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Crime and Social Strain in Fairfax County, VA: Using Geographical Information Science to Test for Social Strain in the Aftermath of the Great Recession

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Introduction:

In 1938 Robert Merton wrote *Social Structure and Anomie* which suggests that crime derives from societal expectations of an individual. Merton's theory later became well known as the Social Strain Theory which suggests that crime exists because societal demands do not meet an individual's needs. After exploring and defining what social strain is, the following study assesses the American Dream and describes examples of what may be considered modern day social strain in the United States. After researching the recent downturn of the American economy, this study suggests that 2007 to 2009 is an appropriate time period to test social strain on the American economy because the unemployment rate was high, individuals were losing their jobs and homes, and the overall American morale was low.

The second half of this study uses Geographical Information Science (GIS) to explore crime patterns of one of the most affluent counties in the United States. This study is a qualitative assessment of Fairfax County to determine if Fairfax County's crime patterns stem from social strain. Fairfax County was chosen for the scope of this study because it is one of the more prosperous and well-educated counties in the United States. Within this study there were three primary research questions for this study:

1) Does crime increase during a recession?
2) Does education attainment have any impact on crime?
3) Does the majority of crime exist only in the less educated and poor areas of Fairfax County?

The overall hypothesis of this study is that crime increases during a recession only in the less affluent areas in Fairfax County.

Literature Review:

The Literature Review section is divided up into four sections: The Social Strain Theory, Different Theories Involving Social Strain, The American Dream and Fairfax County, and Realizing the Threat Today. The first two sections examine what Merton meant by social strain and then explores studies that have evolved from the Social Strain Theory. The last two sections take a look at the American Dream and the social strain that may possibly be brewing among Americans today with the recent downturn of the American economy. The underlying goals of this section are to define what the Social Strain Theory is, to realize past studies that have dealt with social strain, and to illustrate why social strain is being tested on today's American economy.

Social Strain Theory

The Social Strain Theory by Robert Merton derived from Emile Durkheim's Anomie Theory, which suggests that society is made up of individuals, and that there will always be "an underlying conflict or tension between the individual aspirations and society's needs for order and

control."[1] Merton further developed Durkheim's Anomie Theory by the Social Strain Theory, which suggests it is society itself that causes deviant behavior. Within the Social Strain Theory, Merton suggests that:

> *"Societal norms, or socially accepted goals (such as the American Dream), place pressure on the individual to conform, they force the individual to either work within the structure society has produced, or instead, become members of a deviant subculture."*[2]

Deviant behavior according to Merton would be any behavior that goes outside societal norms. Merton ultimately would suggest that living up to the American Dream, of one day living in a single-family home surrounded by a white picket fence, is obtainable for some Americans. However, this dream creates social strain for others, who in turn commit crimes in order to try to fulfill their dream expectations. "Keeping up with the Joneses" is a well known phrase describing Americans who care about their standard of living in relation to their peers. Merton suggests that Americans socially compete against one another because it is enrooted in our everyday culture as we go from childhood to adulthood. Merton suggests that "prestigeful representatives [family, school, and workplace] of the society reinforce the cultural emphasis."[3] The key point that Merton suggests here is that as Americans grow up, they are bombarded with the idea that more education translates to more money, more success, and ultimately more social status in the future.

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[1] Slattery, Martin *Key Ideas in Sociology*. p 22.
[2] Lista, Peter "Robert Merton and Deviant Behavior".
[3] Merton, Robert K. *Social Structure and Anomie* p 191.

In *Social Structure and Anomie*, Merton suggests five ways in which individuals deal with social strain: Conforming, Innovation, Ritualism, Retreatism, and Rebellion. According to Merton, conformists accept the goals of society and accept the means to achieve societal goals. Innovationist accepts the goals of society but reject the means by which to achieve these goals. Ritualistic individuals reject the means to achieve the goals of society but accept the overall goals of society. Retreatists reject both the goals and the means of society and want to escape from them. A rebellious individual replaces both the goals and means of society with their own goals and other means to achieve them.

After understanding what the Social Strain Theory is, there are two questions that this study tries to answer that derived from Merton's Social Strain Theory: Is there any validity to the Social Strain Theory, and could social strain be created by the American Dream? The following three sections: Different Theories involving Social Strain, The American Dream and Fairfax County, and Realizing the Threat Today focus on trying to answer these questions.

Different Theories Involving Social Strain

Since Robert Merton wrote the book *Social Structure and Anomie*, many studies have followed from Merton's Social Strain Theory. Albert Cohen, Richard A. Cloward, Lloyd E. Ohlin, Richard Rosenfield, Steven Messner, and Robert Agnew are just a few of the many sociologist and

criminologists who have performed studies that were based off of the social strain theory.

Albert Cohen, a student of Robert Merton's, wrote a book entitled *Delinquent Boys: The Culture of the Gang* which examined the world of gang activity. Cohen's study not only found gang activity to be the most common form of delinquency, but also found that individuals in gangs commit crimes to gain social status. According to Cohen, delinquents commit crimes for the fun of committing a crime and the more crimes a delinquent commits the higher they go in the gang's hierarchy.

Richard A. Cloward and Lloyd E. Ohlin continued the work of Cohen and introduced the Differential Opportunity Theory. The Differential Opportunity Theory suggests three subcultures of gangs: criminal subculture, conflict subculture, and retreatist subculture. The criminal subcultures are composed of individuals who have been completely closed off to the idea of conventional and legitimate means of acquiring success. Conflict subcultures are comprised of individuals who are torn between legitimate and illegitimate pressures to obtain success. Retreatist subcultures are individuals who forego conventional and legitimate means of acquiring success to commit a crime.

Richard Rosenfeld and Steven Messner wrote the book *Crime and the American Dream*. Rosenfeld and Messner wrote about how the United States economy is different from other countries because the economy is the center

and dominant figure in society. This economic dominance that the United States has comes in three ways: devaluation of non-economic requirements by other institutions, accommodation to economic requirements by other institutions, and incursion of economic norms into other institutional domains. Within all three, education is regarded as a means of occupational attainment. Educational institutions are designed for the demands of the economy by utilizing a grading system that is centered on testing one's own ability and knowledge. Non-economic institutional functions such as family are suggested to be not as important as education. Family roles are centered on schedules and routines that resemble the labor market and more women are starting careers because families cannot afford for women to stay at home.

Robert Agnew developed the General Strain Theory that classifies social strain into three different categories: strain as the failure to achieve positively valued goals, strain as the removal of positively valued stimuli from the individual, and strain as the presentation of negative stimuli. The first social strain that Agnew presents is a conflict of aspirations and expectations between society and the individual. Agnew suggests that failure to obtain certain achievements leads to resentment and anger. The second social strain suggests that limited positive influences in an individual's life may result in social strain. It is suggested that not having positive influences such as friends and family encouraging, or aggressively pressuring an

individual too much, may result in social strain. Agnew's third social strain suggests that negative influences in an individual's life may cause social strain. An example of this type of social strain is an adolescent who cannot legally run away from a negative environment like an abusive home.

This study examines the studies work of Albert Cohen, Richard A. Cloward, Lloyd E.Ohlin, Richard Rosenfield, Steven Messner, and Robert Agnew to gain additional understanding of what social strain is presently considered to be. Cohen's study found social strain in juvenile behavior while Cloward and Ohlin saw social strain as a basis for social acceptance in gang activity. Rosenfled and Messner focused on how balancing between economic norms of society and non-monetary relationships such as friends and family can cause social strain in America. Finally, Agnew's study categorized social strain into three different classifications: strain as the failure to achieve positively valued goals, strain as the removal of positively valued stimuli from the individual, and strain as the presentation of negative stimuli. After reading each of the studies above, this study sets out to determine if affluent and highly educated areas in America could be affected by social strain as described in these studies.

The American Dream and Fairfax County

America was founded on the principles of "Life, Liberty, and the Pursuit of Happiness."[4] Many immigrants have flocked to this country in search of

[4] Hancock, John. *The Declaration of Independence*

freedom of religion, freedom of education, and the freedom to make as much money as they can, since the Declaration of Independence was signed on July 4, 1776. America has been known as the land of opportunity. Such beliefs as "give me your tired, your poor, your huddled masses yearning to breathe free"[5] are ingrained in many Americans who are looking to make something of themselves.

Americans have always been drawn towards success stories of individuals who once had nothing and ended up achieving their dreams and goals. This love affair is clearly depicted through movies such "The Pursuit of Happyness", "The Blind Side", and "Cinderella Man", were all box office hits which were based on true stories of Americans who overcame great obstacles to achieve their dreams. Many citizens look up to great Americans like Benjamin Franklin, who arguably "pioneered the spirit of self-help in America."[6] With only three years of formal education, Franklin was a successful writer, scientist, political figure, and an entrepreneur for America. Franklin was once quoted as saying "energy and persistence conquer all things,"[7] which, it can be argued is the moral fabric of today's American Dream.

Fairfax County is known for being one of the more educated and prosperous areas of the United States. In 2010, Fairfax County, and their

[5] Lazarus, Emma. "Statue of Liberty National Monument."
[6] Powell, Jim. "Benjamin Franklin: The Man Who Invented the American Dream."
[7] Franklin, Benjamin. "The Quotations Page."

neighboring county Loudoun, were "the only two U.S. counties with median household incomes surpassing $100,000."[8] According to the Fairfax County Economic Development 2010 Annual Report, Fairfax County's schools are "nationally recognized for its academic excellence."[9] With roughly a $2.2 million budget, Fairfax County Scholastic Assessment Test (SAT) scores are on average 143 points higher than the rest of Virginia and on average 155 points higher than the rest of the United States. Fairfax County focuses strongly on education to succeed and "95 percent of High School graduates go on to some form of post-secondary education"[10] The majority of the jobs in Fairfax County are in "information technology, homeland security, and federal defense contracting."[11] The county is a highly military focused area that also houses headquarters to many of the national intelligence agencies including the Central Intelligence Agency, National Geospatial-Intelligence Agency, National Reconnaissance Office, National Counterterrorism Center, and Office of the Director of National Intelligence. Fairfax County is also home to "more companies on the prestigious Fortune 500 than do 31 states,"[12] such as: Booze Allen and Hamilton, Freddie Mac, General Dynamics, Computer Sciences Corporation, Capital One Financial, SAIC, Sallie Mae, Gannett Corporation, and NII Holdings.

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[8] Morello, Carol. "D.C. region is nation's richest, most educated."
[9] Fairfax County Economic Development Authority "Fairfax County Public Schools."
[10] IBID
[11] Department of Finance, Fairfax County. "Comprehensive Annual Financial Report."
[12] Fairfax County Economic Development Authority "Fortune 500 list."

America and Fairfax County holds true to believing that through hard work anything is possible. America has a reputation of being a world leader and Fairfax County has a reputation as one of the wealthiest and most educated counties within the United States. The following section focuses on the obstacles that many Americans face in the aftermath of the Great Recession, and describes the struggles that many Americans face today in search of pursuing their dreams.

Realizing the Threat Today

Based on a recent Gallup poll, *American Have Down-to-Earth Goals for Living Comfortably*, 55 percent of Americans "believe they could live comfortably on something less than $75,000 a year."[13] This article points out that the current median family income in America is roughly $52,000. A more interesting fact within this article is that 24 percent of American's "say they would need $100,000 or more to achieve a comfortable lifestyle,"[14] which is considerably more than the 16 percent of Americans who are already making over six figures. This article continues on to say in a 1987 USA Today poll:

> "just 8% of Americans believed they would need $100,000 or more too live comfortably, while the majority, 56%, thought they could achieve that on something less than $50,000."[15]

According to the Bureau of Labor statistics, the national median family income level in 1987 was $35,619.[16] Taking inflation into consideration, this

[13] Saad, Lydia. "Americans Have Down-to-Earth Goals for Living Comfortably."
[14] IBID
[15] IBID

Gallup poll suggests that Americans are starting to become more conservative and realistic about their goals and expectations for their American Dreams. The following study was done to focus on the current 55 percent of Americans who make $23,000 less than what he or she thinks is living comfortably. This study tries to narrow in on the 24 percent of Americans that currently have expectations that double the national median of family household incomes to live comfortably. How will they cope with the fact that they may never reach their goals of a six figure income and living comfortably?

Americans in 2007 to 2009 faced one of the worst economies since the Great Depression. As previously mentioned, Americans today are still recovering from the Great Recession "which started in 2007"[17] according to the National Bureau of Economic Research. According to the decennial census report, the current "national vacancy rate crept up to just over 13%,"[18] up 12.1 percent since 2007. It is predicted that the "pace of foreclosures this year will top 2010, when a record 1 million homes were lost."[19] Mortgage Bankers Association (MBA) predicts that "sales of existing homes will fall 1% to $4.82 million."[20] MBA attributes this to the slow economic recovery of the recession and high unemployment. The United States overall unemployment rate is above nine percent, which "Federal

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[16] Hayghe, Howard V. "Children in 2-worker families and real family home."
[17] Isidore, Chris. "It's Official: Recession since Dec. '07."
[18] Christie, Les. "11.4% of all U.S. homes are vacant."
[19] Herron, Janna. "Banks repossess 1 million homes in 2010."
[20] Christie, Les. "2011 housing market will be pancake flat."

Chairman Ben Bernanke, has repeatedly said it is likely to remain high through the next several years."[21] As unemployment has remained above nine percent for the past twenty-one straight months, some financial analysts suggest that "the new normal unemployment rate may now be 6.7 percent."[22] This is unsettling for young adults who are looking to go into the job market.

Since the recession began in 2007, the job market was hit the hardest. The job market in 2009 was named as having the worst "labor market in at least 25 years."[23] The most affected are those who are either less educated or less experienced. The Bureau of Justice Statistics reported that the "unemployment rate for high school students, at 25.8 percent in October 2009, was about twice the rate for college students (12.2 percent)."[24] To make matters worse, Lisa Kahn, an economist at the Yale School of Management, researched the effects that the bad economy has on college graduates. Ms. Kahn's results found that during a recession, college graduates earn "7% to 8% less in their fields than comparable workers who graduated in better times."[25] According to Kahn's research of the 1982 recession, over an 18 year period a person who graduated in 1981 earned 6.6% less which equates to $100,000 less than individuals who graduated in better economic times.

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[21] Censky, Annalyn. "The 'new normal' unemployment rate: 6.7%."
[22] Chen, Vivien L. "'Normal' Unemployment Rate May Be 6.7 Percent, Fed Paper Says."
[23] Murray, Sara. "The Curse of the Class of 2009."
[24] US Department of Labor, "College Enrollment and Work Activity of 2010 High School Graduates."
[25] Jeremy. "Recent College Graduates, Prepare to Starve."

Looking at Fairfax County's Fiscal Year Report ending in 2010, it is clear that between 2007 and 2009 the Great Recession also affected one of the United States' most educated and affluent counties. The Coincident Index, which measures the overall metropolitan area economy, has dropped from just over 120 in 2006 to 108.3 in 2010 in the region that surrounds Fairfax County. The Consumer Confidence Index (CCI), even though up from the 49.3 in 2009, dropped from just over 100 in 2006 to 54 in 2010. The unemployment rate in Fairfax County went from just over two percent in 2006 to roughly 5.5 percent in 2010. Even though the unemployment rate of Fairfax County is still lower than Virginia's seven percent and the United States' overall unemployment rate of 9.9 percent, it is quite clear that the overall economy is still recovering from the Great Recession.

After reading about the downturn of events in America and Fairfax County, one has to ask whether or not our founding fathers were trying to warn us of this inevitable truth as they wrote that every man has the right to "Life, Liberty, and the Pursuit of Happiness."[26] Currently living in the aftermath of the Great Recession, there is a growing fear that crime will rise as individuals become more and more desperate if the economy does not improve. Even though the majority of American's believe that they can live on $75,000 or less, the fact of the matter is that the current family income is $52,000 with 24% of Americans believing that $100,000 is needed in order

[26] Hancock, John. "The Declaration of Independence."

to live a comfortably. How will these Americans react to the housing market continuing to crash, the risk of possibly losing their jobs due to the unemployment rate going up, and having a degree but not the job that supports the lifestyle that they always wanted? Will these individuals resort to committing crime or will they just accept the lifestyle they have? The following study attempts to answer the question, "Are there areas within Fairfax County that are more at risk of crime than others?" by examining the change in crime patterns during poor economic times.

Design and Implementation

This section describes the steps that were taken in order to establish whether or not Fairfax County crime could be the result of social strain. Fairfax County crime and census data were collected, standardized, linked together, and projected to find areas of high crime within areas of high and low population over age 25, poverty, unemployment, and household income based on education attainment. The following is a step by step walk through of how the data was collected, standardized, linked, and geographically displayed on GIS maps for analysis.

Data Collection

There were three primary sources for data: Fairfax County Police Department (FCPD), U.S. Census Bureau, and the Virginia Department of Transportation (VDOT). Due to data transfers and new policy procedures, FCPD could not provide crime data in point format prior to 2009. Crime

totals from 2005 to 2008 were instead gathered from the FCPD website and copied to Microsoft Excel spread-sheets. 2009 and 2010 crime data were collected by the crime points provided by FCPD that will be discussed further in the data standardization section. FCPD crime data was gathered to determine which years and police district areas had more crime than others. Fairfax County has eight district stations: Fair Oaks, Franconia, Mason, Mclean, Mount Vernon, Reston, Sully, and West Springfield.

