HOCHSCHULE DER MEDIEN

Exploratory data analysis

Exploring categorical data

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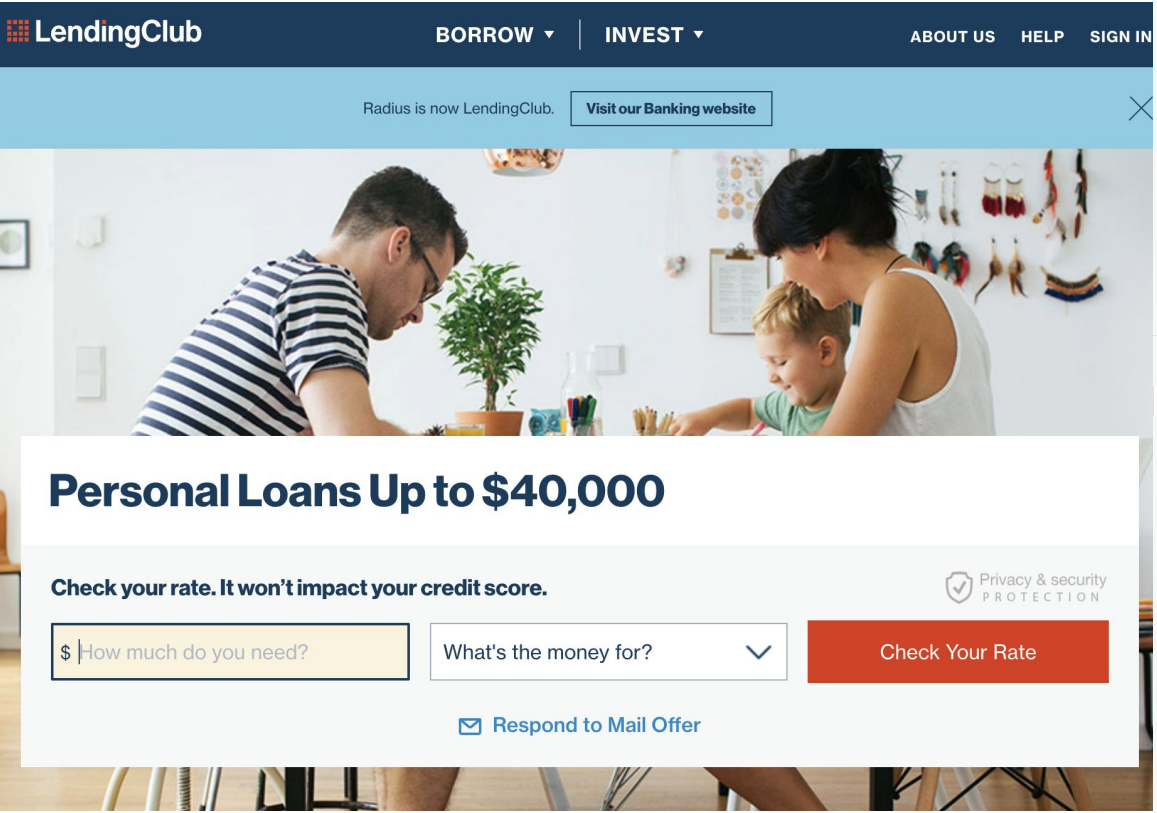
Loan data

Picture credit: Photo by Jonathan Cooper on Unsplash Photo by Tierra Mallorca on Unsplash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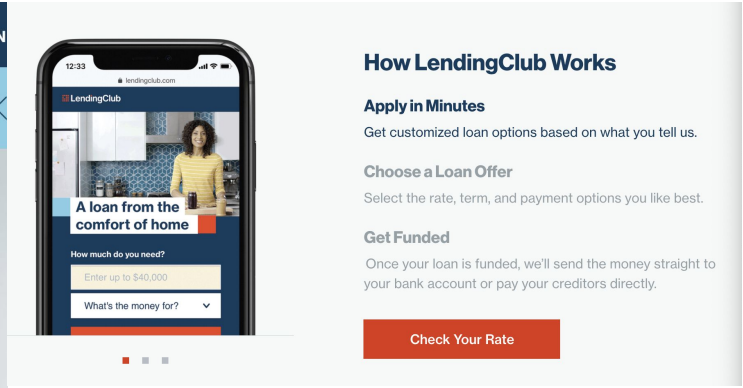
12:33
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What's the money for?
How LendingClub Works
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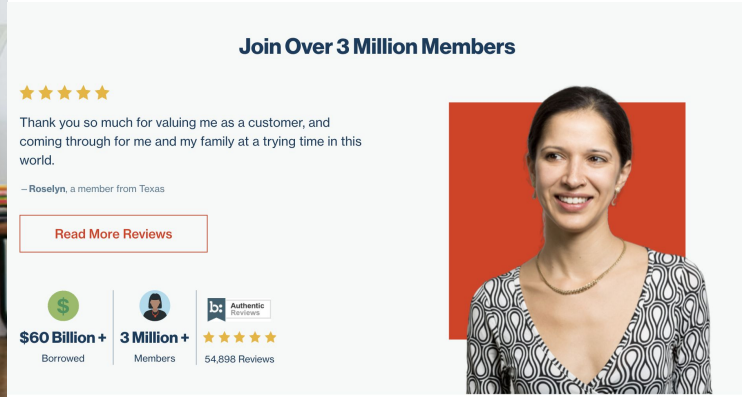
Get customized loan options based on what you tell us.
Choose a Loan Offer
Select the rate, term, and payment options you like best.
Get Funded
Once your loan is funded, we'll send the money straight to your bank account or pay your creditors directly.
Check Your Rate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We will explore these two variables

This data set represents thousands of loans made through the Lending Club platform, which is a platform that allows individuals to lend to other individuals.

- **home_ownership**: The ownership status of the applicant's residence.

- **application_type**: The type of application: either individual or joint.

More information about the data: http://openintrostat.github.io/openintro/reference/loans_full_schema.html

Head and tail of two categorical variables from the loans data

	homeownership	application_type
0	mortgage	individual
1	rent	individual
2	rent	individual
3	rent	individual
4	rent	joint

	homeownership	application_type
9995	rent	individual
9996	mortgage	individual
9997	mortgage	joint
9998	mortgage	individual
9999	rent	individual

Data: loans.csv

Information about our two columns. What is the data type?

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 2 columns):
 #   Column            Non-Null Count  Dtype
---  ------            --------------  -----
 0   homeownership     10000 non-null  category
 1   application_type  10000 non-null  category
dtypes: category(2)
memory usage: 19.9 KB
```

What are the levels and frequencies?

```
homeownership: Index(['mortgage', 'own', 'rent'], dtype='object')

application_type: Index(['individual', 'joint'], dtype='object')
```

```
mortgage    4789
rent        3858
own         1353
Name: homeownership, dtype: int64

