Effects of Environmental Qualities on Housing Rent in the USA

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INTRODUCTION

The paper analyzes the impact of environmental qualities on housing rent. The environmental characteristics of interest are whether or not neighborhood is polluted (represented by having trash and litter), having good schools, having good public transportation system, and having petty crime. The paper also examines the impact of gender and household income on housing rent. Specifically, it looks at whether or not women having higher income will pay higher rent.

The paper uses data from American Housing Survey from ICPSR. The time period of the survey is 2015. The survey covers residents living in different Metropolitan Statistical Areas (MSAs) in the United States.

The hypothesis is that neighborhoods having trash and having high rate of petty crime will have lower monthly house rent amount compared with neighborhoods not having trash or litter. Neighborhoods having good schools and good public transportation system will have higher monthly house rent amount compared with neighborhoods not having good schools and good public transportation system. Also, the expectation is that women having higher income are more likely to pay higher monthly rent amount.

The policy implication of this paper is that determining the impacts of environmental qualities on housing rent can establish grounds for environment and urban planning policies. The results can also provide information to buyers and sellers about how those factors can affect housing prices.

LITERATURE REVIEW

Bourassa et al. (2001) purport that there exists a positive relationship between housing prices and rent. Therefore, we can use previous literature results analyzing the relationship between different factors and housing prices to support our analysis of the influence of those factors on housing rent.

However, under some circumstances, that relationship might not hold. For instance, under income constraints, potential house buyers are more likely to assess the difference between housing prices and rent (Lin et al. 2014). If renting a house leads to higher housing costs, purchasing a house becomes a more reasonable option. In addition, house purchase demands might increase if the increase in rental income results from purchasing a house.

According to Lin et al. (2014), environmental qualities may affect housing prices in different ways. First, the rate of violent crimes may negatively affect housing prices. Increasing in crime rates may trigger migration of inhabitants, leading to a significant decline in demand. Second, an increase in transportation time to the central business district and to work may negatively influence housing prices. Lin et al., (2014) state that as central business district (CBD) is considered the place of employment of majority of people, the distance between home and CBD would be a determinant of purchasing or renting decisions. Thirdly, Lin et al., (2014) purport that air pollution also affects housing prices as this damages people's health. Therefore, housing prices normally decline in areas with higher level of pollution.

Lin et al. (2014) used median housing prices from 363 metropolitan statistical areas (MSAs) in the USA as the dependent variable. The indicator of (petty) crime level is the number of burglaries, motor vehicle theft, and larceny-theft in each MSA. For air quality, the indicator is a six-level index ranging from 1 to 6, where 1 indicates “good” and 6 indicates “hazardous”. For commute time, the indicator is average time required for most residents to commute from their home to their workplace in each MSA. The results show that crime rate has the most significant impact on housing price, followed by air quality and commute time respectively. However, the coefficients of those independent variables are not statistically significant at $p = 0.05$.

In terms of gender, income, and house price, Ruel and Hauser (2012) purport that generally, there is a wealth gap between male and female, which women are more disadvantageous. However, the wealth gap varies based on different factors, such as marital status and education level. Ozawa and Lee (2006) also state that female-headed households are more economically disadvantaged in accumulating net worth. Lin et al. (2014) make a connection between gender and median housing price. On average, compared to women, men pay lower housing price. However, there is no clear link whether or not women having higher income will pay higher monthly rent compared to men.

DATA

The data used in the paper is the American Housing Survey from ICPSR. The purpose of the survey is to provide current and continuous series of data on selected demographic and housing characteristics. The survey has been conducted annually between 1973 and 1981 and biennially

from 1983 onward. The time period of analysis that this survey uses is 2015. This is acknowledged as a limitation of the sample used for this paper as we cannot capture yearly fixed effects.

The geographic area from which the sample is taken is United States, based on Metropolitan Statistical Areas (MSAs) as smallest geographic unit. This survey was asked of a randomly selected sub-sample in occupied-unit interviews. The observation level of the data is individuals (residents). The ICPSR number of the data file is 37236.

Table 1 here

The variables of interest are monthly rent amount, whether or not there is trash or litter in streets, lots, or properties within ½ block, whether neighborhood has good schools, whether neighborhood has god bus, subway, or commuter train service, whether neighborhood has a lot of petty crime, controlling other demographic variables (age, sex, race, education level, household income, and marital status of householders).

There are a few restrictions performed to acquire the sample for regression. First, other irrelevant variables in the data set are dropped. Secondly, values missing monthly rent amount are dropped. Thirdly, independent variables containing value "Not Reported" are also dropped. Finally, missing values in demographics variables also reduce the sample size. The final sample size is 9,827.

Table 2 here

From the Table 2 – Summary Statistics, within the final sample size, we can see that the mean of monthly house rent is approximately USD $950, with the min is $4 and the max is $10,600.

Because the variables TRASH, SCHOOL, TRANSPORT, and CRIME are binary variables, they range from 0 to 1. On average, 13% of respondents say that there is trash (include both small and large amount) near their neighborhood. On average, 87% of respondents agree that there is good school near their living area. On average, there are 65% of respondents say that they can have good access to nearby public transportation. On average, 27% respond that there is petty crime near their neighborhood. The range of respondents' household income is wide, ranging from $0 to $1,699,000 per year. The mean of household income in this sample is $46,401 per year. There are 56% of sample are women.

