credit score

purpose :developing a credit score model **to assess credit risk and support informed loan approval decisions**

result : Provided insights into the **impact of different cutoff scores on acceptance rates, bad rates, and profitability,** enabling informed decision-making for lenders.

methodology : model

use OptBinning library in python to do all this

↓

- bin each independent variable
- calculate each bin’s information value (IV)
- calculate the log of (% of non-events / % of events) as the woe value
- replace each observation of the independent variable with the woe value
- perform WOE logistic regression on the dependent variable against the new woe dataset that has a monotonic trend in woe, and select variables based on IV
- evaluate model and create credit score

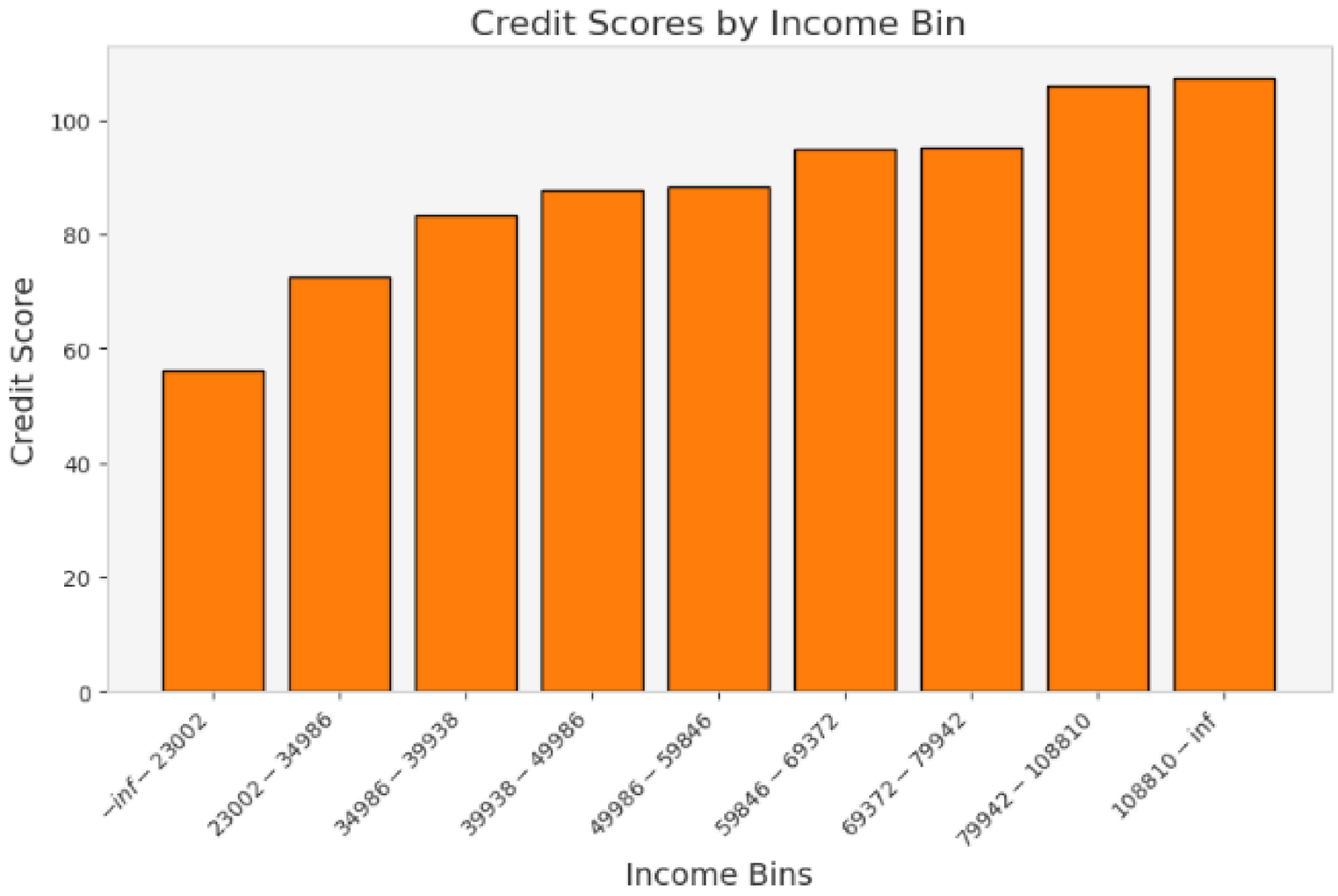
result of model

- Variable: person_income, Coefficient: -0.6266
- Variable: person_home_ownership, Coefficient: -0.8845
- Variable: person_emp_length, Coefficient: -0.2723
- Variable: loan_intent, Coefficient: -1.2654
- Variable: loan_percent_income, Coefficient: -0.9827
- Variable: cb_person_default_on_file, Coefficient: -1.1686
- auc = 0.82
- gini = 0.65

