Group_9_Analysis

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3/7/2022

```
Rows: 1,145
Columns: 8
$ country_of_origin    <chr> "Myanmar", "Uganda", "Ethiopia", "Mexico", "Burun~
$ aroma                <dbl> 7.25, 8.33, 8.42, 7.17, 7.75, 7.92, 7.92, 7.83, 7~
$ flavor               <dbl> 7.42, 7.92, 8.00, 7.08, 7.67, 7.75, 7.83, 7.67, 6~
$ acidity              <dbl> 7.50, 7.92, 8.00, 7.25, 7.50, 7.75, 7.67, 7.58, 7~
$ category_two_defects <dbl> 4, 1, 7, 3, 5, 0, 1, 2, 2, 1, 0, 8, 0, 2, 0, 0, 2~
$ altitude_mean_meters <dbl> 1219.20, 1600.00, 1700.00, 1300.00, 1880.00, 1400~
$ harvested            <dbl> 2015, 2013, 2014, 2012, 2012, 2014, NA, 2015, 201~
$ Qualityclass         <chr> "Poor", "Good", "Good", "Poor", "Good", "Good", "~
```

```
[1] 0.5135371
```

Table 1: Summary statistics of continuous variables.

Variable	Mean	SD	Min.	1st Q.	Median	3rd Q.	Max.
aroma	7.57	0.39	0	7.42	7.58	7.75	8.75
flavor	7.52	0.40	0	7.33	7.58	7.75	8.67
acidity	7.54	0.39	0	7.33	7.50	7.75	8.58
category_two_defects	3.67	5.41	0	0.00	2.00	5.00	55.00
altitude_mean_meters	1850.69	9392.09	1	1100.00	1310.64	1600.00	190164.00
harvested	2013.67	1.81	2010	2012.00	2014.00	2015.00	2018.00

Table 2: Number of batch and proportion of good quality by country of origin

country_of_origin	number_of_batch	Proportion_of_good_quality
Brazil	116	0.47
Burundi	2	0.50
China	14	0.64
Colombia	158	0.80
Costa Rica	41	0.56
Cote d?Ivoire	1	0.00
Ecuador	3	0.33
El Salvador	20	0.70
Ethiopia	38	0.92
Guatemala	152	0.50
Haiti	5	0.20
Hawaii	62	0.55
Honduras	48	0.25
India	10	0.50
Indonesia	16	0.56
Japan	1	1.00
Kenya	24	0.92
Laos	2	0.00
Malawi	11	0.09
Mauritius	1	0.00
Mexico	203	0.27
Myanmar	6	0.00
Nicaragua	23	0.22
Panama	4	0.75
Peru	9	0.56
Philippines	5	0.40
Puerto Rico	3	0.33
Taiwan	62	0.42
Tanzania	32	0.50
Thailand	23	0.70
Uganda	32	0.78
United States	9	0.67
Vietnam	8	0.50
Zambia	1	0.00

Table 3: Summary statistics of continuous variables by quality of coffee

Variable	Qualityclass	n	Mean	SD	Min	Median	Max	IQR
aroma	Good	588	7.76	0.23	7.08	7.75	8.75	0.08
aroma	Poor	557	7.37	0.41	0.00	7.42	8.25	0.16
flavor	Good	588	7.74	0.23	7.00	7.67	8.67	0.16
flavor	Poor	557	7.29	0.42	0.00	7.33	8.08	0.17
acidity	Good	588	7.72	0.25	6.75	7.67	8.58	0.16
acidity	Poor	557	7.34	0.40	0.00	7.33	8.33	0.17
category_two_defects	Good	588	2.87	3.82	0.00	2.00	40.00	2.00
category_two_defects	Poor	557	4.52	6.60	0.00	2.00	55.00	4.00

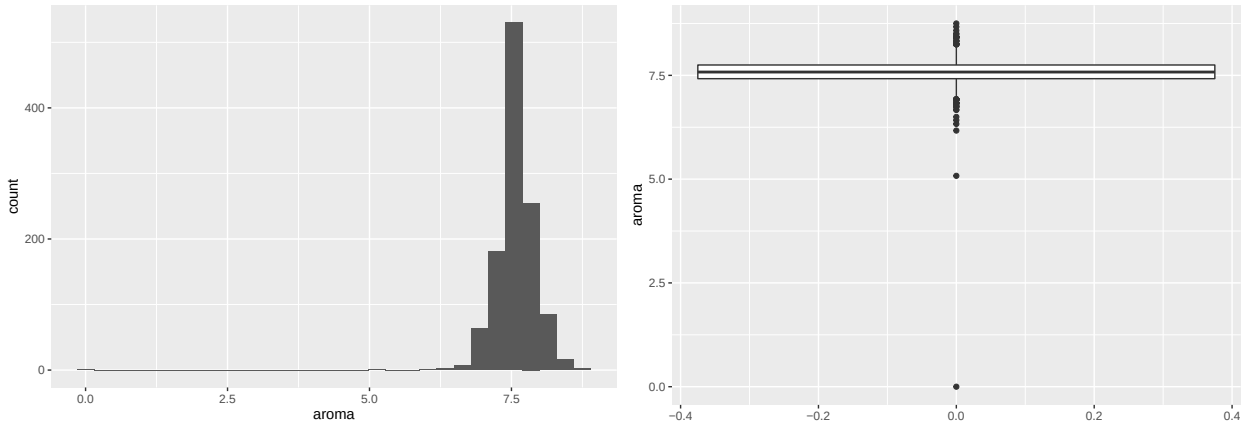


Figure 1: Histogram and boxplot for aroma.

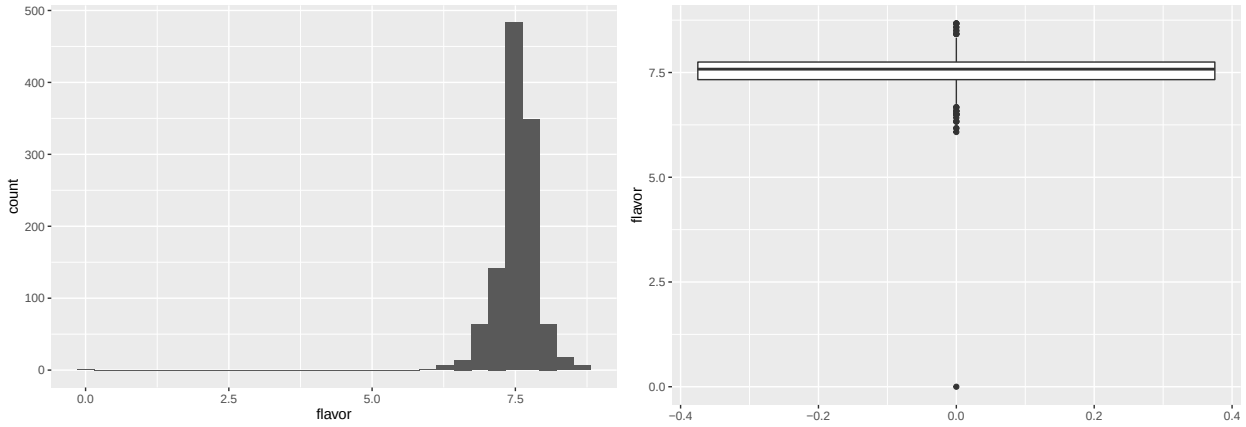


Figure 2: Histogram and boxplot for flavor.