individual    8505
joint         1495
Name: application_type, dtype: int64
```

Contingency table (cross table) - Part I -

Prof. Dr. Jan Kirenz

Columns of the table

homeownership	mortgage	own	rent	All
application_type				
individual	3839	1170	3496	8505
joint	950	183	362	1495
All	4789	1353	3858	10000

Rows of the table

homeownership	mortgage	own	rent	All
application_type				
individual	3839	1170	3496	8505
joint	950	183	362	1495
All	4789	1353	3858	10000

Take a look at **mortgage**

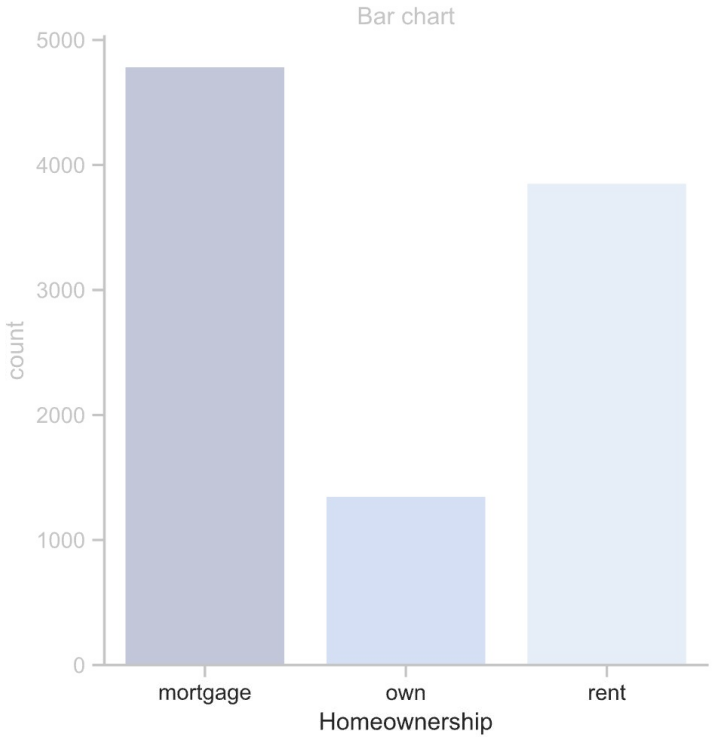
homeownership application_type	mortgage	own	rent	All
individual	3839	1170	3496	8505
joint	950	183	362	1495
All	4789	1353	3858	10000

Contingency table

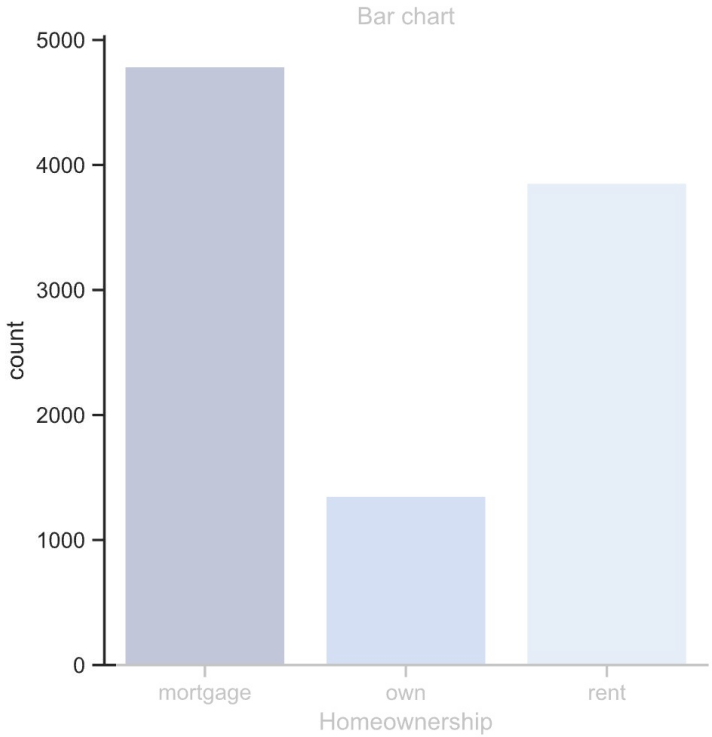