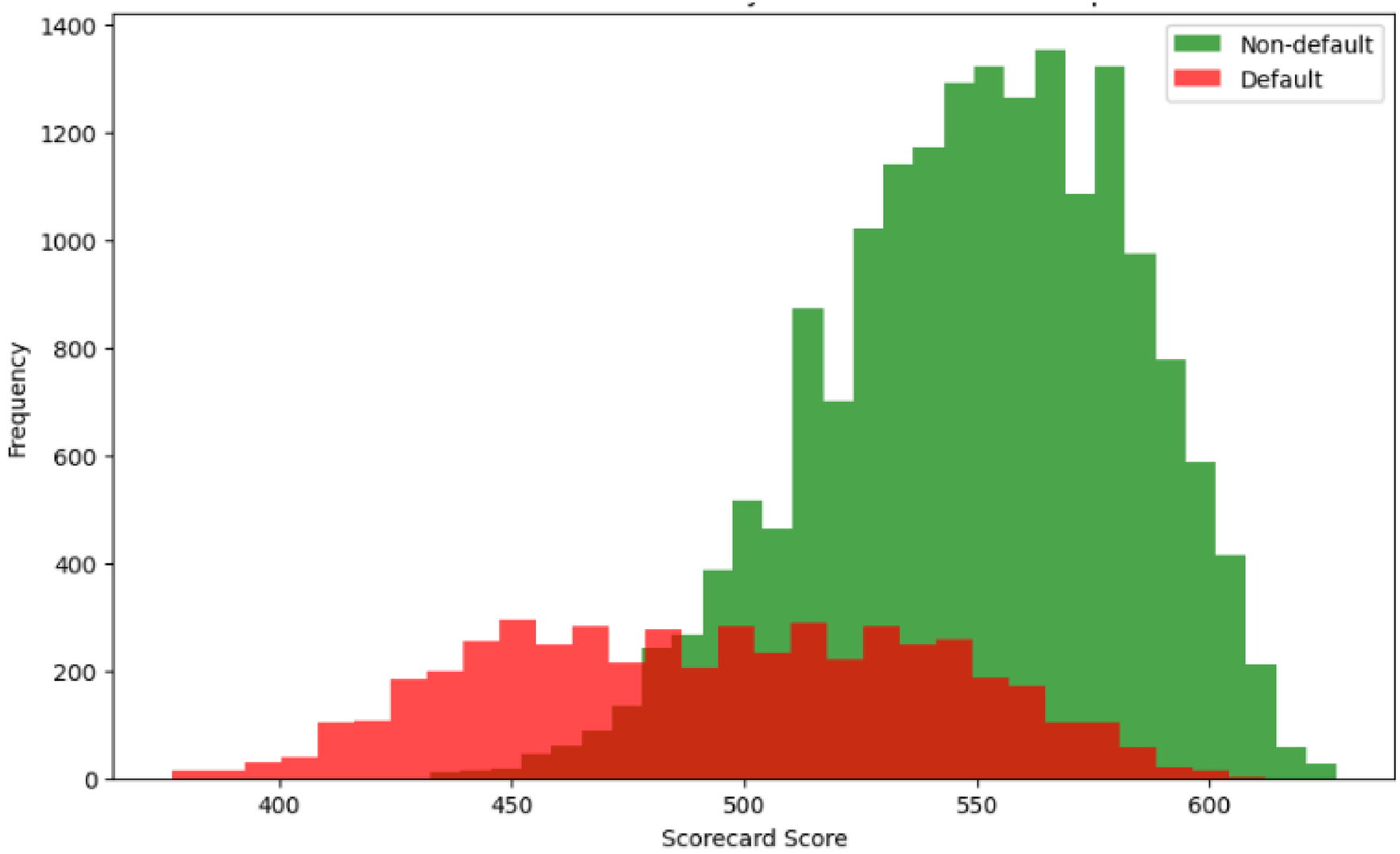
example of credit score

Higher income levels get higher score points

- **as income increases, the risk of defaulting on a loan decreases.**

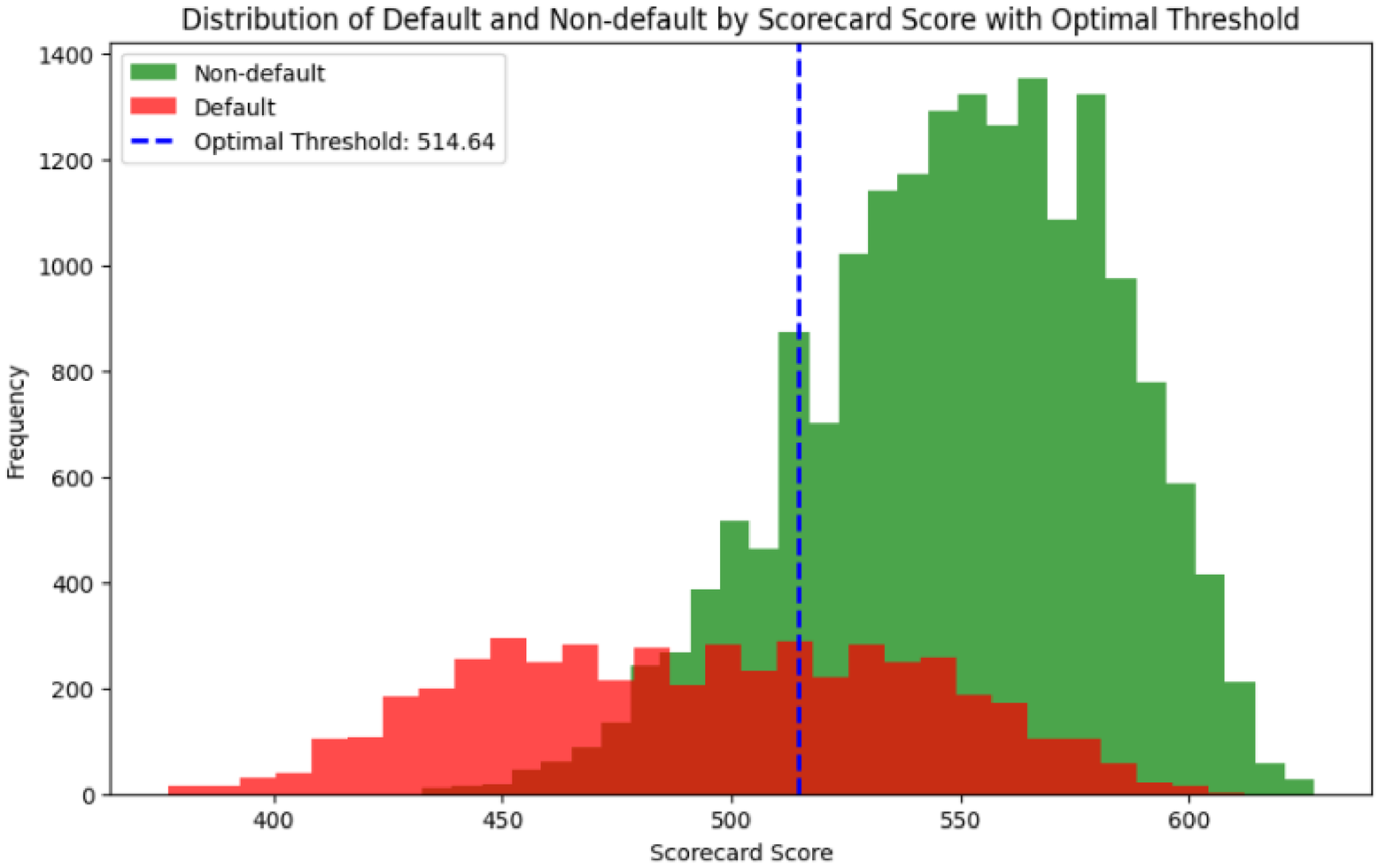


clear separation in score distributions



cut off score analyze : **1. maximizes the difference between the two distributions**

- For each score bin, calculate the difference between the percentage of defaults and non-defaults
- The score value where this **difference is largest represents the optimal cutoff point**
- At this cutoff, you **maximize the separation** between the default and non-defaul



and when we look at bad rate

	Score Threshold	Cumulative Bad Rate	Cumulative Good Rate	Acceptance Rate
0	300	21.69%	78.31%	100.00%
1	400	21.44%	78.56%	99.75%
2	500	10.01%	89.99%	81.79%
3	514	7.98%	92.02%	74.34%
4	550	2.85%	97.15%	43.43%
5	600	0.05%	99.95%	3.63%