Figure 1 here

From Figure 1, we can observe that the distribution of monthly house rent amount is right skewed. There are a few outliers bigger than $4,000.

Figure 2 here

From Figure 2, we visualize the relationship between monthly rent amount and whether or not the householders live in areas having trash through an overlay histogram. We can observe that the distributions of monthly rent amount of two groups are quite similar, with the mean around $1,000. However, the number of renters in "No trash" group paying around $1,500 to $2,000 is much higher than the number of renters in "Trash" group paying the same monthly rent amount.

Figure 3 here

From Figure 3, the overlay histogram shows that there is no significant difference between the distribution of monthly rent amount between the "Good School" group and the "No Good School" group. Therefore, it is important to examine further to understand the impact of living near good schools and monthly rent.

Figure 4 here

Similarly, from Figure 4, we cannot see significant difference in distribution of monthly rent between the "Good Public Transport" group and the "No Good Public Transport" group. We will further examine in the next section to find the impact of living in areas having good public transportation on monthly rent.

Figure 5 here

We can see a clear difference in monthly rent distribution between the "Has Crime" group and the "No Crime" group. There are more people from the "No Crime" group paying more than $1,000 monthly rent than people from the "Has Crime" group.

Figure 6 here

Comparing monthly rent amount between female and male, we can observe that male householders pay higher than female ones. We will see whether or not female householders will pay higher monthly rent than male ones when interacting with income.

MODEL

We use the following multivariate regression model. The key independent variables of interest are TRASH, SCHOOL, TRANSPORT, CRIME, and LOGINCOME_GENDER.

$$LOGRENT_i = \beta_0 + \beta_1 \cdot TRASH_i + \beta_2 \cdot SCHOOL_i + \beta_3 \cdot TRANSPORT_i + \beta_4 \cdot CRIME_i + \beta_5 \cdot LOGINCOME_i + \beta_6 \cdot GENDER_i + \beta_7 \cdot LOGINCOME\_GENDER_i + \beta_8 \cdot X_i + \epsilon_i$$

LOGRENT is a vector of dependent variable that includes log transformation of monthly house rent amount. TRASH is vector of binary independent variable, including the value 1 if the answer says that there is trash or litter in the neighborhood and the value 0 if the answer says that there is no trash in the neighborhood. SCHOOL includes the value 1 if the answer says that there is good school near the neighborhood and the value 0 if there is not any good school in the surrounding area. TRANSPORT includes the value 1 if the answer says that there is good public transportation around the householder' area and the value 0 if there is not good public transportation. CRIME includes the value 1 if the answer says that there is petty crime in the neighborhood and the value 0 otherwise. LOGINCOME is the vector of independent variable that includes the log transformation of household income (measured by USD in the past 12 months). GENDER has the value 1 if householder is Female and the value 0 if householder is Male. The interaction term LOGINCOME_GENDER is to see whether female householders having higher household income are more likely to have higher monthly rent amount or not. X is a vector of controls, including demographics information about householders' marital status, education level, age, and race.

The expected sign for β_{TRASH} is negative. The hypothesis is that living in a house near areas having trash or litter will prevent householders from renting decisions, thus decreasing the monthly rent amount. The expected sign for β_{SCHOOL} is positive. Living in a neighborhood having good schools should raise demands, making monthly house rent increase. The expected sign for $\beta_{TRANSPORT}$ is positive, as having easy access to public transportation saves more commute time and is more convenient for householders; therefore, householders are more willing to pay higher rent. The

expected sign for β_{CRIME} is negative. Living in areas with higher crime rate will make householders feel unsafe. Householders will be less likely to pay high rent in such circumstance. The expected sign for $\beta_{LOGINCOME\_GENDER}$ is positive. We expect that female householders earning higher income are more likely to pay higher house rent. All coefficients are expected to have statistical significance at p-value < 0.01.

RESULTS

Table 3 here

From the regression results, we can observe that on average, holding other variables constant, living in neighborhood that has trash, litter, or junk in streets, lots, or properties within ½ block will decrease monthly house rent by 5.00% (calculated by $100 \cdot \left[e^{\beta_{TRASH}} - 1\right]\%$). However, we can conclude that living in neighborhood that has trash does not matter for monthly house rent as the p-value is 0.078. This is also not economically significant with η_{TRASH} = -0.0500.

On average, holding other variables constant, living in area having good schools increases monthly house rent by 5.70% (calculated by $100 \cdot \left[e^{\beta_{SCHOOL}} - 1\right]\%$). This is what we expected. However, the impact is unclear as the p-value is 0.042. This is also not economically significant with η_{SCHOOL} = -0.0570.

The impact of living in areas having good public transportation system is clear and significant. On average, holding other variables constant, living in neighborhood that has good bus, subway, or commuter train service increases monthly house rent by 18.05% (calculated by 100 ·

$\left[e^{\beta_{TRANSPORT}} - 1\right]\%$). The p-value is much smaller than 0.001. The result is also what we expected. Comparing with the economic significance level of 0.2, even very closed, this can be considered not economically significant with $\eta_{TRANSPORT}$ = 0.1805.

Living in areas having petty crime does negatively impact on renting decision, which matches our expectation, though not as strong as the impact of public transportation. Living in neighborhood that has a lot of petty crime decreases monthly rent by 6.61%, on average, holding other variables constant (calculated by $100 \cdot \left[e^{\beta_{CRIME}} - 1\right]\%$). The p-value is 0.003. This is considered not economically significant with η_{CRIME} = -0.0661.

