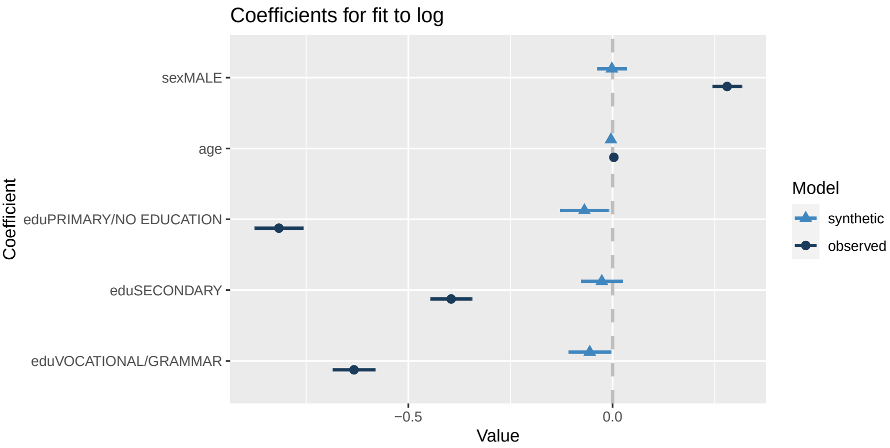


Figure 7: DV $=$ log(income)

- Synthpop may not always be efficient
- How does Synthpop achieve such high levels of utility?