Lending Mortage Analysis

Exploratory Data Analysis

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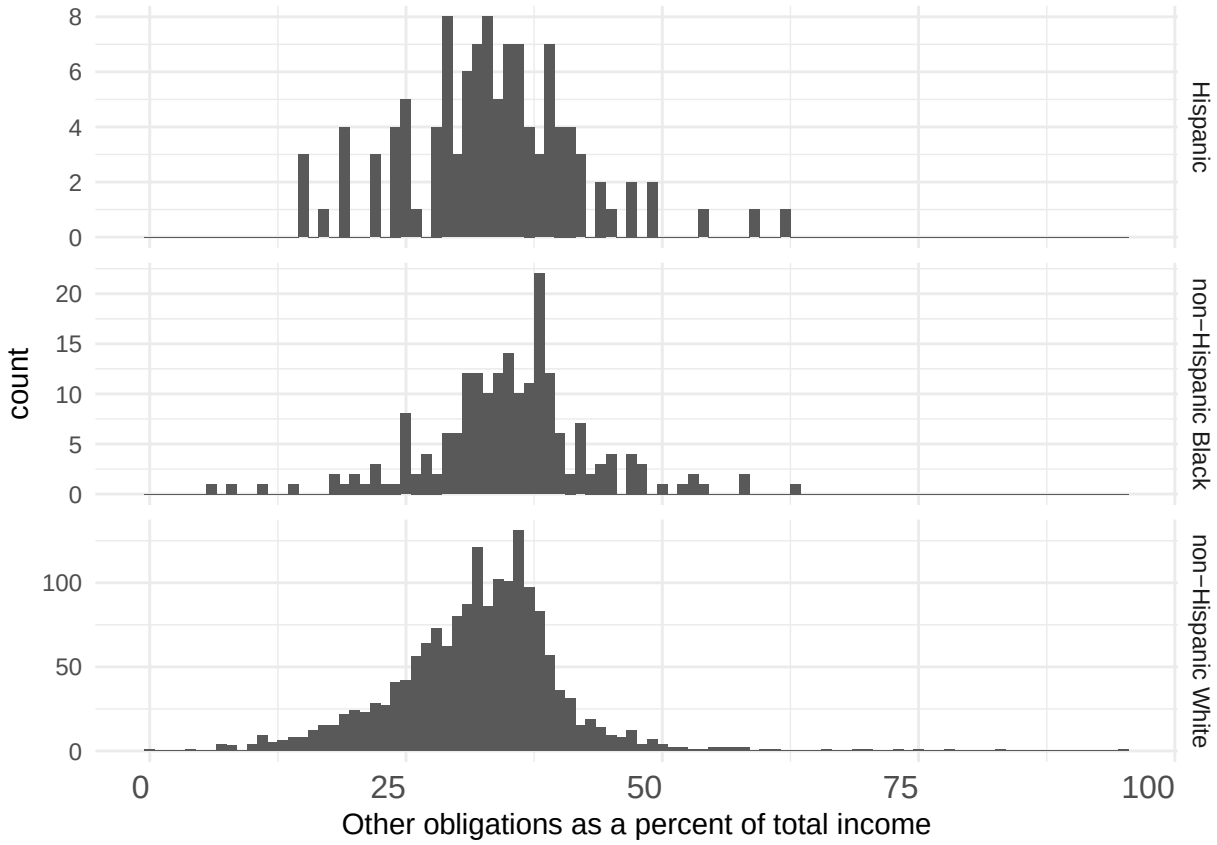
The data set contains 1989 records. The overall descriptive statistics:

```
##     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
```

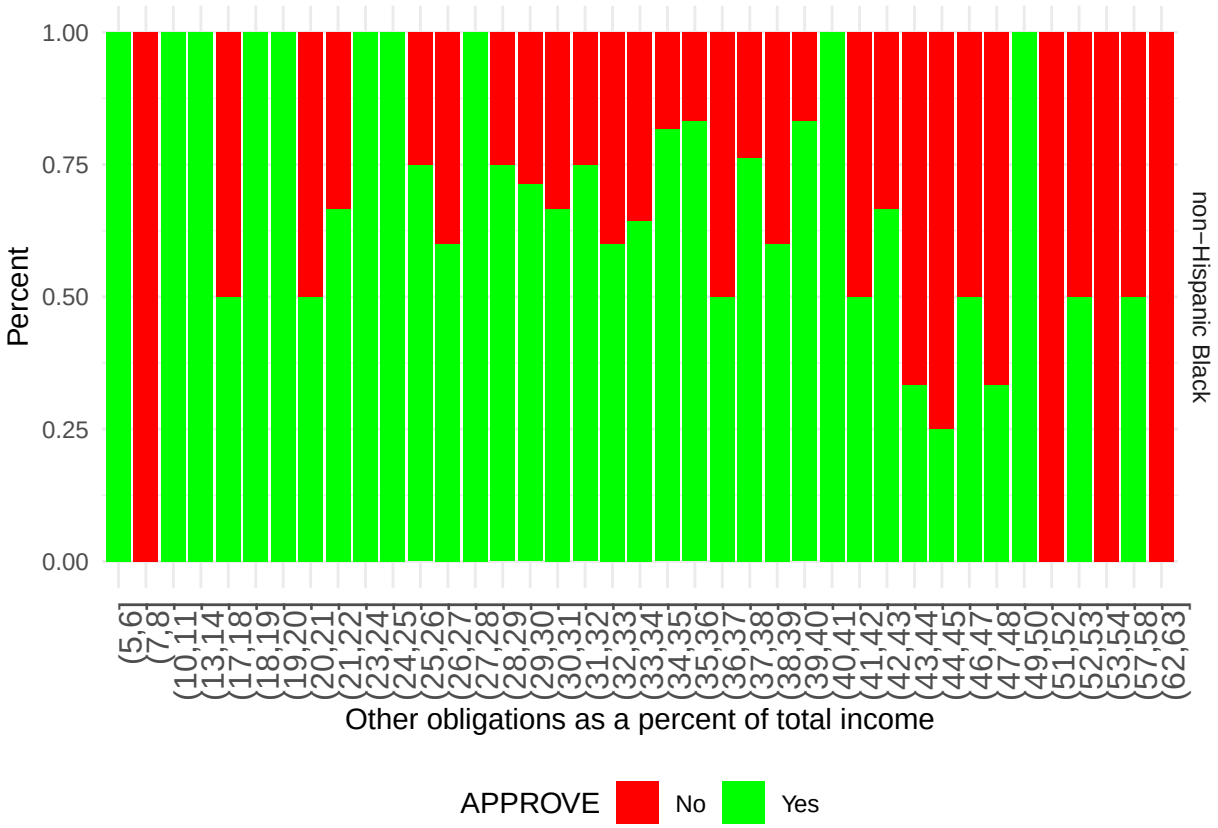
Descriptive statistics by Race:

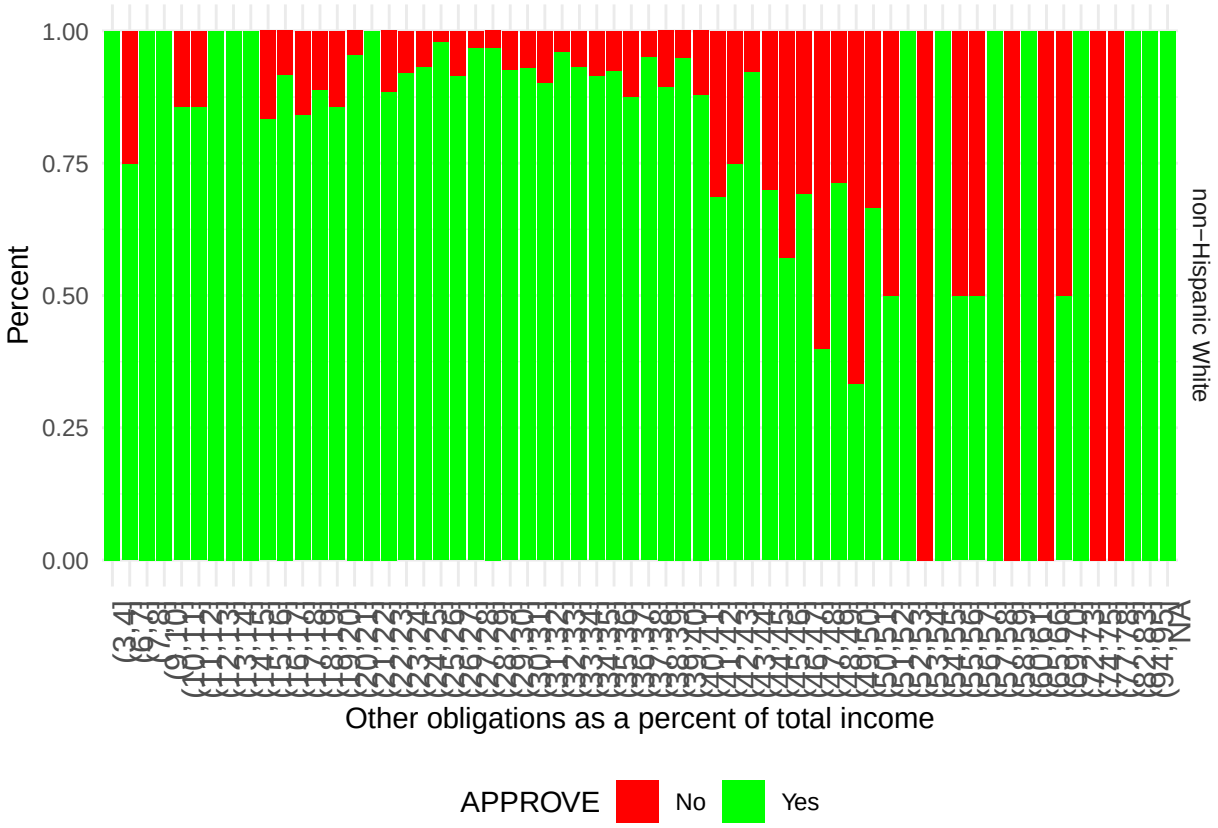
```
## $Hispanic
##     MARRIED   GDLIN        OBRAT            MALE    APPROVE
##  No     :31   0  :16   Min.   :14.60   No     :22   No :26
##  Unknown: 1   1  :95   1st Qu.:29.00   Unknown: 2   Yes:85
##  Yes    :79   666: 0   Median :33.00   Yes    :87
##                        Mean   :33.46
##                        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
```

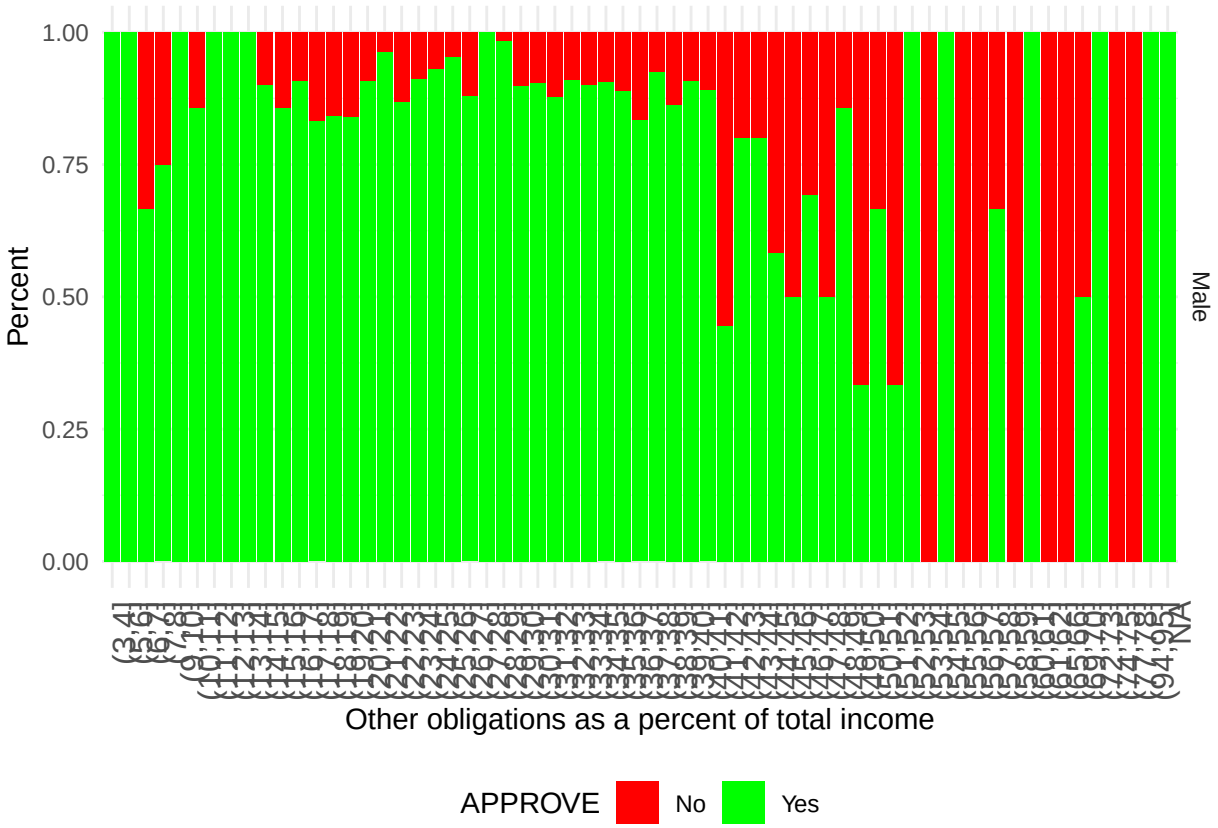
```
##
## $`non-Hispanic Black`
##     MARRIED    GDLIN         OBRAT            MALE     APPROVE
##  No     : 76   0  : 53   Min.   : 5.60   No     : 51   No : 64
##  Unknown:  0   1  :144   1st Qu.:31.00   Unknown:  2   Yes:133
##  Yes    :121   666:  0   Median :35.00   Yes    :144
##                          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
```

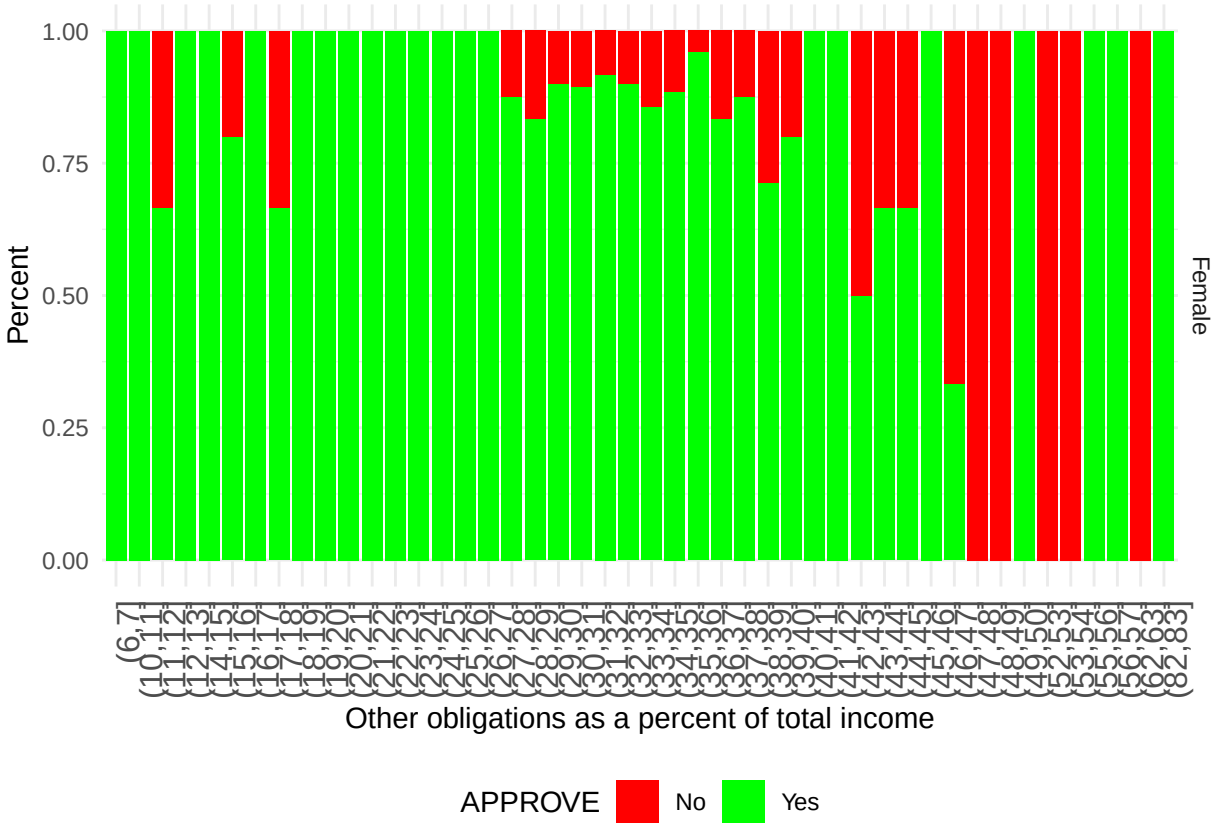

count
Hispanic
non−Hispanic Black
non−Hispanic White
0
25
50
75
100
Other obligations as a percent of total income

