S(0) S(1) Strata Code Strata Name ss notation

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0 1 1 C ss1

1 1 4 2 A ss

0 0 2 3 N s1s1

1 0 4

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Z S SZ index PossibleStrataMembership Stratum\_ind[,1] Stratum\_ind[,2] Stratum\_ind[,3]

[C] [A] [N ]

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1 1 2 11 1/2 [C/A] 1 1 0

1 0 1 10 3 [N ] 0 0 1

0 1 4 01 2 [A ] 0 1 0

0 0 3 00 1/3 [C/N] 1 0 1

1. **Compute betas (using the possible U)**

S(0) S(1) Strata Code Strata Name multinomial logreg: strata~X1,X2,BASE, weight=w

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0 1 1 C [reference] betas = coef(fit)

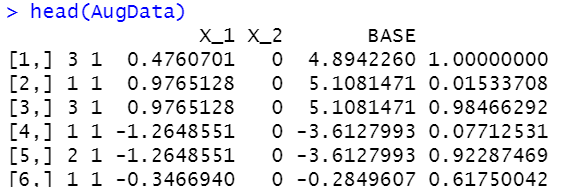
1 1 4 2 A 🡪 beta.a = betas[1, ]

0 0 2 3 N 🡪 2 beta.n = betas[2, ]

1 0 4

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fit = multinom(AugData[, 1] ~ AugData[, (3:(V+1))], weights = AugData[, (V+2)], trace = FALSE)



prob.c = 1

prob.a = exp(t(beta.a)%\*%X[i, ])

prob.n = exp(t(beta.n)%\*%X[i, ])

sum = prob.c + prob.a + prob.n

PROB[i,] = c(prob.c, prob.a, prob.n)/sum

W

Got updated iteratively by EM algo.

1. **Compute principal score matrix PROB (using prob.a, prob.n)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| i | prob.a | prob.n | PROB[1,] | PROB[2,] | PROB[3,] |
|  | using beta.a, beta.n | |  |  |  |
| 1 | Got updated iteratively by EM algo. |  | 1/sum | prob.a/sum | prob.n/sum |
| 2 |  |  |  |  |  |
| 3 |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

1. **Compute membership proportion pr.u**

S(0) S(1) Strata Code Strata Name

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0 1 1 1C [reference]

1. 1 4 2 2A 🡪 pr.a = sum((1 - Z)\*D)/sum(1-Z)

0 0 2 3 3N 🡪 pr.n = sum(Z\*(1 - D))/sum(Z)

🡪 pr.c = 1 - pr.n - pr.a

1. **Compute w,r**

S(0) S(1)

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w0c 0 1 w1c 1 1C

1 1 w1a 4 2 2A

w0n 0 0 2 3 3N

v

Z S index stratum1C(weight,wcoef) stratum2A(weight,wcoef) stratum3N(weight,wcoef)

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0 0 00 w0c(r0c) ep0 0 w0n (r0n)

v

0 1 01 0 1 (r0a) 0

1 1 11 w1c(r1c) ep1 w1a (r1a) 0

1 0 10 0 0 1 (r1n)

wide structure

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| i | Z | S/D | Index | X | Y | PS | w (weights) | | | r (lm Y~X coefficients) | | |
|  |  |  | U=’C’ | U=’A’ | U=’N’ | U=’C’ | U=’A’ | U=’N’ |
| 1 | 0 | 0 | 00 |  |  |  | w0c | 0 | w0n | r0c | 0 | r0n |
| 2 | 0 | 1  v | 01 |  |  |  | 0 | 1 | 0 | 0 | r0a | 0 |
| 3 | 1 | 1 | 11 |  |  |  | w1c | w1a | 0 | r1c | r1a | 0 |
| 4 | 1 | 0 | 10 |  |  |  | 0 | 0 | 1 | 0 | 0 | r1n |
| … |  |  |  |  |  |  |  |  |  |  |  |  |

Long structure

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| i | Z | S/D | index | X | Y | PS | Stratum U | w(i) | Betas(i) | PS score (i) | w | r | weighted.Y.UZ=Y\*w  Yw | weighted.YZU=(Y-X\*r)\*w  Yw.r |
| 1  v | 0 | 0 | 00 |  |  |  | C |  |  | , , | w0c | r0c | weighted.Y.c0 | weighted.Y0c |
| N |  |  | , , | w0n | r0n | weighted.Y.n0 | weighted.Y0n |
| 2 | 0 | 1 | 01 |  |  |  | A |  |  | , , | 1 | r0a | weighted.Y.a0 | weighted.Y0a |
| 3 | 1 | 1 | 11 |  |  |  | C |  |  | , , | w1c | r1c | weighted.Y.c1 | weighted.Y1c |
|  |  |  | A |  |  | , , | w1a | r1a | weighted.Y.a1 | weighted.Y1a |
| 4 | 1 | 0 | 10 |  |  |  | N |  |  | , , | 1 | r1n | weighted.Y.n1 | weighted.Y1n |
| … |  |  |  |  |  |  | Weighted multinomial logistic regression w(0) = 0.5; EM algorithm | | |  |  |  |  |  |

