Lending Mortage Analysis

Exploratory Data Analysis

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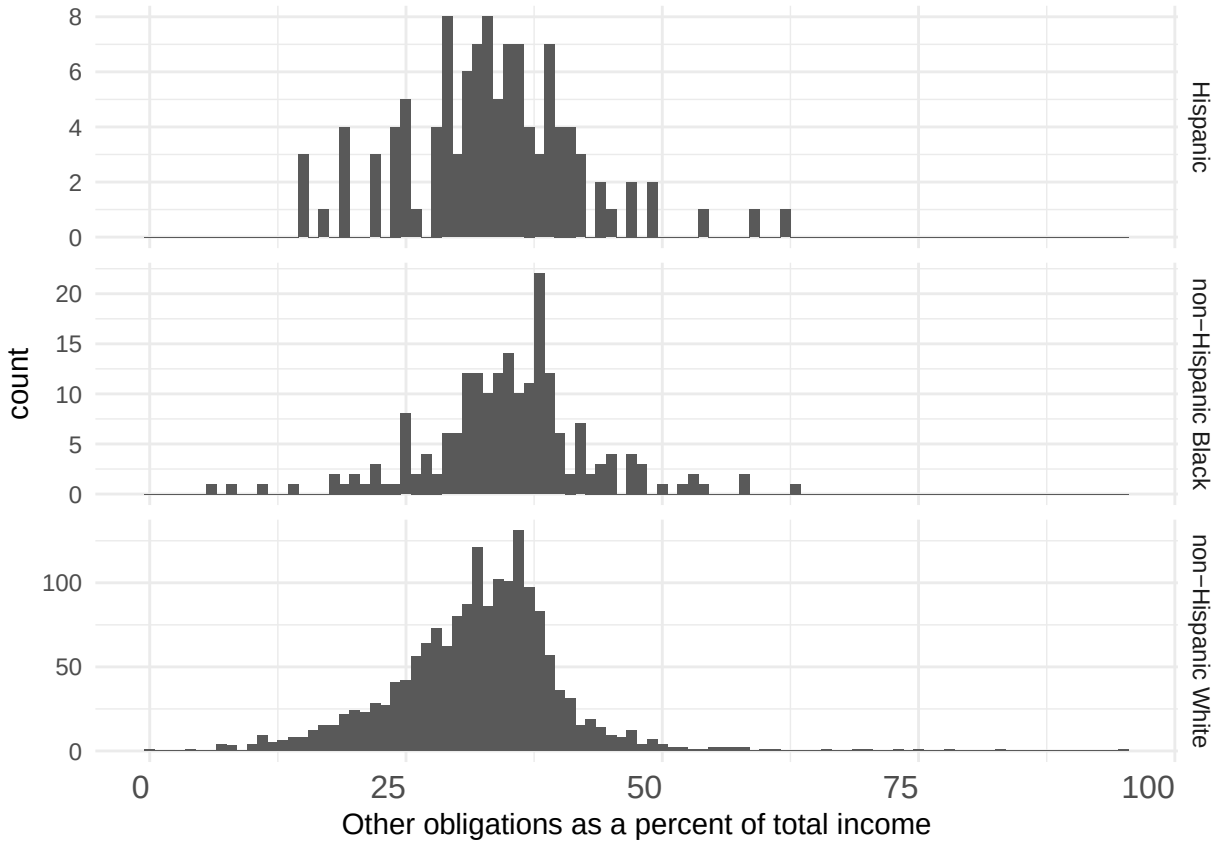
The data set contains 1989 records. The overall descriptive statistics:

```
##     Married     Meet credit history guidelines
##  No     : 678   0  : 171
##  Unknown:   3   1  :1816
##  Yes    :1308   666:   2
##
##
##
##  Other obligations as a percent of total income non-Hispanic Black
##  Min.   : 0.00                                  No :1792
##  1st Qu.:28.00                                  Yes: 197
##  Median :33.00
##  Mean   :32.39
##  3rd Qu.:37.00
##  Max.   :95.00
##  Hispanic        Male      Mortgage loan approved
##  No :1878   No     : 369   No : 244
##  Yes: 111   Unknown:  15   Yes:1745
##             Yes    :1605
##
##
##
##  Loan amount/purchase price                Race
##  Min.   :  2.105            Hispanic          : 111
##  1st Qu.: 70.000            non-Hispanic Black: 197
##  Median : 80.000            non-Hispanic White:1681
##  Mean   : 77.064
##  3rd Qu.: 89.894
##  Max.   :257.143
```

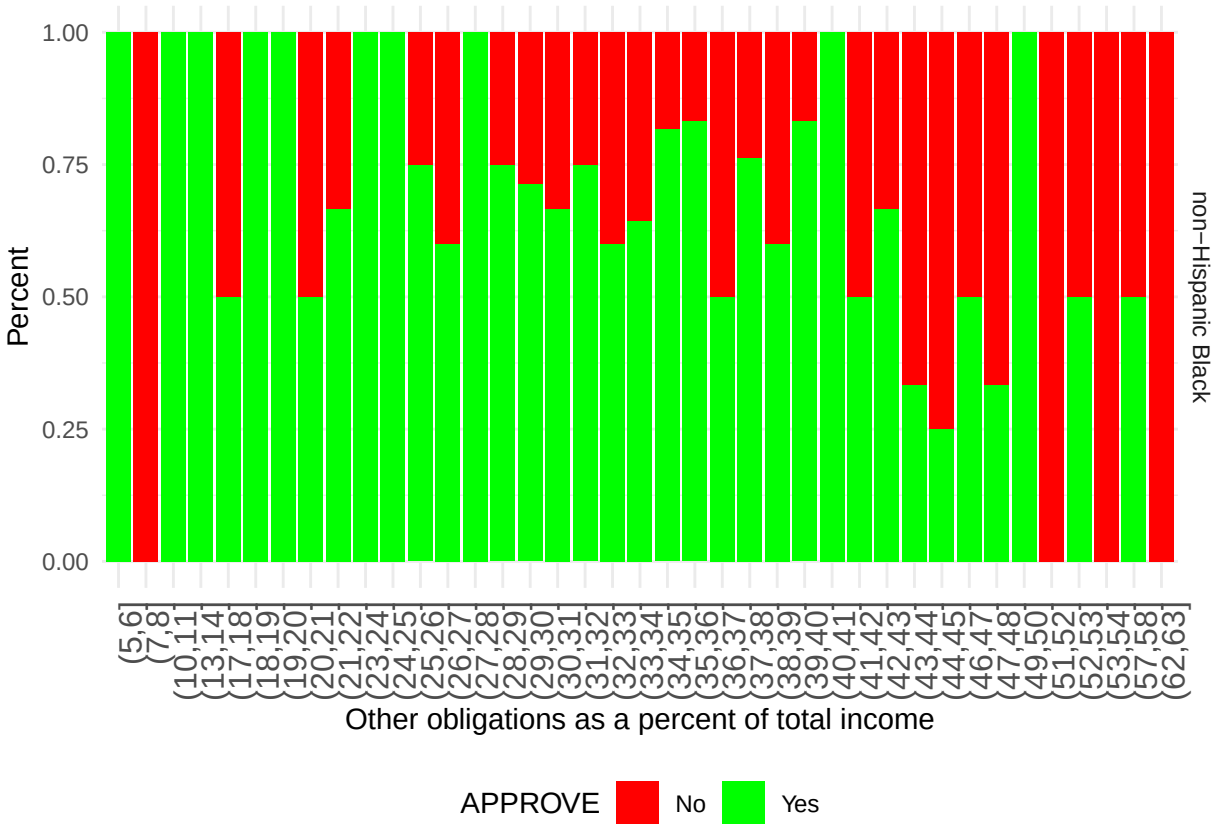
Descriptive statistics by Race:

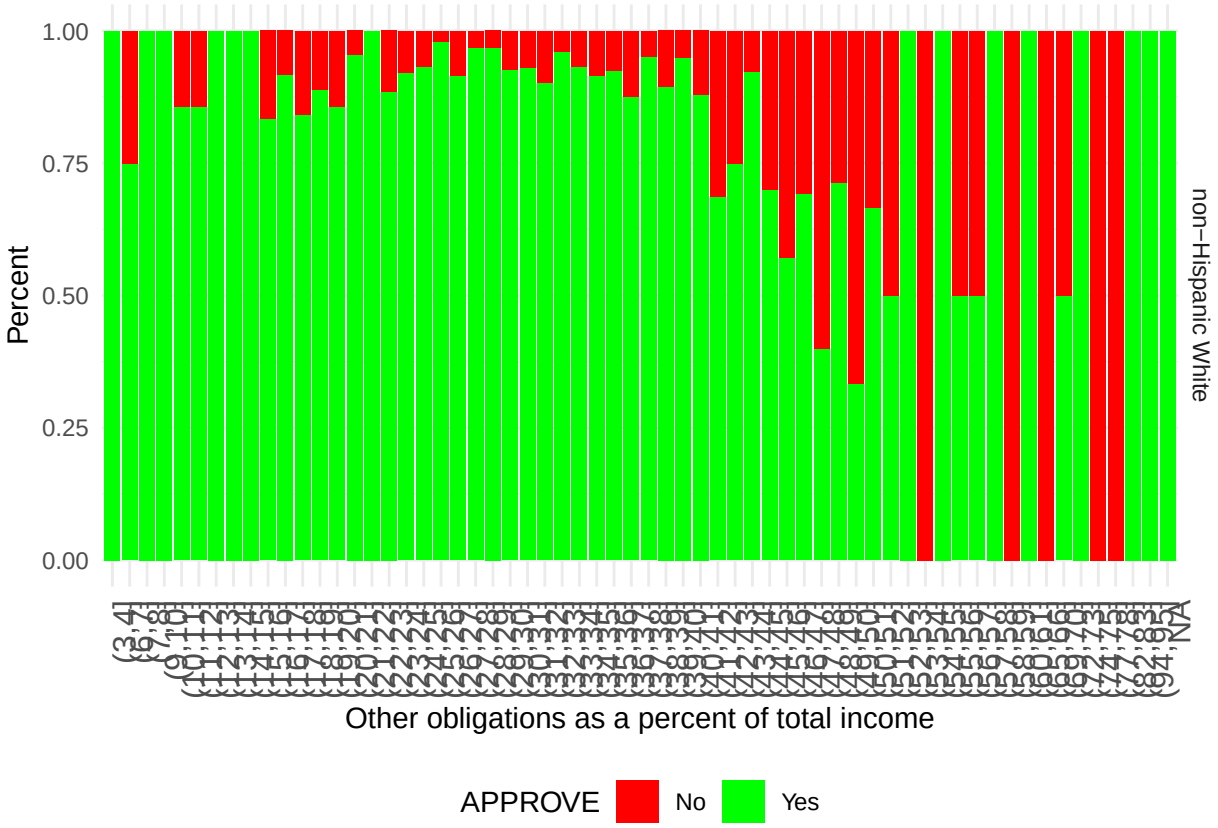
```
## $Hispanic
##     MARRIED   GDLIN        OBRAT            MALE    APPROVE
##  No     :31   0  :16   Min.   :14.60   No     :22   No :26
##  Unknown: 1   1  :95   1st Qu.:29.00   Unknown: 2   Yes:85
##  Yes    :79   666: 0   Median :33.00   Yes    :87
##                        Mean   :33.46
##                        3rd Qu.:38.45
##                        Max.   :62.00
##     LOANPRC                       RACE
##  Min.   : 39.39   Hispanic          :111
##  1st Qu.: 80.00   non-Hispanic Black:  0
##  Median : 89.39   non-Hispanic White:  0
##  Mean   : 85.17
##  3rd Qu.: 90.42
##  Max.   :162.63
```

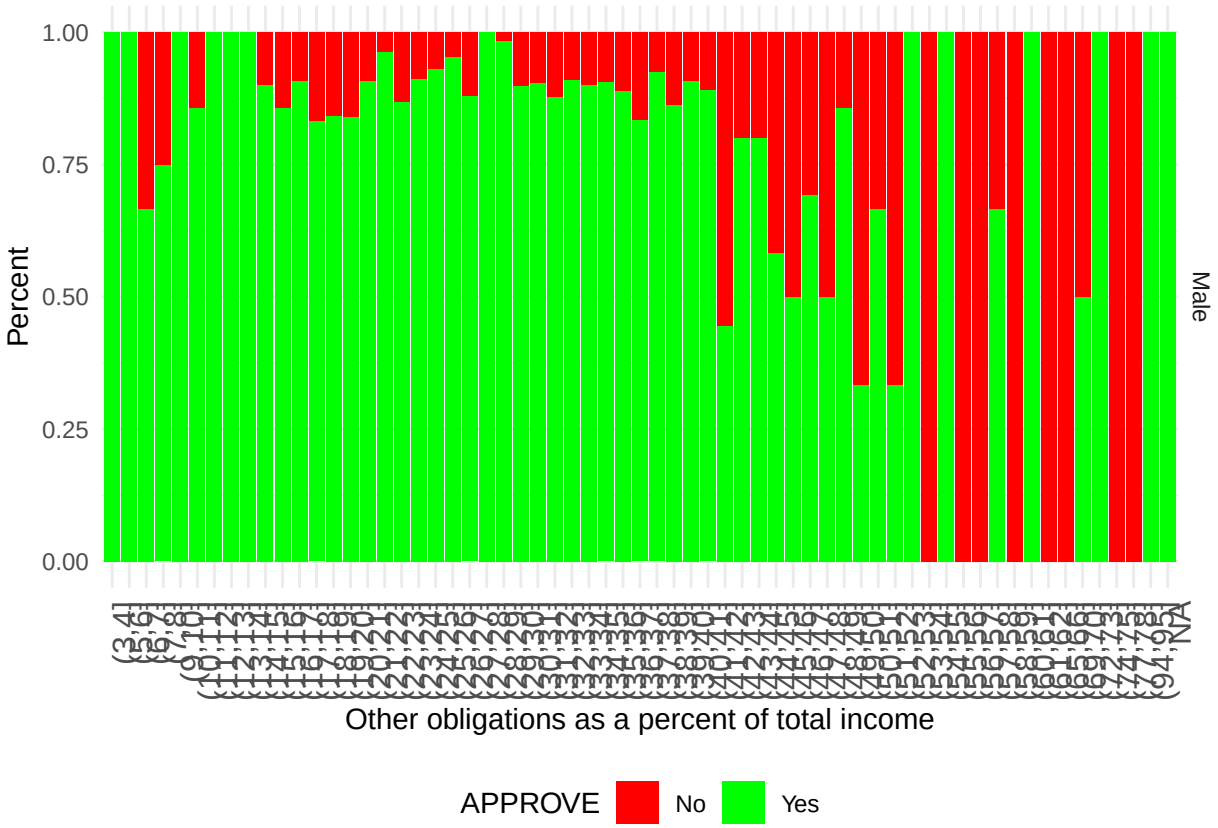
```
##
## $`non-Hispanic Black`
##     MARRIED    GDLIN         OBRAT            MALE     APPROVE
##  No     : 76   0  : 53   Min.   : 5.60   No     : 51   No : 64
##  Unknown:  0   1  :144   1st Qu.:31.00   Unknown:  2   Yes:133
##  Yes    :121   666:  0   Median :35.00   Yes    :144
##                          Mean   :34.94
##                          3rd Qu.:38.90
##                          Max.   :63.00
##     LOANPRC                      RACE
##  Min.   : 28.99   Hispanic          :  0
##  1st Qu.: 80.00   non-Hispanic Black:197
##  Median : 87.02   non-Hispanic White:  0
##  Mean   : 83.97
##  3rd Qu.: 90.24
##  Max.   :255.52
##
## $`non-Hispanic White`
##     MARRIED     GDLIN          OBRAT            MALE      APPROVE
##  No     : 571   0  : 102   Min.   : 0.00   No     : 296   No : 154
##  Unknown:   2   1  :1577   1st Qu.:27.60   Unknown:  11   Yes:1527
##  Yes    :1108   666:   2   Median :32.50   Yes    :1374
##                             Mean   :32.02
##                             3rd Qu.:36.50
##                             Max.   :95.00
##     LOANPRC                       RACE
##  Min.   :  2.105   Hispanic          :   0
##  1st Qu.: 68.182   non-Hispanic Black:   0
##  Median : 79.888   non-Hispanic White:1681
##  Mean   : 75.719
##  3rd Qu.: 89.623
##  Max.   :257.143
```

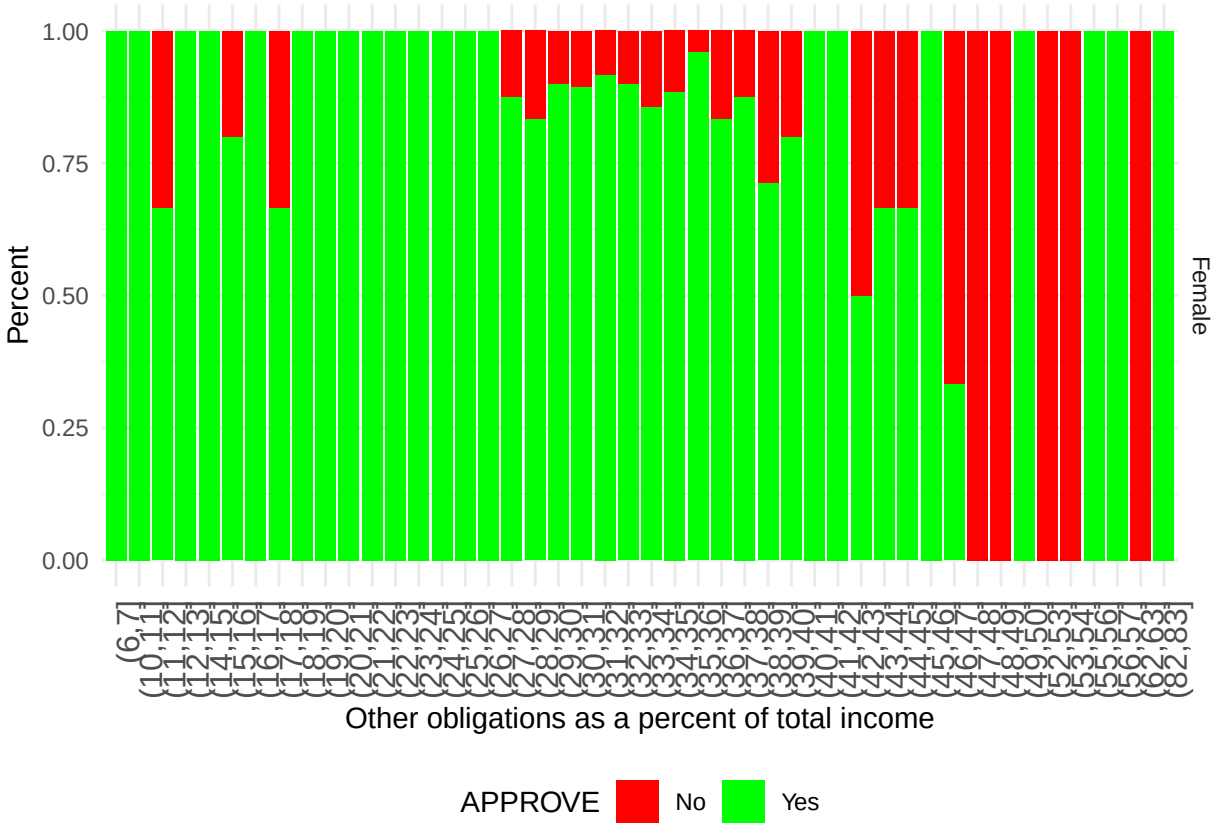

count
Hispanic
non−Hispanic Black
non−Hispanic White
0
25
50
75
100
Other obligations as a percent of total income

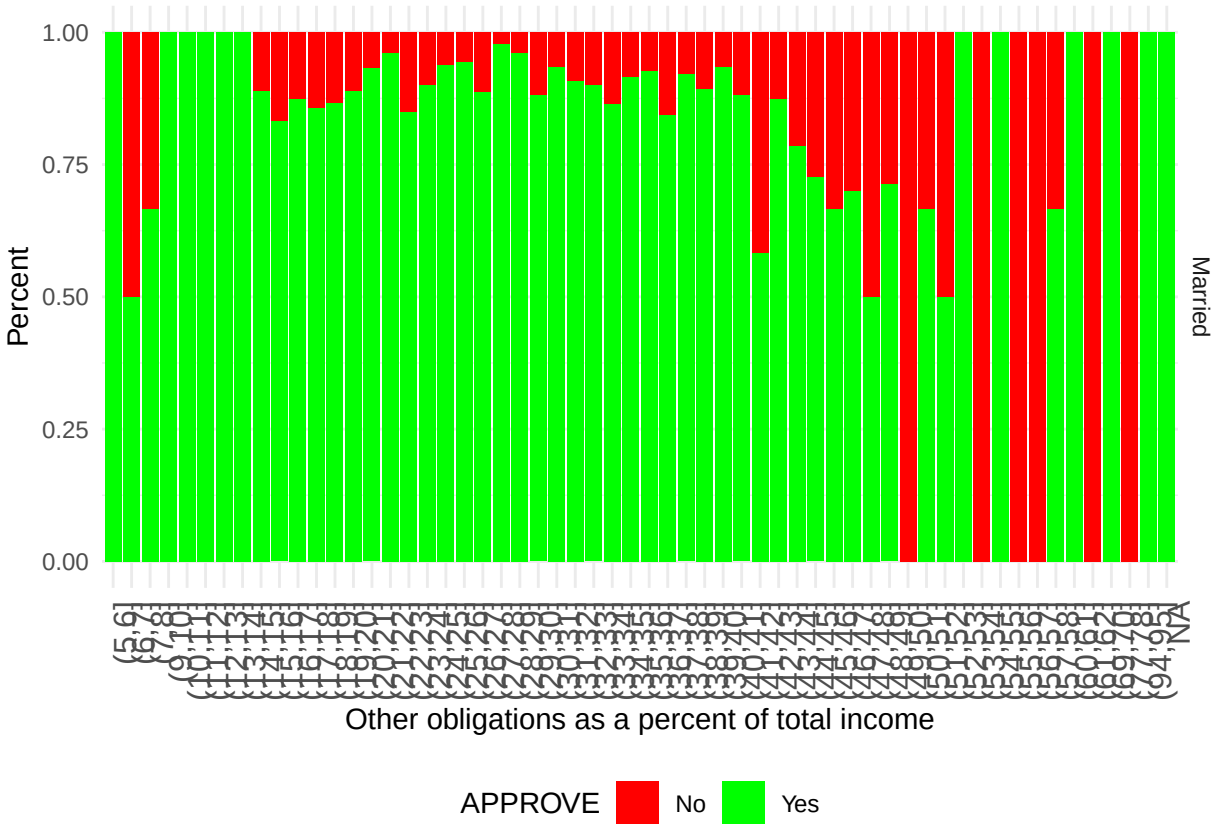

Percent
Hispanic
1.00
0.75
0.50
0.25
0.00
(14,15]
(16,17]
(18,19]
(21,22]
(23,24]
(24,25]
(26,27]
(27,28]
(28,29]
(29,30]
(30,31]
(31,32]
(32,33]
(33,34]
(34,35]
(35,36]
(36,37]
(37,38]
(38,39]
(39,40]
(40,41]
(41,42]
(42,43]
(43,44]
(44,45]
(46,47]
(48,49]
(53,54]
(58,59]
(61,62]
Other obligations as a percent of total income
APPROVE
No
Yes