Finally, on average, holding other variables constant, comparing with male householders, a 1% increase in female householders' income will increase monthly house rent by 7.34%. The p-value is much smaller than 0.001. The result is what we expected. This is not economically significant with $\eta_{LOGINCOME\_GENDER}$ = 0.0734.

We acknowledge that we cannot estimate causal impacts in this paper. This is because there is likely to be omitted variable bias. For instance, there may be other factors affecting both monthly rent amount and the independent variables. Also, there may be other unexplained variables in the residual term that we have not controlled.

CONCLUSION

The paper examines the impact different environmental factors on housing rent and the relationship between gender, income and housing rent. The results show that the impact of living in areas near trash and living in areas having good schools is unclear. However, the impact of living in areas having good public transportation system and living in areas having petty crime is clear and significant. Also, the result confirms that women having higher income are more likely to pay higher rent amount. More controlled variables can be added in future research to improve the results.

REFERENCES

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Lin, W., Tou, J., Lin, S. and Yeh, M. (2014). Effects of socioeconomic factors on regional housing prices in the USA. *International Journal of Housing Markets and Analysis*, 7(1), pp.30-41.

Ozawa, M. and Lee, Y. (2006). The Net Worth of Female-Headed Households: A Comparison to Other Types of Households. *Family Relations*, 55(1), pp.132-145.

Ruel, E. and Hauser, R. (2012). Explaining the Gender Wealth Gap. *Demography*, 50(4), pp.1155-1176.

TABLES

Table 1 – Explanation of Variables

RENT	Monthly rent amount (in USD)
TRASH	Whether neighborhood has trash, litter, or junk in streets, lots, or properties within ½ block. Define TRASH = 1 if there is trash (include small and large amount) = 0 if there is no trash
SCHOOL	Whether neighborhood has good school. Define SCHOOL = 1 if Agree = 0 if Disagree
TRANSPORT	Whether neighborhood has good bus, subway, or commuter train service. Define TRANSPORT = 1 if Agree = 0 if Disagree
CRIME	Whether neighborhood has a lot of petty crime. Define CRIME = 1 if Agree = 0 if Disagree
INCOME	Household income (past 12 months) in USD
GENDER	Define GENDER = 1 if Female = 0 if Male

Table 2 – Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
RENT	9,827	946.6458	847.0484	4	10600
TRASH	9,827	.1321868	.338711	0	1
SCHOOL	9,827	.8714765	.3346888	0	1
TRANSPORT	9,827	.6500458	.4769795	0	1
CRIME	9,827	.2737356	.4458976	0	1
INCOME	9,827	46401.88	70306.87	0	1699000
GENDER	9,827	.5608019	.4963146	0	1

Table 3 – Regression Results

Regression	
	LOGRENT
TRASH	-0.0513
	(0.0291)*
SCHOOL	-0.0587
	(0.0289)**
TRANSPORT	0.1660
	(0.0196)***
CRIME	-0.0684
	(0.0226)***
LOGINCOME_GENDER	0.0734
	(0.0157)***
LOGINCOME	0.2442
	(0.0126)***
GENDER	-0.8176
	(0.1624)***
1b.HHMAR	0.0000
	(0.0000)
2.HHMAR	-0.0095
	(0.0595)
3.HHMAR	-0.0759
	(0.0454)*
4.HHMAR	-0.1702
	(0.0291)***
5.HHMAR	-0.0838
	(0.0441)*
6.HHMAR	-0.1909
	(0.0252)***
31b.HHGRAD	0.0000
	(0.0000)
32.HHGRAD	0.0039
	(0.1578)
33.HHGRAD	-0.0689
	(0.1408)
34.HHGRAD	-0.1389
	(0.1392)
35.HHGRAD	-0.0976
	(0.1395)
36.HHGRAD	-0.1318
	(0.1388)

37.HHGRAD	-0.1601
	(0.1366)
38.HHGRAD	0.0783
	(0.1355)
39.HHGRAD	-0.0230
	(0.1283)
40.HHGRAD	0.0804
	(0.1291)
41.HHGRAD	0.0894
	(0.1353)
42.HHGRAD	0.1066
	(0.1351)
43.HHGRAD	0.1010
	(0.1344)
44.HHGRAD	0.2724
	(0.1295)**
45.HHGRAD	0.3508
	(0.1329)***
46.HHGRAD	0.3686
	(0.1619)**
47.HHGRAD	0.3788
	(0.1524)**
16b.HHAGE	0.0000
	(0.0000)
17.HHAGE	-1.6402
	(0.7154)**
18.HHAGE	-0.0183
	(0.4777)
19.HHAGE	-0.4868
	(0.3777)
20.HHAGE	-0.3482
	(0.3568)
21.HHAGE	-0.2857
	(0.3512)
22.HHAGE	-0.4492
	(0.3485)
23.HHAGE	-0.6010
	(0.3462)*
24.HHAGE	-0.4902
	(0.3440)
25.HHAGE	-0.4908
	(0.3426)
26.HHAGE	-0.5015
	(0.3433)