homeownership application_type	mortgage	own	rent	All
individual	3839	1170	3496	8505
joint	950	183	362	1495
All	4789	1353	3858	10000

Bar plot

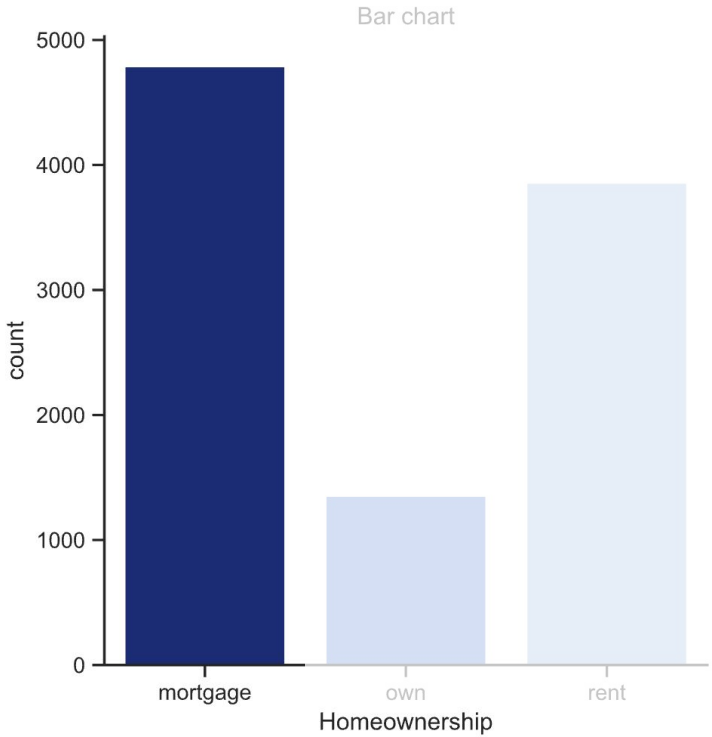
Homeownership is on the x-axes



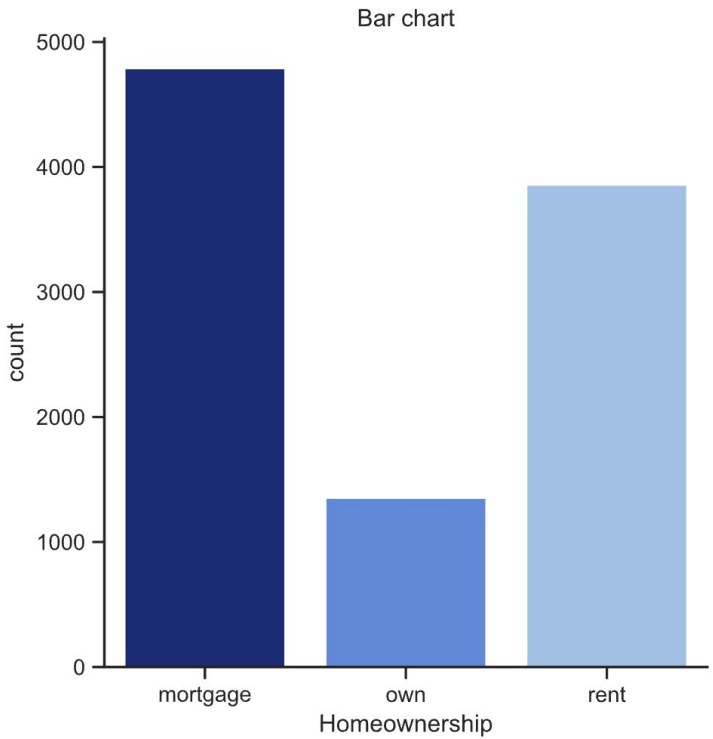
The frequencies (**count**) are on the y-axis



The number of applicants with mortgage



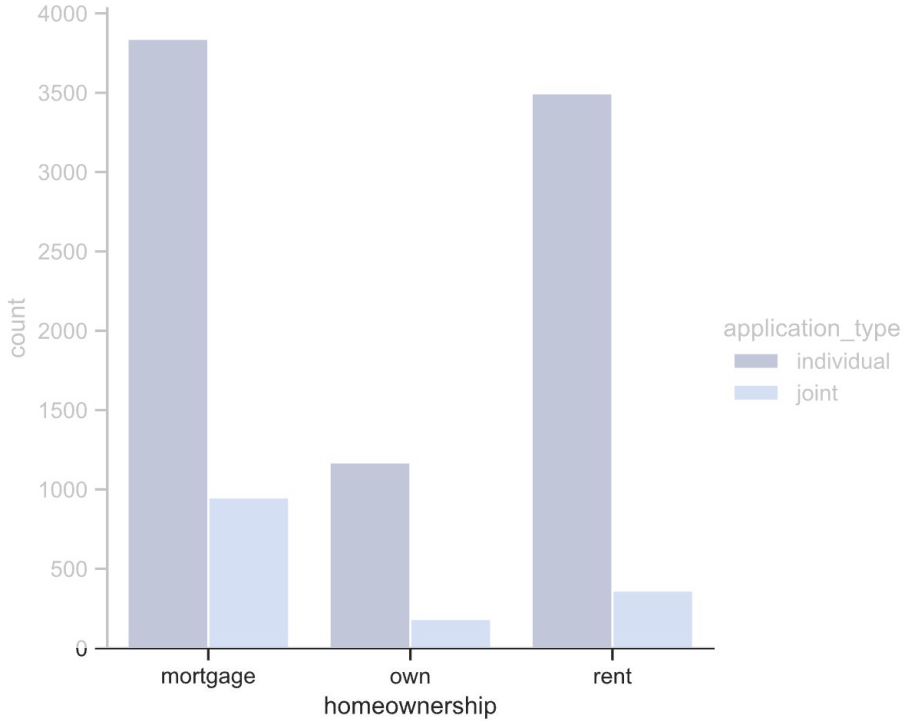
Bar chart


Bar chart
5000
4000
3000
2000
1000
0
count
mortgage
own
rent
Homeownership

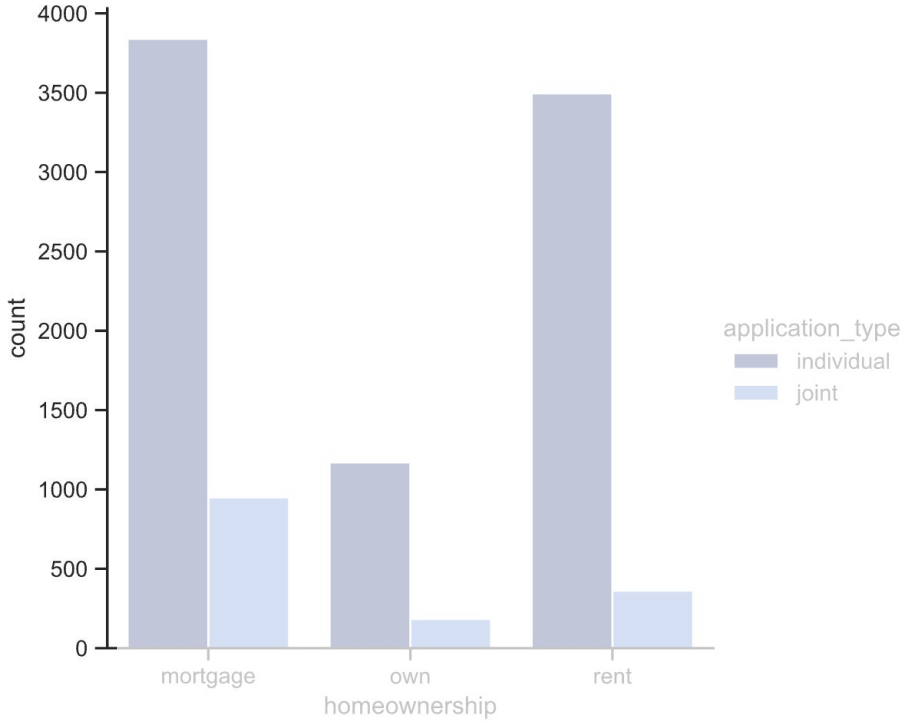
Visualizing two categorical variables

Dodged bar plot

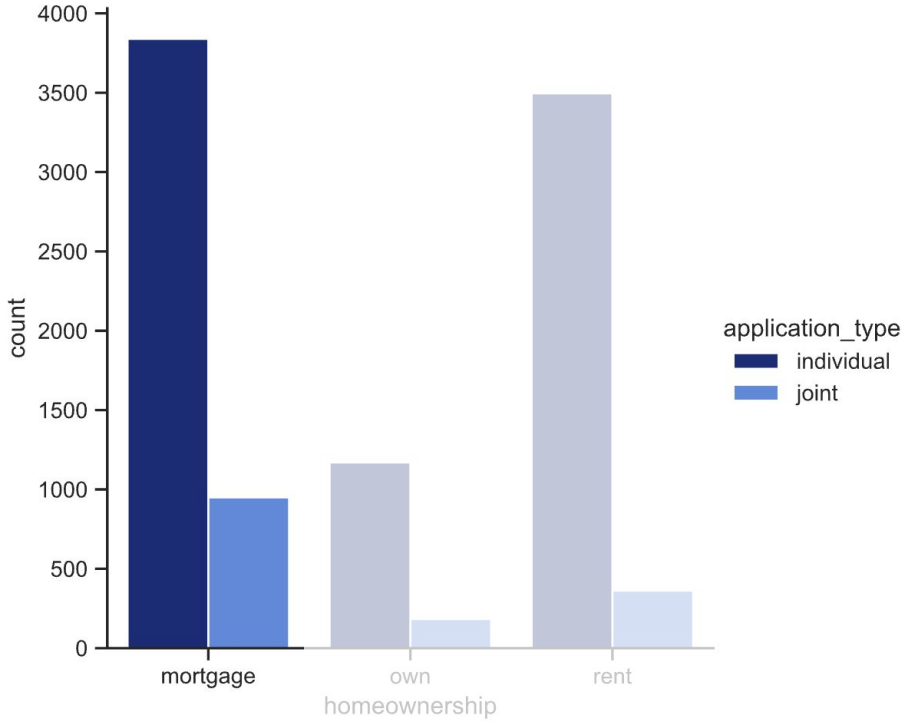
Homeownership is on the x-axis



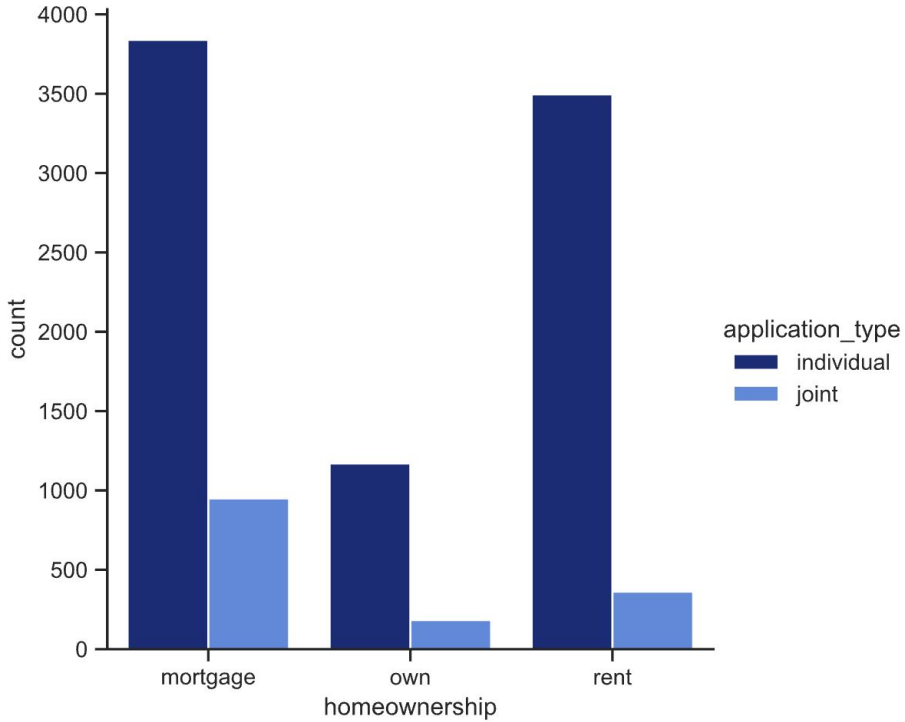