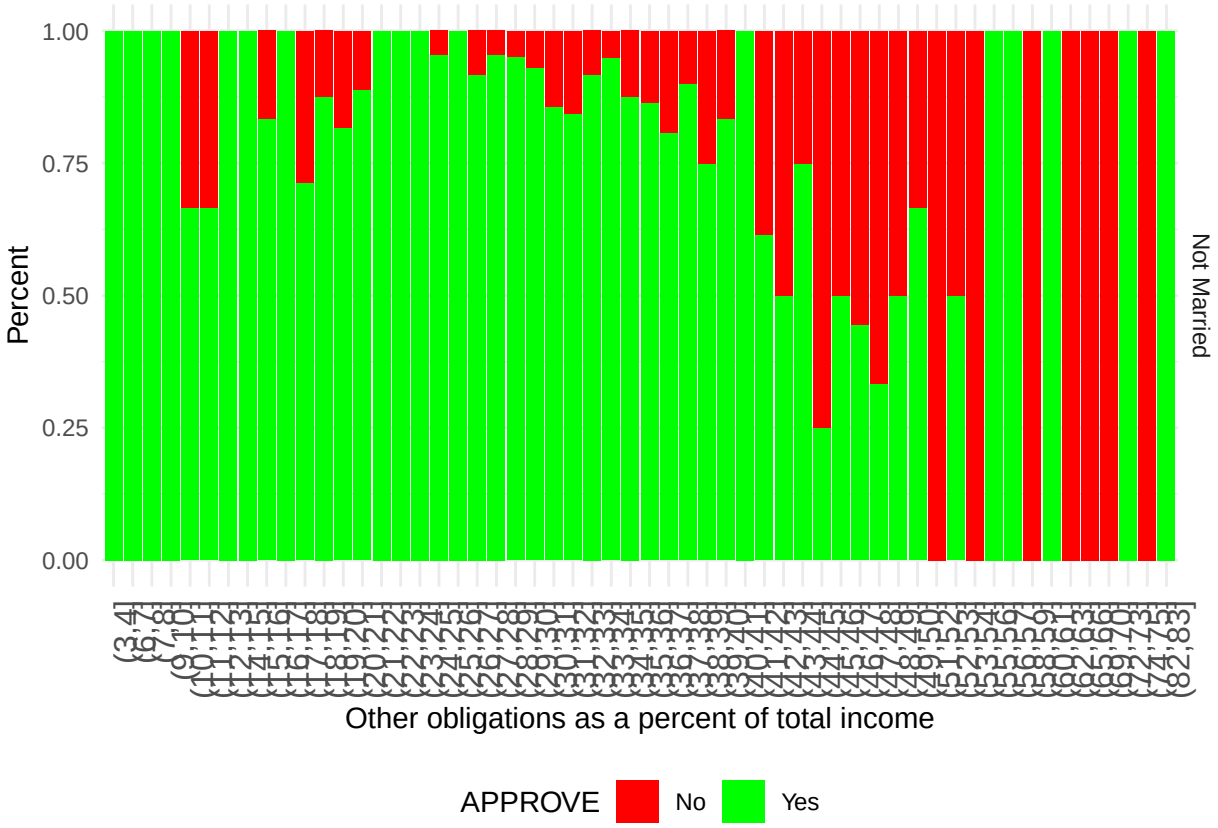

1.00
0.75
0.50
0.25
0.00
Percent
non−Hispanic Black
Other obligations as a percent of total income
APPROVE
No
Yes

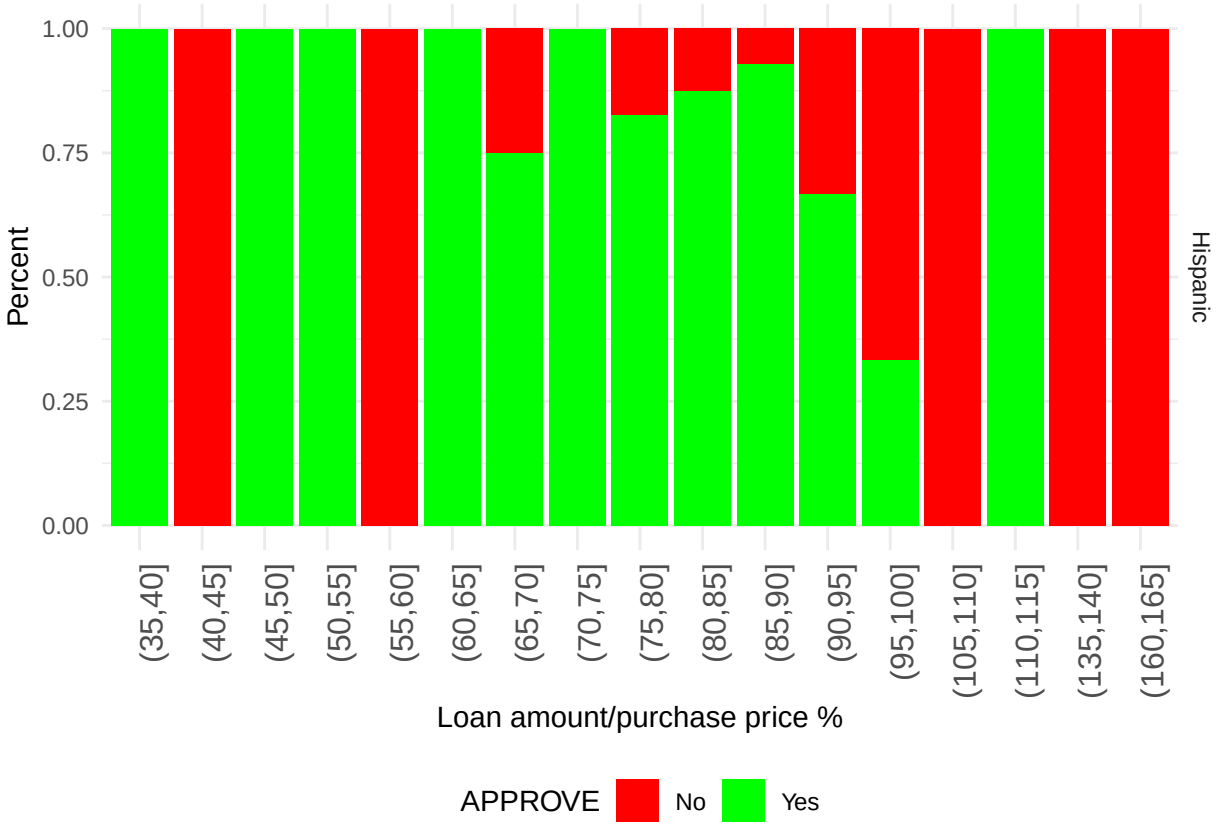

1.00
0.75
0.50
0.25
0.00
Percent
non−Hispanic White
Other obligations as a percent of total income
APPROVE
No
Yes

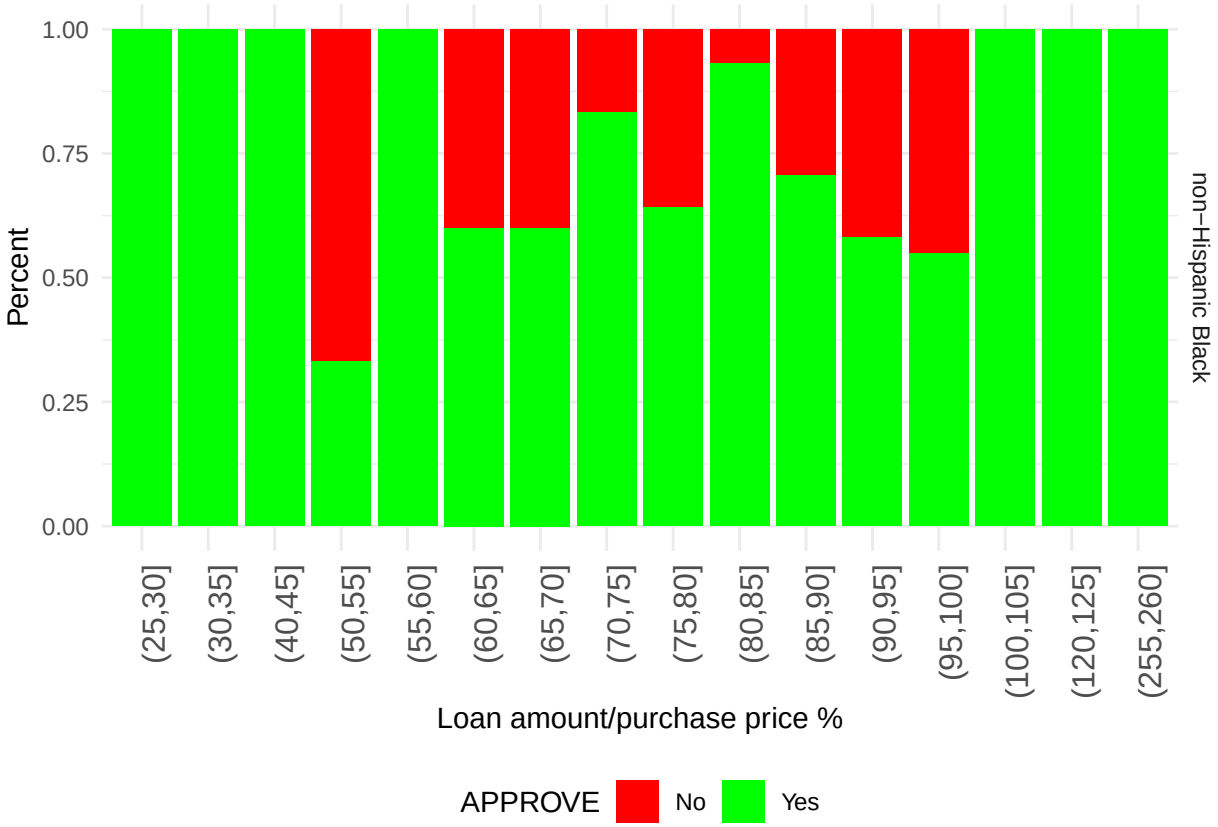

Percent
1.00
0.75
0.50
0.25
0.00
Male
Other obligations as a percent of total income
APPROVE
No
Yes

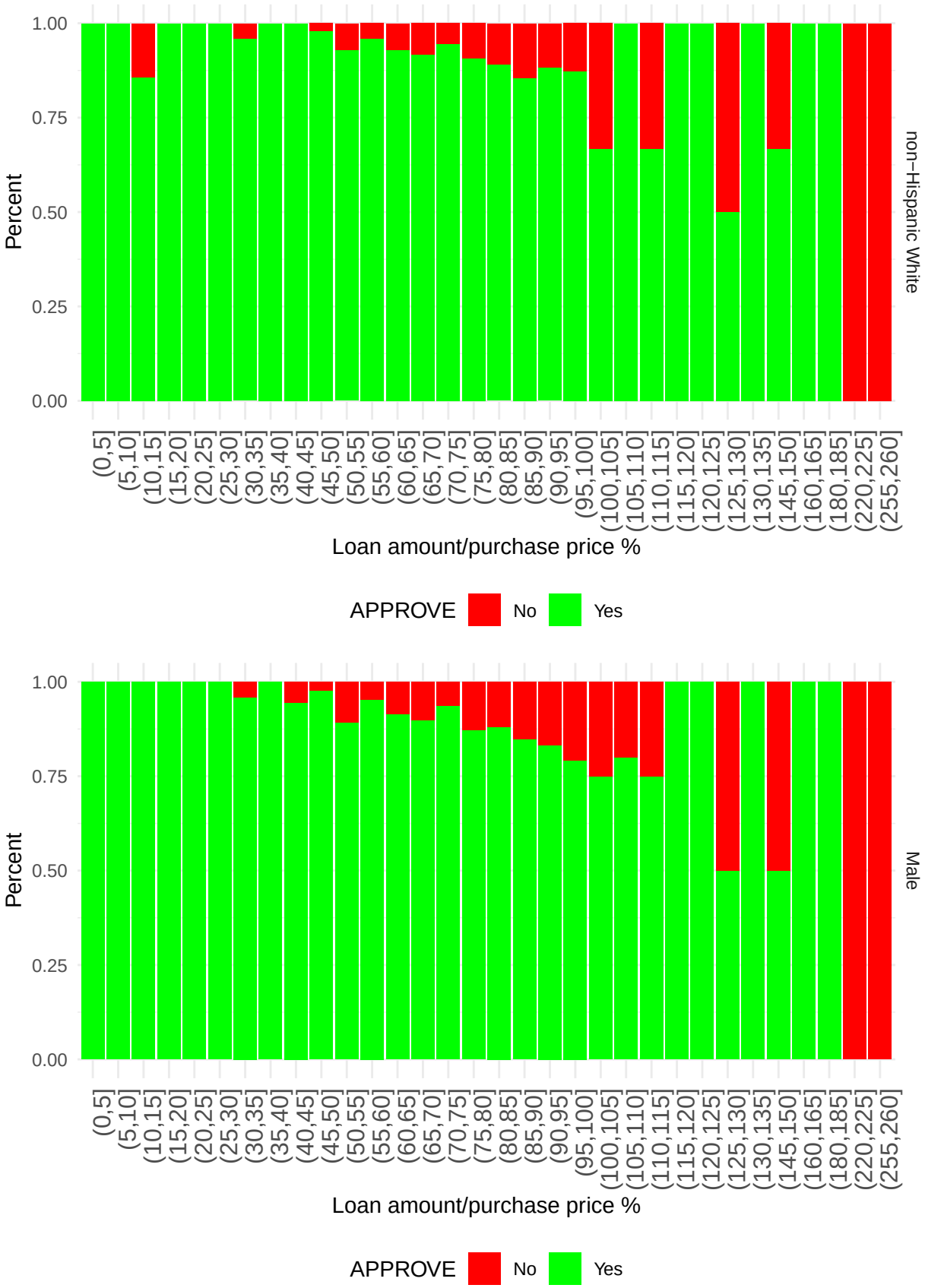

Percent
1.00
0.75
0.50
0.25
0.00
Female
Other obligations as a percent of total income
APPROVE
No
Yes

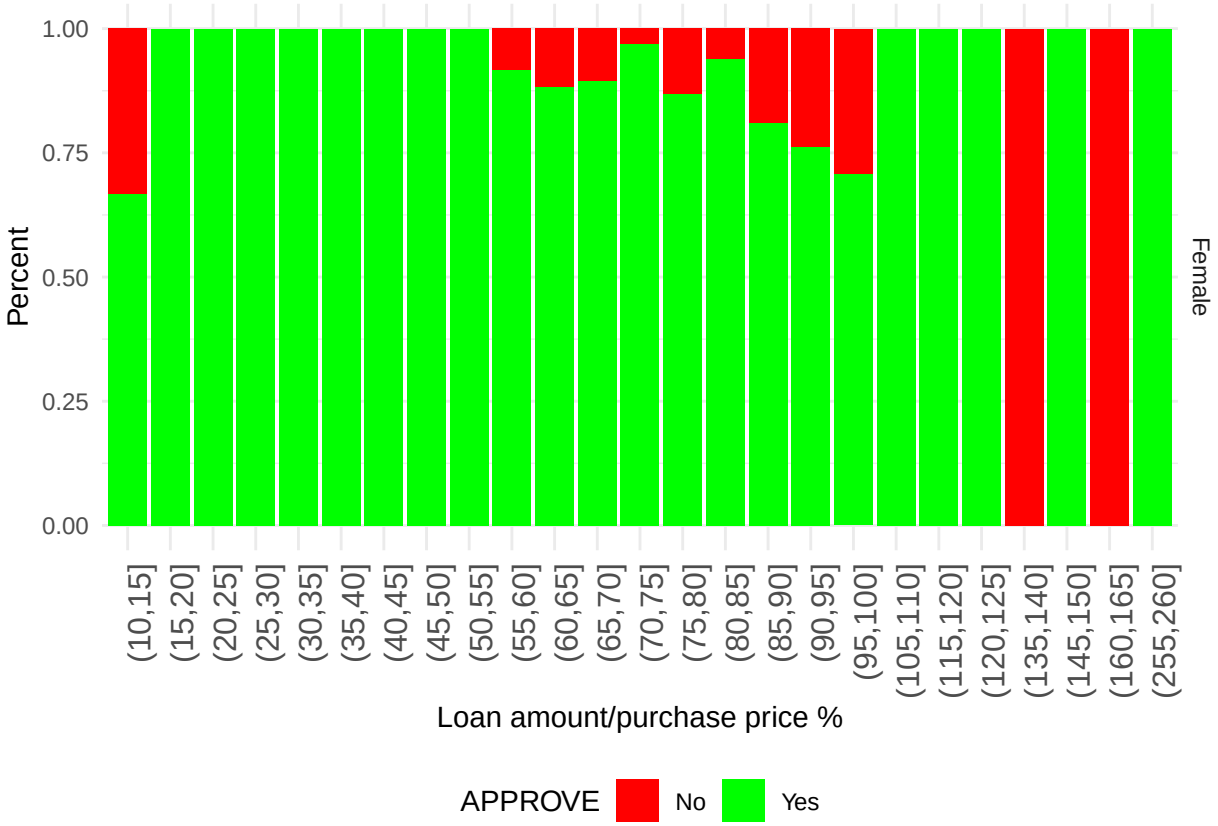

1.00
0.75
0.50
0.25
0.00
Percent
Married
Other obligations as a percent of total income
APPROVE
No
Yes

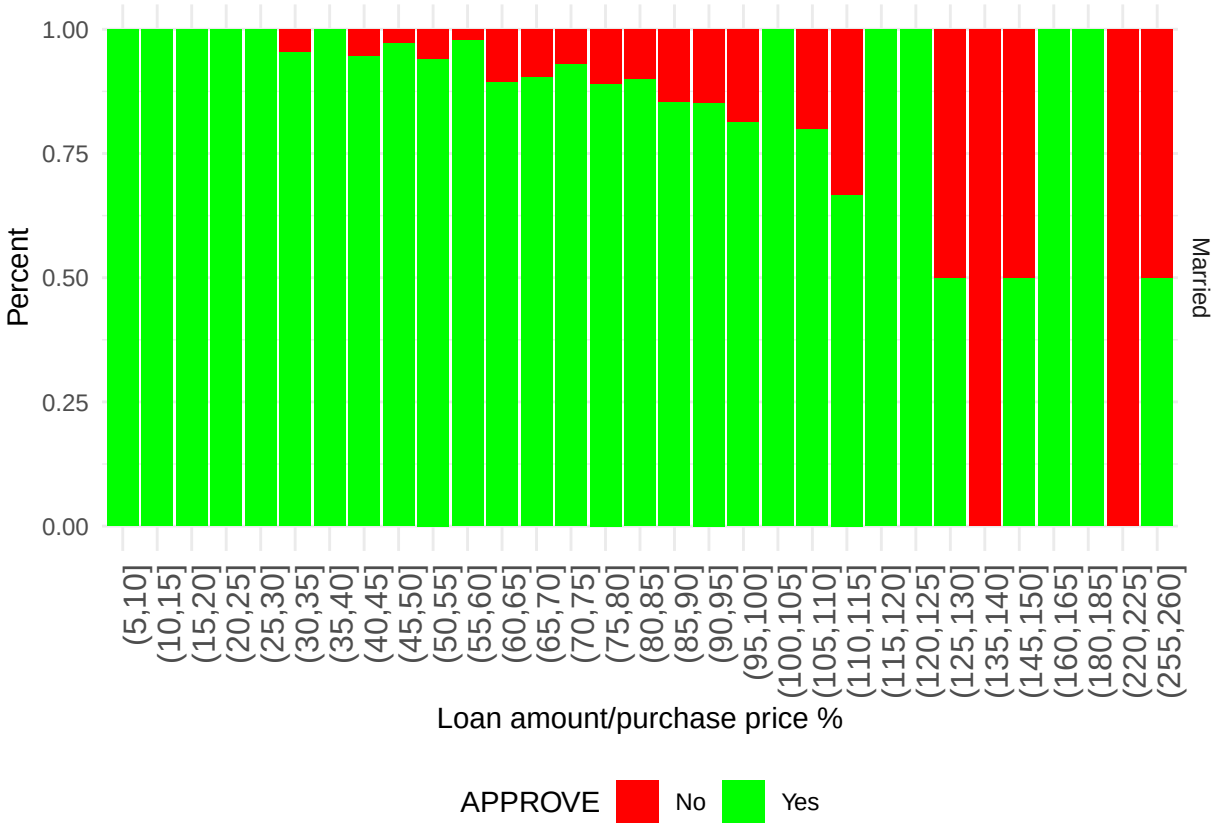

1.00
0.75
0.50
0.25
0.00
Percent
Not Married
Other obligations as a percent of total income
APPROVE
No
Yes

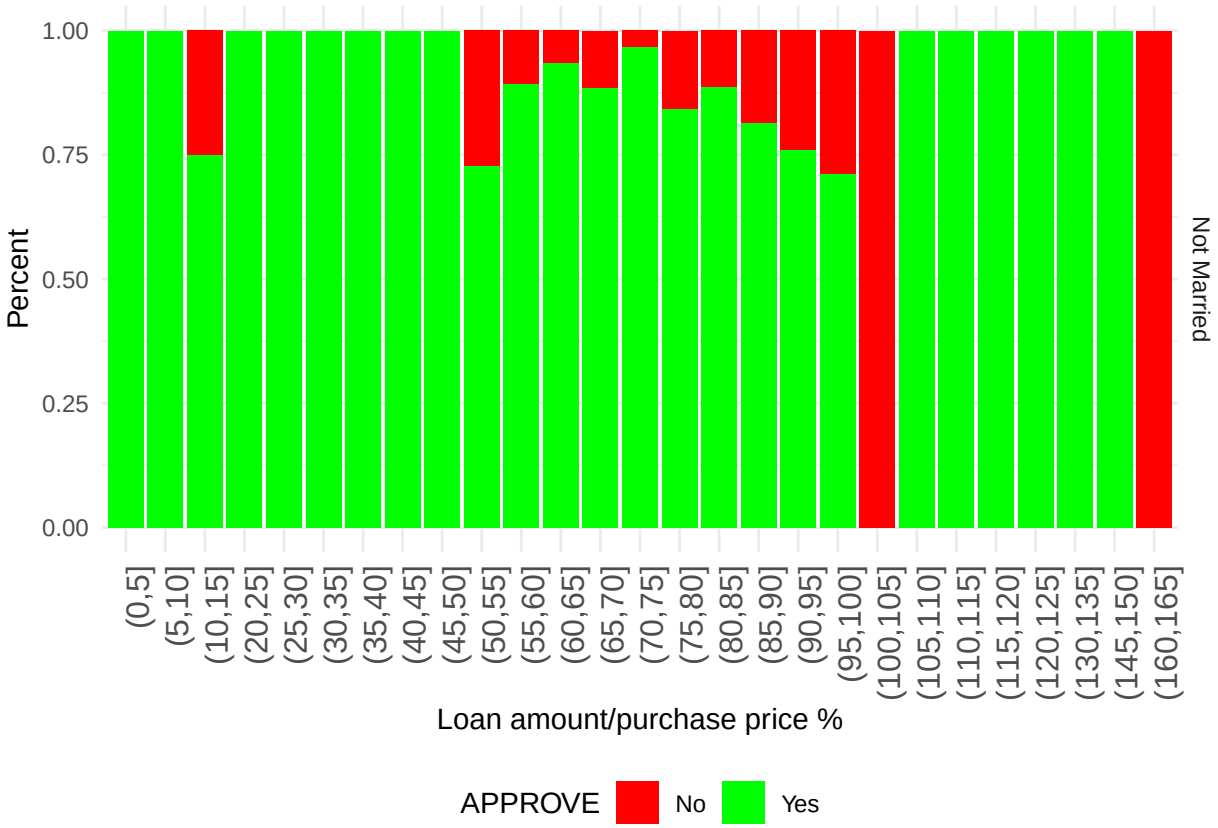

1.00
0.75
0.50
0.25
0.00
Percent
Hispanic
(35,40]
(40,45]
(45,50]
(50,55]
(55,60]
(60,65]
(65,70]
(70,75]
(75,80]
(80,85]
(85,90]
(90,95]
(95,100]
(105,110]
(110,115]
(135,140]
(160,165]
Loan amount/purchase price %
APPROVE
No
Yes


1.00
0.75
0.50
0.25
0.00
Percent
non−Hispanic Black
(25,30]
(30,35]
(40,45]
(50,55]
(55,60]
(60,65]
(65,70]
(70,75]
(75,80]
(80,85]
(85,90]
(90,95]
(95,100]
(100,105]
(120,125]
(255,260]
Loan amount/purchase price %
APPROVE
No
Yes