27.HHAGE	-0.5451
	(0.3432)
28.HHAGE	-0.4945
	(0.3427)
29.HHAGE	-0.4810
	(0.3427)
30.HHAGE	-0.5499
	(0.3424)
31.HHAGE	-0.4906
	(0.3423)
32.HHAGE	-0.5154
	(0.3428)
33.HHAGE	-0.4379
	(0.3424)
34.HHAGE	-0.4187
	(0.3423)
35.HHAGE	-0.4450
	(0.3425)
36.HHAGE	-0.4057
	(0.3429)
37.HHAGE	-0.4421
	(0.3436)
38.HHAGE	-0.3888
	(0.3435)
39.HHAGE	-0.4863
	(0.3444)
40.HHAGE	-0.3175
	(0.3437)
41.HHAGE	-0.4696
	(0.3436)
42.HHAGE	-0.4190
	(0.3442)
43.HHAGE	-0.3700
	(0.3443)
44.HHAGE	-0.4187
	(0.3443)
45.HHAGE	-0.4505
	(0.3429)
46.HHAGE	-0.4597
	(0.3447)
47.HHAGE	-0.4814
	(0.3456)
48.HHAGE	-0.4521
	(0.3454)

49.HHAGE	-0.4528
	(0.3457)
50.HHAGE	-0.4871
	(0.3442)
51.HHAGE	-0.4280
	(0.3443)
52.HHAGE	-0.5707
	(0.3459)*
53.HHAGE	-0.5624
	(0.3451)
54.HHAGE	-0.4939
	(0.3462)
55.HHAGE	-0.5103
	(0.3444)
56.HHAGE	-0.5442
	(0.3460)
57.HHAGE	-0.6763
	(0.3465)*
58.HHAGE	-0.7491
	(0.3482)**
59.HHAGE	-0.4526
	(0.3473)
60.HHAGE	-0.5875
	(0.3471)*
61.HHAGE	-0.5964
	(0.3479)*
62.HHAGE	-0.5655
	(0.3480)
63.HHAGE	-0.5208
	(0.3486)
64.HHAGE	-0.4381
	(0.3498)
65.HHAGE	-0.6090
	(0.3528)*
66.HHAGE	-0.5019
	(0.3482)
67.HHAGE	-0.6355
	(0.3496)*
68.HHAGE	-0.7312
	(0.3492)**
69.HHAGE	-0.6329
	(0.3540)*
70.HHAGE	-0.6707
	(0.3504)*

71.HHAGE	-0.5535
	(0.3572)
72.HHAGE	-0.6238
	(0.3541)*
73.HHAGE	-0.8889
	(0.3576)**
74.HHAGE	-0.4574
	(0.3610)
75.HHAGE	-0.6390
	(0.3726)*
76.HHAGE	-0.3870
	(0.3583)
77.HHAGE	-0.8697
	(0.3658)**
78.HHAGE	-0.4227
	(0.3633)
79.HHAGE	-0.7897
	(0.3649)**
80.HHAGE	-0.5461
	(0.3445)
85.HHAGE	-0.3623
	(0.3444)
1b.RACE	0.0000
	(0.0000)
2.RACE	-0.1762
	(0.0231)***
3.RACE	-0.1446
	(0.0772)*
4.RACE	0.0419
	(0.0411)
5.RACE	0.0804
	(0.1173)
6.RACE	-0.0533
	(0.1154)
7.RACE	-0.2951
	(0.1236)**
8.RACE	0.2996
	(0.2007)
9.RACE	-0.3760
	(0.6332)
10.RACE	0.1355
	(0.2058)
11.RACE	-1.5945
	(0.5167)***

12.RACE	-0.2524
	(0.8954)
13.RACE	-1.1554
	(0.6319)*
14.RACE	-0.3563
	(0.6332)
15.RACE	-0.2393
	(0.3170)
16.RACE	-0.1704
	(0.8946)
19.RACE	0.0143
	(0.8993)
20.RACE	-0.3605
	(0.6337)
_cons	4.5919
	(0.3865)***
R-Squared	0.244
N	9,541
SER	0.89