- Cumulative Bad Rate represents **the expected default rate if all loans with scores at given threshold are approved**
- With a threshold of 514 (previously identified as optimal):
  - Strikes a balance between reasonable acceptance and manageable risk

	loan_amnt	loan_int_rate	profit_loss	loan_status
0	35000	0.16	-35000.00	1
1	1000	0.11	111.40	0
2	5500	0.13	-5500.00	1
3	35000	0.15	-35000.00	1
4	35000	0.14	-35000.00	1
...	...	...	...	...
32576	5800	0.13	763.28	0
32577	17625	0.07	1320.11	0
32578	35000	0.11	-35000.00	1
32579	15000	0.11	1722.00	0
32580	6475	0.10	646.85	0

second method : profit

- (if loan does not default) = income from 1 year interest
- (if loan defaults) = negative value of principle

	Score Threshold	Cumulative Bad Rate	Acceptance Rate	Profit
0	350.00	21.82%	100.00%	-54463425.11
1	400.00	21.57%	99.76%	-53688950.12
2	450.00	17.19%	95.22%	-35332310.50
3	500.00	10.09%	81.83%	-9381296.51
4	514.64	7.86%	73.74%	-5082928.43
5	537.00	4.62%	56.13%	-125748.83
6	538.00	4.48%	55.31%	14842.43
7	550.00	2.85%	43.50%	2292758.42
8	600.00	0.04%	3.59%	767715.67
9	650.00	0.00%	0.00%	0.00

538.0 score threshold:

- Optimizes profit at $14,842.43
- 55.31% acceptance rate

- **Prioritizes profitability and low-risk portfolio by accepting only higher-scored applications**
- **A higher threshold would further limit the acceptance rate**

strategy cut off: Prioritizes profitability and low-risk portfolio

Score Threshold	Cumulative Bad Rate	Acceptance Rate	profit
538+	4.48%	55.31%	14,842.43

This approach may be suitable in the following scenarios:

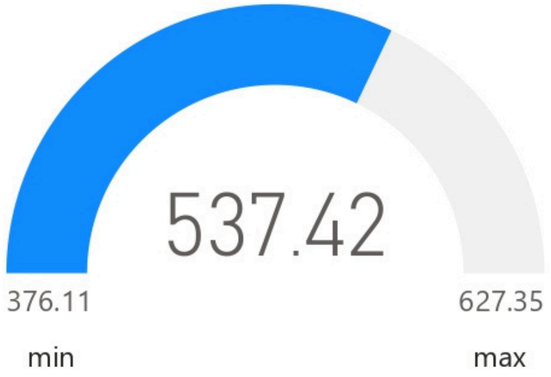
- **Economic Downturn or Recessionary Environment** lenders may adopt a more conservative stance to mitigate potential losses
- **Risk-Averse Lending Approach:** Some lenders may have a lower tolerance for risk and prefer to maintain a high-quality loan portfolio

strategy cut off: Allows higher acceptance rate than 538 threshold, but with increased risk

Score Threshold	Cumulative Bad Rate	Acceptance Rate	profit
514+	7.86%	73.74%	-5,082,928.43

This approach may be advantageous in the following situations:
Aggressive Market Expansion: If the lender operates in a highly competitive market and seeks to gain a significant market share
High Risk Tolerance: Lenders with a higher tolerance for risk may be willing to accept the potential losses

