



# Diversity Equity Inclusion

## In Loans Dispersion

*A marketing analytic report by:*

Kali Krishanu

# Focus of Analysis

## Raw Data Overview:

	loan_id	gender	married	dependents	education	self_employed	applicant_income	co_applicant_income	loan_amount	loan_amount_term	credit_history	property_area
1	LP001015	Male	Yes	0	Graduate	0	5720	0	110	360	1	Urban
2	LP001022	Male	Yes	1	Graduate	0	3076	1500	126	360	1	Urban
3	LP001031	Male	Yes	2	Graduate	0	5000	1800	208	360	1	Urban
4	LP001035	Male	Yes	2	Graduate	0	2340	2546	100	360	NA	Urban
5	LP001051	Male	No	0	Not Graduate	0	3276	0	78	360	1	Urban
6	LP001054	Male	Yes	0	Not Graduate	0	2165	3422	152	360	1	Urban
7	LP001055	Female	No	1	Not Graduate	0	2226	0	59	360	1	Semiurban
8	LP001056	Male	Yes	2	Not Graduate	0	3881	0	147	360	0	Rural
9	LP001059	Male	Yes	2	Graduate	0	13633	0	280	240	1	Urban
10	LP001067	Male	No	0	Not Graduate	0	2400	2400	123	360	1	Semiurban
11	LP001078	Male	No	0	Not Graduate	0	3091	0	90	360	1	Urban
12	LP001082	Male	Yes	1	Graduate	0	2185	1516	162	360	1	Semiurban
13	LP001083	Male	No	0	Graduate	0	4166	0	40	180	NA	Urban
14	LP001094	Male	Yes	2	Graduate	0	12173	0	166	360	0	Semiurban
15	LP001096	Female	No	0	Graduate	0	4666	0	124	360	1	Semiurban
16	LP001099	Male	No	1	Graduate	0	5667	0	131	360	1	Urban
17	LP001105	Male	Yes	2	Graduate	0	4583	2916	200	360	1	Urban
18	LP001107	Male	Yes	0	Graduate	0	3786	333	126	360	1	Semiurban
19	LP001108	Male	Yes	0	Graduate	0	9226	7916	300	360	1	Urban
20	LP001115	Male	No	0	Graduate	0	1300	3470	100	180	1	Semiurban
21	LP001121	Male	Yes	1	Not Graduate	0	1888	1620	48	360	1	Urban
22	LP001124	Female	No	0	Not Graduate	0	2083	0	28	180	1	Urban
23	LP001128	NA	No	0	Graduate	0	3909	0	101	360	1	Urban
24	LP001135	Female	No	0	Not Graduate	0	3765	0	125	360	1	Urban
25	LP001149	Male	Yes	0	Graduate	0	5400	4380	290	360	1	Urban
26	LP001153	Male	No	0	Graduate	0	0	24000	148	360	0	Rural
27	LP001163	Male	Yes	2	Graduate	0	4363	1250	140	360	NA	Urban

Showing 1 to 28 of 367 entries, 12 total columns

Key DEI Indicators Based on Scope: **Gender** : Property Area, Education, Marriage, Dependents

# Cleaned Raw Data:

## Understanding of Analysis

	loan_id	gender	married	dependents	education	applicant_income	co_applicant_income	loan_amount	loan_amount_term	credit_history	property_area
1	LP001015	Male	Yes	0	Graduate	5720	0	110	360.0	1.0	Urban
2	LP001022	Male	Yes	1	Graduate	3076	1500	126	360.0	1.0	Urban
3	LP001031	Male	Yes	2	Graduate	5000	1800	208	360.0	1.0	Urban
4	LP001035	Male	Yes	2	Graduate	2340	2546	100	360.0	unavailable	Urban
5	LP001051	Male	No	0	Not Graduate	3276	0	78	360.0	1.0	Urban
6	LP001054	Male	Yes	0	Not Graduate	2165	3422	152	360.0	1.0	Urban
7	LP001055	Female	No	1	Not Graduate	2226	0	59	360.0	1.0	Semiurban
8	LP001056	Male	Yes	2	Not Graduate	3881	0	147	360.0	0.0	Rural
9	LP001059	Male	Yes	2	Graduate	13633	0	280	240.0	1.0	Urban
10	LP001067	Male	No	0	Not Graduate	2400	2400	123	360.0	1.0	Semiurban