Frequencies (**count**) are on the y-axis



The two application types are next to each other

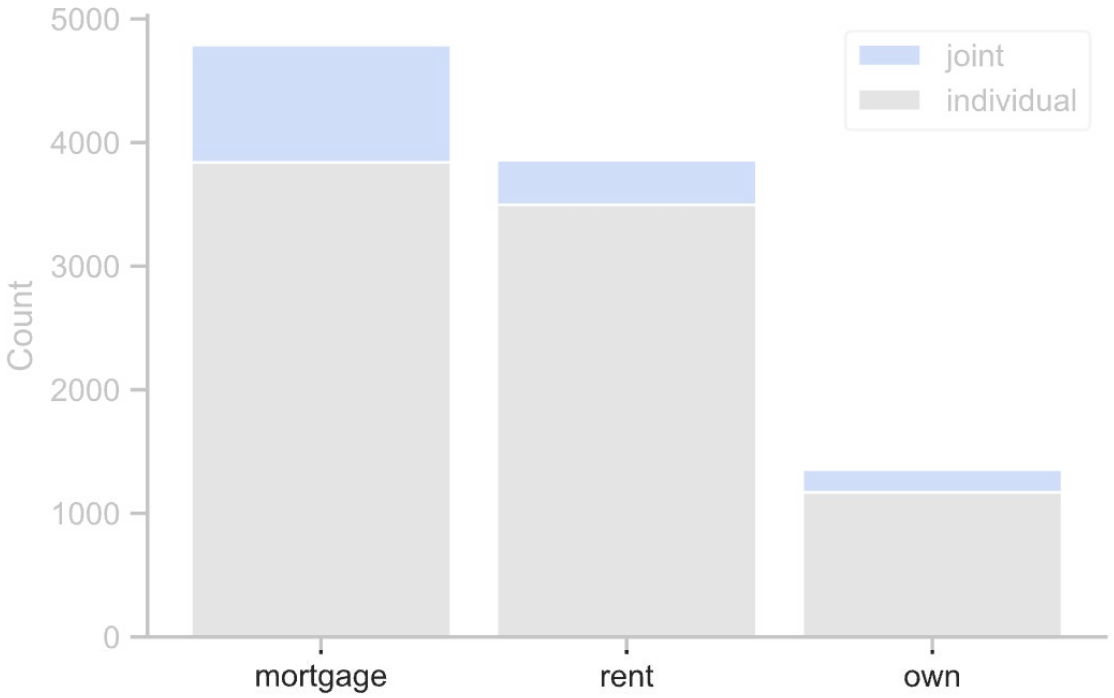


Dodged bar plot

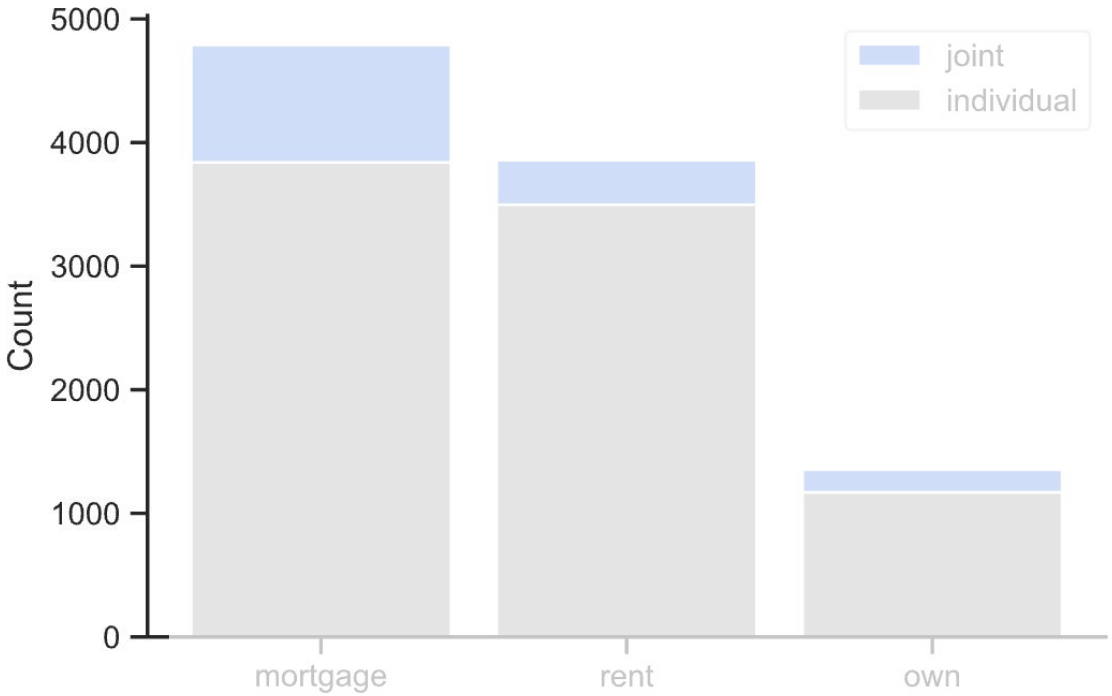


Stacked bar chart

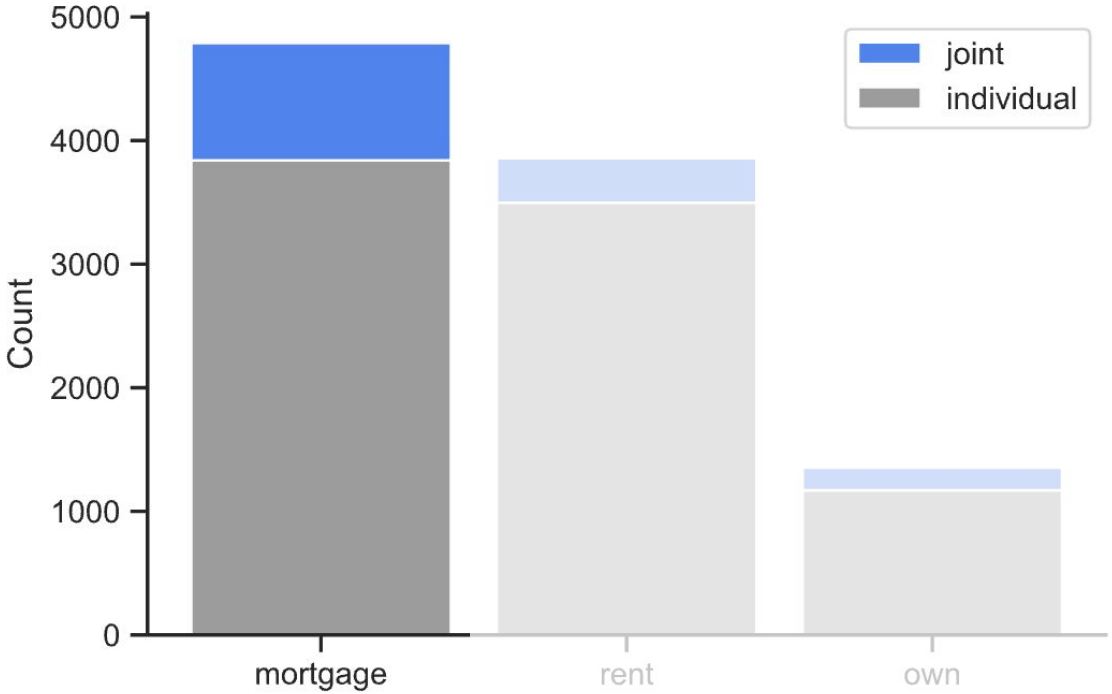
Homeownership is on the x-axis



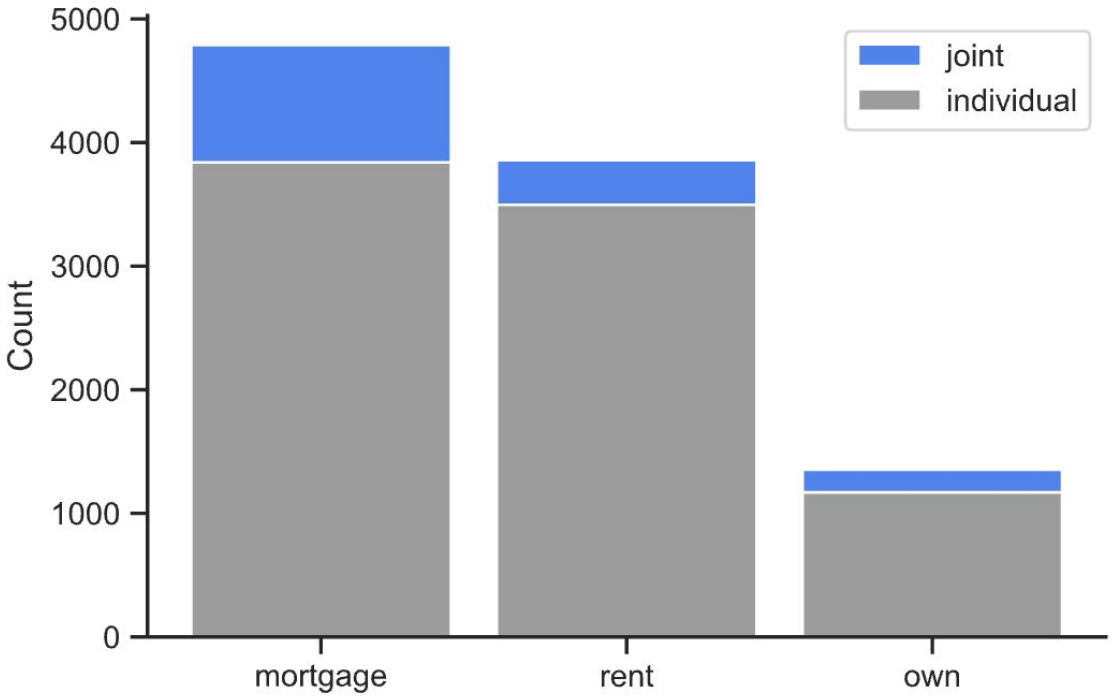
Frequencies (**count**) are on the y-axis



The two application types for mortgage are on top of each other

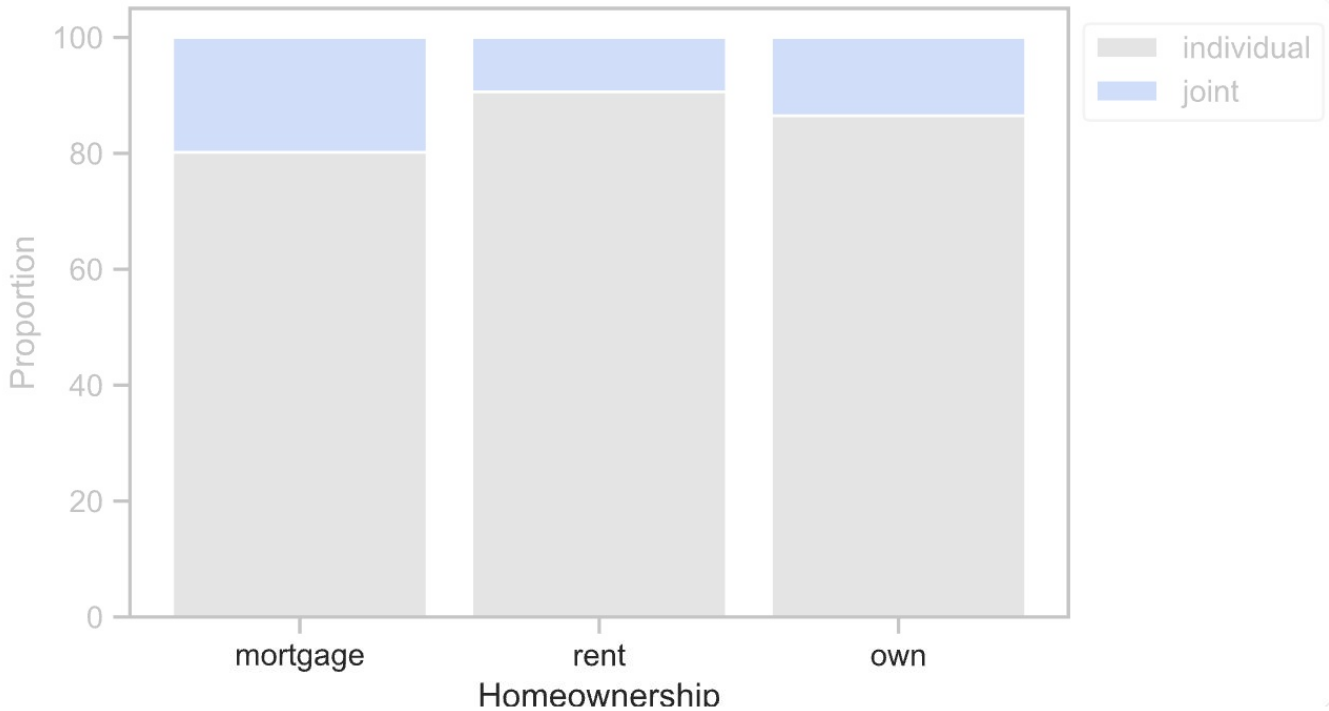


Stacked bar chart

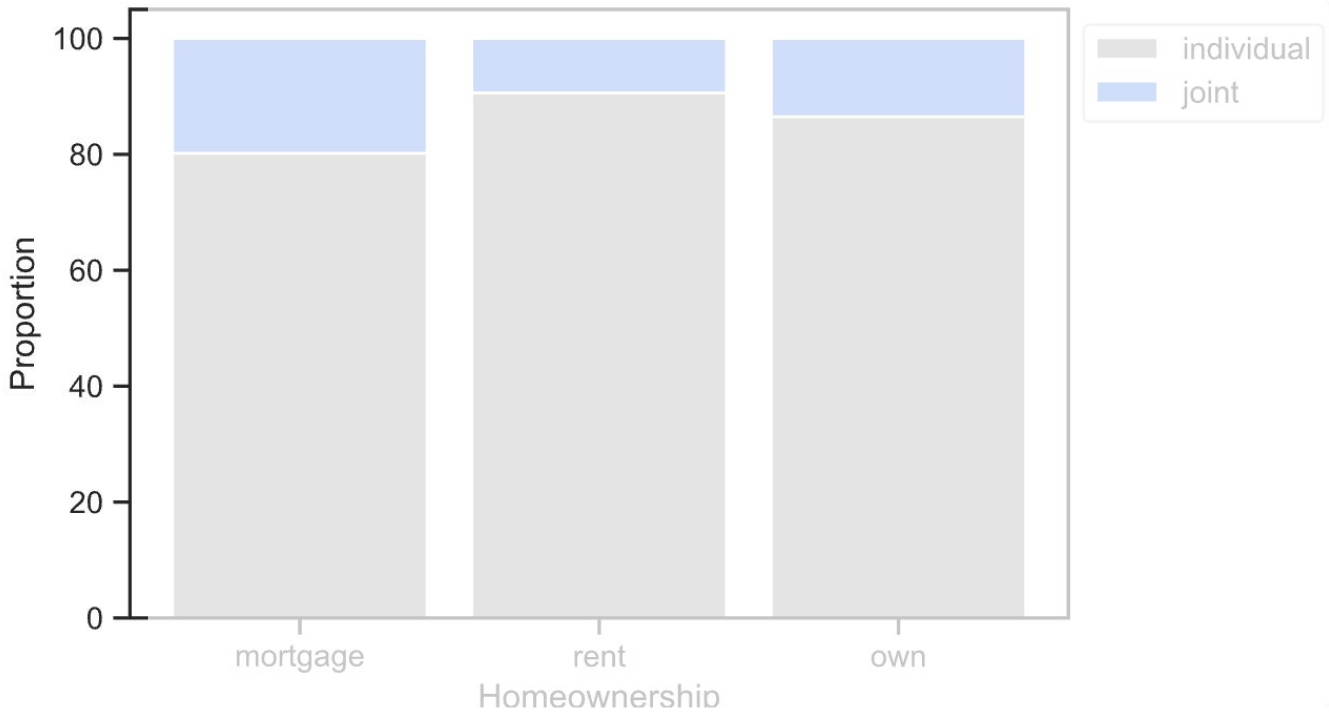


Standardized bar plot

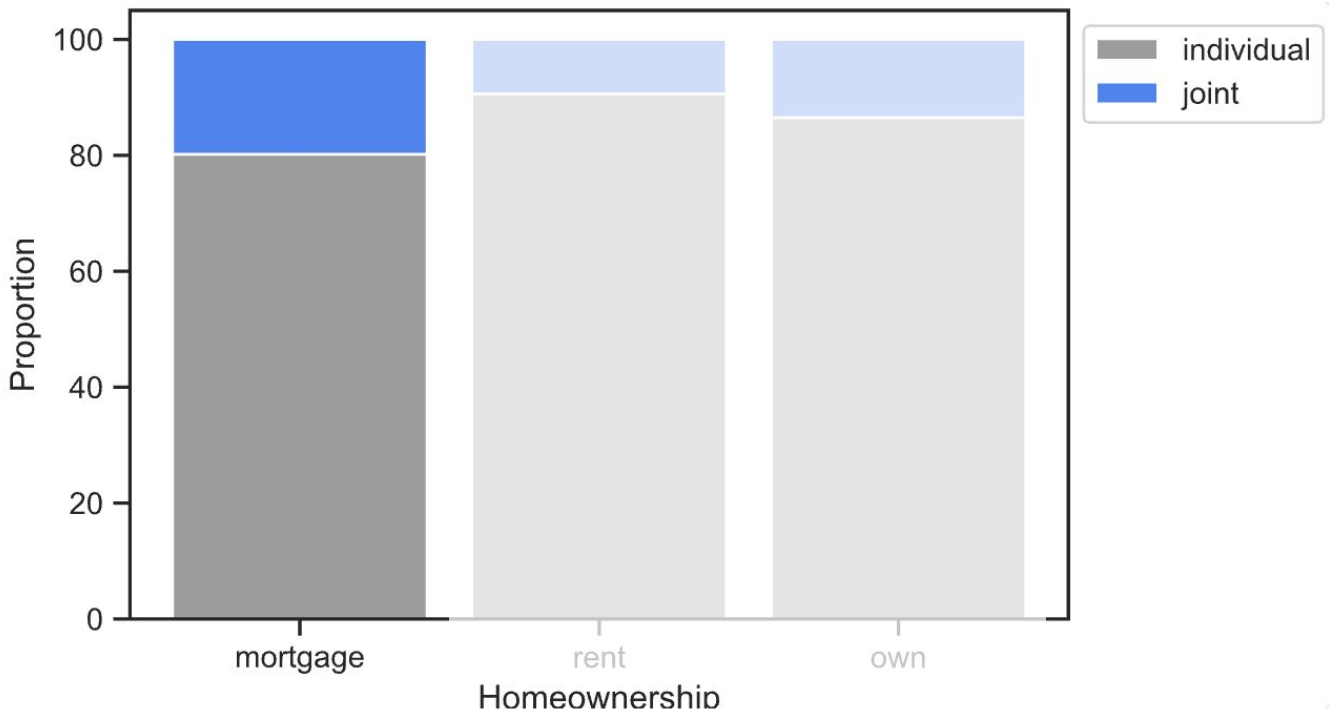
Homeownership is on the x-axis



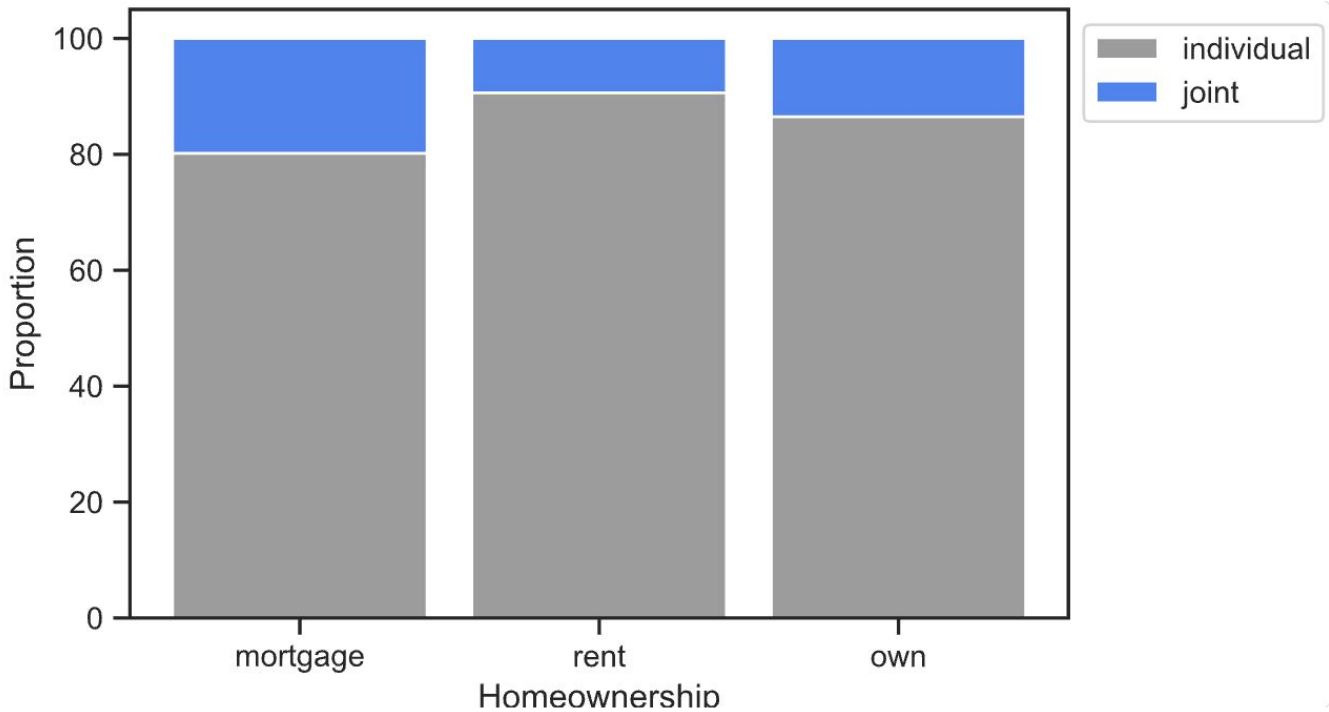
The **proportion** is on the y-axis (in percent)