1.00
0.75
0.50
0.25
0.00
Percent
non−Hispanic White
(0,5]
(5,10]
(10,15]
(15,20]
(20,25]
(25,30]
(30,35]
(35,40]
(40,45]
(45,50]
(50,55]
(55,60]
(60,65]
(65,70]
(70,75]
(75,80]
(80,85]
(85,90]
(90,95]
(95,100]
(100,105]
(105,110]
(110,115]
(115,120]
(120,125]
(125,130]
(130,135]
(145,150]
(160,165]
(180,185]
(220,225]
(255,260]
Loan amount/purchase price %
APPROVE
No
Yes
1.00
0.75
0.50
0.25
0.00
Percent
Male
(0,5]
(5,10]
(10,15]
(15,20]
(20,25]
(25,30]
(30,35]
(35,40]
(40,45]
(45,50]
(50,55]
(55,60]
(60,65]
(65,70]
(70,75]
(75,80]
(80,85]
(85,90]
(90,95]
(95,100]
(100,105]
(105,110]
(110,115]
(115,120]
(120,125]
(125,130]
(130,135]
(145,150]
(160,165]
(180,185]
(220,225]
(255,260]
Loan amount/purchase price %
APPROVE
No
Yes


1.00
0.75
0.50
0.25
0.00
Percent
Female
(10,15]
(15,20]
(20,25]
(25,30]
(30,35]
(35,40]
(40,45]
(45,50]
(50,55]
(55,60]
(60,65]
(65,70]
(70,75]
(75,80]
(80,85]
(85,90]
(90,95]
(95,100]
(105,110]
(115,120]
(120,125]
(135,140]
(145,150]
(160,165]
(255,260]
Loan amount/purchase price %
APPROVE
No
Yes


1.00
0.75
0.50
0.25
0.00
Percent
Married
(5,10]
(10,15]
(15,20]
(20,25]
(25,30]
(30,35]
(35,40]
(40,45]
(45,50]
(50,55]
(55,60]
(60,65]
(65,70]
(70,75]
(75,80]
(80,85]
(85,90]
(90,95]
(95,100]
(100,105]
(105,110]
(110,115]
(115,120]
(120,125]
(125,130]
(135,140]
(145,150]
(160,165]
(180,185]
(220,225]
(255,260]
Loan amount/purchase price %
APPROVE
No
Yes



Descriptive statistics by Marital Status:

```
## $No
##     MARRIED     GDLIN          OBRAT             MALE      APPROVE
##  No      :678   0  : 64   Min.   : 4.00   No      :252   No :102
##  Unknown:  0   1  :614   1st Qu.:28.00   Unknown:  7   Yes:576
##  Yes     :  0   666:  0   Median :33.00   Yes     :419
##                            Mean   :32.74
##                            3rd Qu.:37.00
##                            Max.   :83.00
##     LOANPRC                          RACE
##  Min.   :  2.105   Hispanic          : 31
##  1st Qu.: 72.426   non-Hispanic Black: 76
##  Median : 80.000   non-Hispanic White:571
##  Mean   : 77.967
##  3rd Qu.: 89.978
##  Max.   :162.626
##
## $Unknown
##     MARRIED  GDLIN        OBRAT           MALE   APPROVE    LOANPRC
##  No      :0   0  :0   Min.   :13.0   No      :1   No :0   Min.   : 86.96
##  Unknown:3   1  :3   1st Qu.:23.3   Unknown:0   Yes:3   1st Qu.: 88.62
##  Yes     :0   666:0   Median :33.6   Yes     :2           Median : 90.29
##                       Mean   :27.2                        Mean   : 98.16
##                       3rd Qu.:34.3                        3rd Qu.:103.76
##                       Max.   :35.0                        Max.   :117.24
##                   RACE
##  Hispanic          :1
##  non-Hispanic Black:0
```

```
##  non-Hispanic White:2
##
##
##
##
## $Yes
##     MARRIED     GDLIN          OBRAT            MALE      APPROVE
##  No      :   0   0  : 107   Min.   : 0.00   No     : 116   No : 142
##  Unknown:   0   1  :1199   1st Qu.:28.00   Unknown:   8   Yes:1166
##  Yes    :1308   666:   2   Median :33.00   Yes    :1184
##                             Mean   :32.22
##                             3rd Qu.:37.00
##                             Max.   :95.00
##     LOANPRC                        RACE
##  Min.   :  8.772   Hispanic          :  79
##  1st Qu.: 68.857   non-Hispanic Black: 121
##  Median : 80.000   non-Hispanic White:1108
##  Mean   : 76.547
##  3rd Qu.: 89.866
##  Max.   :257.143
```

Descriptive statistics by Gender:

```
## $No
##     MARRIED    GDLIN         OBRAT            MALE     APPROVE
##  No      :252   0  : 31   Min.   : 6.99   No     :369   No : 50
##  Unknown:  1   1  :338   1st Qu.:28.00   Unknown:  0   Yes:319
##  Yes    :116   666:  0   Median :33.00   Yes    :  0
##                           Mean   :32.64
##                           3rd Qu.:37.00
##                           Max.   :83.00
##     LOANPRC                       RACE
##  Min.   : 11.01   Hispanic          : 22
##  1st Qu.: 70.83   non-Hispanic Black: 51
##  Median : 80.00   non-Hispanic White:296
##  Mean   : 77.66
##  3rd Qu.: 90.00
##  Max.   :255.52
##
## $Unknown
##     MARRIED  GDLIN        OBRAT            MALE    APPROVE
##  No      :7   0  : 0   Min.   :24.00   No     : 0   No : 0
##  Unknown:0   1  :15   1st Qu.:29.95   Unknown:15   Yes:15
##  Yes    :8   666: 0   Median :34.50   Yes    : 0
##                       Mean   :33.33
##                       3rd Qu.:37.65
##                       Max.   :40.30
##     LOANPRC                      RACE
##  Min.   :39.39   Hispanic          : 2
##  1st Qu.:74.93   non-Hispanic Black: 2
##  Median :75.42   non-Hispanic White:11
##  Mean   :75.59
##  3rd Qu.:80.43
##  Max.   :92.90
##
## $Yes
```

```
##     MARRIED     GDLIN          OBRAT            MALE      APPROVE
##  No     : 419   0  : 140   Min.   : 0.00   No     :   0   No : 194
##  Unknown:   2   1  :1463   1st Qu.:28.00   Unknown:   0   Yes:1411
##  Yes    :1184   666:   2   Median :33.00   Yes    :1605
##                             Mean   :32.32
##                             3rd Qu.:37.00
##                             Max.   :95.00
##     LOANPRC                        RACE
##  Min.   :  2.105   Hispanic          :  87
##  1st Qu.: 69.655   non-Hispanic Black: 144
##  Median : 80.000   non-Hispanic White:1374
##  Mean   : 76.942
##  3rd Qu.: 89.881
##  Max.   :257.143
```

There are 3 records are missing married (MARRIED) field.

ID	MARRIED	GDLIN	OBRAT	BLACK	HISPAN	MALE	APPROVE	LOANPRC	RACE
356	Unknown	1	35.0	No	Yes	Yes	Yes	86.95652	Hispanic
759	Unknown	1	33.6	No	No	Yes	Yes	90.28571	non-Hispanic White
1392	Unknown	1	13.0	No	No	No	Yes	117.24140	non-Hispanic White

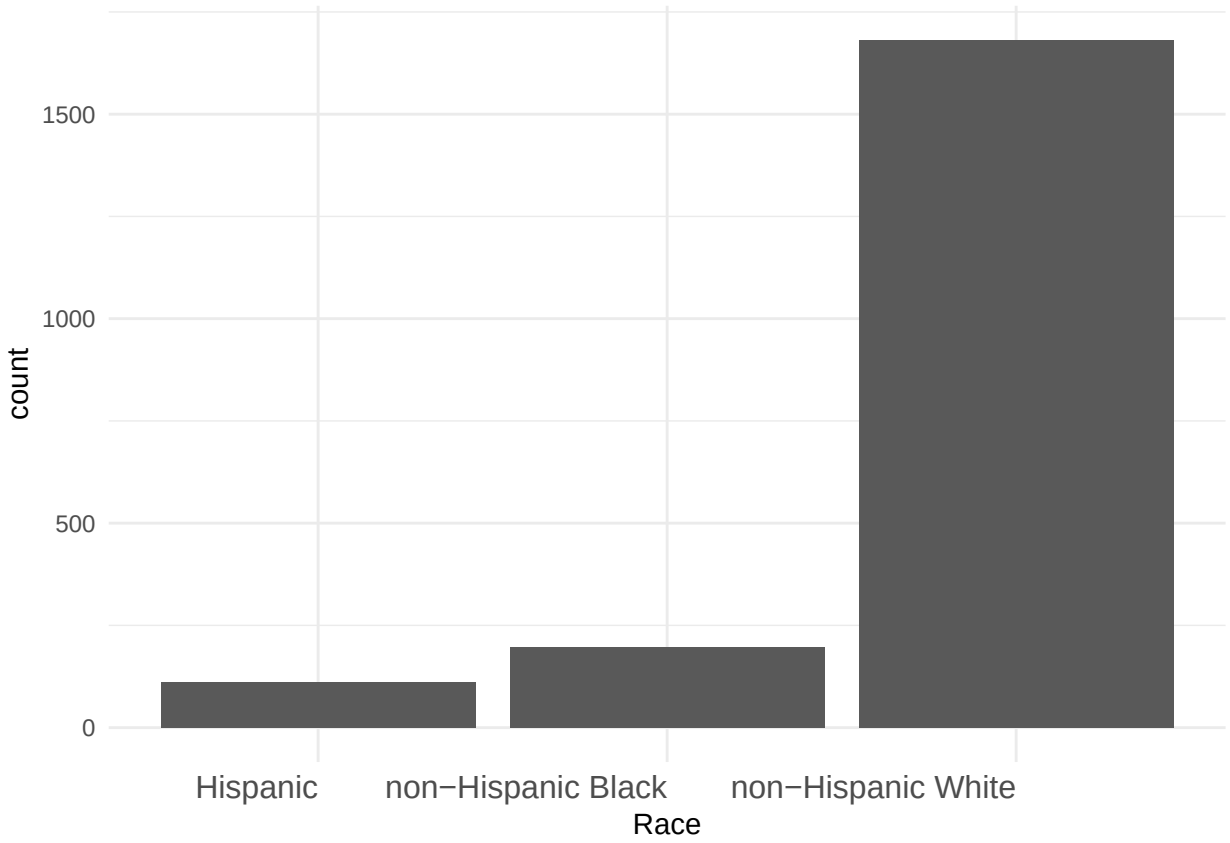
There are 3 records are missing married (GDLIN) field.

ID	MARRIED	GDLIN	OBRAT	BLACK	HISPAN	MALE	APPROVE	LOANPRC	RACE
881	Yes	666	35	No	No	Yes	Yes	75.82939	non-Hispanic White
1229	Yes	666	26	No	No	Yes	Yes	100.00000	non-Hispanic White

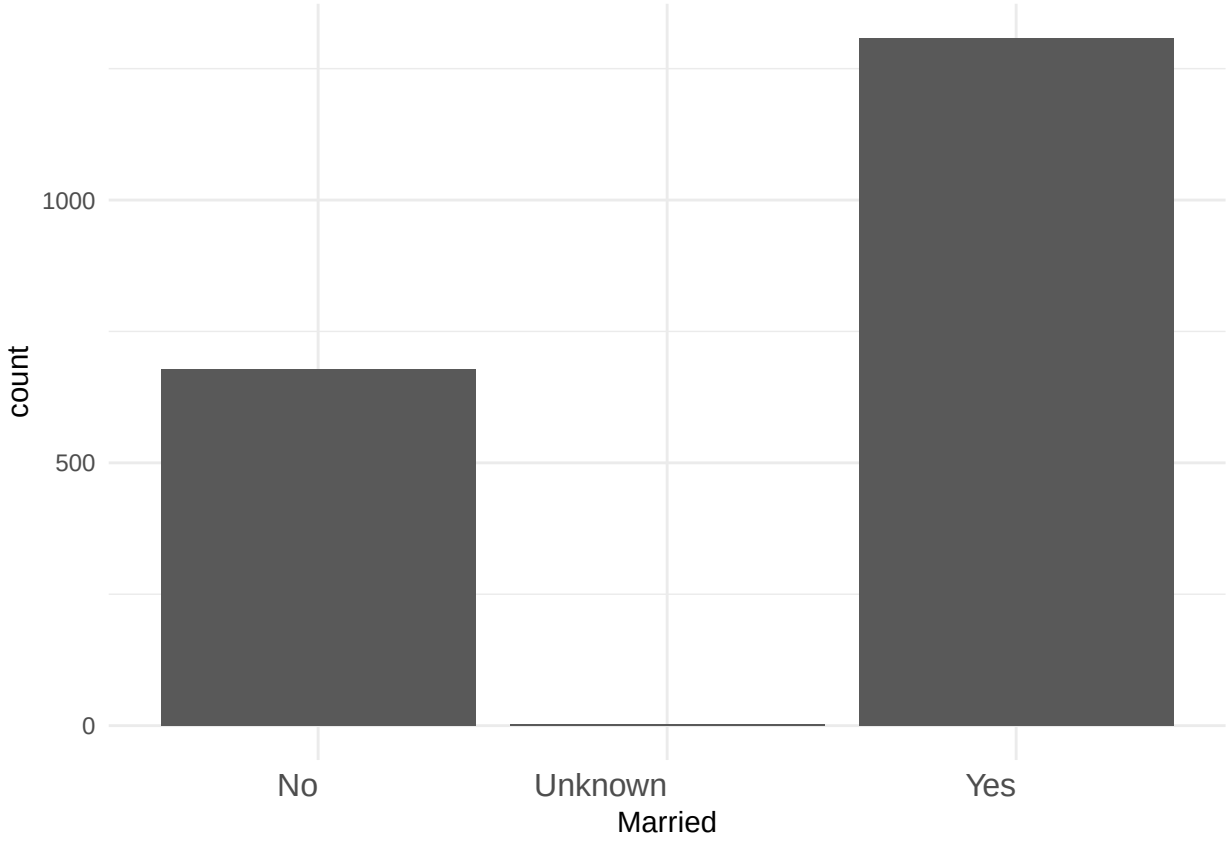
There are 15 records are missing gender (MALE) field.

ID	MARRIED	GDLIN	OBRAT	BLACK	HISPAN	MALE	APPROVE	LOANPRC	RACE
1	No	1	34.5	No	No	Unknown	Yes	75.42373	non-Hispanic White
127	No	1	31.6	No	No	Unknown	Yes	80.80000	non-Hispanic White
286	Yes	1	37.3	No	No	Unknown	Yes	80.05337	non-Hispanic White
452	Yes	1	40.1	Yes	No	Unknown	Yes	75.00000	non-Hispanic Black
618	Yes	1	38.5	No	No	Unknown	Yes	92.90323	non-Hispanic White
695	Yes	1	25.0	No	No	Unknown	Yes	64.48276	non-Hispanic White
762	Yes	1	27.6	No	No	Unknown	Yes	75.55556	non-Hispanic White
768	No	1	35.6	No	No	Unknown	Yes	64.74397	non-Hispanic White
833	Yes	1	24.0	No	Yes	Unknown	Yes	79.80769	Hispanic
979	No	1	31.7	No	No	Unknown	Yes	74.86033	non-Hispanic White
1040	No	1	38.0	Yes	No	Unknown	Yes	75.38462	non-Hispanic Black
1070	Yes	1	40.3	No	Yes	Unknown	Yes	39.39394	Hispanic
1092	Yes	1	29.7	No	No	Unknown	Yes	90.10239	non-Hispanic White
1613	No	1	30.2	No	No	Unknown	Yes	90.00000	non-Hispanic White
1924	No	1	35.8	No	No	Unknown	Yes	75.32051	non-Hispanic White

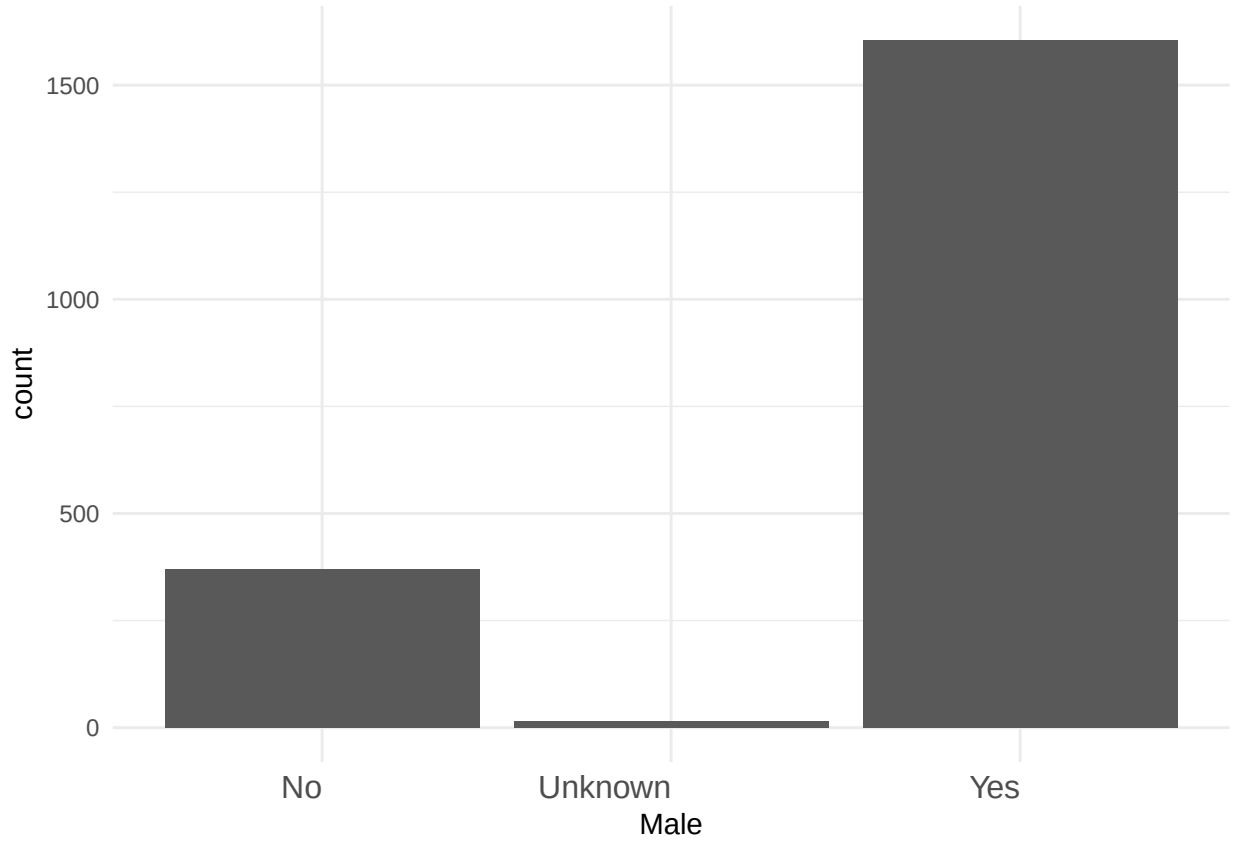
```
##                       APPROVE
## RACE                     No  Yes
##   Hispanic               26   85
##   non-Hispanic Black     64  133
##   non-Hispanic White    154 1527
```



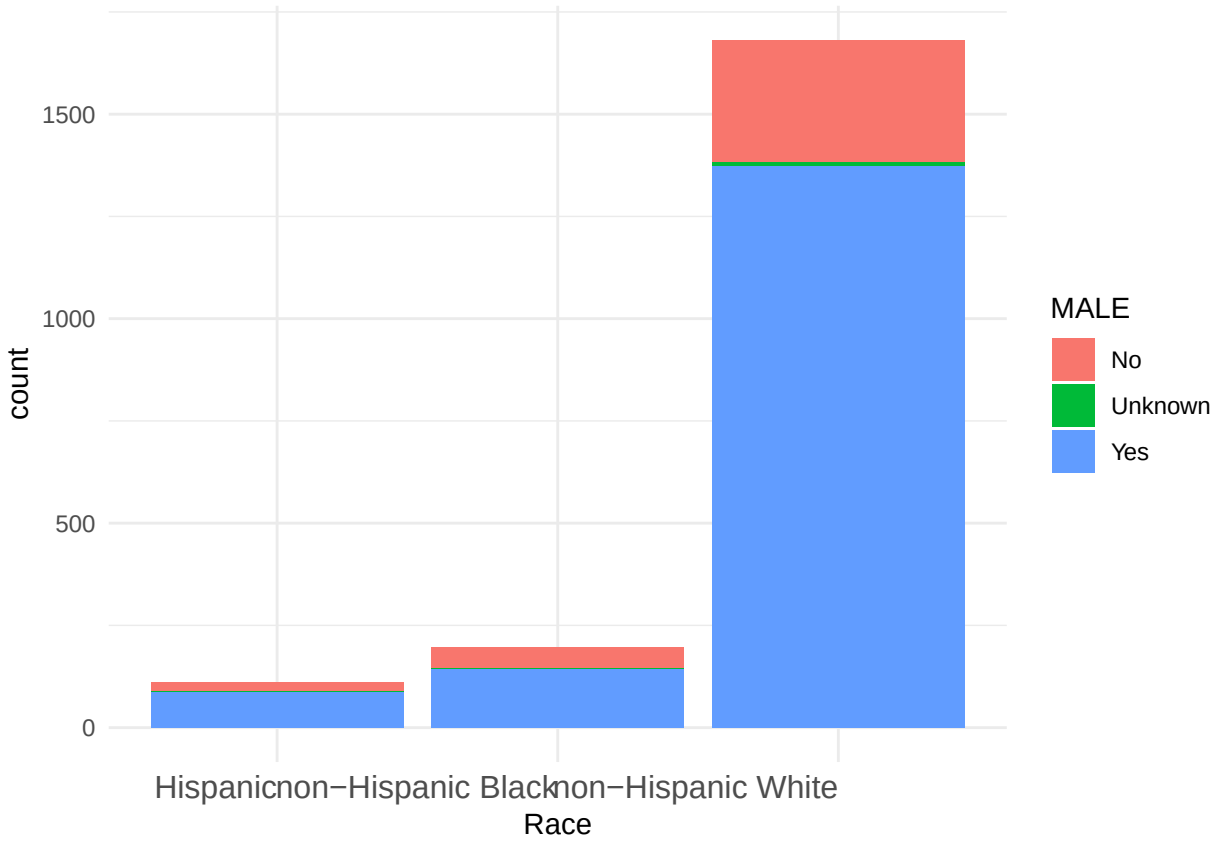

```
##          APPROVE
## MARRIED     No  Yes
##   No       102  576
##   Unknown    0    3
##   Yes      142 1166
```