* $p<0.1$; ** $p<0.05$; *** $p<0.01$
Standard errors in parentheses

FIGURES

Figure 1 – Distribution of Monthly Rent Amount

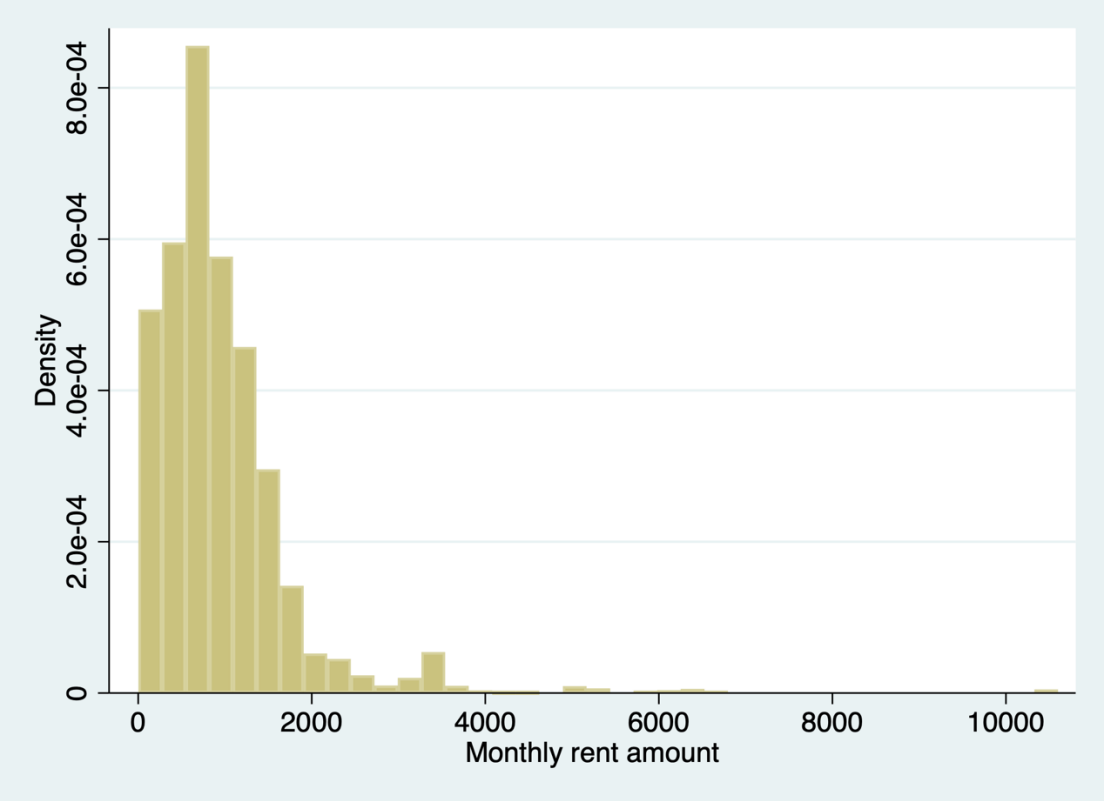


Figure 2 – Relationship Between Monthly Rent Amount and Whether Neighborhood Has Trash

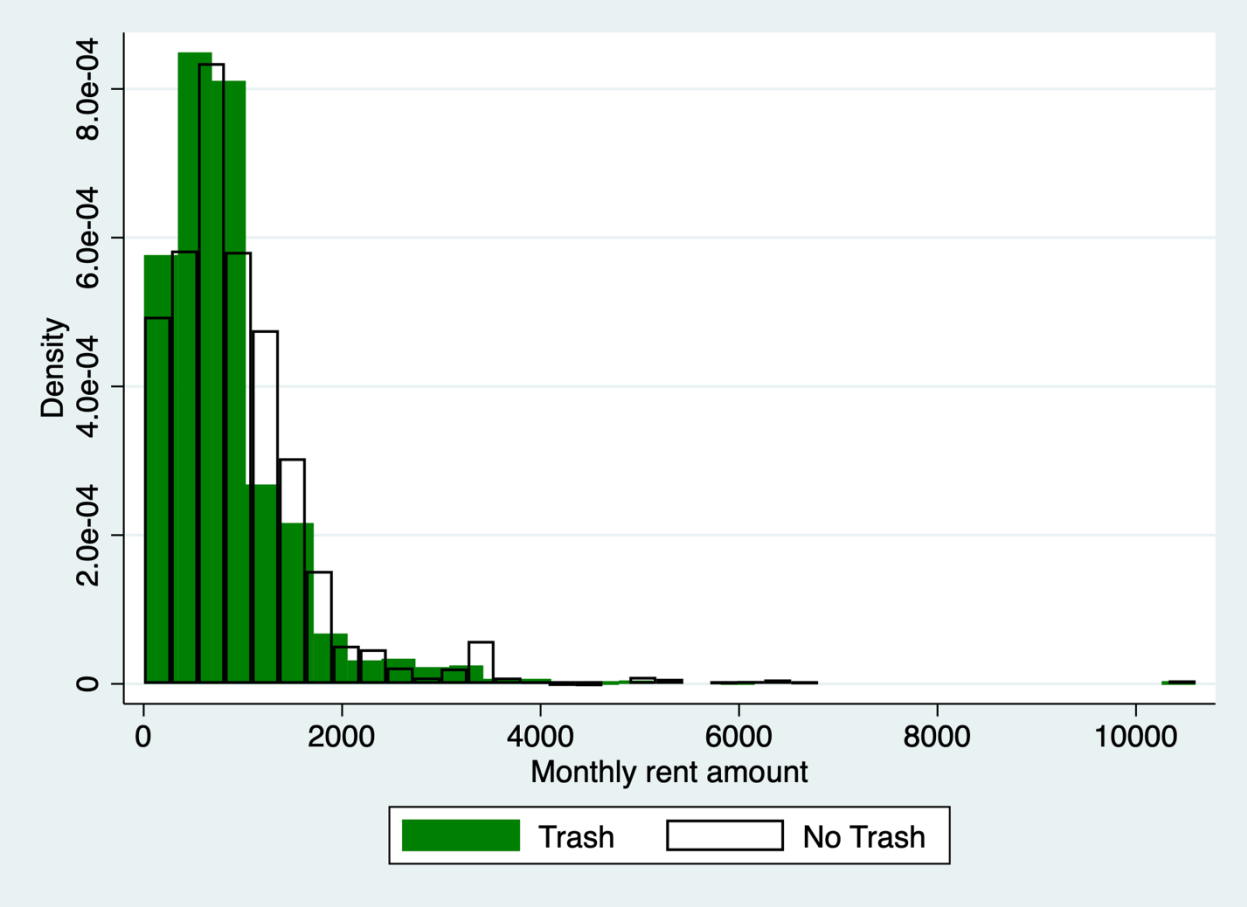


Figure 3 – Relationship Between Monthly Rent Amount and Whether Neighborhood Has Good Schools

