Violent Crime Rate Prediction Models – Wisconsin

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December 6th, 2019

Abstract

The state of Wisconsin has 72 counties, each with some level of violent crime. In order to predict future violent crime rates an analysis of past crime rates, crime growth rates, populations, population growth rates, and additional socioeconomic facts was completed with the goal of creating a valid model. Initial models only included past crime and growth rates while later models considered socioeconomic factors of each county such as education level, poverty level and the age of the population. These two distinct models were then compared and combined to create the best model for predicting future crime rates. The only socioeconomic factor that made it to the final model was the share of the population between the ages of 15 and 19. While additional important variables included the previous year's violent crime rate and the growth factor of violent crime for that county.

Introduction

Predicting the violent crime for every county in a state is a powerful tool. There are many applications such as redistributing state funds among counties and hiring additional police and medical help in increasingly dangerous areas. This analysis produces a forecast of violent crime in each of Wisconsin’s 72 counties. The analysis starts out by only looking at past crime and growth rates and then later branches out and includes different socioeconomic factors such as education, poverty and ages of residents. These two different models are then combined to create the best model which is then used to predict the violent crime rate of each county for the year 2019.

Data Sources

Data for this report came from the FBI’s Uniform Crime Reporting database and the Census Bureau’s American Fact Finder. The UCR data includes crime rates for violent and property offenses in nearly every county. Due to not effect collection, the crime rates of some counties were not found, but the vast majority were available. The American Fact Finder was used to get data relating to each county’s age distribution, education levels, poverty levels and unemployment rate. Again, irregularities between these data sources means it is impossible to predict crime rates for every county in the state of Wisconsin, but the vast majority are unaffected. Summary statistics of the collected data can be found in Appendix D.

Analysis

Initial Models

To start the analysis Poisson regression was used with combinations of population and crime data. The dependent variables of each regression are in the left-most column and the root mean square error is in the first row after the header rows.

Model 1:

poisson violent2018 violent2017 violentGrowth property2017 propertyGrowth lnpop popgrowth, robust

Model 2:

poisson violent2018 lnviolent2017 violentGrowth lnproperty2017 propertyGrowth, robust

Model 3:

poisson violent2018 lnviolent2017 violentGrowth, robust

The next task was to use the results from the three model above to see if a better model could be made. This is done by using a series of joint test to see if a combination of variables has combined little effect on the model.

In Model 1 the three growth variables (*violentGrowth*, *propertyGrowth*, *popgrowth*) had very high p-values, I conducted a joint test on them and got a p-value of 0.44. This is statistically significant and is a good indication that these variables don't affect the model. It can be seen in Models 1 & 2, however, that the p-values for the growth statistics decrease greatly, so I am not willing to throw them out yet.

Model 2 has slightly high p-values for both *violentGrowth* and *propertyGrowth* but when a joint test is conducted the given p-value of 0.015 show there is good evidence these variables are influential in the model.

In the end, the best model I found (Model 4) includes *lnviolent2017*, *violentGrowth* and *popgrowth*. Model 3 had the smallest RMSE of all three initial models, but I felt the population was very important to the model (it seems natural that higher populations leads to higher crime rates). I then included both *lnpop* and *popgrowth* separately into Model 3 and concluded that popgrowth is significant in the model while lnpop is not. Additionally, the RMSE of Model 4 is the lowest of them all, which is a good indication that Model 4 is the best option.

Model 4:

poisson violent2018 lnviolent2017 violentGrowth popgrowth, robust

Initial Models – Table 1				
	Model 1	**Model 2**	**Model 3**	**Model 4**
RMSE	49.16789	13.087796	12.576183	12.041794
violent2017	0.0172 (0.006)			
violentGrowth	-0.142 (0.409)	-0.839 (0.489)	-0.990 (0.411)	-1.014 (0.434)
property2017	0.000813 (0.001)			
propertyGrowth	0.00364 (0.004)	0.00385 (0.003)		
lnpop	0.183 (0.095)			
popgrowth	-0.0000381 (0.000)			0.0000770 (0.000)
lnviolent2017		0.753 (0.132)	0.915 (0.082)	0.865 (0.082)
lnproperty2017		0.278 (0.121)		
_cons	0.547 (0.896)	-0.546 (0.360)	0.297 (0.274)	0.431 (0.267)
N	60	60	60	60

Table 1 (Shown above) contains the regressions of the first four models from **Initial Models**.

Correlates/Drivers of Crime

The second analysis is aimed to see if the socioeconomic variables of a country affects the reported violent crime.

The baseline model includes *lnpop*, *popgrowth*, *shareyoung*, *shareold*, *unemployment*, *sharepoverty*, *lessthanhs* and *bachelorup.*

Model 5: (Baseline Model)

poisson violent2017 lnpop popgrowth shareyoung shareold unemployment sharepoverty lessthanhs bachelorup, robust

The correlation matrix and regression VIF was calculated to provide information on the relationships between the variables before the analysis of individual factors begins.

	lnpop	popgro~h	sharey~g	shareold	unempl~t	sharep~y	lessth~s	bachel~p
lnpop	1.0000							
popgrowth	0.4239	1.0000						
shareyoung	0.4020	0.2197	1.0000					
shareold	-0.6527	-0.3490	-0.6418	1.0000				
unemployment	-0.2004	-0.1511	-0.0337	0.3205	1.0000			
sharepoverty	-0.2849	-0.1029	0.2646	0.0650	0.5825	1.0000		
lessthanhs	-0.2262	-0.3321	-0.1879	0.2406	0.1843	0.3358	1.0000	
bachelorup	0.6154	0.5844	0.3539	-0.4415	-0.2004	-0.2769	-0.7107	1.0000

(Table 2)

The correlation matrix shows several relationships that have a high correlation, many which are logical. It is logical to assume a correlation between *sharepoverty* and *unemployment* since higher unemployment means less people have a job and then more people are likely to live in poverty. The percent of people with a bachelor’s degree or higher is highly correlated to *lnpop.* This is expected since larger populations tend to be in more urban areas and people living in urban areas are more likely to have jobs that require a bachelor’s degree. It is also interesting to see that *shareold* is negatively correlated with *popgrowth* and *shareyoung.* This is again logical since younger people are more likely to live in urban areas (which have higher populations) and having a higher proportion of older people means you must have a lower proportion of younger people. The last relationship that should be mentioned is the negative correlation between *bachelorup* and *lessthanhs.* This is logical since having a large proportion of people with bachelor’s degrees or higher means a lower proportion of its population has less than a high school degree.

Variable	VIF	1/VIF
bachelorup	4.39	0.227805
lnpop	3.21	0.311050
shareold	3.01	0.331872
lessthanhs	2.74	0.364430
sharepoverty	2.53	0.395288
shareyoung	2.15	0.465712
unemployment	1.94	0.516337
popgrowth	1.60	0.626263
Mean VIF	2.70	

(Table 3)

The VIF, calculated after a multiple regression, shows slightly high inflation for *bachelorup.* This is expected since that variable has high correlations with other variables (as seen in the above correlation matrix). The variables *unemployment* and *popgrowth* each have low VIF values which is a good indication they are not influenced much by other variables. The remaining variables have middle of the pack VIF values, not too low to be excited about but not too high to be worried about.

Each of the next models in this part of the analysis will be nearly identical to Model 5 except for one variable being replaced by one or more variables that measure the same thing but in a more specific way. Each model will be explained below, including the test to determine if the change was meaningful or not.

Model 6:

poisson violent2017 lnpop popgrowth share15to19 share20to24 shareold unemployment sharepoverty lessthanhs bachelorup, robust

Model 6 replaced *shareyoung* with *share15to19* and *share20to24.* Testing if these variables are the same return a p-value of 0.15. While not that high it is still not the best evidence that these values are different. A joint test of significance returns a p-value of 0.21, again, evidence saying that they have no influence but not overwhelming evidence. When looking at the regression output you see that *share15to19* has a p-value of 0.099 while *share20to24* has a p-value of 0.623. This leads me to believe that *share15to19* influenced the model while *share20to24* does not.

Model 7:

poisson violent2017 lnpop popgrowth shareyoung share65to84 share85up unemployment sharepoverty lessthanhs bachelorup, robust

Model 7 replaced *shareold* with *share65to84* and *share85up.* The test to see if the coefficients of these variables were the same, and this test returned a p-value of 0.52. This means there is no good evidence to say that the coefficients of these variables differ. The joint test of significance returns a p-value of 0.79. This is strong evidence that these variables don't influence the model. Combined with the p-value of *shareold*, which is 0.78 in the Model 5, there is good evidence that the proportion of people older than 64 do not influence the model on violent crime.

Model 8:

poisson violent2017 lnpop popgrowth shareyoung shareold unemployment sharepoor shareverypoor lessthanhs bachelorup, robust

Model 8 replace *sharepoverty* with *sharepoor* and *shareverypoor.* The test to see if the coefficients were the same had a p-value of 0.99, overwhelming evidence to say their coefficients are most definitely the same. The joint test of significance has a p-value of 0.06. This test has strong evidence that these variables are important to the model. Since these variables are determined to have the same coefficient and are significant to the test, I would say that it is best to keep *sharepoverty* in the model, but it is not necessary to substitute in *sharepoor* and *shareverypoor.*

Model 9:

poisson violent2017 lnpop popgrowth shareyoung shareold unemployment sharepoverty lessthanhs bachelor graduate, robust

Model 9 replaced *bachelorup* with *bachelor* and *graduate.* The test to see if these coefficients are the same has a p-value of 0.79 which is good evidence to say these coefficients are the same. The joint test of significance has a p-value of 0.26, not significant enough to say that these variables influence the model. If these variables were to be kept in the model it would be best to include the combined variable *bachelorup* rather than keep them separate.

Model 10:

poisson violent2017 lnpop popgrowth shareyoung shareold unemployment sharepoverty highschool somecollege associate bachelorup, robust

Model 10 replaced *lessthanhs* with *highschool*, *somecollege* and *associate.* The test to see if these variables' coefficients are the same has a p-value of 0.1, which is slight evidence to say their values are not the same. The joint test of significance ahs a p-value of 0.19, again, not definite but evidence to say these variables don't influence the model. When looking at the individual p-values of each of these variables in the regression of Model 10, *somecollege* has a significant p-value of 0.08 while *highschool* and *associate* are not significant with p-value of 0.24 and 0.56 respectively. I conducted one more regression to explore *lessthanhs* and the other variables.

Model 11:

poisson violent2017 lnpop popgrowth shareyoung shareold unemployment sharepoverty somecollege bachelorup, robust

Model 11 is like Model 10 except I removed *highschool* and *associate.* I did this because the p-values of the tests in Model 10 were not significant, but they were close to being significant and the individual p-value for *somecollege* was significant while *highschool* and *associate* were not. The regression results were not that revolutionary. The p-value of *somecollege* was now 0.26, much higher than in Model 10. I still think this regression could be useful and will include it in the table below.