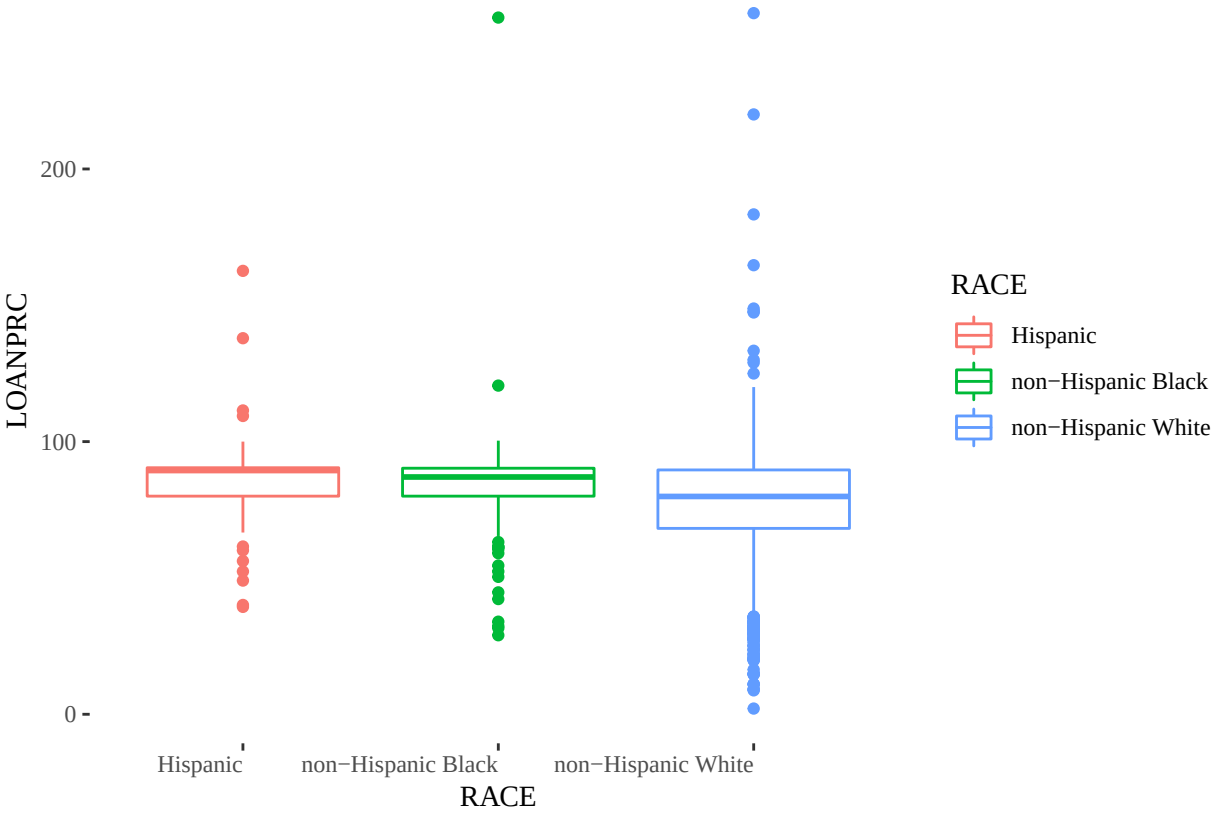


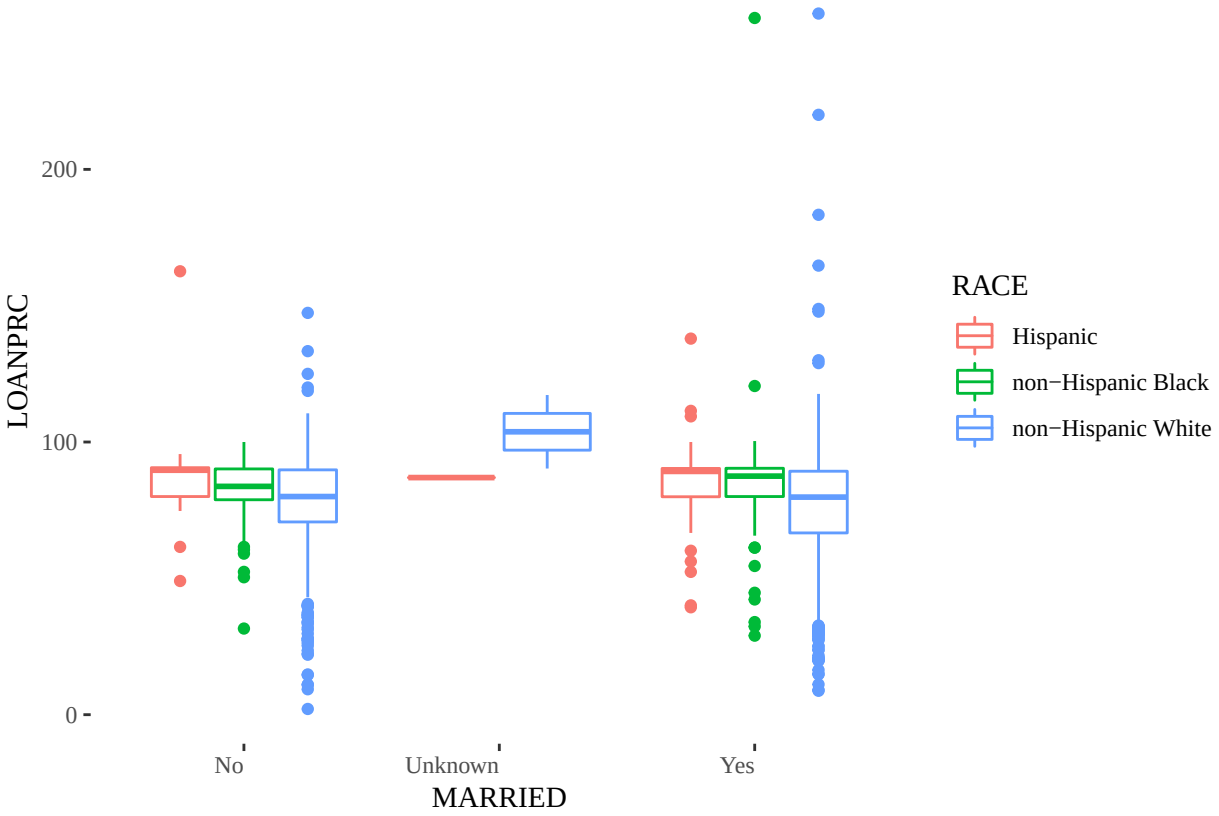

```
##          APPROVE
## MALE        No  Yes
##   No        50  319
##   Unknown    0   15
##   Yes      194 1411
```

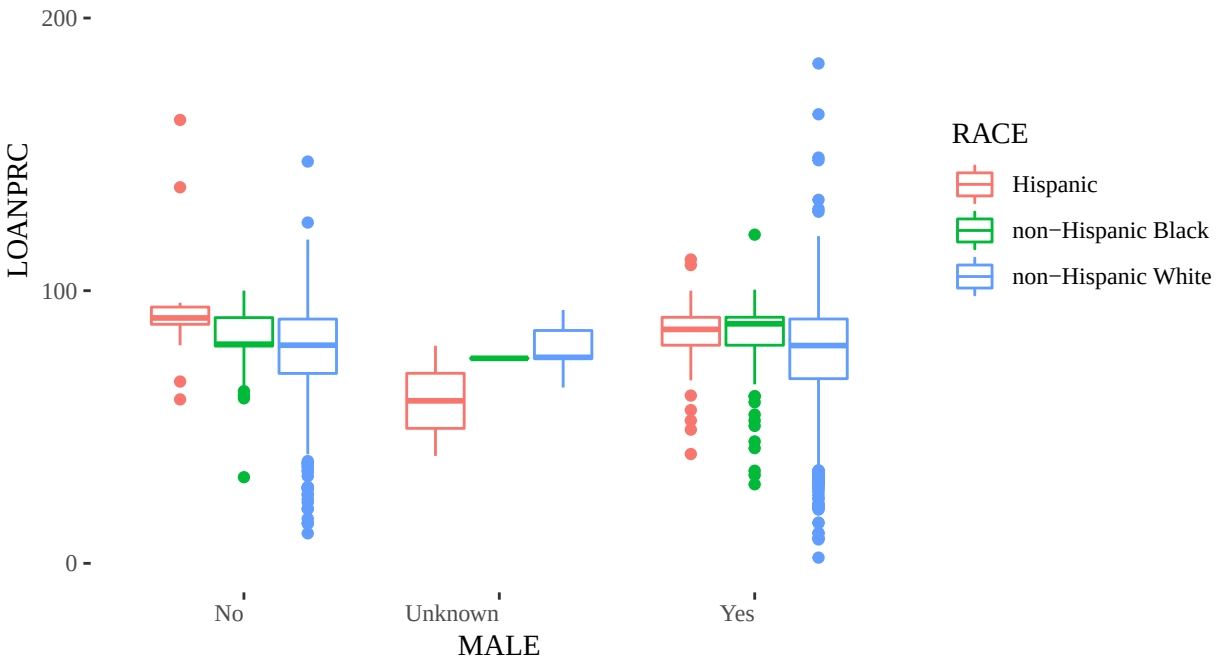


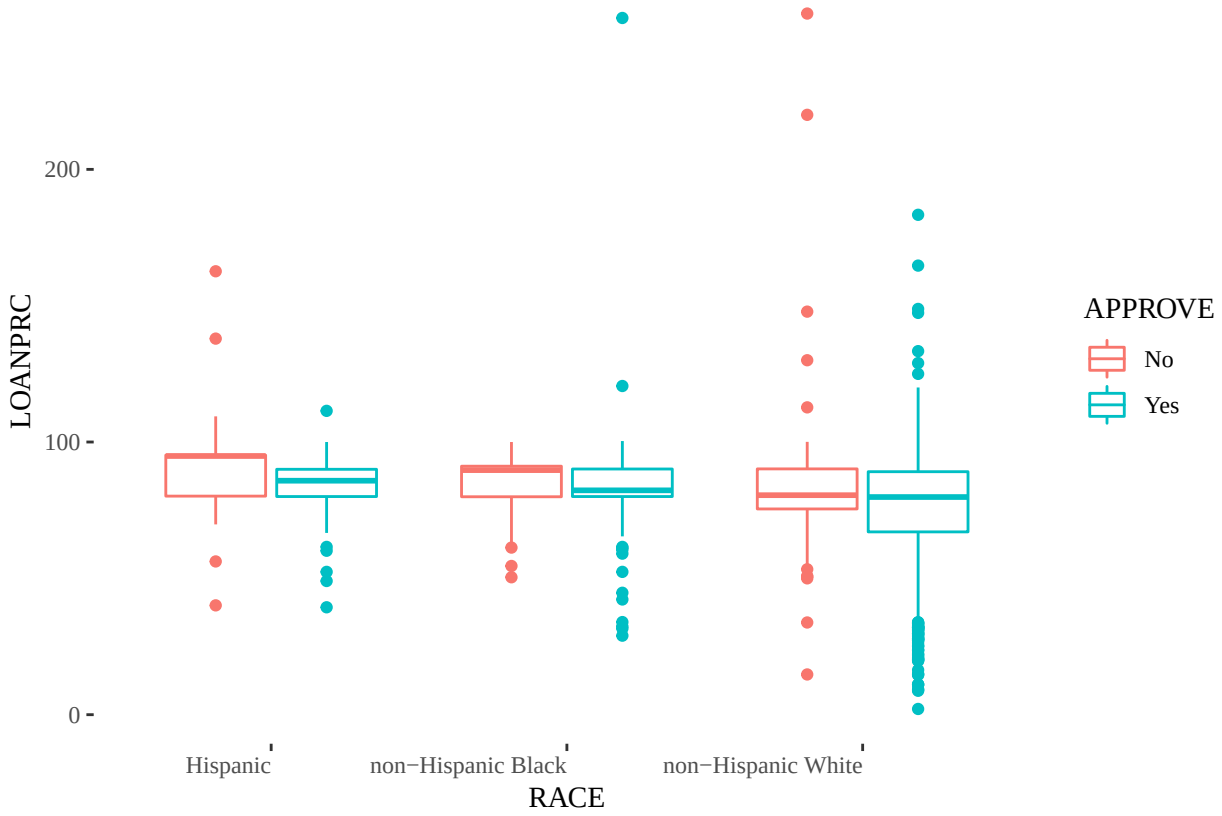

```
## , , RACE = Hispanic
##
##          APPROVE
## MARRIED     No  Yes
##   No         7   24
##   Unknown    0    1
##   Yes       19   60
##
## , , RACE = non-Hispanic Black
##
##          APPROVE
## MARRIED     No  Yes
##   No        27   49
##   Unknown    0    0
##   Yes       37   84
##
## , , RACE = non-Hispanic White
##
##          APPROVE
## MARRIED     No  Yes
##   No        68  503
##   Unknown    0    2
##   Yes       86 1022
```


1500
1000
500
0
count
Hispanic
non−Hispanic Black
non−Hispanic White
Race
MALE
No
Unknown
Yes


200
100
0
LOANPRC
Hispanic
non−Hispanic Black
non−Hispanic White
RACE
RACE
Hispanic
non−Hispanic Black
non−Hispanic White

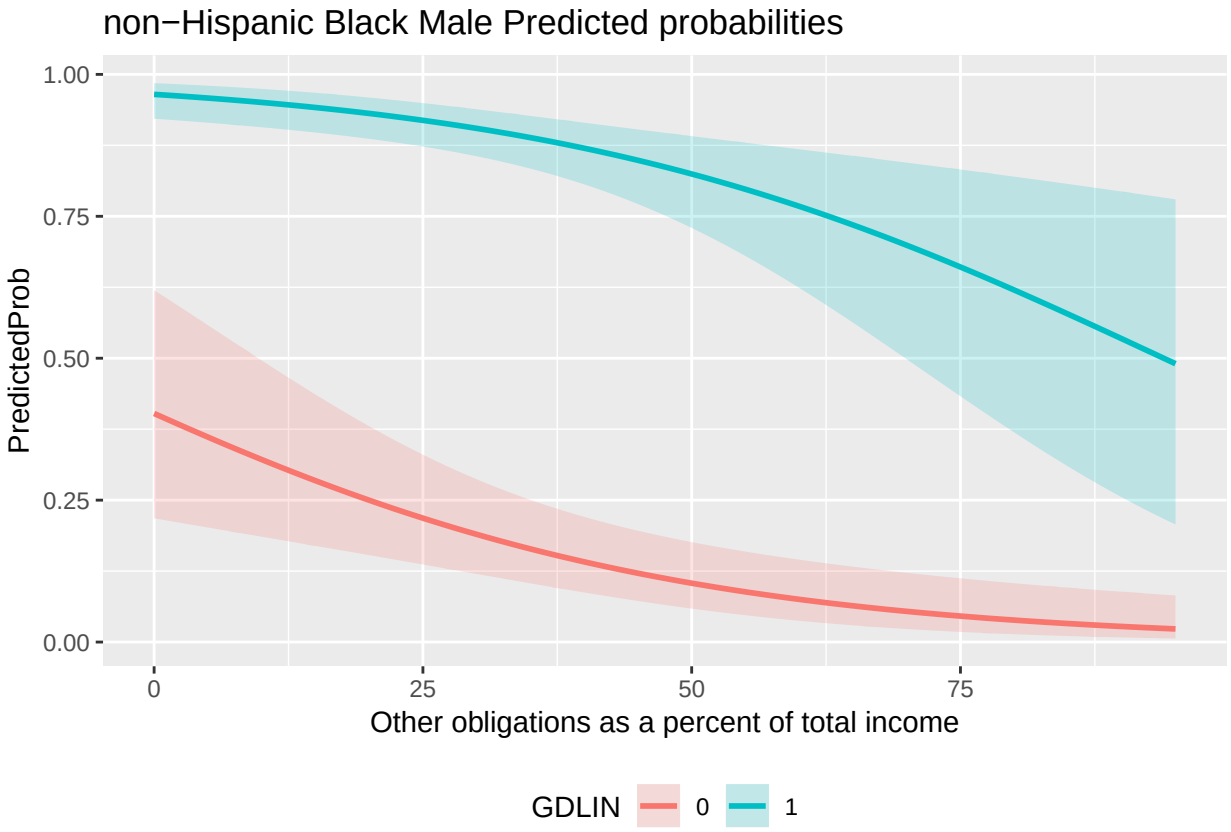

LOANPRC
200
100
0
No
Unknown
Yes
MARRIED
RACE
Hispanic
non−Hispanic Black
non−Hispanic White

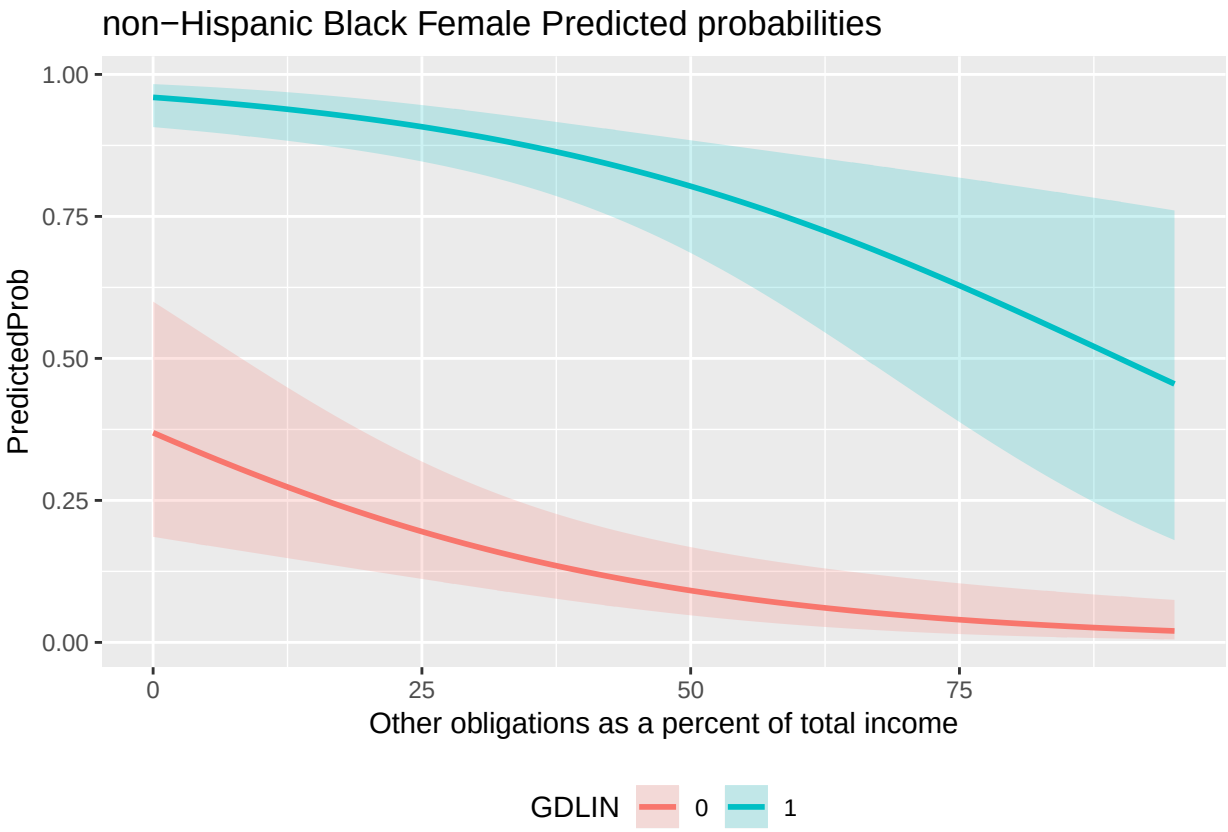

LOANPRC
200
100
0
No
Unknown
Yes
MALE
RACE
Hispanic
non−Hispanic Black
non−Hispanic White

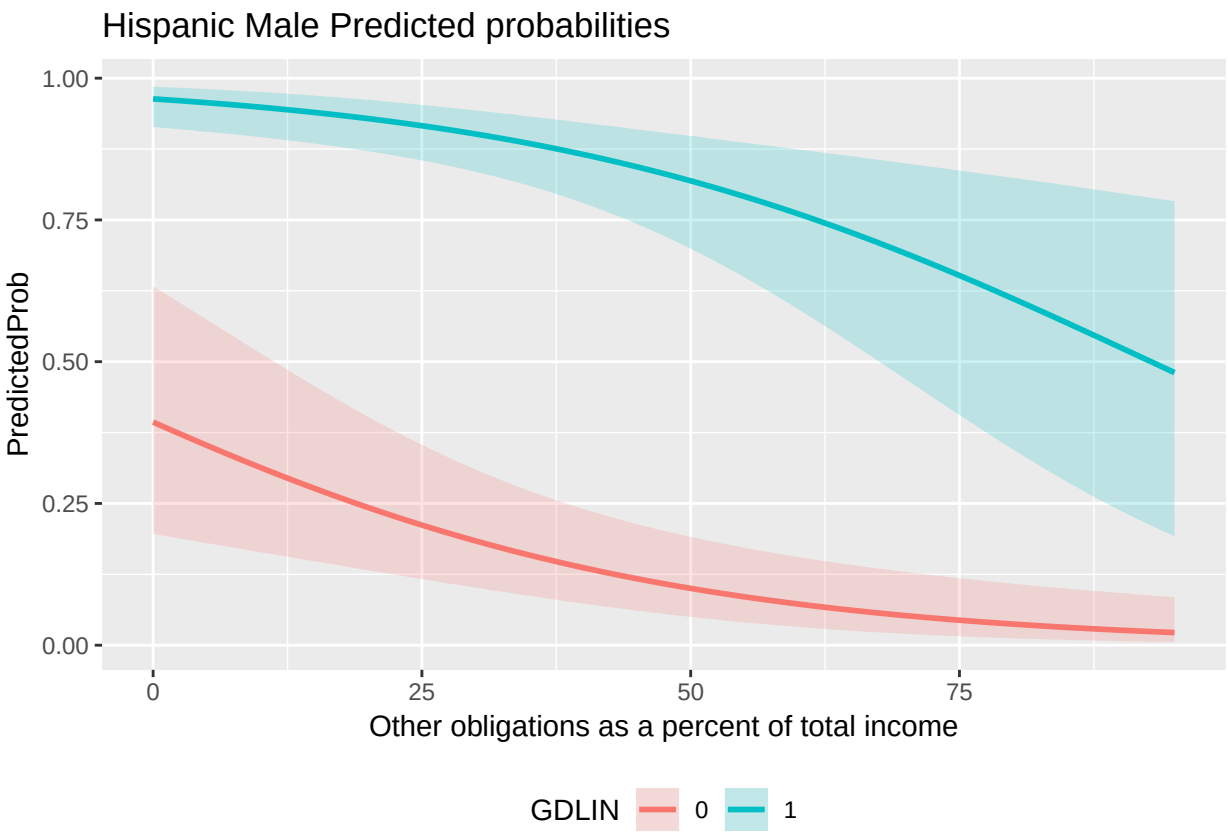


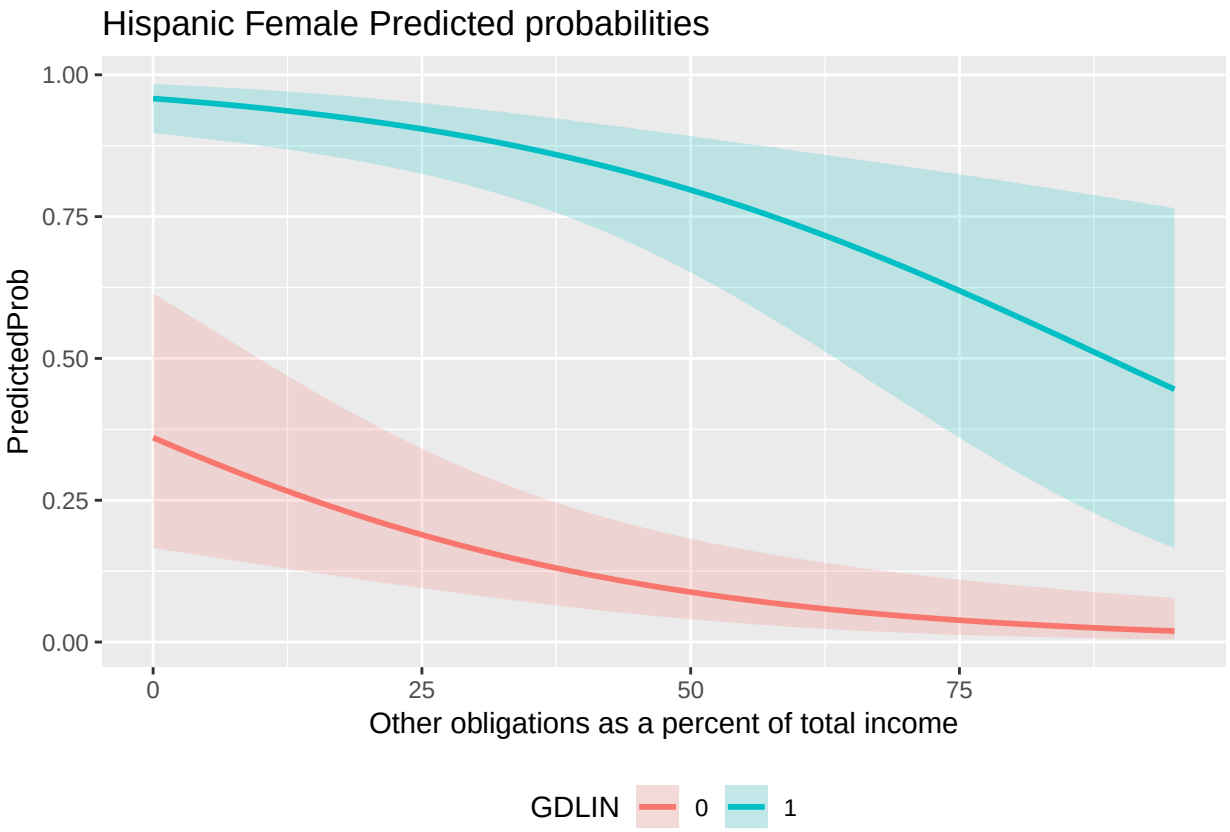

```
##
## Call:  glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + MALE +
##     LOANPRC, family = "binomial", data = data)
##
## Coefficients:
## (Intercept)       GDLIN1        OBRAT       BLACK1      HISPAN1
##     1.53721      3.70447     -0.03525     -0.80680     -0.84499
##       MALE1      LOANPRC
##     0.14139     -0.01643
##
## Degrees of Freedom: 1971 Total (i.e. Null);  1965 Residual
## Null Deviance:       1476
## Residual Deviance: 966   AIC: 980

##                   2.5 %       97.5 %
## (Intercept)  0.39043496  2.703252996
## GDLIN1       3.29115094  4.137733306
## OBRAT       -0.05549706 -0.015038547
## BLACK1      -1.26962817 -0.326297080
## HISPAN1     -1.42913599 -0.215005260
## MALE1       -0.30298683  0.565437899
## LOANPRC     -0.02663168 -0.006658542

##                   2.5 %       97.5 %
## (Intercept)  0.38363811  2.690789543
## GDLIN1       3.28199418  4.126951904
## OBRAT       -0.05547873 -0.015022012
## BLACK1      -1.27779072 -0.335818281
```

