

Final Report

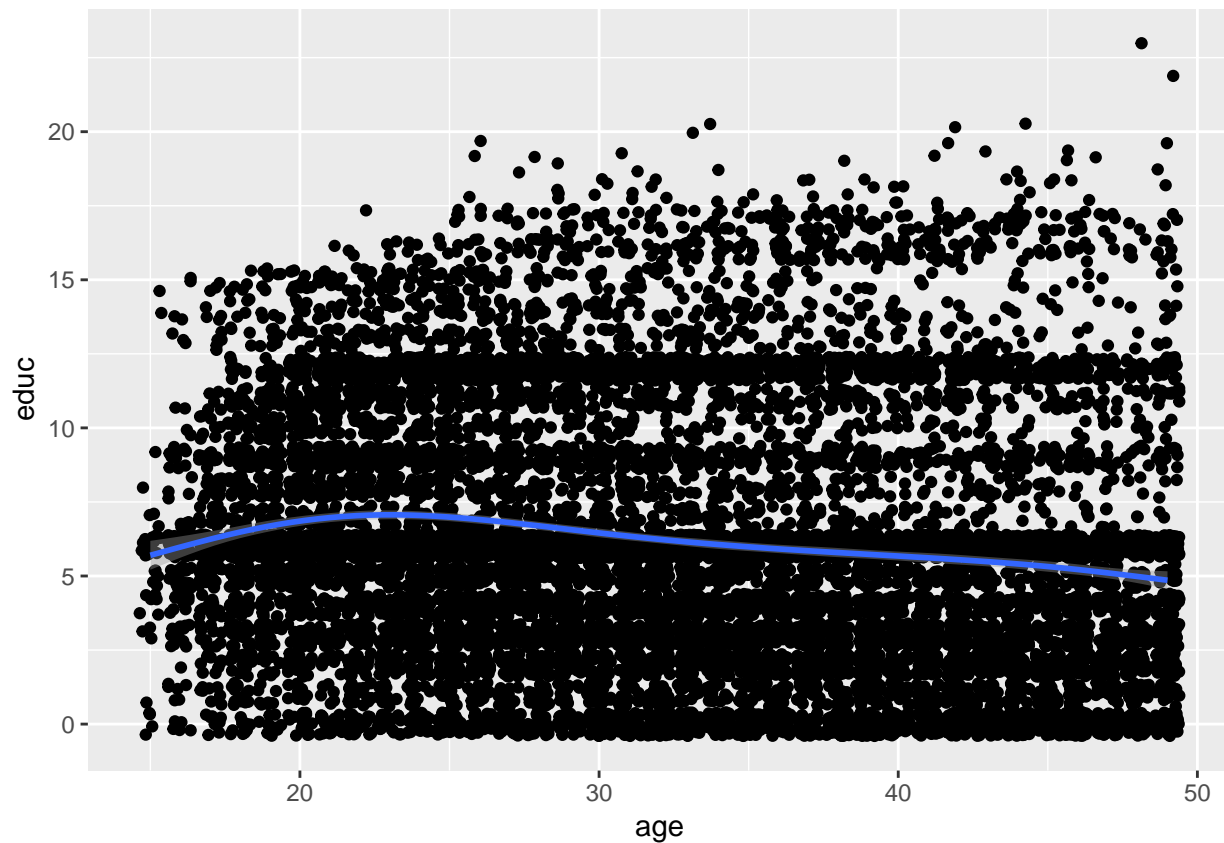
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Max McDonald

Austin Sell

February 27, 2019



```
##
```

```
## Call:
```

```
## lm(formula = educ ~ religion + age + region + wealthCat + urban,
```

```
##     data = data)
```

```
##
```

```
## Residuals:
```

```
##      Min       1Q   Median       3Q      Max
```

```
## -12.602  -2.146  -0.146   1.821  14.603
```

```
##
```

```
## Coefficients:
```

```
##                                Estimate Std. Error t value
```

```
## (Intercept)                   8.73904    0.36817   23.74
```

```
## religionCatholic               0.45810    0.33303    1.38
```