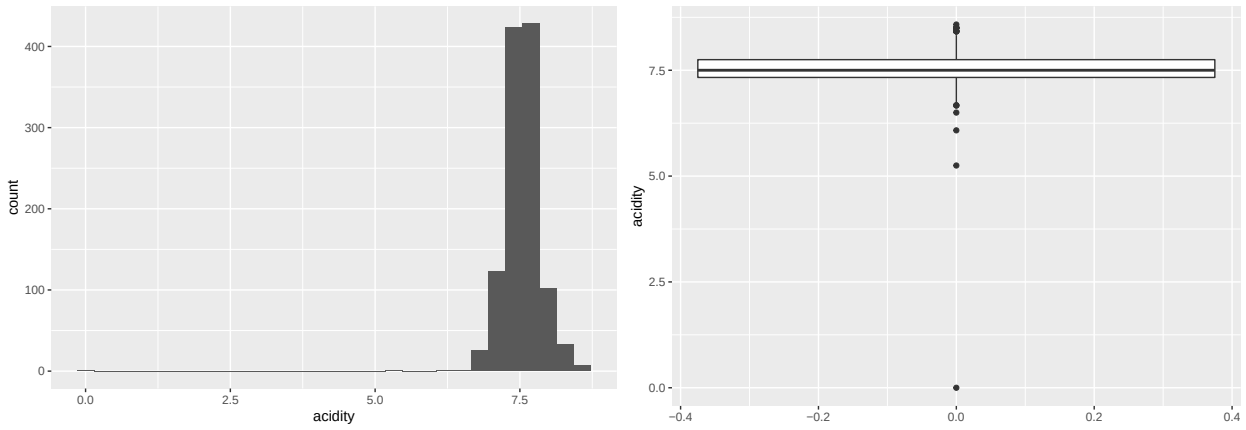


Figure 3: Histogram and boxplot for acidity.

```
# A tibble: 1 x 8
  country_of_origin aroma flavor acidity category_two_defects altitude_mean_met~
```

```
  <chr>             <dbl>  <dbl>   <dbl>                <dbl>             <dbl>
1 Honduras              0      0       0                    2              1400
# ... with 2 more variables: harvested <dbl>, Qualityclass <chr>
```

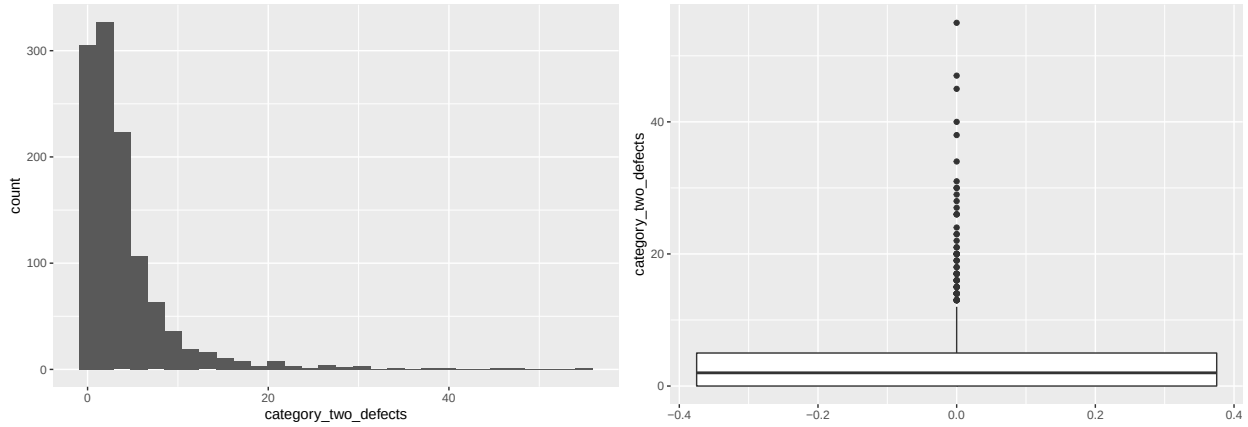


Figure 4: Histogram and boxplot for category two defects.

Due to the right-skewed distribution of category_two_defects, log-transformation is applied.

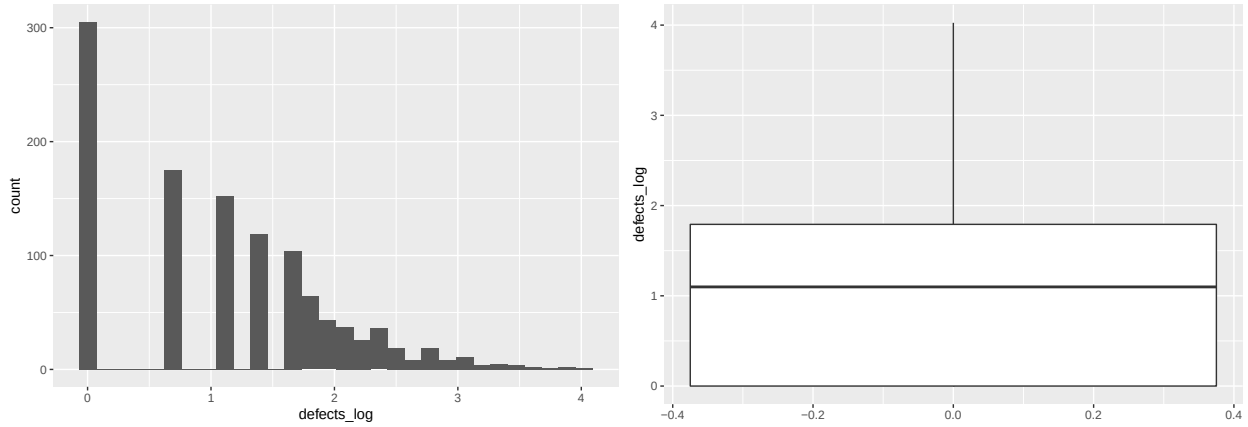


Figure 5: Histogram and boxplot for category two defects after log transformation.