Correlates/Drivers of Crime - Table 4							
	Model 5	**Model 6**	**Model 7**	**Model 8**	**Model 9**	**Model 10**	**Model 11**
RMSE	18.156669	15.379938	17.350007	18.371456	18.986501	15.448863	16.478571
lnpop	0.518 (0.102)	0.542 (0.104)	0.543 (0.109)	0.518 (0.103)	0.513 (0.104)	0.519 (0.098)	0.500 (0.090)
popgrowth	0.000125 (0.000)	0.000167 (0.000)	0.000119 (0.000)	0.000125 (0.000)	0.000135 (0.000)	0.000104 (0.000)	0.000104 (0.000)
shareyoung	3.538 (3.335)		3.773 (3.318)	3.537 (3.404)	3.809 (3.413)	3.922 (3.439)	2.998 (3.408)
shareold	1.118 (4.050)	2.711 (4.028)		1.118 (4.039)	1.501 (4.382)	2.818 (4.420)	0.688 (4.004)
unemployment	0.144 (0.071)	0.147 (0.062)	0.124 (0.080)	0.144 (0.071)	0.146 (0.072)	0.208 (0.090)	0.202 (0.088)
sharepoverty	-6.417 (2.734)	-6.371 (2.585)	-6.080 (2.711)		-6.203 (2.850)	-8.266 (2.809)	-7.070 (2.427)
lessthanhs	0.0174 (0.040)	0.0190 (0.041)	0.0145 (0.039)	0.0174 (0.041)	0.0213 (0.042)		
bachelorup	-0.0266 (0.016)	-0.0273 (0.016)	-0.0292 (0.016)	-0.0266 (0.017)		-0.0820 (0.047)	-0.0300 (0.012)
share15to19		22.59 (13.683)					
share20to24		-2.528 (5.139)					
share65to84			3.071 (5.199)				

share85up			-12.37 (21.146)				
sharepoor				-6.426 (8.574)			
shareverypoor				-6.406 (10.157)			
bachelor					-0.0133 (0.052)		
graduate					-0.0446 (0.069)		
highschool						-0.0722 (0.062)	
somecollege						-0.104 (0.061)	-0.0610 (0.054)
associate						0.0280 (0.048)	
_cons	-2.564 (1.473)	-4.055 (1.879)	-2.684 (1.487)	-2.564 (1.528)	-2.755 (1.653)	2.953 (4.876)	-0.888 (2.049)
N	70	70	70	70	70	70	70

After reviewing the models from Table 4, I tried to find the best model by reviewing the analysis above.

Model 12:

poisson violent2017 lnpop popgrowth share15to19 unemployment sharepoverty lessthanhs bachelorup, robust

Model 12 does not include *share20to24* and *shareold.* Removed them because of the tests and analysis done on Model 6 and Model 7.

Model 13:

poisson violent2017 lnpop popgrowth share15to19 unemployment sharepoverty bachelorup, robust

Model 13 does not include *share20to24*, *shareold* and *lessthanhs.* Like the reasoning for Model 12, I also took out *lessthanhs*, my thoughts on why can be found in analysis of Model 10.

Model 14:

poisson violent2017 lnpop popgrowth share15to19 unemployment sharepoverty lessthanhs bachelor graduate, robust

Model 14 does not include *share20to24* and *shareold,* but it substitutes *bachelor* and *graduate* for *bachelorup.* I wanted to see if having *bachelorup* split up affects the RMSE of Model 12, look to analysis of Model 9 for more thoughts.

Model 15:

poisson violent2017 lnpop popgrowth share15to19 unemployment sharepoverty bachelor graduate, robust

Model 15 does not include *share20to24*, *shareold* and *lessthanhs* but it substitutes *bachelor* and *graduate* for *bachelorup.* Just like Model 14, this separates *bachelorup* to see if it affects the RMSE of Model 13.

After reviewing the table below (Table 5), Model 13 is found to have the lowest RMSE. Since this model does not include *lessthanhs* there is good reason to believe this variable does not have high influence on the model. It is also found that splitting *bachelorup* into *bachelor* and *graduate* is not good for the models, since Models 14 and 15 both have higher RMSE because of it. Model 13 is the best model because of its low RMSE.

Possible Best Models – Table 5				
	Model 12	**Model 13**	**Model 14**	**Model 15**
RMSE	15.342847	14.952309	16.335665	16.401767
lnpop	0.487 (0.076)	0.508 (0.068)	0.483 (0.085)	0.508 (0.072)
popgrowth	0.000144 (0.000)	0.000145 (0.000)	0.000147 (0.000)	0.000144 (0.000)
share15to19	12.72 (9.676)	11.78 (9.361)	12.73 (9.674)	11.79 (9.394)
unemployment	0.155 (0.059)	0.152 (0.059)	0.156 (0.062)	0.152 (0.062)
sharepoverty	-6.482 (2.672)	-5.824 (2.247)	-6.385 (2.766)	-5.848 (2.510)
lessthanhs	0.0212 (0.041)		0.0225 (0.042)	
bachelorup	-0.0256 (0.017)	-0.0312 (0.013)		
bachelor			-0.0211 (0.049)	-0.0319 (0.044)
graduate			-0.0316 (0.063)	-0.0301 (0.064)
_cons	-2.576 (0.860)	-2.487 (0.822)	-2.589 (0.865)	-2.485 (0.825)
N	70	70	70	70

Prediction using Past Crime and other Correlates

Next, it will be determined if socioeconomic factors are worthwhile to predict violent crime data or if all that is needed to predict violent crime is past crime rates and their growth rates. I will be using the best models from each section (Models 4 and 13).

Model 4:

poisson violent2018 lnviolent2017 violentGrowth popgrowth, robust

Model 13:

poisson violent2017 lnpop popgrowth share15to19 unemployment sharepoverty bachelorup, robust

First, I will create a baseline model including all the variables in Models 4 and 13.

Model 16:

poisson violent2018 lnviolent2017 violentGrowth popgrowth lnpop share15to19 unemployment sharepoverty bachelorup, robust

Model 16 is the baseline model. After looking at the regression I completed a joint test on *sharepoverty* and *bachelorup* because their p-values were very high. The test has a p-value of 0.28, not a significant value. I therefore decided to remove those variables.

Model 17:

poisson violent2018 lnviolent2017 violentGrowth popgrowth lnpop share15to19 unemployment, robust

Model 17 does not include *sharepoverty* and *bachelorup* from Model 16. I again joint tested *lnpop* and *unemployment* to see if they were significant despite their low individual p-values. The joint test had a p-value of 0.49, not significant at all. I then chose to drop both of those variables as well.

Model 18:

poisson violent2018 lnviolent2017 violentGrowth popgrowth lnpop share15to19, robust

Model 18 is the same as Model 17 but without *lnpop* and *unemployment.* All variables were significant at a 10% significance level, so I stopped looking for new models here and proceeded to organize them in a table (Table 6) to compare them.

Prediction Models – Table 6			
	Model 16	**Model 17**	**Model 18**
RMSE	14.016226	12.235904	11.847905
lnviolent2018	0.836 (0.118)	0.839 (0.113)	0.896 (0.084)
violentGrowth	-0.858 (0.478)	-0.941 (0.458)	-1.082 (0.431)
popgrowth	0.0000690 (0.000)	0.0000485 (0.000)	0.0000726 (0.000)
lnpop	0.115 (0.093)	0.0760 (0.074)	
share15to19	-12.12 (4.929)	-10.31 (4.979)	-8.765 (4.532)
unemployment	-0.0701 (0.059)	-0.0279 (0.042)	
sharepoverty	2.039 (2.179)		
bachelorup	-0.00900 (0.013)		
_cons	0.383 (0.612)	0.513 (0.597)	0.931 (0.350)
N	60	60	60

I would consider Model 18 the best model. It has the lowest RMSE out of all the Models. The Model with the next lowest RMSE is Model 3. The only difference between Models 3 and 18 is the inclusion of *share15to19.* This is an indication that the proportion of the population between ages 15 and 19 has influence over the amount of violent crime in a county.

Predictions for 2019

In order to predict violent crime for 2019 the variable *violentGrowth2018* was created (shown in Do-File, Appendix B). I then ran the regression from Model 18 substituting *violentGrowth2018* for *violentGrowth* and *lnviolent2018* for *lnviolent2017.* The forecasts for 2019 can be found in appendix A.

Discussion and Conclusion

After reviewing all the conducted test and calculated statistics predicting future crime rates is more effective with past crime rates and growth rates rather than using socioeconomic data. In fact, the only independent variable used in the final model that wasn't a past crime or growth rate was *share15to19*, which is the percent of the population between the ages of 15 and 19 years. It is important to note that this analysis did not include all the different factors of each county and it is very possible some unexplored factors are responsible for the violent crime rates. It is also possible that missing data accounts for little effects of the socioeconomic factors. Of the 72 counties in Wisconsin, 7 were not able to be predicted because of missing information from either of the two data sources. While more than 90% of the counties had enough data, it is still a significant amount of information to be missing.

The final model (Model 18) included the independent variables *lnviolent2018*, *violentGrowth*, *popgrowth* and *share15to19*, where *lnviolent2018* is the natural log of the 2018 violent crime rate, *violentGrowth* is the growth of the violent crime rate from 2012 to 2018, *popgrowth* is the population growth rate from 2012 to 2017 and *share15to19* is the percentage of the population with ages between the years of 15 up to and including 19. It is important to note that the data in this model is not all from the same year, the violent crime statistics are form 2018, the population growth rate is calculated from 2012 to 2017 and the share of the population between ages 15 and 19 is from 2017 values as well. Getting consistent, up to date data would make this model more effective.

Conclusion

This analysis was able to find the best model to predict the violent crime rate of Wisconsin's counties using the data mentioned above. While these models can be improved, they give you the best possible predictions using the data that was available.