## religionEvangelical / Protestant	0.12439	0.33242	0.37
## religionNo religion	-0.34007	0.34014	-1.00
## age	-0.09624	0.00294	-32.75
## regionCholulteca	0.45189	0.16164	2.80
## regionCol?n	-0.14107	0.16369	-0.86
## regionComayagua	0.42010	0.16055	2.62
## regionCop?n	-0.91155	0.16493	-5.53
## regionCort?s	-0.65717	0.14164	-4.64
## regionEl Para?so	0.89467	0.16139	5.54
## regionFrancisco Moraz?n	0.81296	0.14026	5.80
## regionGracias a Dios	2.01383	0.18753	10.74
## regionIntibuc?	0.43491	0.16783	2.59
## regionIslas de la Bah?a	-0.04356	0.19951	-0.22
## regionLa Paz	0.69689	0.16240	4.29
## regionLempira	0.10312	0.16791	0.61
## regionOcotepeque	-0.43198	0.16473	-2.62
## regionOlancho	0.54658	0.16145	3.39
## regionSanta B?rbara	-0.23473	0.16416	-1.43
## regionValle	1.09966	0.16569	6.64
## regionYoro	-0.10323	0.15881	-0.65
## wealthCatPoorer	-1.31890	0.08251	-15.99
## wealthCatPoorest	-2.77674	0.08587	-32.34
## wealthCatRicher	1.82872	0.08625	21.20
## wealthCatRichest	4.60238	0.09301	49.48
## urban	0.22292	0.06769	3.29
##		Pr(> t)	
## (Intercept)	< 0.0000000000000002	***	

## religionCatholic	0.16898	
## religionEvangelical / Protestant	0.70825	
## religionNo religion	0.31742	
## age	< 0.0000000000000002	***
## regionCholuteca	0.00518	**
## regionCol?n	0.38881	
## regionComayagua	0.00889	**
## regionCop?n	0.000000033138	***
## regionCort?s	0.000003517724	***
## regionEl Para?so	0.000000030099	***
## regionFrancisco Moraz?n	0.000000006911	***
## regionGracias a Dios	< 0.0000000000000002	***
## regionIntibuc?	0.00957	**
## regionIslas de la Bah?a	0.82716	
## regionLa Paz	0.000017883298	***
## regionLempira	0.53915	
## regionOcotepeque	0.00874	**
## regionOlancho	0.00071	***
## regionSanta B?rbara	0.15276	
## regionValle	0.000000000033	***
## regionYoro	0.51571	
## wealthCatPoorer	< 0.0000000000000002	***
## wealthCatPoorest	< 0.0000000000000002	***
## wealthCatRicher	< 0.0000000000000002	***
## wealthCatRichest	< 0.0000000000000002	***
## urban	0.00099	***
## ---		

```

## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.21 on 15809 degrees of freedom
## Multiple R-squared:  0.382, Adjusted R-squared:  0.381
## F-statistic: 376 on 26 and 15809 DF, p-value: <0.00000000000000002
## Linear mixed model fit by maximum likelihood ['lmerMod']
## Formula: educ ~ religion + age + wealthCat + urban + (1 | region)
## Data: data
##
##      AIC      BIC   logLik deviance df.resid
## 81996.7 82088.7 -40986.3 81972.7    15824
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -3.916 -0.669 -0.046  0.566  4.548
##
## Random effects:
## Groups   Name      Variance Std.Dev.
## region   (Intercept) 0.441    0.664
## Residual                10.323    3.213
## Number of obs: 15836, groups: region, 18
##
## Fixed effects:
##
##              Estimate Std. Error t value
## (Intercept)      9.00690    0.38238   23.55
## religionCatholic      0.46108    0.33292    1.38
## religionEvangelical / Protestant 0.12752    0.33232    0.38