- **Gender: No reporting = Unknown**
- **Dependents[0] = No dependents**
- **Co Applicant Income: Unclear Data Reporting (is it monthly income?)**
- **Credit history: 1 = Passed, 0 = Failed, No Reporting = unavailable**

**\*Note Quality of data collected affects the quality of insights**

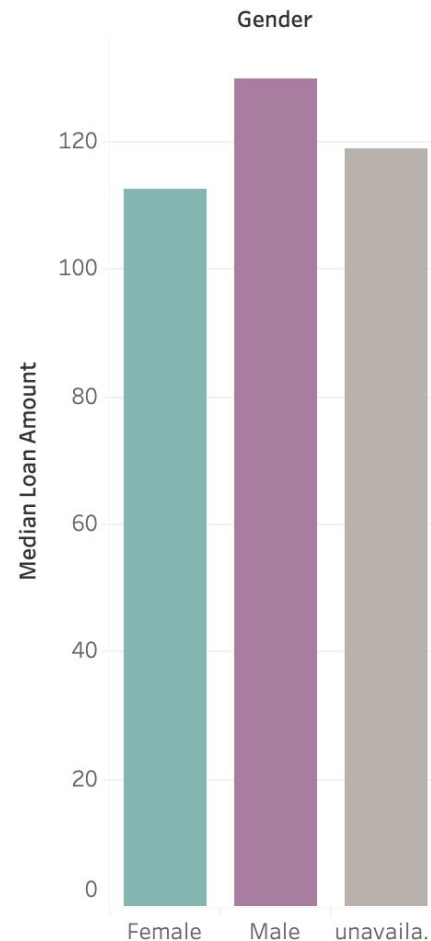
# Key Indicators

Gender: Male  
Median Loan Amount: 130.00

Gender: Female  
Median Loan Amount: 112.50

- **The median loan amount for men was 15% higher than women**

Gender/Education/LoanAmt



# How it compares to other data

**RESEARCH REPORT:** Women Are Better than Men at Paying Their Mortgages Laurie Goodman Jun Zhu Bing Bai September 2016

## The Urban Institute:

<https://www.urban.org/sites/default/files/publication/84206/2000930-Women-Are-Better-Than-Men-At-Paying-Their-Mortgages.pdf>

- Public data analyzed by the urban institute on loan origination collected by Home Mortgage Disclosure Act (HMDA), found that the median loan size difference between men and women was 13% with a 700 Fico score.

\*factors to consider. This data is 12 years old. We could not adequately compare our data against the FICO score

Category	FICO score	LTV	DTI	Loan size (\$000s)	Income (\$000s)	Loan size/ income
<b>Full sample</b>						
Female only	711	75.07	33.25	176.41	69.22	2.91
Male only	712	77.63	33.11	202.94	94.72	2.66
Male-female	725	74.43	32.96	227.60	119.48	2.26
Female-male	718	75.86	33.29	213.24	110.23	2.25
Female-female	714	76.35	33.73	210.11	105.92	2.39
Male-male	717	77.37	33.27	230.42	151.38	2.11
<b>All</b>	<b>718</b>	<b>75.64</b>	<b>33.10</b>	<b>208.33</b>	<b>101.18</b>	<b>2.52</b>
<b>2004-07</b>						
Female only	684	74.35	30.70	181.96	69.74	2.90
Male only	686	76.20	30.44	203.58	93.91	2.64
Male-female	694	74.38	30.27	220.53	108.48	2.35
Female-male	686	75.48	30.74	207.82	99.72	2.35
Female-female	686	75.18	30.85	205.47	98.15	2.44
Male-male	694	76.31	29.98	226.12	149.32	2.11
<b>All</b>	<b>688</b>	<b>75.04</b>	<b>30.46</b>	<b>205.18</b>	<b>94.68</b>	<b>2.57</b>
<b>2008-10</b>						
Female only	732	73.98	36.08	170.29	66.23	2.95
Male only	731	76.82	36.11	197.65	91.51	2.74
Male-female	743	72.13	34.88	229.41	122.61	2.27
Female-male	735	74.33	35.55	215.78	113.17	2.26
Female-female	727	76.30	36.72	212.08	107.38	2.40
Male-male	729	77.64	36.75	228.56	145.86	2.16
<b>All</b>	<b>737</b>	<b>74.00</b>	<b>35.53</b>	<b>208.25</b>	<b>102.75</b>	<b>2.53</b>
<b>2011-14</b>						
Female only	741	76.82	36.19	171.24	70.16	2.89
Male only	739	80.08	35.94	204.89	97.67	2.65
Male-female	748	75.83	35.07	234.17	129.75	2.17
Female-male	744	77.19	35.34	218.17	121.34	2.13
Female-female	741	77.92	36.16	215.00	115.44	2.30
Male-male	742	78.68	36.34	237.75	157.96	2.08
<b>All</b>	<b>744</b>	<b>77.35</b>	<b>35.57</b>	<b>212.43</b>	<b>108.72</b>	<b>2.44</b>