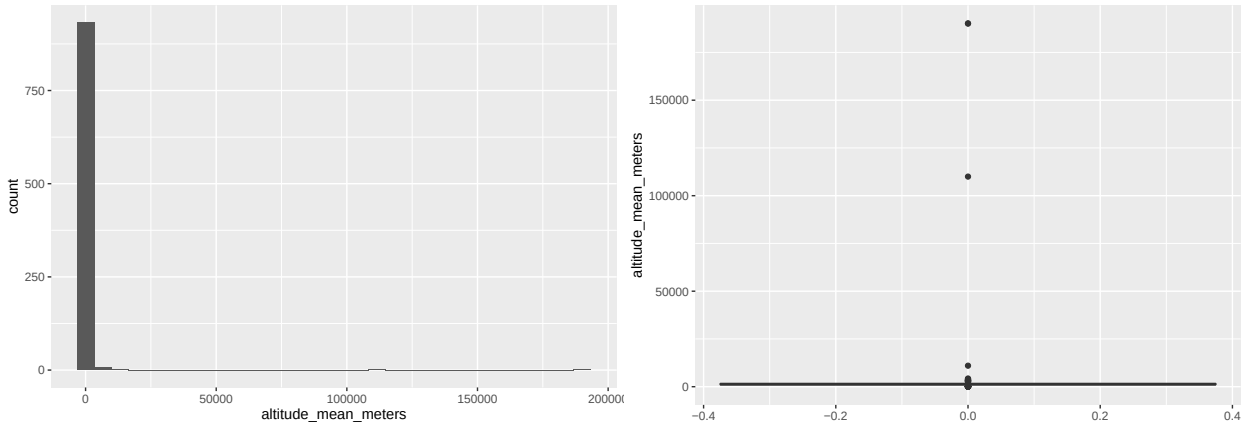


Figure 6: Histogram and boxplot for altitude.

Mt. Everest is only 8,849 meters tall. Remove any observations with altitudes higher than that.

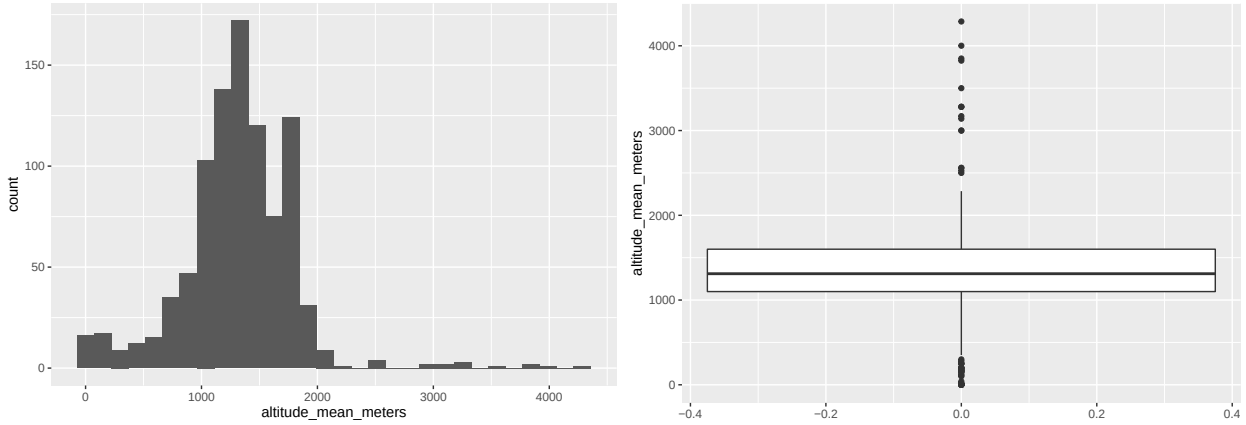


Figure 7: Histogram and boxplot for altitude after removing implausuble observations.

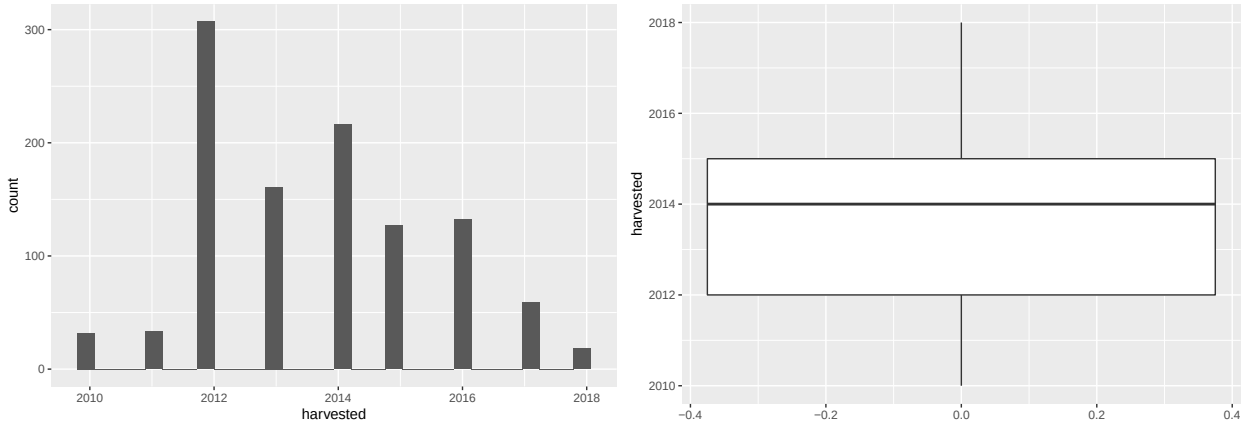
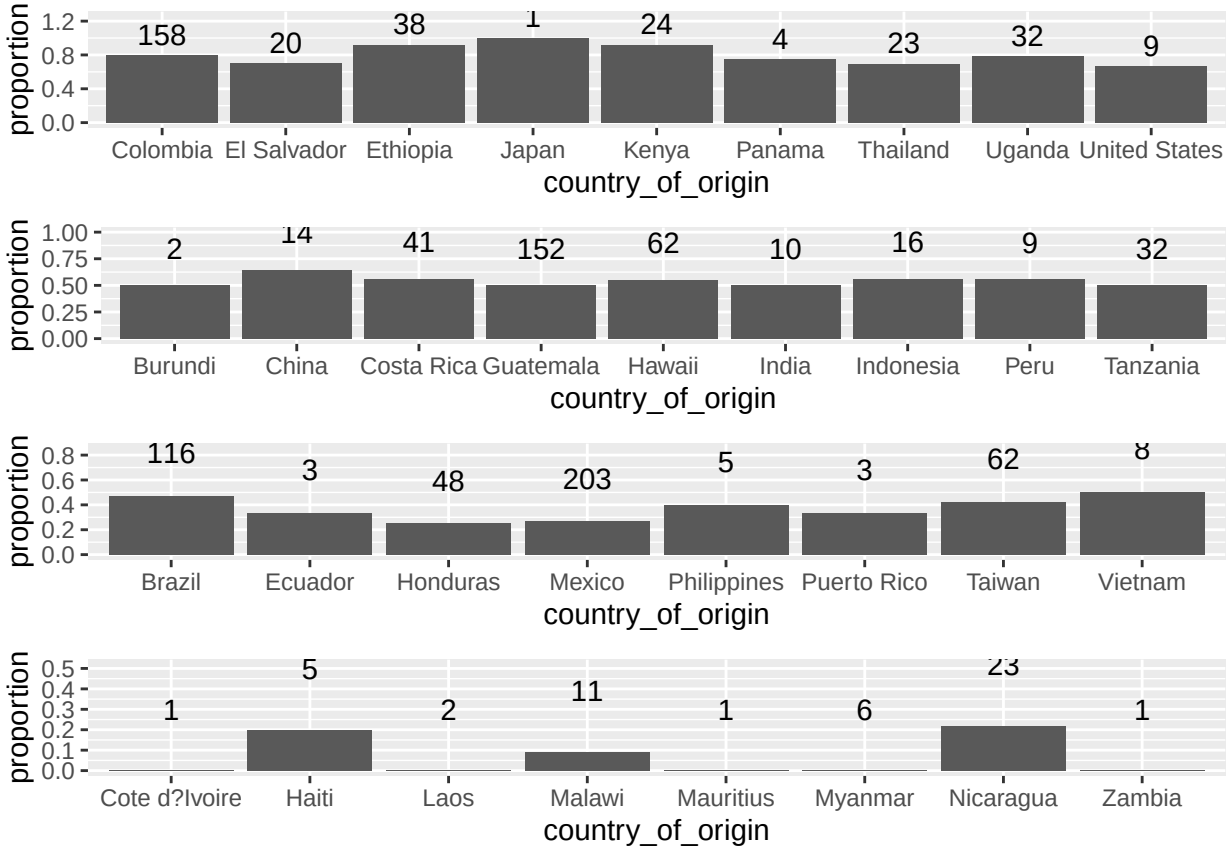