The crime data that was collected was based on the Federal Bureau of Investigation's (FBI) Part I and Part II criminal offenses. Part I crimes are violent crimes such as Murder/Manslaughter, Forcible Rape, Robbery, and Aggravated Assault. Part II offenses are property crimes such as Burglary, Larceny/Theft, and Motor Vehicle Theft. FCPD provided a shapefile called "Police Stations" that joined with crime data in order to display the crime data on the base map of Fairfax County. Tables 1.1 to 1.6 show the crime data that was collected after the 2009 and 2010 crime totals were calculated in the data standardization section.

Table 1.1 "Fairfax County Crimes 2005"

FID	Year	Station	Murder	Rape	Robbery	Agg_Assault	Burglary	Larceny	M_Veh_Theft	Total
MT05001	2005	Mt Vernon	6	17	142	78	232	2024	342	2841
MA05002	2005	Mason	0	21	97	85	186	1957	222	2568
MC05003	2005	Mclean	3	7	45	30	193	2292	172	2742
FO05004	2005	Fair Oaks	3	9	20	30	92	1568	120	1842
RT05005	2005	Reston	3	11	35	41	150	1327	87	1654
FR05006	2005	Franconia	2	17	66	58	215	2270	281	2909
WS05007	2005	West Springfield	1	6	43	35	172	1882	243	2382
SU05008	2005	Sully	2	5	36	21	101	1145	129	1439
FFC2005	2005	Fairfax_County	20	93	484	378	1341	14465	1596	18377

Table 1.2 "Fairfax County Crimes 2006"

FID	Year	Station	Murder	Rape	Robbery	Agg_Assault	Burglary	Larceny	M_Veh_Theft	Total
MT05001	2006	Mt Vernon	1	15	158	64	254	1748	263	2503
MA05002	2006	Mason	5	9	124	71	197	1789	214	2409
MC05003	2006	Mclean	1	2	60	28	228	2120	194	2633
FO05004	2006	Fair Oaks	0	10	27	24	124	1334	112	1631
RT05005	2006	Reston	1	7	37	32	157	1304	122	1660
FR05006	2006	Franconia	6	14	77	56	312	2077	254	2796
WS05007	2006	West Springfield	1	11	42	36	222	1575	166	2053
SU05008	2006	Sully	4	5	48	23	84	1111	127	1402
FFC2005	2006	Fairfax_County	19	73	573	334	1578	13058	1452	17087

Table 1.3 "Fairfax County Crimes 2007"

FID	Year	Station	Murder	Rape	Robbery	Agg_Assault	Burglary	Larceny	M_Veh_Theft	Total
MT05001	2007	Mt Vernon	5	9	151	52	177	1996	260	2650
MA05002	2007	Mason	1	14	149	93	194	1932	226	2609
MC05003	2007	Mclean	0	12	46	35	253	2185	169	2700
FO05004	2007	Fair Oaks	0	15	33	18	113	1605	92	1876
RT05005	2007	Reston	1	5	37	28	114	1339	127	1651
FR05006	2007	Franconia	3	16	86	51	239	2293	256	2944
WS05007	2007	West Springfield	1	16	63	41	200	1725	220	2266
SU05008	2007	Sully	2	8	32	21	118	1145	107	1433
FFC2005	2007	Fairfax_County	13	95	597	339	1408	14220	1457	18129

Table 1.4 "Fairfax County Crimes 2008"

FID	Year	Station	Murder	Rape	Robbery	Agg_Assault	Burglary	Larceny	M_Veh_Theft	Total
MT05001	2008	Mt Vernon	2	22	129	65	202	1970	266	2656
MA05002	2008	Mason	5	11	79	110	196	2094	195	2690
MC05003	2008	Mclean	4	9	47	31	239	2722	141	3193
FO05004	2008	Fair Oaks	1	12	30	23	141	1836	83	2126
RT05005	2008	Reston	2	10	42	25	141	1495	84	1799
FR05006	2008	Franconia	3	12	75	66	205	2716	245	3322
WS05007	2008	West Springfield	4	12	31	30	188	2108	172	2545
SU05008	2008	Sully	1	8	14	34	119	1274	103	1553
FFC2005	2008	Fairfax_County	22	96	447	384	1431	16215	1289	19884

Table 1.5 "Fairfax County Crimes 2009"

FID	Year	Station	Murder	Rape	Robbery	Agg_Assault	Burglary	Larceny	M_Veh_Theft	Total
MT05001	2009	Mt Vernon	0	7	35	28	136	1775	95	2076
MA05002	2009	Mason	1	10	60	60	243	2407	175	2956
MC05003	2009	Mclean	4	11	81	90	132	2061	126	2505
FO05004	2009	Fair Oaks	1	6	46	28	235	2582	90	2988
RT05005	2009	Reston	2	12	86	68	236	1913	149	2466
FR05006	2009	Franconia	2	9	42	31	105	1345	57	1591
WS05007	2009	West Springfield	0	2	13	28	84	1241	86	1454
SU05008	2009	Sully	1	8	17	42	187	1979	99	2333
FFC2005	2009	Fairfax_County	11	65	380	375	1358	15303	877	18369

Table 1.6 "Fairfax County Crimes 2010"

FID	Year	Station	Murder	Rape	Robbery	Agg_Assault	Burglary	Larceny	M_Veh_Theft	Total
MT05001	2010	Mt Vernon	2	11	98	82	177	1858	194	2422
MA05002	2010	Mason	1	11	73	84	139	2047	115	2470
MC05003	2010	Mclean	1	5	37	38	235	2294	106	2716
FO05004	2010	Fair Oaks	1	4	24	29	111	1478	91	1738
RT05005	2010	Reston	0	11	31	25	120	1187	75	1449
FR05006	2010	Franconia	2	12	64	58	183	2248	159	2726
WS05007	2010	West Springfield	5	5	32	54	143	1853	112	2204
SU05008	2010	Sully	3	7	30	25	89	1117	79	1350
FFC2010	2010	Fairfax_County	15	66	389	395	1197	14082	931	17075

Using the Fact Sheet tool on the U.S. Census Bureau website, 2005 to 2008 census data was gathered from the American Community Survey (ACS). The U.S. Census Bureau data provided the study census data from nine districts within Fairfax County in order to determine which areas were more affluent than others. The U.S. Census Bureau did not have a year by year census data for Fairfax County District areas. Instead, five year census data of Fairfax County from the ACS was used to determine whether or not the hypothesis is valid. The "FFC Districts" shapefile was used to display the U.S. Census Bureau census data.

The U.S. Census Bureau data of Fairfax County was broken into nine districts: Braddock District, Dranesville District, Hunter Mill District, Lee District, Mason District, Mount Vernon District, Providence District, Springfield District, and Sully District. Querying each district separately, there were four Microsoft Excel spreadsheets that were created: Population over 25, Poverty, Unemployment, and Household Income. These four spreadsheets housed each of the districts statistics by educational attainment. Educational attainment was categorized into four primary areas:

No Diploma, High School Graduate, Some College (includes Associates Degrees), and Bachelors Degree or Higher. Household Income was the only area that separated the "Bachelors and Higher" category into two different groups: "Bachelors Degree" and "Graduate or Professional Degrees." Tables 2.1 to 2.4 show the four tables that were used to collect the census data for Fairfax County.

Table 2.1 "Population Over 25"

FID	District	Pop Over 25	No_Diploma	Highschool_grad	Some_College	Bachelors_or_Higher
EAbrad001	**Braddock**	59619	4851	8622	13009	33137
EAdran002	**Dranesville**	71365	5359	6830	11028	48148
EAHM003	**Hunter Mill**	78356	3750	7760	13276	53570
EALee004	**Lee**	80213	10431	15467	17802	36513
EAmas005	**Mason**	65812	10243	11561	13562	30446
EAMV006	**Mount Vernon**	65585	4415	11228	14870	35072
EAProv007	**Providence**	76272	5257	8937	13186	48892
EAspri008	**Springfield**	66164	2746	7893	13911	41614
EAsull009	**Sully**	105340	5597	13797	21660	64286

Table 2.2 "Poverty"

FID	District	Below_Poverty	No_Diploma	Highschool_Grad	Some_College	Bachelors_Higher
PEbrad001	**Braddock**	2314	940	466	352	556
PEdran002	**Dranesville**	1901	300	345	291	965
PEHM003	**Hunter Mill**	2714	759	497	542	916
PELee004	**Lee**	4015	1516	1375	607	517
PEmas005	**Mason**	5093	2209	932	705	1247
PEMV006	**Mount Vernon**	2386	505	581	597	703
PEProv007	**Providence**	3503	983	807	705	1008
PEspri008	**Springfield**	1272	263	280	408	321
PEsull009	**Sully**	3342	700	932	490	1230

Table 2.3 "Unemployment"

FID	District	Unemployment	No_Diploma	Highschool_Grad	Some_College	Bachelors_Higher
UNbrad001	**Braddock**	50760.0	4331.0	7292.0	11165.0	27972.0
UNdran002	**Dranesville**	59407.0	4208.0	4964.0	9069.0	41166.0
UNHM003	**Hunter Mill**	67852.0	2836.0	5898.0	10889.0	48229.0
UNLee004	**Lee**	69591.0	8555.0	12723.0	15543.0	32770.0
UNmas005	**Mason**	54592.0	8527.0	9508.0	11273.0	25284.0
UNMV006	**Mount Vernon**	55741.0	3244.0	9336.0	12709.0	30452.0
UNProv007	**Providence**	66277.0	3923.0	7050.0	11303.0	44001.0
UNspri008	**Springfield**	57000.0	1838.0	6142.0	12098.0	36922.0
UNsull009	**Sully**	96095.0	4194.0	11268.0	19892.0	60741.0

Table 2.4 "Household Income"

FID	District	Median_Income	No_Diploma	Highschool_Grad	Some_College	Bachelors_degree	Graduate_Professional
HObrad001	**Braddock**	51130	21469	33267	40304	58734	84668
HOdran002	**Dranesville**	68906	25011	33431	45870	68886	111708
HOHM003	**Hunter Mill**	67949	22611	33460	44473	73179	96099
HOLee004	**Lee**	47343	22782	31293	43987	62456	88809
HOmas005	**Mason**	44582	22369	31162	39968	58810	91236
HOMV006	**Mount Vernon**	55670	27500	33969	45611	64409	92925
HOProv007	**Providence**	61225	20292	30788	43161	65323	89215
HOspri008	**Springfield**	66735	27534	37541	46467	72175	100669
HOsull009	**Sully**	62232	23850	31779	48027	68400	95248

After the crime data was collected, base layers for the maps were provided by the VDOT so the census and crime data could be geographically referenced and displayed on the base map. "FFC Districts" was a shapefile provided by VDOT which geographically displayed Fairfax County's district stations. Other layers that were collected consisted of water features polygons and airports. The base layers that were used are shown in both the base map section and the results section.

Data Standardization

Once all of the data had been collected, the data standardization process began. Microsoft Excel was used to standardize the data to make sure data formats could be loaded and later linked to shapefiles in ArcGIS. There were a total of four data standardization procedures that were implemented in order to analyze Fairfax County's crime data and census data. The first procedure tallied up the crime by crime totals. The second procedure standardized the crime data by year and location. The third procedure standardized the crime data by violent and property crimes. The final procedure standardized the census data by educational attainment.

The first procedure required the 2009 and 2010 crime points to be converted to crime totals. In order to figure out the crime totals for 2009 and 2010, crime point data for 2009 and 2010 was imported into ArcGIS using the "Display XY" tool in ArcGIS based on the longitude and latitude coordinates of each crime point. Using the "Search by Attribute" tool in ArcGIS, 2009 and 2010 crime points were then queried by police station, then by crime type. Tables 1.5 and 1.6 above in the data collection section show the final result of the crime tables that were used for 2009 and 2010.

The second procedure was to create a 2005 to 2010 crime data spreadsheet that can be used in ArcGIS to analyze crime totals by year and location. This step was essential in order to later perform time series analysis by year and to use bivariate choropleth analysis to compare the crime data by location with the census data. The 2005 to 2010 crime tables above in Tables 1.1 to 1.6 were converted to Table 3.1 by using Microsoft Excel to sum up all of the total crime data by year based on police districts. A percentage column was added to Table 3.1 by totaling up all of the crime totals by year and dividing them by the total crime of Fairfax County from 2005 to 2010. Another percentage column was then added to the table by totaling up all of the crime totals by police district and dividing their total crime by the total crime of Fairfax County from 2005 to 2010. These two percentage columns were essential for analyzing crime by year and police district to figure out which year and police district had the most crime from

2005 to 2010. After the two frequency statistics were added, the file was saved as a Microsoft Excel Comma Separated Value (CSV). Table 3.1 shows the crime table that was created in order to later perform analysis on crime in Fairfax County. Table 3.2 shows the data dictionary that was created and later used to join the Table 3.1 to "Police Stations" shapefile in ArcGIS.

Table 3.1 "2005 to 2010 Crime Totals by Year and Location"

Districts	Y2005	Y2006	Y2007	Y2008	Y2009	Y2010	Total	f
Sully	1439	1402	1433	1553	2333	2204	10364	0.10
Reston	1654	1660	1651	1800	2466	2422	11653	0.11
West Springfield	2382	2053	2266	2545	1454	1350	12050	0.11
Fair Oaks	1842	1631	1876	2126	2988	2716	13179	0.12
Mt Vernon	2841	2503	2650	2656	2076	1738	14464	0.13
Franconia	2909	2796	2944	3322	1591	1449	15011	0.14
Mason	2568	2409	2609	2692	2956	2726	15960	0.15
Mclean	2742	2633	2700	3193	2505	2470	16243	0.15
Total	18377	17087	18129	19887	18369	17075	108924	1.00
f	0.17	0.16	0.17	0.18	0.17	0.16		

Table 3.2: "Fairfax County Crime Totals by Location Data Dictionary"

Attibute:	Type:	Estimated Width:	Domain/Range:
Districts	Text	7	Braddock,Dranesville, Hunter Mill, Lee,Mason,Mount Vernon, Providence, Springfield, Sully
OID	Text	6	FFC001, FFC002,FFC003,FFC004,FFC005,FFC006,FFC007,FFC008,FFC009
Y2005	Number	6	000000 to 999999
Y2006	Number	6	000000 to 999999
Y2007	Number	6	000000 to 999999
Y2008	Number	6	000000 to 999999
Y2009	Number	6	000000 to 999999
Y2010	Number	6	000000 to 999999
Total	Number	6	000000 to 999999
f	Number	4	0.00 to 9.99

The third procedure was to set up the crime data to be analyzed by crime type. The standardization process was to convert the crime data into crime totals per year based on crime type. Part I violent crimes were compare to Part II property crimes from 2005 to 2010. There were twelve

spreadsheets that were made from Table 1.1 to 1.6 to Tables 4.1 to 4.12: Y2005V, Y2005P, Y2006V, Y2006P, Y2007V, Y2007P, Y2008V, Y2008P, Y2009V, Y2009P, Y2010V, and Y2010P. The spreadsheets that had a "V" at the end of them were for the violent crime totals for Murder, Forcible Rape, Aggravated Assault, and Robbery. The spreadsheets that had a "P" at the end of them were for the property crime totals for Burglary, Larceny, and Motor Vehicle Theft. This step was essential in order to later perform time series analysis by crime type. A percentage column was then added to the table by taking each police district station and dividing it by the total crime of Fairfax County. This step was essential for understanding where most of the crime from 2005 to 2010 was located by each crime type. After the percentage column was added, the files were saved as CSV files. Tables 4.1 to 4.12 show the twelve crime tables that were calculated by crime type. Table 4.13 show the data dictionary that was created and used to ensure all twelve spreadsheets could be joined later to "Crime Type" shapefile in ArcGIS.