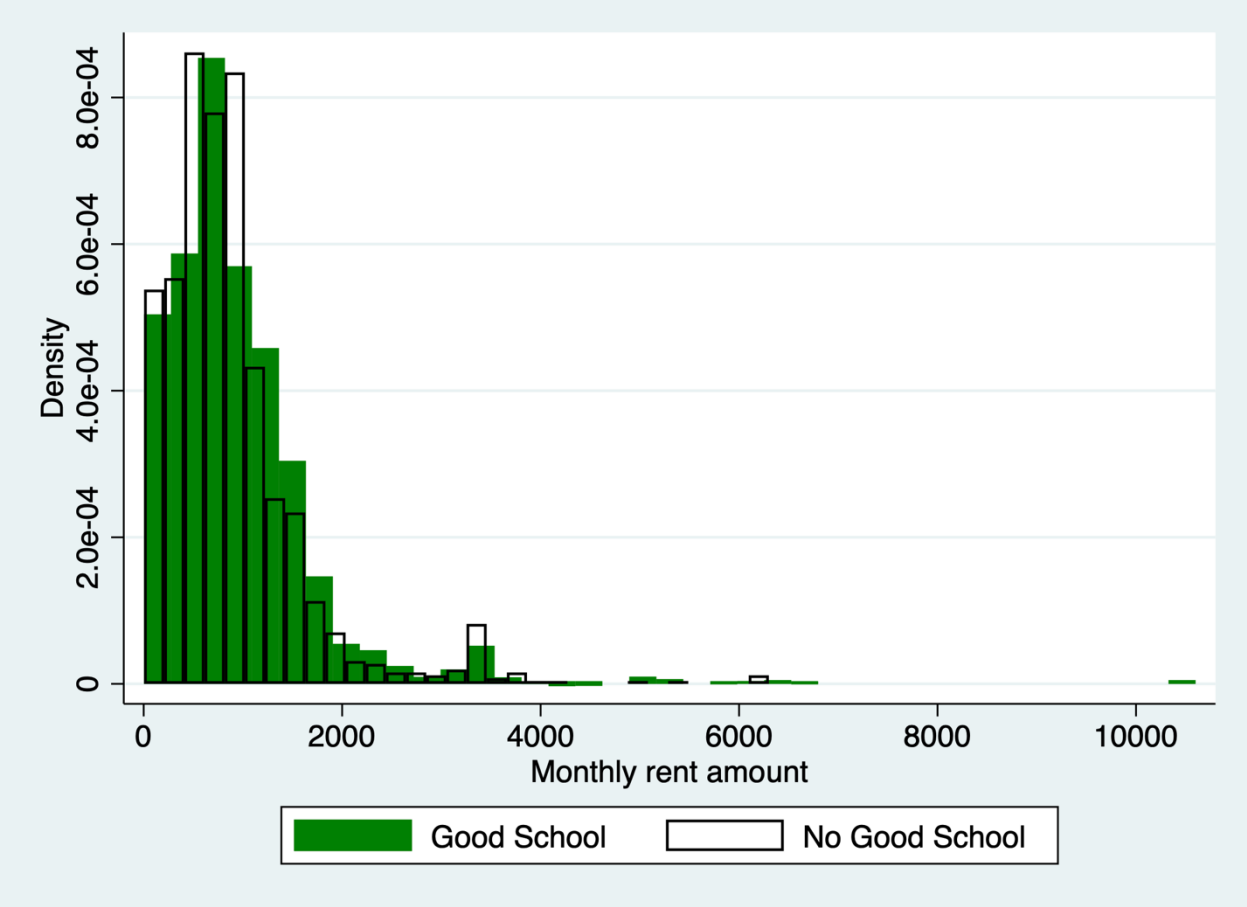


Figure 4 – Relationship Between Monthly Rent Amount and Whether Neighborhood Has Good Transportation