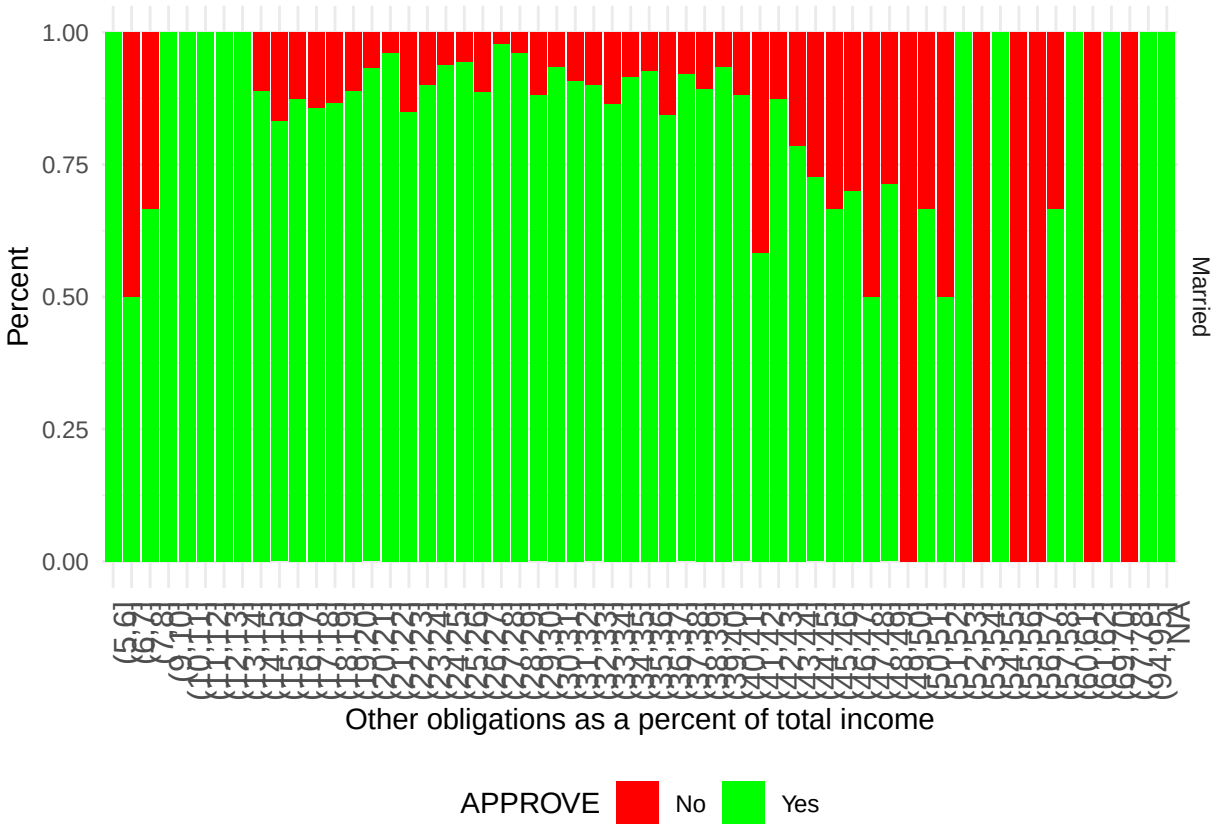

Percent
Hispanic
1.00
0.75
0.50
0.25
0.00
(14,15]
(16,17]
(18,19]
(21,22]
(23,24]
(24,25]
(26,27]
(27,28]
(28,29]
(29,30]
(30,31]
(31,32]
(32,33]
(33,34]
(34,35]
(35,36]
(36,37]
(37,38]
(38,39]
(39,40]
(40,41]
(41,42]
(42,43]
(43,44]
(44,45]
(46,47]
(48,49]
(53,54]
(58,59]
(61,62]
Other obligations as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

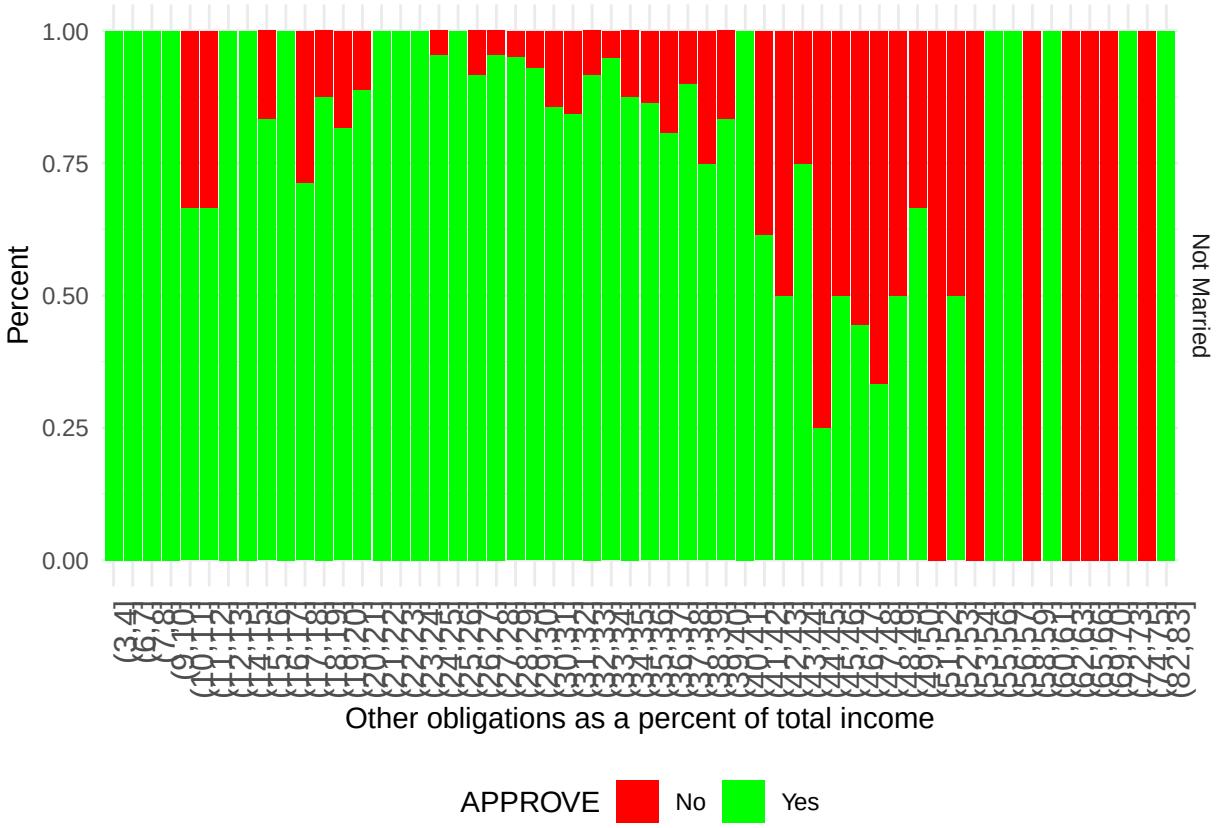

1.00
0.75
0.50
0.25
0.00
Percent
non−Hispanic Black
Other obligations as a percent of total income
APPROVE
No
Yes

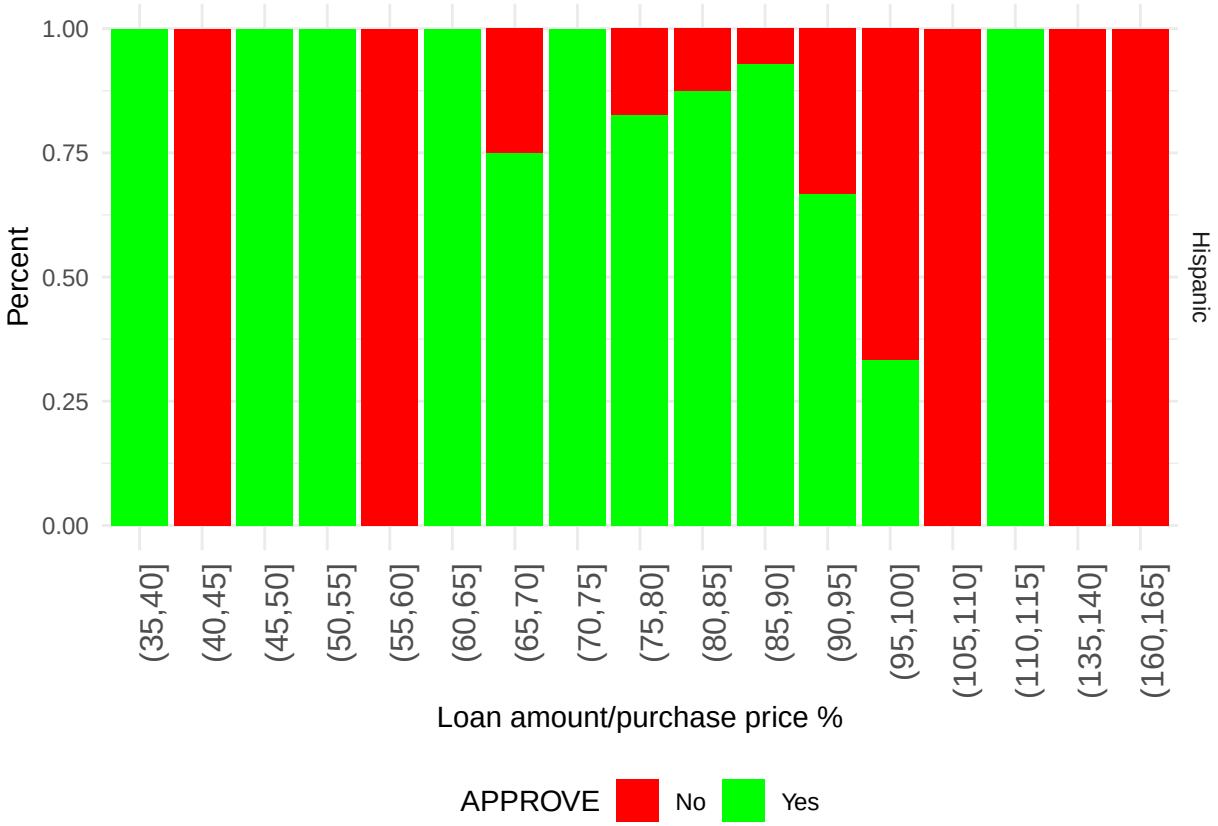

1.00
0.75
0.50
0.25
0.00
Percent
non−Hispanic White
Other obligations as a percent of total income
APPROVE
No
Yes

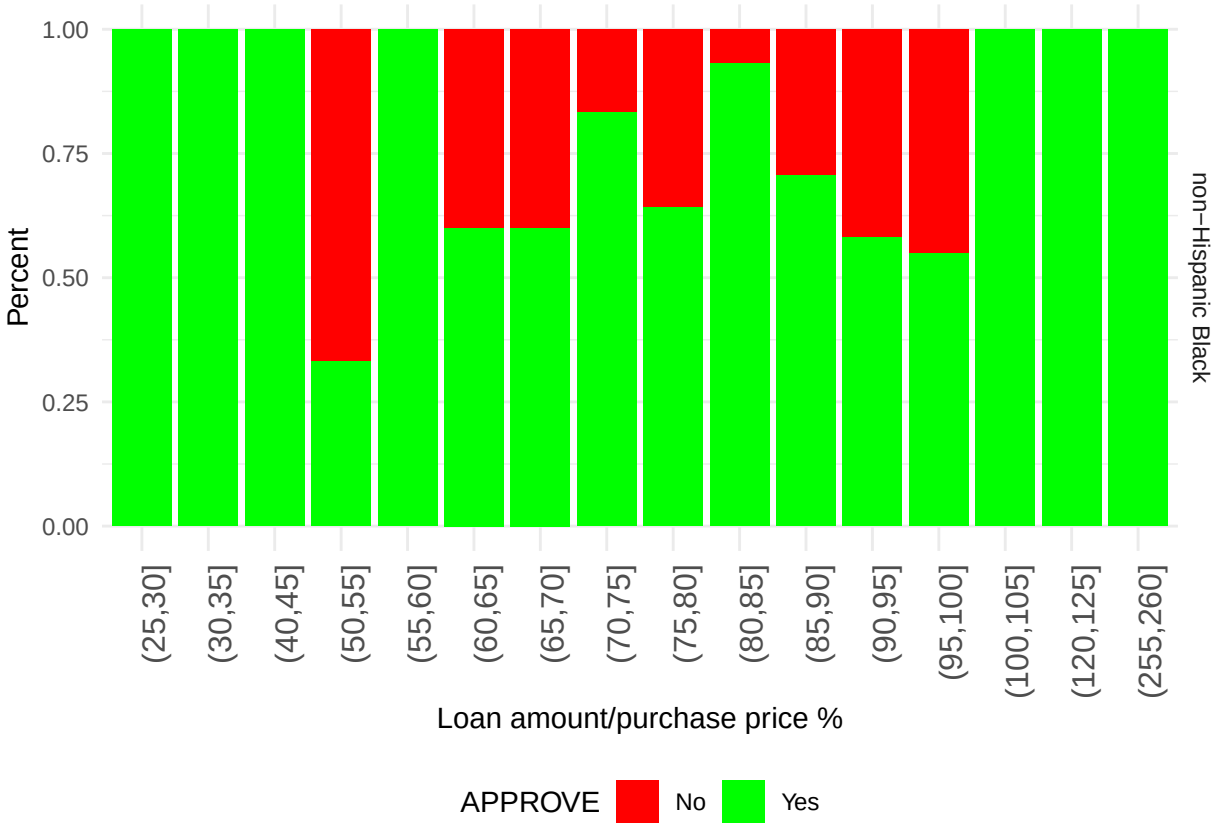

Percent
1.00
0.75
0.50
0.25
0.00
Male
Other obligations as a percent of total income
APPROVE
No
Yes

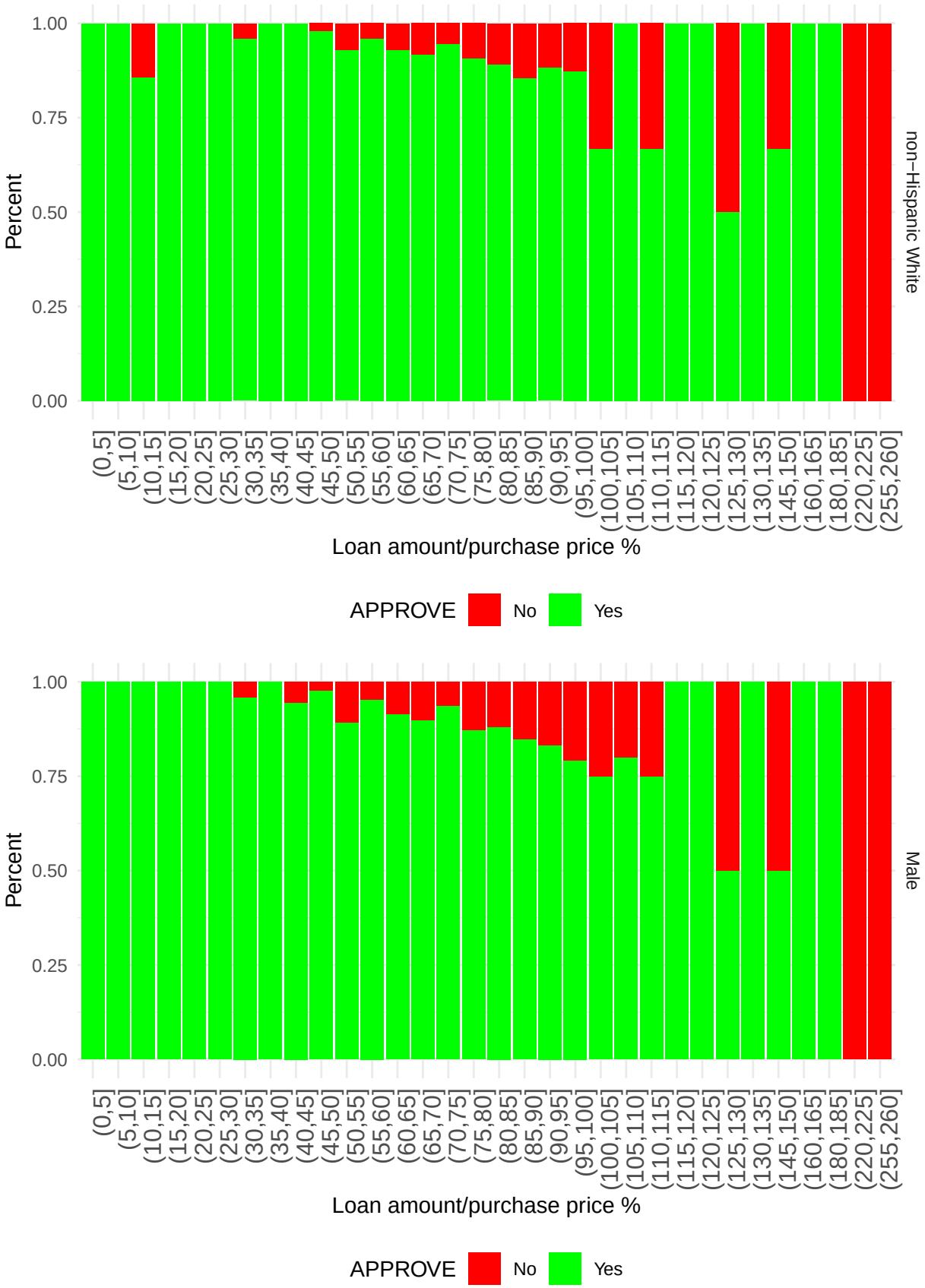

Percent
1.00
0.75
0.50
0.25
0.00
Female
Other obligations as a percent of total income
APPROVE
No
Yes

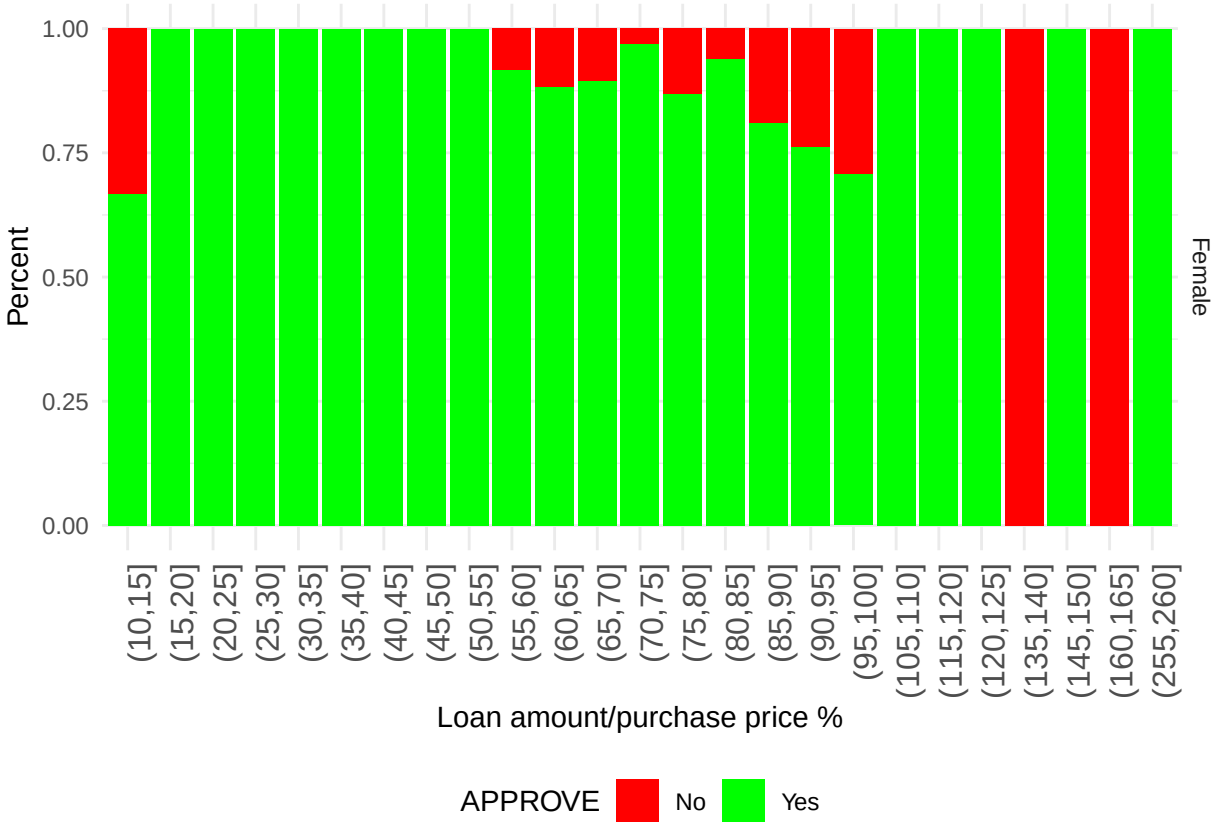

1.00
0.75
0.50
0.25
0.00
Percent
Married
Other obligations as a percent of total income
APPROVE
No
Yes