Table 4.1 "Y2005V"

FID	Year	Station	Murder	Rape	Robbery	Agg_Assault	Total	f
MT05001	2005	Mt Vernon	6	17	142	78	243	0.25
MA05002	2005	Mason	0	21	97	85	203	0.21
MC05003	2005	Mclean	3	7	45	30	85	0.09
FO05004	2005	Fair Oaks	3	9	20	30	62	0.06
RT05005	2005	Reston	3	11	35	41	90	0.09
FR05006	2005	Franconia	2	17	66	58	143	0.15
WS05007	2005	West Springfield	1	6	43	35	85	0.09
SU05008	2005	Sully	2	5	36	21	64	0.07
FFC2005	2005	Fairfax_County	20	93	484	378	975	1.00

Table 4.2 "Y2005P"

FID	Year	Station	Burglary	Larceny	M_Veh_Theft	Total	f
MT05001	2005	Mt Vernon	232	2024	342	2598	0.15
MA05002	2005	Mason	186	1957	222	2365	0.14
MC05003	2005	Mclean	193	2292	172	2657	0.15
FO05004	2005	Fair Oaks	92	1568	120	1780	0.10
RT05005	2005	Reston	150	1327	87	1564	0.09
FR05006	2005	Franconia	215	2270	281	2766	0.16
WS05007	2005	West Springfield	172	1882	243	2297	0.13
SU05008	2005	Sully	101	1145	129	1375	0.08
FFC2005	2005	Fairfax_County	1341	14465	1596	17402	1.00

Table 4.3 "Y2006V"

FID	Year	Station	Murder	Rape	Robbery	Agg_Assault	Total	f
MT06001	2006	Mt Vernon	1	15	158	64	238	0.24
MA06002	2006	Mason	5	9	124	71	209	0.21
MC06003	2006	Mclean	1	2	60	28	91	0.09
FO06004	2006	Fair Oaks	0	10	27	24	61	0.06
RT06005	2006	Reston	1	7	37	32	77	0.08
FR06006	2006	Franconia	6	14	77	56	153	0.15
WS06007	2006	West Springfield	1	11	42	36	90	0.09
SU06008	2006	Sully	4	5	48	23	80	0.08
FFC2006	2006	Fairfax_County	19	73	573	334	999	1.00

Table 4.4 "Y2006P"

FID	Year	Station	Burglary	Larceny	M_Veh_Theft	Total	f
MT06001	2006	Mt Vernon	254	1748	263	2265	0.14
MA06002	2006	Mason	197	1789	214	2200	0.14
MC06003	2006	Mclean	228	2120	194	2542	0.16
FO06004	2006	Fair Oaks	124	1334	112	1570	0.10
RT06005	2006	Reston	157	1304	122	1583	0.10
FR06006	2006	Franconia	312	2077	254	2643	0.16
WS06007	2006	West Springfield	222	1575	166	1963	0.12
SU06008	2006	Sully	84	1111	127	1322	0.08
FFC2006	2006	Fairfax_County	1578	13058	1452	16088	1.00

Table 4.5 "Y2007V"

FID	Year	Station	Murder	Rape	Robbery	Agg_Assault	Total	f
MT06001	2007	Mt Vernon	5	9	151	52	217	0.21
MA06002	2007	Mason	1	14	149	93	257	0.25
MC06003	2007	Mclean	0	12	46	35	93	0.09
FO06004	2007	Fair Oaks	0	15	33	18	66	0.06
RT06005	2007	Reston	1	5	37	28	71	0.07
FR06006	2007	Franconia	3	16	86	51	156	0.15
WS06007	2007	West Springfield	1	16	63	41	121	0.12
SU06008	2007	Sully	2	8	32	21	63	0.06
FFC2006	2007	Fairfax_County	13	95	597	339	1044	1.00

Table 4.6 "Y2007P"

FID	Year	Station	Burglary	Larceny	M_Veh_Theft	Total
FO05004	2007	Fair Oaks	177	1996	260	2433
FR05006	2007	Franconia	194	1932	226	2352
MA05002	2007	Mason	253	2185	169	2607
MC05003	2007	Mclean	113	1605	92	1810
MT05001	2007	Mt Vernon	114	1339	127	1580
RT05005	2007	Reston	239	2293	256	2788
SU05008	2007	Sully	200	1725	220	2145
WS05007	2007	West Springfield	118	1145	107	1370
FFC2009	2007	Fairfax_County	1408	14220	1457	17085

Table 4.7 "Y2008V"

FID	Year	Station	Murder	Rape	Robbery	Agg_Assault	Total	f
FO05004	2008	Fair Oaks	2	22	129	65	218	0.23
FR05006	2008	Franconia	5	11	79	110	205	0.22
MA05002	2008	Mason	4	9	47	31	91	0.10
MC05003	2008	Mclean	1	12	30	23	66	0.07
MT05001	2008	Mt Vernon	2	10	42	25	79	0.08
RT05005	2008	Reston	3	12	75	66	156	0.16
SU05008	2008	Sully	4	12	31	30	77	0.08
WS05007	2008	West Springfield	1	8	14	34	57	0.06
FFC2010	2008	Fairfax_County	22	96	447	384	949	1.00

Table 4.8 "Y2008P"

FID	Year	Station	Burglary	Larceny	M_Veh_Theft	Total	f
FO05004	2008	Fair Oaks	202	1970	266	2438	0.13
FR05006	2008	Franconia	196	2094	195	2485	0.13
MA05002	2008	Mason	239	2722	141	3102	0.16
MC05003	2008	Mclean	141	1836	83	2060	0.11
MT05001	2008	Mt Vernon	141	1495	84	1720	0.09
RT05005	2008	Reston	205	2716	245	3166	0.17
SU05008	2008	Sully	188	2108	172	2468	0.13
WS05007	2008	West Springfield	119	1274	103	1496	0.08
FFC2009	2008	Fairfax_County	1431	16215	1289	18935	1.00

Table 4.9: "Y2009V"

FID	Year	Station	Murder	Rape	Robbery	Agg_Assault	Total	f
FO05004	2009	Fair Oaks	0	7	35	28	70	0.08
FR05006	2009	Franconia	1	10	60	60	131	0.16
MA05002	2009	Mason	4	11	81	90	186	0.22
MC05003	2009	Mclean	1	6	46	28	81	0.10
MT05001	2009	Mt Vernon	2	12	86	68	168	0.20
RT05005	2009	Reston	2	9	42	31	84	0.10
SU05008	2009	Sully	0	2	13	28	43	0.05
WS05007	2009	West Springfield	1	8	17	42	68	0.08
FFC2010	2009	Fairfax_County	11	65	380	375	831	1.00

Table 4.10 "Y2009P"

FID	Year	Station	Burglary	Larceny	M_Veh_Theft	Total	f
FO05004	2009	Fair Oaks	136	1775	95	2006	0.11
FR05006	2009	Franconia	243	2407	175	2825	0.16
MA05002	2009	Mason	132	2061	126	2319	0.13
MC05003	2009	Mclean	235	2582	90	2907	0.17
MT05001	2009	Mt Vernon	236	1913	149	2298	0.13
RT05005	2009	Reston	105	1345	57	1507	0.09
SU05008	2009	Sully	84	1241	86	1411	0.08
WS05007	2009	West Springfield	187	1979	99	2265	0.13
FFC2009	2009	Fairfax_County	1358	15303	877	17538	1.00

Table 4.11: "Y2010V"

FID	Year	Station	Murder	Rape	Robbery	Agg_Assault	Total	f
FO05004	2010	Fair Oaks	1	4	24	29	58	0.07
FR05006	2010	Franconia	2	12	64	58	136	0.16
MA05002	2010	Mason	1	11	73	84	169	0.20
MC05003	2010	Mclean	1	5	37	38	81	0.09
MT05001	2010	Mt Vernon	2	11	98	82	193	0.22
RT05005	2010	Reston	0	11	31	25	67	0.08
SU05008	2010	Sully	3	7	30	25	65	0.08
WS05007	2010	West Springfield	5	5	32	54	96	0.11
FFC2010	2010	Fairfax_County	15	66	389	395	865	1.00

Table 4.12 "Y2010P"

FID	Year	Station	Burglary	Larceny	M_Veh_Theft	Total	f
FO05004	2010	Fair Oaks	111	1478	91	1680	0.10
FR05006	2010	Franconia	183	2248	159	2590	0.16
MA05002	2010	Mason	139	2047	115	2301	0.14
MC05003	2010	Mclean	235	2294	106	2635	0.16
MT05001	2010	Mt Vernon	177	1858	194	2229	0.14
RT05005	2010	Reston	120	1187	75	1382	0.09
SU05008	2010	Sully	89	1117	79	1285	0.08
WS05007	2010	West Springfield	143	1853	112	2108	0.13
FFC2010	2010	Fairfax_County	1197	14082	931	16210	1.00

Table 4.13 "Crime by Type Data Dictionary"

Attibute:	Type:	Estimated Width:	Domain/Range:
FID	Text	7	USDE001_USDE025
Year	Number	4	2005 to 2010
Station	Number	16	Fair Oaks,Franconia,Mason,Mclean,Mt Vernon, Reston, Sully, West Springfield, Fairfax County
Murder	Number	4	0000 to 9999
Rape	Number	4	0000 to 9999
Robbery	Number	4	0000 to 9999
Agg_Assault	Number	4	0000 to 9999
Burglary	Number	4	0000 to 9999
Larceny	Number	4	0000 to 9999
M_Veh_Thef	Number	4	0000 to 9999
Total	Number	4	0000 to 9999
f	Number	4	0.00 to 9.99

The fourth and final procedure was to standardize the Fairfax County census data. Within this process, there were three primary steps: a data dictionary was created, identification numbers were added, and files were saved as a CSV file. Fairfax County's census data consisted of four spreadsheets: Population over 25, Poverty, Unemployment, and Household Income. Within each spreadsheet, short names were created to distinguish between each of the individual variables described in the data collection section. After the spreadsheets were modified, each one was saved separately into four CSV files to later be joined with the "FFC District" shapefile in ArcGIS. Tables 5.1 to 5.4 show the data tables that were used to standardize Fairfax County's census data from 2005 to 2009.

Table 5.1: "Population over 25 Data Dictionary"

Attibute:	Type:	Estimated Width:	Domain/Range:
*FID	Text	10	EAbrad001,EAdran002,EAHM003,EALee004,EAmas005,EAMV006,EAProv007,EAspri008,EAsull009
District	Text	15	Braddock,Dranesville, Hunter Mill, Lee,Mason,Mount Vernon, Providence, Springfield, Sully
Pop_Over_25	Number	11	00000000.00 to 99999999.98
No_Diploma	Number	11	00000000.00 to 99999999.99
Highschool_Grad	Number	11	00000000.00 to 99999999.99
Some_College	Number	11	00000000.00 to 99999999.99
Bachelors_or_Higher	Number	11	00000000.00 to 99999999.99

Table 5.2: "Poverty Data Dictionary"

Attibute:	Type:	Estimated Width:	Domain/Range:
*FID	Text	10	PEbrad001,PEdran002,PEHM003,PELee004,PEmas005,PEMV006,PEProv007,PEspri008,PEsull009
District	Text	15	Braddock,Dranesville, Hunter Mill, Lee,Mason,Mount Vernon, Providence, Springfield, Sully
Below_Poverty	Number	11	00000000.00 to 99999999.98
No_Diploma	Number	11	00000000.00 to 99999999.99
Highschool_Grad	Number	11	00000000.00 to 99999999.99
Some_College	Number	11	00000000.00 to 99999999.99
Bachelors_or_Higher	Number	11	00000000.00 to 99999999.99

Table 5.3: "Unemployment Data Dictionary"

Attibute:	Type:	Estimated Width:	Domain/Range:
*FID	Text	10	UNbrad001,UNdran002,UNHM003,UNLee004,UNmas005,UNMV006,UNProv007,UNspri008,UNsull009
District	Text	15	Braddock,Dranesville, Hunter Mill, Lee,Mason,Mount Vernon, Providence, Springfield, Sully
Unemployment	Number	11	00000000.00 to 99999999.98
No_Diploma	Number	11	00000000.00 to 99999999.99
Highschool_Grad	Number	11	00000000.00 to 99999999.99
Some_College	Number	11	00000000.00 to 99999999.99
Bachelors_or_Higher	Number	11	00000000.00 to 99999999.99

Table 5.4: "Household Income Data Dictionary"

Attibute:	Type:	Estimated Width:	Domain/Range:
*FID	Text	10	HIbrad001,HIdran002,HIHM003,HILee004,HImas005,HIMV006,HIProv007,HIspri008,HIsull009
District	Text	15	Braddock,Dranesville, Hunter Mill, Lee,Mason,Mount Vernon, Providence, Springfield, Sully
Household_Income	Number	11	00000000.00 to 99999999.98
No_Diploma	Number	11	00000000.00 to 99999999.99
Highschool_Grad	Number	11	00000000.00 to 99999999.99
Some_College	Number	11	00000000.00 to 99999999.99
Bachelors_or_Higher	Number	11	00000000.00 to 99999999.99

After the fourth standardization procedure was completed, Fairfax County's crime data and census data were ready to be analyzed. There were a total of six tables, two crime data tables and four census data tables, that were ready to be linked up to the base map for analysis. The following section discusses the links that were needed in order to display crime and census data.

Geoprocessing and Linking of the Data

After the standardization process was completed, the next phase was to import the Fairfax County crime data and census data into ArcGIS for analysis. There were three problems that quickly arose when trying to import and link the data together in ArcGIS. The first problem was figuring

out how Fairfax County's census data and crime data were going to be added to the base map. The second problem was that the "Police Stations", "Crime Type", and "FFC Districts" layers were in two different projection systems. The third problem was figuring out how Fairfax County's sub crime data and census data were going to be displayed together. The links described are the steps that were taken in order to fix all three problems and to start the analysis process in ArcGIS. When all of the links were made, the projection was defined and the end result was two main base maps that set the overall stage for the analysis process to begin.

In order to solve the first problem, there were three keys that were needed to link Fairfax County's crime and census data to ArcGIS. Each Key was created in Microsoft Excel and loaded into the base map to make the joins. Key001 joined Fairfax County's crime totals by crime location with the "Police Station" base layer in ArcGIS. Key002 joined Fairfax County's crime totals by year and crime location with a base layer called "Crime Type" shapefile in ArcGIS. The "Crime Type" base layer was a copy of the "Police Station". Key003 joined Fairfax County's census data with the "FFC Districts" base layer in ArcGIS. The "join and relate" tool in ArcGIS was used to make all three joins.

To perform the joins for Key001, the "join and relate" tool in ArcGIS was used to join the "District" field name in Table 3.1 with the "District" field name in "Key001." The "join and relate" tool was then used to join the

"STATION_NA" field in the "Police Stations" shapefile with the "STATION_NA" field in "Key001". Figure 1.1 shows how Key001 linked Fairfax County's crime data by crime type with the "Police Stations" layer. Figure 1.2 presents the information that is shown by linking Table 3.1 together with the "Police Stations" shapefile.

Figure 1.1: "Key001"

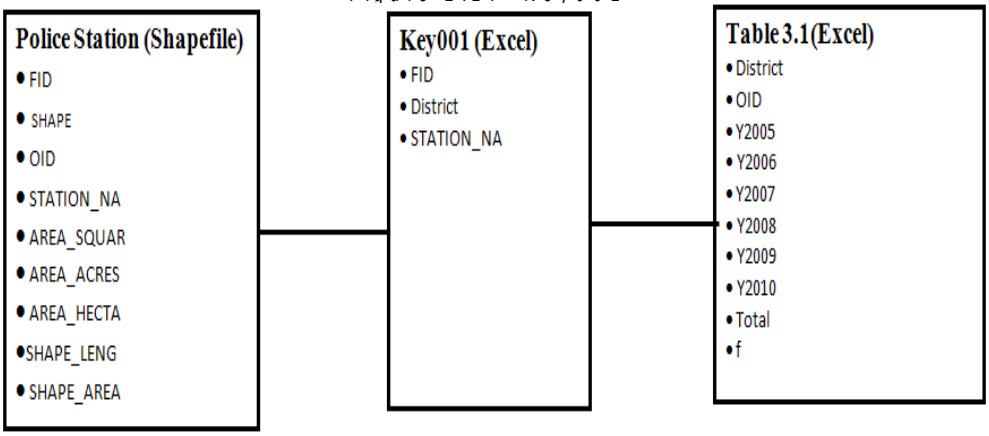
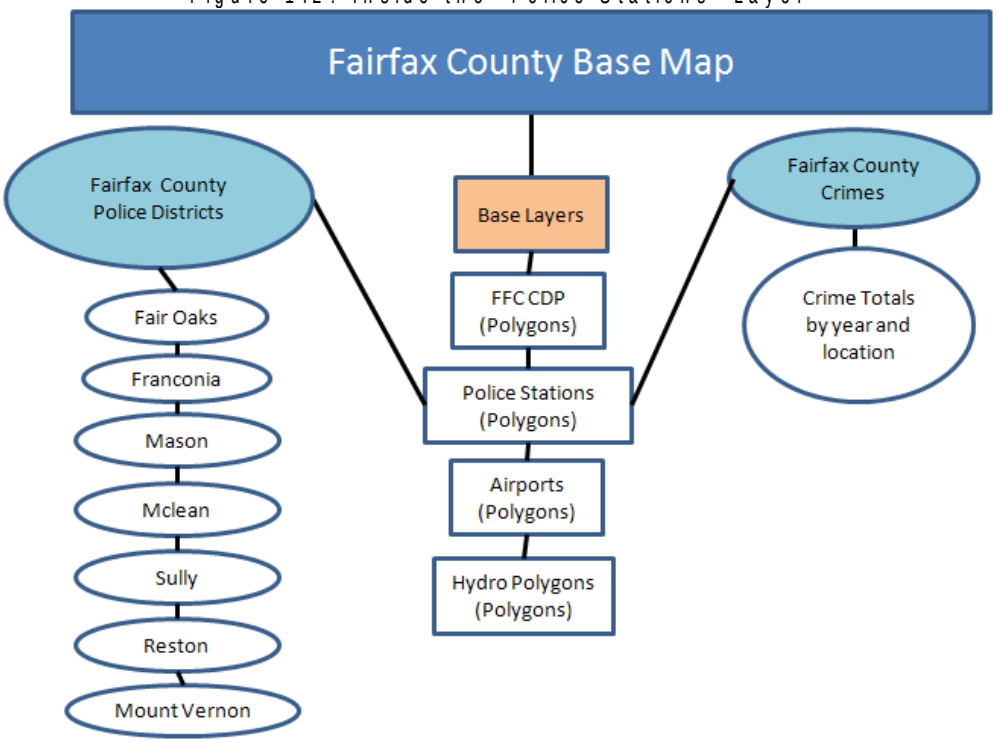


Figure 1.2: Inside the "Police Stations" Layer



To perform the links for Key002, the "join and relate" tool in ArcGIS was used to join the "OID" field in Tables 4.1 to 4.12 with the "OID" field in Key002. The "join and relate" tool in ArcGIS was then used to join the "STATION_NA" field in the "Crime Totals" shapefile with the "STATION_NA" field name in Key002. Figure 1.3 shows how Key002 joins Fairfax County's crime data by crime type with the "Crime Type" shapefile in ArcGIS. Figure 1.4 displays the information that is shown by linking together Table 4.1 to 4.12 with the "Crime Type" shapefile.