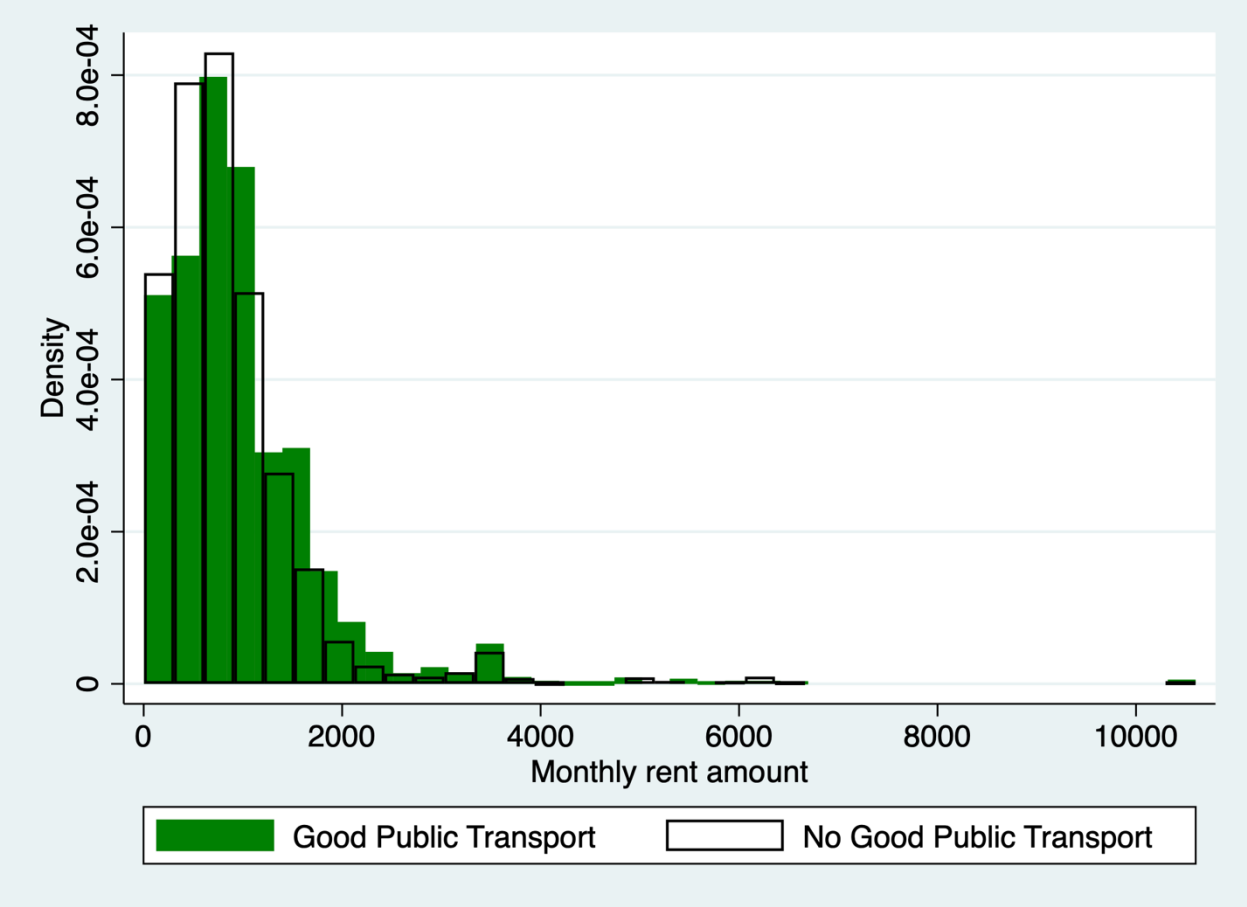


Figure 5 – Relationship Between Monthly Rent Amount and Whether Neighborhood Has Crime