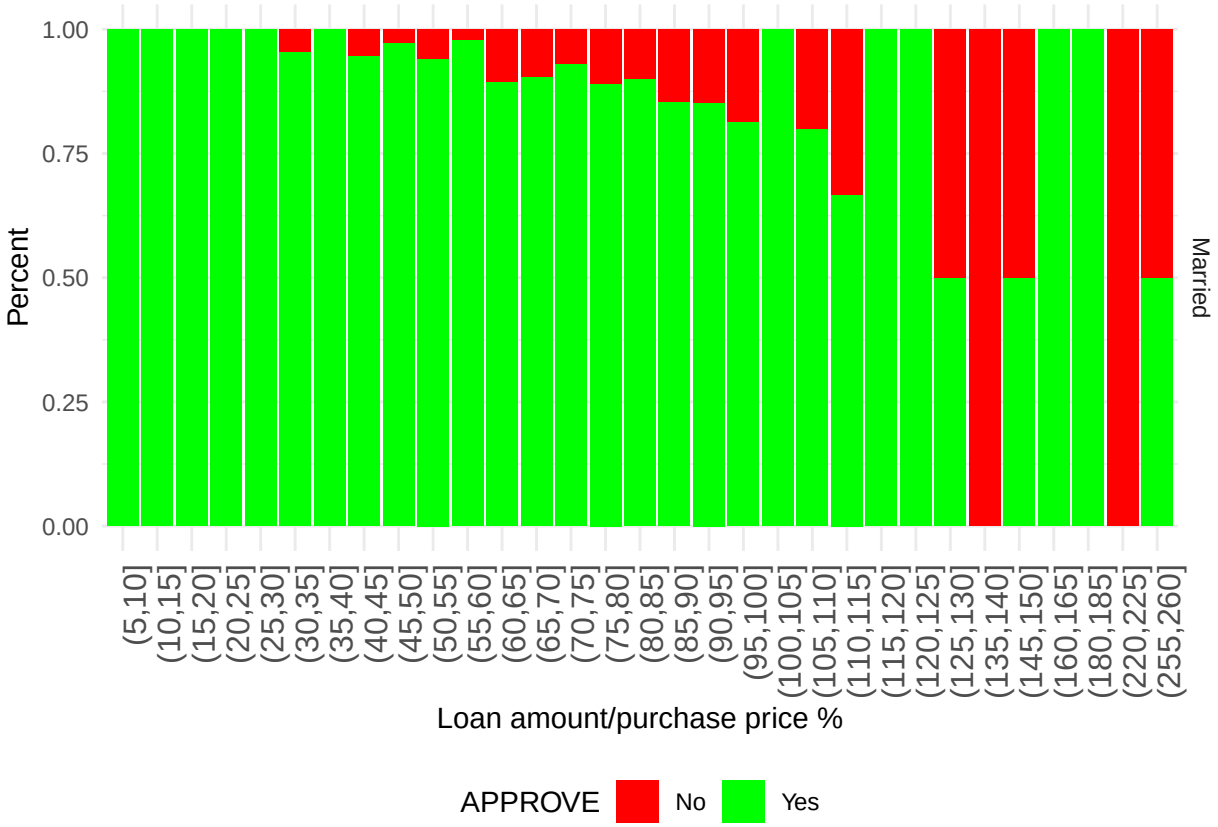

1.00
0.75
0.50
0.25
0.00
Percent
Not Married
Other obligations as a percent of total income
APPROVE
No
Yes

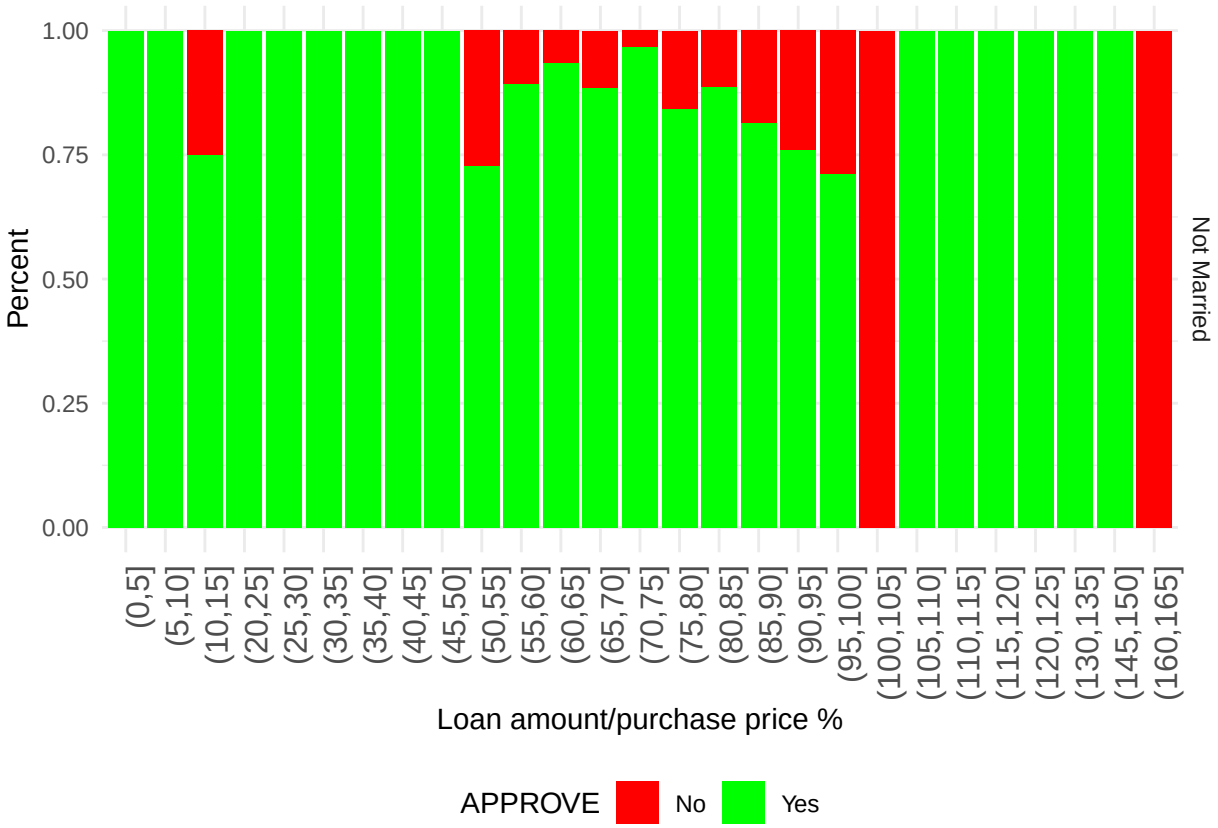

1.00
0.75
0.50
0.25
0.00
Percent
Hispanic
(35,40]
(40,45]
(45,50]
(50,55]
(55,60]
(60,65]
(65,70]
(70,75]
(75,80]
(80,85]
(85,90]
(90,95]
(95,100]
(105,110]
(110,115]
(135,140]
(160,165]
Loan amount/purchase price %
APPROVE
No
Yes


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
356	Unknown	1	35.0	No	Yes	Yes	Yes	86.95652
759	Unknown	1	33.6	No	No	Yes	Yes	90.28571
1392	Unknown	1	13.0	No	No	No	Yes	117.24140

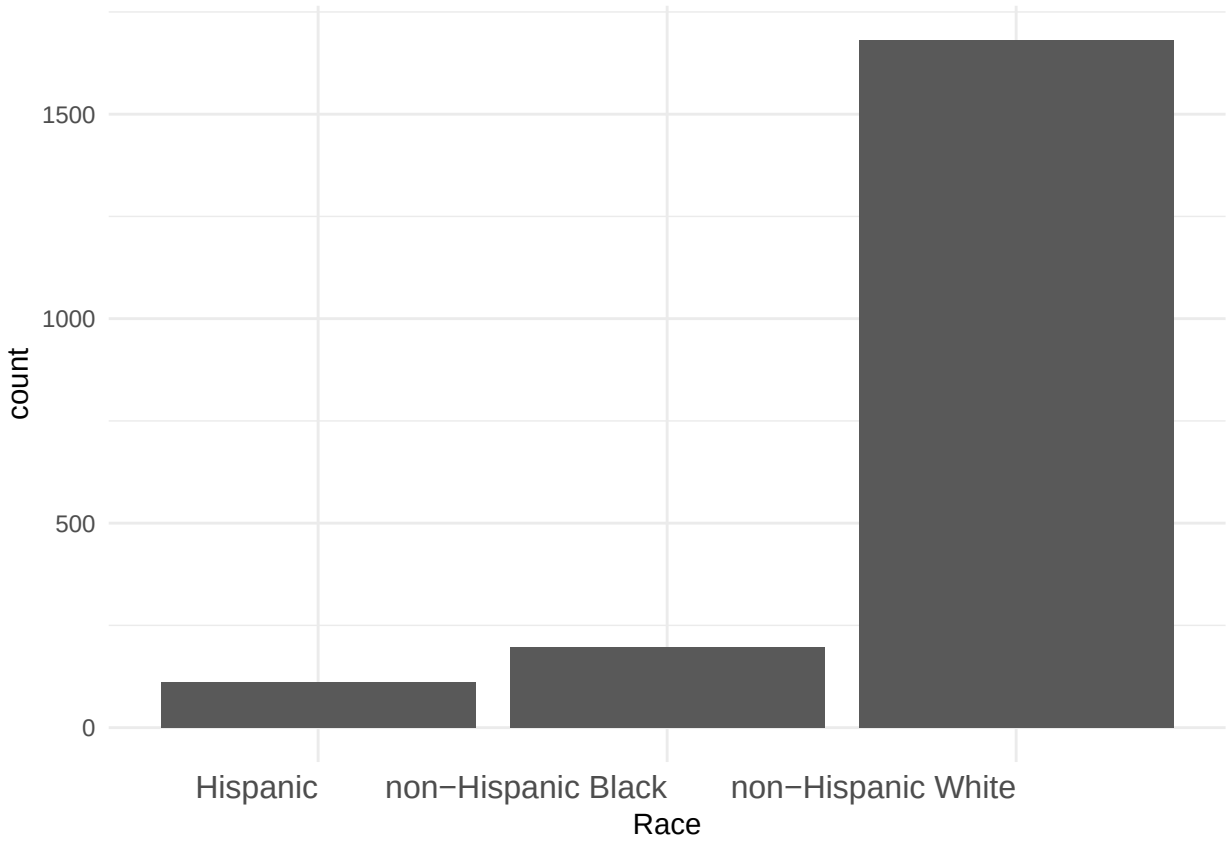
There are 3 records are missing married (GDLIN) field.

ID	MARRIED	GDLIN	OBRAT	BLACK	HISPAN	MALE	APPROVE	LOANPRC
881	Yes	666	35	No	No	Yes	Yes	75.82939
1229	Yes	666	26	No	No	Yes	Yes	100.00000

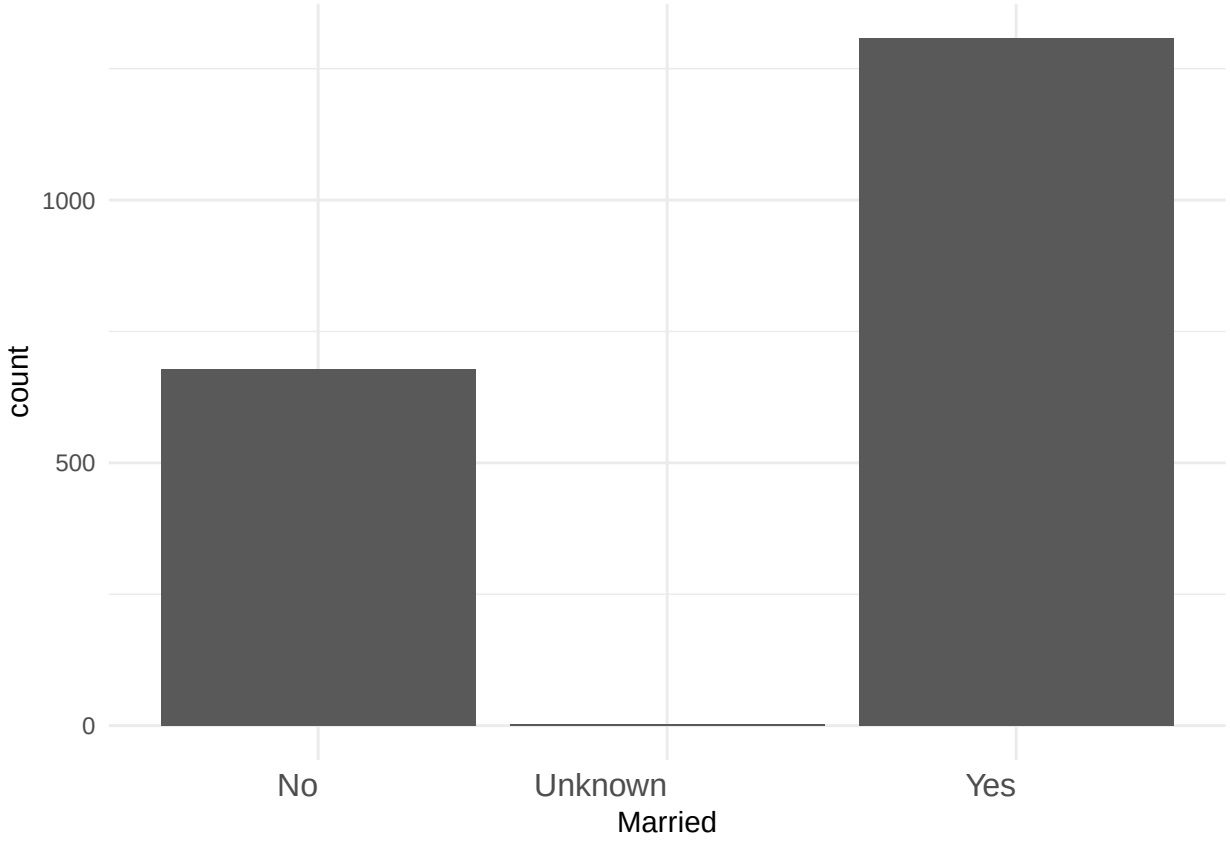
There are 15 records are missing gender (MALE) field.

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

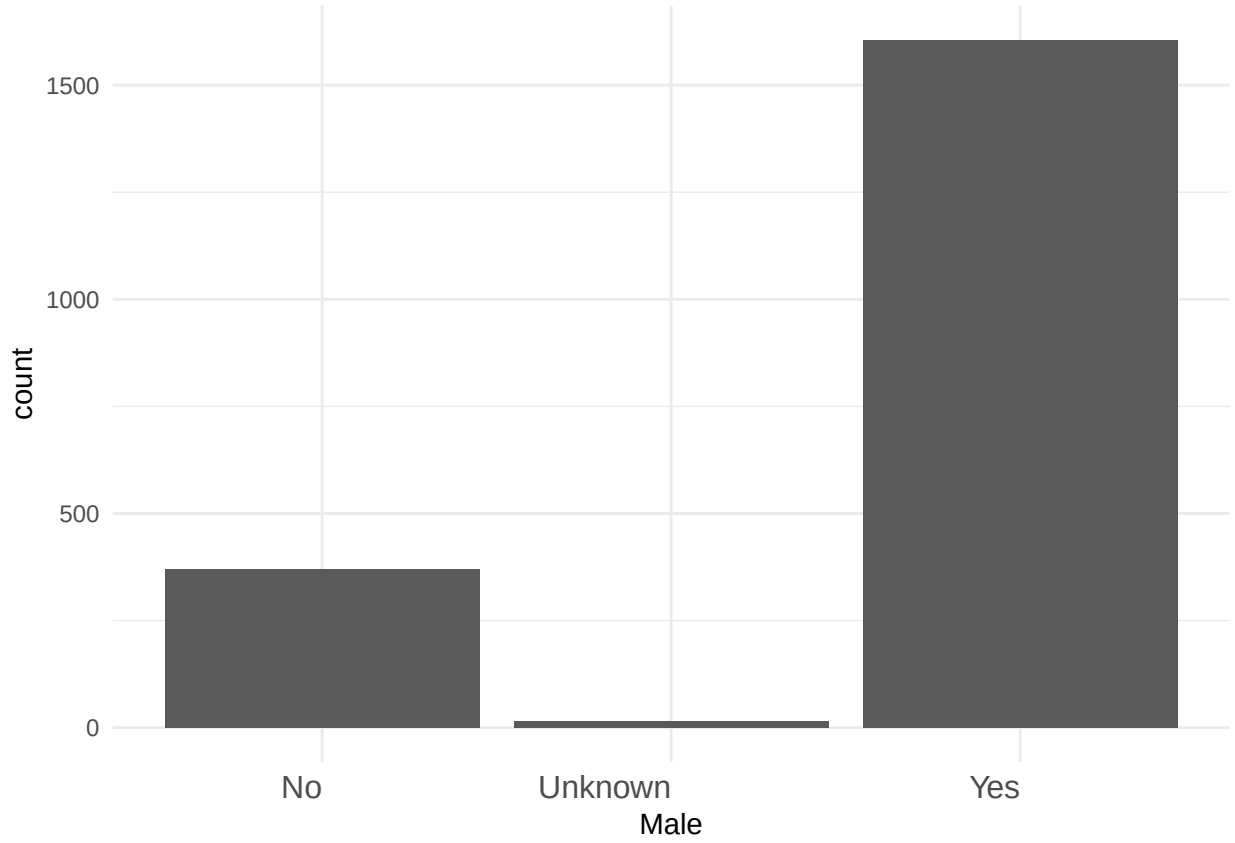
```
##                       APPROVE
## RACE                     No  Yes
##   Hispanic               26   85
##   non-Hispanic Black     64  133
##   non-Hispanic White    154 1527
```