Figure 8: Histogram and boxplot for harvested.



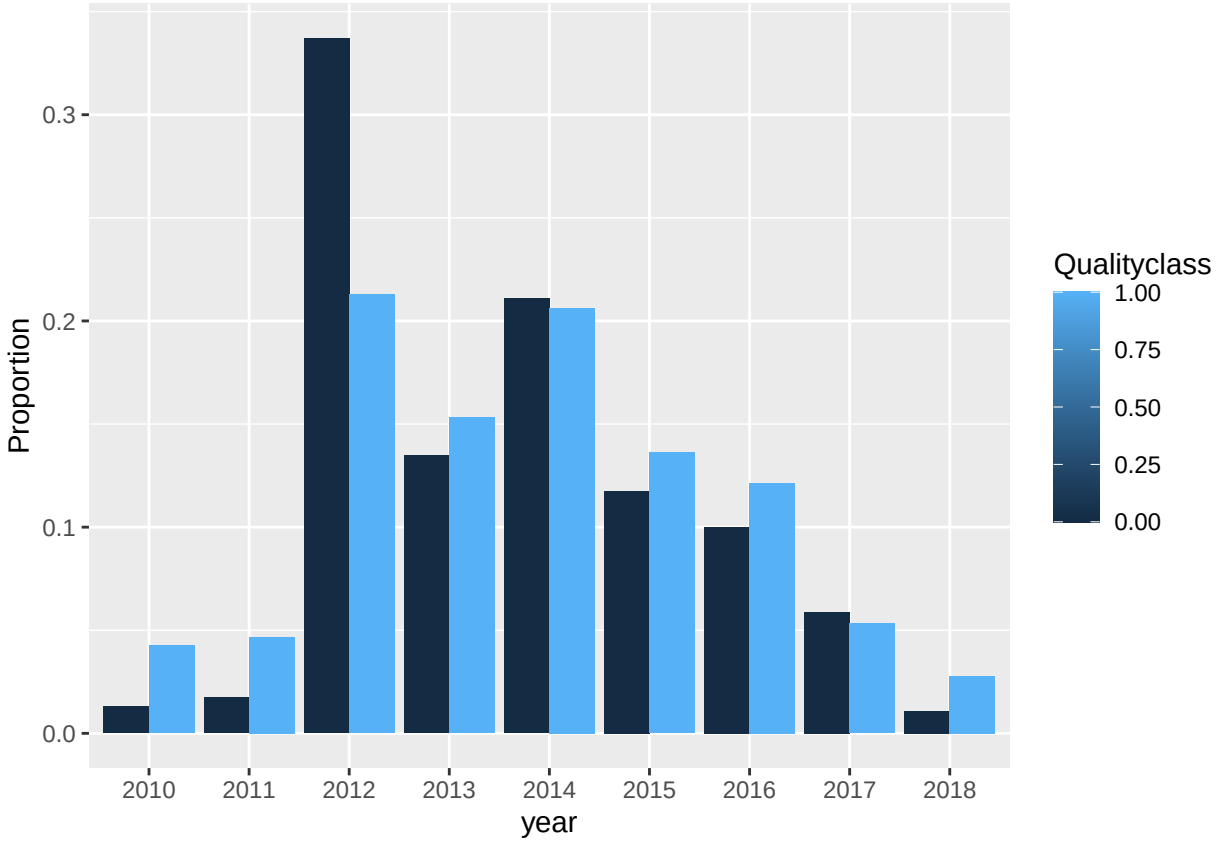

```
Rows: 930
Columns: 8
$ country_of_origin <chr> "Myanmar", "Uganda", "Ethiopia", "Mexico", "Burundi"~
$ aroma             <dbl> -1.084245709, 2.451292211, 2.745920371, -1.346137407~
$ flavor            <dbl> -0.32474610, 1.21692758, 1.46359537, -1.37308420, 0.~
$ acidity           <dbl> -0.1080856, 1.2368728, 1.4930554, -0.9086561, -0.108~
$ defects_log       <dbl> 1.6094379, 0.6931472, 2.0794415, 1.3862944, 1.791759~
$ year              <fct> 2015, 2013, 2014, 2012, 2012, 2014, 2015, 2013, 2013~
$ level             <chr> "3", "3", "3", "3", "3", "3", "3", "3", "3", "3", "3~
$ Qualityclass      <dbl> 0, 1, 1, 0, 1, 1, 1, 0, 0, 1, 0, 1, 0, 1, 1, 0, 1, 1~
```

```
# A tibble: 9 x 2
  year      n
  <fct> <int>
1 2010     26
2 2011     30
3 2012    255
4 2013    134
5 2014    194
6 2015    118
7 2016    103
8 2017     52
9 2018     18
```

```
 Qualityclass     Brazil  Burundi    China    Colombia Costa Rica Cote d?Ivoire
```

```
           0  9.6% (44) 0.2% (1) 1.1% (5)  4.8%  (22)  3.5% (16)      0.2% (1)
           1 10.0% (47) 0.2% (1) 1.9% (9) 22.3% (105)  4.3% (20)      0.0% (0)
 Ecuador El Salvador  Ethiopia  Guatemala    Haiti   Hawaii  Honduras    India
0.2% (1)   1.1%  (5) 0.0%  (0) 13.3% (61) 0.9% (4) 0.0% (0) 7.4% (34) 1.1% (5)
0.2% (1)   2.8% (13) 4.9% (23) 14.0% (66) 0.2% (1) 0.2% (1) 2.6% (12) 1.1% (5)
Indonesia     Kenya     Laos    Malawi Mauritius      Mexico  Myanmar
 1.3% (6) 0.4%  (2) 0.4% (2) 2.2% (10)  0.2% (1) 32.2% (148) 1.3% (6)
 1.7% (8) 3.8% (18) 0.0% (0) 0.2%  (1)  0.0% (0) 11.1%  (52) 0.0% (0)
Nicaragua   Panama     Peru Philippines Puerto Rico    Taiwan  Tanzania
2.2% (10) 0.2% (1) 0.2% (1)    0.7% (3)    0.4% (2) 7.4% (34) 3.3% (15)
0.6%  (3) 0.6% (3) 0.0% (0)    0.4% (2)    0.2% (1) 4.9% (23) 3.0% (14)
Thailand    Uganda United States  Vietnam   Zambia
1.3% (6) 1.5%  (7)      0.7% (3) 0.7% (3) 0.2% (1)
1.7% (8) 4.9% (23)      1.3% (6) 0.9% (4) 0.0% (0)
```

```
Qualityclass      2010      2011        2012       2013       2014       2015
           0 1.3%  (6) 1.7%  (8) 33.7% (155) 13.5% (62) 21.1% (97) 11.7% (54)
           1 4.3% (20) 4.7% (22) 21.3% (100) 15.3% (72) 20.6% (97) 13.6% (64)
      2016      2017      2018
10.0% (46) 5.9% (27) 1.1%  (5)
12.1% (57) 5.3% (25) 2.8% (13)
```