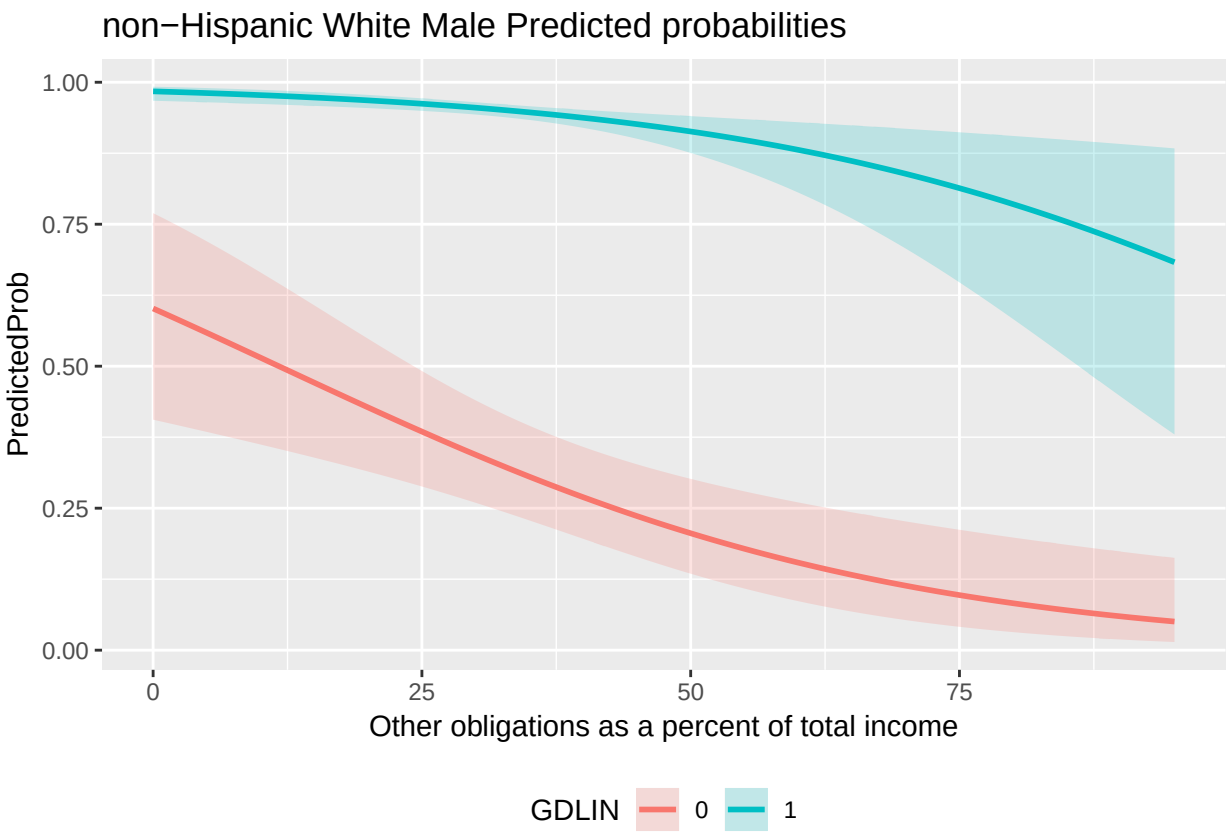
```
## HISPAN1     -1.45043209 -0.239548275
## MALE1       -0.29193829  0.574720492
## LOANPRC     -0.02635892 -0.006504892

## (Intercept)      GDLIN1       OBRAT      BLACK1     HISPAN1       MALE1
##   4.6516120  40.6286322   0.9653637   0.4462819   0.4295616   1.1518751
##     LOANPRC
##   0.9837024

##                     OR      2.5 %     97.5 %
## (Intercept)  4.6516120  1.4776234 14.9282142
## GDLIN1      40.6286322 26.8737761 62.6606279
## OBRAT        0.9653637  0.9460148  0.9850740
## BLACK1       0.4462819  0.2809361  0.7215908
## HISPAN1      0.4295616  0.2395158  0.8065372
## MALE1        1.1518751  0.7386088  1.7602184
## LOANPRC      0.9837024  0.9737198  0.9933636
```

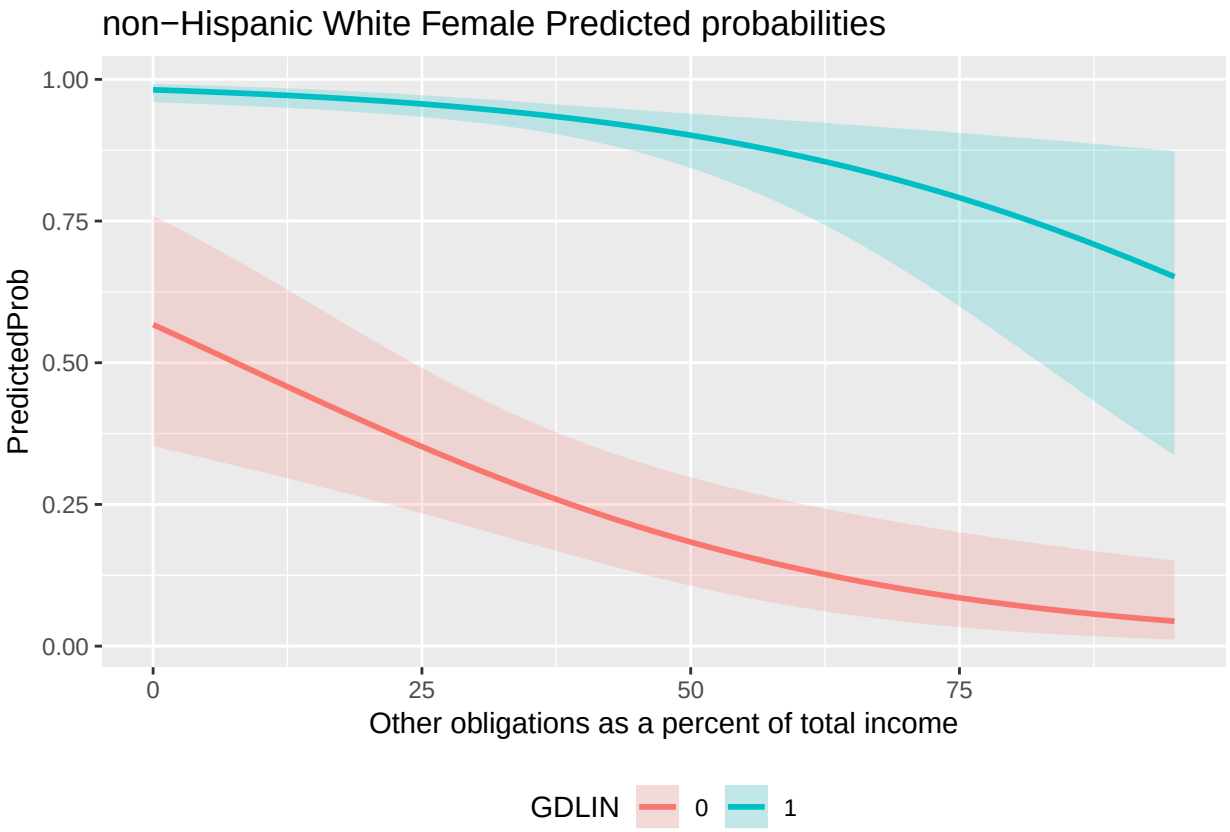


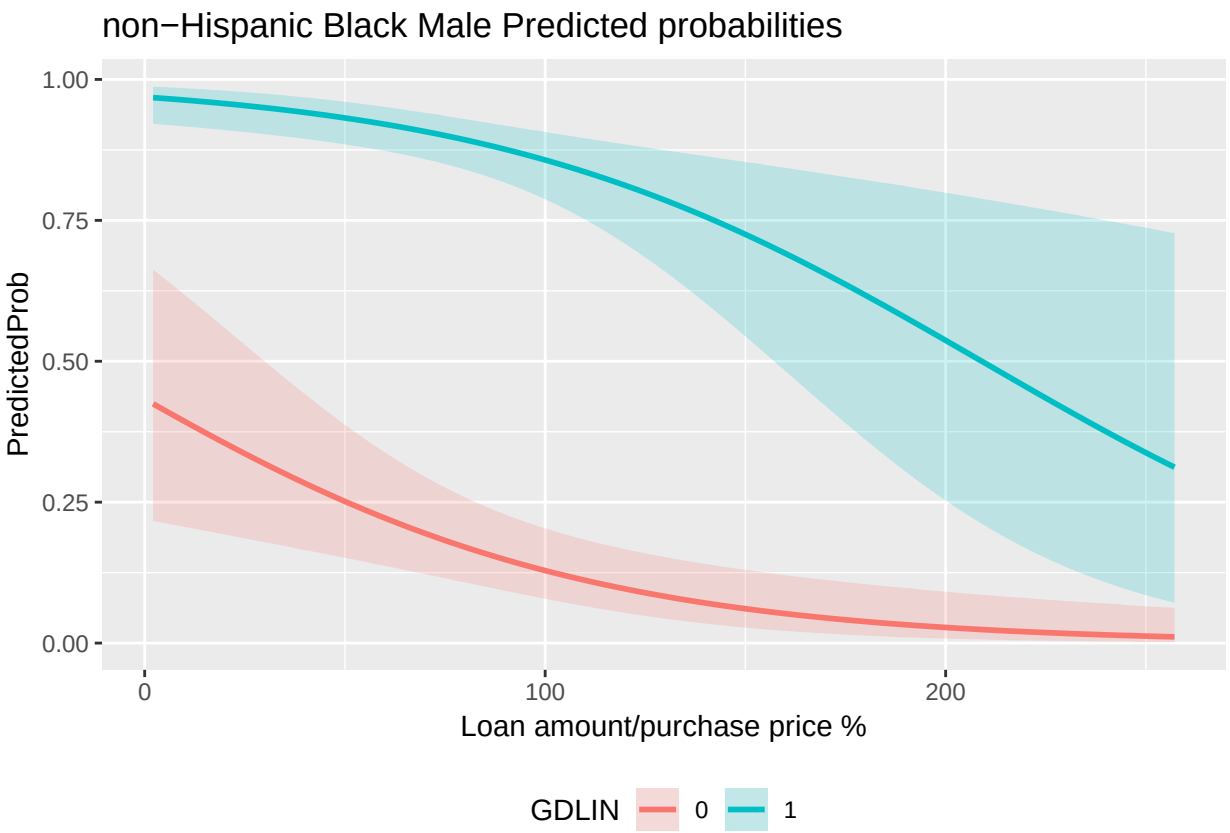

non−Hispanic Black Female Predicted probabilities
PredictedProb
1.00
0.75
0.50
0.25
0.00
0
25
50
75
Other obligations as a percent of total income
GDLIN
0
1

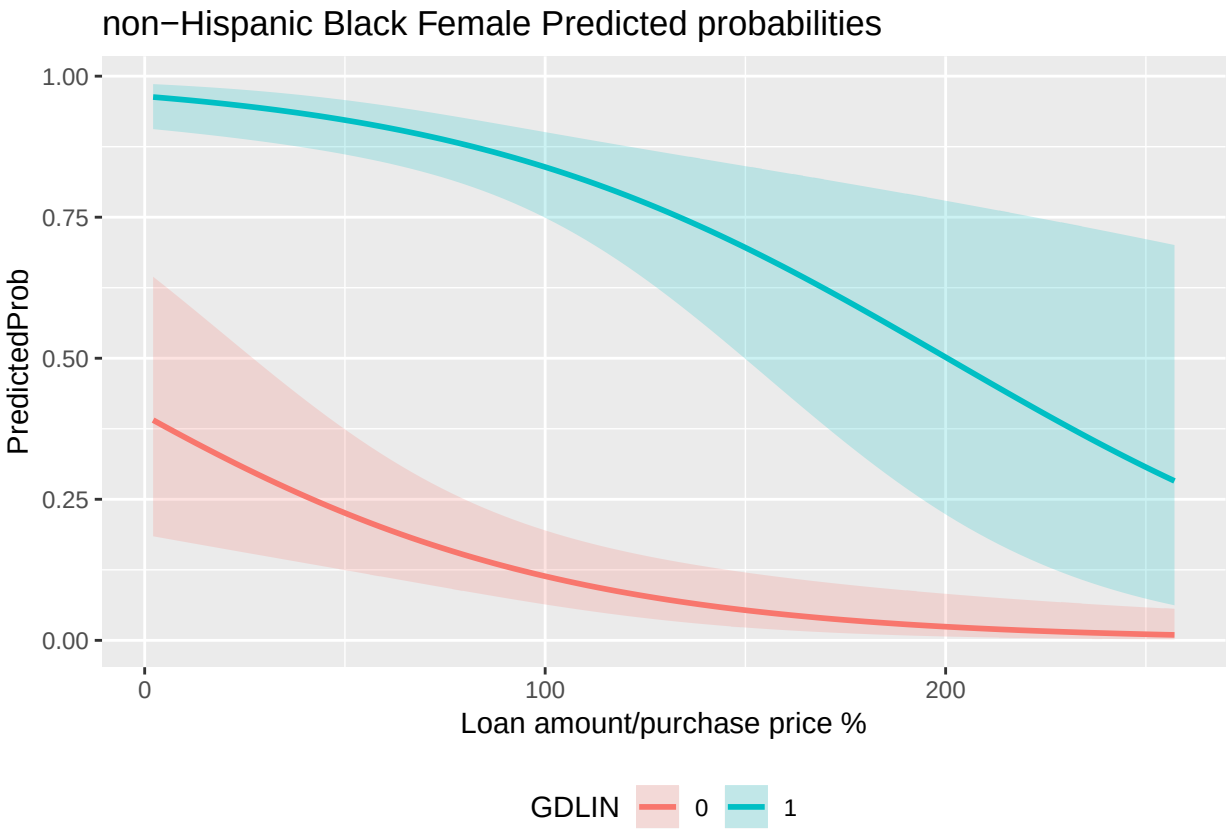

Hispanic Male Predicted probabilities
PredictedProb
1.00
0.75
0.50
0.25
0.00
0
25
50
75
Other obligations as a percent of total income
GDLIN
0
1

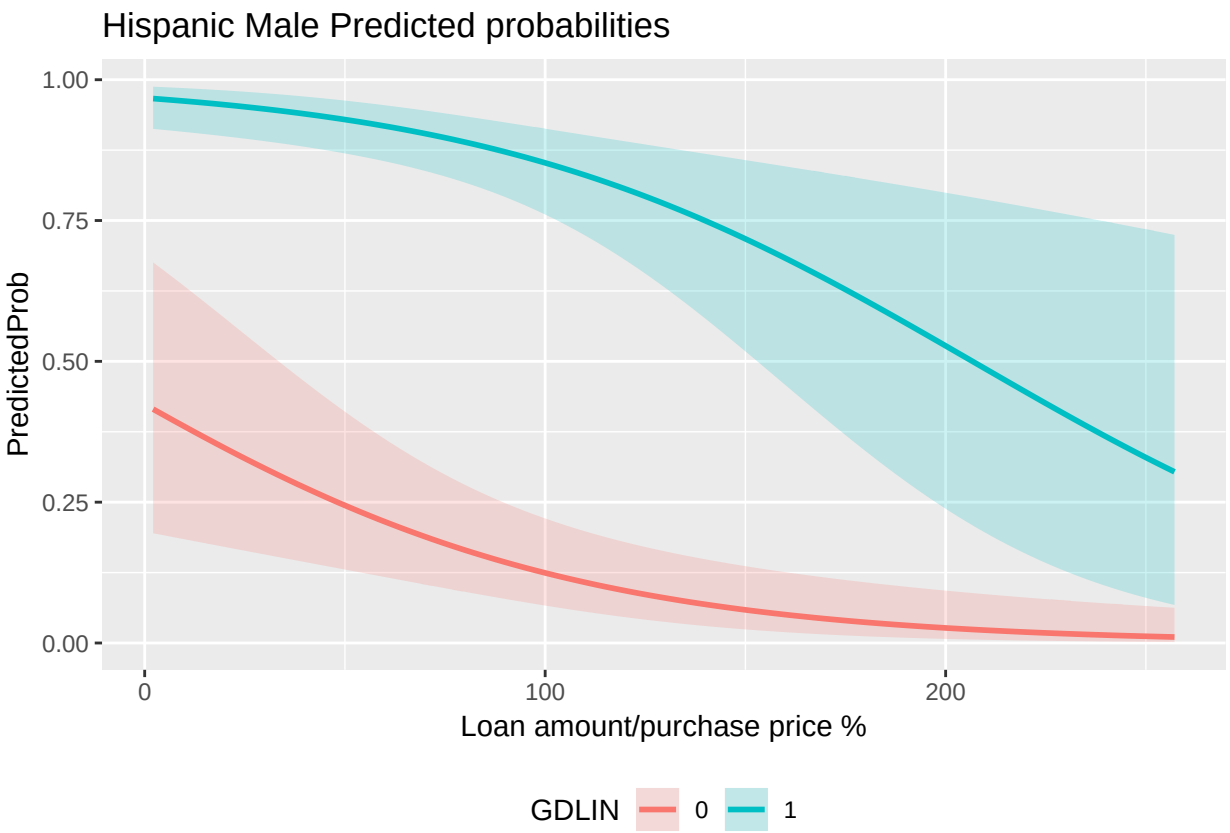

Hispanic Female Predicted probabilities
1.00
0.75
0.50
0.25
0.00
PredictedProb
0
25
50
75
Other obligations as a percent of total income
GDLIN
0
1

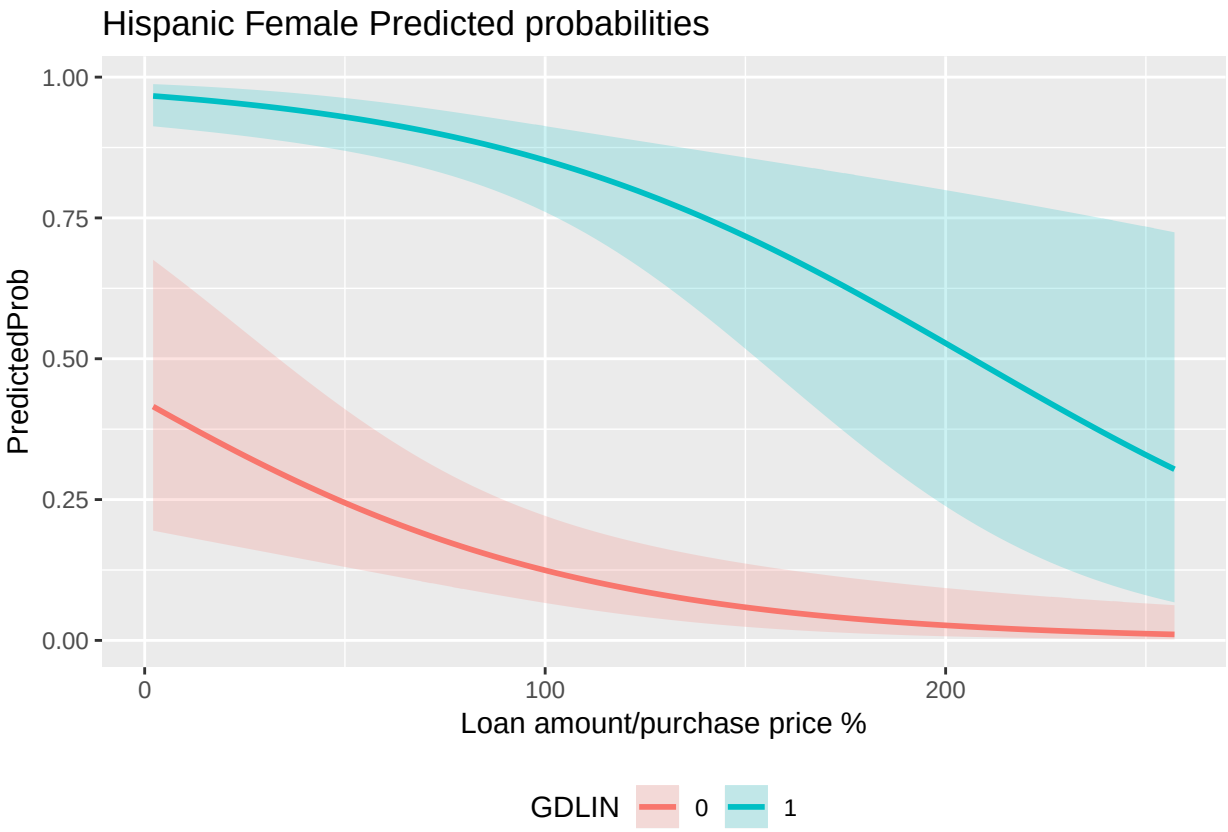

non−Hispanic White Male Predicted probabilities
1.00
0.75
0.50
0.25
0.00
PredictedProb
0
25
50
75
Other obligations as a percent of total income
GDLIN
0
1

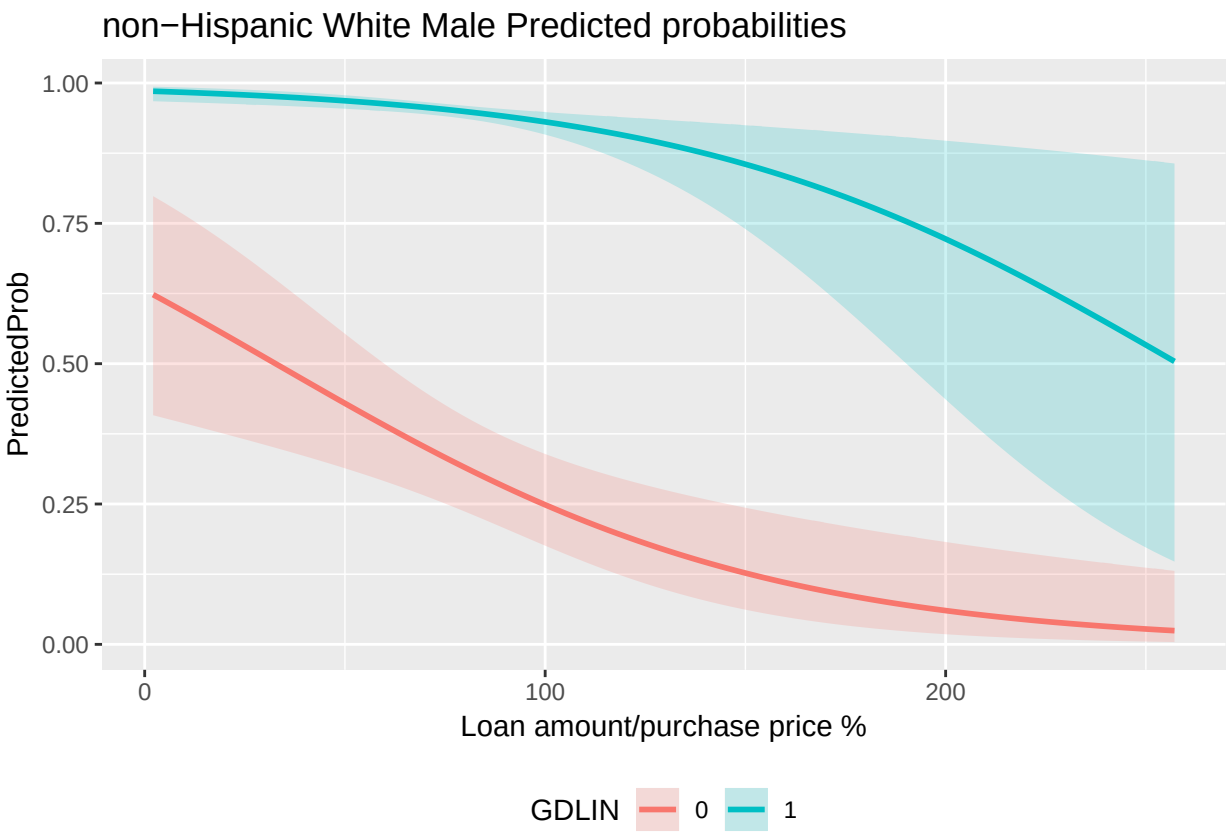

non−Hispanic White Female Predicted probabilities
PredictedProb
1.00
0.75
0.50
0.25
0.00
0
25
50
75
Other obligations as a percent of total income
GDLIN
0
1