Figure 1.3: "Key002"

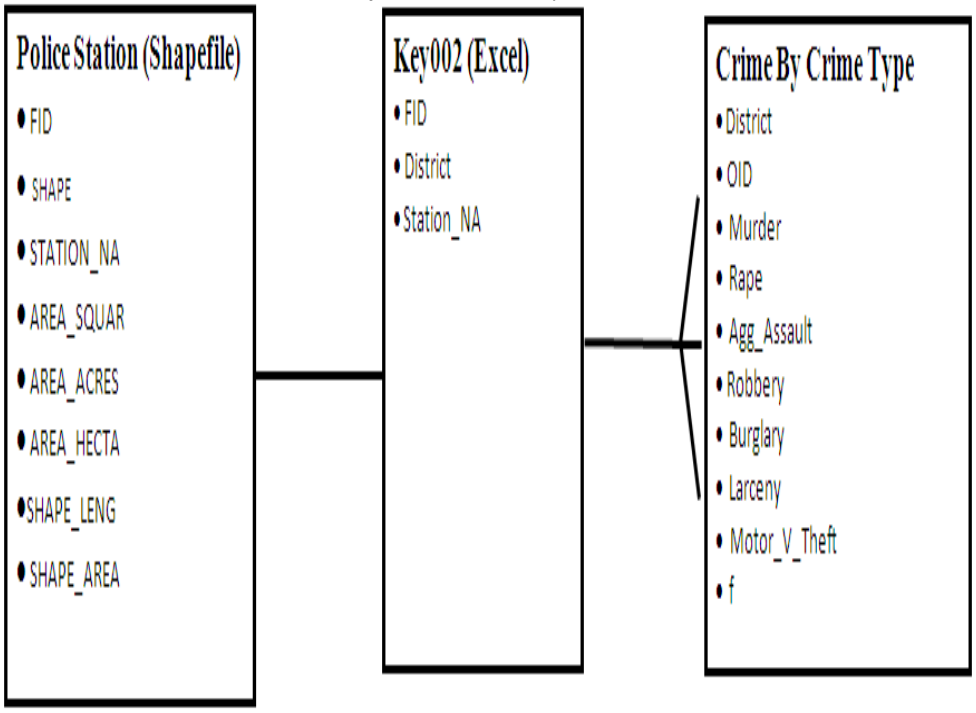
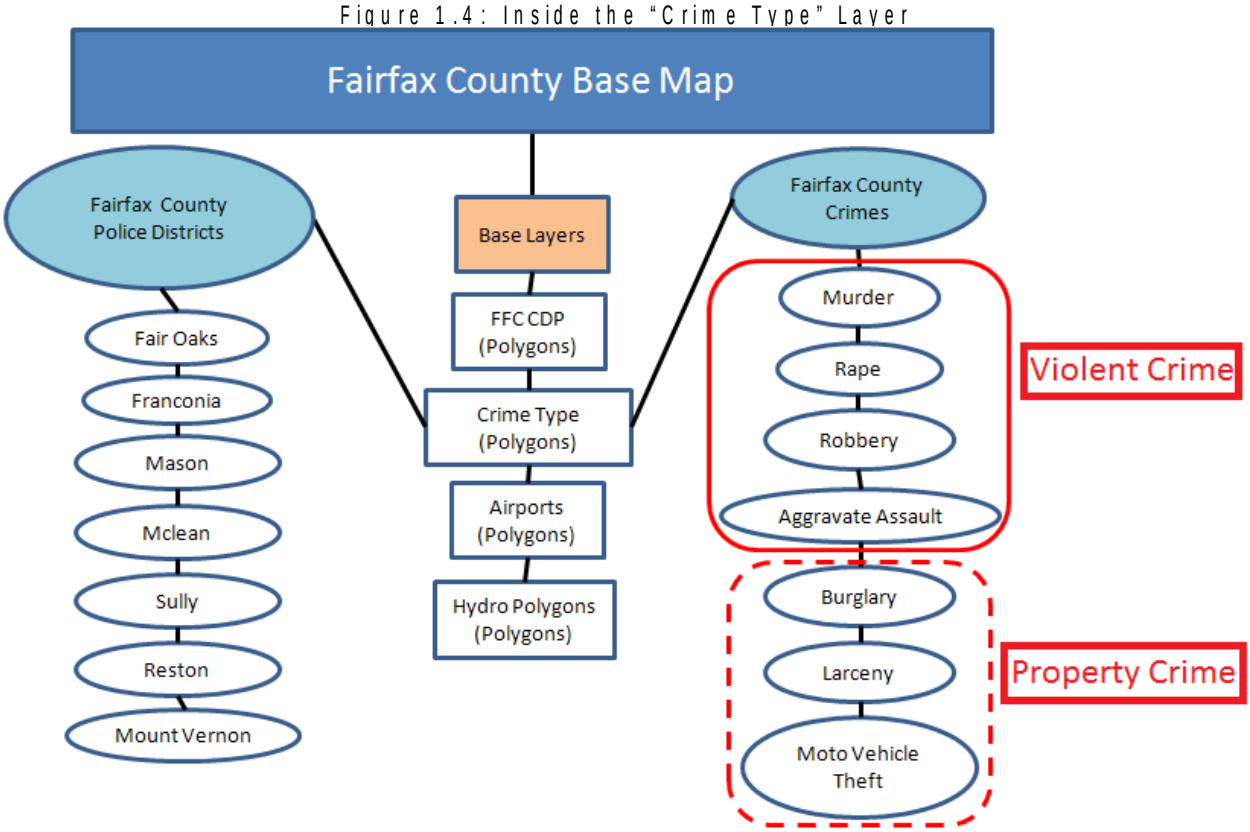


Figure 1.4: Inside the "Crime Type" Layer



Key003 joined the census data with the "FFC Districts" shapefile in the base map. The "District" field name in all four of the census spreadsheets was joined with the "District" field name in Key003. The "STATION_NA" field name in the "Police Stations" shapefile was then joined together with the "STATION_NA" in Key003. Figure 1.5 shows how Key003 joins Fairfax County's census data with the "FFC District" base layer. Figure 1.6 presents the information that is shown by linking together the census data with the "FFC Districts" shapefile.

Figure 1.5: "Key003"

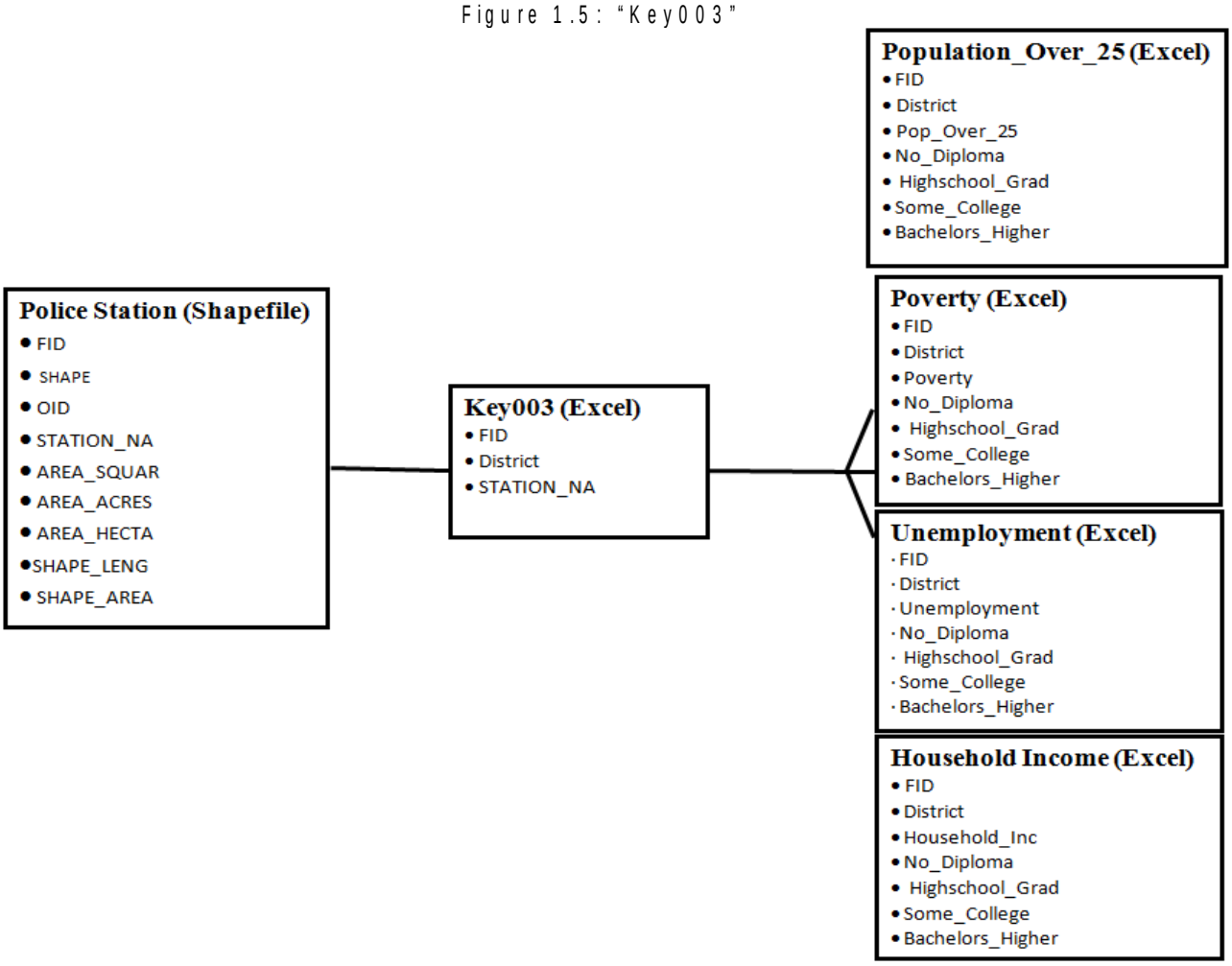
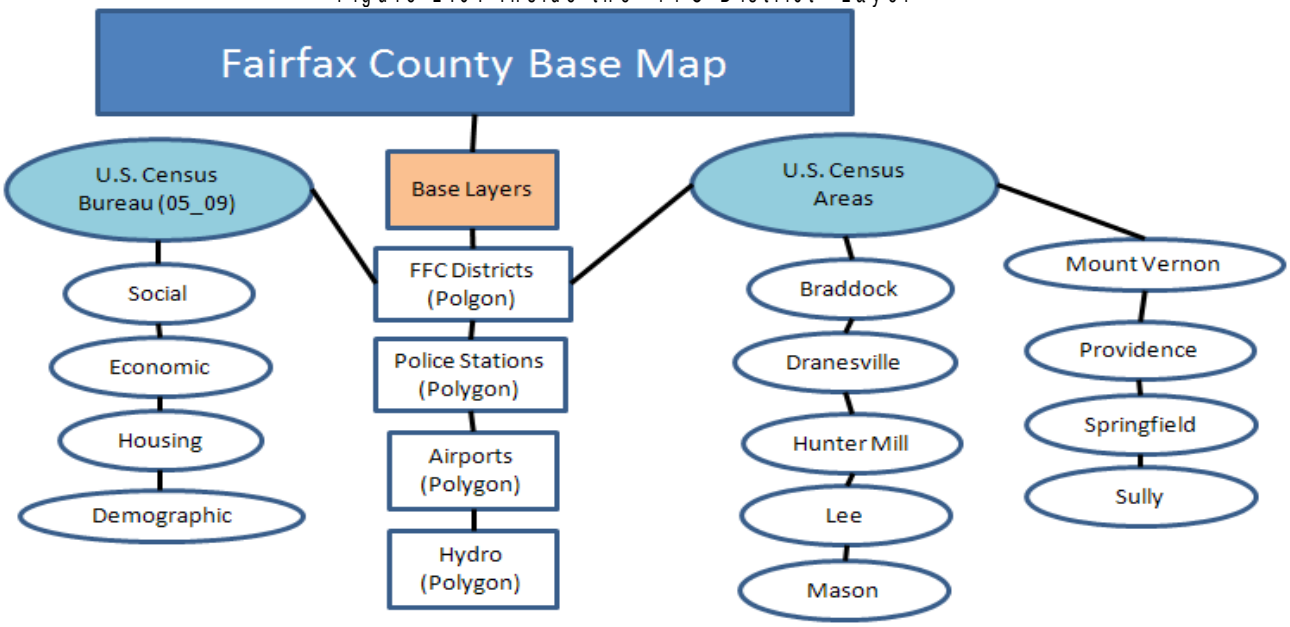


Figure 1.6: Inside the "FFC District" Layer



To resolve the second problem, the process below was used for "FFC District", "Police Station", and "Crime Totals" layers. Using the "Define Projection" tool under the "Projection and Translation" section of the toolbox in ArcGIS, the projection system was cleared and both layers were then projected into Geographical Coordinate System North American Datum 1983. The "Projection" tool under the "Features" section in the ArcGIS toolbox was then used to project both of the layers into "North America Datum 1983 State plane Virginia North" projection. After this step was completed, all layers lined up together.

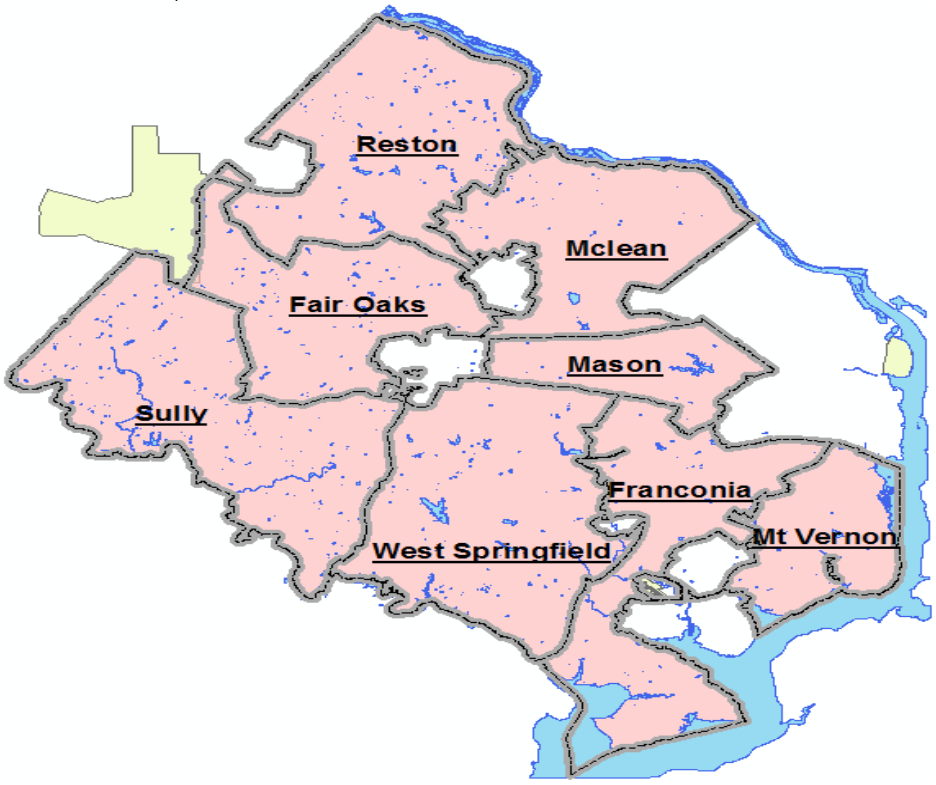
To solve the third problem, two sets of maps were needed. One set of maps would have the "Police Stations" layers to analyze Fairfax County's crime by crime type. The other set of maps would have both "Crime Totals" and the "FFC Districts" layers to analyze Fairfax County's census data and crime data by crime total.