# Key Indicators

Education: Graduate  
Gender: Male  
Median Loan Amount: 131.50

Education: Graduate  
Gender: Female  
Median Loan Amount: 110.00

Education: Not Graduate  
Gender: Female  
Median Loan Amount: 117.00

Education: Not Graduate  
Gender: Male  
Median Loan Amount: 122.00

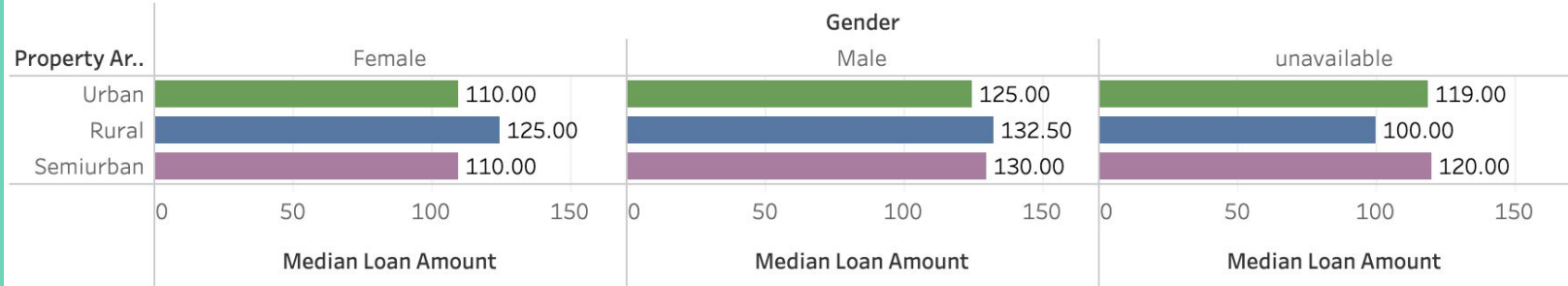
- The median loan amount for men with were a graduate degree was 18% higher than women who were a graduate
- The median loan amount for men who were not a graduate was 4% higher than women with who was not a graduate

## Gender/Education/LoanAmt



# Key Indicators

Gender/PropertyArea/LoanAmount



- The median loan amount for men in Urban areas was 13% higher than women in urban areas

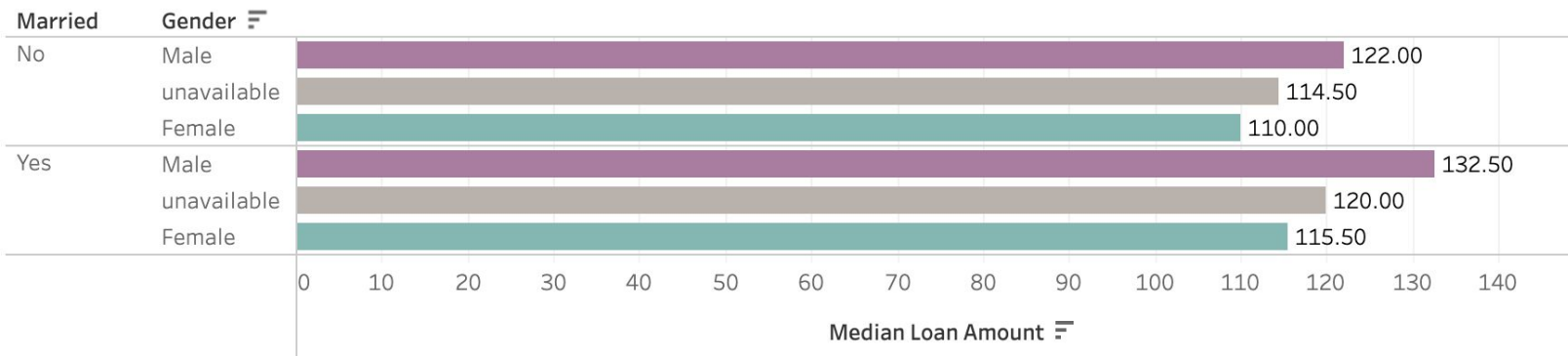
- The median loan amount for men in Rural areas was 5% higher than women in rural areas