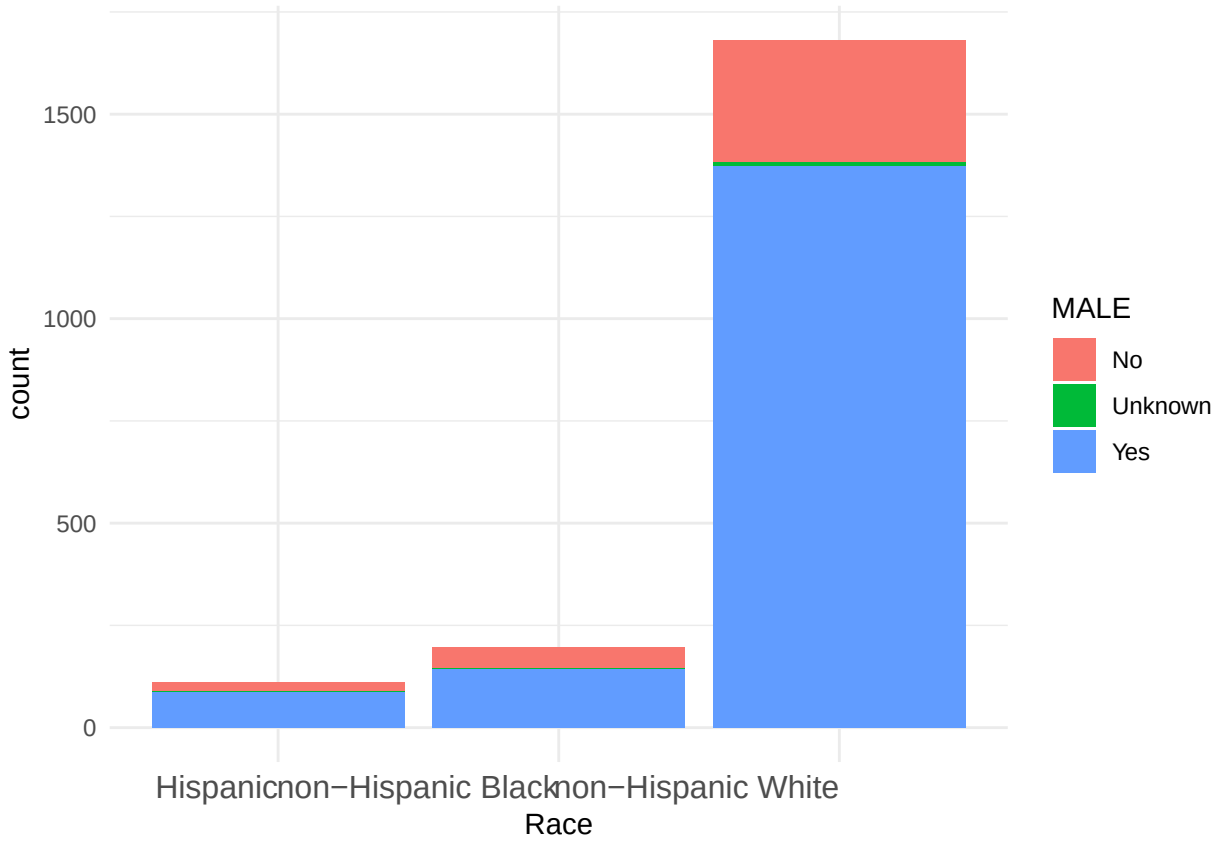

```
##          APPROVE
## MARRIED     No  Yes
##   No       102  576
##   Unknown    0    3
##   Yes      142 1166
```

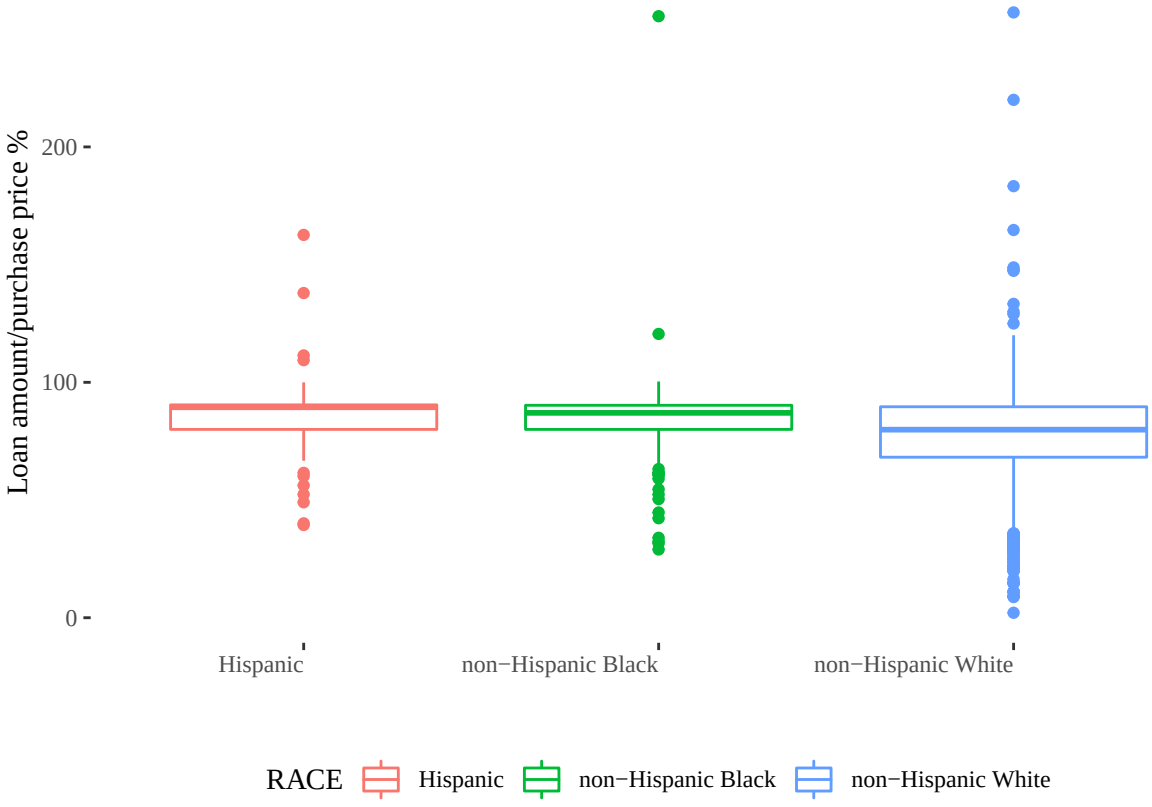


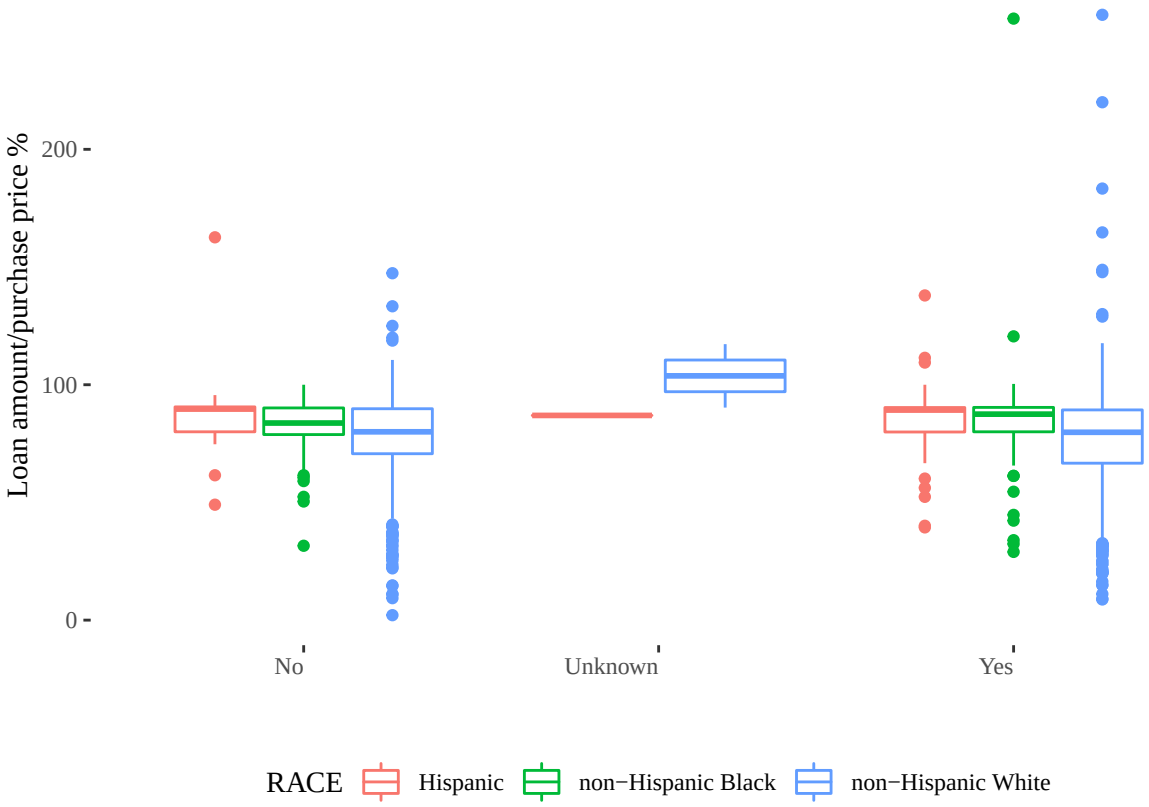

```
##          APPROVE
## MALE        No  Yes
##   No        50  319
##   Unknown    0   15
##   Yes      194 1411
```