Fairfax County Base Maps

After linking all of the data together, there were two base maps created. Map 1.1 shows Fairfax County's eight police districts stations that are found within both the "Crime Totals" layer and the "Police Station" layer. The "Crime Totals" layer held the crime data of crime totals from 2005 to 2010 by police district station. The "Police Station" layer held the crime data of crime totals for each individual year by police station. These eight police

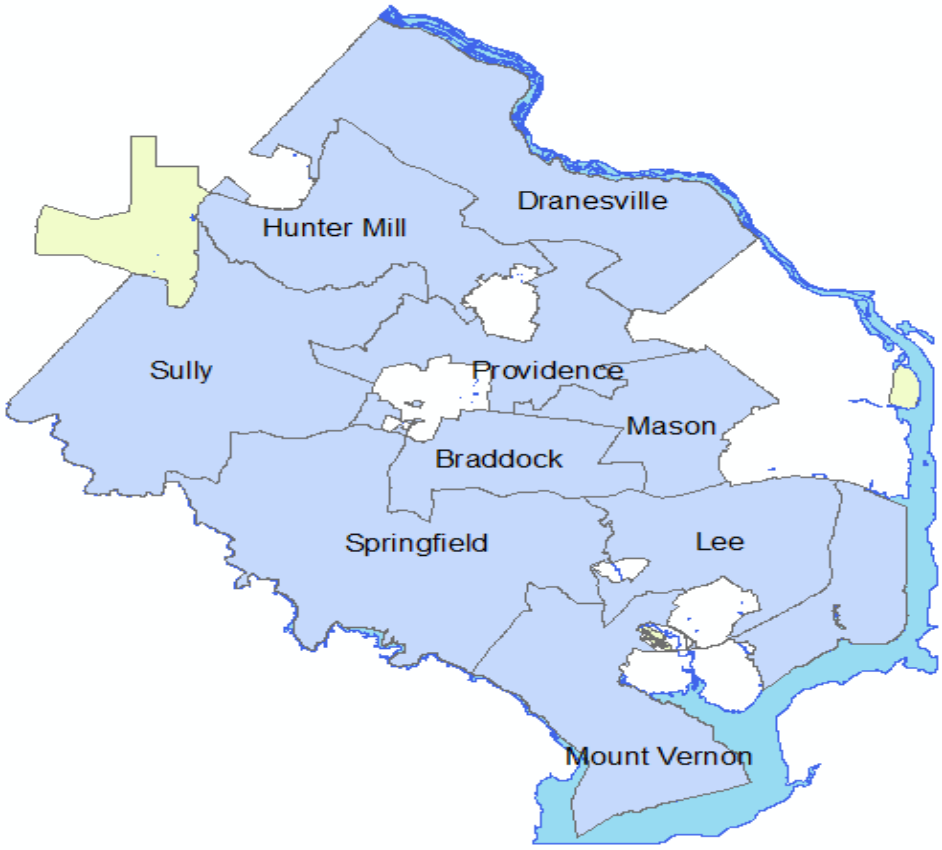
district stations include: Fair Oaks, Franconia, Mclean, Mount Vernon, Reston, Sully, and West Springfield.

Map 1.1: "Police Station" / "Crime Totals" Areas



Map 1.2 below shows the Fairfax County's district areas that are found within the "FFC Districts" layer. The "FFC Districts" layer held the census data for Fairfax County in four different maps. Each map showed nine Fairfax County district areas: Braddock, Dranesville, Hunter Mill, Lee, Mason, Mount Vernon, Providence, Springfield, and Sully.

Map 1.2: "FFC District" Areas



It is clear by looking at both of the layers above, that the two sets of district areas do not line up. Attempts were made to generate a single map layer that would encompass both types of districts, however, it was decided that setting up the layers separately would result in a more accurate representation of both sets of data. As shown in both Maps 1.1 and 1.2, cities where Fairfax County Police does not have jurisdiction were taken out of both shapefiles. Water and airports were added to the base map for geographical references. The layers that were within this base map consisted of: FFC Districts, Police Stations/Crime Type, airports, and water. The two

maps above provide reference points for the analytical procedures described below.

Data Analysis

After the standardization procedures were completed, the data analysis process began. As mentioned in the Introduction, the data analysis procedures focus on answering three main research questions:

1) Does crime increase during a recession?
2) Do changes in levels of educational attainment correlate to changes in crime volume?
3) Does the majority of crime exist only in the less educated and poor areas of Fairfax County?

The overall hypothesis of this study is that crime increases during a recession only in the less educated and less affluent areas in Fairfax County. The following procedures were done to test the validity of this hypothesis.

Fairfax County was first divided into eight police districts to study the overall crime pattern throughout the county. Analysis was first conducted on crime totals to see which police districts had the most crime. The results were then compared with nine census districts in Fairfax County to see if educational attainment correlates with crime patterns in Fairfax County. The variables that were used within the census assessments were Population over 25, Poverty, Unemployment, and Household Income. The two analytical methods used to test if the hypothesis is valid or not were Time Series Analysis and Bivarate Choropleth Analysis. The analysis was done in three parts: Time Series Analysis of Crime Totals, Time Series Analysis of Crime

Types, and Bivariate Choropleth Analysis of Crime Totals. The overall results of the study are located within the Results section.

Time Series Analysis of Crime Totals

The first type of analysis used on Fairfax County's crime data was Time Series Analysis on the overall crime totals based on individual years from 2005 to 2010. There were two goals of this analysis: the first, to figure out which years had the highest and lowest amount of total crime by year, and the second to figure out where the majority of crime exists within the nine police districts based on the Fairfax County overall crime total. Microsoft Excel charts were used to help visually examine crime patterns. After both goals were accomplished, the crime patterns were geographically displayed on maps to show Fairfax County's overall crime pattern.

The first step was to use line graphs with markers in Microsoft Excel to figure out which years had the highest and lowest amount of crime. Going left to right, the selection tool in Microsoft Excel was used to horizontally select years Y2005 to Y2010 in Table 3.1. Cells with crime totals of 18377 to 17075 in the horizontal "Total" field were then selected. After highlighting both sets of cells, they were put into a line graph for analysis. Figure 2.0 in the Results section shows the years that have the highest and lowest amount of crime.

The second step was to look at the crime totals by police district station to figure out which of the police district stations had the highest and

lowest amount of crime from 2005 to 2010. Going from top to bottom, the selection tool in Microsoft Excel was used to select the vertical police district station names, and then the vertical crime total cells were selected. After both sets of data were selected, they were inserted into a line graph with markers for results. Figure 2.1 in the Results section shows the crime totals by police district station.

The final step was to create a map that displayed a year by year crime pattern of Fairfax County from 2005 to 2010. After loading Table 3.1 into ArcGIS, and joining it up to the "Crime Total" layer, there were six data sets that displayed crime totals for each year from 2005 to 2010. By right-clicking on the "Crime Total" layer, the "Graduated Color" scheme in the "symbology" tab was used to display each year's crime total. Under the "fields" section, each year was picked from Table 3.1 in the "value" sub section, and the crime totals were geographically displayed on the map. The standard deviation classification was used to figure out where 68 percent, or one standard deviation, of the crime totals was located on the map. Standard deviation was the classification used to find which police district stations had the average crime totals, as well as, which police district stations were located above and below the average police district stations. Hot spots were considered the police district stations above the average and cold spots were considered the police district stations below the average.

Appendix A shows the overall crime pattern of Fairfax County from 2005 to 2010.

Time Series Analysis by Crime Type

The second type of analysis used on Fairfax County's crime data was Time Series Analysis based on crime type. The goals of this analysis were first to find out if individual crimes have changed during the Great Recession; and then to discover if patterns of crime categorized by violent crime and property crime have changed during the Great Recession. After these goals were accomplished, the crime patterns were geographically displayed on eight different graphs and eight different maps to show Fairfax County's overall crime pattern from 2005 to 2010.

The first step was to graph Tables 4.1 to 4.12 based on individual crime types. The individual crimes that were used to graph each of the crime types were: Murder, Forcible Rape, Robbery, Aggravated Assault, Burglary, Motor Vehicle Theft, and Larceny. Figure 3.1 to 3.7 in the results section shows the years that have the highest and lowest amount of crime based on the individual crimes.

The second step was to group and map the crimes based on Part I, violent crimes, and Part II, property crimes, to analyze Fairfax County's overall crime patterns by police district station. There were a total of twelve maps, six maps each for both violent and property crimes, that showed the overall crime totals and percentages of crime for each police district station.

Appendices B and C show the second step of performing Time Series Analysis by crime type. Appendix B shows the crime patterns for violent crimes from 2005 to 2010; and Appendix C shows crime patterns for property crimes from 2005 to 2010.

Tables 4.1 to 4.13 were used to analyze the crime data by crime type and year. As mentioned above, Tables 4.1 to 4.13 were linked to the "Crimes Type" base layer. Using the layer options tools in the "Crime Type" base layer, the "Graduated Color" scheme in the "Quantities" section of the "Symbology" tab of "Layer Properties" was chosen to geographically display violent and property crime totals on eight maps. The "Totals" field and the "f" field in Tables 4.1 to 4.13 were picked for the "Value" to be displayed. Crime totals and percentages were rounded to the nearest whole number.

Standard Deviation was used for the classification in order to figure out which police district stations held the majority of Fairfax County's crime totals, as well as, which police district stations were located above and below the average. Hot spots were considered the police district stations above the average police district, and cold spots were considered the police district stations below the average. Appendices B and C in the Results section shows the results of the Time Series Analysis on crime totals based on crime type.

Bivariate Choropleth Analysis

The third type of analysis used was Bivariate Choropleth Analysis. Bivariate Choropleth Analysis takes two variables and compares them with

each other to see if the two variables spatially correlate or not. Bivariate choropleth maps within this study were used to show if Fairfax County's census data had any impact on crime data. Bivariate Choropleth Analysis was chosen for the second part of the analysis because the original crime data from 2005 to 2008 was only in crime total format. Even though a 1:1 ratio between Fairfax County's district areas and police district stations could never be obtained, Bivariate Choropleth Analysis proved to be a valuable tool in assessing if Fairfax County's census data had any spatial correlation to their crime total data.

The two base layers that were used within this study were the "Crime Totals" layer and the "FFC Districts" layer. The "Crime Totals" base layer provided the ability to analyze Fairfax County's overall crime total patterns. Table 3.1 was linked together with the "Crime Totals" layer. The "FFC Districts" layer provided the ability to see if census data followed the same pattern as the crime pattern in Fairfax County. Tables 2.1 to 2.4 were linked together with the "FFC District" shapefile. Standard deviation was chosen for the classification type that was used on both the "Crime Totals" layer and the "FFC Districts" layer. The following explains the steps that were used when performing bivariate chloropleth analysis in ArcGIS on Fairfax County's census and crime data.

Crime data in the "Crime Totals" layer was used to display the overall crime totals of Fairfax County from 2005 to 2010 based on police district

station. The "Graduated Colors" palette was used to symbolize the data. Ranges for the data were picked by using the standard deviation classification and rounding to the nearest whole number. Percentages and decimal numbers were rounded to the nearest tenth. The red, grey, and blue color scheme was chosen for this part of the analysis to show the hot, average, and cold spots of the data. Red areas (hot spot) are indicative of above the average crime totals, grey areas exhibit average crime totals, and blue areas have below the average crime totals.

Census data in the "FFC District" layer was displayed using "Graduated symbols" in the "Symbology" tab of the "Layers properties" section of ArcGIS. Using the "Graduated symbols" tool for the census data allowed the census data to be displayed on top of the crime data simultaneously. Ranges for the data were picked by using the standard deviation classification and rounding to the nearest whole number. Percentages and decimal numbers were rounded to the nearest tenth. Different colors symbolize the four different types of census data used for the analysis: Purple for the "Population over 25", Orange for "Poverty", Blue for "Unemployment", and Green for "Household Income".

When the Bivariate Choropleth Analysis was finished the result was four maps "Population over 25", "Poverty", "Unemployment, and "Household Income." The results of each can be found in Appendices D, E, F, and G.

After the four maps were completed, comparison analysis began between crime data and census data and the results are shown in the results section.

Results

After completing all three parts of the analysis, the results were recorded. The three results sections in this study are listed in the same way the crime data and census data were analyzed: Time Series Analysis Results of Crime Totals, Time Series Analysis Results by Crime Type, and Bivariate Choropleth Analysis of Crime Totals.

Time Series Analysis Results of Crime Totals:

Figure 2.0 shows which years from 2005 to 2010 had the highest and lowest amount of crime. 2008 had the highest amount of crime and was also the year that crime totals seemed to peak. Years 2005, 2007, and 2009 had roughly the average amount of crime. Years 2006 and 2010 had the lowest amount of crime.

Figure 2.0 "2005 to 2010 Crimes Totals by Year"

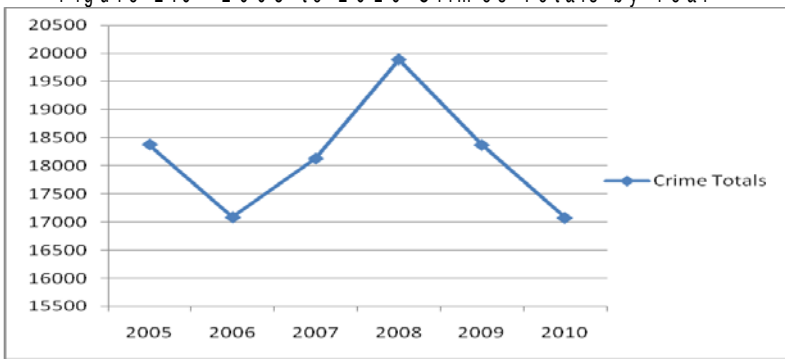
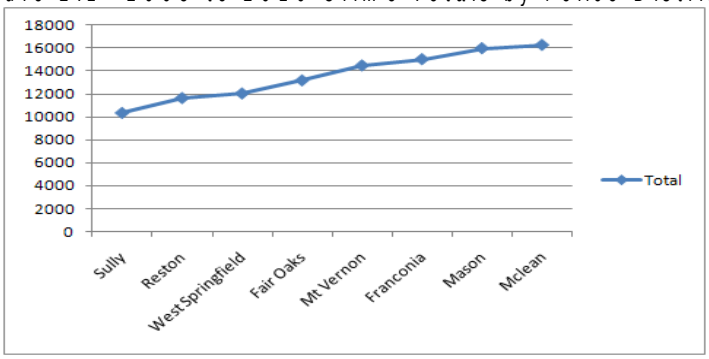


Figure 2.1 shows the police district stations that had the highest, average, and lowest amount of crime from 2005 to 2010. Mason, McLean,

and Franconia had the highest amount of crime, while Mount Vernon and Fair Oaks had an average amount of crime. Sully, Reston, and West Springfield had the lowest amount of crime.

Figure 2.1 "2005 to 2010 Crime Totals by Police District"



The crime map that was created in Appendix A shows the overall crime distribution of Fairfax County from 2005 to 2010. The overall crime total pattern from 2005 to 2007 shows a high amount of crime in the eastern part of Fairfax County. McLean, Mason, Franconia, and Mount Vernon police district stations are shown to be the areas with the highest amount of crime. In 2008, crime increases significantly and starts to spread out to the more northern parts of the county with McLean and Franconia police districts having the highest amount of crime. By 2009, the majority of the high crime areas are located in the northern parts of the county, with Fair Oaks and Mason police districts having the highest amounts of crime in 2009. By 2010, the highest amounts of crime are all located in the northern parts of the county. Fair Oaks, Reston, McLean, and Mason police districts are the areas with the highest amounts of crime. Results from Appendix A shows

that crime has shifted from the eastern police districts to the northern police districts.

Time Series Analysis on Crime Totals, results show that before the Great Recession started in 2007, the majority of the crime was in the eastern part of the county. This could have been in part due to Fairfax County being right next to Washington D.C. During the Great Recession, High crime totals in Fairfax County spread throughout the majority of the county. In the years shortly after the Great Recession high crime totals were in the northern parts of the county. These results show how a recession can have an effect on crime pattern changes are one possible result of the Great Recession in Fairfax County.

Time Series Analysis Results by Crime Type:

Figure 3.1 to 3.7 shows the first step of performing Time Series Analysis by Crime Type. Figure 3.1 shows that murders declined from 2005 to 2007, spiked in 2008, dropped to their lowest rates in 2009, and slightly increased in 2010. Figure 3.2 shows that rape crime totals went down from 2005 to 2006, spiked in 2007 to 2008, then went back down in 2009 and 2010. Figure 3.3 shows that robbery crime totals were the highest in 2006 and 2007 and the lowest in 2009 to 2010. Figure 3.4 shows that aggravated assault crime totals went down from 2005 to 2006, went up from 2007 to 2008, and remained high in 2009 and 2010. Figures 3.5 and 3.6 shows that burglary and motor vehicle thefts crime totals are slowly going down from

2005 to 2010. Figure 3.7 shows that larceny crime totals were going down from 2005 to 2006, went up in 2007, spiked in 2008, and then started to go back down in 2009 and 2010.