- The median loan amount for men in semi-urban areas was 17% higher than women in semi-urban areas

**Men were more likely to receive a higher loan amount than women for homes in semi-urban areas**

# Key Indicators

## Gender/Married/LoanAmt



- The median loan amount for unmarried men was 10% higher than unmarried women
- The median loan amount for married men was 13% higher than married women



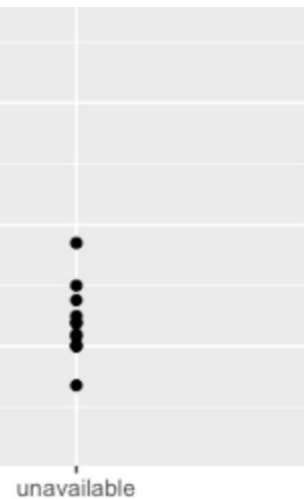
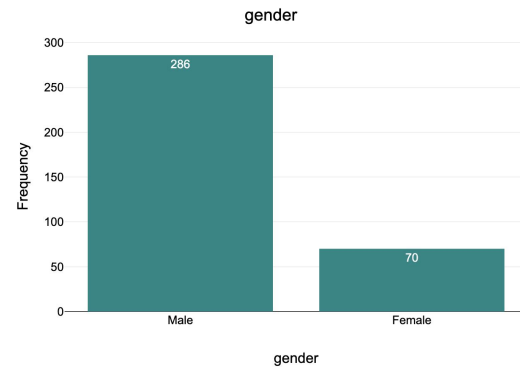
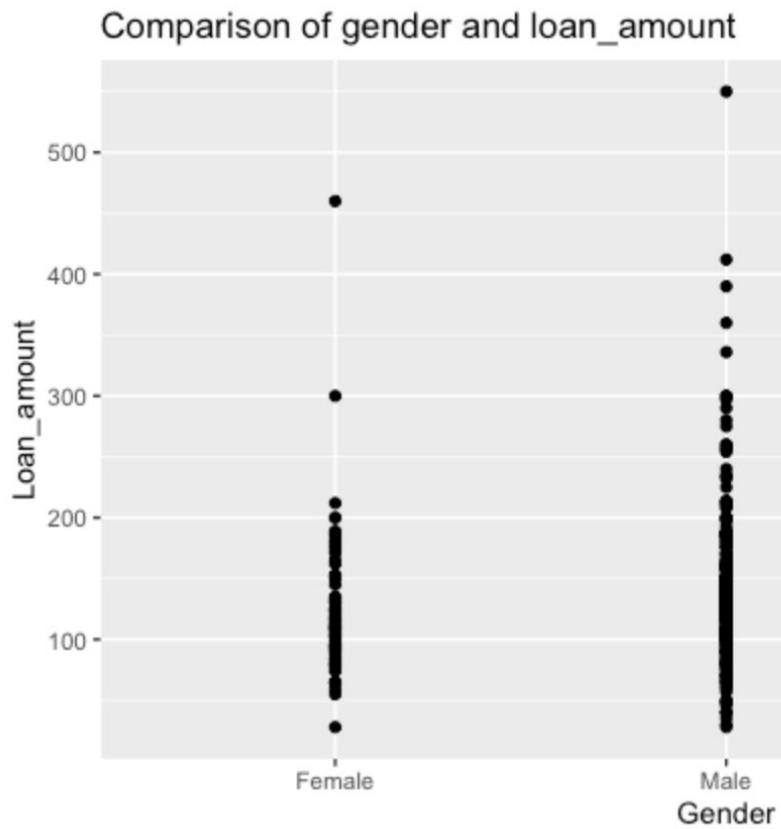
## Null Hypothesis:

- There is no statistical significant interaction between the two variables gender and dependents in relation to the dependent variable loan\_amount.