```

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## religionNo religion          -0.34154    0.34004   -1.00
## age                         -0.09623    0.00294  -32.76
## wealthCatPoorer            -1.31413    0.08244  -15.94
## wealthCatPoorest           -2.76633    0.08571  -32.28
## wealthCatRicher             1.82346    0.08619   21.16
## wealthCatRichest            4.59673    0.09294   49.46
## urban                       0.22507    0.06764    3.33
##
## Correlation of Fixed Effects:
##          (Intr) rlgnCt rlgE/P rlgnNr age    wlthCtPrr wlthCtPrs
## relignCthlc -0.855
## rlgnEvngl/P -0.858  0.986
## relignNrlgn -0.843  0.964  0.964
## age         -0.241 -0.015 -0.008  0.013
## wealthCtPrr -0.125 -0.012 -0.008 -0.011  0.022
## welthCtPrst -0.138 -0.012 -0.003 -0.008  0.042  0.595
## welthCtRchr -0.089  0.007  0.007  0.012 -0.007  0.398    0.360
## wlthCtRchst -0.064  0.006  0.010  0.022 -0.057  0.345    0.301
## urban       -0.099  0.021  0.017  0.015  0.009  0.242    0.316
##          wlthCtRchr wlthCtRchs
## relignCthlc
## rlgnEvngl/P
## relignNrlgn
## age
## wealthCtPrr
## welthCtPrst
## welthCtRchr

```

```
## wlthCtRchst  0.488
## urban        -0.178      -0.264

##

## Call:
## lm(formula = educ ~ religion + age + age2 + region + wealthCat +
##      urban, data = data)

##

## Residuals:
##      Min       1Q   Median       3Q      Max
## -12.574  -2.148  -0.146   1.813  14.632

##

## Coefficients:
##
##              Estimate Std. Error t value
## (Intercept)      8.158005   0.494958   16.48
## religionCatholic      0.452495   0.333021    1.36
## religionEvangelical / Protestant  0.119827   0.332410    0.36
## religionNo religion  -0.342596   0.340117   -1.01
## age              -0.057835   0.022064   -2.62
## age2             -0.000584   0.000333   -1.76
## regionCholuteca      0.450385   0.161627    2.79
## regionCol?n         -0.135500   0.163710   -0.83
## regionComayagua      0.416663   0.160547    2.60
## regionCop?n         -0.911332   0.164923   -5.53
## regionCort?s        -0.659439   0.141638   -4.66
## regionEl Para?so      0.890014   0.161397    5.51
## regionFrancisco Moraz?n  0.810240   0.140255    5.78
## regionGracias a Dios  2.018013   0.187529   10.76
```

## regionIntibuc?	0.433822	0.167818	2.59
## regionIslas de la Bah?a	-0.047948	0.199513	-0.24
## regionLa Paz	0.693709	0.162401	4.27
## regionLempira	0.102983	0.167903	0.61
## regionOcotepeque	-0.437272	0.164743	-2.65
## regionOlancho	0.545583	0.161439	3.38
## regionSanta B?rbara	-0.237714	0.164155	-1.45
## regionValle	1.102679	0.165690	6.66
## regionYoro	-0.103126	0.158804	-0.65
## wealthCatPoorer	-1.316443	0.082515	-15.95
## wealthCatPoorest	-2.772002	0.085904	-32.27
## wealthCatRicher	1.825197	0.086268	21.16
## wealthCatRichest	4.599342	0.093019	49.45
## urban	0.225460	0.067699	3.33
##		Pr(> t)	
## (Intercept)	< 0.0000000000000002	***	
## religionCatholic		0.17424	
## religionEvangelical / Protestant		0.71849	
## religionNo religion		0.31381	
## age		0.00877	**
## age2		0.07906	.
## regionCholuteca		0.00533	**
## regionCol?n		0.40786	
## regionComayagua		0.00946	**
## regionCop?n		0.000000033316	***
## regionCort?s		0.000003253352	***
## regionEl Para?so		0.000000035540	***