Figure 3.1 "Fairfax County's Murder Totals 2005 to 2010"

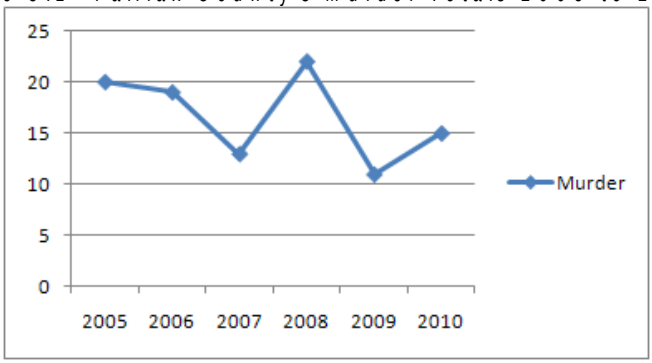


Figure 3.2 "Fairfax County's Rape Totals 2005 to 2010"

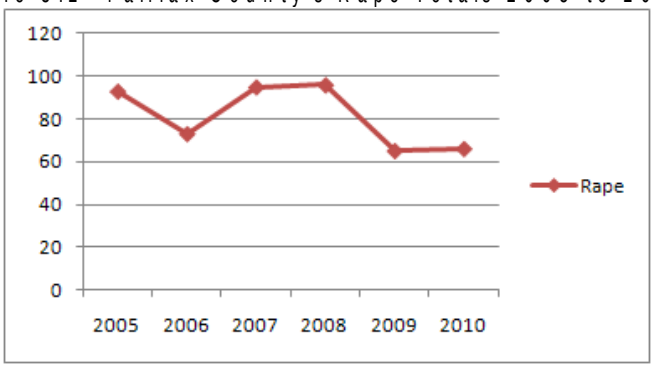


Figure 3.3 "Fairfax County's Robbery Totals 2005 to 2010"

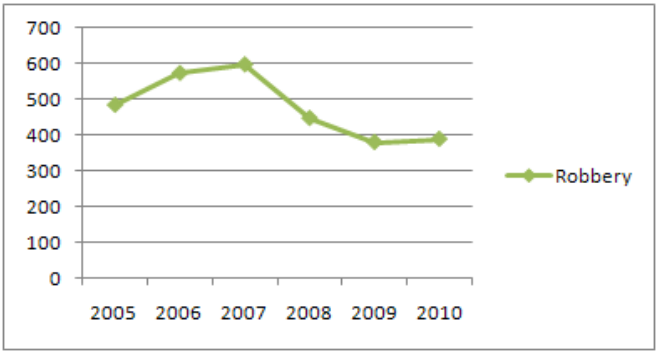


Figure 3.4 "Fairfax County's Aggravated Assault Totals 2005 to 2010"

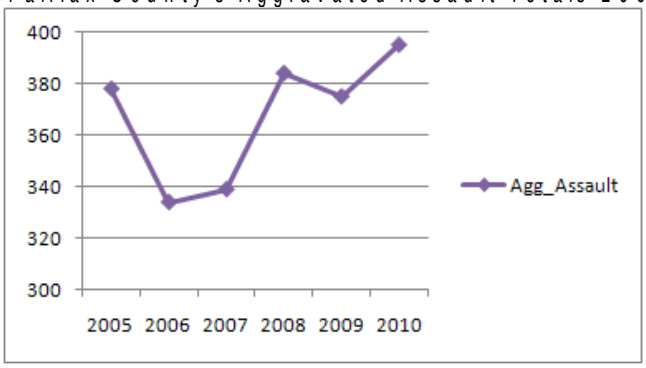


Figure 3.5 "Fairfax County's Burglary Totals 2005 to 2010"

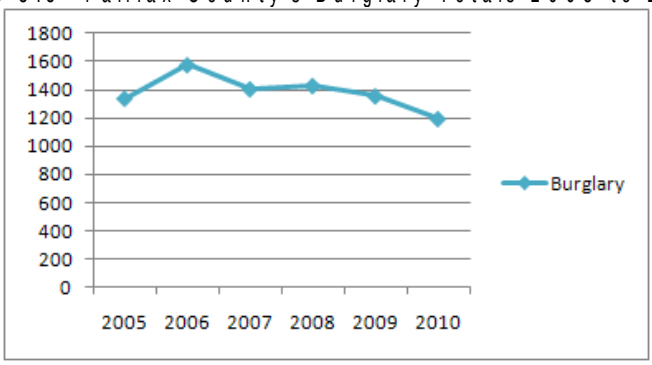


Figure 3.6 "Fairfax County's Motor Vehicle Theft Totals 2005 to 2010"

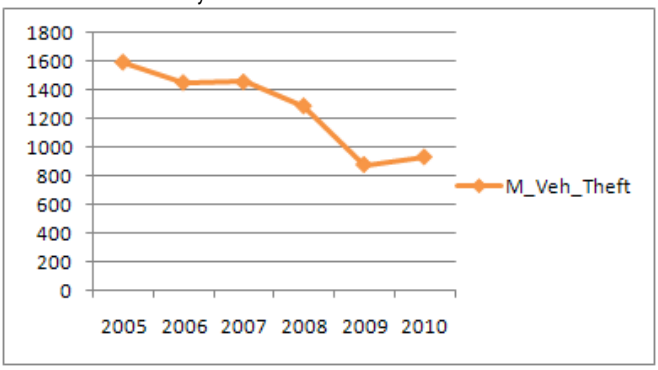
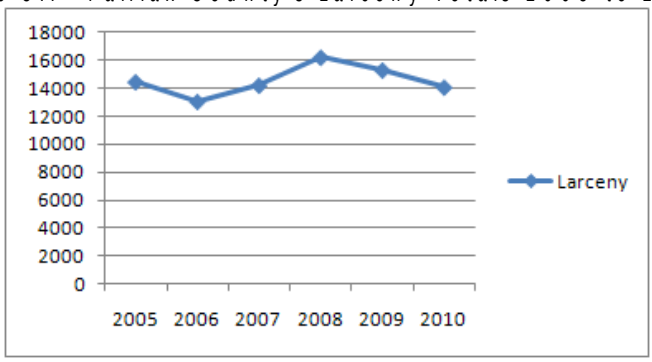


Figure 3.7 "Fairfax County's Larceny Totals 2005 to 2010"



Appendix B and C show the second step of performing Time Series Analysis by crime type. Appendix B and C show a comparison of Fairfax County's violent crime and property crime from 2005 to 2010. Appendix B shows the crime pattern for violent crimes and Appendix C shows the crime pattern for property crimes. When looking at both Appendix B and C, results show that violent and property crime have significantly changed.

Violent crime totals from 2005 to 2006 were high in the southeast parts of the county with Mount Vernon police district station having the highest violent crime total for both years. By 2007, violent crimes shifted north to the central eastern part of the county with Mason police district station had the highest violent crime total. In 2008, most of the violent crimes were now on the west central part of the county with Fair Oaks police district station having the highest violent crime total. There were also spurts of high violent crime totals also in Reston and Franconia police district stations. By 2009, violent crime totals started to dissipate back to the southeast part of the county with Mount Vernon and Mason police district stations having the highest amount of violent crime totals. By 2010, violent crime totals went back to the way they were before the Great Recession started in 2007.

Property crime totals from 2005 to 2006 were the highest in the eastern to southeast part of the county with Mclean, Franconia, and Mount Vernon having the highest property crime totals. In 2007, property crimes

totals were high mainly in the north central parts of the county with Reston, Fair Oaks, and Mason police district stations having the highest property crime totals. By 2008, high property crime totals started to head back eastern part of the county with Reston and Mason police district stations having the highest property crimes. Property crimes in 2008 were also more spread throughout the rest of the county. In 2009, high property crime totals shifted again to mainly the eastern police district stations with Mclean and Franconia police district stations having the highest property crime totals. By 2010, property crime totals went back to the same pattern as they did in 2005 to 2006 with Mclean, Mason, and Franconia police district stations having the majority of the highest property crime totals.

Time Series Analysis by Crime Type, results show that before the Great Recession started in 2007, the majority of the violent and property crime was in the south eastern part of the county. This could have been again in part due to Fairfax County being right next to Washington D.C. During the Great Recession, High crime totals in Fairfax County spread throughout the majority of the county. Looking at the years shortly after the Great Recession high crime totals began to dissipate back to the way they were before the Great Recession started. These results show how a recession can have an effect on crime patterns and how the Great Recession changed the overall crime pattern of Fairfax County.

Bivariate Choropleth Analysis Results:

Appendices D, E, F, and G, show the analysis of data using Bivariate Choropleth Analysis of Fairfax County's crime data and census data by education attainment. Within each of the five appendices, Fairfax County's overall crime totals from 2005 to 2010 were compared to population over 25, poverty, unemployment, and household income by census district from 2005 to 2009. Ordinal classifications were used to analyze if the census data correlated with the crime data. There were three types of classifications: "positive correlation", "weak correlation", and "negative correlation". Positive correlations exhibited a strong connection with patterns between crime and the given demographic variable. Weak correlations appeared to have little or no connection patterns. Negative correlations were those observed to have a strong dissimilarity between patterns. The overall correlation between crime data and census data seemed to correlate when looking at population, poverty, unemployment, and household income as a whole. However, when each census data was broken down based on education attainment the correlations became more problematic.

Appendix D shows a comparison of Fairfax County's crime totals to their population over 25 based on education attainment. Individuals with no high school diploma appear to have a strong positive correlation with high crime totals. High school graduates appear to have less of a positive correlation with high crime totals than individuals with no high school

diploma. Individuals with some college appear to have a weak correlation across the map with high crime totals and individuals with a bachelor's degree or higher appear to have a negative correlation with high crime totals. Results show that as the education attainment increases, the high crime totals decreases.

Appendix E shows a comparison of Fairfax County's crime totals to their poverty totals based on education attainment. Individuals living in poverty with no high school diploma appear to have a slight positive correlation with areas of higher crime totals. High school graduates that live in poverty appear to have a weak correlation with high crime totals. Individuals living in poverty with some college appear to have a weak correlation with high crime totals and individuals with a bachelor's degree or higher have a weak correlation to high crime totals. Results show that poverty correlates positively to crime totals but only individuals with no diploma appeared to have a positive correlation.

Appendix F shows a comparison of Fairfax County's crime totals to their unemployment totals based on their education attainment. Unemployed individuals with no diploma appear to have a weak correlation with high crime totals. Unemployed high school graduates also appear to have a weak correlation with high crime totals. Unemployed individuals with some college appear to have a negative correlation with high crime totals and individuals with a bachelor's degree or higher have a strong positive correlation with

high crime totals. Results show that overall unemployment does have a positive correlation on crime totals; however, when based on education attainment results were inconclusive.

Appendix G shows a comparison of Fairfax County's crime totals to their household income based on their education attainment. Individuals with no high school diploma have a weak correlation with crime totals. High school graduates also have a weak correlation to crime totals. Individuals with some college or bachelors degree appear to have a negative correlation with crime totals. Individuals with a graduate degree appear to have a weak correlation. By looking at the ranges of the amount of money that an individual makes, results show that as education attainment goes up, so does the money that individual makes. Results suggest that the police district stations in the west have more household income then the police district stations in the east, however, when based on education attainment there appears to be individuals with high education attainment mixed together with individuals of lower education attainment.

Bivariate Choropleth Analysis results show that population, poverty, unemployment, and household income appear to have a correlation with crime patterns of Fairfax County. By looking at all four of the maps, it appears that the majority of Fairfax County residents in the western parts of Fairfax County have less population lower poverty, lower unemployment, higher educational attainment and higher paying jobs. The residents in the

eastern parts of Fairfax County where the population is higher have higher poverty and unemployment, and lower educational attainment and lower paying jobs. As previously mentioned, when results were based on education attainment they became more problematic. However, overall results show that higher educated residents live in the western parts of Fairfax County and lower educated residents live in the eastern parts of Fairfax County. Low crime police districts are located on the western part of Fairfax County and high crime police districts are located on the eastern part of Fairfax County. Based on these results, the study shows that population, poverty, unemployment and household income does correlate with crime and that where an individual lives does have some correlation to their education attainment.

Discussion:

As shown in the Results section, the three analytical procedures performed within this study support the hypothesis of the study. Crime patterns were impacted by the Great Recession and education attainment did have some impact on crime patterns in Fairfax County. This section discusses how performing each of three analytical procedures within this study shows that crime patterns in Fairfax County did increase during the Great Recession and that education attainment did have some impact on crime.

Performing Time Series Analysis of Crime Totals, results suggest that crime totals were impacted by the Great Recession. Results show that the highest amount of crime was in 2008 which was the middle of the Great Recession. Looking at Figures 3.1 to 3.7, Fairfax County's individual crimes such as murder, rape, aggravated assault, and larceny are shown to have spiked during the Great Recession. This is also demonstrated in Fairfax County's overall crime totals in Figure 2.1. Appendix A also shows how crime spiked in 2008, and further shows how crime total patterns drastically changed since the Great Recession started in 2007. The majority of the crime went from the eastern police district stations to the northern police district stations of Fairfax County. By 2009, when the Great Recession ended, crime totals went down and the overall crime pattern shifted. 2009 and 2010 crime totals show that the majority of the crime was located in the north instead of the east as it was before the Great Recession began in 2007. The overall results of performing Time Series Analysis of Crime Totals suggest that the Great Recession did impact Fairfax County's overall crime totals.

Performing Time Series Analysis of Crime Types, results show that violent crime patterns were affected by the Great Recession. From 2005 to 2008, the police district stations with the highest amount of violent crime shifted twice going from the east side of Fairfax County to the west side of Fairfax County. From 2008 to 2010, violent crime totals shifted twice back to

the east side of Fairfax County in reverse order of how it shifted to the west. In 2010, the overall crime pattern of violent crimes went back to the same pattern as it was before the Great Recession started in 2007; the only difference is that violent crime was more spread out in the southeastern parts of Fairfax County in 2010. By performing Time Series Analysis based on violent crime, overall results suggest that the Great Recession did impact Fairfax County's violent crime pattern.

Performing Time Series Analysis of Crime Types, results show that property crime patterns were affected by the Great Recession. From 2005 to 2008, the police district stations with the highest amount of property crime shifted twice from southeast to north central parts of Fairfax County. In 2008 property crime was spread out across Fairfax County with the majority of crimes in the north central police district stations. From 2008 to 2010 the crime patterns went back to the way they were before the Great Recession started in 2007. By performing Time Series Analysis based on property crime, overall results suggest that the Great Recession did impact Fairfax County's property crime pattern.

After performing Bivariate Choropleth Analysis on Crime Totals, the overall results show that education attainment, based on population, does have some impact on crime patterns. Results seemed to show that as education attainment increases crime totals decrease. When it came to analyzing the overall impact that poverty, unemployment, and household

income, has on crime totals, crime patterns seem to suggest that all three do impact crime totals. However, results were more problematic when they were based on education attainment.

The results seemed to show that the overall poverty pattern does have a positive correlation with crime totals, but only individuals with no high school diploma appeared to have a slight positive correlation. Results show that overall unemployment does have a positive correlation on crime totals, but only towards individuals with no diploma to high school graduates. Results show that overall household income does have a negative correlation with crime totals, and suggest that individuals with a high level of education attainment are mixed with individuals of lower education attainment. It is suggested that individuals with higher amount of education live in wealthier areas throughout Fairfax County. It was noted with household income that as the education attainment goes up the ranges of the amount of median income also goes up.

Limitations/Future Studies

Data analysis can only be as good as the data itself. Throughout the course of the study there were three limitations that were discovered. The first was that crime totals aggregated to police districts were used instead of crime points. The second was that crime data and census data did not have a 1:1 correspondence which prevented performing further analysis. The third limitation was that the census data was collected by a five-year census

rather than a year-by-year census. If these limitations could be fixed further analysis could be conducted.

Within the first limitation, crime data could be collected only as crime totals and not as crime points. Fairfax County Police Department could provide crime data only by crime totals from 2005 to 2008 and not by crime points. If crime points could have been used further analysis such as point pattern analysis could have been conducted. Further analysis could have led to a better understanding of crime patterns by pin pointing which areas within each police district station has higher crimes than others; Crimes analysis would be based on crime incidents verses police district stations. Studying crime patterns by police district stations rather than by individual crimes over generalizes the data.

Similar to the first limitation, the second limitation of the study is that census data was collected by the Fairfax County police district station and not by census blocks or census tracts. Police district stations were used instead of census blocks because the crime data could be standardized only at the district level based on the crime totals provided. Attempts were made to align census blocks and census tracts with Fairfax County's police districts; however, they did not line up. Attempts were also made to merge the census tracts with police district stations; however, it was concluded that results would misrepresent data of both. There was never a 1:1

correspondence between crime data and census data which also prevented from performing further analysis from being conducted.

The third limitation of the study was that census data was collected by a five-year census instead of a one year census. ACS does provide one year for county wide census data for Fairfax County but not for the nine districts within Fairfax County. If Fairfax County census data could be collected year by year, census trends would be more accurate when performing Time Series Analysis.

If all three limitations could have been removed, further analysis could have been conducted and data would have been more accurate. Attempts were made to work around all three of these limitations. If further studies are to be conducted in the future, crime points instead of crime totals, census blocks instead of police district stations, and one-year census data instead of five-year census data should be used. If all three of these limitations could be fixed, then crime data and census data would have a 1:1 correspondence. Point Pattern Analysis techniques could then generate better correlations with the use of Moran's Autocorrelation and directional ellipses tools in ArcGIS.

Conclusion

As mentioned in the introduction, the Social Strain Theory suggests that crime exists because societal demands do not meet an individual's needs. After explaining what the Social Strain Theory is and explaining how

the American Dream could lead to social strain, Fairfax County's crime and census data were used to test if social strain had any impact on crime during the Great Recession. The overall hypothesis of this study was that crime increases during a recession only in the less educated and economically challenged areas of Fairfax County. Less educated and poor areas of Fairfax County were picked as the focal point of this study because it was assumed that these areas would be more at risk of social strain due to the pressure of trying to live up to the reputation of Fairfax County.

This study analyzed crime by both crime type and overall crime total to figure out if Fairfax County's crime patterns were impacted by the Great Recession. This study also compares Fairfax County's socioeconomic variables of population, poverty, unemployment, and household income with its crime patterns to determine if education attainment had any impact on the overall crime pattern of Fairfax County. Results of the study ended up showing that crime does increase during the Great Recession and education attainment does have some impact on crime. However, the results also show that the hypothesis is not valid because crime patterns show that crime spreads to every part of Fairfax County during the Great Recession and not just the less educated and poor areas. It is suggested that further studies are needed, and that crime points instead of crime totals should be used in order to test the effect that a recession, and ultimately social strain, has on crime in Fairfax County.