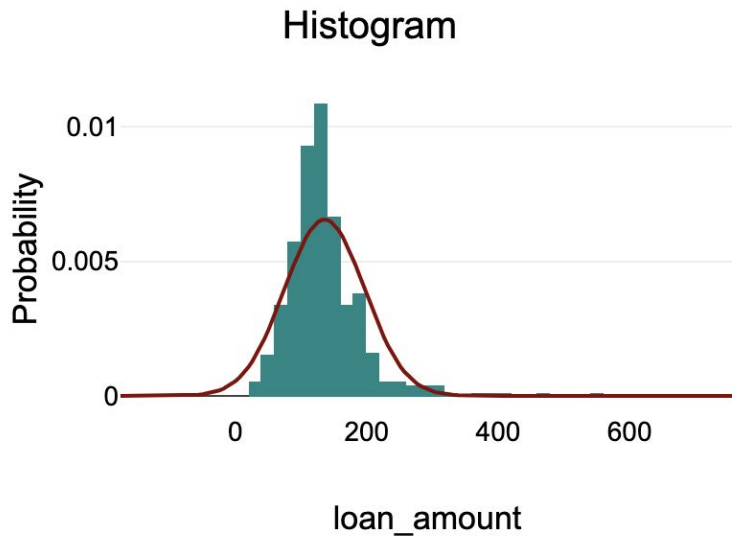
## Alternative Hypothesis:

- There is a significant interaction between the two variables gender and dependents in relation to the dependent variable loan\_amount.