Appendices

Appendix A: Predicted Violent Crime Rates for 2019

2019 Predicted Violent Crime Rate for Each County in Wisconsin					
County	**Prediction**	**County**	**Prediction**	**County**	**Prediction**
Adams	27	Iowa	12	Polk	35
Ashland	5	Iron	6	Portage	35
Barron	2	Jackson	11	Price	9
Bayfield	16	Jefferson	34	Racine	21
Brown	103	Juneau		Richland	
Buffalo	3	Kenosha	42	Rock	34
Burnett	30	Kewaunee	3	Rusk	
Calumet	9	La Crosse	15	Sauk	26
Chippewa	30	Lafayette	14	Sawyer	13
Clark	6	Langlade		Shawano	42
Columbia	21	Lincoln	21	Sheboygan	42
Crawford		Manitowoc	23	St. Croix	25
Dane	82	Marathon		Taylor	14
Dodge	67	Marinette	6	Trempealeau	18
Door	16	Marquette	3	Vernon	10
Douglas	20	Menominee	1	Vilas	8
Dunn	15	Milwaukee	82	Walworth	9
Eau Claire	30	Monroe	7	Washburn	
Florence	8	Oconto	15	Washington	6
Fond du Lac	22	Oneida	44	Waukesha	56
Forest	21	Outagamie	52	Waupaca	65
Grant	32	Ozaukee	12	Waushara	18
Green	7	Pepin	10	Winnebago	21
Green Lake	5	Pierce	15	Wood	17

Appendix B: Do-File

```
//Joshua Cantera

//QMB 3200

//Project Analysis Tables


log using "C:\Users\Josh\Desktop\QMBProject\Cantera_Log_Project.smcl",
replace


use "C:\Users\Josh\Desktop\QMBProject\projectData.dta"

cd "C:\Users\Josh\Desktop\QMBProject\"


gen popgrowth = (pop2017 - pop2012) / 5

gen propertyGrowth = (property2017 - property2012) / 5

gen lnproperty2017 = ln(property2017)


//Summary Statistics

//Populations and Population growth

summarize pop15to19 pop20to24 pop65to84 pop85up

summarize shareyoung shareold, detail

summarize popGrowth, detail

summarize pop, detail


//Violent Crimes and growth

summarize violent2012 violent2017 violent2018

summarize lnviolent2012 lnviolent2017 lnviolent2018

summarize violentGrowth

summarize violentGrowth, detail


//Education

summarize highschool somecollege associate bachelor graduate
```

```
summarize bachelorup lessthanhs

//Poverty
summarize poppov verypoor poor
summarize shareverypoor sharepoor sharepoverty

//Unemployment
summarize unemployment, detail

//Data Types
describe

//Inintial Models
loocv poisson violent2018 violent2017 violentGrowth property2017
propertyGrowth lnpop popgrowth
eststo: poisson violent2018 violent2017 violentGrowth property2017
propertyGrowth lnpop popgrowth, robust
test violentGrowth propertyGrowth popgrowth

loocv poisson violent2018 lnviolent2017 violentGrowth lnproperty2017
propertyGrowth
eststo: poisson violent2018 lnviolent2017 violentGrowth lnproperty2017
propertyGrowth, robust
test violentGrowth propertyGrowth



loocv poisson violent2018 lnviolent2017 violentGrowth
eststo: poisson violent2018 lnviolent2017 violentGrowth, robust
test lnviolent2017 violentGrowth

//Best Model
```

```
loocv poisson violent2018 lnviolent2017 violentGrowth popgrowth

eststo: poisson violent2018 lnviolent2017 violentGrowth popgrowth,
robust


esttab using "initialModelsLog.rtf", se(3) nostar replace

eststo clear


//Drivers of crime

eststo: poisson violent2017 lnpop popgrowth shareyoung shareold
unemployment sharepoverty lessthanhs bachelorup, robust


regress violent2017 lnpop popgrowth shareyoung shareold unemployment
sharepoverty lessthanhs bachelorup, robust

vif

correlate lnpop popgrowth shareyoung shareold unemployment
sharepoverty lessthanhs bachelorup


// a

eststo: poisson violent2017 lnpop popgrowth share15to19 share20to24
shareold unemployment sharepoverty lessthanhs bachelorup, robust

test share15to19 share20to24

test share15to19=share20to24


// b

eststo: poisson violent2017 lnpop popgrowth shareyoung share65to84
share85up unemployment sharepoverty lessthanhs bachelorup, robust

test share65to84 share85up

test share65to84=share85up


// c

eststo: poisson violent2017 lnpop popgrowth shareyoung shareold
unemployment sharepoor shareverypoor lessthanhs bachelorup, robust

test sharepoor shareverypoor
```

```
test sharepoor=shareverypoor


// d

eststo: poisson violent2017 lnpop popgrowth shareyoung shareold
unemployment sharepoverty lessthanhs bachelor graduate, robust

test bachelor graduate

test bachelor=graduate


// e

eststo: poisson violent2017 lnpop popgrowth shareyoung shareold
unemployment sharepoverty highschool somecollege associate bachelorup,
robust

test highschool somecollege associate

test highschool=somecollege=associate


//Additional

eststo: poisson violent2017 lnpop popgrowth shareyoung shareold
unemployment sharepoverty somecollege bachelorup, robust


esttab using "crimeDriversLog.rtf", se(3) nostar replace

eststo clear


loocv poisson violent2017 lnpop popgrowth shareyoung shareold
unemployment sharepoverty lessthanhs bachelorup, robust


loocv poisson violent2017 lnpop popgrowth share15to19 share20to24
shareold unemployment sharepoverty lessthanhs bachelorup


loocv poisson violent2017 lnpop popgrowth shareyoung share65to84
share85up unemployment sharepoverty lessthanhs bachelorup


loocv poisson violent2017 lnpop popgrowth shareyoung shareold
unemployment sharepoor shareverypoor lessthanhs bachelorup
```

```
loocv poisson violent2017 lnpop popgrowth shareyoung shareold
unemployment sharepoverty lessthanhs bachelor graduate


loocv poisson violent2017 lnpop popgrowth shareyoung shareold
unemployment sharepoverty highschool somecollege associate bachelorup


loocv eststo: poisson violent2017 lnpop popgrowth shareyoung shareold
unemployment sharepoverty somecollege bachelorup, robust


// Combining models

loocv poisson violent2017 lnpop popgrowth share15to19 unemployment
sharepoverty lessthanhs bachelorup

eststo: poisson violent2017 lnpop popgrowth share15to19 unemployment
sharepoverty lessthanhs bachelorup, robust


loocv poisson violent2017 lnpop popgrowth share15to19 unemployment
sharepoverty bachelorup

eststo: poisson violent2017 lnpop popgrowth share15to19 unemployment
sharepoverty bachelorup, robust


loocv poisson violent2017 lnpop popgrowth share15to19 unemployment
sharepoverty lessthanhs bachelor graduate

eststo: poisson violent2017 lnpop popgrowth share15to19 unemployment
sharepoverty lessthanhs bachelor graduate, robust


loocv poisson violent2017 lnpop popgrowth share15to19 unemployment
sharepoverty bachelor graduate

eststo: poisson violent2017 lnpop popgrowth share15to19 unemployment
sharepoverty bachelor graduate, robust


esttab using "combinedModelsLog.rtf", se(3) nostar replace

eststo clear
```

```
//Prediction Models

loocv poisson violent2018 lnviolent2017 violentGrowth popgrowth lnpop share15to19 unemployment sharepoverty bachelorup

eststo: poisson violent2018 lnviolent2017 violentGrowth popgrowth lnpop share15to19 unemployment sharepoverty bachelorup, robust


test sharepoverty bachelorup


loocv poisson violent2018 lnviolent2017 violentGrowth popgrowth lnpop share15to19 unemployment

eststo: poisson violent2018 lnviolent2017 violentGrowth popgrowth lnpop share15to19 unemployment, robust


test lnpop unemployment


loocv poisson violent2018 lnviolent2017 violentGrowth popgrowth share15to19

eststo: poisson violent2018 lnviolent2017 violentGrowth popgrowth share15to19, robust


esttab using "predictionModelsLog.rtf", se(3) nostar replace

eststo clear


// Predict 2019


gen violentGrowth2018 = (violent2018 - violent2012)/6


poisson violent2018 lnviolent2018 violentGrowth2018 popgrowth share15to19, robust

predict prediction2018

save "PredictionLog.dta", replace

log close
```