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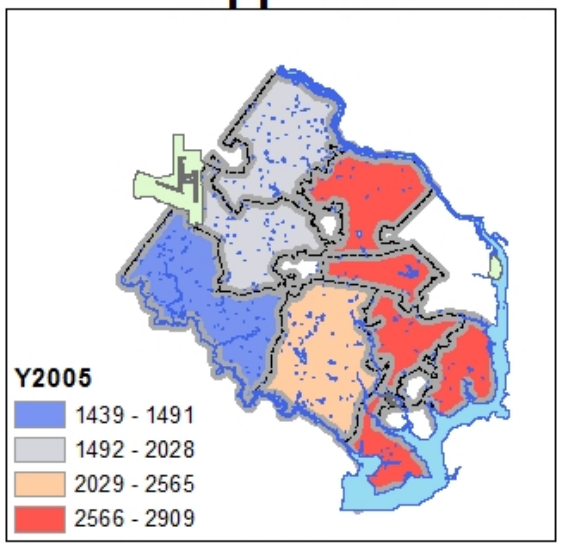
Appendix A: "2005 to 2010 Fairfax County's Crime Totals"



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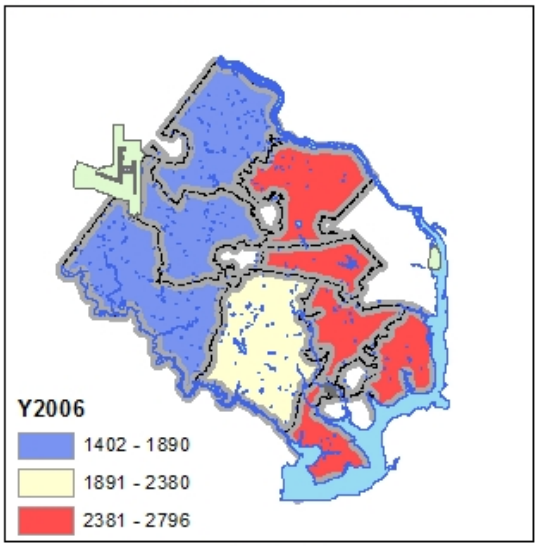

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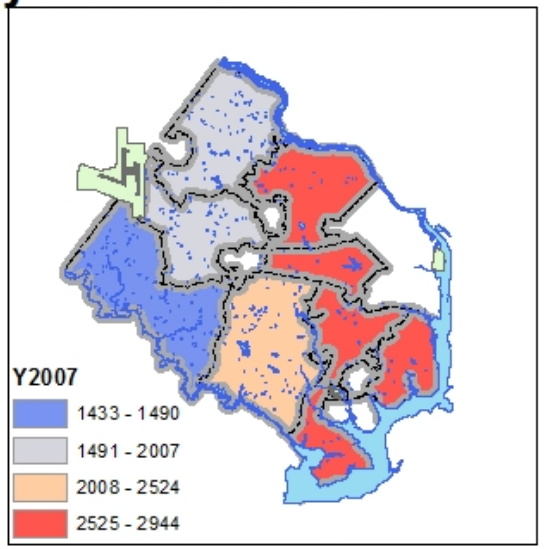

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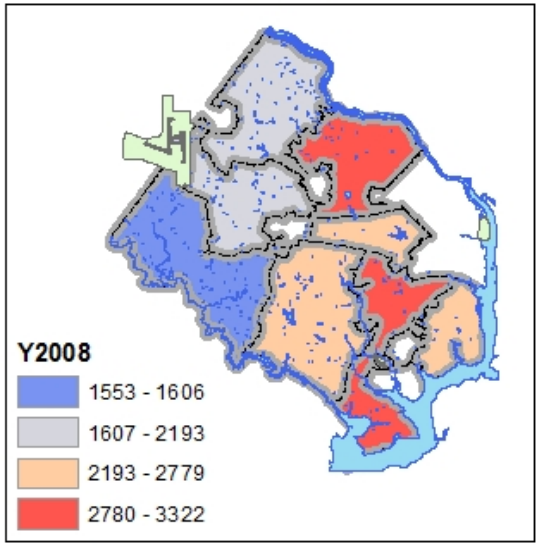

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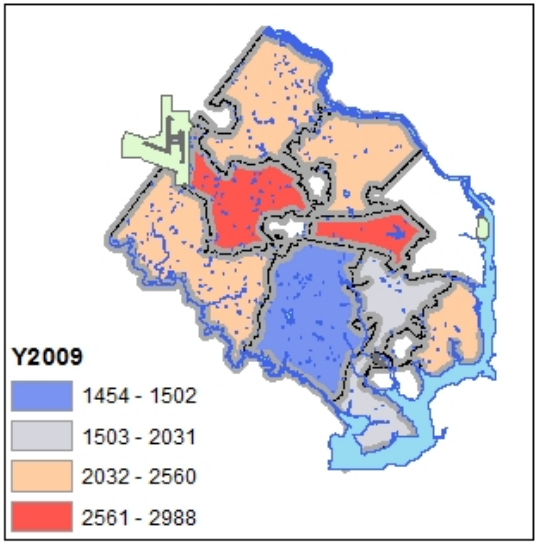
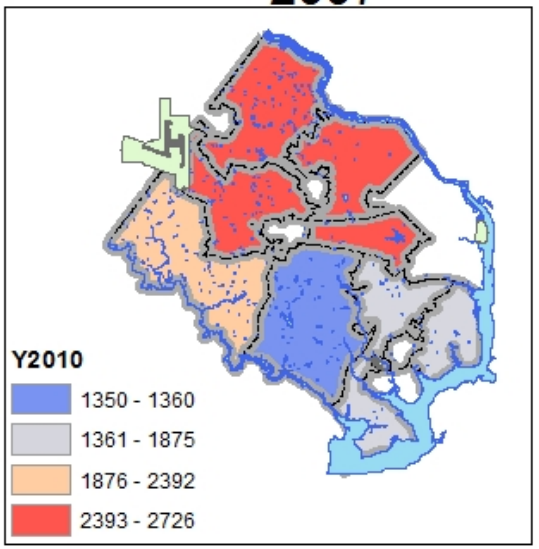


2009



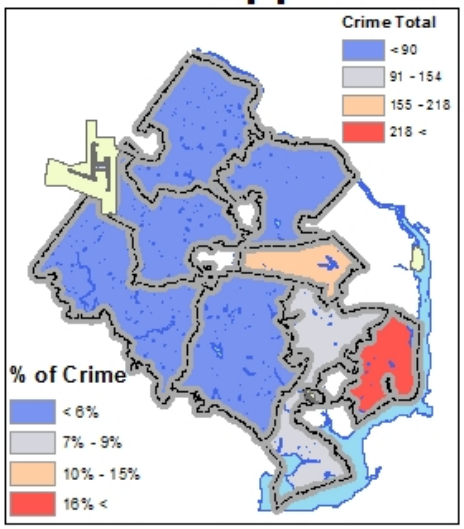
2010

Resolution: 1:700,000

Sources: Fairfax County Police Department & Virginia Department of Transportation

Map Created by: Jason D Reyes

Appendix B: "Time Series Analysis of Violent Crime"



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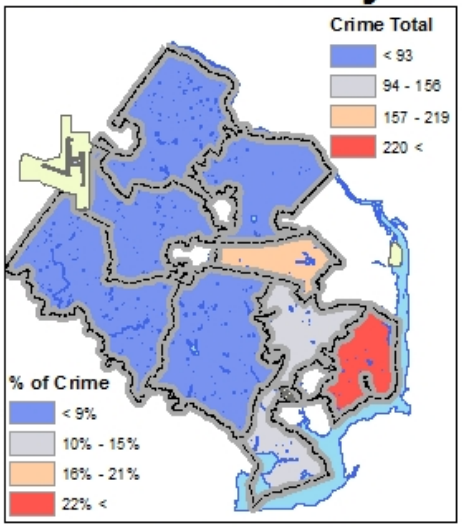

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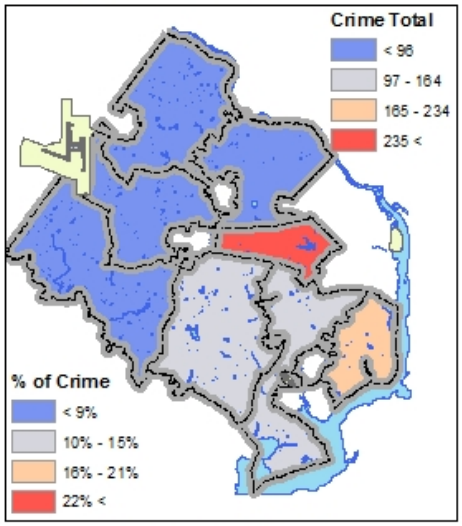

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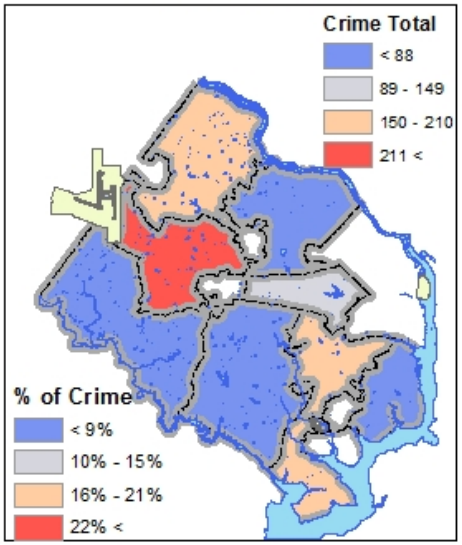

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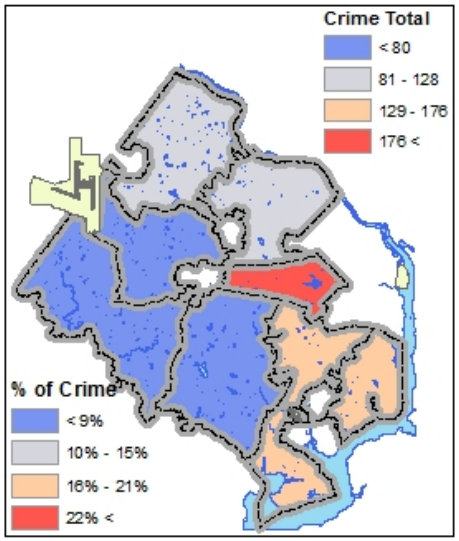

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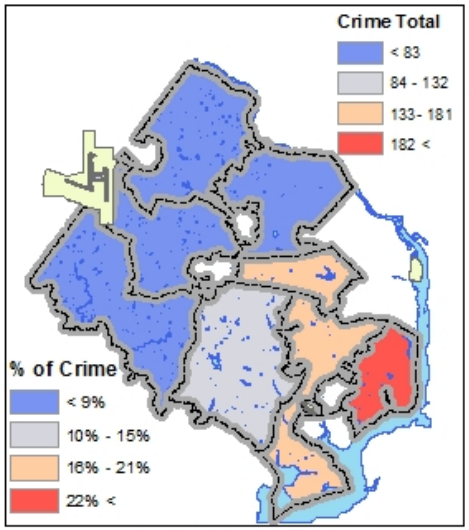
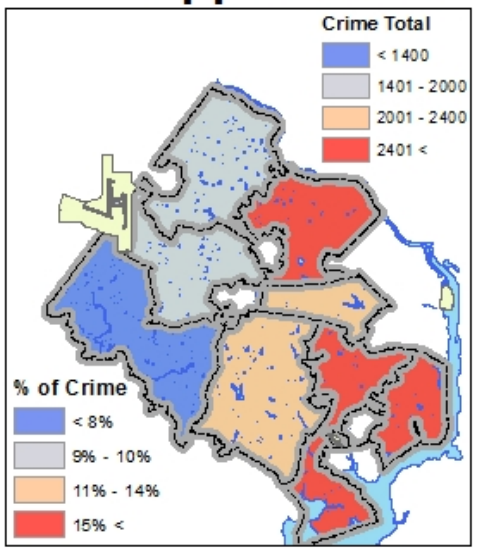


2010 Part I

Resolution: 1:700,000 Sources: Fairfax County Police Department & Virginia Department of Transportation Map Created by: Jason D Reyes

Appendix C: "Time Series Comparison of Property Crime"



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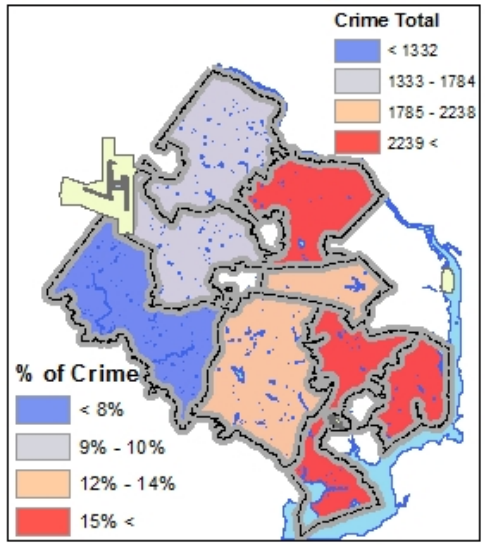

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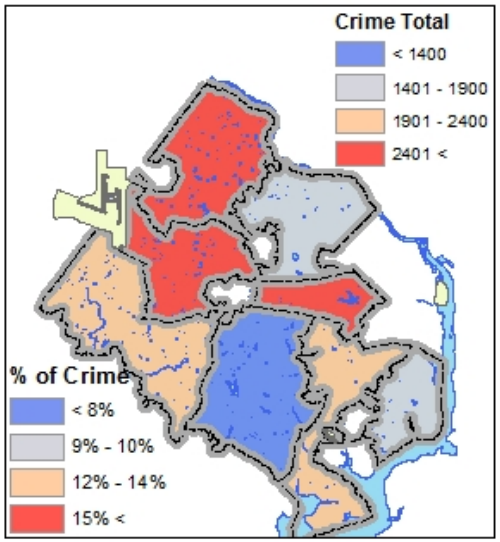

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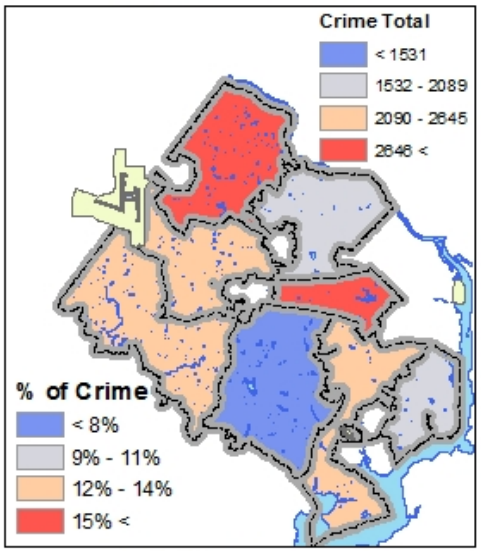

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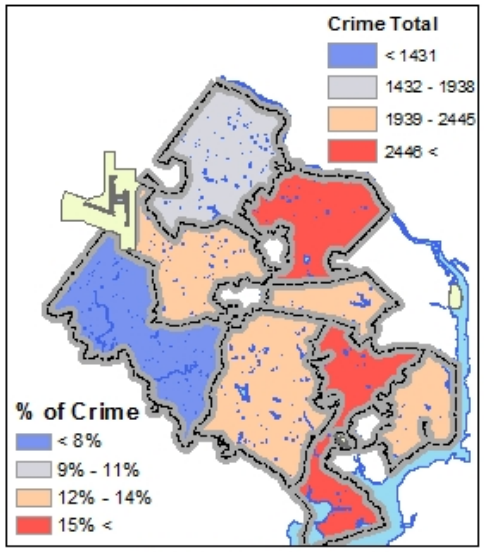

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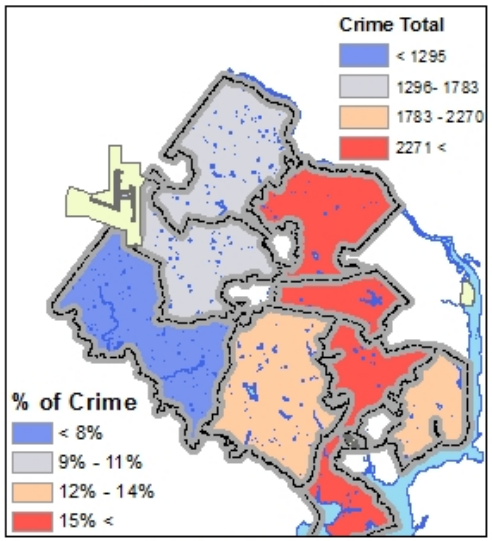