```

## regionFrancisco Moraz?n          0.000000007752 ***
## regionGracias a Dios             < 0.0000000000000002 ***
## regionIntibuc?                   0.00974 **
## regionIslas de la Bah?a          0.81008
## regionLa Paz                     0.000019523508 ***
## regionLempira                    0.53965
## regionOcotepeque                 0.00796 **
## regionOlancho                    0.00073 ***
## regionSanta B?rbara              0.14761
## regionValle                      0.000000000029 ***
## regionYoro                       0.51609
## wealthCatPoorer                  < 0.0000000000000002 ***
## wealthCatPoorest                 < 0.0000000000000002 ***
## wealthCatRicher                  < 0.0000000000000002 ***
## wealthCatRichest                 < 0.0000000000000002 ***
## urban                           0.00087 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.21 on 15808 degrees of freedom
## Multiple R-squared:  0.382, Adjusted R-squared:  0.381
## F-statistic: 362 on 27 and 15808 DF, p-value: <0.0000000000000002
## Linear mixed model fit by maximum likelihood ['lmerMod']
## Formula: educ ~ religion + age + age2 + wealthCat + urban + (1 | region)
## Data: data
##
##      AIC      BIC  logLik deviance df.resid

```

```

## 81995.6 82095.4 -40984.8 81969.6 15823
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -3.908 -0.669 -0.046  0.563  4.558
##
## Random effects:
##      Groups   Name      Variance Std.Dev.
##   region  (Intercept)  0.442    0.665
##   Residual                10.321    3.213
## Number of obs: 15836, groups:  region, 18
##
## Fixed effects:
##
##              Estimate Std. Error t value
## (Intercept)      8.428533   0.505993   16.66
## religionCatholic      0.455504   0.332906    1.37
## religionEvangelical / Protestant  0.122983   0.332301    0.37
## religionNo religion    -0.344048   0.340007   -1.01
## age                -0.058069   0.022056   -2.63
## age2               -0.000581   0.000333   -1.75
## wealthCatPoorer      -1.311702   0.082442  -15.91
## wealthCatPoorest     -2.761627   0.085744  -32.21
## wealthCatRicher       1.819970   0.086203   21.11
## wealthCatRichest      4.593711   0.092949   49.42
## urban                0.227590   0.067653    3.36
##
## Correlation of Fixed Effects:

```

```

##          (Intr) rlgncT rlgE/P rlgncNr age    age2    wlthCtPrr wlthCtPrs
## relignCthlc -0.640
## rlgncEvngl/P -0.643  0.986
## relignNrLgn -0.635  0.964  0.964
## age         -0.673 -0.012 -0.009 -0.002
## age2         0.655  0.010  0.008  0.004 -0.991
## wealthCtPrr -0.106 -0.012 -0.008 -0.011  0.020 -0.017
## wlthCtPrst  -0.125 -0.013 -0.003 -0.008  0.037 -0.032  0.596
## wlthCtRchr  -0.052  0.007  0.008  0.012 -0.024  0.023  0.397      0.359
## wlthCtRchst -0.036  0.006  0.010  0.023 -0.026  0.019  0.345      0.300
## urban       -0.089  0.021  0.017  0.015  0.022 -0.021  0.242      0.316
##          wlthCtRchr wlthCtRchs
## relignCthlc
## rlgncEvngl/P
## relignNrLgn
## age
## age2
## wealthCtPrr
## wlthCtPrst
## wlthCtRchr
## wlthCtRchst  0.489
## urban       -0.178      -0.264