Formal Analysis

Build the models

Only base on the altitude

```
Call:
glm(formula = Qualityclass ~ level - 1, family = binomial(link = "logit"),
    data = coffee_final)

Deviance Residuals:
   Min      1Q  Median      3Q     Max
-1.287  -1.287   1.071   1.071   1.369

Coefficients:
       Estimate Std. Error z value Pr(>|z|)
level1 -0.43891    0.18321  -2.396  0.01659 *
level2 -0.40968    0.14513  -2.823  0.00476 **
level3  0.25508    0.08184   3.117  0.00183 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 1289.3  on 930  degrees of freedom
Residual deviance: 1265.4  on 927  degrees of freedom
AIC: 1271.4

Number of Fisher Scoring iterations: 4
```

Base on the year of harvest

```
Call:
glm(formula = Qualityclass ~ year, family = binomial(link = "logit"),
    data = coffee_final)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.7125  -1.1774   0.7244   1.1146   1.3683

Coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept)   1.2040     0.4655   2.587 0.009694 **
year2011     -0.1924     0.6222  -0.309 0.757181
year2012     -1.6422     0.4828  -3.401 0.000671 ***
year2013     -1.0544     0.4967  -2.123 0.033753 *
year2014     -1.2040     0.4871  -2.472 0.013450 *
year2015     -1.0341     0.5008  -2.065 0.038941 *
year2016     -0.9896     0.5059  -1.956 0.050466 .
year2017     -1.2809     0.5419  -2.364 0.018099 *
year2018     -0.2485     0.7026  -0.354 0.723600
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 1289.1  on 929  degrees of freedom
Residual deviance: 1256.0  on 921  degrees of freedom
AIC: 1274

Number of Fisher Scoring iterations: 4
```

Base on the country

```
Call:
glm(formula = Qualityclass ~ country_of_origin, family = binomial(link = "logit"),
    data = coffee_final)

Deviance Residuals:
     Min        1Q    Median        3Q       Max
-2.14597  -1.01655   0.00036   1.08424   2.18993

Coefficients:
                              Estimate Std. Error z value Pr(>|z|)
(Intercept)                    0.06596    0.20977   0.314  0.75320
country_of_originBurundi      -0.06596    1.42969  -0.046  0.96320
country_of_originChina         0.52183    0.59592   0.876  0.38121
country_of_originColombia      1.49696    0.31461   4.758 1.95e-06 ***
country_of_originCosta Rica    0.15719    0.39561   0.397  0.69112
country_of_originCote d?Ivoire -16.63203 2399.54473  -0.007  0.99447
country_of_originEcuador      -0.06596    1.42969  -0.046  0.96320
country_of_originEl Salvador   0.88955    0.56650   1.570  0.11636
country_of_originEthiopia     16.50011  500.33971   0.033  0.97369
country_of_originGuatemala     0.01282    0.27486   0.047  0.96279
country_of_originHaiti        -1.45225    1.13754  -1.277  0.20172
country_of_originHawaii       16.50011 2399.54473   0.007  0.99451
country_of_originHonduras     -1.10741    0.39592  -2.797  0.00516 **
country_of_originIndia        -0.06596    0.66634  -0.099  0.92115
country_of_originIndonesia     0.22172    0.57937   0.383  0.70194
country_of_originKenya         2.13127    0.77431   2.752  0.00591 **
country_of_originLaos        -16.63203 1696.73436  -0.010  0.99218
country_of_originMalawi       -2.36854    1.06958  -2.214  0.02680 *
country_of_originMauritius    -16.63203 2399.54473  -0.007  0.99447
country_of_originMexico       -1.11193    0.26456  -4.203 2.63e-05 ***
country_of_originMyanmar      -16.63203  979.61005  -0.017  0.98645
country_of_originNicaragua    -1.26993    0.69090  -1.838  0.06605 .
country_of_originPanama        1.03265    1.17360   0.880  0.37891
country_of_originPeru         -16.63203 2399.54473  -0.007  0.99447
country_of_originPhilippines  -0.47142    0.93666  -0.503  0.61475
country_of_originPuerto Rico  -0.75911    1.24258  -0.611  0.54126
country_of_originTaiwan       -0.45682    0.34190  -1.336  0.18150
country_of_originTanzania     -0.13495    0.42673  -0.316  0.75182
country_of_originThailand      0.22172    0.57937   0.383  0.70194
country_of_originUganda        1.12363    0.47994   2.341  0.01922 *
country_of_originUnited States 0.62719    0.73757   0.850  0.39513
country_of_originVietnam       0.22172    0.79205   0.280  0.77952
country_of_originZambia       -16.63203 2399.54473  -0.007  0.99447
```

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 1289.1  on 929  degrees of freedom
Residual deviance: 1072.1  on 897  degrees of freedom
AIC: 1138.1

Number of Fisher Scoring iterations: 15
```

According the result before, we choose some significant country as a class variable.