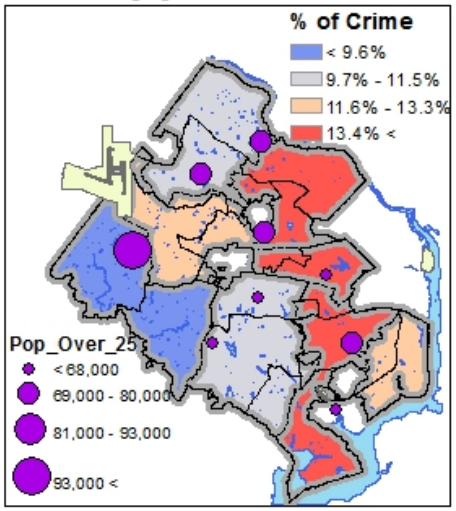
2010 Part II

Resolution: 1:700,000

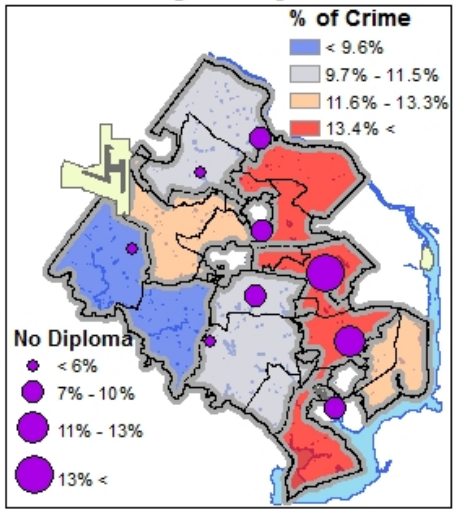
Sources: Fairfax County Police Department & Virginia Department of Transportation

Map Created by: Jason D Reyes

Appendix D: "Fairfax County Population Over 25 2005 to 2009"



Population Over 25



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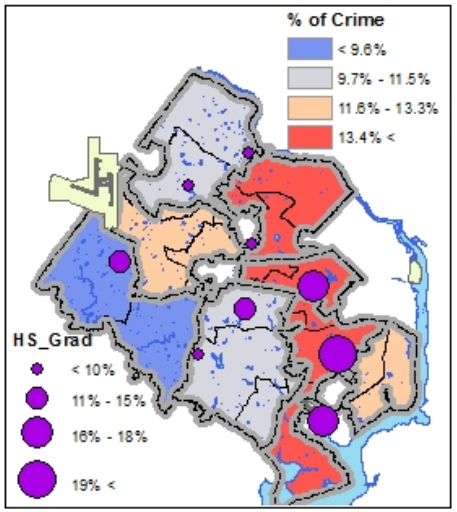

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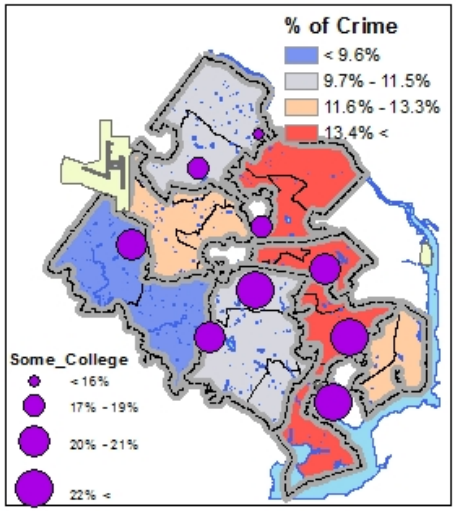
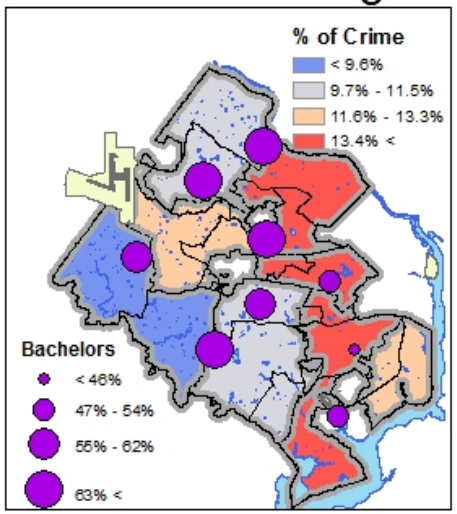


Some College



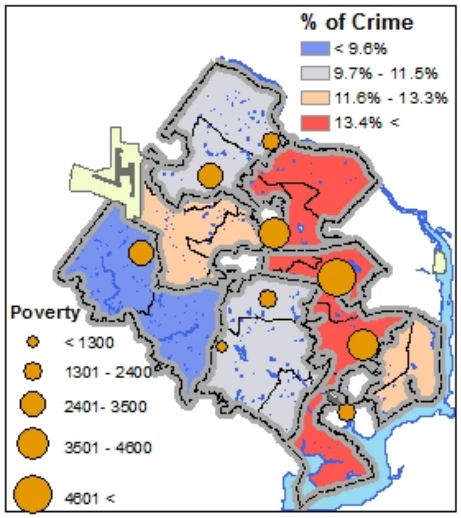
Bachelors or Higher

Resolution: 1:700,000

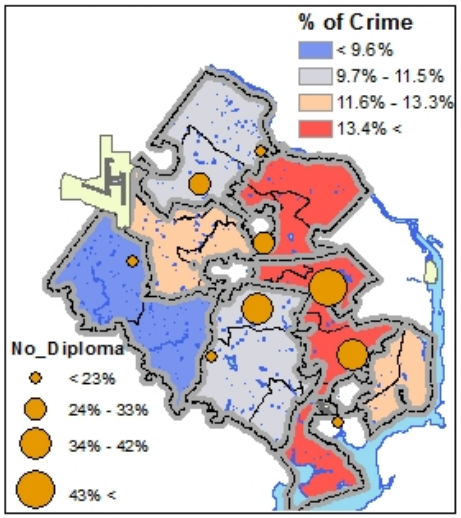
Sources: Fairfax County Police Department & Virginia Department of Transportation & United States Census Bureau

Map Created by: Jason D Reyes

Appendix E: "Fairfax County Poverty 2005 to 2009"



Below Poverty



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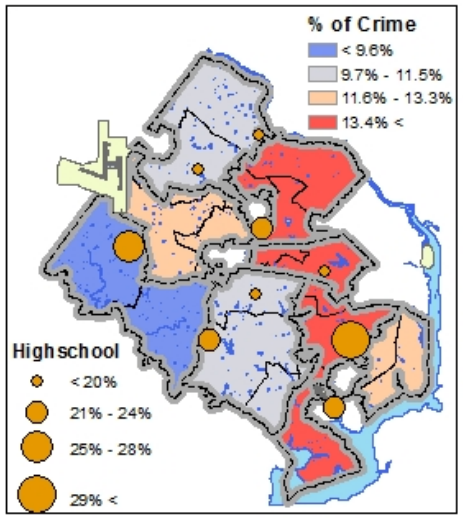
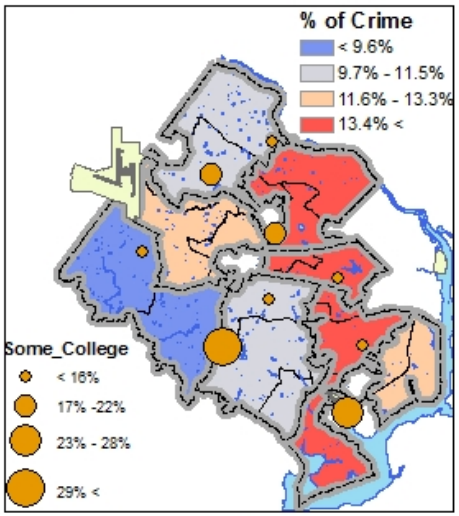


High School Graduate



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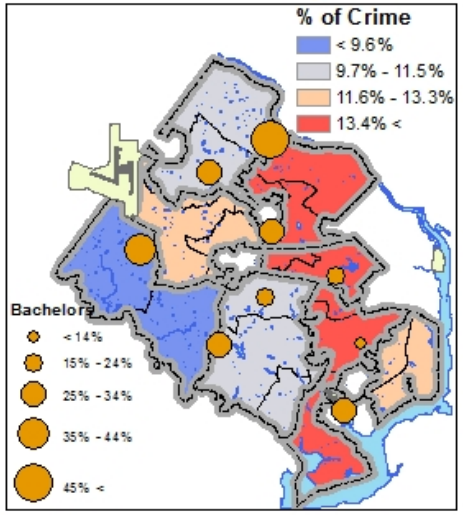


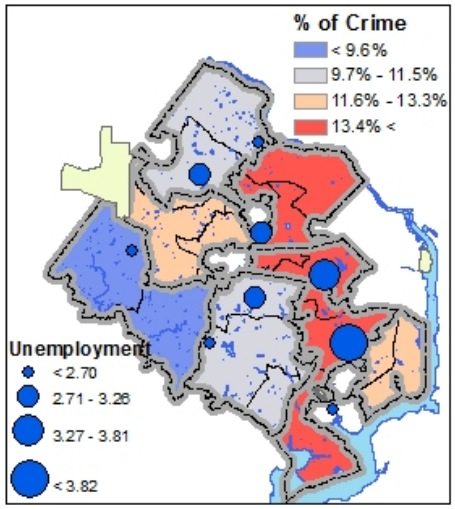
Bachelors or Higher

Resolution: 1:700,000

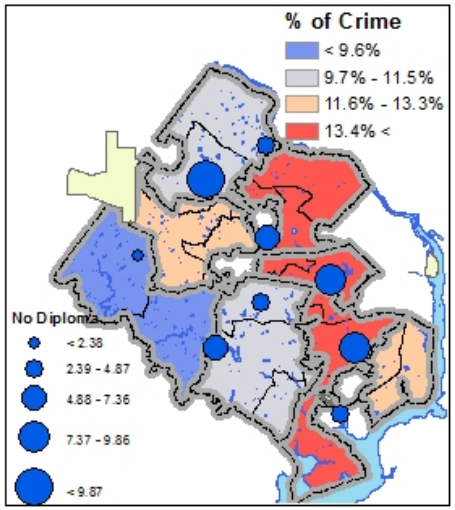
Sources: Fairfax County Police Department & Virginia Department of Transportation & United States Census Bureau

Map Created by: Jason D Reyes

Appendix F: "Fairfax County Unemployment 2005 to 2009"



Unemployment



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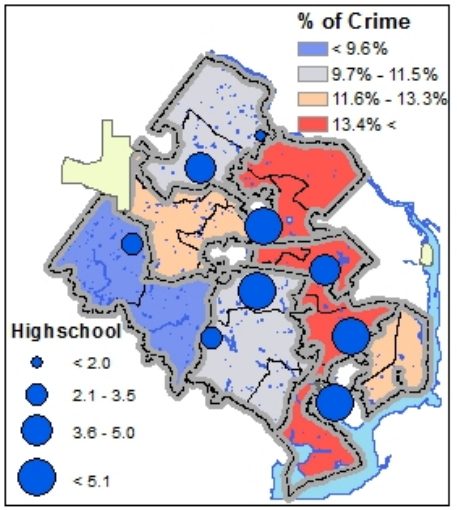
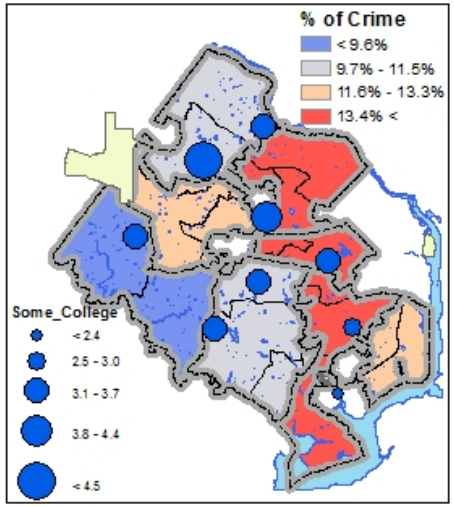


High School Graduate



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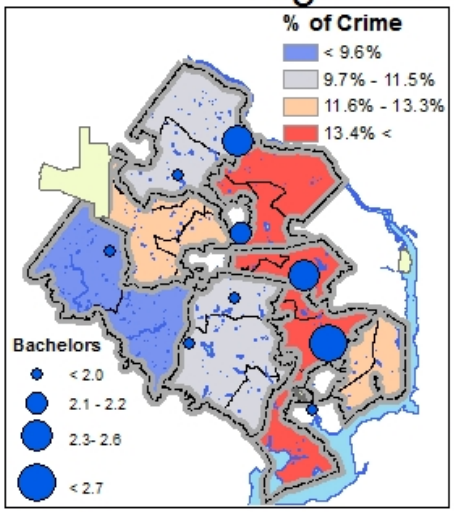


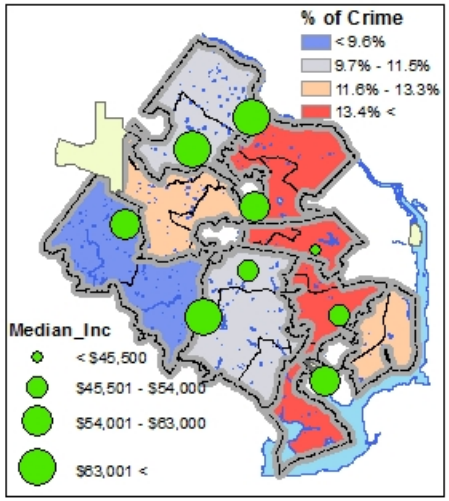
Bachelors or Higher

Resolution: 1:700,000

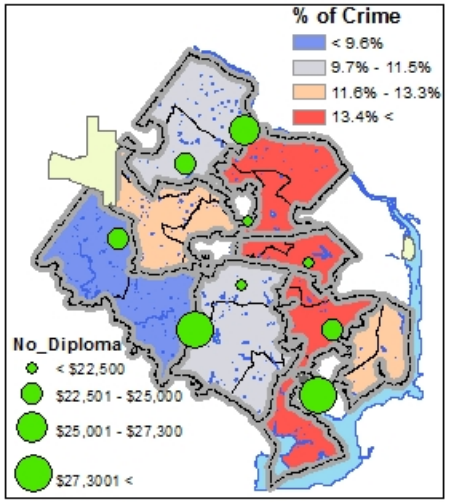
Sources: Fairfax County Police Department & Virginia Department of Transportation & United States Census Bureau

Map Created by: Jason D Reyes

Appendix G: "Fairfax County Median Household Income 2005 to 2009"



Median Income



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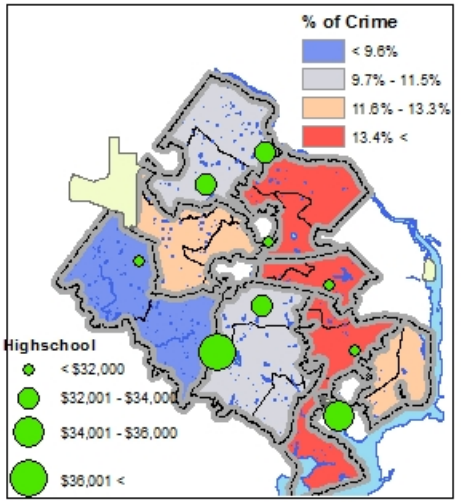
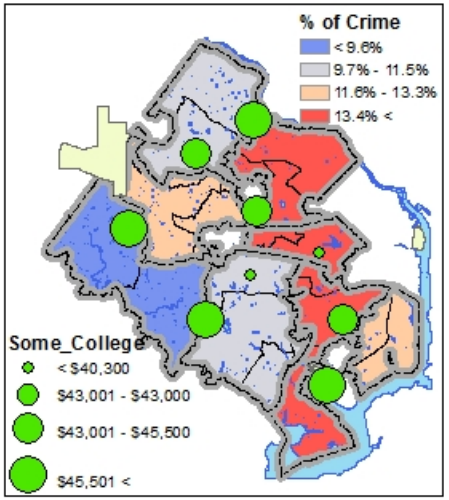


High School Graduate



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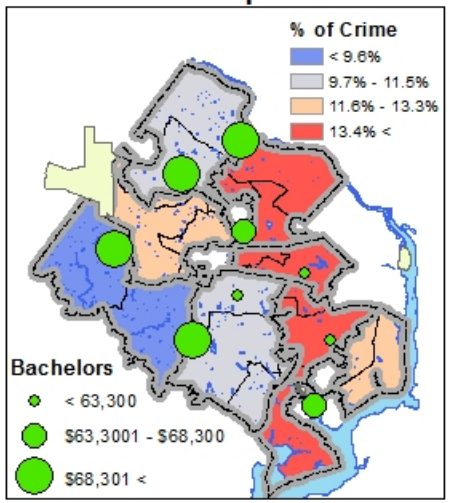
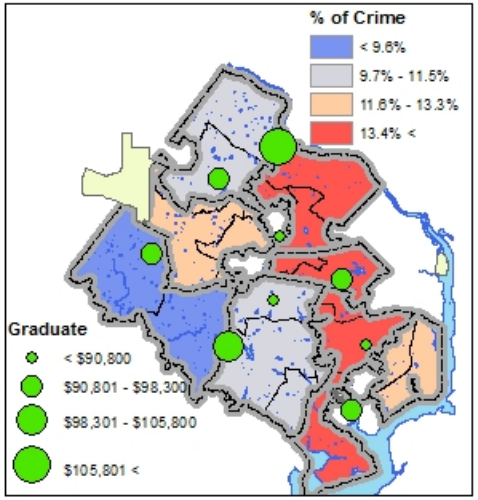


Bachelors Degree



Graduate Degree

Resolution: 1:700,000

Sources: Fairfax County Police Department & Virginia Department of Transportation & United States Census Bureau

Map Created by: Jason D Reyes