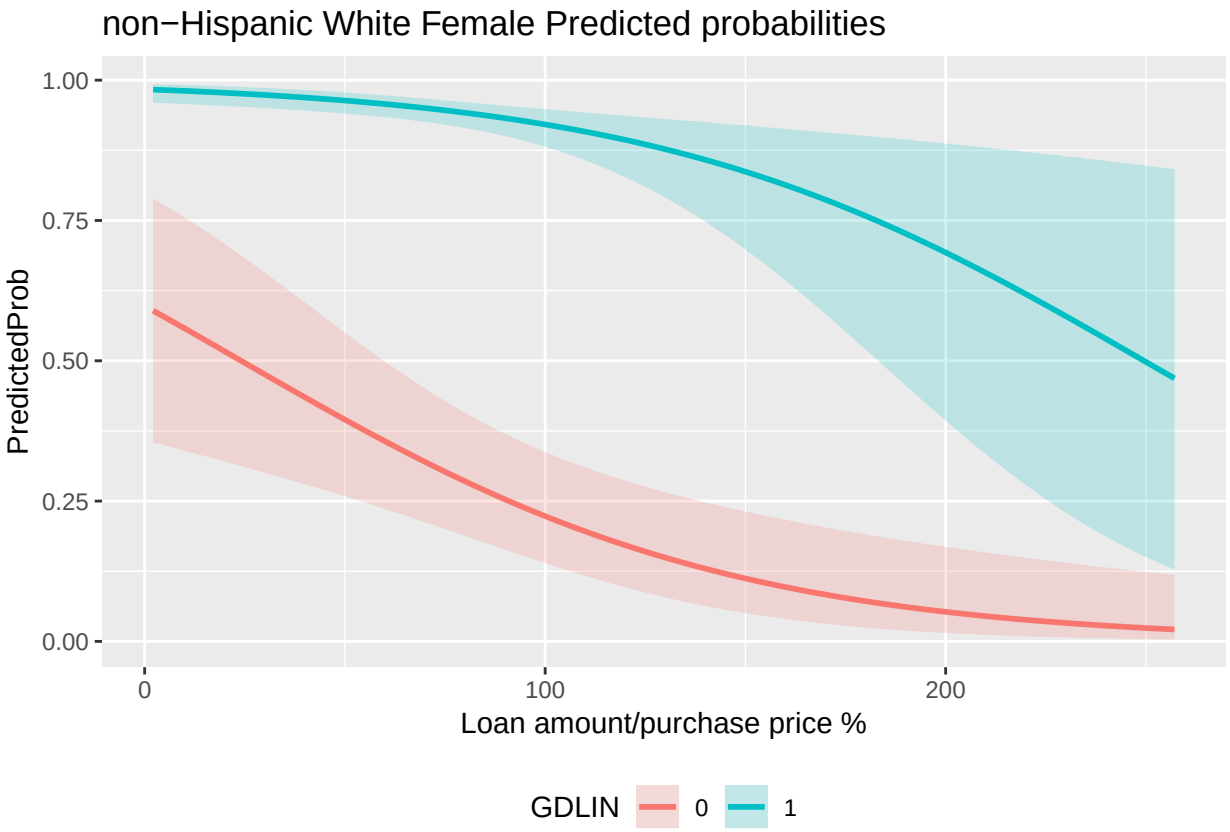

non−Hispanic Black Male Predicted probabilities
PredictedProb
1.00
0.75
0.50
0.25
0.00
0
100
200
Loan amount/purchase price %
GDLIN
0
1


non−Hispanic Black Female Predicted probabilities
1.00
0.75
0.50
0.25
0.00
PredictedProb
0
100
200
Loan amount/purchase price %
GDLIN
0
1


Hispanic Male Predicted probabilities
1.00
0.75
0.50
0.25
0.00
PredictedProb
0
100
200
Loan amount/purchase price %
GDLIN
0
1


Hispanic Female Predicted probabilities
1.00
0.75
0.50
0.25
0.00
PredictedProb
0
100
200
Loan amount/purchase price %
GDLIN
0
1


non−Hispanic White Male Predicted probabilities
1.00
0.75
0.50
0.25
0.00
PredictedProb
0
100
200
Loan amount/purchase price %
GDLIN
0
1




```
##
## Call:  glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC,
##     family = "binomial", data = data)
##
## Coefficients:
## (Intercept)       GDLIN1        OBRAT       BLACK1      HISPAN1
##     1.66644      3.69659     -0.03524     -0.81891     -0.84836
##     LOANPRC
##    -0.01652
##
## Degrees of Freedom: 1971 Total (i.e. Null);  1966 Residual
## Null Deviance:       1476
## Residual Deviance: 966.4     AIC: 978.4

##
## Call:  glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + MALE +
##     LOANPRC, family = binomial(link = "probit"), data = data)
##
## Coefficients:
## (Intercept)       GDLIN1        OBRAT       BLACK1      HISPAN1
##     0.64766      2.13928     -0.01705     -0.42091     -0.43124
##       MALE1      LOANPRC
##     0.06307     -0.00827
##
## Degrees of Freedom: 1971 Total (i.e. Null);  1965 Residual
## Null Deviance:       1476
## Residual Deviance: 965.5     AIC: 979.5

##            Overall
```

```
## GDLIN1  17.7034125
## OBRAT    3.1949750
## BLACK1   3.3211862
## HISPAN1  2.6512623
## MALE1    0.5695835
## LOANPRC  3.2178042

##
## Call:  glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC,
##     family = binomial(link = "probit"), data = data)
##
## Coefficients:
## (Intercept)       GDLIN1        OBRAT       BLACK1      HISPAN1
##    0.706553     2.136046    -0.017060    -0.427179    -0.432845
##     LOANPRC
##   -0.008317
##
## Degrees of Freedom: 1971 Total (i.e. Null);  1966 Residual
## Null Deviance:       1476
## Residual Deviance: 965.8     AIC: 977.8

##           Overall
## GDLIN1  17.702452
## OBRAT    3.197948
## BLACK1   3.383556
## HISPAN1  2.662084
## LOANPRC  3.236990

## Analysis of Deviance Table
##
## Model 1: APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + MALE + LOANPRC
## Model 2: APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC
##   Resid. Df Resid. Dev Df Deviance Pr(>Chi)
## 1      1965     965.48
## 2      1966     965.80 -1  -0.3199   0.5717

## Likelihood ratio test
##
## Model 1: APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + MALE + LOANPRC
## Model 2: APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC
##   #Df  LogLik Df  Chisq Pr(>Chisq)
## 1   7 -482.74
## 2   6 -482.90 -1 0.3199     0.5717

##
## Call:  glm(formula = APPROVE ~ GDLIN + BLACK + HISPAN + MALE + LOANPRC,
##     family = binomial(link = "probit"), data = data)
##
## Coefficients:
## (Intercept)       GDLIN1       BLACK1      HISPAN1        MALE1
##    0.105974     2.184604    -0.441909    -0.441348     0.064210
##     LOANPRC
##   -0.009121
##
## Degrees of Freedom: 1971 Total (i.e. Null);  1966 Residual
## Null Deviance:       1476
## Residual Deviance: 977.2     AIC: 989.2
```

```
##            Overall
## GDLIN1  18.2133105
## BLACK1   3.4982924
## HISPAN1  2.7352593
## MALE1    0.5837877
## LOANPRC  3.6344426
```

```
## Analysis of Deviance Table
##
## Model 1: APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + MALE + LOANPRC
## Model 2: APPROVE ~ GDLIN + BLACK + HISPAN + MALE + LOANPRC
##   Resid. Df Resid. Dev Df Deviance  Pr(>Chi)
## 1      1965     965.48
## 2      1966     977.18 -1  -11.697 0.0006261 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

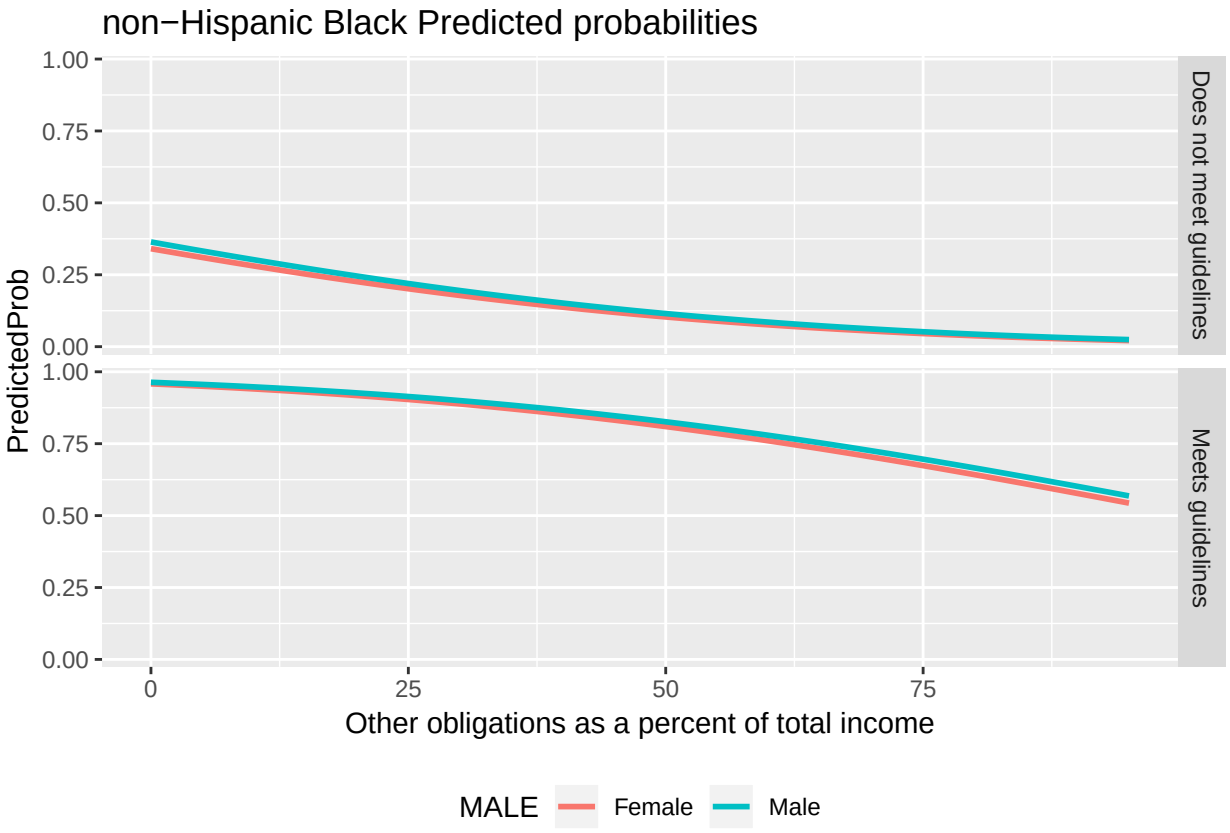
```
## Likelihood ratio test
##
## Model 1: APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + MALE + LOANPRC
## Model 2: APPROVE ~ GDLIN + BLACK + HISPAN + MALE + LOANPRC
##   #Df  LogLik Df  Chisq Pr(>Chisq)
## 1   7 -482.74
## 2   6 -488.59 -1 11.697  0.0006261 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

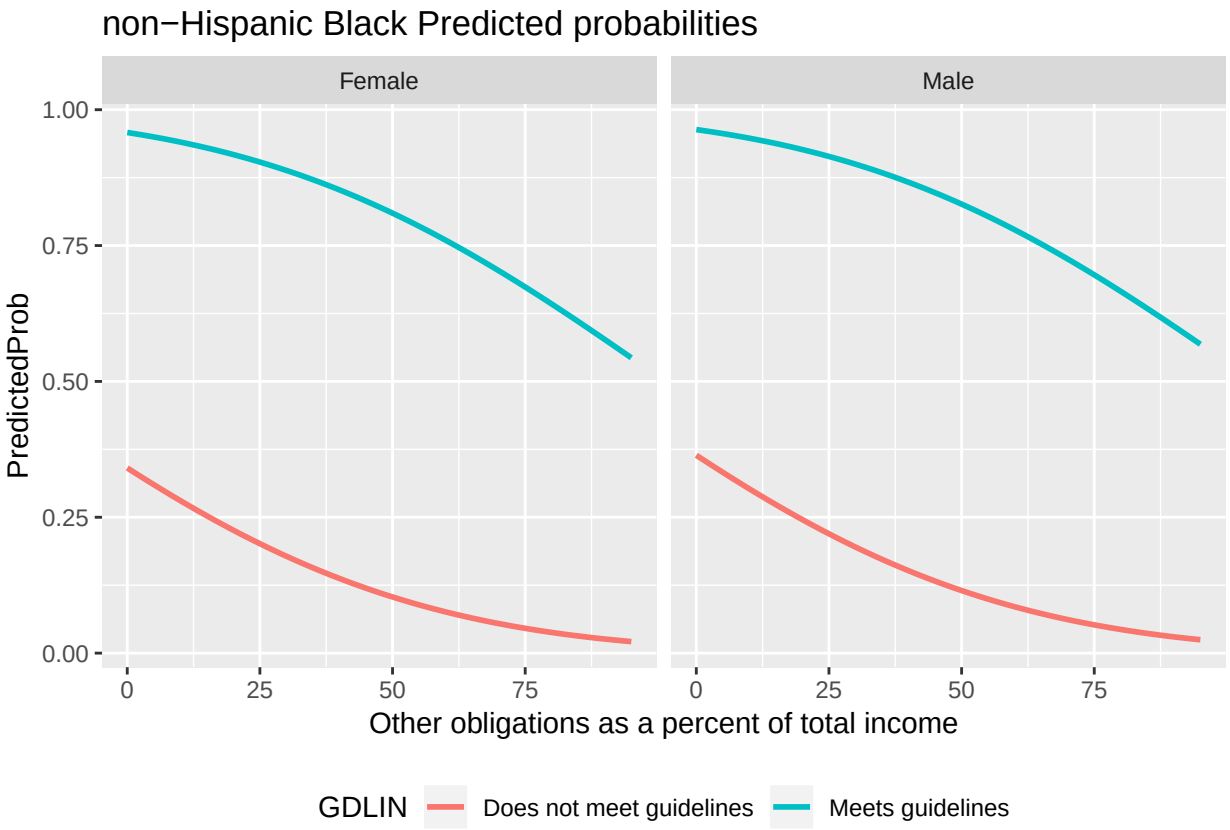
```
##
## Call:  glm(formula = APPROVE ~ GDLIN + BLACK + HISPAN + LOANPRC, family = binomial(link = "probit"),
##     data = data)
##
## Coefficients:
## (Intercept)       GDLIN1       BLACK1      HISPAN1      LOANPRC
##    0.165274     2.181533    -0.448539    -0.443199    -0.009168
##
## Degrees of Freedom: 1971 Total (i.e. Null);  1967 Residual
## Null Deviance:       1476
## Residual Deviance: 977.5     AIC: 987.5
```

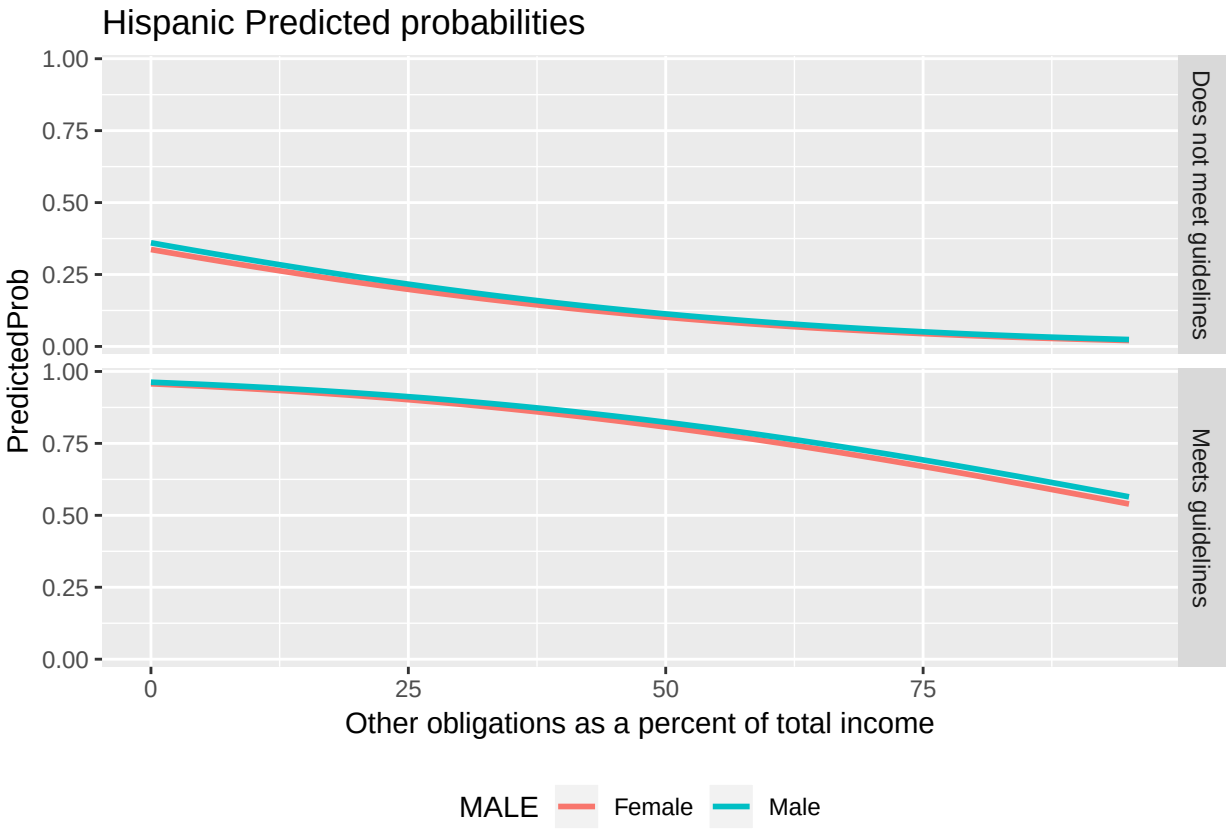
```
##           Overall
## GDLIN1  18.213136
## BLACK1   3.565111
## HISPAN1  2.748035
## LOANPRC  3.654179
```

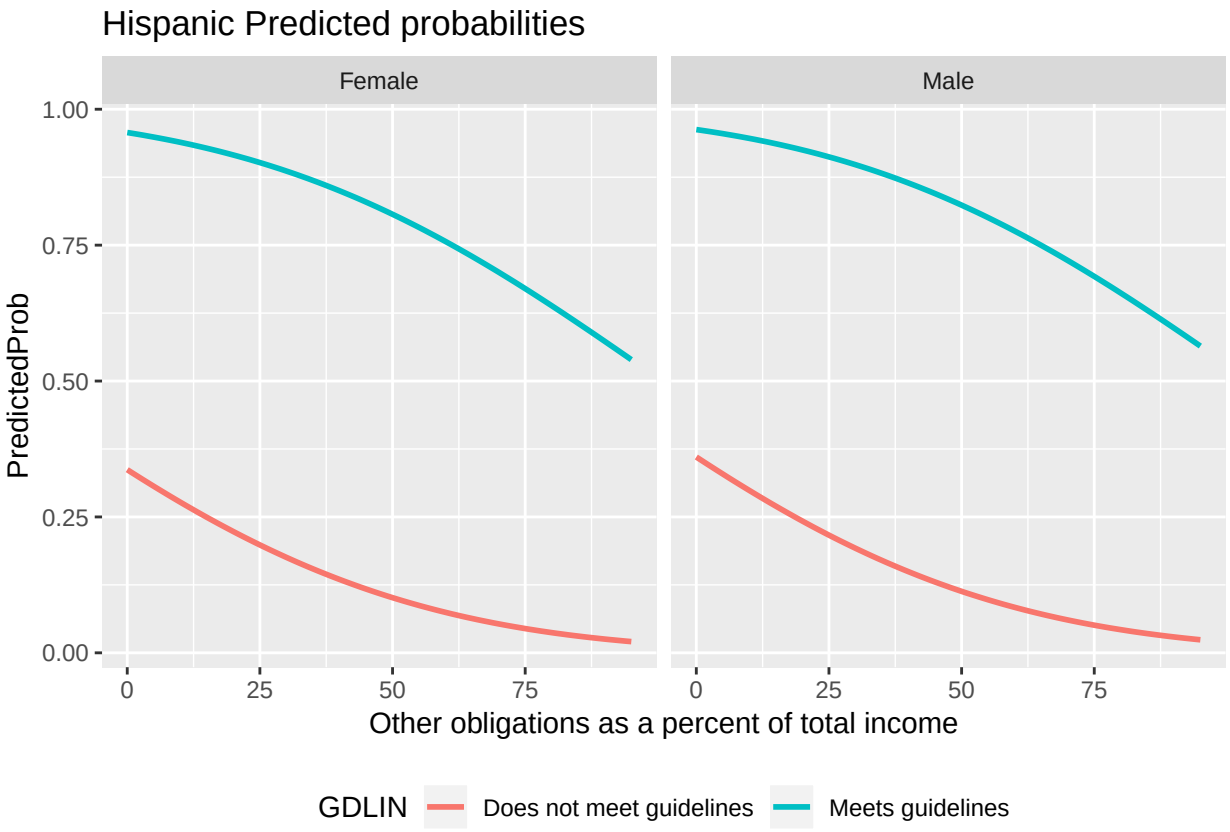
```
## Analysis of Deviance Table
##
## Model 1: APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + MALE + LOANPRC
## Model 2: APPROVE ~ GDLIN + BLACK + HISPAN + LOANPRC
##   Resid. Df Resid. Dev Df Deviance Pr(>Chi)
## 1      1965     965.48
## 2      1967     977.52 -2  -12.033 0.002438 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

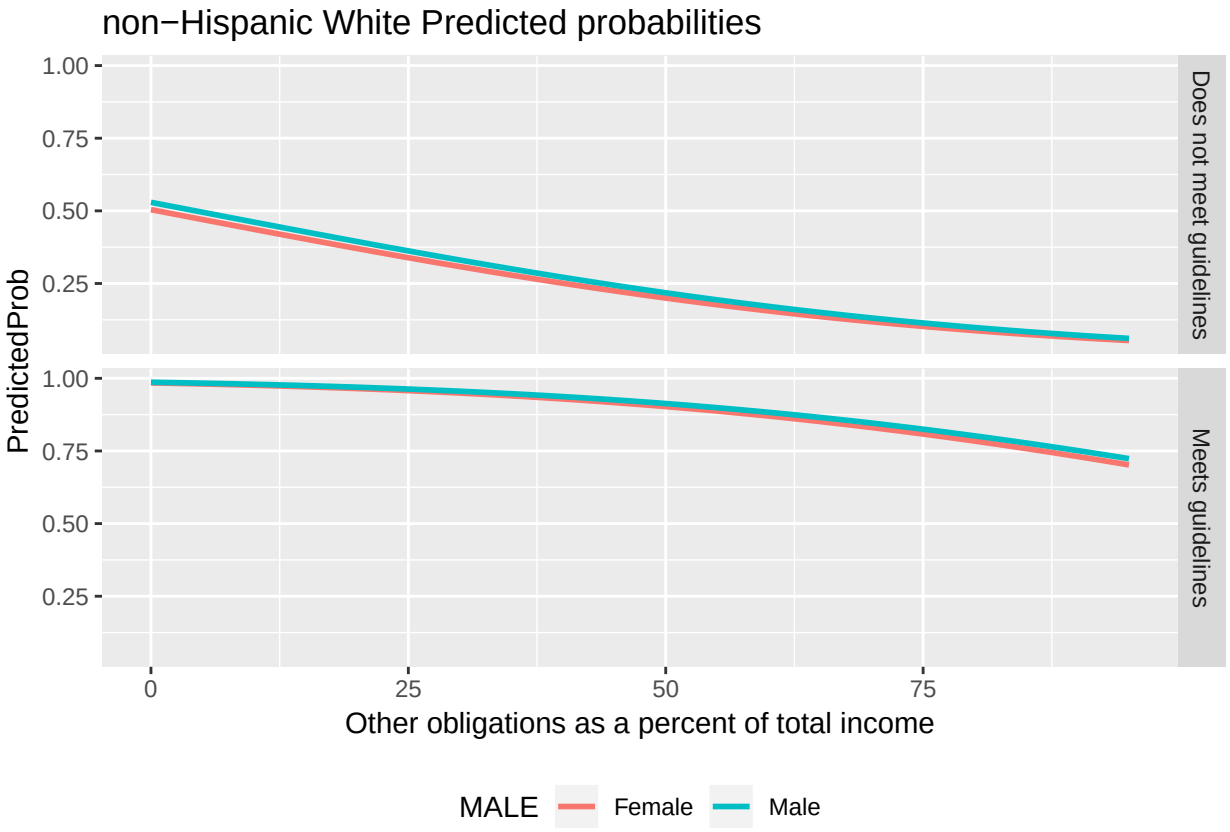
```
## Likelihood ratio test
##
## Model 1: APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + MALE + LOANPRC
## Model 2: APPROVE ~ GDLIN + BLACK + HISPAN + LOANPRC
##   #Df  LogLik Df  Chisq Pr(>Chisq)
## 1   7 -482.74
## 2   5 -488.76 -2 12.033   0.002438 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