Appendix C: Log-File

```
--------------------------------------------------------------------------------
      name:  <unnamed>
       log:  C:\Users\Josh\Desktop\QMBProject\Cantera_Log_Project.smcl
  log type:  smcl
 opened on:   6 Dec 2019, 16:18:40

.
. use "C:\Users\Josh\Desktop\QMBProject\projectData.dta"

. cd "C:\Users\Josh\Desktop\QMBProject\"
C:\Users\Josh\Desktop\QMBProject

.
. gen popgrowth = (pop2017 - pop2012) / 5

. gen propertyGrowth = (property2017 - property2012) / 5
(7 missing values generated)

. gen lnproperty2017 = ln(property2017)
(1 missing value generated)

.
. //Summary Statistics
. //Populations and Population growth
. summarize pop15to19 pop20to24 pop65to84 pop85up

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
   pop15to19 |         72    5544.569    9565.036        250      69912
   pop20to24 |         72    5368.778    10918.82        157      77957
   pop65to84 |         72    9150.125    12708.65        457      90146
     pop85up |         72    1645.903    2539.943         25      18987
```

```
. summarize shareyoung shareold, detail

                          shareyoung
-------------------------------------------------------------
      Percentiles      Smallest
 1%     .0856998       .0856998
 5%     .0909701       .0875183
10%     .0934574       .0896874       Obs                  72
25%      .107801       .0909701       Sum of Wgt.          72

50%     .1135534                      Mean           .1239414
                        Largest       Std. Dev.      .0313313
75%     .1316317       .2070991
90%     .1613894        .208073       Variance       .0009816
95%     .2070991       .2092145       Skewness          1.681
99%     .2321864       .2321864       Kurtosis       5.459558

                           shareold
-------------------------------------------------------------
      Percentiles      Smallest
 1%     .1003972       .1003972
 5%     .1122361       .1027387
10%     .1160814        .104415       Obs                  72
25%     .1353499       .1122361       Sum of Wgt.          72

50%     .1586834                      Mean           .1638153
                        Largest       Std. Dev.      .0370411
75%     .1878331       .2308986
90%     .2107245       .2346826       Variance        .001372
95%     .2308986       .2538878       Skewness       .4639113
99%     .2592627       .2592627       Kurtosis       2.613443

. summarize popGrowth, detail
```

```
                          popGrowth
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -.0074749      -.0074749
 5%    -.0052114      -.0064299
10%    -.0041265      -.0052397       Obs                  72
25%    -.0022431      -.0052114       Sum of Wgt.          72

50%     -.000012                      Mean           .0003725
                        Largest       Std. Dev.      .0039692
75%     .0026976       .0077377
90%     .0048552       .0082249       Variance       .0000158
95%     .0077377       .0125319       Skewness       .8190459
99%     .0130428       .0130428       Kurtosis        4.16537

. summarize pop, detail

                             Pop
-------------------------------------------------------------
      Percentiles      Smallest
 1%         4232           4232
 5%         7469           4423
10%        14755           5916       Obs                  72
25%        19514           7469       Sum of Wgt.          72

50%        41384                      Mean           78985.92
                        Largest       Std. Dev.      132198.8
75%        85370         248007
90%       166426         389891       Variance       1.75e+10
95%       248007         488073       Skewness       4.639431
99%       947735         947735       Kurtosis       28.46624

.
. //Violent Crimes and growth
```

```
. summarize violent2012 violent2017 violent2018

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
 violent2012 |         66    24.63636      29.088          0        184
 violent2017 |         70    24.12857    19.48461          0         89
 violent2018 |         71    22.76056    20.45515          0        103

. summarize lnviolent2012 lnviolent2017 lnviolent2018

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
lnviole~2012 |         65    2.729422      1.0588          0   5.214936
lnviole~2017 |         68    2.868541     .937405          0   4.488636
lnviole~2018 |         70    2.772094    .9211613          0   4.634729

. summarize violentGrowth

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
violentGro~h |         61    .0221093    .1831783  -.4795791   .6182085

. summarize violentGrowth, detail

                        violentGrowth
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -.4795791      -.4795791
 5%    -.2143602      -.4200122
10%    -.1911023      -.3649098       Obs                  61
25%    -.0749387      -.2143602       Sum of Wgt.          61

50%     .0364643                      Mean           .0221093
                        Largest       Std. Dev.      .1831783
```

```
75%     .0989392       .2598566
90%     .2387845        .308089       Variance       .0335543
95%     .2598566       .3583519       Skewness       .0031043
99%     .6182085       .6182085       Kurtosis       4.550498

.
. //Education
. summarize highschool somecollege associate bachelor graduate

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
  highschool |         72    36.15417    5.708751       17.9       45.4
 somecollege |         72    21.44861    2.071401       17.6       30.4
   associate |         72    11.14583    1.558614        7.6       15.6
    bachelor |         72    15.25833    4.775104        8.1       29.9
    graduate |         72    7.394444    2.993179        3.1       20.1

. summarize bachelorup lessthanhs

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
  bachelorup |         72    22.65278    7.571499       11.4         50
  lessthanhs |         72    8.598611    2.491478   3.900001       17.9

.
. //Poverty
. summarize poppov verypoor poor

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
      poppov |         72    77952.93    132035.2       4289     934232
    verypoor |         72    4129.194    10508.54        149      84036
        poor |         72    5491.903    13129.03        213     107937
```

```
. summarize shareverypoor sharepoor sharepoverty

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
shareveryp~r |         72    .0486735    .0195342   .0180882   .1584761
   sharepoor |         72    .0707906    .0234431   .0274545   .1999549
sharepoverty |         72    .1194642    .0416488   .0476047    .358431

.
. //Unemployment
. summarize unemployment, detail

                        Unemployment
-------------------------------------------------------------
      Percentiles      Smallest
 1%            2              2
 5%          2.7            2.6
10%          3.1            2.7       Obs                  72
25%          3.5            2.7       Sum of Wgt.          72

50%          4.1                      Mean           4.570833
                        Largest       Std. Dev.      1.498303
75%          5.3            7.9
90%          7.1            8.1       Variance       2.244912
95%          7.9            8.1       Skewness       .9741297
99%          8.3            8.3       Kurtosis       3.200197

.
. //Data Types
. describe

Contains data from C:\Users\Josh\Desktop\QMBProject\projectData.dta
  obs:            72
 vars:            51                          12 Nov 2019 18:34
```

```
-------------------------------------------------------------------------------
              storage   display    value
variable name   type    format     label      variable label
-------------------------------------------------------------------------------
county          str11   %11s                  County
pop2012         long    %12.0g                Pop2012
pop2017         long    %12.0g                Pop2017
pop15to19       long    %12.0g                Pop15to19
pop20to24       long    %12.0g                Pop20to24
pop65up         long    %12.0g                Pop65up
pop85up         int     %8.0g                 Pop85up
pop65to69       int     %8.0g                 Pop65to69
pop70to74       int     %8.0g                 Pop70to74
pop75to79       int     %8.0g                 Pop75to79
pop80to84       int     %8.0g                 Pop80to84
violent2012     int     %8.0g
property2012    int     %8.0g
violent2017     byte    %8.0g
property2017    int     %8.0g
violent2018     int     %8.0g
property2018    int     %8.0g
highschool      float   %9.0g                 HighSchool
somecollege     float   %9.0g                 SomeCollege
associate       float   %9.0g                 Associate
bachelor        float   %9.0g                 Bachelor
graduate        float   %9.0g                 Graduate
poppov          long    %12.0g                PopPov
verypoor        long    %12.0g                VeryPoor
poor            long    %12.0g                Poor
unemployment    float   %9.0g                 Unemployment
lnpop2012       float   %9.0g
lnpop2017       float   %9.0g
lnviolent2012   float   %9.0g
lnviolent2017   float   %9.0g
```

```
violentGrowth   float   %9.0g
popGrowth       float   %9.0g
pop             long    %12.0g                Pop
_merge          byte    %23.0g     _merge
share15to19     float   %9.0g
lnpop           float   %9.0g
share20to24     float   %9.0g
pop65to84       float   %9.0g
share65to84     float   %9.0g
share85up       float   %9.0g
shareyoung      float   %9.0g
shareold        float   %9.0g
shareverypoor   float   %9.0g
sharepoor       float   %9.0g
sharepoverty    float   %9.0g
bachelorup      float   %9.0g
lessthanhs      float   %9.0g
lnviolent2018   float   %9.0g
popgrowth       float   %9.0g
propertyGrowth  float   %9.0g
lnproperty2017  float   %9.0g
-------------------------------------------------------------------------------
Sorted by: county
     Note: Dataset has changed since last saved.


.
. //Inintial Models
. loocv poisson violent2018 violent2017 violentGrowth property2017 propertyGrow
> th lnpop popgrowth



 Leave-One-Out Cross-Validation Results
-----------------------------------------
         Method          |    Value
```

```
-------------------------+---------------
Root Mean Squared Errors |   49.16789
Mean Absolute Errors     |   16.686745
Pseudo-R2                |   .32761972
-----------------------------------------

. eststo: poisson violent2018 violent2017 violentGrowth property2017 propertyGr
> owth lnpop popgrowth, robust

Iteration 0:   log pseudolikelihood = -298.99509
Iteration 1:   log pseudolikelihood = -285.57039
Iteration 2:   log pseudolikelihood = -285.53145
Iteration 3:   log pseudolikelihood = -285.53144

Poisson regression                              Number of obs     =         60
                                                Wald chi2(6)      =     214.48
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -285.53144               Pseudo R2         =     0.5258

-------------------------------------------------------------------------------
> -
              |               Robust
  violent2018 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval
> ]
--------------+----------------------------------------------------------------
> -
  violent2017 |   .0172014   .0059838     2.87   0.004     .0054733    .028929
> 5
violentGrowth |  -.1421818   .4093599    -0.35   0.728    -.9445124    .660148
> 9
 property2017 |   .0008132   .0006969     1.17   0.243    -.0005528    .002179
> 1
propertyGrowth |   .0036433   .0042864     0.85   0.395    -.0047579    .012044
> 4
```

```
        lnpop |   .1828191   .0950393     1.92   0.054    -.0034545    .369092
> 7
    popgrowth |  -.0000381   .0000484    -0.79   0.432     -.000133    .000056
> 9
        _cons |   .5468982   .8963836     0.61   0.542    -1.209981    2.30377
> 8
-------------------------------------------------------------------------------
> -
(est4 stored)

. test violentGrowth propertyGrowth popgrowth

 ( 1)  [violent2018]violentGrowth = 0
 ( 2)  [violent2018]propertyGrowth = 0
 ( 3)  [violent2018]popgrowth = 0

           chi2(  3) =    2.73
         Prob > chi2 =    0.4360

.
. loocv poisson violent2018 lnviolent2017 violentGrowth lnproperty2017 property
> Growth


 Leave-One-Out Cross-Validation Results
-----------------------------------------
         Method          |    Value
-------------------------+---------------
Root Mean Squared Errors |   13.087796
Mean Absolute Errors     |   8.5439274
Pseudo-R2                |   .65138898
-----------------------------------------

. eststo: poisson violent2018 lnviolent2017 violentGrowth lnproperty2017 proper
```

```
> tyGrowth, robust

Iteration 0:   log pseudolikelihood = -249.16539
Iteration 1:   log pseudolikelihood =  -248.7585
Iteration 2:   log pseudolikelihood = -248.75841
Iteration 3:   log pseudolikelihood = -248.75841

Poisson regression                              Number of obs     =         60
                                                Wald chi2(4)      =     312.96
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -248.75841               Pseudo R2         =     0.5869

--------------------------------------------------------------------------------
> -
               |               Robust