## [1] "Iteration 1000: 2019-02-27 10:51:01"
## [1] "Iteration 2000: 2019-02-27 10:51:35"
## [1] "Iteration 3000: 2019-02-27 10:52:09"
## [1] "Iteration 4000: 2019-02-27 10:52:43"
## [1] "Iteration 5000: 2019-02-27 10:53:17"

```

[1] "Iteration 6000: 2019-02-27 10:53:51"
[1] "Iteration 7000: 2019-02-27 10:54:26"
[1] "Iteration 8000: 2019-02-27 10:55:00"
[1] "Iteration 9000: 2019-02-27 10:55:34"
[1] "Iteration 10000: 2019-02-27 10:56:08"
[1] "Iteration 11000: 2019-02-27 10:56:43"
[1] "Iteration 12000: 2019-02-27 10:57:17"
[1] "Iteration 13000: 2019-02-27 10:57:51"
[1] "Iteration 14000: 2019-02-27 10:58:25"
[1] "Iteration 15000: 2019-02-27 10:58:59"

[1] "Iteration 500: 2019-02-27 11:02:03"
[1] "Iteration 1000: 2019-02-27 11:04:39"
[1] "Iteration 1500: 2019-02-27 11:07:16"
[1] "Iteration 2000: 2019-02-27 11:09:52"
[1] "Iteration 2500: 2019-02-27 11:12:28"
[1] "Iteration 3000: 2019-02-27 11:15:03"
[1] "Iteration 3500: 2019-02-27 11:17:39"
[1] "Iteration 4000: 2019-02-27 11:20:14"
[1] "Iteration 4500: 2019-02-27 11:22:50"
[1] "Iteration 5000: 2019-02-27 11:25:26"
[1] "Iteration 5500: 2019-02-27 11:28:01"
[1] "Iteration 6000: 2019-02-27 11:30:38"
[1] "Iteration 6500: 2019-02-27 11:33:14"
[1] "Iteration 7000: 2019-02-27 11:35:50"
[1] "Iteration 7500: 2019-02-27 11:38:25"
[1] "Iteration 8000: 2019-02-27 11:41:01"
[1] "Iteration 8500: 2019-02-27 11:43:38"

```
## [1] "Iteration 9000: 2019-02-27 11:46:14"
## [1] "Iteration 9500: 2019-02-27 11:48:50"
## [1] "Iteration 10000: 2019-02-27 11:51:27"
## [1] "Iteration 10500: 2019-02-27 11:54:03"
## [1] "Iteration 11000: 2019-02-27 11:56:39"
## [1] "Iteration 11500: 2019-02-27 11:59:15"
## [1] "Iteration 12000: 2019-02-27 12:01:51"
## [1] "Iteration 12500: 2019-02-27 12:04:27"
## [1] "Iteration 13000: 2019-02-27 12:07:02"
## [1] "Iteration 13500: 2019-02-27 12:09:38"
## [1] "Iteration 14000: 2019-02-27 12:12:14"
## [1] "Iteration 14500: 2019-02-27 12:14:50"
## [1] "Iteration 15000: 2019-02-27 12:17:26"
## [1] "Iteration 15500: 2019-02-27 12:20:01"
```

Introduction and Motivation

Here we can introduce our central research question. I don't believe citations are crucial to this project, but we can include them if necessary (McFakerson and Shenanigans 2019).

Data

Here is where we explain where the data comes from. Any descriptive statistics would be included here.

Analysis

In this section we explain how our model is set up and any necessary assumptions. Model selection criteria should be included here as well.

Model	BIC	MAE
1	82160.475989	2.49675
2	82088.731745	2.496738
3	82167.056438	2.496008
4	82095.354913	2.495984

Results

We present the results of the model, including tables and/or figures. This should have the direct numerical interpretation of the key coefficients.

Conclusion

Discussion of the substantive interpretation of the model, including any meaningful impact of findings as well as limitations of model.

References

McFakerson, Fakey F., and Bull Shenanigans. 2019. “An Example Citation: Examples from an Article of Examples.” *QJBS* 1 (1): 50–90.