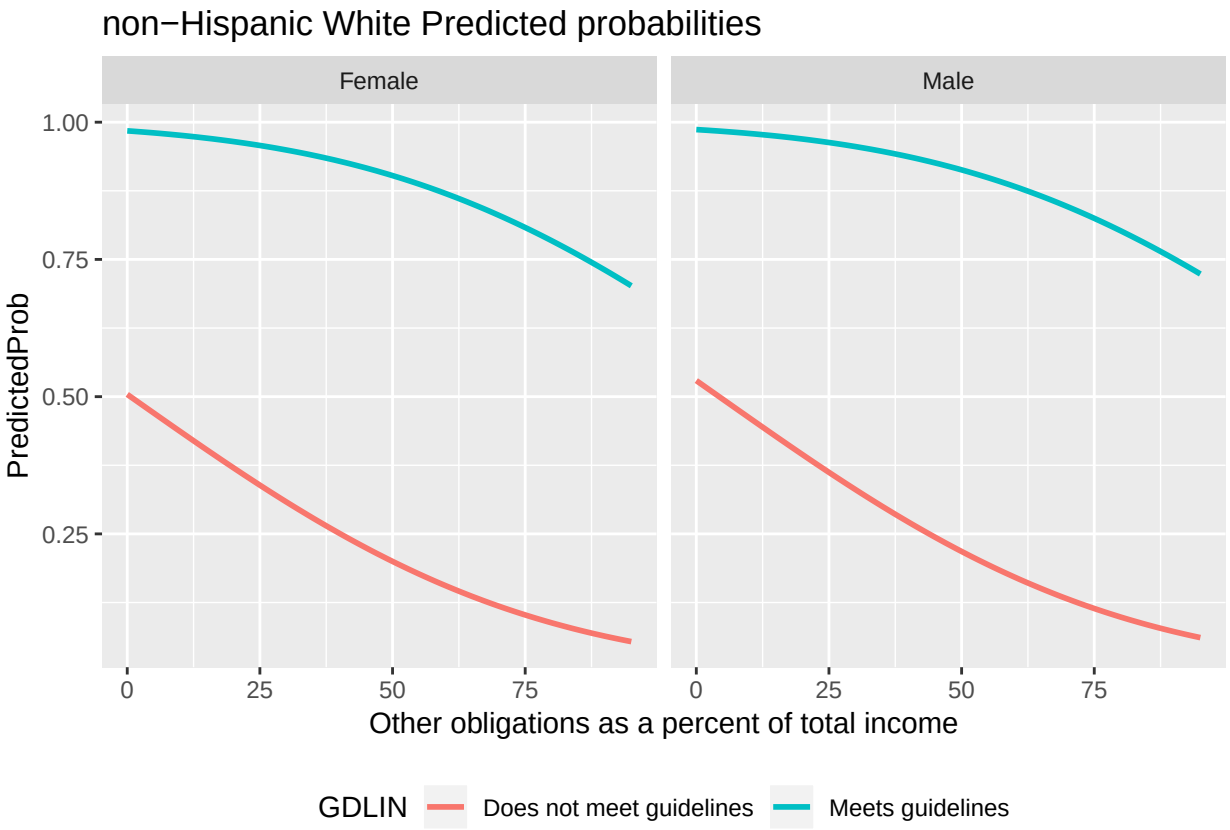


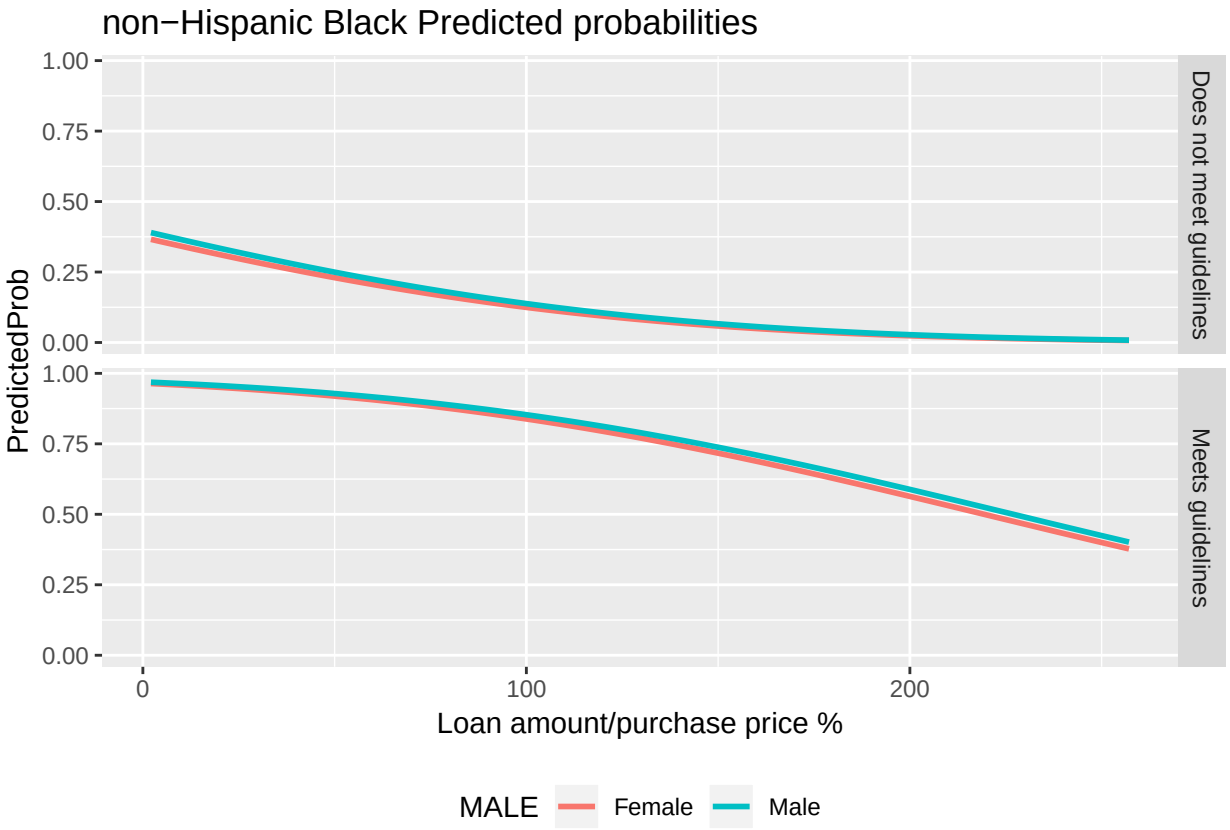

non−Hispanic Black Predicted probabilities
Female
Male
PredictedProb
1.00
0.75
0.50
0.25
0.00
0
25
50
75
Other obligations as a percent of total income
GDLIN
Does not meet guidelines
Meets guidelines

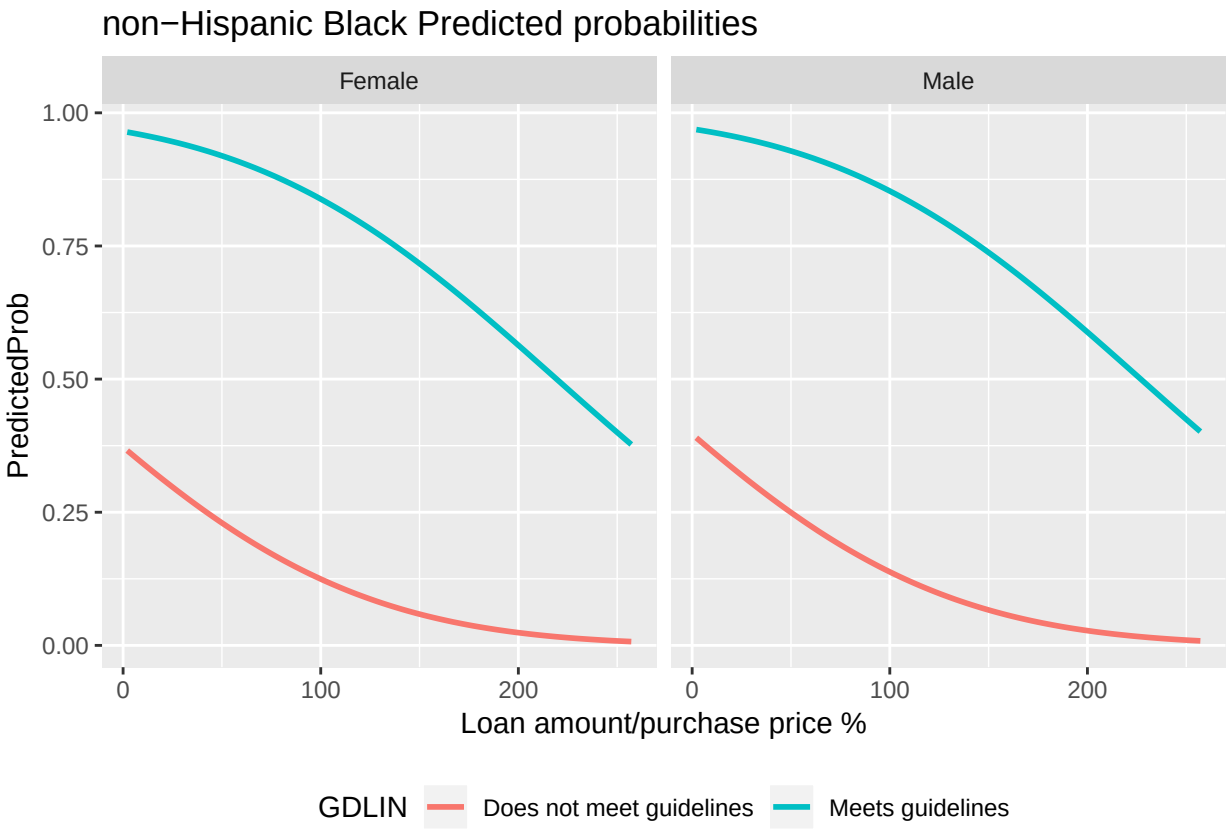

Hispanic Predicted probabilities
PredictedProb
1.00
0.75
0.50
0.25
0.00
Does not meet guidelines
Meets guidelines
0
25
50
75
Other obligations as a percent of total income
MALE
Female
Male

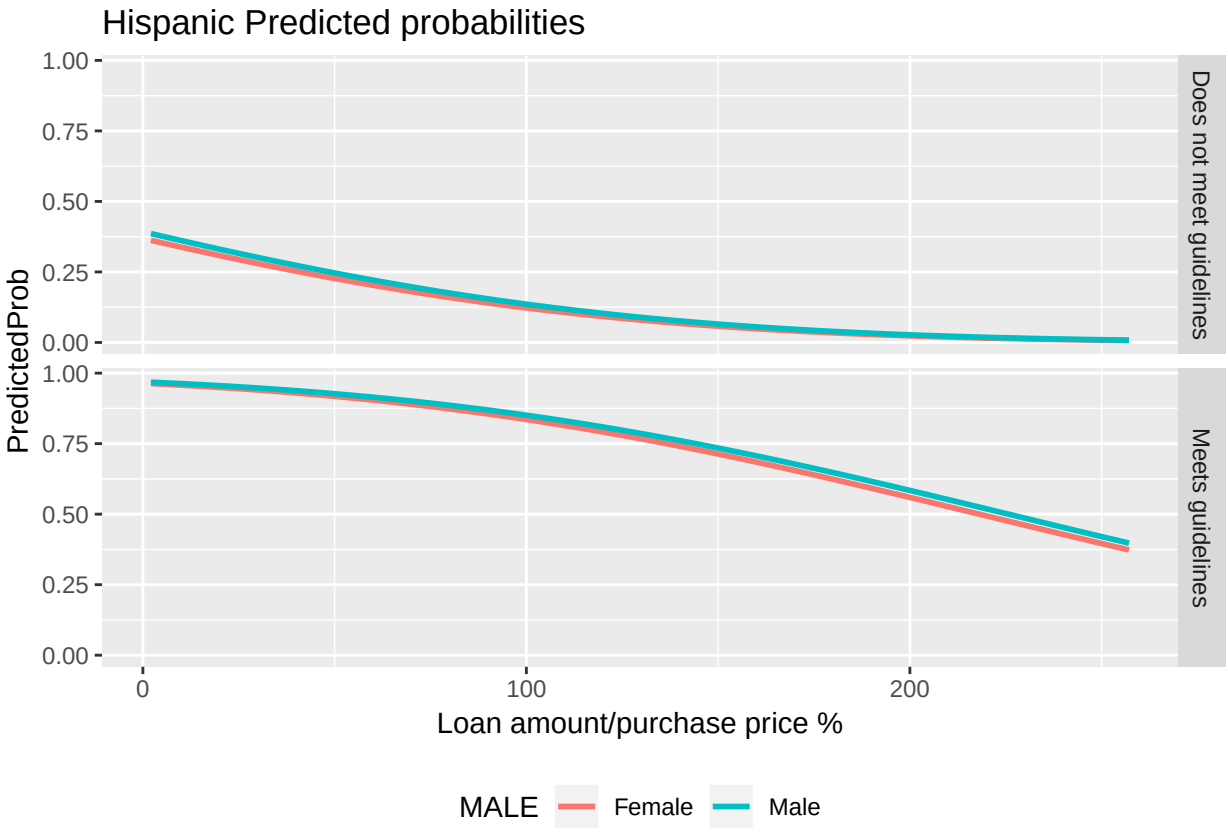

Hispanic Predicted probabilities
Female
Male
PredictedProb
1.00
0.75
0.50
0.25
0.00
0
25
50
75
Other obligations as a percent of total income
GDLIN
Does not meet guidelines
Meets guidelines

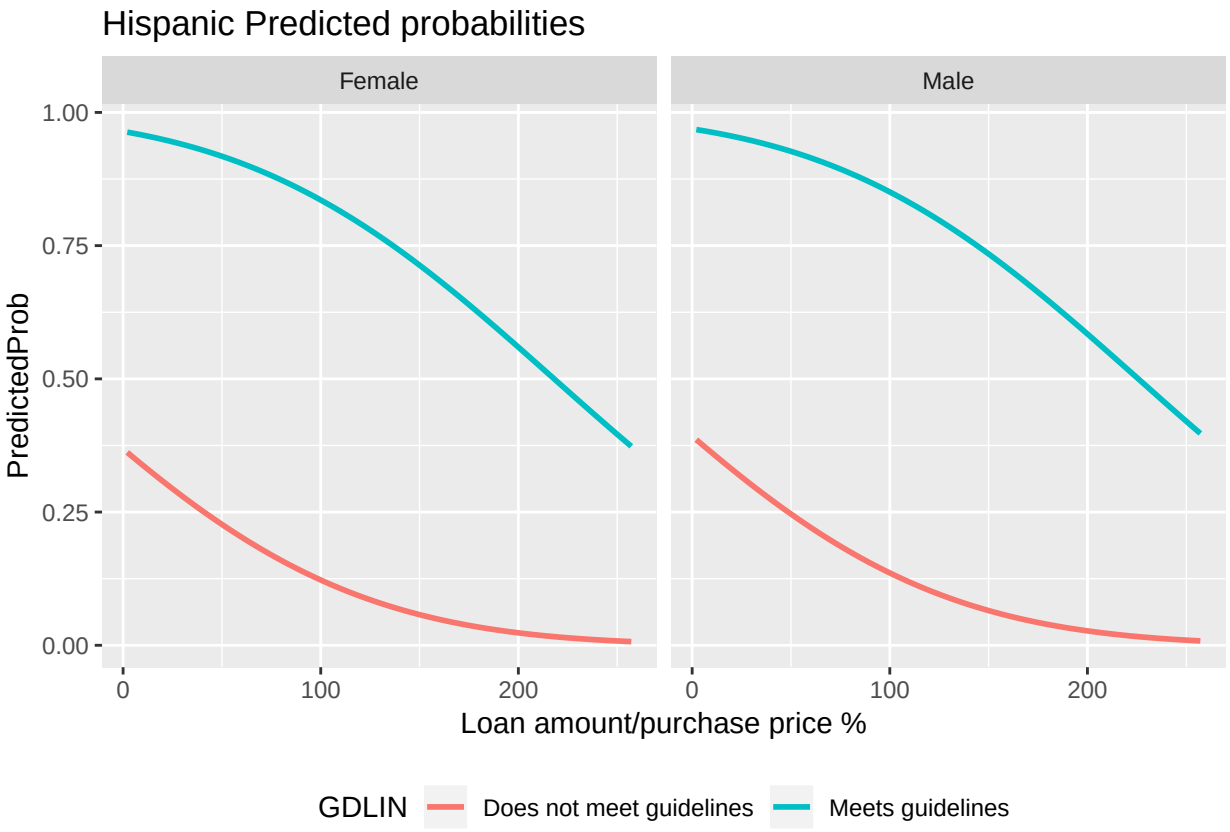

non−Hispanic White Predicted probabilities
PredictedProb
1.00
0.75
0.50
0.25
Does not meet guidelines
Meets guidelines
0
25
50
75
Other obligations as a percent of total income
MALE
Female
Male

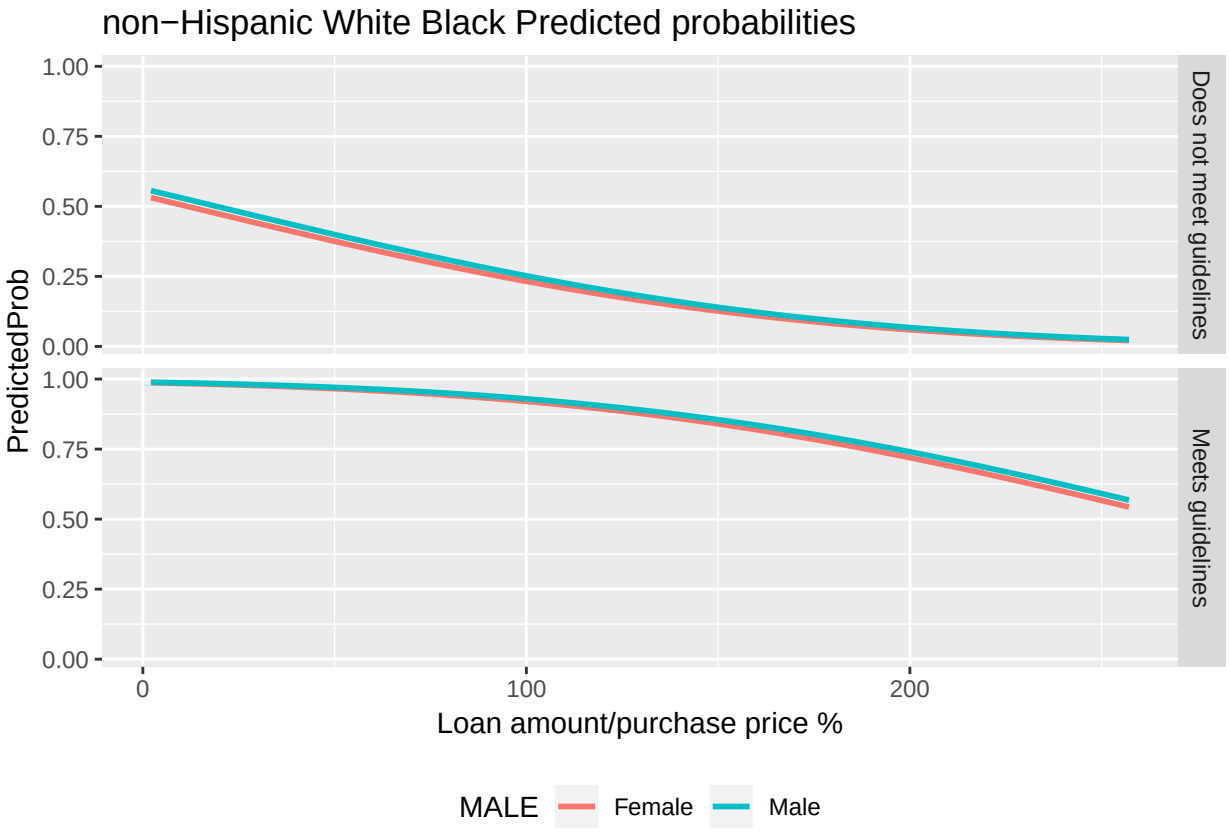

non−Hispanic White Predicted probabilities
Female
Male
PredictedProb
1.00
0.75
0.50
0.25
0
25
50
75
Other obligations as a percent of total income
GDLIN
Does not meet guidelines
Meets guidelines