   violent2018 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval
> ]
---------------+----------------------------------------------------------------
> -
 lnviolent2017 |   .7530633   .1323573     5.69   0.000     .4936478    1.01247
> 9
 violentGrowth |  -.8388623   .4892003    -1.71   0.086    -1.797677    .119952
> 7
lnproperty2017 |   .2780459   .1205639     2.31   0.021      .041745    .514346
> 8
propertyGrowth |   .0038512   .0025093     1.53   0.125    -.0010668    .008769
> 3
         _cons |  -.5457216   .3601207    -1.52   0.130    -1.251545     .16010
> 2
--------------------------------------------------------------------------------
> -
(est5 stored)

. test violentGrowth propertyGrowth
```

```
 ( 1)  [violent2018]violentGrowth = 0
 ( 2)  [violent2018]propertyGrowth = 0

           chi2(  2) =    8.46
         Prob > chi2 =    0.0146

.
.
. loocv poisson violent2018 lnviolent2017 violentGrowth


 Leave-One-Out Cross-Validation Results
-----------------------------------------
         Method          |    Value
-------------------------+---------------
Root Mean Squared Errors |   12.576183
Mean Absolute Errors     |   8.8211161
Pseudo-R2                |   .64701083
-----------------------------------------

. eststo: poisson violent2018 lnviolent2017 violentGrowth, robust

Iteration 0:   log pseudolikelihood = -274.32254
Iteration 1:   log pseudolikelihood =   -274.269
Iteration 2:   log pseudolikelihood =   -274.269

Poisson regression                              Number of obs     =         60
                                                Wald chi2(2)      =     130.85
                                                Prob > chi2       =     0.0000
Log pseudolikelihood =   -274.269               Pseudo R2         =     0.5445

------------------------------------------------------------------------------
             |               Robust
```

```
  violent2018 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
--------------+----------------------------------------------------------------
lnviolent2017 |   .9154279   .0824788    11.10   0.000     .7537723    1.077083
violentGrowth |  -.9900517   .4114969    -2.41   0.016    -1.796571   -.1835325
        _cons |   .2973159   .2741911     1.08   0.278    -.2400888    .8347206
-------------------------------------------------------------------------------
(est6 stored)

. test lnviolent2017 violentGrowth

 ( 1)  [violent2018]lnviolent2017 = 0
 ( 2)  [violent2018]violentGrowth = 0

           chi2(  2) =  130.85
         Prob > chi2 =    0.0000

.
. //Best Model
.
. loocv poisson violent2018 lnviolent2017 violentGrowth popgrowth


 Leave-One-Out Cross-Validation Results
-----------------------------------------
         Method          |    Value
-------------------------+---------------
Root Mean Squared Errors |   12.041794
Mean Absolute Errors     |   8.6250449
Pseudo-R2                |   .67740948
-----------------------------------------

. eststo: poisson violent2018 lnviolent2017 violentGrowth popgrowth, robust

Iteration 0:   log pseudolikelihood =  -270.8161
```

```
Iteration 1:   log pseudolikelihood =   -265.144
Iteration 2:   log pseudolikelihood =  -265.1386
Iteration 3:   log pseudolikelihood =  -265.1386

Poisson regression                              Number of obs     =         60
                                                Wald chi2(3)      =     295.71
                                                Prob > chi2       =     0.0000
Log pseudolikelihood =  -265.1386               Pseudo R2         =     0.5597

------------------------------------------------------------------------------
             |               Robust
 violent2018 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnviolent2017 |   .8649144   .0822558    10.51   0.000      .703696    1.026133
violentGrowth |   -1.01415   .4340663    -2.34   0.019    -1.864905   -.1633961
    popgrowth |    .000077   .0000236     3.26   0.001     .0000307    .0001232
        _cons |   .4312538   .2668983     1.62   0.106    -.0918573    .9543649
------------------------------------------------------------------------------
(est7 stored)

.
. esttab using "initialModelsLog.rtf", se(3) nostar replace
(note: file initialModelsLog.rtf not found)
(output written to initialModelsLog.rtf)

. eststo clear

.
. //Drivers of crime
. eststo: poisson violent2017 lnpop popgrowth shareyoung shareold unemployment
> sharepoverty lessthanhs bachelorup, robust

Iteration 0:   log pseudolikelihood = -412.37025
Iteration 1:   log pseudolikelihood = -411.05959
```

```
Iteration 2:   log pseudolikelihood = -411.05533
Iteration 3:   log pseudolikelihood = -411.05533

Poisson regression                              Number of obs     =         70
                                                Wald chi2(8)      =     137.93
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -411.05533               Pseudo R2         =     0.3921

------------------------------------------------------------------------------
             |               Robust
 violent2017 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lnpop |   .5177841   .1024369     5.05   0.000     .3170113    .7185568
   popgrowth |   .0001251   .0000399     3.13   0.002     .0000468    .0002034
  shareyoung |   3.537947   3.335203     1.06   0.289    -2.998931    10.07482
    shareold |   1.118201    4.04999     0.28   0.782    -6.819634    9.056036
unemployment |   .1435464   .0707333     2.03   0.042     .0049117    .2821811
sharepoverty |  -6.417162   2.734456    -2.35   0.019     -11.7766   -1.057727
  lessthanhs |   .0174396   .0404676     0.43   0.667    -.0618754    .0967545
  bachelorup |  -.0265705   .0164311    -1.62   0.106    -.0587749    .0056339
       _cons |  -2.564468   1.473326    -1.74   0.082    -5.452133    .3231971
------------------------------------------------------------------------------
(est1 stored)

.
. regress violent2017 lnpop popgrowth shareyoung shareold unemployment sharepov
> erty lessthanhs bachelorup, robust

Linear regression                               Number of obs     =         70
                                                F(8, 61)          =       9.73
                                                Prob > F          =     0.0000
                                                R-squared         =     0.5304
                                                Root MSE          =     14.201
```

```
------------------------------------------------------------------------------
             |               Robust
 violent2017 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lnpop |   12.27476   2.415176     5.08   0.000     7.445322    17.10421
   popgrowth |   .0046319   .0015862     2.92   0.005     .0014602    .0078037
  shareyoung |  -9.417672   74.61063    -0.13   0.900    -158.6108    139.7755
    shareold |  -32.26748   92.71421    -0.35   0.729     -217.661     153.126
unemployment |   3.556483    1.87502     1.90   0.063    -.1928501    7.305816
sharepoverty |  -48.06369   42.62143    -1.13   0.264    -133.2905    37.16313
  lessthanhs |   .4567819   1.015434     0.45   0.654    -1.573704    2.487268
 bachelorup  |  -.3969344   .4243546    -0.94   0.353    -1.245484     .451615
       _cons |  -106.3314   30.49586    -3.49   0.001    -167.3117   -45.35118
------------------------------------------------------------------------------


. vif

    Variable |       VIF       1/VIF
-------------+----------------------
  bachelorup |      4.39    0.227805
       lnpop |      3.21    0.311050
    shareold |      3.01    0.331872
  lessthanhs |      2.74    0.364430
sharepoverty |      2.53    0.395288
  shareyoung |      2.15    0.465712
unemployment |      1.94    0.516337
   popgrowth |      1.60    0.626263
-------------+----------------------
    Mean VIF |      2.70

. correlate lnpop popgrowth shareyoung shareold unemployment sharepoverty lesst
> hanhs bachelorup
(obs=72)
```

```
             |    lnpop popgro~h sharey~g shareold unempl~t sharep~y lessth~s b
> achel~p
-------------+------------------------------------------------------------------
> -------
       lnpop |   1.0000
   popgrowth |   0.4239   1.0000
  shareyoung |   0.4020   0.2197   1.0000
    shareold |  -0.6527  -0.3490  -0.6418   1.0000
unemployment |  -0.2004  -0.1511  -0.0337   0.3205   1.0000
sharepoverty |  -0.2849  -0.1029   0.2646   0.0650   0.5825   1.0000
  lessthanhs |  -0.2262  -0.3321  -0.1879   0.2406   0.1843   0.3358   1.0000
  bachelorup |   0.6154   0.5844   0.3539  -0.4415  -0.2004  -0.2769  -0.7107
>  1.0000


.
. // a
. eststo: poisson violent2017 lnpop popgrowth share15to19 share20to24 shareold
> unemployment sharepoverty lessthanhs bachelorup, robust

Iteration 0:   log pseudolikelihood = -407.06725
Iteration 1:   log pseudolikelihood = -406.13358
Iteration 2:   log pseudolikelihood = -406.13049
Iteration 3:   log pseudolikelihood = -406.13049

Poisson regression                              Number of obs     =         70
                                                Wald chi2(9)      =     169.27
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -406.13049               Pseudo R2         =     0.3994

------------------------------------------------------------------------------
             |               Robust
 violent2017 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
```

```
       lnpop |   .5421668   .1041747     5.20   0.000     .3379881    .7463455
   popgrowth |   .0001668   .0000532     3.13   0.002     .0000625    .0002712
 share15to19 |   22.59395   13.68331     1.65   0.099    -4.224836    49.41274
 share20to24 |  -2.527932    5.13894    -0.49   0.623    -12.60007    7.544205
    shareold |   2.711416   4.028433     0.67   0.501    -5.184168      10.607
unemployment |   .1469954   .0615525     2.39   0.017     .0263548    .2676361
sharepoverty |  -6.370541   2.585038    -2.46   0.014    -11.43712   -1.303961
  lessthanhs |   .0189563   .0408667     0.46   0.643     -.061141    .0990535
  bachelorup |  -.0272509   .0164422    -1.66   0.097     -.059477    .0049752
       _cons |  -4.055459   1.879286    -2.16   0.031    -7.738793   -.3721257
------------------------------------------------------------------------------
(est2 stored)

. test share15to19 share20to24

 ( 1)  [violent2017]share15to19 = 0
 ( 2)  [violent2017]share20to24 = 0

           chi2(  2) =    3.12
         Prob > chi2 =    0.2105

. test share15to19=share20to24

 ( 1)  [violent2017]share15to19 - [violent2017]share20to24 = 0

           chi2(  1) =    2.12
         Prob > chi2 =    0.1457

.
. // b
. eststo: poisson violent2017 lnpop popgrowth shareyoung share65to84 share85up
> unemployment sharepoverty lessthanhs bachelorup, robust

Iteration 0:   log pseudolikelihood = -410.74749
```

```
Iteration 1:   log pseudolikelihood = -409.49127
Iteration 2:   log pseudolikelihood = -409.48726
Iteration 3:   log pseudolikelihood = -409.48726

Poisson regression                              Number of obs     =         70
                                                Wald chi2(9)      =     144.00
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -409.48726               Pseudo R2         =     0.3945

------------------------------------------------------------------------------
             |               Robust
 violent2017 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lnpop |   .5426835   .1090459     4.98   0.000     .3289575    .7564094
   popgrowth |   .0001192     .00004     2.98   0.003     .0000407    .0001976
  shareyoung |   3.773446   3.317864     1.14   0.255    -2.729448    10.27634
 share65to84 |   3.070618   5.198663     0.59   0.555    -7.118575    13.25981
   share85up |  -12.36934   21.14572    -0.58   0.559     -53.8142    29.07552
unemployment |    .124313   .0801364     1.55   0.121    -.0327515    .2813775
sharepoverty |  -6.080302   2.710668    -2.24   0.025    -11.39311   -.7674895
  lessthanhs |   .0145118   .0389723     0.37   0.710    -.0618726    .0908962
  bachelorup |  -.0292312    .016181    -1.81   0.071    -.0609454     .002483
       _cons |  -2.683715   1.487225    -1.80   0.071    -5.598623    .2311923
------------------------------------------------------------------------------
(est3 stored)

. test share65to84 share85up

 ( 1)  [violent2017]share65to84 = 0
 ( 2)  [violent2017]share85up = 0

           chi2(  2) =    0.47
         Prob > chi2 =    0.7913
```

```
. test share65to84=share85up

 ( 1)  [violent2017]share65to84 - [violent2017]share85up = 0

           chi2(  1) =    0.41
         Prob > chi2 =    0.5210

.
. // c
. eststo: poisson violent2017 lnpop popgrowth shareyoung shareold unemployment
> sharepoor shareverypoor lessthanhs bachelorup, robust

Iteration 0:   log pseudolikelihood = -412.37009
Iteration 1:   log pseudolikelihood = -411.05959
Iteration 2:   log pseudolikelihood = -411.05533
Iteration 3:   log pseudolikelihood = -411.05533

Poisson regression                              Number of obs     =         70
                                                Wald chi2(9)      =     138.16
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -411.05533               Pseudo R2         =     0.3921

-------------------------------------------------------------------------------
              |               Robust
  violent2017 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