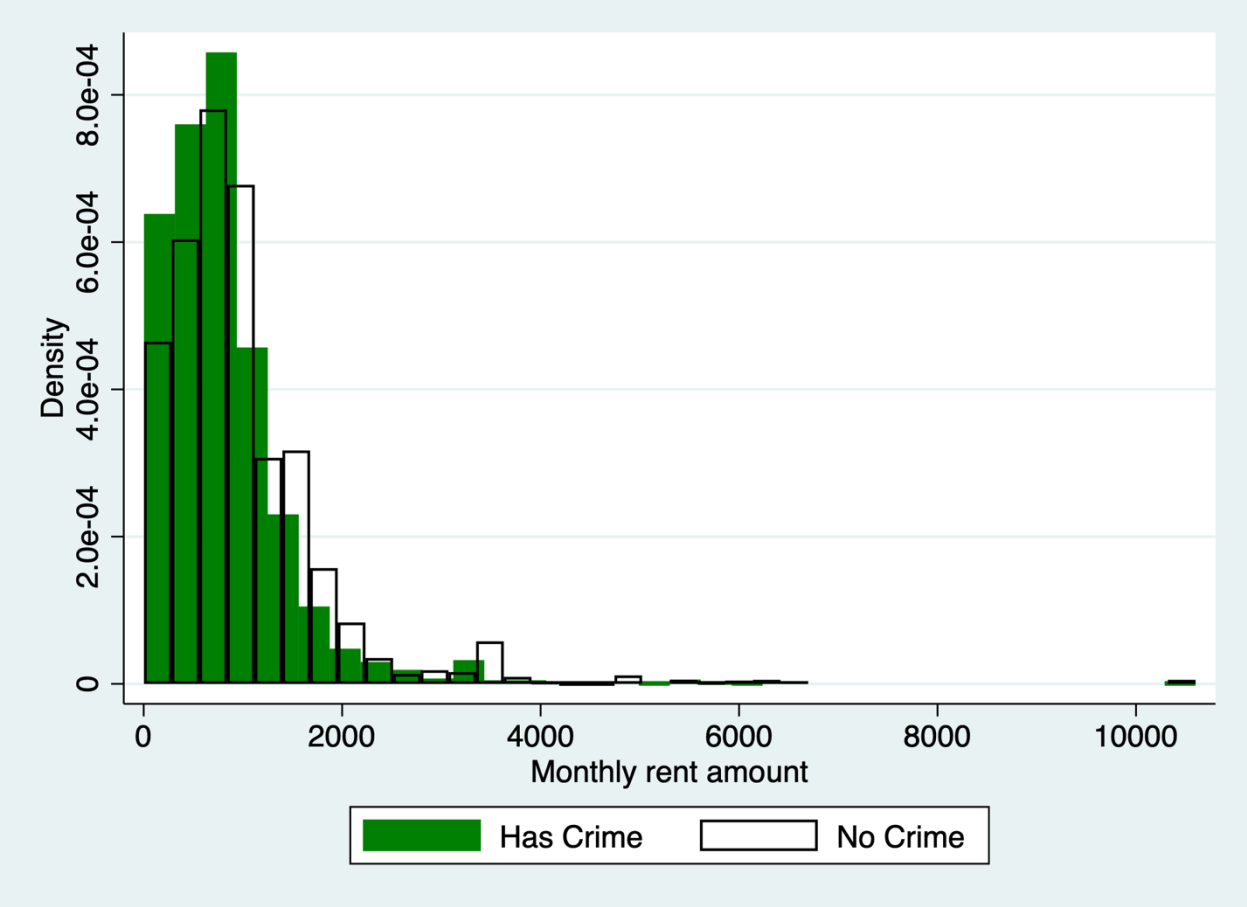
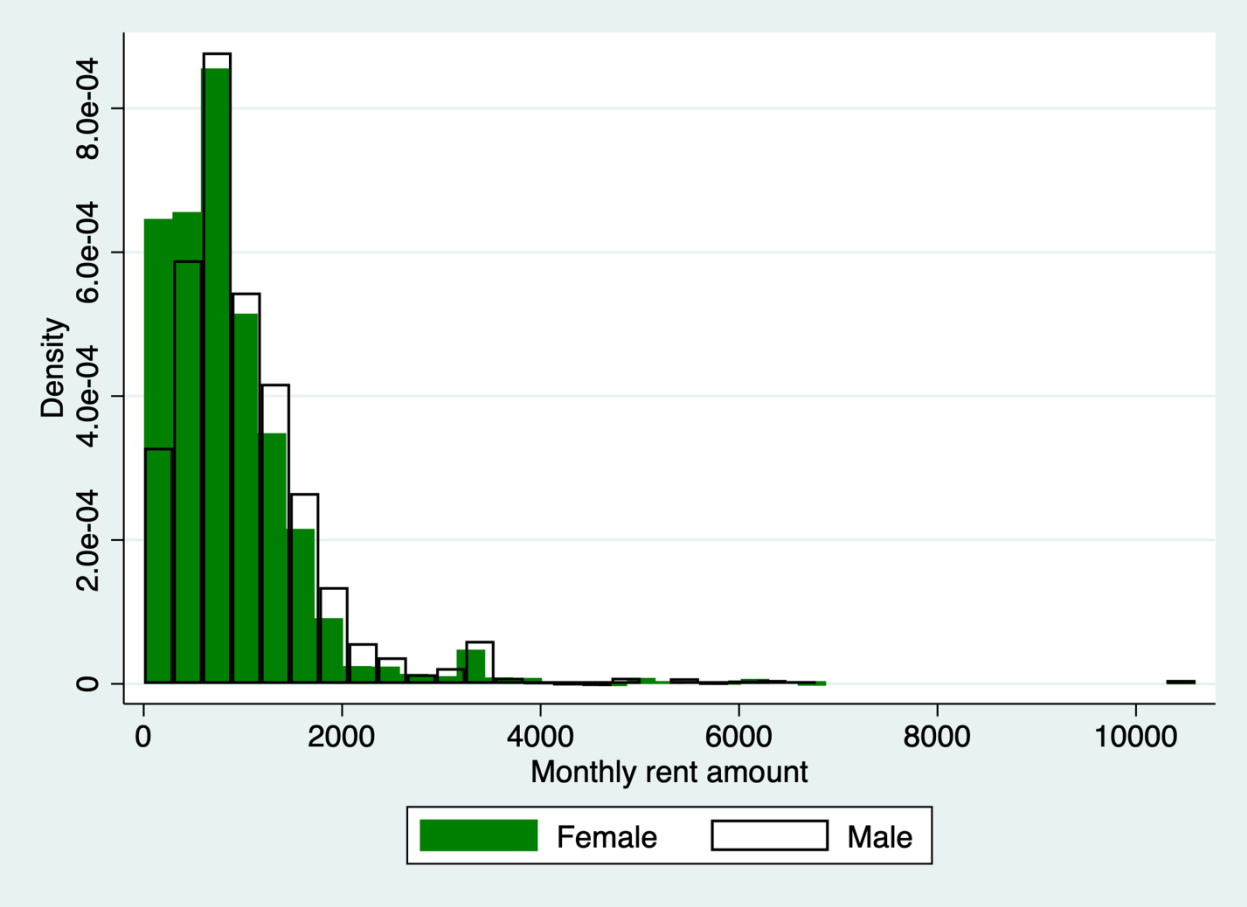


Figure 6 – Relationship Between Monthly Rent Amount and Gender



APPENDIX

Calculations of Economic Significance:

$\eta_{TRASH} = 100 \cdot [e^{-0.05} - 1]\%) =$ -0.0500

$\eta_{SCHOOL} = 100 \cdot [e^{-0.06} - 1]\%) =$ -0.0570

$\eta_{TRANSPORT} = 100 \cdot [e^{0.17} - 1]\%) =$ 0.1805

$\eta_{CRIME} = 100 \cdot [e^{-0.07} - 1]\%) =$ -0.0661

$\eta_{LOGINCOME\_GENDER} =$ 0.73