Proportions per application type for mortgage

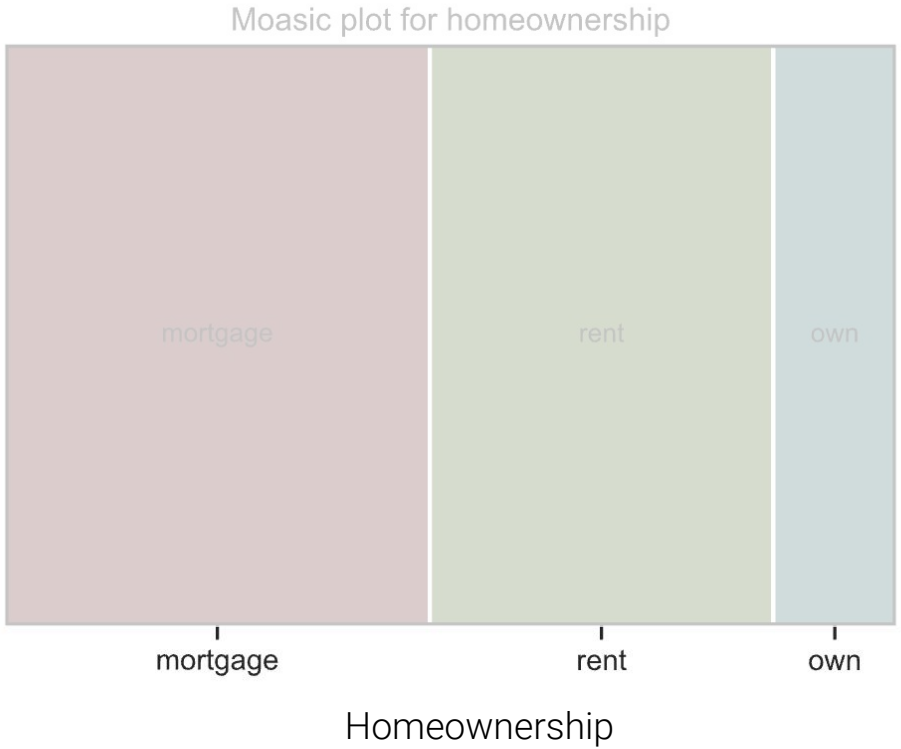


Standardized bar chart

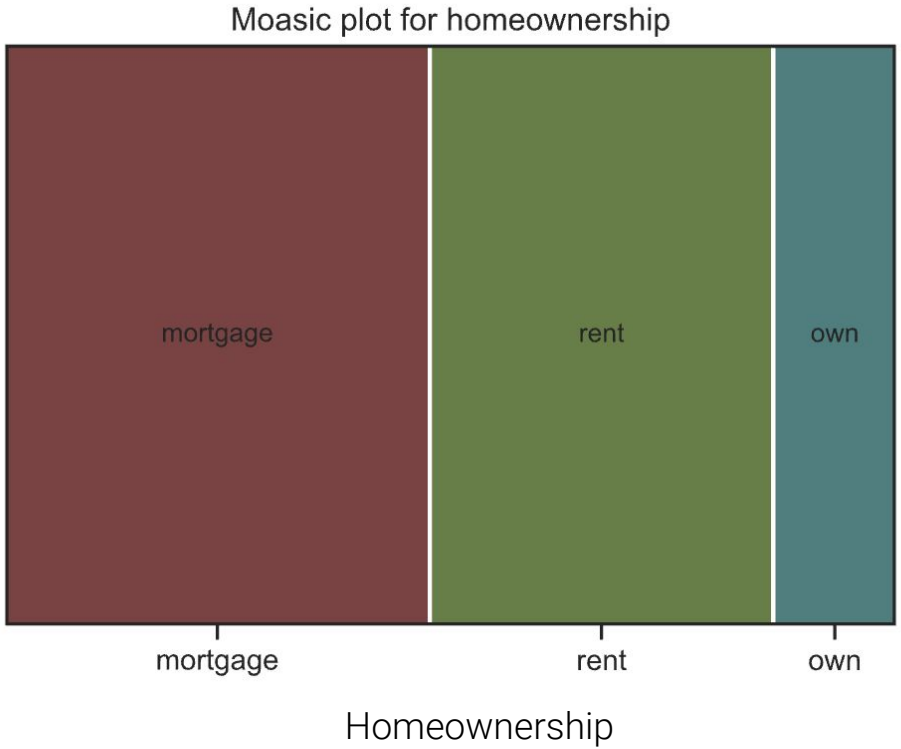


Mosaic plot

Example with only one variable (**homeownership**)

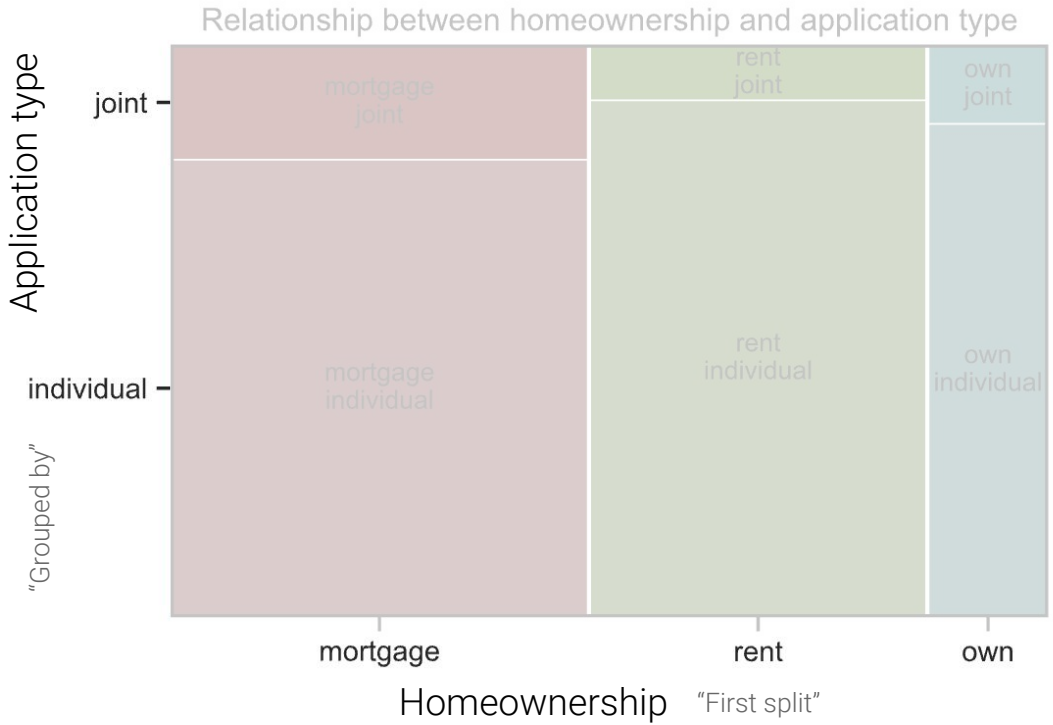


Resembles a standardized stacked bar plot

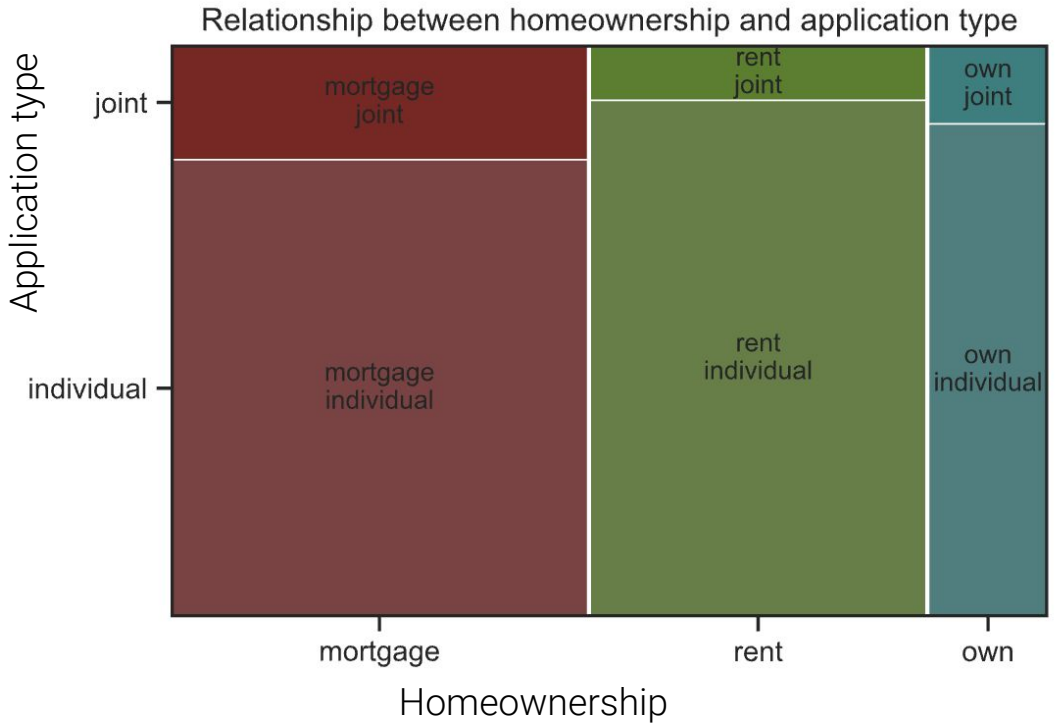


Column widths correspond to the proportion of loans in each of those categories

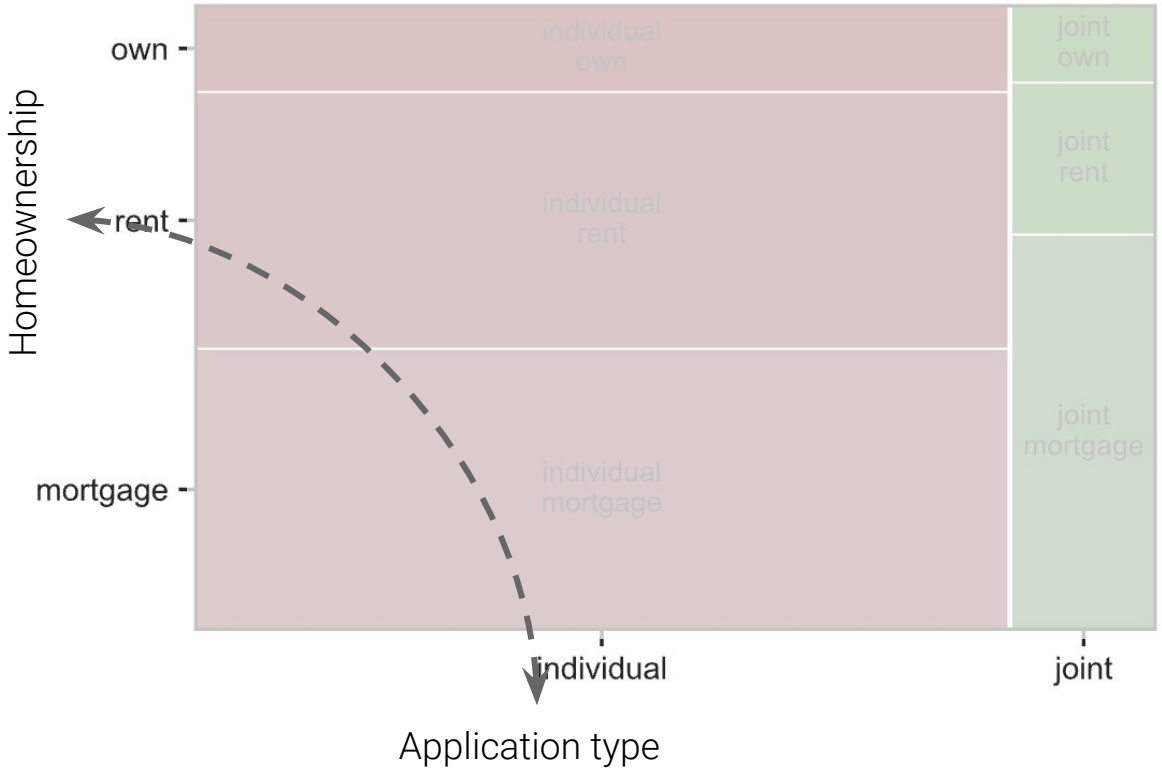
Relationship between **homeownership** and **application type**



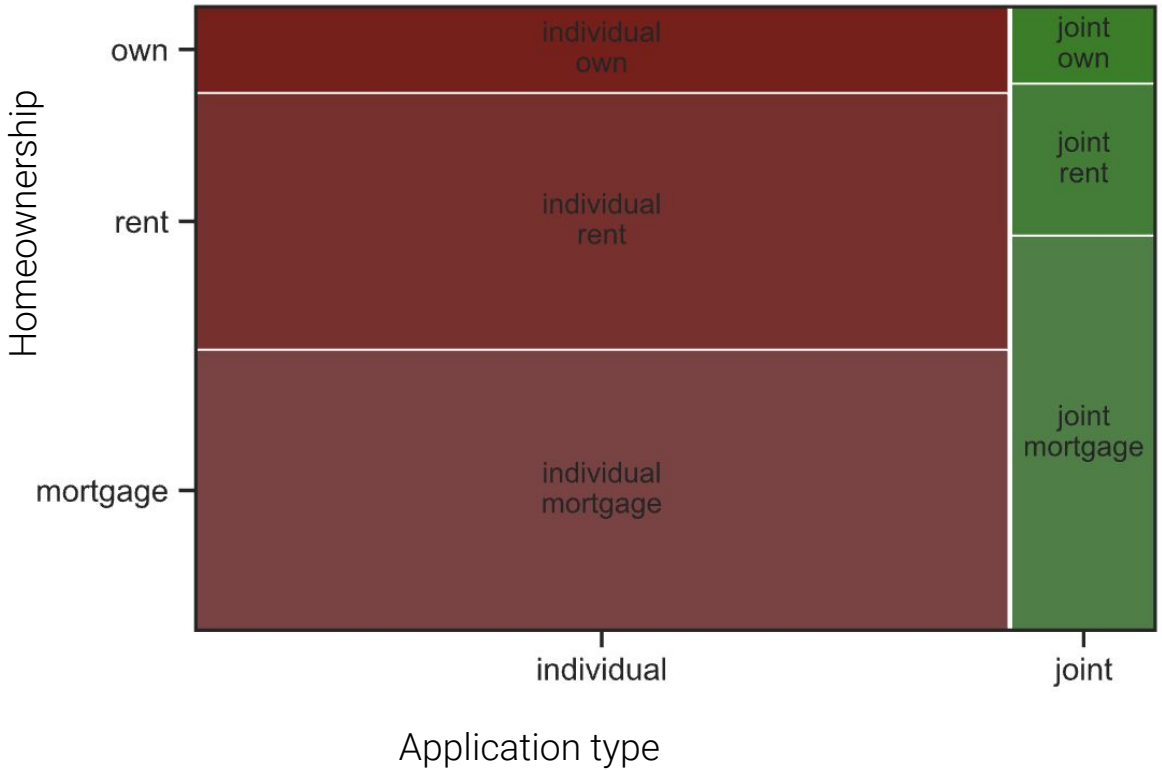
Relationship between **homeownership** and **application type**



New plot: grouped by homeownership