--------------+----------------------------------------------------------------
        lnpop |   .5177832   .1025479     5.05   0.000     .3167929    .7187735
    popgrowth |   .0001251   .0000416     3.00   0.003     .0000435    .0002067
   shareyoung |   3.537129   3.404036     1.04   0.299    -3.134659    10.20892
     shareold |   1.118295   4.039072     0.28   0.782     -6.79814     9.03473
 unemployment |   .1435424   .0705964     2.03   0.042     .0051761    .2819088
    sharepoor |  -6.426115   8.573936    -0.75   0.454    -23.23072    10.37849
shareverypoor |  -6.406171   10.15725    -0.63   0.528    -26.31401    13.50166
   lessthanhs |   .0174412   .0406185     0.43   0.668    -.0621696    .0970519
```

```
   bachelorup |  -.0265742   .0167198    -1.59   0.112    -.0593444     .006196
        _cons |  -2.564183   1.528032    -1.68   0.093     -5.55907    .4307044
------------------------------------------------------------------------------
(est4 stored)

. test sharepoor shareverypoor

 ( 1)  [violent2017]sharepoor = 0
 ( 2)  [violent2017]shareverypoor = 0

           chi2(  2) =    5.51
         Prob > chi2 =    0.0635

. test sharepoor=shareverypoor

 ( 1)  [violent2017]sharepoor - [violent2017]shareverypoor = 0

           chi2(  1) =    0.00
         Prob > chi2 =    0.9991

.
. // d
. eststo: poisson violent2017 lnpop popgrowth shareyoung shareold unemployment
> sharepoverty lessthanhs bachelor graduate, robust

Iteration 0:   log pseudolikelihood = -411.94838
Iteration 1:   log pseudolikelihood = -410.76192
Iteration 2:   log pseudolikelihood = -410.75749
Iteration 3:   log pseudolikelihood = -410.75749

Poisson regression                              Number of obs     =         70
                                                Wald chi2(9)      =     145.25
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -410.75749               Pseudo R2         =     0.3926
```

```
------------------------------------------------------------------------------
             |               Robust
 violent2017 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lnpop |   .5131852   .1037117     4.95   0.000     .3099141    .7164564
   popgrowth |   .0001347    .000054     2.50   0.013     .0000289    .0002404
  shareyoung |    3.80891   3.413405     1.12   0.264    -2.881241    10.49906
    shareold |   1.500886   4.382222     0.34   0.732    -7.088111    10.08988
unemployment |   .1463868   .0724195     2.02   0.043     .0044471    .2883264
sharepoverty |  -6.203397   2.850445    -2.18   0.030    -11.79017   -.6166287
  lessthanhs |   .0213221   .0420093     0.51   0.612    -.0610146    .1036589
    bachelor |  -.0132843    .052356    -0.25   0.800    -.1159002    .0893315
    graduate |  -.0446037   .0685988    -0.65   0.516     -.179055    .0898475
       _cons |  -2.754839   1.652534    -1.67   0.096    -5.993745    .4840672
------------------------------------------------------------------------------
(est5 stored)

. test bachelor graduate

 ( 1)  [violent2017]bachelor = 0
 ( 2)  [violent2017]graduate = 0

           chi2(  2) =    2.70
         Prob > chi2 =    0.2597

. test bachelor=graduate

 ( 1)  [violent2017]bachelor - [violent2017]graduate = 0

           chi2(  1) =    0.07
         Prob > chi2 =    0.7877

.
```

```
. // e

. eststo: poisson violent2017 lnpop popgrowth shareyoung shareold unemployment

> sharepoverty highschool somecollege associate bachelorup, robust


Iteration 0:   log pseudolikelihood = -399.99515

Iteration 1:   log pseudolikelihood = -398.50282

Iteration 2:   log pseudolikelihood = -398.49887

Iteration 3:   log pseudolikelihood = -398.49887


Poisson regression                              Number of obs     =         70

                                                Wald chi2(10)     =     198.69

                                                Prob > chi2       =     0.0000

Log pseudolikelihood = -398.49887               Pseudo R2         =     0.4107


------------------------------------------------------------------------------

             |               Robust

 violent2017 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]

-------------+----------------------------------------------------------------

       lnpop |   .5191844   .0976631     5.32   0.000     .3277682    .7106007

   popgrowth |   .0001043   .0000414     2.52   0.012     .0000232    .0001855

  shareyoung |   3.922412   3.439434     1.14   0.254    -2.818756    10.66358

    shareold |   2.818076   4.420462     0.64   0.524    -5.845871    11.48202

unemployment |   .2082313   .0900407     2.31   0.021     .0317549    .3847078

sharepoverty |  -8.265553   2.809045    -2.94   0.003    -13.77118   -2.759926

  highschool |  -.0721661    .061826    -1.17   0.243    -.1933429    .0490107

 somecollege |  -.1042602   .0609609    -1.71   0.087    -.2237413    .0152209

   associate |   .0280272    .048201     0.58   0.561     -.066445    .1224994

  bachelorup |  -.0820269   .0468995    -1.75   0.080    -.1739481    .0098944

       _cons |   2.953093   4.875793     0.61   0.545    -6.603285    12.50947

------------------------------------------------------------------------------

(est6 stored)


. test highschool somecollege associate
```

```
 ( 1)  [violent2017]highschool = 0
 ( 2)  [violent2017]somecollege = 0
 ( 3)  [violent2017]associate = 0

           chi2(  3) =    4.75
         Prob > chi2 =    0.1914

. test highschool=somecollege=associate

 ( 1)  [violent2017]highschool - [violent2017]somecollege = 0
 ( 2)  [violent2017]highschool - [violent2017]associate = 0

           chi2(  2) =    4.52
         Prob > chi2 =    0.1041

.
. //Additional
. eststo: poisson violent2017 lnpop popgrowth shareyoung shareold unemployment
> sharepoverty somecollege bachelorup, robust

Iteration 0:   log pseudolikelihood = -408.00018
Iteration 1:   log pseudolikelihood = -406.78269
Iteration 2:   log pseudolikelihood = -406.77898
Iteration 3:   log pseudolikelihood = -406.77898

Poisson regression                              Number of obs     =         70
                                                Wald chi2(8)      =     157.67
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -406.77898               Pseudo R2         =     0.3985

------------------------------------------------------------------------------
             |               Robust
 violent2017 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
```

```
       lnpop |   .4999271   .0902241     5.54   0.000     .3230912     .676763
   popgrowth |   .0001043   .0000433     2.41   0.016     .0000194    .0001893
  shareyoung |   2.998253   3.408266     0.88   0.379    -3.681826    9.678331
    shareold |   .6880529   4.004426     0.17   0.864    -7.160477    8.536583
unemployment |   .2023948   .0882539     2.29   0.022     .0294203    .3753694
sharepoverty |  -7.069932   2.427216    -2.91   0.004    -11.82719   -2.312676
 somecollege |  -.0610434   .0541876    -1.13   0.260    -.1672491    .0451624
  bachelorup |  -.0300401   .0123064    -2.44   0.015    -.0541603     -.00592
       _cons |  -.8883561   2.048593    -0.43   0.665    -4.903524    3.126812
------------------------------------------------------------------------------
(est7 stored)


.
. esttab using "crimeDriversLog.rtf", se(3) nostar replace
(note: file crimeDriversLog.rtf not found)
(output written to crimeDriversLog.rtf)

. eststo clear


.
. loocv poisson violent2017 lnpop popgrowth shareyoung shareold unemployment sh
> arepoverty lessthanhs bachelorup, robust



 Leave-One-Out Cross-Validation Results
-----------------------------------------
         Method          |    Value
-------------------------+---------------
Root Mean Squared Errors |   18.156669
Mean Absolute Errors     |   13.222717
Pseudo-R2                |   .35033617
-----------------------------------------


.
```

```
. loocv poisson violent2017 lnpop popgrowth share15to19 share20to24 shareold un
> employment sharepoverty lessthanhs bachelorup


 Leave-One-Out Cross-Validation Results
-----------------------------------------
         Method          |    Value
-------------------------+---------------
Root Mean Squared Errors |   15.379938
Mean Absolute Errors     |   12.235847
Pseudo-R2                |   .41879987
-----------------------------------------

.
. loocv poisson violent2017 lnpop popgrowth shareyoung share65to84 share85up un
> employment sharepoverty lessthanhs bachelorup


 Leave-One-Out Cross-Validation Results
-----------------------------------------
         Method          |    Value
-------------------------+---------------
Root Mean Squared Errors |   17.350007
Mean Absolute Errors     |   13.097056
Pseudo-R2                |   .35819884
-----------------------------------------

.
. loocv poisson violent2017 lnpop popgrowth shareyoung shareold unemployment sh
> arepoor shareverypoor lessthanhs bachelorup


 Leave-One-Out Cross-Validation Results
-----------------------------------------
```

```
         Method          |    Value
-------------------------+---------------
Root Mean Squared Errors |   18.371456
Mean Absolute Errors     |   13.433351
Pseudo-R2                |   .3409986
-----------------------------------------

.
. loocv poisson violent2017 lnpop popgrowth shareyoung shareold unemployment sh
> arepoverty lessthanhs bachelor graduate


 Leave-One-Out Cross-Validation Results
-----------------------------------------
         Method          |    Value
-------------------------+---------------
Root Mean Squared Errors |   18.986501
Mean Absolute Errors     |   13.576504
Pseudo-R2                |   .32578779
-----------------------------------------

.
. loocv poisson violent2017 lnpop popgrowth shareyoung shareold unemployment sh
> arepoverty highschool somecollege associate bachelorup


 Leave-One-Out Cross-Validation Results
-----------------------------------------
         Method          |    Value
-------------------------+---------------
Root Mean Squared Errors |   15.448863
Mean Absolute Errors     |   12.195429
Pseudo-R2                |   .40548981
-----------------------------------------
```

```
.
. loocv eststo: poisson violent2017 lnpop popgrowth shareyoung shareold unemplo
> yment sharepoverty somecollege bachelorup, robust


 Leave-One-Out Cross-Validation Results
-----------------------------------------
        Method          |    Value
------------------------+----------------
Root Mean Squared Errors |   16.478571
Mean Absolute Errors     |   12.818964
Pseudo-R2                |   .38739067
-----------------------------------------

.
. // Combining models
. loocv poisson violent2017 lnpop popgrowth share15to19 unemployment sharepover
> ty lessthanhs bachelorup


 Leave-One-Out Cross-Validation Results
-----------------------------------------
        Method          |    Value
------------------------+----------------
Root Mean Squared Errors |   15.342847
Mean Absolute Errors     |   12.051063
Pseudo-R2                |   .43705222
-----------------------------------------

. eststo: poisson violent2017 lnpop popgrowth share15to19 unemployment sharepov
> erty lessthanhs bachelorup, robust

Iteration 0:   log pseudolikelihood = -409.73544
```

```
Iteration 1:   log pseudolikelihood = -408.52089
Iteration 2:   log pseudolikelihood = -408.51812
Iteration 3:   log pseudolikelihood = -408.51812

Poisson regression                              Number of obs     =         70
                                                Wald chi2(7)      =     142.38
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -408.51812               Pseudo R2         =     0.3959

------------------------------------------------------------------------------
             |               Robust
 violent2017 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lnpop |   .4872675   .0761501     6.40   0.000     .3380161     .636519
   popgrowth |   .0001436   .0000459     3.13   0.002     .0000538    .0002335
 share15to19 |   12.71581   9.676295     1.31   0.189    -6.249383      31.681
unemployment |    .154851   .0588949     2.63   0.009     .0394192    .2702828
sharepoverty |   -6.48178   2.671508    -2.43   0.015    -11.71784    -1.24572
  lessthanhs |   .0212328   .0405269     0.52   0.600    -.0581984    .1006641
  bachelorup |  -.0256356   .0166846    -1.54   0.124    -.0583369    .0070657
       _cons |  -2.575799   .8596609    -3.00   0.003    -4.260703   -.8908945
------------------------------------------------------------------------------
(est72 stored)

.
. loocv poisson violent2017 lnpop popgrowth share15to19 unemployment sharepover
> ty bachelorup


 Leave-One-Out Cross-Validation Results
-----------------------------------------
         Method          |    Value
-------------------------+---------------
Root Mean Squared Errors |   14.952309
```

```
Mean Absolute Errors     |   11.74114
Pseudo-R2                |   .44958327
-----------------------------------------

. eststo: poisson violent2017 lnpop popgrowth share15to19 unemployment sharepov
> erty bachelorup, robust

Iteration 0:   log pseudolikelihood = -410.40814
Iteration 1:   log pseudolikelihood = -409.25508
Iteration 2:   log pseudolikelihood =  -409.2525
Iteration 3:   log pseudolikelihood =  -409.2525

Poisson regression                              Number of obs     =         70