Sorted by stratum

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| i | Z | S/D | index | X | Y | PS | Stratum U | PS score | w | r | weighted.Y.UZ=Y\*w | weighted.YZU=(Y-X\*r)\*w | weighted.rU |
| 1 | 0 | 0 | 00 |  |  |  | C |  | w0c | r0c | weighted.Y.c0 | weighted.Y0c | weighted.rc |
| 3 | 1 | 1 | 11 |  |  |  |  | w1c | r1c | weighted.Y.c1 | weighted.Y1c |
| … |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 0 | 0 | 00 |  |  |  | N |  | w0n | r0n | weighted.Y.n0 | weighted.Y0n | weighted.rn |
| 4 | 1 | 0 | 10 |  |  |  |  | 1 | r1n | weighted.Y.n1 | weighted.Y1n |
| … |  |  |  |  |  |  |  |  |  |  |  |
| 2 | 0 | 1 | 01 |  |  |  | A |  | 1 | r0a | weighted.Y.a0 | weighted.Y0a | weighted.ra |
| 3 | 1 | 1 | 11 |  |  |  |  | w1a | r1a | weighted.Y.a1 | weighted.Y1a |
| … |  |  |  |  |  |  |  |  |  |  |  |

f\_EM\_betas

|  |  |  |
| --- | --- | --- |
|  |  | Betas(1) |
| Iter=1  Betas(1)  🡪w(1): | W(1) | Betas(2)  Iter =2  Error = 12.77089 |
| Iter =2  Betas(2) | W(2) | Betas(3)    Iter=3  Error= 0.6838148 |
| Iter = 3  Betas(3) |  | Betas(4)    Iter=4  Error= 0.1801041 |
|  | … | … |
|  |  |  |

f\_w

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| i | Z | S/D | Index | X | Y | PS | w (weights) | | | r (lm Y~X coefficients) | | |
|  |  |  | U=’C’ | U=’A’ | U=’N’ | U=’C’ | U=’A’ | U=’N’ |
| 1 | 0 | 0 | 00 |  |  |  | w0c | 0 | w0n | r0c | 0 | r0n |
| 2 | 0 | 1  v | 01 |  |  |  | 0 | 1 | 0 | 0 | r0a | 0 |
| 3 | 1 | 1 | 11 |  |  |  | w1c | w1a | 0 | r1c | r1a | 0 |
| 4 | 1 | 0 | 10 |  |  |  | 0 | 0 | 1 | 0 | 0 | r1n |
| … |  |  |  |  |  |  |  |  |  |  |  |  |

w1c =

w0c =

w0n =

w1a =

r1c = lm(Y[index11] ~ 0 + X[index11, ], weights = w1c)$coef

r0c = lm(Y[index00] ~ 0 + X[index00, ], weights = w0c)$coef

r1n = lm(Y[index10] ~ 0 + X[index10, ])$coef

r0n = lm(Y[index00] ~ 0 + X[index00, ], weights = w0n)$coef

r1a = lm(Y[index11] ~ 0 + X[index11, ], weights = w1a)$coef

r0a = lm(Y[index01] ~ 0 + X[index01, ])$coef

#CACE, NACE and AACE

weighted.Y.c1 = Y[index11]\*w1c

weighted.Y.c0 = Y[index00]\*w0c

weighted.Y.n0 = Y[index00]\*w0n

weighted.Y.a1 = Y[index11]\*w1a

CACE = mean(weighted.Y.c1 , na.rm=T ) - mean(weighted.Y.c0 , na.rm=T )

NACE = mean(Y[index10] , na.rm=T ) - mean(weighted.Y.n0 , na.rm=T )

AACE = mean(weighted.Y.a1 , na.rm=T ) - mean(Y[index01] , na.rm=T )

#CACE.reg, NACE.reg and AACE.reg

weighted.Y1c = (Y[index11]-X[index11, ]%\*%r1c)\*w1c

weighted.Y0c = (Y[index00]-X[index00, ]%\*%r0c)\*w0c

weighted.Y1n = Y[index10]-X[index10, ]%\*%r1n

weighted.Y0n = (Y[index00]-X[index00, ]%\*%r0n)\*w0n

weighted.Y1a = (Y[index11]-X[index11, ]%\*%r1a)\*w1a

weighted.Y0a = Y[index01]-X[index01, ]%\*%r0a

weighted.rc = rbind(X[index11, ]\*w1c, X[index00, ]\*w0c) %\*% (r1c - r0c)

weighted.rn = rbind(X[index10, ], X[index00, ]\*w0n) %\*% (r1n - r0n)

weighted.ra = rbind(X[index11, ]\*w1a, X[index01, ]) %\*% (r1a - r0a)

CACE.reg = mean(weighted.Y1c , na.rm=T ) - mean(weighted.Y0c , na.rm=T ) + mean(weighted.rc , na.rm=T )

NACE.reg = mean(weighted.Y1n , na.rm=T ) - mean(weighted.Y0n , na.rm=T ) + mean(weighted.rn , na.rm=T )

AACE.reg = mean(weighted.Y1a , na.rm=T ) - mean(weighted.Y0a , na.rm=T ) + mean(weighted.ra , na.rm=T )