New plot: grouped by homeownership



Contingency table - Part II -

Table with absolute values (focus on **mortgage**)

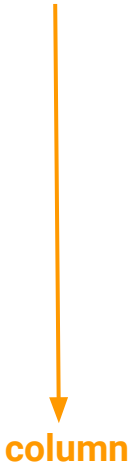
homeownership	mortgage	own	rent	All
application_type				
individual	3839	1170	3496	8505
joint	950	183	362	1495
All	4789	1353	3858	10000

Inspection of application type "**individual**" (row)

homeownership application_type	mortgage	own	rent	All
individual	3839	1170	3496	8505
joint	950	183	362	1495
All	4789	1353	3858	10000

Inspection of homeownership "**mortgage**" (column)

homeownership	mortgage	own	rent	All
application_type				
individual	3839	1170	3496	8505
joint	950	183	362	1495
All	4789	1353	3858	10000



Contingency table with proportions

Table with **row** proportions

homeownership	mortgage	own	rent	Total
application_type				
individual	0.451	0.138	0.411	1.0
joint	0.635	0.122	0.242	1.0

How many of the individual applicants **rent**?

homeownership	mortgage	own	rent
application_type			
individual	0.451	0.138	0.411
joint	0.635	0.122	0.242

Proportion of individual applicants who rent: 41.1%

Table with **column** proportions

homeownership	mortgage	own	rent
application_type			
individual	0.802	0.865	0.906
joint	0.198	0.135	0.094
Total	1.0	1.0	1.0

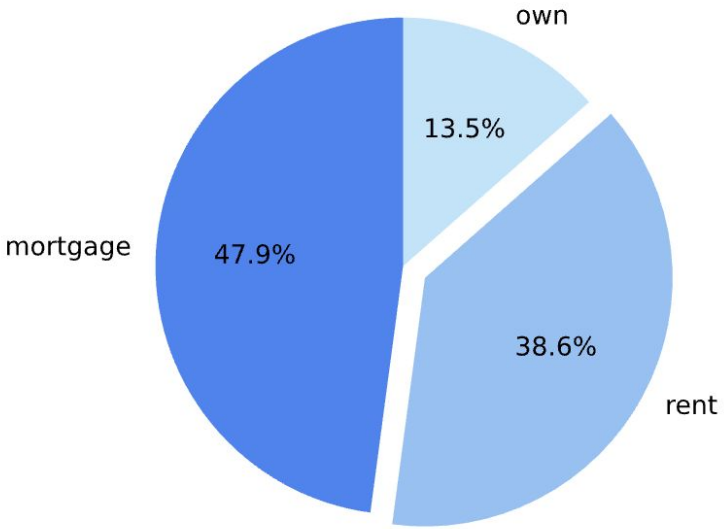
How many of the renters applied as **individuals**?

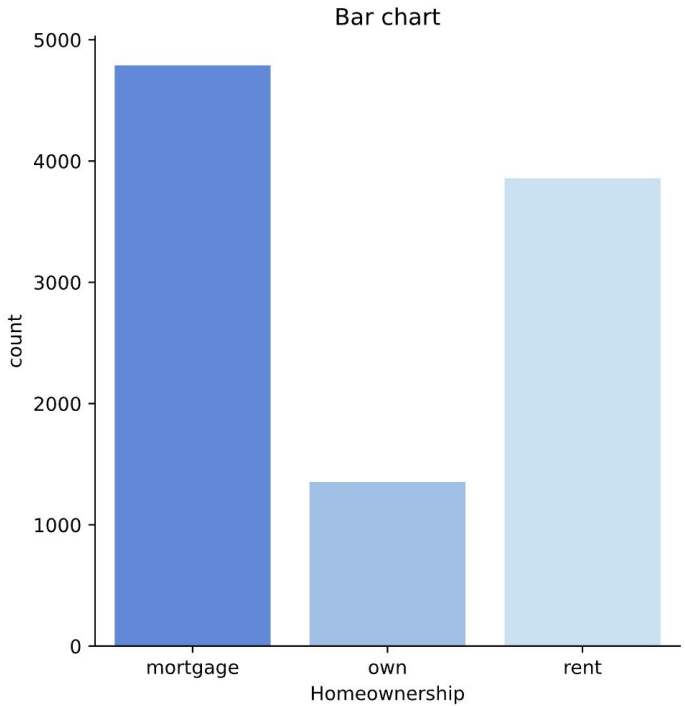
homeownership	mortgage	own	rent
application_type			