```
Call:
glm(formula = Qualityclass ~ Colombia + Mexico + Honduras + Kenya -
    1, family = binomial(link = "logit"), data = coffee_final)

Deviance Residuals:
   Min      1Q  Median      3Q     Max
-2.146  -1.177   0.459   1.177   1.641

Coefficients:
         Estimate Std. Error z value Pr(>|z|)
Colombia   1.5629     0.2345   6.666 2.64e-11 ***
Mexico    -1.0460     0.1612  -6.488 8.68e-11 ***
Honduras  -1.0415     0.3358  -3.102  0.00192 **
Kenya      2.1972     0.7453   2.948  0.00320 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 1289.3  on 930  degrees of freedom
Residual deviance: 1156.6  on 926  degrees of freedom
AIC: 1164.6

Number of Fisher Scoring iterations: 4
```

Base on the year and country

```
Call:
glm(formula = Qualityclass ~ country_of_origin + year, family = binomial(link = "logit"),
    data = coffee_final)

Deviance Residuals:
     Min        1Q    Median        3Q       Max
-2.17448  -0.97437   0.00032   1.00309   2.18993

Coefficients:
                              Estimate Std. Error z value Pr(>|z|)
(Intercept)                  -0.03468    0.59460  -0.058  0.95349
country_of_originBurundi      0.15624    1.44037   0.108  0.91362
country_of_originChina        0.77187    0.63053   1.224  0.22089
```

```
country_of_originColombia         1.84054    0.34098   5.398 6.75e-08 ***
country_of_originCosta Rica       0.49081    0.42149   1.164  0.24423
country_of_originCote d?Ivoire  -16.57149 2399.54474  -0.007  0.99449
country_of_originEcuador          0.32438    1.45807   0.222  0.82395
country_of_originEl Salvador      1.15147    0.58475   1.969  0.04893 *
country_of_originEthiopia        16.82884  497.80415   0.034  0.97303
country_of_originGuatemala        0.41515    0.30673   1.353  0.17591
country_of_originHaiti           -0.94200    1.15374  -0.816  0.41423
country_of_originHawaii          16.60075 2399.54479   0.007  0.99448
country_of_originHonduras        -0.88360    0.41906  -2.109  0.03499 *
country_of_originIndia            0.27588    0.69004   0.400  0.68930
country_of_originIndonesia        0.42228    0.60048   0.703  0.48191
country_of_originKenya            2.57473    0.79133   3.254  0.00114 **
country_of_originLaos           -16.57882 1696.72545  -0.010  0.99220
country_of_originMalawi          -1.91280    1.09277  -1.750  0.08005 .
country_of_originMauritius      -16.57149 2399.54474  -0.007  0.99449
country_of_originMexico          -0.71989    0.31440  -2.290  0.02204 *
country_of_originMyanmar        -16.52163  976.27716  -0.017  0.98650
country_of_originNicaragua       -1.11252    0.70712  -1.573  0.11565
country_of_originPanama           1.47628    1.18697   1.244  0.21360
country_of_originPeru           -16.24816 2399.54474  -0.007  0.99460
country_of_originPhilippines     -0.11413    0.95334  -0.120  0.90471
country_of_originPuerto Rico     -0.03897    1.26851  -0.031  0.97549
country_of_originTaiwan          -0.10856    0.37283  -0.291  0.77092
country_of_originTanzania         0.21667    0.45820   0.473  0.63630
country_of_originThailand         0.61483    0.60175   1.022  0.30691
country_of_originUganda           1.68023    0.51792   3.244  0.00118 **
country_of_originUnited States    1.07504    0.76568   1.404  0.16031
country_of_originVietnam          0.66336    0.81159   0.817  0.41372
country_of_originZambia         -16.17628 2399.54474  -0.007  0.99462
year2011                          0.45958    0.71314   0.644  0.51928
year2012                         -0.28323    0.58365  -0.485  0.62749
year2013                         -0.61950    0.59127  -1.048  0.29476
year2014                         -0.35511    0.58834  -0.604  0.54613
year2015                          0.05473    0.59555   0.092  0.92678
year2016                          0.04011    0.59731   0.067  0.94646
year2017                         -0.37725    0.63786  -0.591  0.55423
year2018                          0.81484    0.79630   1.023  0.30617
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 1289.1  on 929  degrees of freedom
Residual deviance: 1060.4  on 889  degrees of freedom
AIC: 1142.4

Number of Fisher Scoring iterations: 15
```

Base on the altitude and country

```
Call:
glm(formula = Qualityclass ~ level + Colombia + Mexico + Honduras +
    Kenya, family = binomial(link = "logit"), data = coffee_final)
```

```
Deviance Residuals:
    Min       1Q   Median       3Q      Max
-2.2327  -0.9800   0.4155   1.0322   1.9251

Coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  -0.4838     0.1948  -2.484   0.0130 *
level2        0.4061     0.2476   1.640   0.1010
level3        0.8352     0.2144   3.896 9.79e-05 ***
Colombia      1.3248     0.2544   5.207 1.92e-07 ***
Mexico       -1.1988     0.1859  -6.448 1.13e-10 ***
Honduras     -1.3846     0.3520  -3.933 8.39e-05 ***
Kenya         2.0547     0.7551   2.721   0.0065 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 1289.1  on 929  degrees of freedom
Residual deviance: 1137.0  on 923  degrees of freedom
AIC: 1151

Number of Fisher Scoring iterations: 4
```

Base on the 3

```
Call:
glm(formula = Qualityclass ~ level + country_of_origin + year -
    1, family = binomial(link = "logit"), data = coffee_final)

Deviance Residuals:
     Min        1Q    Median        3Q       Max
-2.24878  -0.87349   0.00031   0.98739   2.12047