                                                Wald chi2(6)      =     141.71
                                                Prob > chi2       =     0.0000
Log pseudolikelihood =  -409.2525               Pseudo R2         =     0.3948

------------------------------------------------------------------------------
             |               Robust
 violent2017 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lnpop |   .5075216   .0678648     7.48   0.000      .374509    .6405343
   popgrowth |   .0001446   .0000458     3.16   0.002     .0000548    .0002345
 share15to19 |   11.78132   9.360907     1.26   0.208    -6.565725    30.12836
unemployment |   .1524327   .0591999     2.57   0.010     .0364031    .2684623
sharepoverty |  -5.824287   2.246664    -2.59   0.010    -10.22767   -1.420906
  bachelorup |  -.0311947    .012942    -2.41   0.016    -.0565605   -.0058288
       _cons |  -2.486545   .8222774    -3.02   0.002    -4.098179    -.874911
------------------------------------------------------------------------------
(est73 stored)

.
. loocv poisson violent2017 lnpop popgrowth share15to19 unemployment sharepover
> ty lessthanhs bachelor graduate
```

```
 Leave-One-Out Cross-Validation Results
-----------------------------------------
         Method          |    Value
-------------------------+---------------
Root Mean Squared Errors |   16.335665
Mean Absolute Errors     |   12.475284
Pseudo-R2                |   .39947824
-----------------------------------------

. eststo: poisson violent2017 lnpop popgrowth share15to19 unemployment sharepov
> erty lessthanhs bachelor graduate, robust

Iteration 0:   log pseudolikelihood = -409.45941
Iteration 1:   log pseudolikelihood = -408.48335
Iteration 2:   log pseudolikelihood = -408.48002
Iteration 3:   log pseudolikelihood = -408.48002

Poisson regression                              Number of obs     =         70
                                                Wald chi2(8)      =     149.38
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -408.48002               Pseudo R2         =     0.3960

------------------------------------------------------------------------------
             |               Robust
 violent2017 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lnpop |   .4833222    .084923     5.69   0.000     .3168761    .6497683
   popgrowth |   .0001466   .0000576     2.54   0.011     .0000337    .0002594
 share15to19 |   12.72541   9.673905     1.32   0.188    -6.235096    31.68592
unemployment |   .1561465   .0621983     2.51   0.012       .03424     .278053
sharepoverty |  -6.385391   2.765687    -2.31   0.021    -11.80604   -.9647455
  lessthanhs |   .0225381   .0423804     0.53   0.595     -.060526    .1056022
```

```
    bachelor |   -.021083   .0491839    -0.43   0.668    -.1174817    .0753156
    graduate |   -.031553   .0629488    -0.50   0.616    -.1549304    .0918245
       _cons |  -2.589168   .8651562    -2.99   0.003    -4.284843   -.8934925
------------------------------------------------------------------------------
(est74 stored)

.
. loocv poisson violent2017 lnpop popgrowth share15to19 unemployment sharepover
> ty bachelor graduate



 Leave-One-Out Cross-Validation Results
-----------------------------------------
         Method          |    Value
-------------------------+---------------
Root Mean Squared Errors |   16.401767
Mean Absolute Errors     |   12.288472
Pseudo-R2                |   .39753808
-----------------------------------------

. eststo: poisson violent2017 lnpop popgrowth share15to19 unemployment sharepov
> erty bachelor graduate, robust

Iteration 0:   log pseudolikelihood = -410.23702
Iteration 1:   log pseudolikelihood = -409.25413
Iteration 2:   log pseudolikelihood = -409.25127
Iteration 3:   log pseudolikelihood = -409.25127

Poisson regression                              Number of obs     =         70
                                                Wald chi2(7)      =     146.28
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -409.25127               Pseudo R2         =     0.3948

------------------------------------------------------------------------------
```

```
             |               Robust
 violent2017 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lnpop |   .5079744   .0722811     7.03   0.000     .3663061    .6496427
   popgrowth |   .0001441   .0000579     2.49   0.013     .0000306    .0002576
 share15to19 |   11.78921   9.393516     1.26   0.209    -6.621748    30.20016
unemployment |   .1522361    .061693     2.47   0.014     .0313201    .2731522
sharepoverty |  -5.847692   2.510242    -2.33   0.020    -10.76768    -.927708
    bachelor |  -.0319199    .043707    -0.73   0.465    -.1175841    .0537442
    graduate |  -.0301096   .0637237    -0.47   0.637    -.1550057    .0947865
       _cons |  -2.485102   .8246943    -3.01   0.003    -4.101473   -.8687305
------------------------------------------------------------------------------
(est75 stored)

.
. esttab using "combinedModelsLog.rtf", se(3) nostar replace
(note: file combinedModelsLog.rtf not found)
(output written to combinedModelsLog.rtf)

. eststo clear

.
. //Prediction Models
.
. loocv poisson violent2018 lnviolent2017 violentGrowth popgrowth lnpop share15
> to19 unemployment sharepoverty bachelorup


 Leave-One-Out Cross-Validation Results
-----------------------------------------
         Method          |    Value
-------------------------+---------------
Root Mean Squared Errors |   14.016226
Mean Absolute Errors     |   9.683358
```

```
Pseudo-R2                |   .60378361
-----------------------------------------


. eststo: poisson violent2018 lnviolent2017 violentGrowth popgrowth lnpop share
> 15to19 unemployment sharepoverty bachelorup, robust


Iteration 0:   log pseudolikelihood = -261.76555
Iteration 1:   log pseudolikelihood = -254.82534
Iteration 2:   log pseudolikelihood = -254.80953
Iteration 3:   log pseudolikelihood = -254.80953


Poisson regression                              Number of obs     =         60
                                                Wald chi2(8)      =     338.20
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -254.80953               Pseudo R2         =     0.5768


--------------------------------------------------------------------------------
              |               Robust
  violent2018 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
--------------+-----------------------------------------------------------------
lnviolent2017 |   .8364854   .1177387     7.10   0.000     .6057218    1.067249
violentGrowth |  -.8584422   .4781311    -1.80   0.073    -1.795562    .0786776
    popgrowth |    .000069   .0000433     1.59   0.111    -.0000159    .0001538
        lnpop |   .1145994   .0932934     1.23   0.219    -.0682523     .297451
  share15to19 |  -12.11531   4.929093    -2.46   0.014    -21.77615   -2.454462
 unemployment |  -.0701173   .0591769    -1.18   0.236     -.186102    .0458673
 sharepoverty |   2.039403   2.179005     0.94   0.349    -2.231368    6.310173
   bachelorup |  -.0089961   .0125558    -0.72   0.474    -.0336051    .0156128
        _cons |   .3831605    .611736     0.63   0.531    -.8158201    1.582141
--------------------------------------------------------------------------------
(est1 stored)


.
. test sharepoverty bachelorup
```

```
 ( 1)  [violent2018]sharepoverty = 0
 ( 2)  [violent2018]bachelorup = 0

           chi2(  2) =    2.56
         Prob > chi2 =    0.2781

.
. loocv poisson violent2018 lnviolent2017 violentGrowth popgrowth lnpop share15
> to19 unemployment


 Leave-One-Out Cross-Validation Results
-----------------------------------------
         Method          |    Value
-------------------------+---------------
Root Mean Squared Errors |   12.235904
Mean Absolute Errors     |   8.8036559
Pseudo-R2                |   .66603695
-----------------------------------------

. eststo: poisson violent2018 lnviolent2017 violentGrowth popgrowth lnpop share
> 15to19 unemployment, robust

Iteration 0:   log pseudolikelihood = -264.35839
Iteration 1:   log pseudolikelihood = -258.61308
Iteration 2:   log pseudolikelihood = -258.60561
Iteration 3:   log pseudolikelihood = -258.60561

Poisson regression                              Number of obs     =         60
                                                Wald chi2(6)      =     319.53
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -258.60561               Pseudo R2         =     0.5705
```

```
------------------------------------------------------------------------------
             |               Robust
 violent2018 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnviolent2017 |   .8386199   .1130639     7.42   0.000     .6170188    1.060221
violentGrowth |  -.9405693   .4583478    -2.05   0.040    -1.838915    -.042224
    popgrowth |   .0000485   .0000289     1.68   0.093    -8.14e-06     .000105
        lnpop |   .0759517   .0735728     1.03   0.302    -.0682483    .2201517
  share15to19 |  -10.30515    4.97881    -2.07   0.038    -20.06344     -.54686
 unemployment |  -.0278689   .0419425    -0.66   0.506    -.1100747    .0543368
        _cons |    .513055   .5974949     0.86   0.391    -.6580135    1.684123
------------------------------------------------------------------------------
(est2 stored)

.
. test lnpop unemployment

 ( 1)  [violent2018]lnpop = 0
 ( 2)  [violent2018]unemployment = 0

           chi2(  2) =    1.44
         Prob > chi2 =    0.4864

.
. loocv poisson violent2018 lnviolent2017 violentGrowth popgrowth share15to19


 Leave-One-Out Cross-Validation Results
-----------------------------------------
         Method          |    Value
-------------------------+---------------
Root Mean Squared Errors |   11.847905
Mean Absolute Errors     |   8.5259778
Pseudo-R2                |   .68778041
```

```
-----------------------------------------

. eststo: poisson violent2018 lnviolent2017 violentGrowth popgrowth share15to19
> , robust

Iteration 0:   log pseudolikelihood = -267.51299
Iteration 1:   log pseudolikelihood = -261.48169
Iteration 2:   log pseudolikelihood = -261.47481
Iteration 3:   log pseudolikelihood = -261.47481

Poisson regression                              Number of obs     =         60
                                                Wald chi2(4)      =     327.77
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -261.47481               Pseudo R2         =     0.5658

-------------------------------------------------------------------------------
              |               Robust
  violent2018 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
--------------+----------------------------------------------------------------
lnviolent2017 |   .8961913   .0837888    10.70   0.000     .7319684    1.060414
violentGrowth |  -1.081979   .4313989    -2.51   0.012    -1.927506    -.236453
    popgrowth |   .0000726   .0000237     3.07   0.002     .0000262     .000119
  share15to19 |   -8.76482   4.531619    -1.93   0.053    -17.64663    .1169892
        _cons |   .9310544   .3503824     2.66   0.008     .2443174    1.617791
-------------------------------------------------------------------------------
(est3 stored)

.
. esttab using "predictionModelsLog.rtf", se(3) nostar replace
(note: file predictionModelsLog.rtf not found)
(output written to predictionModelsLog.rtf)

. eststo clear
```

```
.
. // Predict 2019
.
. gen violentGrowth2018 = (violent2018 - violent2012)/6
(7 missing values generated)

.
. poisson violent2018 lnviolent2018 violentGrowth2018 popgrowth share15to19, ro
> bust

Iteration 0:   log pseudolikelihood = -157.14905
Iteration 1:   log pseudolikelihood = -150.62749
Iteration 2:   log pseudolikelihood =  -150.6168
Iteration 3:   log pseudolikelihood =  -150.6168

Poisson regression                              Number of obs     =         65
                                                Wald chi2(3)      =          .
                                                Prob > chi2       =          .
Log pseudolikelihood =  -150.6168               Pseudo R2         =     0.7704

-------------------------------------------------------------------------------
> ----
                  |               Robust
      violent2018 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Inter
> val]
------------------+------------------------------------------------------------
> ----
    lnviolent2018 |          1   1.49e-08  6.7e+07   0.000            1
>    1
violentGrowth2018 |  -8.75e-09   2.16e-09    -4.04   0.000    -1.30e-08   -4.51
> e-09
        popgrowth |   3.41e-11   1.09e-11     3.14   0.002     1.28e-11    5.55
> e-11
      share15to19 |  -8.05e-08   6.80e-07    -0.12   0.906    -1.41e-06    1.25
```

```
> e-06
           _cons |  -9.42e-09   5.15e-08    -0.18   0.855    -1.10e-07    9.16
> e-08
------------------------------------------------------------------------------
> ----

. predict prediction2018
(option n assumed; predicted number of events)
(7 missing values generated)

. save "PredictionLog.dta", replace
(note: file PredictionLog.dta not found)
file PredictionLog.dta saved

.
. log close
      name:  <unnamed>
       log:  C:\Users\Josh\Desktop\QMBProject\Cantera_Log_Project.smcl
  log type:  smcl
 closed on:   6 Dec 2019, 16:20:09
------------------------------------------------------------------------------
```