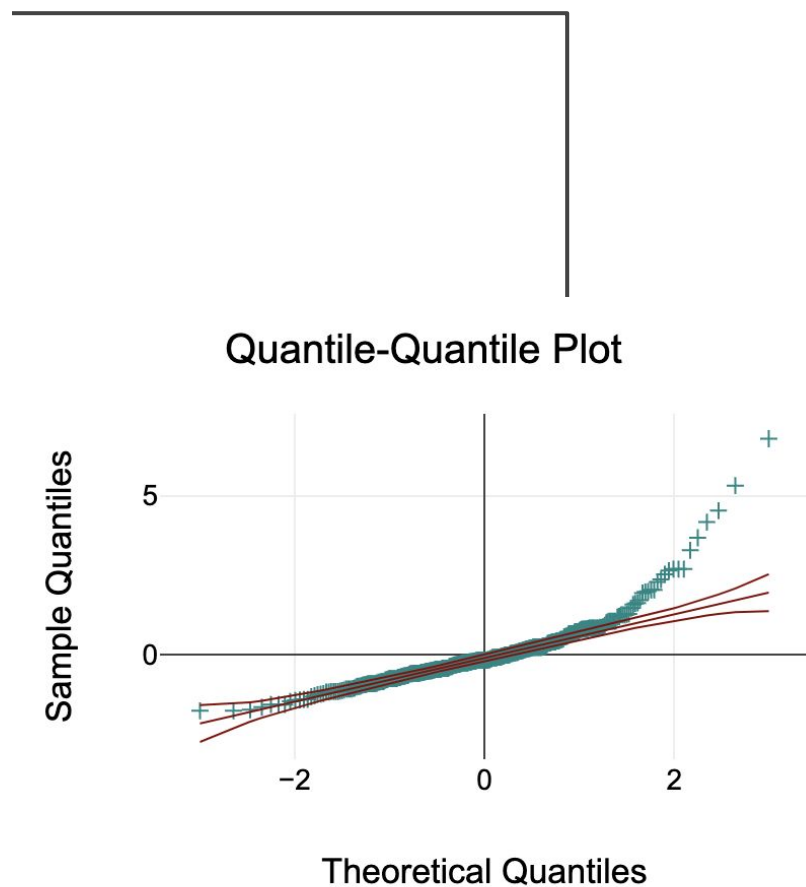
# Further Findings



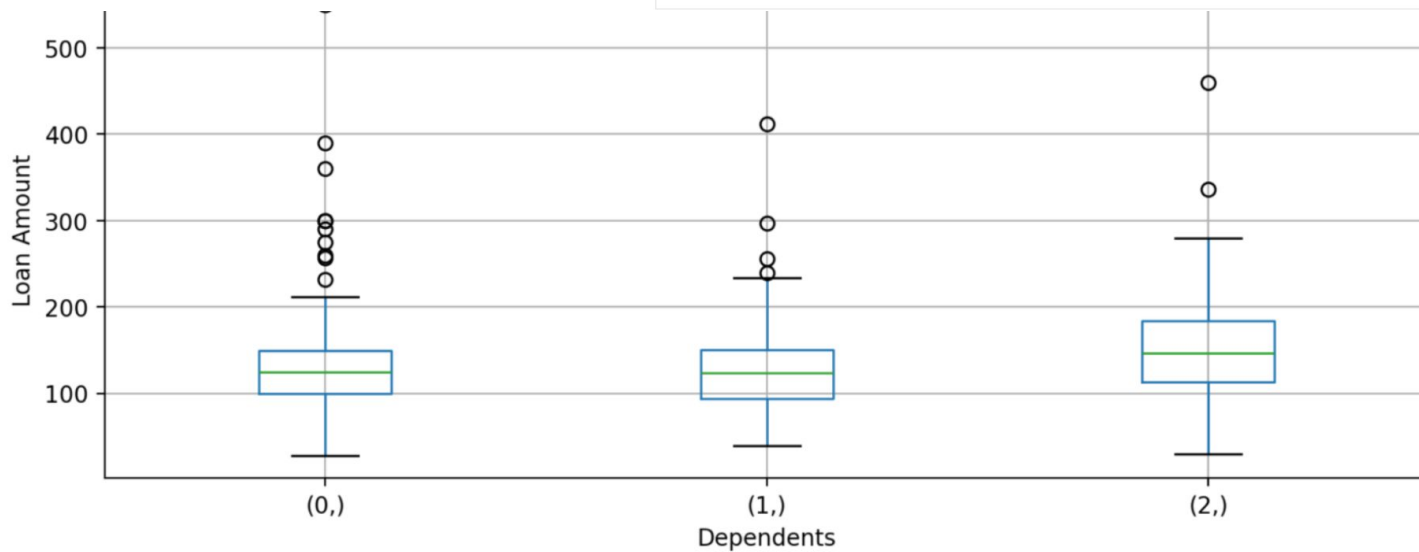
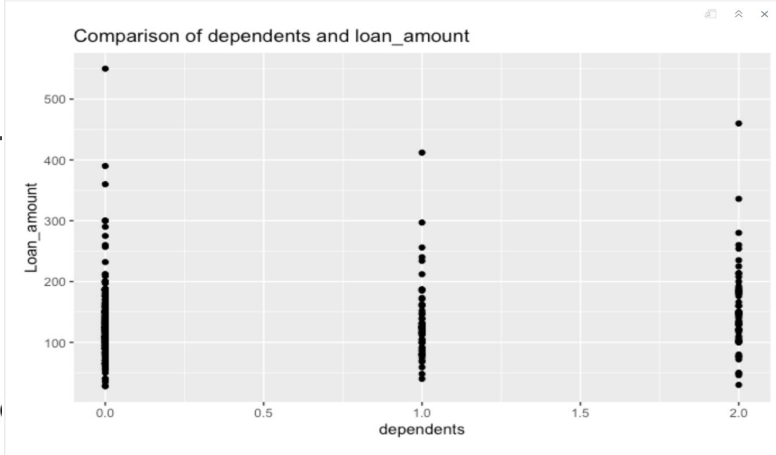
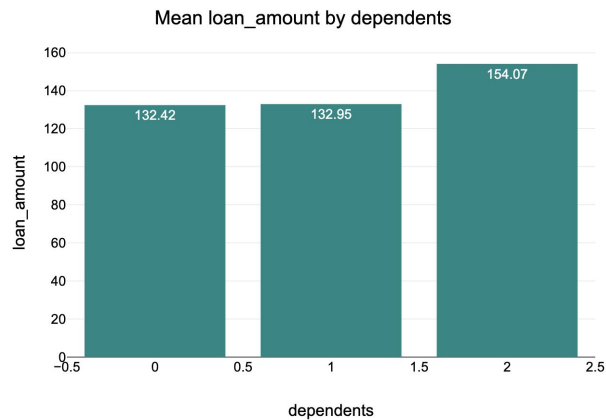
# Further Findings