Coefficients:
                               Estimate Std. Error z value Pr(>|z|)
level1                       -6.057e-01  6.460e-01  -0.938  0.34842
level2                        6.539e-02  6.237e-01   0.105  0.91650
level3                        4.660e-01  6.327e-01   0.736  0.46144
country_of_originBurundi     -3.436e-01  1.454e+00  -0.236  0.81321
country_of_originChina        4.626e-01  6.421e-01   0.721  0.47119
country_of_originColombia     1.525e+00  3.612e-01   4.223 2.42e-05 ***
country_of_originCosta Rica   2.346e-01  4.355e-01   0.539  0.59011
country_of_originCote d?Ivoire -1.606e+01  2.400e+03  -0.007  0.99466
country_of_originEcuador      9.024e-01  1.481e+00   0.609  0.54239
country_of_originEl Salvador  7.797e-01  5.933e-01   1.314  0.18874
country_of_originEthiopia     1.639e+01  4.970e+02   0.033  0.97369
country_of_originGuatemala   -2.782e-03  3.394e-01  -0.008  0.99346
country_of_originHaiti       -7.446e-01  1.185e+00  -0.628  0.52988
country_of_originHawaii       1.717e+01  2.400e+03   0.007  0.99429
country_of_originHonduras    -1.345e+00  4.471e-01  -3.008  0.00263 **
country_of_originIndia        3.083e-01  7.105e-01   0.434  0.66438
country_of_originIndonesia    4.157e-03  6.167e-01   0.007  0.99462
```

```
country_of_originKenya          2.400e+00  8.037e-01   2.986  0.00283 **
country_of_originLaos          -1.707e+01  1.696e+03  -0.010  0.99197
country_of_originMalawi        -2.146e+00  1.097e+00  -1.957  0.05035 .
country_of_originMauritius     -1.606e+01  2.400e+03  -0.007  0.99466
country_of_originMexico        -9.546e-01  3.255e-01  -2.933  0.00336 **
country_of_originMyanmar       -1.682e+01  9.735e+02  -0.017  0.98622
country_of_originNicaragua     -1.245e+00  7.120e-01  -1.748  0.08044 .
country_of_originPanama         1.155e+00  1.192e+00   0.969  0.33234
country_of_originPeru          -1.669e+01  2.400e+03  -0.007  0.99445
country_of_originPhilippines   -2.897e-01  9.557e-01  -0.303  0.76183
country_of_originPuerto Rico    6.030e-01  1.289e+00   0.468  0.63987
country_of_originTaiwan         2.949e-01  3.980e-01   0.741  0.45863
country_of_originTanzania      -1.655e-01  4.788e-01  -0.346  0.72962
country_of_originThailand       7.166e-01  6.329e-01   1.132  0.25752
country_of_originUganda         1.292e+00  5.338e-01   2.420  0.01554 *
country_of_originUnited States  8.490e-01  7.818e-01   1.086  0.27750
country_of_originVietnam        4.664e-01  8.165e-01   0.571  0.56787
country_of_originZambia        -1.658e+01  2.400e+03  -0.007  0.99449
year2011                        2.581e-01  7.296e-01   0.354  0.72350
year2012                       -3.418e-01  6.032e-01  -0.567  0.57092
year2013                       -6.905e-01  6.106e-01  -1.131  0.25814
year2014                       -4.561e-01  6.076e-01  -0.751  0.45289
year2015                       -1.422e-02  6.148e-01  -0.023  0.98154
year2016                        9.710e-02  6.157e-01   0.158  0.87469
year2017                       -4.201e-01  6.555e-01  -0.641  0.52156
year2018                        1.284e+00  8.242e-01   1.557  0.11939
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 1289.3  on 930  degrees of freedom
Residual deviance: 1047.4  on 887  degrees of freedom
AIC: 1133.4

Number of Fisher Scoring iterations: 15
```

Colombia + Mexico + Honduras + Kenya

Consider everything

```
Call:
glm(formula = Qualityclass ~ aroma + flavor + acidity + country_of_origin +
    defects_log + level + year, family = binomial(link = "logit"),
    data = coffee_final)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-4.5914  -0.2397   0.0000   0.2843   3.5781

Coefficients:
                              Estimate Std. Error z value Pr(>|z|)
(Intercept)                   -1.57595    1.09508  -1.439  0.15012
aroma                          1.58526    0.25890   6.123 9.18e-10 ***
```

```
flavor                           2.78982    0.34848   8.006 1.19e-15 ***
acidity                          1.64741    0.25864   6.369 1.90e-10 ***
country_of_originBurundi         1.88240    5.12830   0.367  0.71357
country_of_originChina           0.49916    1.08844   0.459  0.64652
country_of_originColombia        1.84638    0.57358   3.219  0.00129 **
country_of_originCosta Rica      0.26961    0.76612   0.352  0.72491
country_of_originCote d?Ivoire -12.11826 6522.63865  -0.002  0.99852
country_of_originEcuador        -1.02265    1.52999  -0.668  0.50388
country_of_originEl Salvador     0.32640    0.96977   0.337  0.73644
country_of_originEthiopia       13.49329  894.76317   0.015  0.98797
country_of_originGuatemala      -0.75268    0.57572  -1.307  0.19108
country_of_originHaiti           2.27451    2.16150   1.052  0.29267
country_of_originHawaii          4.41740 6522.63879   0.001  0.99946
country_of_originHonduras       -0.72501    0.71286  -1.017  0.30913
country_of_originIndia          -2.55120    1.07559  -2.372  0.01770 *
country_of_originIndonesia      -0.38258    1.01141  -0.378  0.70524
country_of_originKenya           0.52684    1.54516   0.341  0.73313
country_of_originLaos          -15.24675 4515.00054  -0.003  0.99731
country_of_originMalawi         -0.65398    1.30094  -0.503  0.61518
country_of_originMauritius     -11.76872 6522.63865  -0.002  0.99856
country_of_originMexico         -0.80196    0.52029  -1.541  0.12323
country_of_originMyanmar       -15.49786 2401.00369  -0.006  0.99485
country_of_originNicaragua       0.53829    1.98308   0.271  0.78605
country_of_originPanama          3.27141    1.79738   1.820  0.06874 .
country_of_originPeru          -14.50164 6522.63864  -0.002  0.99823
country_of_originPhilippines     2.89981    2.57307   1.127  0.25975
country_of_originPuerto Rico    -2.65794    1.78541  -1.489  0.13657
country_of_originTaiwan          1.18951    0.70762   1.681  0.09276 .
country_of_originTanzania        0.91717    0.75964   1.207  0.22729
country_of_originThailand        2.87480    0.99592   2.887  0.00389 **
country_of_originUganda         -1.53625    0.79415  -1.934  0.05306 .
country_of_originUnited States   0.19578    1.52935   0.128  0.89814
country_of_originVietnam         2.24627    1.15874   1.939  0.05256 .
country_of_originZambia        -13.96552 6522.63865  -0.002  0.99829
defects_log                      0.33145    0.17162   1.931  0.05345 .
level2                           0.52403    0.48450   1.082  0.27943
level3                           1.03968    0.48225   2.156  0.03109 *
year2011                        -0.22625    1.12956  -0.200  0.84125
year2012                         0.03098    0.98109   0.032  0.97481
year2013                         0.48471    0.98717   0.491  0.62342
year2014                        -0.07904    0.99385  -0.080  0.93661
year2015                        -0.14258    0.98571  -0.145  0.88499
year2016                         0.78470    1.03677   0.757  0.44913
year2017                         0.46753    1.03839   0.450  0.65254
year2018                         2.35570    1.32235   1.781  0.07484 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 1289.15  on 929  degrees of freedom
Residual deviance:  448.42  on 883  degrees of freedom
AIC: 542.42
```