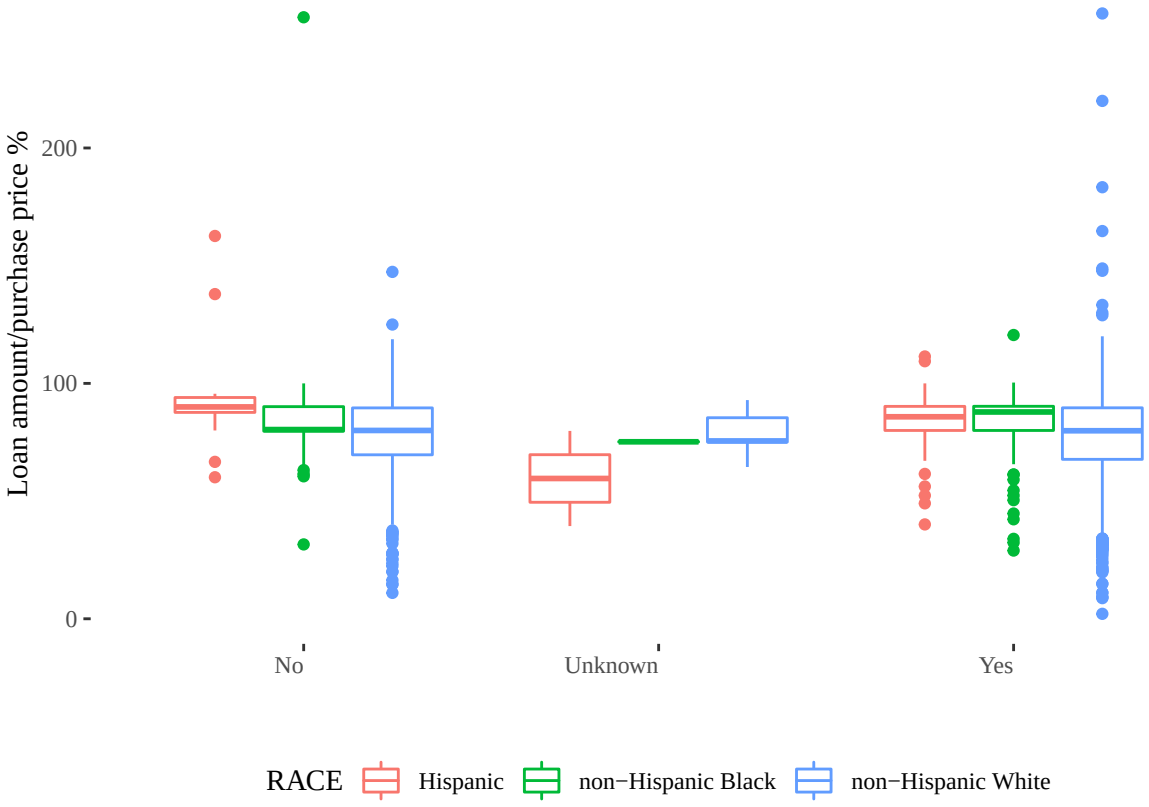


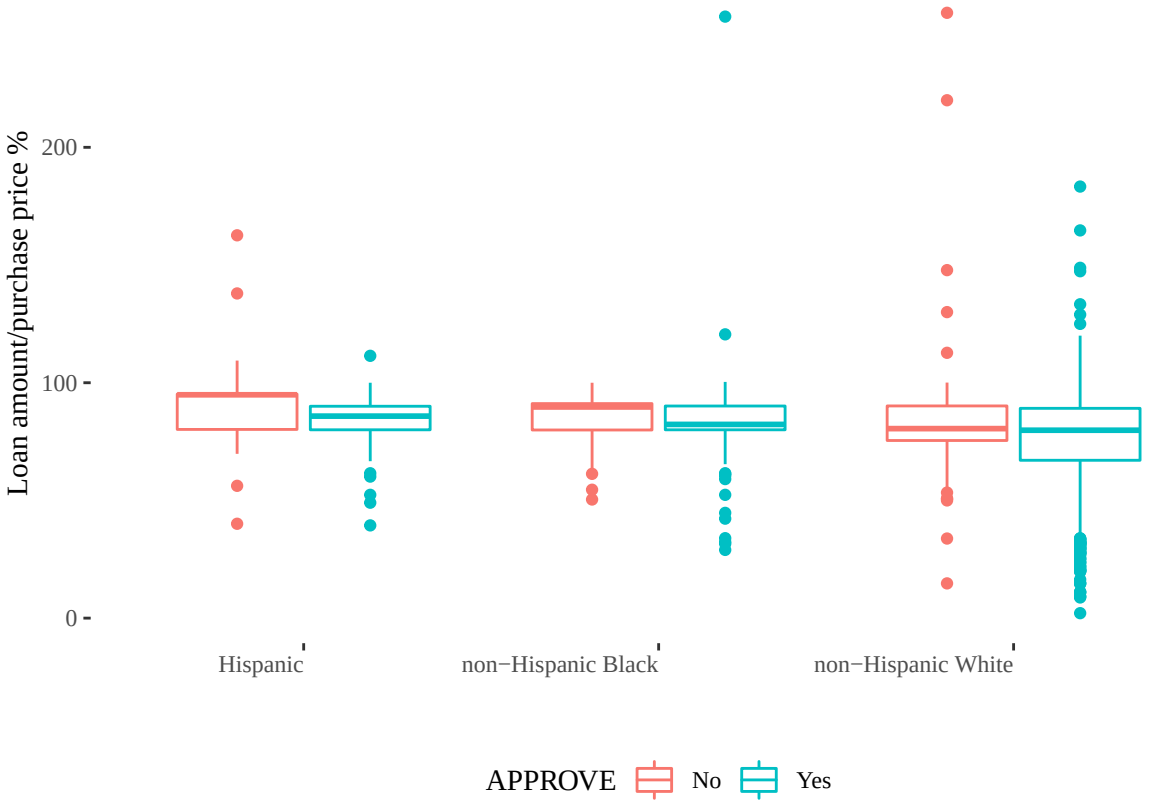

```
## , , RACE = Hispanic
##
##          APPROVE
## MARRIED     No  Yes
##   No         7   24
##   Unknown    0    1
##   Yes       19   60
##
## , , RACE = non-Hispanic Black
##
##          APPROVE
## MARRIED     No  Yes
##   No        27   49
##   Unknown    0    0
##   Yes       37   84
##
## ,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

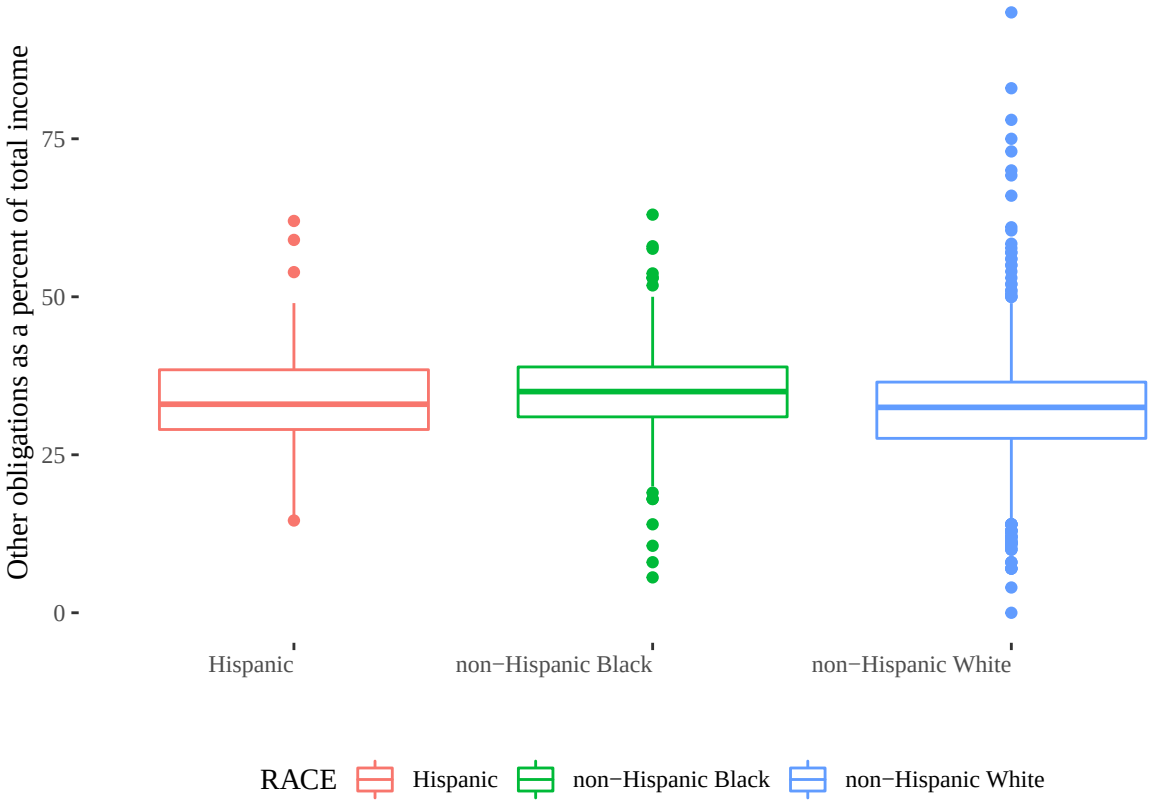

1500
1000
500
0
count
MALE
No
Unknown
Yes
Hispanic
non−Hispanic Black
non−Hispanic White
Race

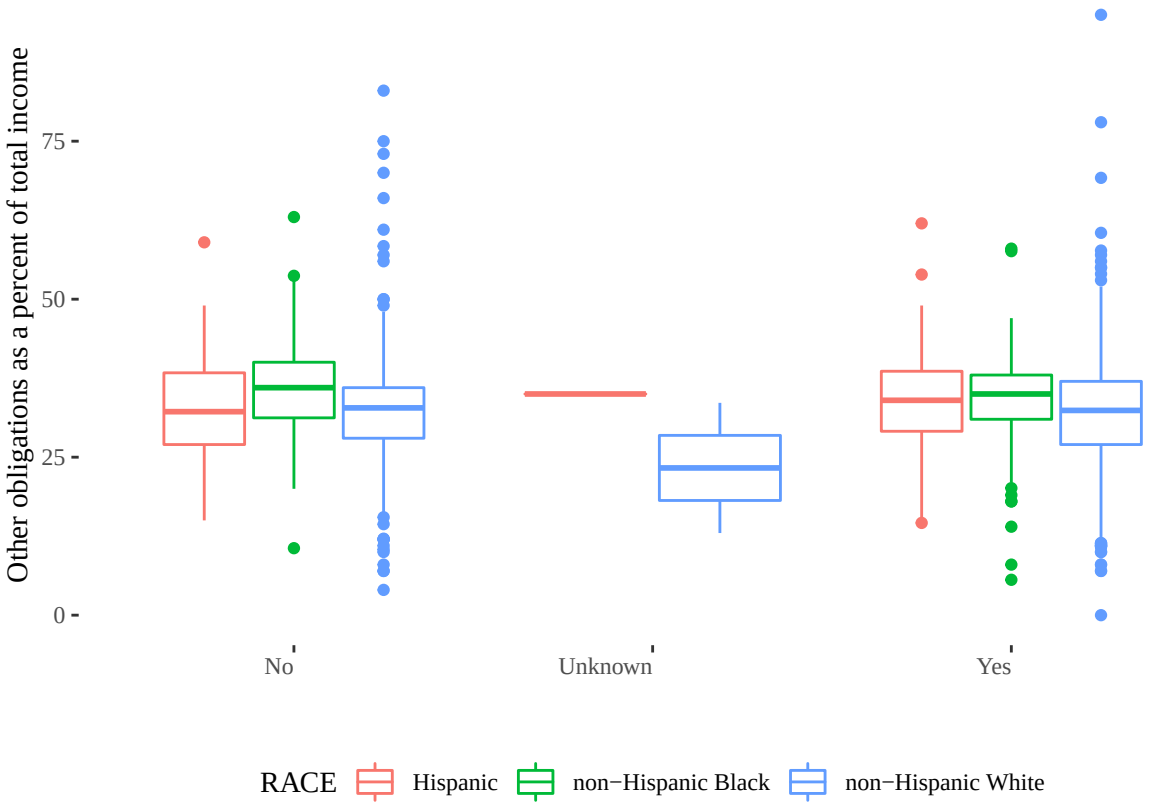

200
100
0
Loan amount/purchase price %
Hispanic
non−Hispanic Black
non−Hispanic White
RACE
Hispanic
non−Hispanic Black
non−Hispanic White

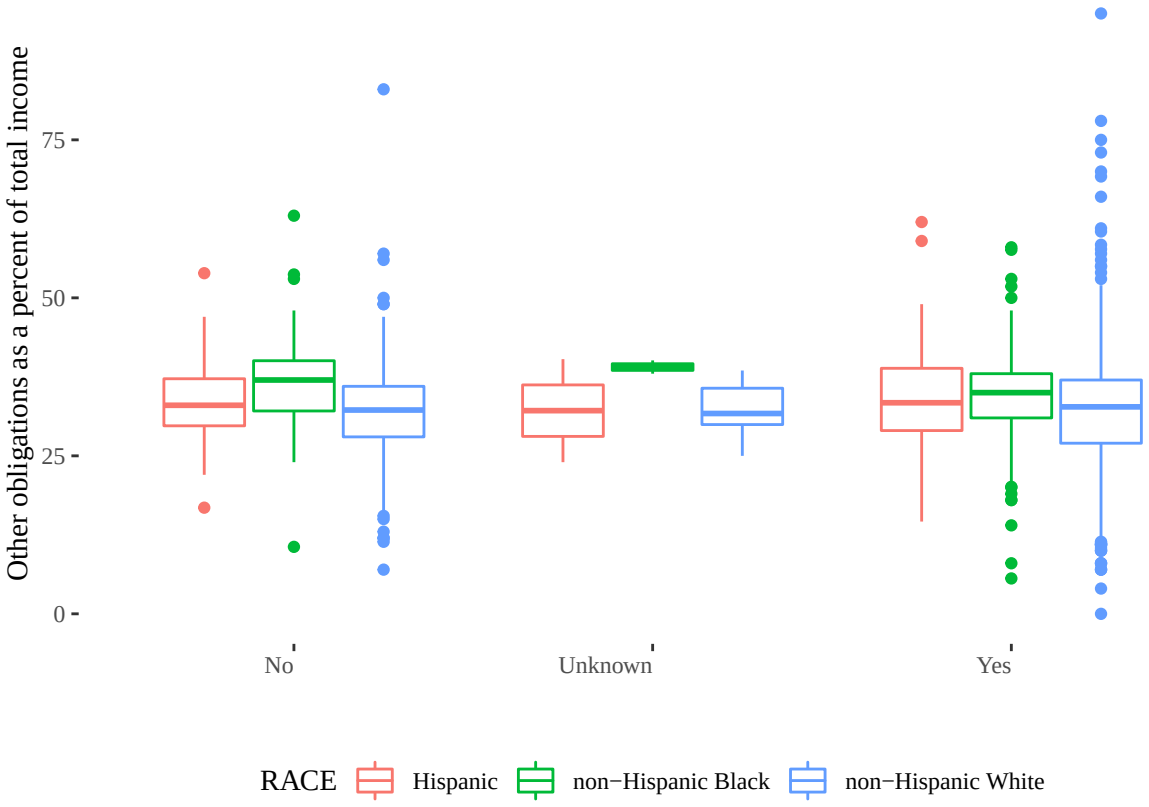

Loan amount/purchase price %
200
100
0
No
Unknown
Yes
RACE
Hispanic
non−Hispanic Black
non−Hispanic White

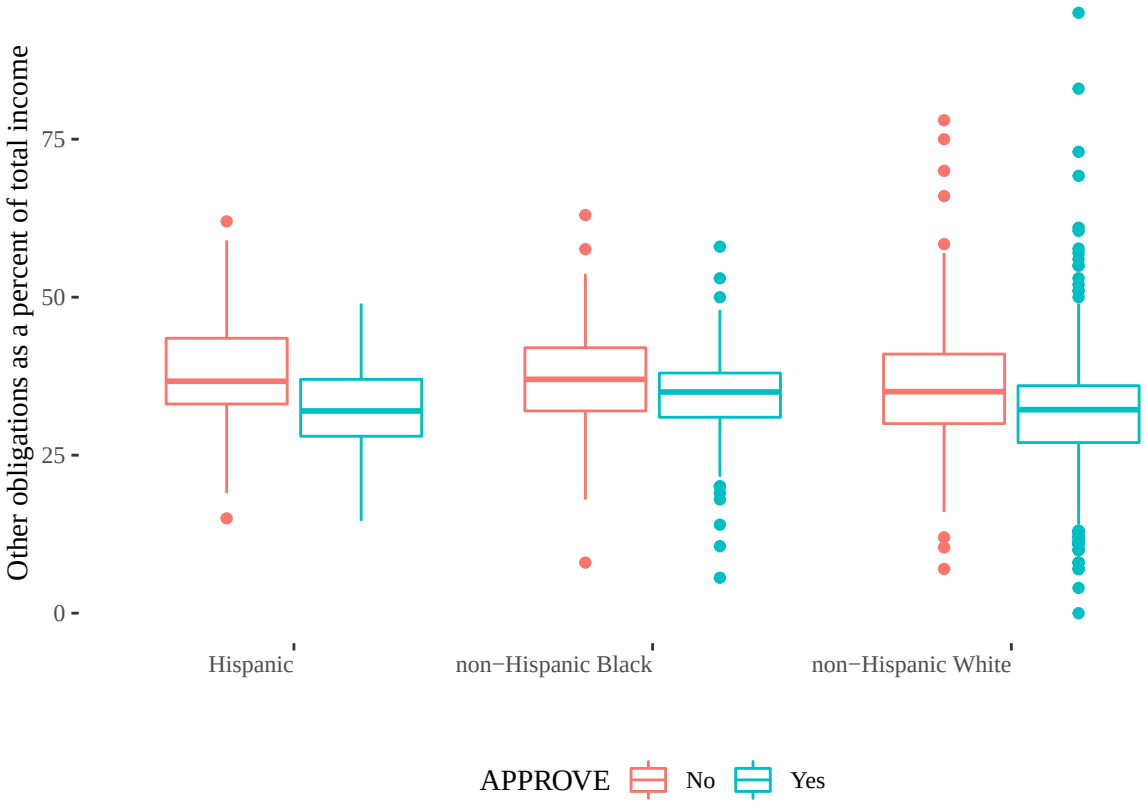

Loan amount/purchase price %
200
100
0
No
Unknown
Yes
RACE
Hispanic
non−Hispanic Black
non−Hispanic White


Loan amount/purchase price %
200
100
0
Hispanic
non−Hispanic Black
non−Hispanic White
APPROVE
No
Yes


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


Other obligations as a percent of total income
75
50
25
0
No
Unknown
Yes
RACE
Hispanic
non−Hispanic Black
non−Hispanic White


Other obligations as a percent of total income
75
50
25
0
No
Unknown
Yes
RACE
Hispanic
non−Hispanic Black
non−Hispanic White



Data Discription

The data set includes the following variables:

- APPROVE = 1 if mortgage loan was approved, = 0 otherwise
- GDLIN = 1 if credit history meets guidelines, = 0 otherwise
- LOANPRC = loan amount/purchase price
- OBRAT = other obligations as a percent of total income
- MALE = 1 if male, = 0 otherwise
- MARRIED = 1 if married, = 0 otherwise
- BLACK = 1 if black, = 0 otherwise
- HISPAN = 1 if Hispanic, = 0 otherwise

Logistic Regression Full Model

log(p/1-p) = $b_0 + b_1 * GDLIN + b_2 * OBRAT + b_3 * BLACK + b_4 * HISPAN + b_5 * LOANPRC + b_6 * MARRIED + b_7 * MALE$

```
##
## Call:
## glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED + MALE, family = "binomial", data = data1)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.8933   0.2445   0.3128   0.3742   2.3261
```

```
##
## Coefficients:
##              Estimate Std. Error z value             Pr(>|z|)
## (Intercept)  1.381531   0.591656   2.335             0.019542 *
## GDLIN1       3.719269   0.217169  17.126 < 0.0000000000000002 ***
## OBRAT       -0.034074   0.010310  -3.305             0.000950 ***
## BLACK1      -0.815693   0.240177  -3.396             0.000683 ***
## HISPAN1     -0.900010   0.310585  -2.898             0.003758 **
## LOANPRC     -0.016812   0.005074  -3.313             0.000922 ***
## MARRIED1     0.475742   0.192005   2.478             0.013221 *
## MALE1       -0.053947   0.234573  -0.230             0.818107
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 1475.4  on 1968  degrees of freedom
## Residual deviance:  959.4  on 1961  degrees of freedom
## AIC: 975.4
##
## Number of Fisher Scoring iterations: 6
```

For every one unit change in `OBRAT`, the log odds of loan approval (versus non loan approval) decreases by 0.0340739.

For every one unit change in `LOANPRC`, the log odds of loan approval (versus non loan approval) decreases by 0.0168119.

The log odds of loan approval for applicants that meet credit guidelines increases by 3.719269.

The log odds of loan approval for married applicants increases by 0.4757419.

The log odds of loan approval for Black applicants decreases by 0.8156932.

The log odds of loan approval for Hispanic applicants decreases by 0.9000102.

For a black married male whose credit history meets guidline (GDLIN = 1), loan amount price is 100 (LOANPRC = 100) and other obligations as a percent of total income is none (OBRAT = 0), the log odds of loan approval is 95.37%

Statistical Tests for Individual Predictors

```
##            Overall
## GDLIN1   17.126161
## OBRAT     3.305071
## BLACK1    3.396220
## HISPAN1   2.897795
## LOANPRC   3.313389
## MARRIED1  2.477753
## MALE1     0.229981

## Wald test for GDLIN
##  in glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED + MALE, family = "binomial", data = data1)
## F =  293.3054  on  1  and  1961  df: p= < 0.000000000000000222

## Wald test for OBRAT
##  in glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED + MALE, family = "binomial", data = data1)
## F =  10.9235  on  1  and  1961  df: p= 0.00096664
```

```
## Wald test for BLACK
##  in glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED + MALE, family = "binomial", data = data1)
## F =  11.53431  on  1  and  1961  df: p= 0.00069686

## Wald test for HISPAN
##  in glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED + MALE, family = "binomial", data = data1)
## F =  8.397215  on  1  and  1961  df: p= 0.0037997

## Wald test for MALE
##  in glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED + MALE, family = "binomial", data = data1)
## F =  0.05289126  on  1  and  1961  df: p= 0.81813

## Wald test for LOANPRC
##  in glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED + MALE, family = "binomial", data = data1)
## F =  10.97855  on  1  and  1961  df: p= 0.00093849

## Wald test for MARRIED
##  in glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED + MALE, family = "binomial", data = data1)
## F =  6.13926  on  1  and  1961  df: p= 0.013305

##          llh      llhNull           G2     McFadden         r2ML
## -479.7016510 -737.7148785  516.0264551    0.3497465    0.2305470
##         r2CU
##    0.4372079
```

Logistic Regression Reduced Model 1

$\log(\text{p/1-p}) = b_0 + b_1 * GDLIN + b_2 * OBRAT + b_3 * BLACK + b_4 * HISPAN + b_5 * LOANPRC + b_6 * MARRIED$

```
##
## Call:  glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED, family = "binomial", data = data1)
##
## Coefficients:
## (Intercept)       GDLIN1        OBRAT       BLACK1      HISPAN1
##     1.34239      3.72139     -0.03410     -0.81143     -0.89733
##     LOANPRC     MARRIED1
##    -0.01677      0.46093
##
## Degrees of Freedom: 1968 Total (i.e. Null);  1962 Residual
## Null Deviance:       1475
## Residual Deviance: 959.5     AIC: 973.5

## Wald test for GDLIN
##  in glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED, family = "binomial", data = data1)
## F =  294.1283  on  1  and  1962  df: p= < 0.000000000000000222
```

```
## Wald test for OBRAT
##  in glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED, family = "binomial", data = data1)
## F =  10.93867  on  1  and  1962  df: p= 0.00095878

## Wald test for BLACK
##  in glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED, family = "binomial", data = data1)
## F =  11.47424  on  1  and  1962  df: p= 0.00071961

## Wald test for HISPAN
##  in glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED, family = "binomial", data = data1)
## F =  8.358631  on  1  and  1962  df: p= 0.0038808

## Wald test for MARRIED
##  in glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED, family = "binomial", data = data1)
## F =  6.482227  on  1  and  1962  df: p= 0.010972

## Wald test for LOANPRC
##  in glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED, family = "binomial", data = data1)
## F =  10.92337  on  1  and  1962  df: p= 0.00096669
```

For every one unit change in `OBRAT`, the log odds of loan approval (versus non loan approval) decreases by 0.0340979.

For every one unit change in `LOANPRC`, the log odds of loan approval (versus non loan approval) decreases by 0.0167734.

The log odds of loan approval for applicants that meet credit guidelines increase by 3.721387.

The log odds of loan approval for married applicants decreases by 0.4609301.

The log odds of loan approval for non married applicants decreases by NA.

The log odds of loan approval for Black applicants decreases by 0.8114263.

The log odds of loan approval for Hispanic applicants decreases by 0.8973309.

For a black married person whose credit history meets guidline (GDLIN = 1), loan amount price is 100 (LOANPRC = 100) and other obligations as a percent of total income is none (OBRAT = 0), the log odds of loan approval is 95.42%

CIs using profiled log-likelihood

```
##                    2.5 %       97.5 %
## (Intercept)  0.23664368  2.465735226
## GDLIN1       3.30547346  4.157682544
## OBRAT       -0.05434377 -0.013920887
## BLACK1      -1.27292218 -0.332543498
## HISPAN1     -1.48462721 -0.264593691
## LOANPRC     -0.02697832 -0.006937324
## MARRIED1     0.10487116  0.815796783
```

CIs using standard errors

```
##                   2.5 %       97.5 %
## (Intercept)  0.23158635  2.453187301
## GDLIN1       3.29609767  4.146676358
## OBRAT       -0.05430447 -0.013891283
## BLACK1      -1.28092587 -0.341926697
## HISPAN1     -1.50565235 -0.289009441
## LOANPRC     -0.02672039 -0.006826433
## MARRIED1     0.10609951  0.815760700
```

Odds ratios only

```
## (Intercept)      GDLIN1       OBRAT      BLACK1     HISPAN1     LOANPRC
##   3.8281698  41.3216682   0.9664769   0.4442240   0.4076563   0.9833665
##    MARRIED1
##   1.5855480
```

Odds ratios and 95% CI

```
##                      OR      2.5 %     97.5 %
## (Intercept)  3.8281698  1.2669896 11.7721341
## GDLIN1      41.3216682 27.2614457 63.9232116
## OBRAT        0.9664769  0.9471065  0.9861756
## BLACK1       0.4442240  0.2800122  0.7170975
## HISPAN1      0.4076563  0.2265868  0.7675177
## LOANPRC      0.9833665  0.9733823  0.9930867
## MARRIED1     1.5855480  1.1105675  2.2609765
```

Logistic Regression Reduced Model 2

$\log(\text{p/1-p}) = b_0 + b_1 * GDLIN + b_2 * OBRAT + b_3 * BLACK + b_4 * HISPAN + b_5 * LOANPRC$

```
##
## Call:  glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC,
##     family = "binomial", data = data1)
##
## Coefficients:
## (Intercept)       GDLIN1        OBRAT       BLACK1      HISPAN1
##     1.66805      3.69461     -0.03512     -0.81768     -0.85828
##     LOANPRC
##    -0.01659
##
## Degrees of Freedom: 1968 Total (i.e. Null);  1963 Residual
## Null Deviance:       1475
## Residual Deviance: 965.9     AIC: 977.9
```

```
## Wald test for GDLIN
##  in glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC,
##     family = "binomial", data = data1)
## F =  295.2972  on  1  and  1963  df: p= < 0.00000000000000222
```