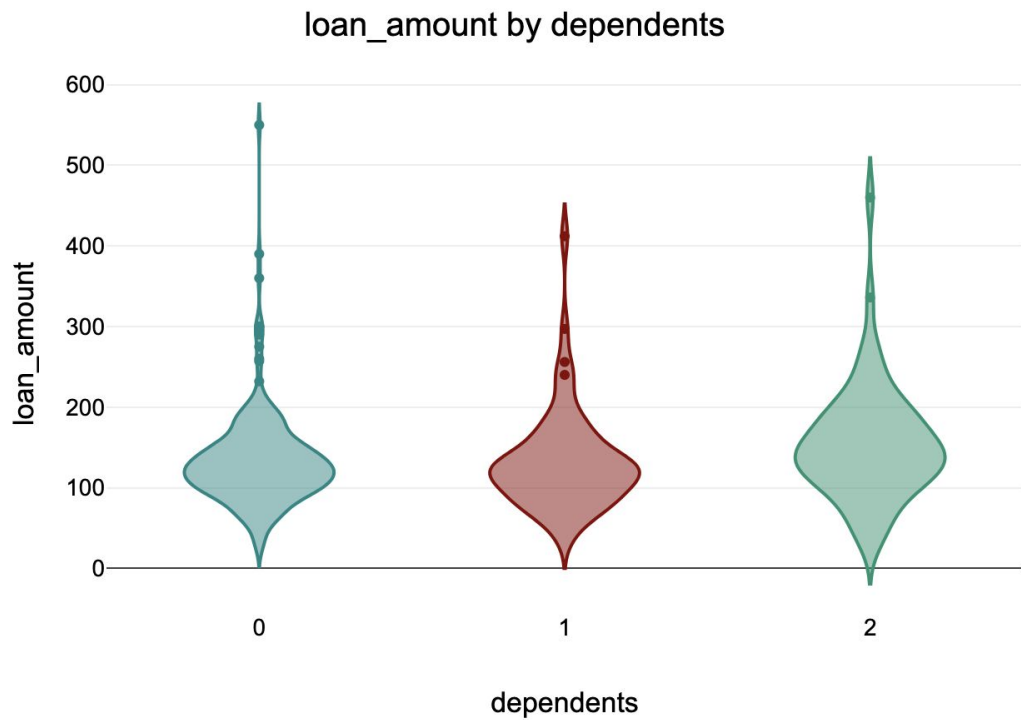
**Normal Distribution**



# Further Findings

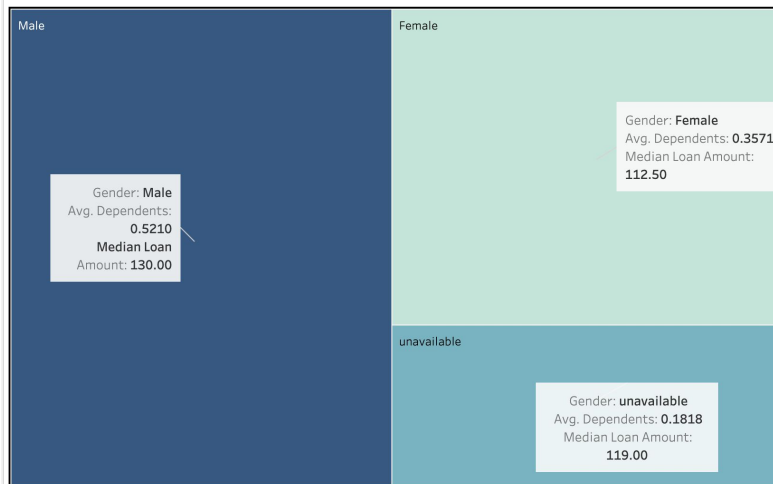


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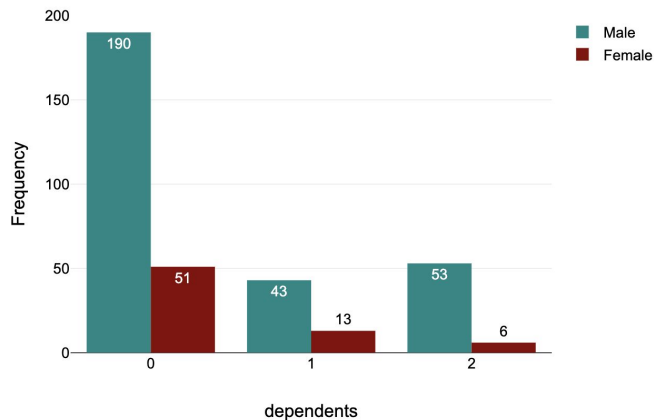