```
Number of Fisher Scoring iterations: 17

Call:
glm(formula = Qualityclass ~ aroma + flavor + acidity + Colombia +
    Mexico + Honduras + Kenya + defects_log + level + year, family = binomial(link = "logit"),
    data = coffee_final)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-4.2576  -0.2933   0.0010   0.3296   3.6482

Coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  -1.3371     0.9359  -1.429   0.1531
aroma         1.3517     0.2267   5.964 2.47e-09 ***
flavor        2.3658     0.2899   8.162 3.30e-16 ***
acidity       1.4612     0.2311   6.324 2.55e-10 ***
Colombia      1.9282     0.4095   4.708 2.50e-06 ***
Mexico       -0.7003     0.3512  -1.994   0.0461 *
Honduras     -0.5767     0.5473  -1.054   0.2920
Kenya         0.8497     1.3961   0.609   0.5427
defects_log   0.3119     0.1509   2.067   0.0387 *
level2        0.4545     0.4188   1.085   0.2779
level3        0.6754     0.3769   1.792   0.0731 .
year2011     -0.1599     1.0447  -0.153   0.8783
year2012      0.1019     0.8983   0.113   0.9097
year2013      0.1358     0.8937   0.152   0.8793
year2014      0.4155     0.8995   0.462   0.6441
year2015     -0.1081     0.9090  -0.119   0.9054
year2016      0.8173     0.9402   0.869   0.3847
year2017      0.2811     0.9682   0.290   0.7716
year2018      2.0529     1.1977   1.714   0.0865 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 1289.15  on 929  degrees of freedom
Residual deviance:  493.82  on 911  degrees of freedom
AIC: 531.82

Number of Fisher Scoring iterations: 7

Start:  AIC=531.82
Qualityclass ~ aroma + flavor + acidity + Colombia + Mexico +
    Honduras + Kenya + defects_log + level + year

             Df Deviance    AIC
- year        8   503.11 525.11
- Kenya       1   494.24 530.24
- Honduras    1   494.97 530.97
- level       2   497.14 531.14
<none>            493.82 531.82
- Mexico      1   497.85 533.85
```

```
- defects_log  1   498.16 534.16
- Colombia     1   520.03 556.03
- acidity      1   543.95 579.95
- aroma        1   544.44 580.44
- flavor       1   584.68 620.68

Step:  AIC=525.11
Qualityclass ~ aroma + flavor + acidity + Colombia + Mexico +
    Honduras + Kenya + defects_log + level

              Df Deviance    AIC
- level        2   503.99 521.99
- Kenya        1   503.79 523.79
- Honduras     1   504.15 524.15
<none>             503.11 525.11
- defects_log  1   508.43 528.43
+ year         8   493.82 531.82
- Mexico       1   511.95 531.95
- Colombia     1   530.49 550.49
- aroma        1   551.81 571.81
- acidity      1   557.40 577.40
- flavor       1   593.89 613.89

Step:  AIC=521.99
Qualityclass ~ aroma + flavor + acidity + Colombia + Mexico +
    Honduras + Kenya + defects_log

              Df Deviance    AIC
- Honduras     1   504.71 520.71
- Kenya        1   504.78 520.78
<none>             503.99 521.99
+ level        2   503.11 525.11
- defects_log  1   509.68 525.68
- Mexico       1   512.91 528.91
+ year         8   497.14 531.14
- Colombia     1   535.47 551.47
- aroma        1   554.81 570.81
- acidity      1   560.36 576.36
- flavor       1   593.96 609.96

Step:  AIC=520.71
Qualityclass ~ aroma + flavor + acidity + Colombia + Mexico +
    Kenya + defects_log

              Df Deviance    AIC
- Kenya        1   505.57 519.57
<none>             504.71 520.71
+ Honduras     1   503.99 521.99
- defects_log  1   509.97 523.97
+ level        2   504.15 524.15
- Mexico       1   513.00 527.00
+ year         8   497.78 529.78
- Colombia     1   538.07 552.07
- aroma        1   556.11 570.11
```

```
- acidity      1   561.95 575.95
- flavor       1   594.88 608.88

Step:  AIC=519.57
Qualityclass ~ aroma + flavor + acidity + Colombia + Mexico +
    defects_log

              Df Deviance    AIC
<none>             505.57 519.57
+ Kenya        1   504.71 520.71
+ Honduras     1   504.78 520.78
+ level        2   504.92 522.92
- defects_log  1   510.96 522.96
- Mexico       1   514.26 526.26
+ year         8   498.34 528.34
- Colombia     1   538.58 550.58
- aroma        1   556.46 568.46
- acidity      1   563.79 575.79
- flavor       1   597.26 609.26

Call:  glm(formula = Qualityclass ~ aroma + flavor + acidity + Colombia +
    Mexico + defects_log, family = binomial(link = "logit"),
    data = coffee_final)

Coefficients:
(Intercept)        aroma       flavor      acidity     Colombia       Mexico
    -0.5381       1.2882       2.3012       1.5419       1.8858      -0.8483
defects_log
     0.3276

Degrees of Freedom: 929 Total (i.e. Null);  923 Residual
Null Deviance:      1289
Residual Deviance: 505.6    AIC: 519.6

Call:
glm(formula = Qualityclass ~ aroma + flavor + acidity + Colombia +
    Mexico + defects_log, family = binomial(link = "logit"),
    data = coffee_final)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-4.0930  -0.3190   0.0012   0.3521   3.5017

Coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  -0.5381     0.1981  -2.716  0.00661 **
aroma         1.2882     0.2134   6.036 1.58e-09 ***
flavor        2.3012     0.2781   8.276  < 2e-16 ***
acidity       1.5419     0.2238   6.889 5.61e-12 ***
Colombia      1.8858     0.3584   5.261 1.43e-07 ***
Mexico       -0.8483     0.2919  -2.906  0.00366 **
defects_log   0.3276     0.1424   2.300  0.02142 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 1289.15  on 929  degrees of freedom
Residual deviance:  505.57  on 923  degrees of freedom
AIC: 519.57

Number of Fisher Scoring iterations: 7

[1] 0.8924731

[1] 0.9032471

[1] 0.8811642
```