```
## Wald test for OBRAT
##  in glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC,
```

```
##     family = "binomial", data = data1)
## F =  11.55879  on  1  and  1963  df: p= 0.00068779

## Wald test for BLACK
##  in glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC,
##     family = "binomial", data = data1)
## F =  11.68361  on  1  and  1963  df: p= 0.0006434

## Wald test for HISPAN
##  in glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC,
##     family = "binomial", data = data1)
## F =  7.696649  on  1  and  1963  df: p= 0.0055847

## Wald test for LOANPRC
##  in glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC,
##     family = "binomial", data = data1)
## F =  10.76933  on  1  and  1963  df: p= 0.0010501
```

For every one unit change in `OBRAT`, the log odds of loan approval (versus non loan approval) decreases by 0.0351171.

For every one unit change in `LOANPRC`, the log odds of loan approval (versus non loan approval) decreases by 0.0165852.

The log odds of loan approval for applicants that meet credit guidelines increases by 3.6946116.

The log odds of loan approval for Black applicants decreases by 0.8176845.

The log odds of loan approval for Hispanic applicants decreases by 0.8582767.

For a black person whose credit history meets guidline (GDLIN = 1), loan amount price is 100 (LOANPRC = 100) and other obligations as a percent of total income is none (OBRAT = 0), the log odds of loan approval is 94.72%

CIs using profiled log-likelihood

```
##                   2.5 %       97.5 %
## (Intercept)  0.59360475  2.764561689
## GDLIN1       3.28231679  4.126731408
## OBRAT       -0.05537654 -0.014888611
## BLACK1      -1.27852143 -0.339452086
## HISPAN1     -1.44328269 -0.227316096
## LOANPRC     -0.02676923 -0.006824773
```

CIs using standard errors

```
##                   2.5 %       97.5 %
## (Intercept)  0.58607300  2.750024092
## GDLIN1       3.27321875  4.116004514
## OBRAT       -0.05536176 -0.014872430
## BLACK1      -1.28654690 -0.348822144
## HISPAN1     -1.46462838 -0.251925037
## LOANPRC     -0.02649064 -0.006679743
```

Odds ratios only

```
## (Intercept)      GDLIN1       OBRAT      BLACK1     HISPAN1     LOANPRC
##   5.3018115  40.2299456   0.9654924   0.4414526   0.4238919   0.9835516
```

Odds ratios and 95% CI

```
##                     OR      2.5 %     97.5 %
## (Intercept)  5.3018115  1.8105031 15.8720816
## GDLIN1      40.2299456 26.6374146 61.9750205
## OBRAT        0.9654924  0.9461288  0.9852217
## BLACK1       0.4414526  0.2784487  0.7121604
## HISPAN1      0.4238919  0.2361513  0.7966689
## LOANPRC      0.9835516  0.9735859  0.9931985
```

Model comparison

```
## Analysis of Deviance Table
##
## Model 1: APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC + MARRIED +
##     MALE
## Model 2: APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC + MARRIED
## Model 3: APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC
##   Resid. Df Resid. Dev Df Deviance Pr(>Chi)
## 1      1961     959.40
## 2      1962     959.46 -1  -0.0531  0.81770
## 3      1963     965.87 -1  -6.4163  0.01131 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
## Likelihood ratio test
##
## Model 1: APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC + MARRIED +
##     MALE
## Model 2: APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC + MARRIED
## Model 3: APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC
##   #Df  LogLik Df  Chisq Pr(>Chisq)
## 1   8 -479.70
## 2   7 -479.73 -1 0.0531    0.81770
## 3   6 -482.94 -1 6.4163    0.01131 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Probit Regression Full Model

```
##
## Call:
## glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED + MALE, family = binomial(link = "probit"), data = data1)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.9694   0.2361   0.3119   0.3762   2.2711
##
## Coefficients:
##              Estimate Std. Error z value             Pr(>|z|)
## (Intercept)  0.566210   0.309521   1.829             0.067353 .
## GDLIN1       2.142459   0.121264  17.668 < 0.0000000000000002 ***
## OBRAT       -0.016400   0.005344  -3.069             0.002148 **
## BLACK1      -0.425865   0.126958  -3.354             0.000795 ***
```

```
## HISPAN1     -0.463475   0.163507  -2.835             0.004588 **
## LOANPRC     -0.008409   0.002590  -3.247             0.001166 **
## MARRIED1     0.237894   0.096134   2.475             0.013338 *
## MALE1       -0.033267   0.117944  -0.282             0.777896
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 1475.43  on 1968  degrees of freedom
## Residual deviance:  958.84  on 1961  degrees of freedom
## AIC: 974.84
##
## Number of Fisher Scoring iterations: 6
```

For every one unit change in `OBRAT`, the log odds of loan approval (versus non loan approval) decreases by 0.0163999.

For every one unit change in `LOANPRC`, the log odds of loan approval (versus non loan approval) decreases by 0.0084095.

The log odds of loan approval for applicants that meet credit guidelines increases by 2.1424592.

The log odds of loan approval for married applicants increases by 0.2378937.

The log odds of loan approval for Black applicants decreases by 0.4258647.

The log odds of loan approval for Hispanic applicants decreases by 0.4634752.

For a black married male whose credit history meets guidline (GDLIN = 1), loan amount price is 100 (LOANPRC = 100) and other obligations as a percent of total income is none (OBRAT = 0), the log odds of loan approval is 95.02%

Statistical Tests for Individual Predictors

```
## Wald test for GDLIN
##  in glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED + MALE, family = binomial(link = "probit"), data = data1)
## F =  312.1492  on  1  and  1961  df: p= < 0.000000000000000222

## Wald test for OBRAT
##  in glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED + MALE, family = binomial(link = "probit"), data = data1)
## F =  9.41885  on  1  and  1961  df: p= 0.0021771

## Wald test for BLACK
##  in glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED + MALE, family = binomial(link = "probit"), data = data1)
## F =  11.25188  on  1  and  1961  df: p= 0.00081057

## Wald test for HISPAN
##  in glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED + MALE, family = binomial(link = "probit"), data = data1)
## F =  8.034928  on  1  and  1961  df: p= 0.0046354

## Wald test for MALE
##  in glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED + MALE, family = binomial(link = "probit"), data = data1)
## F =  0.0795587  on  1  and  1961  df: p= 0.77793
```

```
## Wald test for LOANPRC
##  in glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED + MALE, family = binomial(link = "probit"), data = data1)
## F =  10.54337  on  1  and  1961  df: p= 0.0011857

## Wald test for MARRIED
##  in glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED + MALE, family = binomial(link = "probit"), data = data1)
## F =  6.123722  on  1  and  1961  df: p= 0.013422
```

Probit Regression Reduced Model 1

```
##
## Call:
## glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED, family = binomial(link = "probit"), data = data1)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.9709   0.2362   0.3118   0.3775   2.2602
##
## Coefficients:
##              Estimate Std. Error z value             Pr(>|z|)
## (Intercept)  0.541687   0.297610   1.820             0.068740 .
## GDLIN1       2.143873   0.121184  17.691 < 0.0000000000000002 ***
## OBRAT       -0.016411   0.005344  -3.071             0.002136 **
## BLACK1      -0.422677   0.126641  -3.338             0.000845 ***
## HISPAN1     -0.461722   0.163423  -2.825             0.004723 **
## LOANPRC     -0.008386   0.002588  -3.240             0.001196 **
## MARRIED1     0.228926   0.090475   2.530             0.011397 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 1475.43  on 1968  degrees of freedom
## Residual deviance:  958.92  on 1962  degrees of freedom
## AIC: 972.92
##
## Number of Fisher Scoring iterations: 6

##            Overall
## GDLIN1   17.691026
## OBRAT     3.070619
## BLACK1    3.337594
## HISPAN1   2.825314
## LOANPRC   3.239942
## MARRIED1  2.530275

##          llh      llhNull           G2     McFadden         r2ML
## -479.4603569 -737.7148785  516.5090432    0.3500736    0.2307356
##         r2CU
##    0.4375655
```

For every one unit change in OBRAT, the log odds of loan approval (versus non loan approval) decreases by 0.0164109.

For every one unit change in `LOANPRC`, the log odds of loan approval (versus non loan approval) decreases by 0.0083864.

The log odds of loan approval for applicants that meet credit guidelines increases by 2.1438732.

The log odds of loan approval for married applicants increases by 0.2289263.

The log odds of loan approval for Black applicants decreases by 0.4226766.

The log odds of loan approval for Hispanic applicants decreases by 0.4617224.

For a black married person whose credit history meets guidline (GDLIN = 1), loan amount price is 100 (LOANPRC = 100) and other obligations as a percent of total income is none (OBRAT = 0), the log odds of loan approval is 95.09%

Probit Regression Reduced Model 2

```
##
## Call:
## glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC,
##     family = binomial(link = "probit"), data = data1)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.8976   0.2466   0.3190   0.3719   2.2140
##
## Coefficients:
##              Estimate Std. Error z value             Pr(>|z|)
## (Intercept)  0.708006   0.290189   2.440             0.014695 *
## GDLIN1       2.135031   0.120676  17.692 < 0.0000000000000002 ***
## OBRAT       -0.017003   0.005340  -3.184             0.001453 **
## BLACK1      -0.426583   0.126242  -3.379             0.000727 ***
## HISPAN1     -0.438093   0.163021  -2.687             0.007202 **
## LOANPRC     -0.008356   0.002573  -3.248             0.001163 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 1475.43  on 1968  degrees of freedom
## Residual deviance:  965.27  on 1963  degrees of freedom
## AIC: 977.27
##
## Number of Fisher Scoring iterations: 5
```

```
##           Overall
## GDLIN1  17.692269
## OBRAT    3.183979
## BLACK1   3.379077
## HISPAN1  2.687345
## LOANPRC  3.247739
```

```
##          llh      llhNull           G2     McFadden         r2ML
## -482.6350057 -737.7148785  510.1597458    0.3457703    0.2282510
##         r2CU
##    0.4328537
```

For every one unit change in `OBRAT`, the log odds of loan approval (versus non loan approval) decreases by 0.017003.

For every one unit change in `LOANPRC`, the log odds of loan approval (versus non loan approval) decreases by 0.0083562.

The log odds of loan approval for applicants that meet credit guidelines increases by 2.1350313.

The log odds of loan approval for Black applicants decreases by 0.4265831.

The log odds of loan approval for Hispanic applicants decreases by 0.4380932.

For a black person whose credit history meets guidline (GDLIN = 1), loan amount price is 100 (LOANPRC = 100) and other obligations as a percent of total income is none (OBRAT = 0), the log odds of loan approval is 94.3%

Model comparison

```
## Analysis of Deviance Table
##
## Model 1: APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC + MARRIED +
##     MALE
## Model 2: APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC + MARRIED
## Model 3: APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC
##   Resid. Df Resid. Dev Df Deviance Pr(>Chi)
## 1      1961     958.84
## 2      1962     958.92 -1  -0.0799  0.77742
## 3      1963     965.27 -1  -6.3493  0.01174 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
## Likelihood ratio test
##
## Model 1: APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC + MARRIED +
##     MALE
## Model 2: APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC + MARRIED
## Model 3: APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC
##   #Df  LogLik Df  Chisq Pr(>Chisq)
## 1   8 -479.42
## 2   7 -479.46 -1 0.0799    0.77742
## 3   6 -482.64 -1 6.3493    0.01174 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

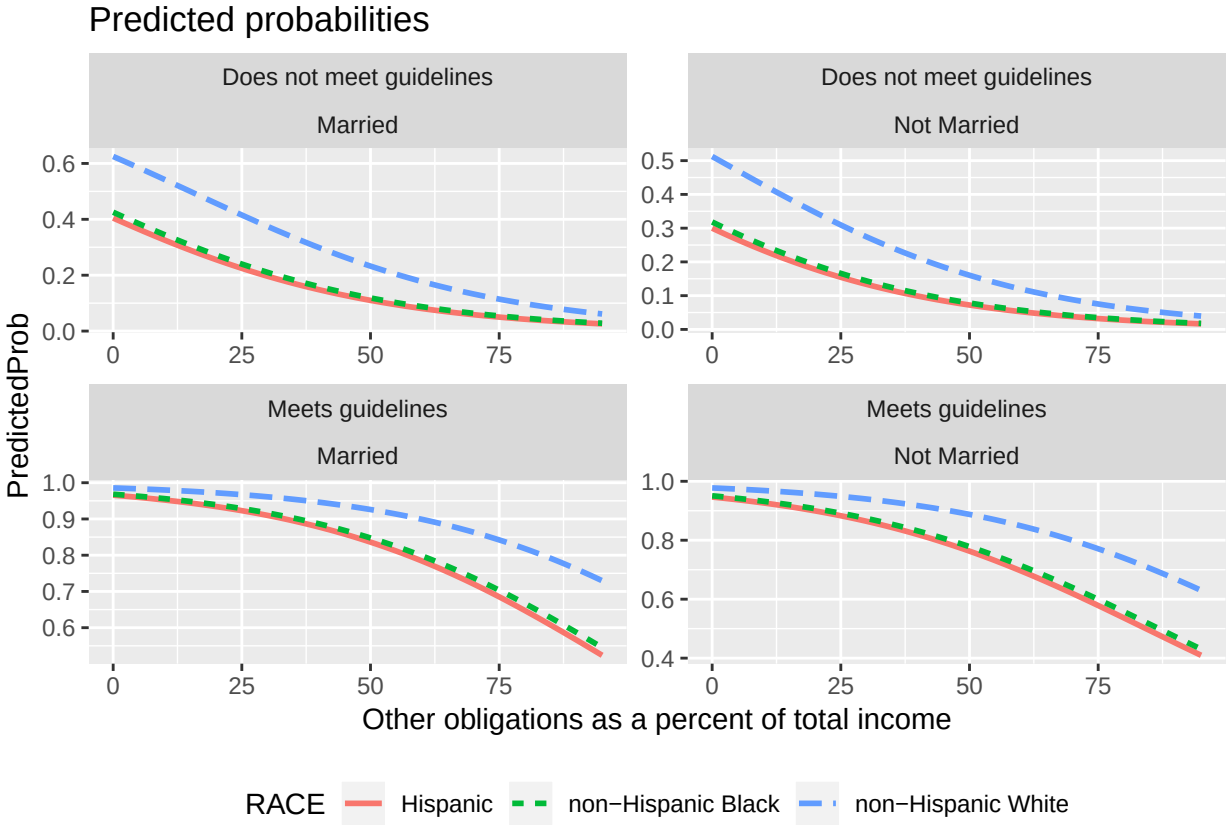
Logit Prediction

Logit Model 1

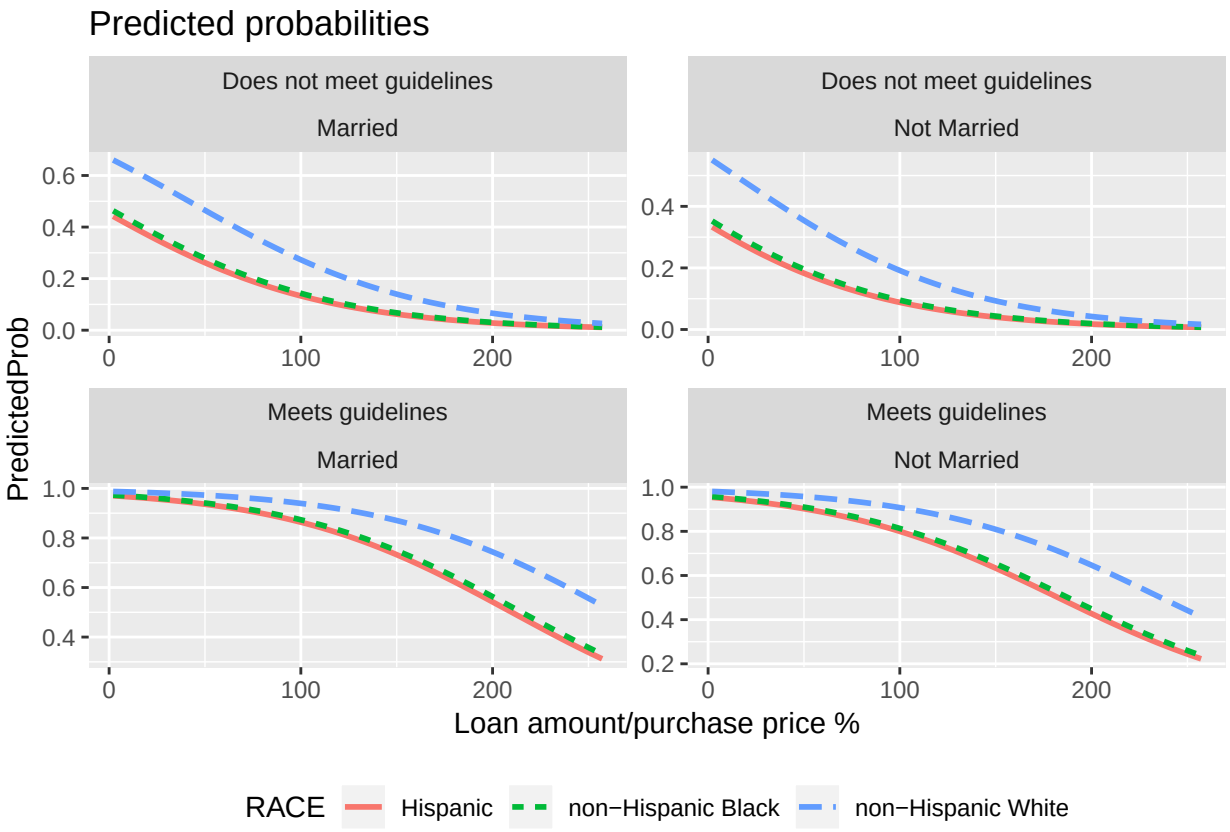
```
##
## Call:  glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED, family = "binomial", data = data1)
##
## Coefficients:
## (Intercept)       GDLIN1        OBRAT       BLACK1      HISPAN1
##     1.34239      3.72139     -0.03410     -0.81143     -0.89733
##     LOANPRC     MARRIED1
##    -0.01677      0.46093
```