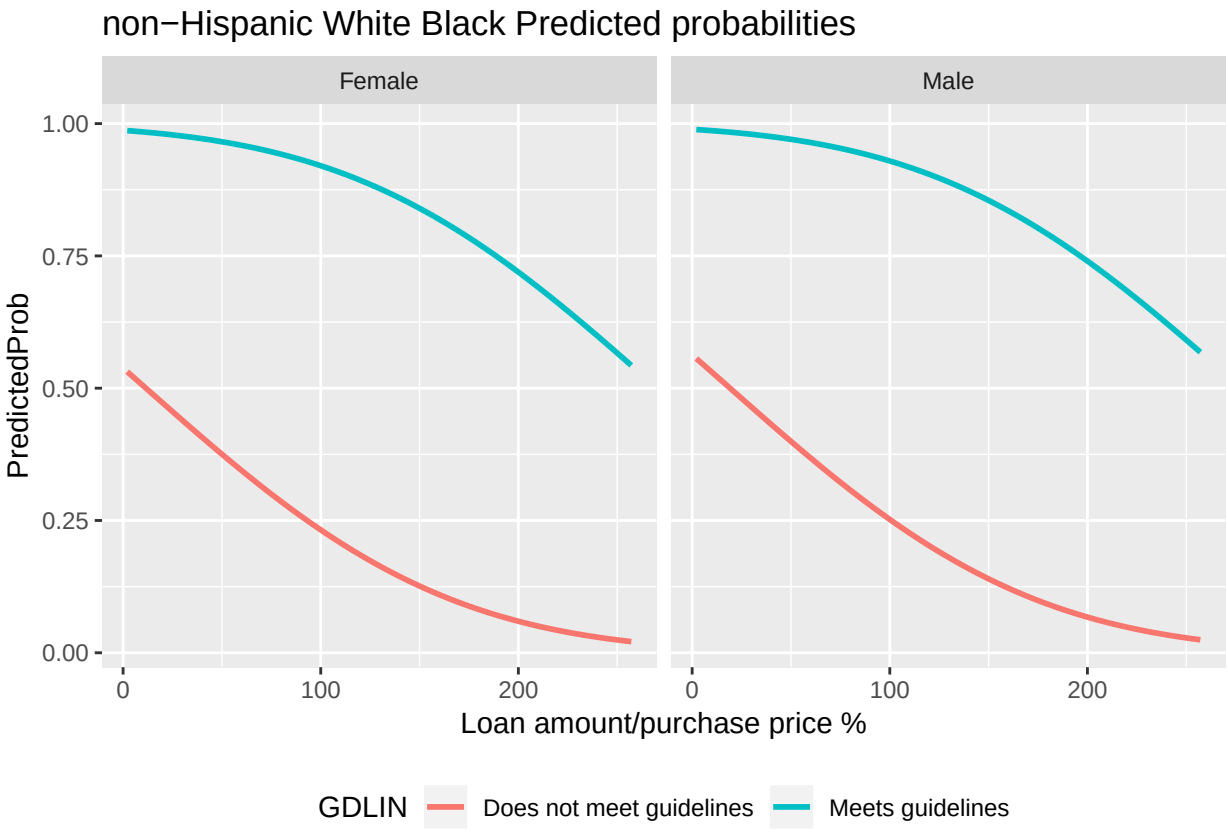

non−Hispanic Black Predicted probabilities
PredictedProb
1.00
0.75
0.50
0.25
0.00
Does not meet guidelines
Meets guidelines
0
100
200
Loan amount/purchase price %
MALE
Female
Male

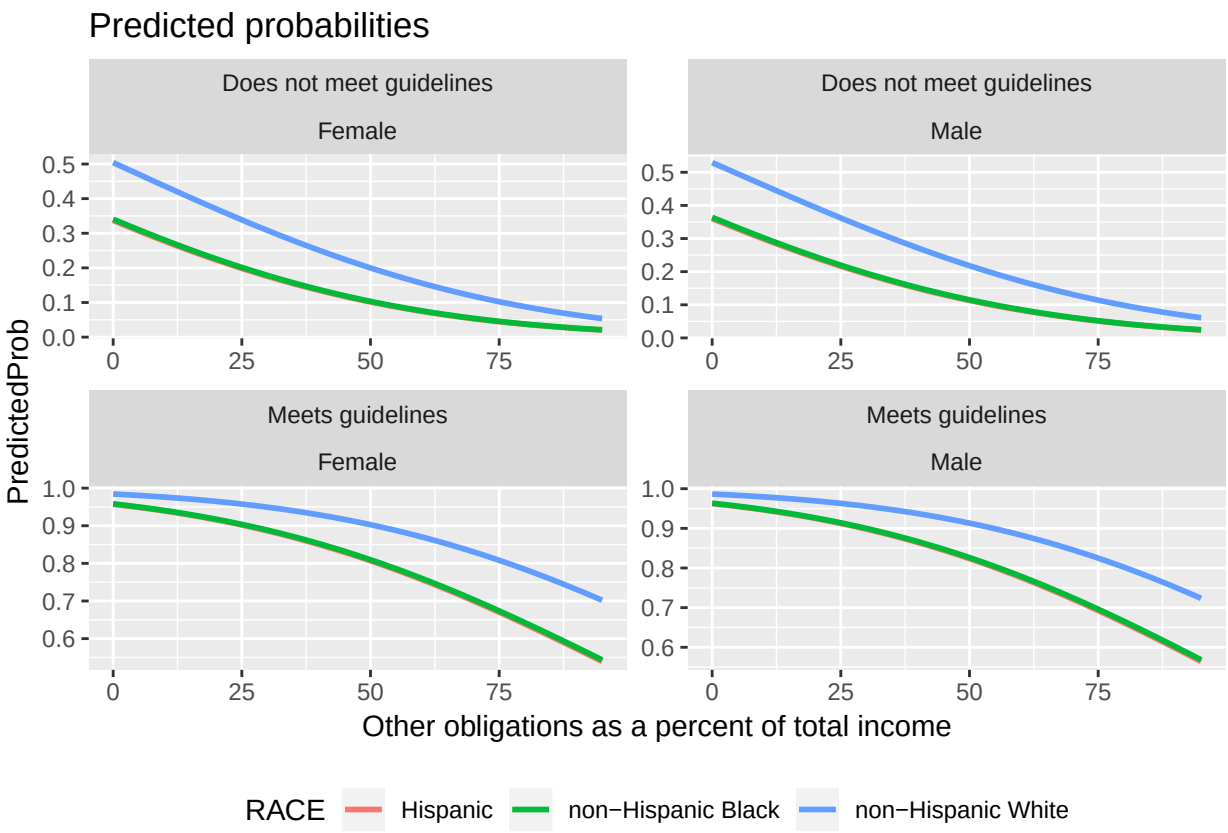

non−Hispanic Black Predicted probabilities
Female
Male
PredictedProb
1.00
0.75
0.50
0.25
0.00
0
100
200
Loan amount/purchase price %
GDLIN
Does not meet guidelines
Meets guidelines

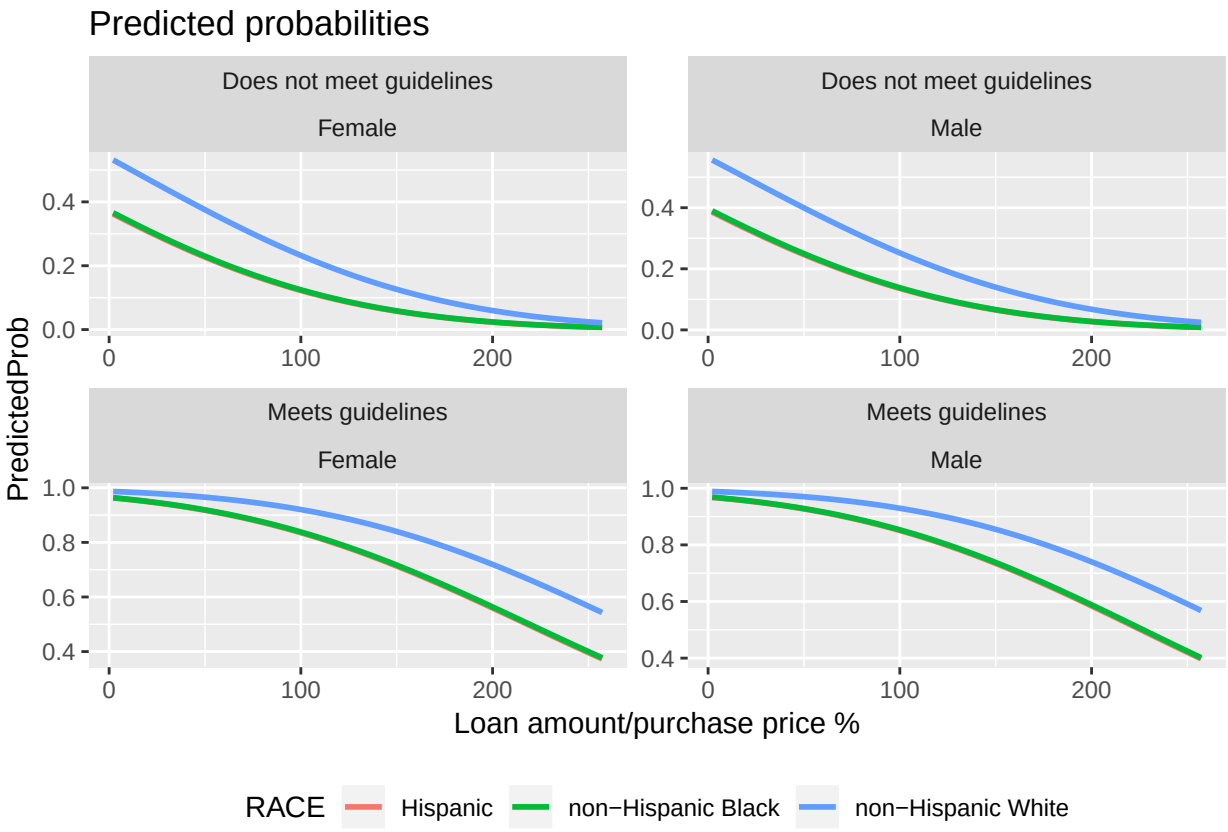

Hispanic Predicted probabilities
PredictedProb
1.00
0.75
0.50
0.25
0.00
Does not meet guidelines
Meets guidelines
0
100
200
Loan amount/purchase price %
MALE
Female
Male

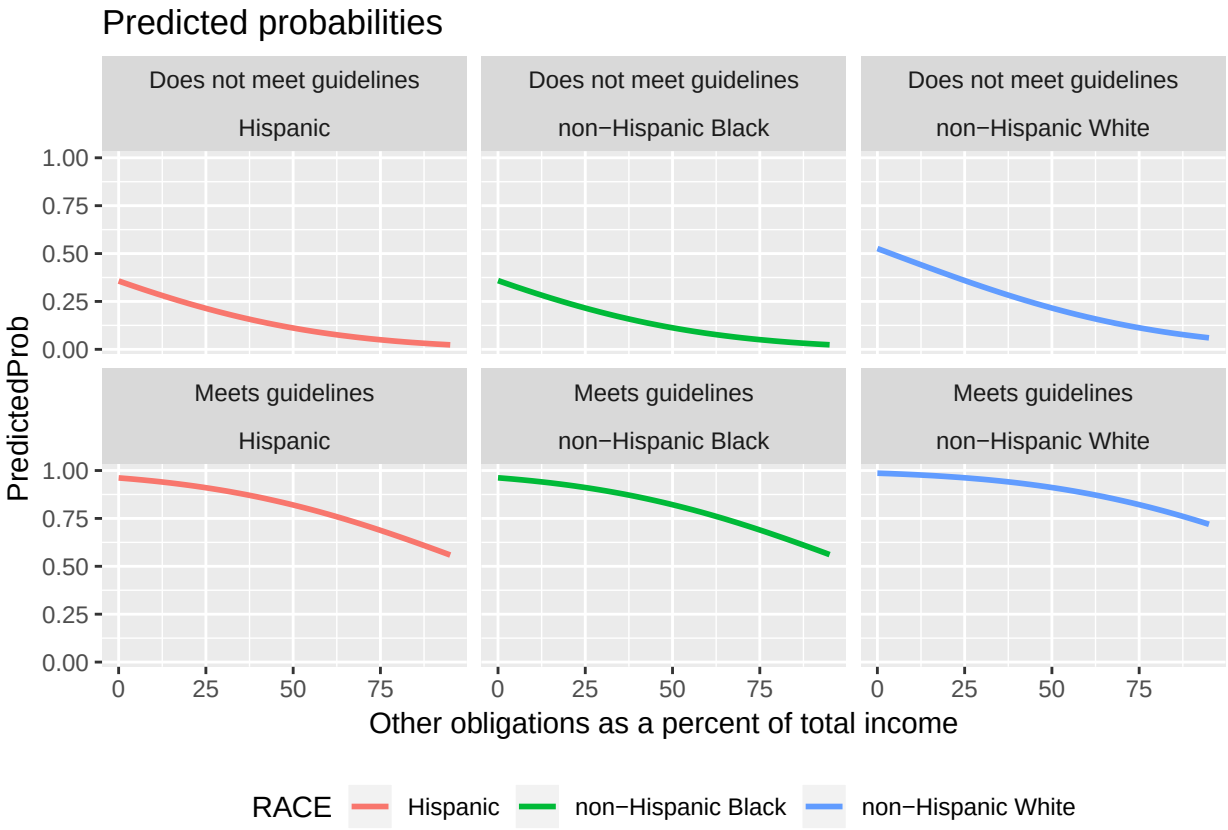

Hispanic Predicted probabilities
Female
Male
PredictedProb
1.00
0.75
0.50
0.25
0.00
0
100
200
Loan amount/purchase price %
GDLIN
Does not meet guidelines
Meets guidelines

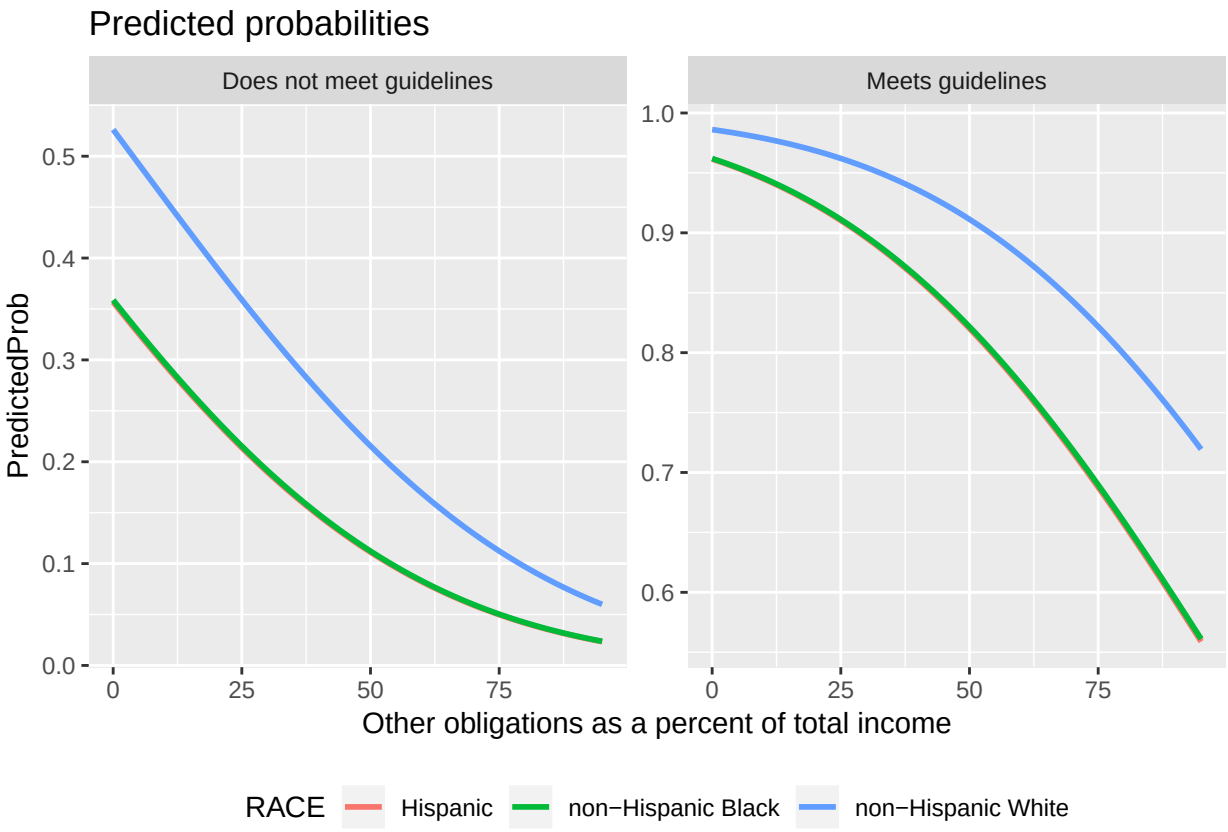

non−Hispanic White Black Predicted probabilities
PredictedProb
1.00
0.75
0.50
0.25
0.00
Does not meet guidelines
Meets guidelines
0
100
200
Loan amount/purchase price %
MALE
Female
Male

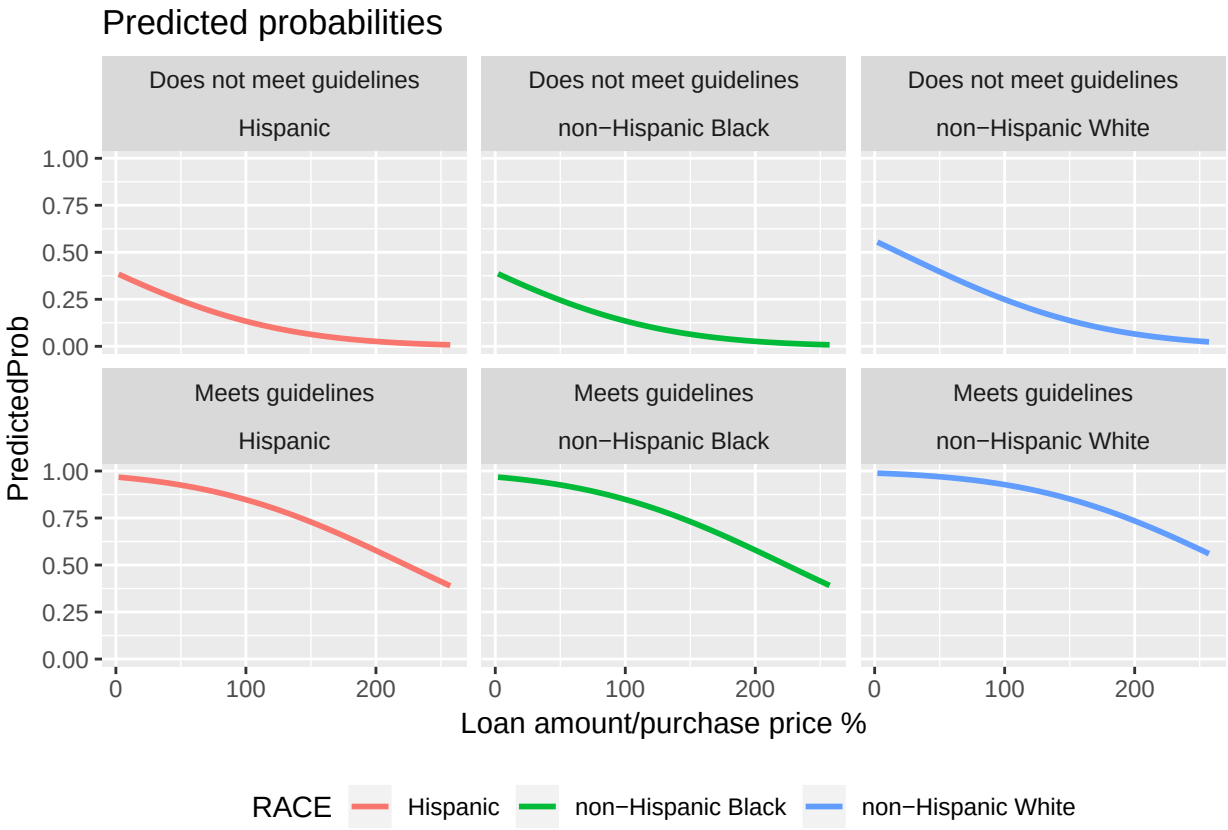

non−Hispanic White Black Predicted probabilities
Female
Male
PredictedProb
1.00
0.75
0.50
0.25
0.00
0
100
200
Loan amount/purchase price %
GDLIN
Does not meet guidelines
Meets guidelines

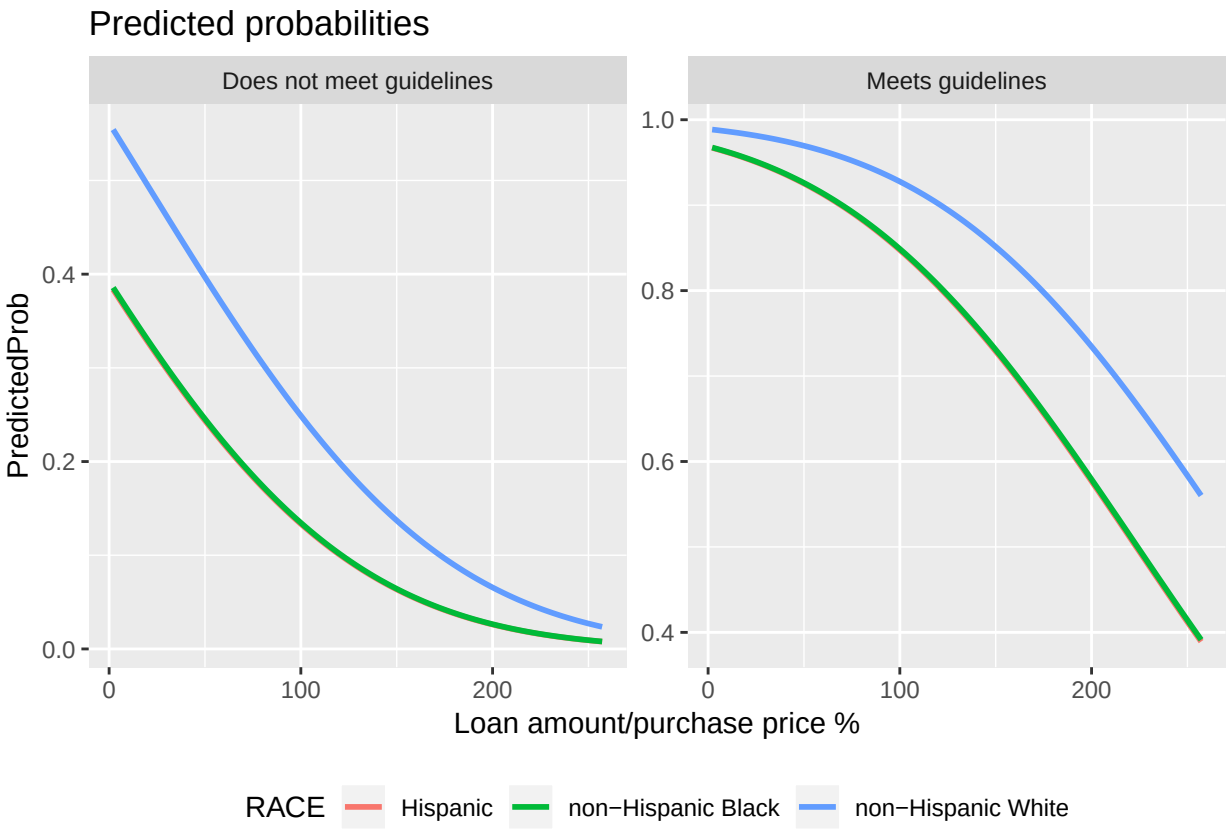

Predicted probabilities
Does not meet guidelines
Female
Does not meet guidelines
Male
Meets guidelines
Female
Meets guidelines
Male
PredictedProb
0.5
0.4
0.3
0.2
0.1
0.0
1.0
0.9
0.8
0.7
0.6
0
25
50
75
Other obligations as a percent of total income
RACE
Hispanic
non−Hispanic Black
non−Hispanic White


Predicted probabilities
Does not meet guidelines
Female
Does not meet guidelines
Male
Meets guidelines
Female
Meets guidelines
Male
PredictedProb
0.0
0.2
0.4
0.6
0.8
1.0
0
100
200
Loan amount/purchase price %
RACE
Hispanic
non−Hispanic Black
non−Hispanic White


Predicted probabilities
Does not meet guidelines
Hispanic
Does not meet guidelines
non−Hispanic Black
Does not meet guidelines
non−Hispanic White
Meets guidelines
Hispanic
Meets guidelines
non−Hispanic Black
Meets guidelines
non−Hispanic White
PredictedProb
0.00
0.25
0.50
0.75
1.00
0
25
50
75
Other obligations as a percent of total income
RACE
Hispanic
non−Hispanic Black
non−Hispanic White


Predicted probabilities
Does not meet guidelines
Meets guidelines
PredictedProb
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
0
25
50
75
Other obligations as a percent of total income
RACE
Hispanic
non−Hispanic Black
non−Hispanic White


Predicted probabilities
Does not meet guidelines
Hispanic
Does not meet guidelines
non−Hispanic Black
Does not meet guidelines
non−Hispanic White
Meets guidelines
Hispanic
Meets guidelines
non−Hispanic Black
Meets guidelines
non−Hispanic White
PredictedProb
0.00
0.25
0.50
0.75
1.00
0
100
200
Loan amount/purchase price %
RACE
Hispanic
non−Hispanic Black
non−Hispanic White


Predicted probabilities
Does not meet guidelines
Meets guidelines
PredictedProb
0.0
0.2
0.4
0.4
0.6
0.8
1.0
0
100
200
0
100
200
Loan amount/purchase price %
RACE
Hispanic
non−Hispanic Black
non−Hispanic White