Appendix D: Summary Statistics

```
summarize pop15to19 pop20to24 pop65to84 pop85up

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
   pop15to19 |         72    5544.569    9565.036        250      69912
   pop20to24 |         72    5368.778    10918.82        157      77957
   pop65to84 |         72    9150.125    12708.65        457      90146
     pop85up |         72    1645.903    2539.943         25      18987

. summarize violent2012 violent2017 violent2018

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
 violent2012 |         66    24.63636      29.088          0        184
 violent2017 |         70    24.12857    19.48461          0         89
 violent2018 |         71    22.76056    20.45515          0        103

. summarize shareyoung shareold, detail

                         shareyoung
-------------------------------------------------------------
      Percentiles      Smallest
 1%     .0856998       .0856998
 5%     .0909701       .0875183
10%     .0934574       .0896874       Obs                  72
25%      .107801       .0909701       Sum of Wgt.          72

50%     .1135534                      Mean           .1239414
                        Largest       Std. Dev.      .0313313
75%     .1316317       .2070991
90%     .1613894        .208073       Variance       .0009816
```

```
95%     .2070991       .2092145       Skewness          1.681
99%     .2321864       .2321864       Kurtosis       5.459558

                          shareold
-------------------------------------------------------------
      Percentiles      Smallest
 1%     .1003972       .1003972
 5%     .1122361       .1027387
10%     .1160814        .104415       Obs                  72
25%     .1353499       .1122361       Sum of Wgt.          72

50%     .1586834                      Mean           .1638153
                        Largest       Std. Dev.      .0370411
75%     .1878331       .2308986
90%     .2107245       .2346826       Variance        .001372
95%     .2308986       .2538878       Skewness       .4639113
99%     .2592627       .2592627       Kurtosis       2.613443

. summarize bachelorup lessthanhs

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
  bachelorup |         72    22.65278    7.571499       11.4         50
  lessthanhs |         72    8.598611    2.491478   3.900001       17.9

. summarize violentGrowth

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
violentGro~h |         61    .0221093    .1831783  -.4795791   .6182085

. summarize violentGrowth, detail
```

```
                         violentGrowth
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -.4795791      -.4795791
 5%    -.2143602      -.4200122
10%    -.1911023      -.3649098       Obs                  61
25%    -.0749387      -.2143602       Sum of Wgt.          61

50%     .0364643                      Mean           .0221093
                        Largest       Std. Dev.      .1831783
75%     .0989392       .2598566
90%     .2387845        .308089       Variance       .0335543
95%     .2598566       .3583519       Skewness       .0031043
99%     .6182085       .6182085       Kurtosis       4.550498

. summarize popGrowth, detail

                           popGrowth
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -.0074749      -.0074749
 5%    -.0052114      -.0064299
10%    -.0041265      -.0052397       Obs                  72
25%    -.0022431      -.0052114       Sum of Wgt.          72

50%     -.000012                      Mean           .0003725
                        Largest       Std. Dev.      .0039692
75%     .0026976       .0077377
90%     .0048552       .0082249       Variance       .0000158
95%     .0077377       .0125319       Skewness       .8190459
99%     .0130428       .0130428       Kurtosis        4.16537
```

```
. summarize shareverypoor sharepoor shaverpoverty
variable shaverpoverty not found
r(111);

. summarize shareverypoor sharepoor sharepoverty

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
shareveryp~r |         72    .0486735    .0195342   .0180882   .1584761
   sharepoor |         72    .0707906    .0234431   .0274545   .1999549
sharepoverty |         72    .1194642    .0416488   .0476047    .358431

. summarize lnviolent2012 lnviolent2017 lnviolent2018
variable lnviolent2018 not found
r(111);

. gen lnviolent = ln(violent2018)
(2 missing values generated)

. gen lnviolent2018 = lnviolent
(2 missing values generated)

. drop lnviolent

. summarize lnviolent2012 lnviolent2017 lnviolent2018

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
lnviole~2012 |         65    2.729422      1.0588          0   5.214936
lnviole~2017 |         68    2.868541     .937405          0   4.488636
lnviole~2018 |         70    2.772094    .9211613          0   4.634729
```

```
. summarize highschool somecollege associate bachelor graduate

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
  highschool |         72    36.15417    5.708751       17.9       45.4
 somecollege |         72    21.44861    2.071401       17.6       30.4
   associate |         72    11.14583    1.558614        7.6       15.6
    bachelor |         72    15.25833    4.775104        8.1       29.9
    graduate |         72    7.394444    2.993179        3.1       20.1

. summarize poppov verypoor poor

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
      poppov |         72    77952.93    132035.2       4289     934232
    verypoor |         72    4129.194    10508.54        149      84036
        poor |         72    5491.903    13129.03        213     107937

. summarize unemployment, detail

                        Unemployment
-------------------------------------------------------------
      Percentiles      Smallest
 1%            2              2
 5%          2.7            2.6
10%          3.1            2.7       Obs                  72
25%          3.5            2.7       Sum of Wgt.          72

50%          4.1                      Mean           4.570833
                        Largest       Std. Dev.      1.498303
75%          5.3            7.9
```

```
90%           7.1             8.1       Variance       2.244912
95%           7.9             8.1       Skewness       .9741297
99%           8.3             8.3       Kurtosis       3.200197

. describe

Contains data from projectData.dta
  obs:             72
 vars:             48                            12 Nov 2019 16:36
-----------------------------------------------------------------------------
--
              storage   display    value
variable name   type    format     label      variable label
-----------------------------------------------------------------------------
--
county          str11   %11s                  County
pop2012         long    %12.0g                Pop2012
pop2017         long    %12.0g                Pop2017
pop15to19       long    %12.0g                Pop15to19
pop20to24       long    %12.0g                Pop20to24
pop65up         long    %12.0g                Pop65up
pop85up         int     %8.0g                 Pop85up
pop65to69       int     %8.0g                 Pop65to69
pop70to74       int     %8.0g                 Pop70to74
pop75to79       int     %8.0g                 Pop75to79
pop80to84       int     %8.0g                 Pop80to84
violent2012     int     %8.0g
property2012    int     %8.0g
violent2017     byte    %8.0g
property2017    int     %8.0g
violent2018     int     %8.0g
property2018    int     %8.0g
highschool      float   %9.0g                 HighSchool
```

```
somecollege     float   %9.0g                    SomeCollege
associate       float   %9.0g                    Associate
bachelor        float   %9.0g                    Bachelor
graduate        float   %9.0g                    Graduate
poppov          long    %12.0g                   PopPov
verypoor        long    %12.0g                   VeryPoor
poor            long    %12.0g                   Poor
unemployment    float   %9.0g                    Unemployment
lnpop2012       float   %9.0g
lnpop2017       float   %9.0g
lnviolent2012   float   %9.0g
lnviolent2017   float   %9.0g
violentGrowth   float   %9.0g
popGrowth       float   %9.0g
pop             long    %12.0g                   Pop
_merge          byte    %23.0g      _merge
share15to19     float   %9.0g
lnpop           float   %9.0g
share20to24     float   %9.0g
pop65to84       float   %9.0g
share65to84     float   %9.0g
share85up       float   %9.0g
shareyoung      float   %9.0g
shareold        float   %9.0g
shareverypoor   float   %9.0g
sharepoor       float   %9.0g
sharepoverty    float   %9.0g
bachelorup      float   %9.0g
lessthanhs      float   %9.0g
lnviolent2018   float   %9.0g
-----------------------------------------------------------------------------
--
```

```
Sorted by: county
     Note: Dataset has changed since last saved.

. summarize pop, detail

                             Pop
-------------------------------------------------------------
      Percentiles      Smallest
 1%         4232           4232
 5%         7469           4423
10%        14755           5916       Obs                  72
25%        19514           7469       Sum of Wgt.          72

50%        41384                      Mean           78985.92
                        Largest       Std. Dev.      132198.8
75%        85370         248007
90%       166426         389891       Variance       1.75e+10
95%       248007         488073       Skewness       4.639431
99%       947735         947735       Kurtosis       28.46624
```