```
##
## Degrees of Freedom: 1968 Total (i.e. Null);  1962 Residual
## Null Deviance:       1475
## Residual Deviance: 959.5     AIC: 973.5
```

GDLIN	OBRAT	BLACK	HISPAN	MARRIED	LOANPRC	fit	PredictedProb
0	0	1	0	0	77.06418	-0.7616686	0.3182841
0	1	1	0	0	77.06418	-0.7957664	0.3109318
0	2	1	0	0	77.06418	-0.8298643	0.3036738
0	3	1	0	0	77.06418	-0.8639622	0.2965122
0	4	1	0	0	77.06418	-0.8980601	0.2894493
0	5	1	0	0	77.06418	-0.9321579	0.2824871



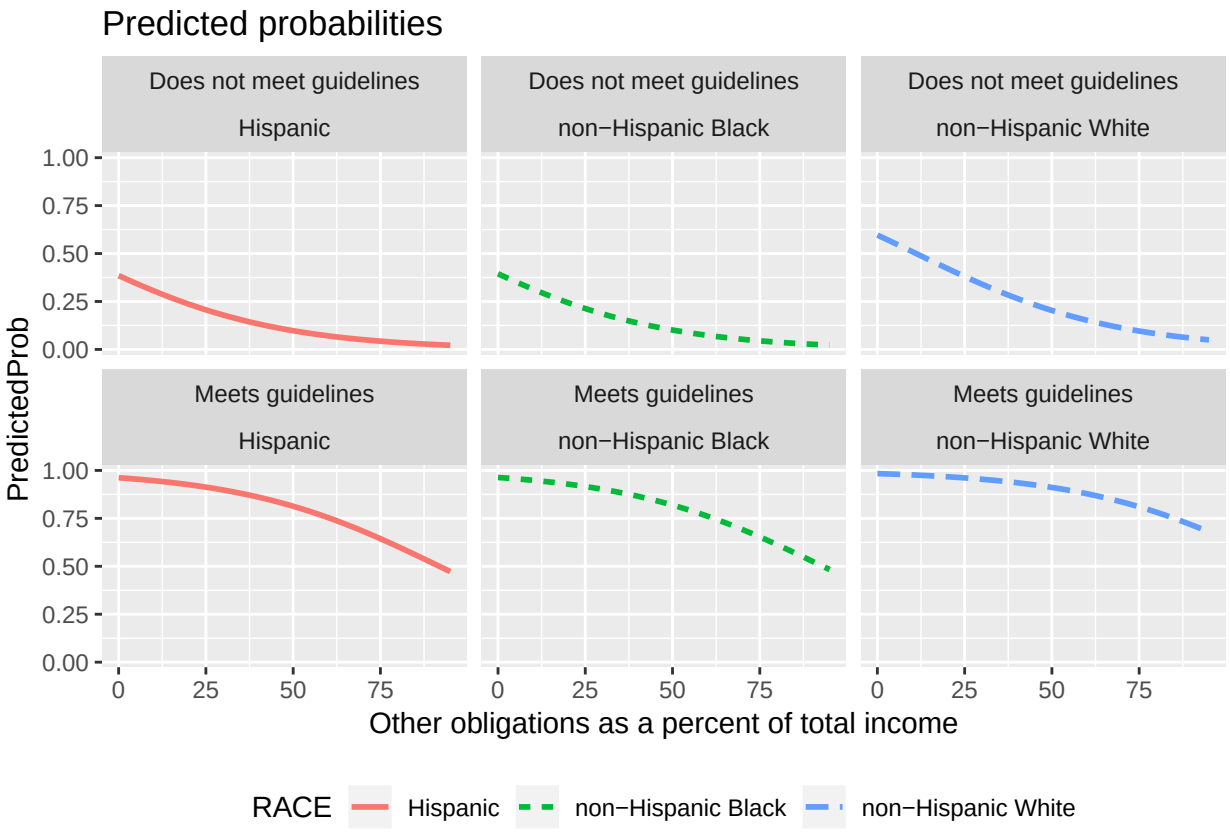
GDLIN	OBRAT	BLACK	HISPAN	MARRIED	LOANPRC	fit	PredictedProb
0	32.38382	1	0	0	2.105000	-0.6085669	0.3523862
0	32.38382	1	0	0	4.681141	-0.6517776	0.3425891
0	32.38382	1	0	0	7.257283	-0.6949883	0.3329243
0	32.38382	1	0	0	9.833424	-0.7381990	0.3233981
0	32.38382	1	0	0	12.409566	-0.7814096	0.3140162
0	32.38382	1	0	0	14.985707	-0.8246203	0.3047838

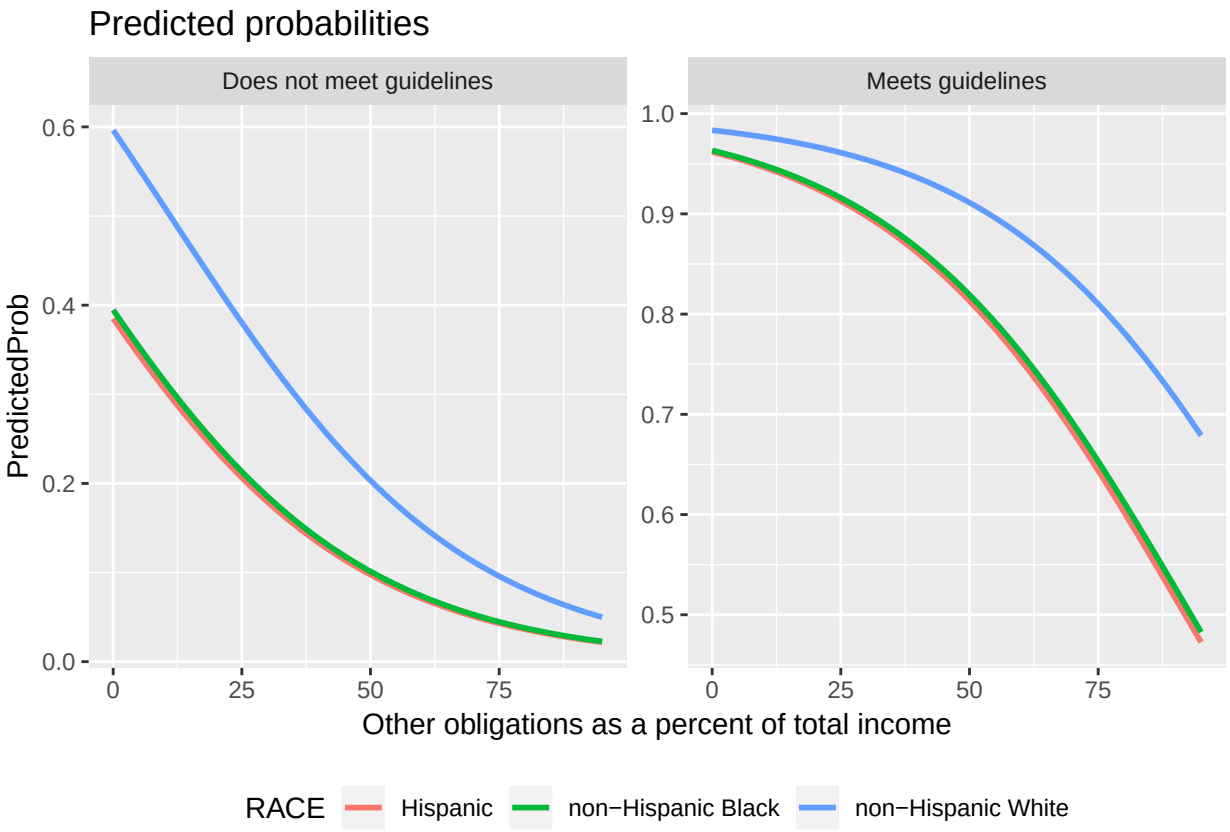


Logit Model 2

```
##
## Call:  glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC,
##     family = "binomial", data = data1)
##
## Coefficients:
## (Intercept)       GDLIN1        OBRAT       BLACK1      HISPAN1
##     1.66805      3.69461     -0.03512     -0.81768     -0.85828
##     LOANPRC
##    -0.01659
##
## Degrees of Freedom: 1968 Total (i.e. Null);  1963 Residual
## Null Deviance:       1475
## Residual Deviance: 965.9     AIC: 977.9
```

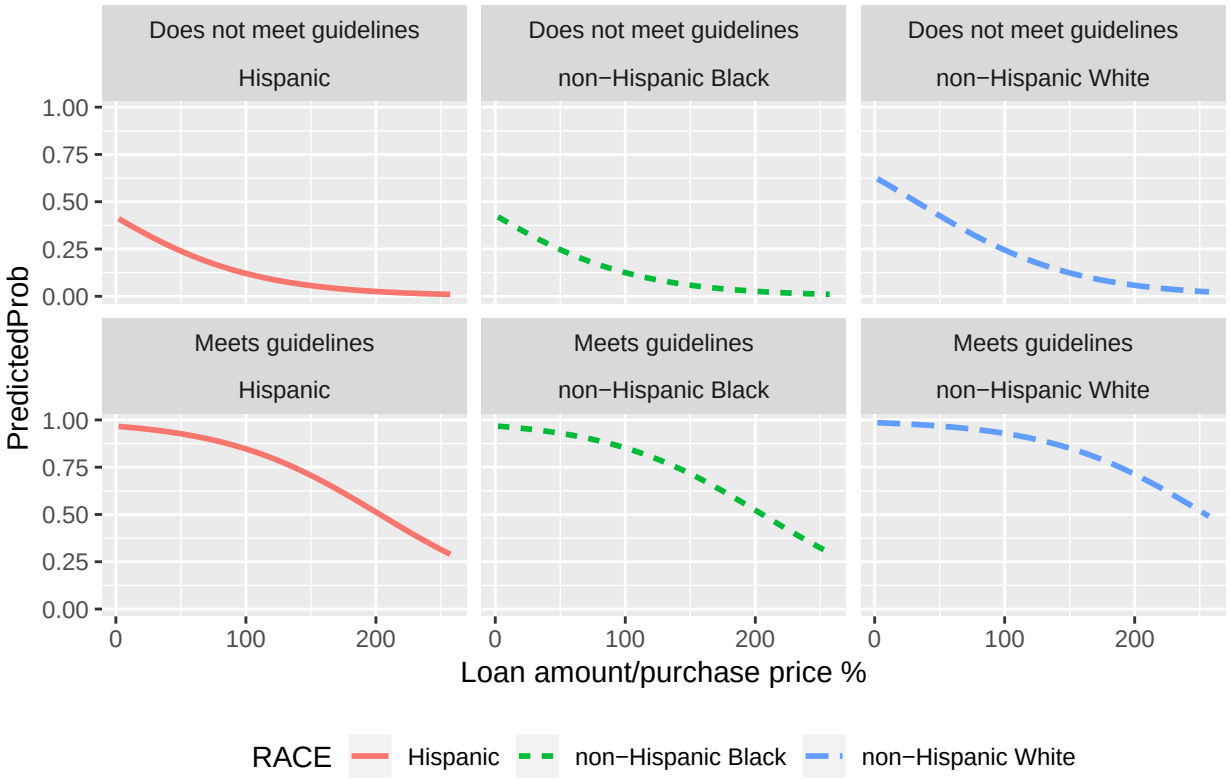
GDLIN	OBRAT	BLACK	HISPAN	LOANPRC	fit	PredictedProb
0	0	1	0	77.06418	-0.4277603	0.3946613
0	1	1	0	77.06418	-0.4628774	0.3863034
0	2	1	0	77.06418	-0.4979945	0.3780121
0	3	1	0	77.06418	-0.5331116	0.3697914
0	4	1	0	77.06418	-0.5682287	0.3616456
0	5	1	0	77.06418	-0.6033458	0.3535786

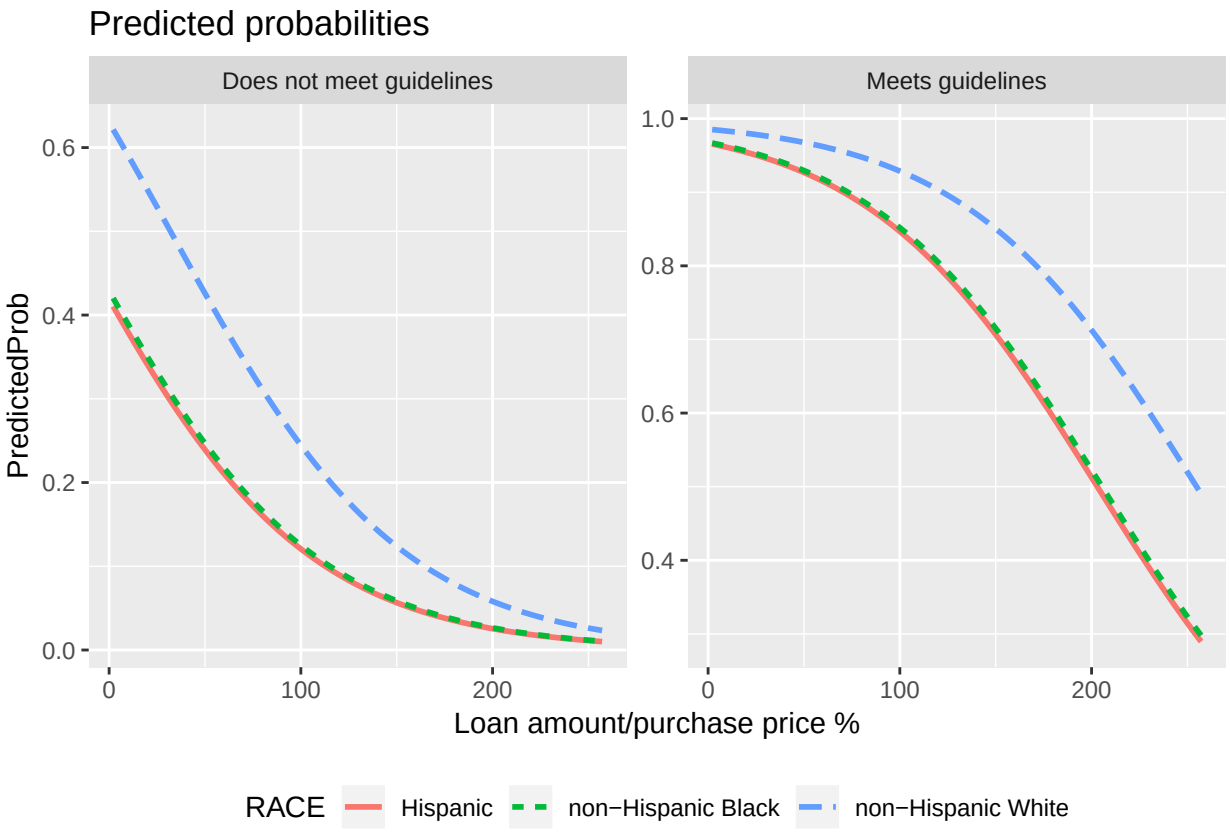

Predicted probabilities
Does not meet guidelines
Hispanic
Does not meet guidelines
non−Hispanic Black
Does not meet guidelines
non−Hispanic White
Meets guidelines
Hispanic
Meets guidelines
non−Hispanic Black
Meets guidelines
non−Hispanic White
PredictedProb
1.00
0.75
0.50
0.25
0.00
0
25
50
75
Other obligations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


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

GDLIN	OBRAT	BLACK	HISPAN	LOANPRC	fit	PredictedProb
0	32.38382	1	0	2.105000	-0.3217734	0.4202436
0	32.38382	1	0	4.681141	-0.3644992	0.4098709
0	32.38382	1	0	7.257283	-0.4072250	0.3995777
0	32.38382	1	0	9.833424	-0.4499508	0.3893725
0	32.38382	1	0	12.409566	-0.4926766	0.3792632
0	32.38382	1	0	14.985707	-0.5354024	0.3692578

Predicted probabilities



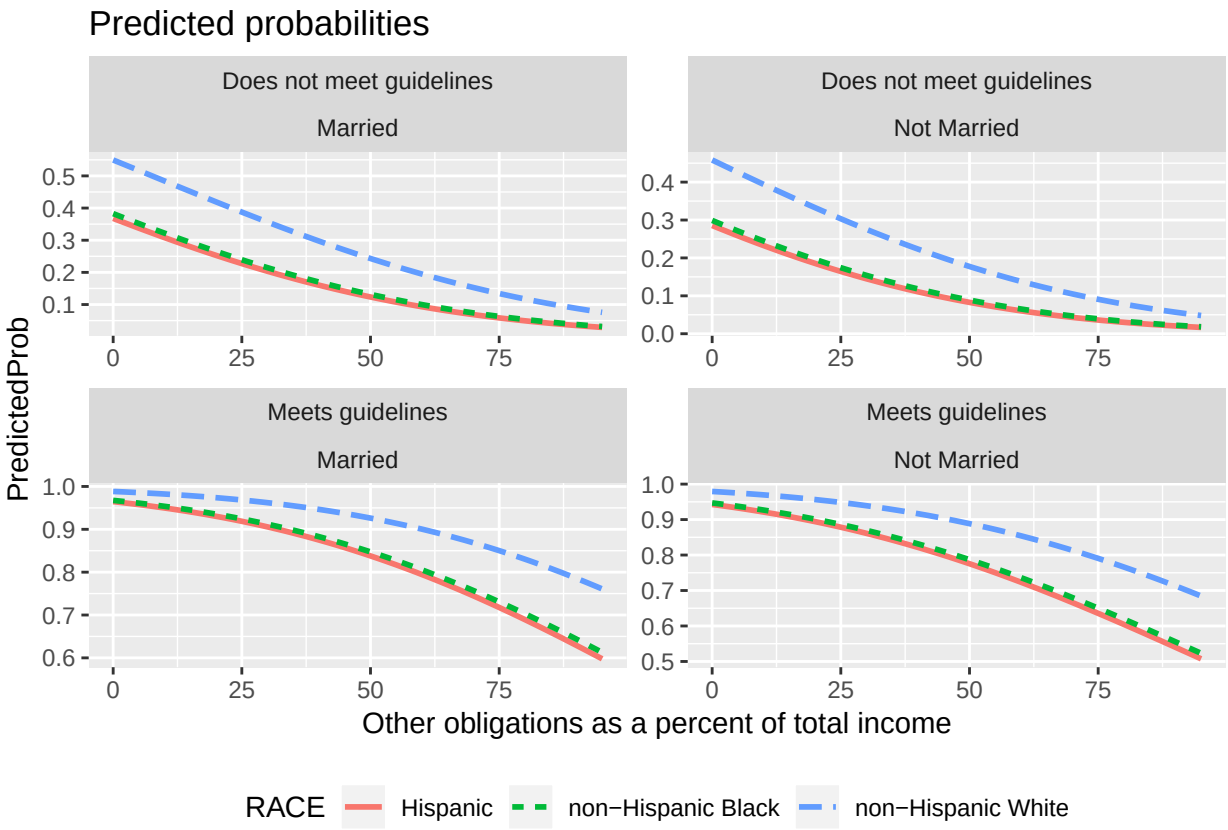


Probit Prediction

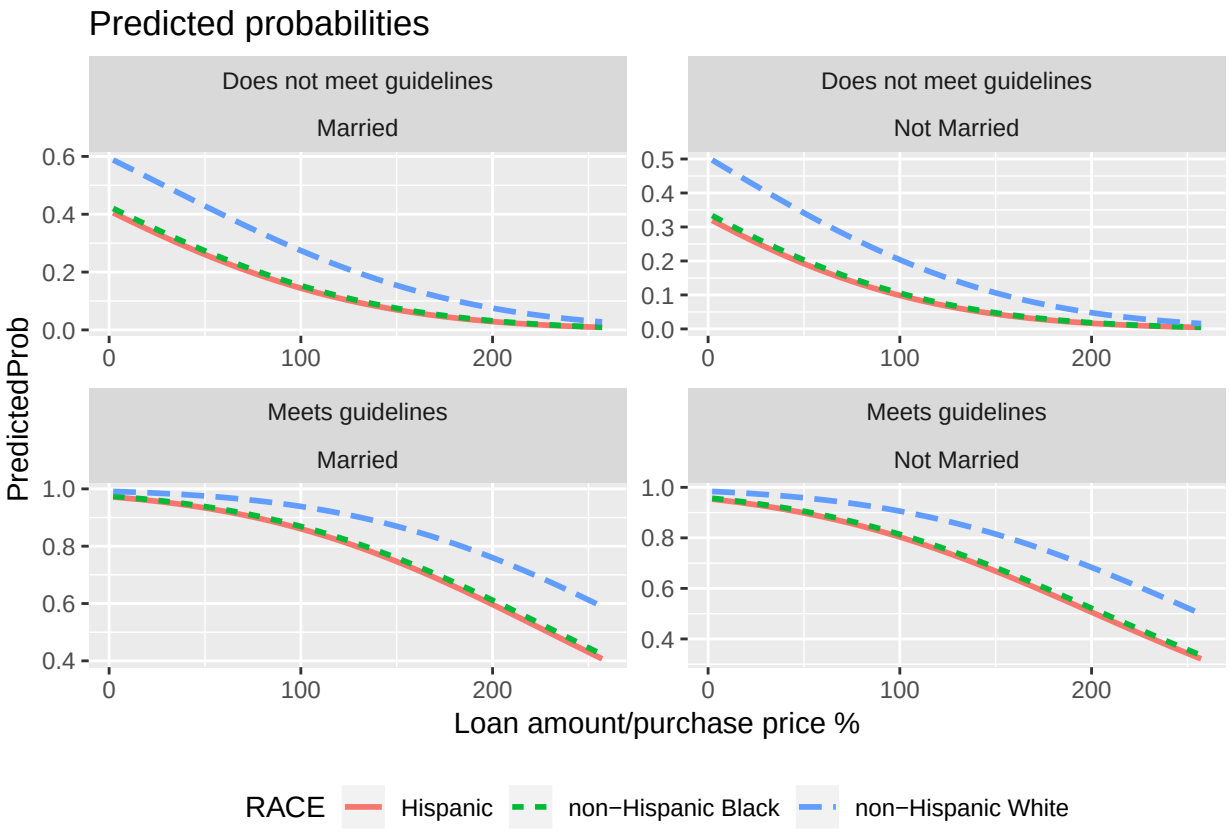
Probit Model 1