Average score

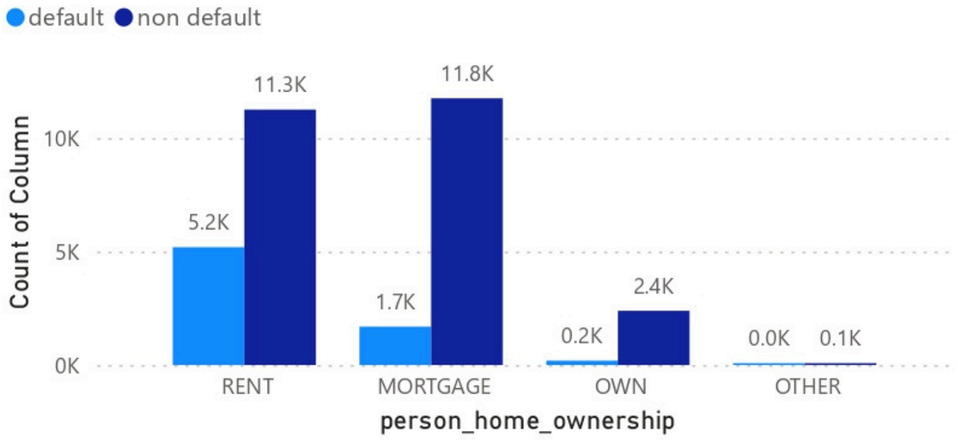


Sum of Loan Amounts

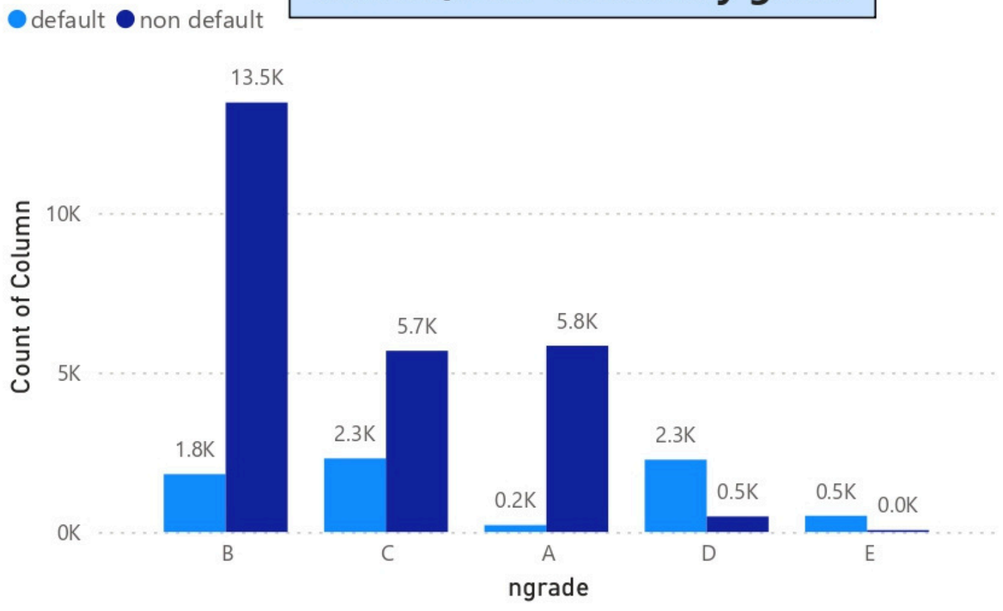
non default
235305925

default
77125375

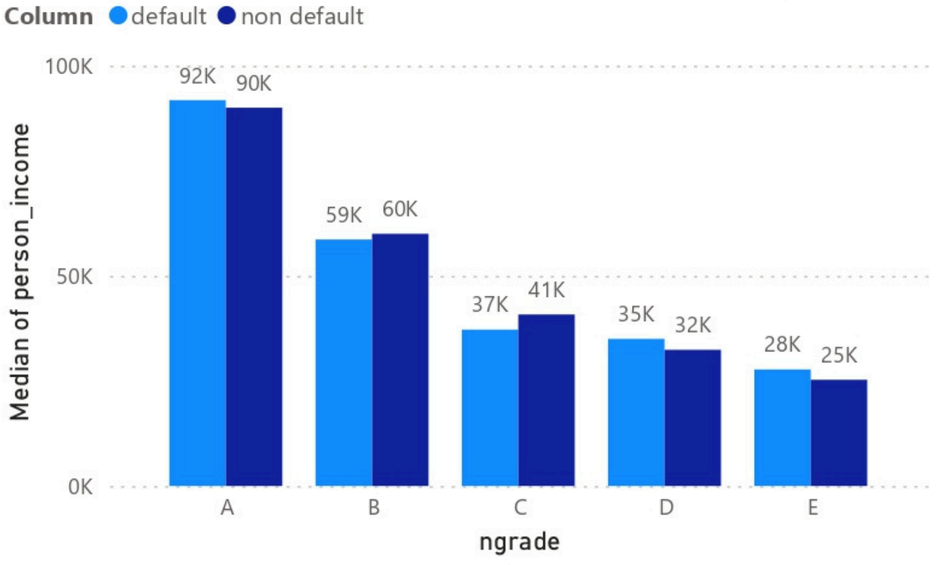
Loan Count Comparison by Purpose



default/non-default by grade



Median of person by grade



Quick measure