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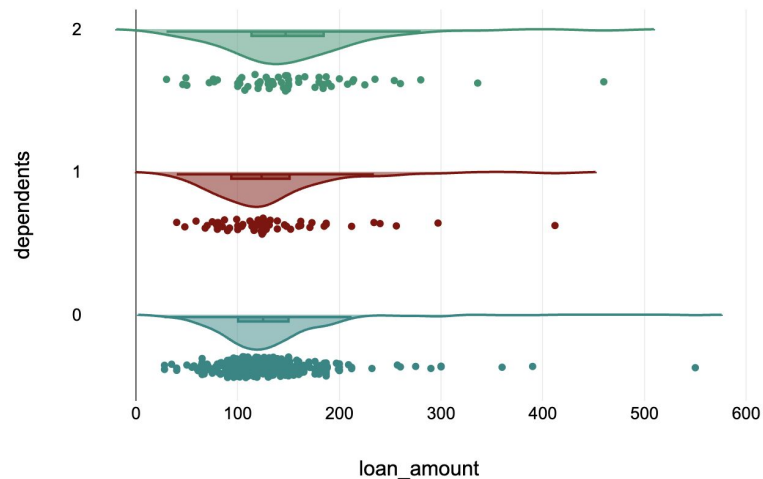
Gender/Dependents/LoanAmount



gender by dependents



loan\_amount nach dependents



## Conclusion

## Statistical Testing

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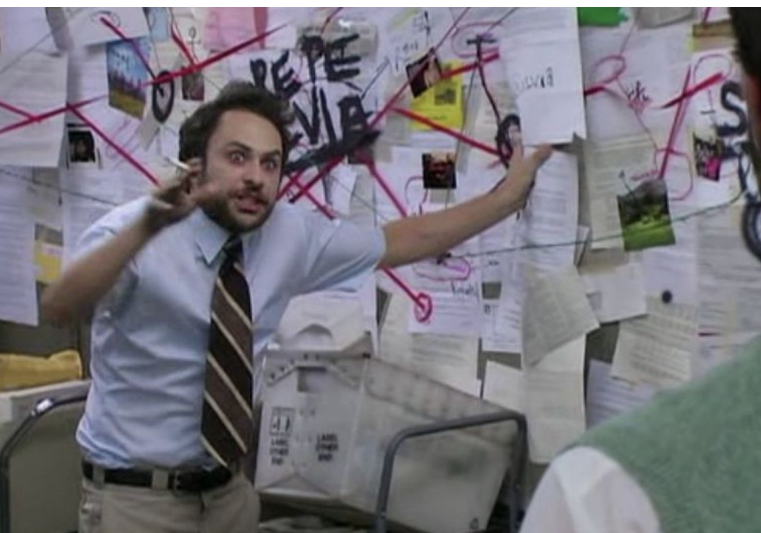
```
t.test(df_overview4['dependents'], df_overview4['loan_amount'])
```

Welch Two Sample t-test

```
data: df_overview4["dependents"] and df_overview4["loan_amount"]
t = -42.579, df = 366.11, p-value < 2.2e-16
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -141.7593 -129.2434
sample estimates:
mean of x  mean of y
 0.479564 135.980926
```

### Interpretation:

The p-value < 2.2e-16, is scientific notation for the equivalent of  $p < .000000000000000016$ . Therefore, we can conclude that there is a significant (positive) relationship between dependents, and loan amount dispersion.



## In conclusion:

When comparing loan amount to gender in the domains of **Property Area, Education, Marriage, Dependents** men obtained larger mortgage loans to purchase homes.

Men had more dependents than women and received a higher loan amount.



# THANKS!