```
##
## Call:  glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC +
##     MARRIED, family = binomial(link = "probit"), data = data1)
##
## Coefficients:
## (Intercept)       GDLIN1        OBRAT       BLACK1      HISPAN1
##    0.541687     2.143873    -0.016411    -0.422677    -0.461722
##     LOANPRC     MARRIED1
##   -0.008386     0.228926
##
## Degrees of Freedom: 1968 Total (i.e. Null);  1962 Residual
## Null Deviance:       1475
## Residual Deviance: 958.9     AIC: 972.9
```

GDLIN	OBRAT	BLACK	HISPAN	MARRIED	LOANPRC	fit	se.fit
0	0	1	0	0	77.06418	0.2989992	0.0861630
0	1	1	0	0	77.06418	0.2933267	0.0839904
0	2	1	0	0	77.06418	0.2877046	0.0818437
0	3	1	0	0	77.06418	0.2821340	0.0797245
0	4	1	0	0	77.06418	0.2766158	0.0776346
0	5	1	0	0	77.06418	0.2711510	0.0755755



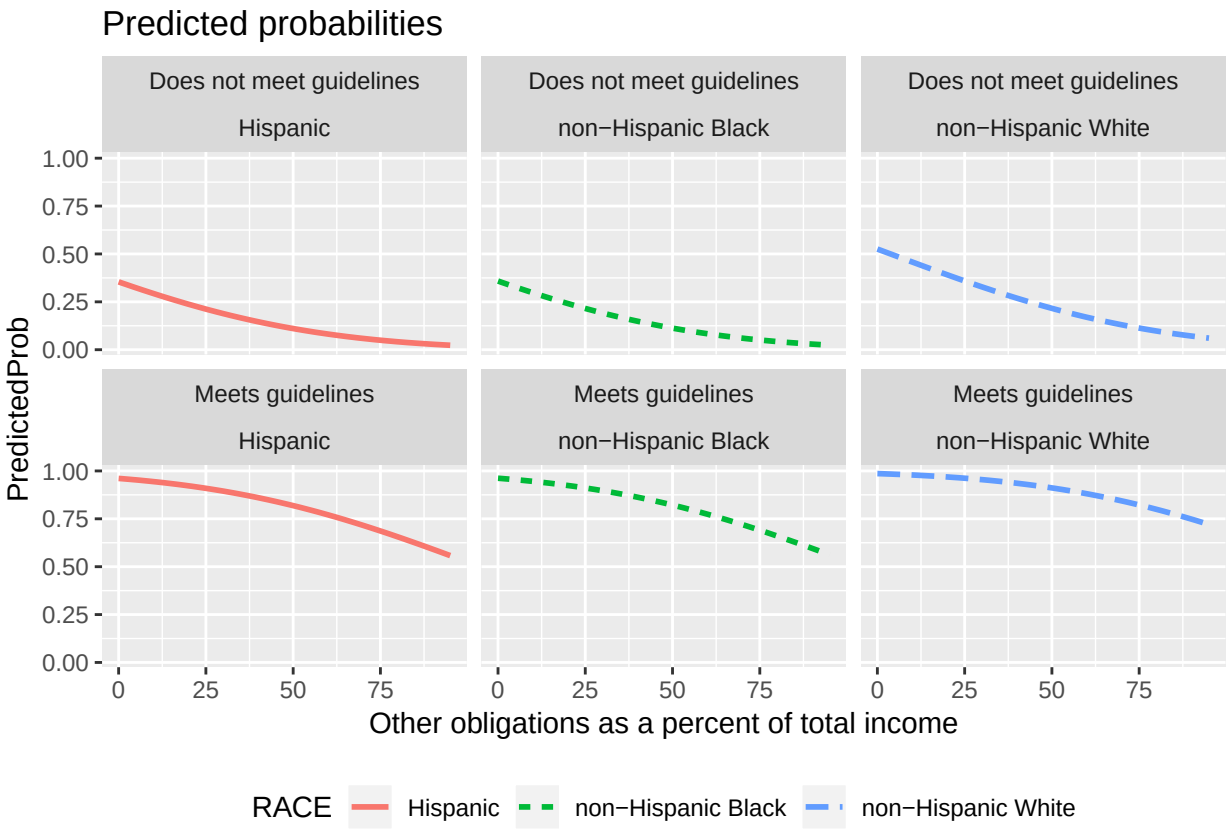
GDLIN	OBRAT	BLACK	HISPAN	MARRIED	LOANPRC
0	32.38382	1	0	0	2.105000
0	32.38382	1	0	0	4.681141
0	32.38382	1	0	0	7.257283
0	32.38382	1	0	0	9.833424
0	32.38382	1	0	0	12.409566
0	32.38382	1	0	0	14.985707

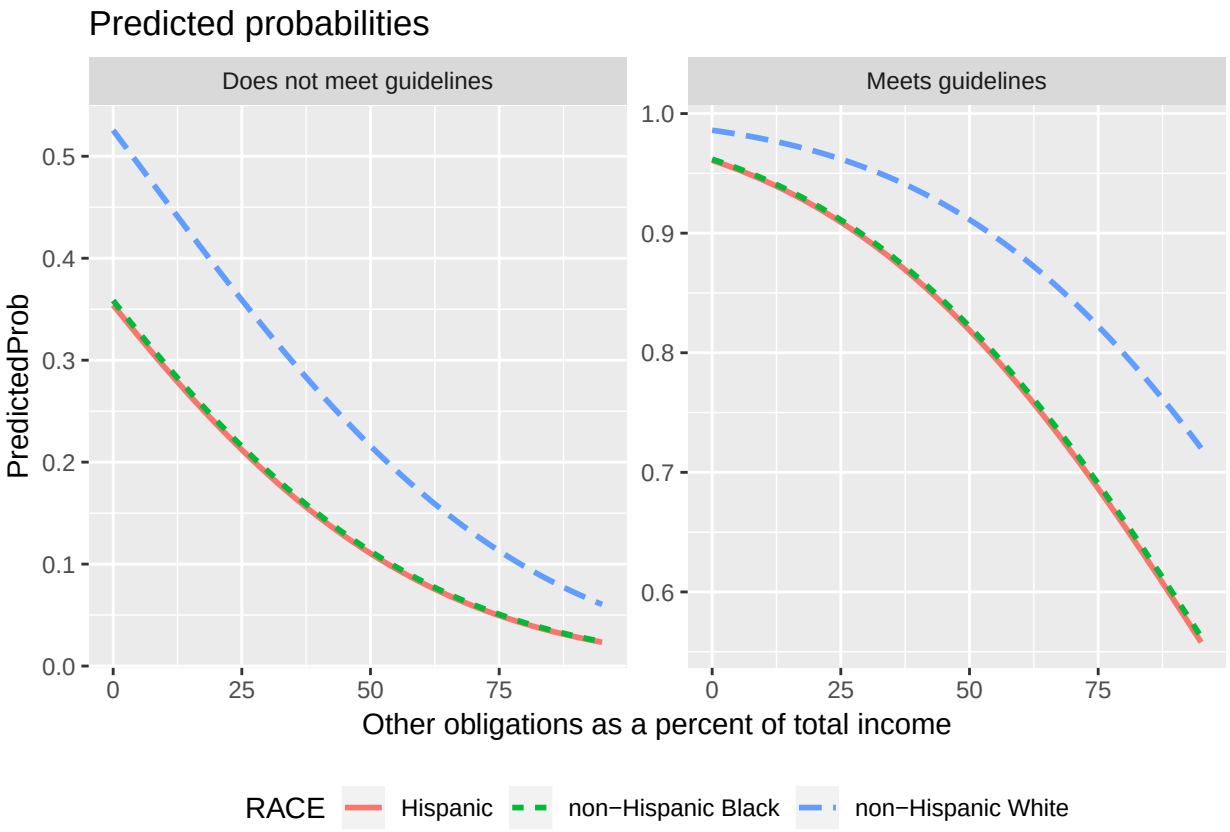


Probit Model 2

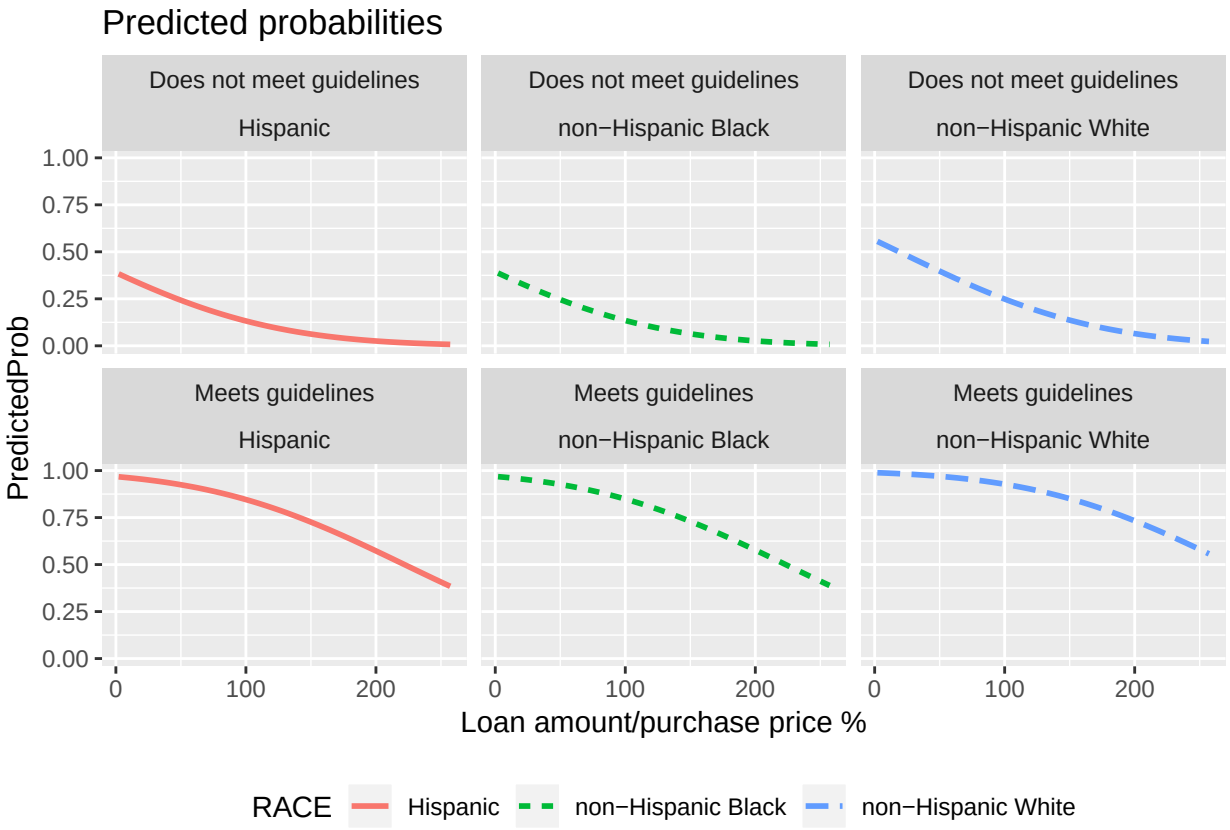
```
##
## Call:  glm(formula = APPROVE ~ GDLIN + OBRAT + BLACK + HISPAN + LOANPRC,
##     family = binomial(link = "probit"), data = data1)
##
## Coefficients:
## (Intercept)       GDLIN1        OBRAT       BLACK1      HISPAN1
##    0.708006     2.135031    -0.017003    -0.426583    -0.438093
##     LOANPRC
##   -0.008356
##
## Degrees of Freedom: 1968 Total (i.e. Null);  1963 Residual
## Null Deviance:       1475
## Residual Deviance: 965.3     AIC: 977.3
```

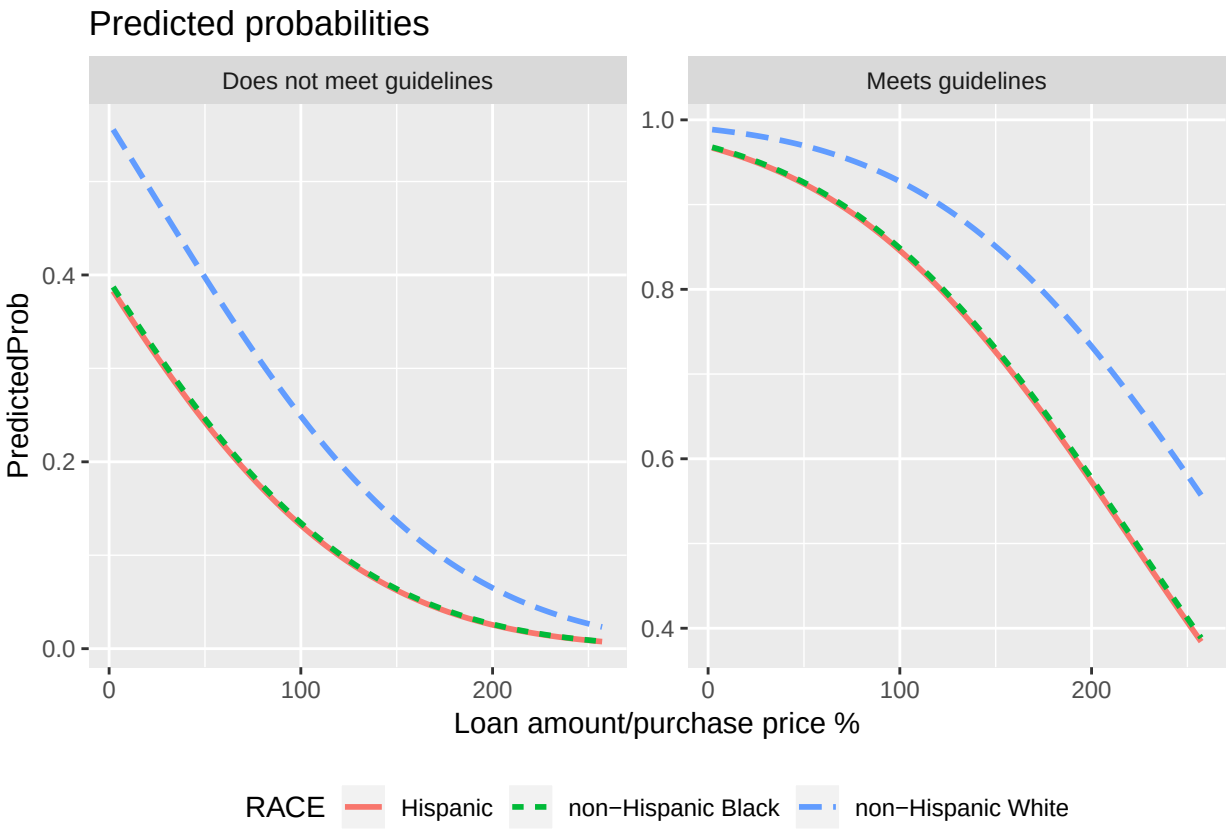
GDLIN	OBRAT	BLACK	HISPAN	LOANPRC	fit
0	0	1	0	77.06418	0.3584733
0	1	1	0	77.06418	0.3521414
0	2	1	0	77.06418	0.3458502
0	3	1	0	77.06418	0.3396013
0	4	1	0	77.06418	0.3333962
0	5	1	0	77.06418	0.3272363


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
1.00
0.75
0.50
0.25
0.00
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
0.5
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

GDLIN	OBRAT	BLACK	HISPAN	LOANPRC	fit
0	32.38382	1	0	2.105000	0.3871373
0	32.38382	1	0	4.681141	0.3789214
0	32.38382	1	0	7.257283	0.3707598
0	32.38382	1	0	9.833424	0.3626560
0	32.38382	1	0	12.409566	0.3546132
0	32.38382	1	0	14.985707	0.3466347




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
Loan amount/purchase price %
RACE
Hispanic
non−Hispanic Black
non−Hispanic White