individual	0.802	0.865	0.906
joint	0.198	0.135	0.094

Proportion of renters who applied as individuals: 90.6%

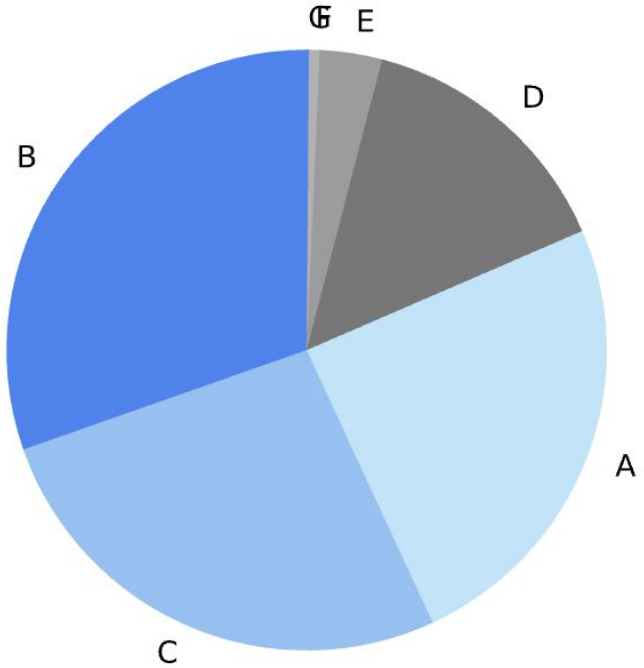
Pie charts

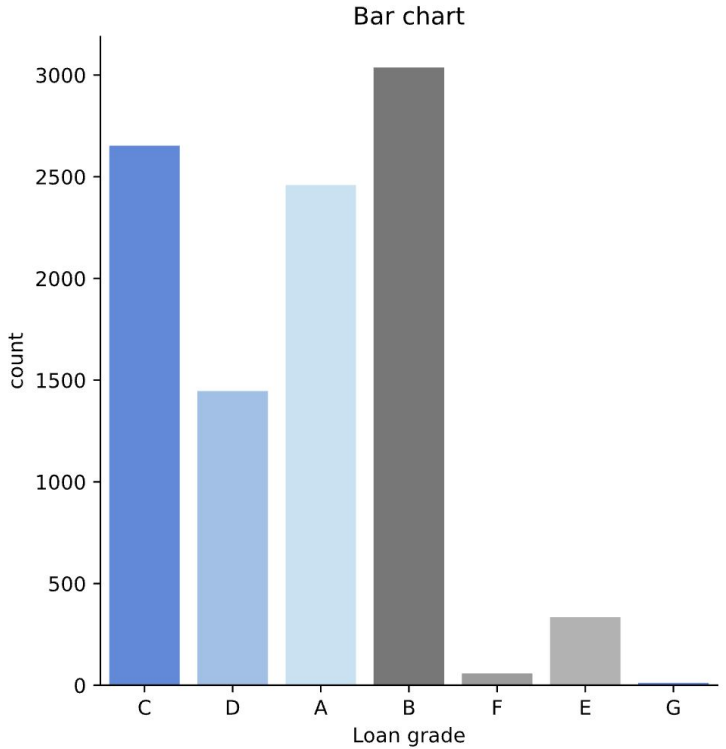
Pie chart vs bar chart





Pie chart vs bar chart

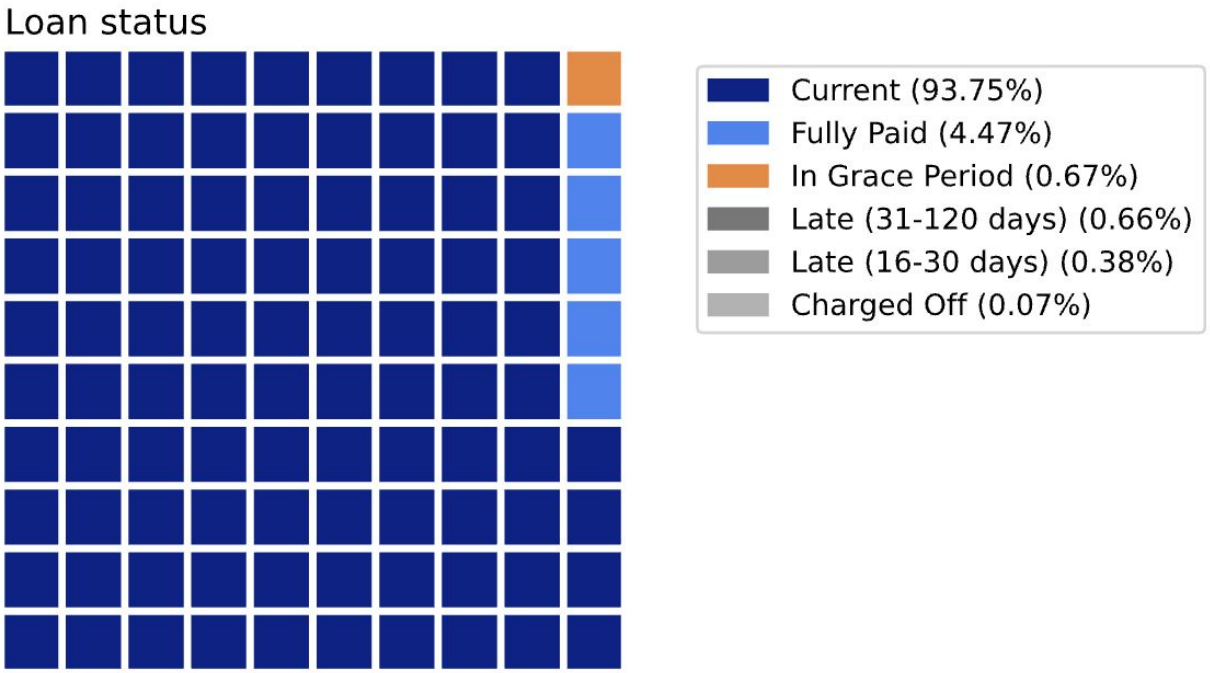




Waffle chart

Waffle chart of homeownership, with levels rent, mortgage, and own

Waffle chart of loan status, with levels current, fully paid, in grade period, and late



Resources

The slides are based on the excellent book “Introduction to Modern Statistics” by Mine Çetinkaya-Rundel and Johanna Hardin.

The online version can be **accessed for free**:

https://openintro-ims.netlify.app/explore-categorical.html