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Determinants of Local Police Protection Expenditures: A Panel Study of Large City Governments

Zachary A. Carter
St. Cloud State University, caza0801@stcloudstate.edu

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Determinants of Local Police Protection Expenditures:

A Panel Study of Large City Governments

By

Zachary A. Carter

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Dr. Lynn MacDonald, Chairperson

Dr. Mana Komai

Dr. Dick Andzenge

DETERMINANTS OF LOCAL POLICE PROTECTION EXPENDITURES:

A PANEL STUDY OF LARGE CITY GOVERNMENTS

Zac Carter

Since the 1980's, justice system expenditures in the United States have increased nearly 300%, adjusting for inflation. And though rates of violent and property crimes have decreased by close to 50% since the 1990's, total arrests have fallen by only 20% in the same period. The relationship between crime and police expenditures has yet to be answered to a definitive degree. This paper attempts to identify the social and economic factors that drive the changes in per-capita police spending of 140 large city governments in the United States, for the eight year period of 2005 to 2012. A fixed-effects panel model of per-capita police expenditures is developed using two-stage least-squares estimation. These findings suggest that local police expenditures may respond to local budgetary capacities and past spending to a greater degree than rates of violent crime and other social or demographic factors.

"Fear follows crime, and is its punishment"

- Voltaire

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I.   Introduction

The U.S. spent a record $185 billion on police protection, corrections, and judicial and legal activities in 2003, a 418% unadjusted increase over 1982 expenditure levels. Adjusting for inflation, these expenditures almost tripled (U.S. Bureau of Justice Statistics, 2006). Local governments (city and county) funded 50% of the expenditure, while states funded 33%, meaning that state and local governments spent four times more on the justice system than on education, and two times more than on public welfare that year. 45% of the total justice system spending went towards funding police protection, while corrections and detention accounted for roughly 33% (BJS, 2006).

Policing has traditionally been a locally funded function, but local governments funded just 69% of total police protection expenditures in 2003, with much of the remaining funding coming from federal law enforcement grants (BJS, 2006). Much of the increase in U.S. justice system spending in recent decades has been attributed to these federal law enforcement grant programs, which became popular in the 1980's and 90's, aimed at deterring increased criminal activity. Since 1994, the Office of Community Oriented Policing Services (COPS), a component of the U.S. Department of Justice, has invested over $14 billion to help advance community policing.

The rapid expansion of police funding in recent years has sparked controversy among local constituents, and many would argue that such increases in police expenditures are unjustified. This argument would point out that rates of violent crimes and property crimes have fallen nearly 50% since 1991 (Justice Police Institute, 2012). Additionally, though violent and property offenses have fallen significantly, total arrests have decreased by only 20%, and arrests

for non-violent drug offenses have increased nearly 50% between 1993 and 2010, disproportionately affecting low-income communities of color. (JPI, 2012). When crime rates were especially high in the 80's and early 90's, the response of local governments increasing allocations to local police departments seemed justified. Today, however, with crime rates near their lowest levels in decades, we continue to see high levels of police expenditures, though a shift in focus among police departments seems to have taken place. If policing resources are employed as a result, or in response to criminal activities, one would expect such expenditures to have declined in recent years, as the need for these resources is lessened.

Local justice systems are comprised of three main areas: police protection, judicial/legal, and corrections/detention. This work focuses on identifying determinants of one area of city justice expenditures in particular – police protection. Specifically, this analysis focuses on the determinants of per-capita police protection expenditures of large-city governments, for the eight-year period of 2005-2012. Police protection is defined as "preservation of law and order and traffic safety; includes police patrols and communications, crime prevention activities, detention and custody of persons awaiting trial, traffic safety, vehicular inspection, and the like." (U.S. Census, 1992).

In addition to analyzing the sample as a whole, the sample is divided into two population strata (low and high) to examine potential differences in police expenditure determinants, as there is an expectation that cities of varying populations may respond differently to their local environments. Identifying the characteristics and local conditions that explain how expenditures are affected within a city is not only useful for the purpose of efficiently allocating future revenues to better serve the needs of the community, but this paper is also a necessary addition to

public finance literature. Few studies in recent years have focused specifically on identifying factors affecting police expenditures while using more recent and robust data.

So far, the discussion has focused on aggregate levels of U.S. justice system spending in order to show just how much the justice system has expanded in the last 20-30 years. However, this analysis emphasizes city-level expenditures, as opposed to national expenditures. Variations in city size, population, and other socio-economic factors are expected. Moreover, we would assume that a city's spending habits would reflect those differences. People and governments respond to changes within their communities. Preferences for particular public services can be revealed directly to local representatives by democratic processes, social movements, or indirectly based on the immediate needs of the city. Whatever the case, governments are responding.

Local governments, much like state and federal governments, draw funds from a common tax base, and allocate revenues based on a community's preferences for public goods. While some revenues are restricted for certain uses by law, others are subject to the decisions of local representatives based on the needs of the community. The "general fund" is used to account for "money that is not required legally or by sound financial management to be accounted for in another fund" (Census). Policing expenses fall under this category. While the primary source of city revenues are local property taxes, others include sales and use taxes, business license taxes, hotel taxes, and utility use taxes. State and federal revenues can find their way back into local community's budgets through intergovernmental revenues and grants.

The sample used in this analysis includes only large cities, with populations greater than 150K in the beginning year period of 2005. Beaton (1974) argued that using too broad of a

range of population sizes may pose problems with estimation, and may lead to incorrect statistical inferences. Furthermore, he argues that small cities – compared to larger cities – are entirely different environments, and that the degree of political activity on the part of local constituents changes greatly with city size (Beaton, 1974). Thus, a separate analysis is conducted by separating the sample into different population strata to examine any differences in determinants of police spending, though the model specifications for each subgroup remains the same.

Findings indicate that police departments, in recent years, haven't responded to rates of violent crime to the degree that they have responded to other community characteristics and fiscal capacities. This is one interpretation of the results presented here, and while it is possible that police don't respond directly to violent crime to the same extent as they have in the past, they may be responding to other types of crime, or community pressures instead. These findings suggest that policing in the U.S may have undergone significant changes in the last few decades. The remainder of this paper is ordered as follows: literature review, data, methodology, hypotheses, results, and a final conclusion.

II.   Literature Review

Using data on the 43 largest U.S. cities in 1970, McPheters and Stronge (1974) attempted to identify determinants of police force expenditures, and argued that a definitive relationship between crime rates and police expenditures has yet to be shown. They argue that while economic theory would suggest a negative relationship between police expenditures and crime rates (more police spending leads to less crime), results of some studies have shown the

relationship to be positive (Pressman and Carol, 1971). A simultaneous model of both crime and police force expenditures was used in the analysis. Other independent variables included population density, unemployment rates, percent change in the black population, percent of families on welfare, and percent aged 15-24, to name a few.

McPheters and Stronge (1974) find that police expenditures are significantly and positively related to crime rates and local budgetary constraints (McPheters and Stronge, 1974). In the police expenditure equation, crime rates and city revenue are shown to exert a strong positive influence on the level of police expenditures, yet in the crime equation, the effect of police expenditures on crime rates is smaller, indicating that law enforcement expenditures, historically, have responded to crime to a greater degree than they have deterred criminal activity. The findings of McPheters and Stronge (1974) seem to be at odds with what we have seen in recent decades, with police expenditures continuing to rise, despite having some of the lowest rates of violent/property crimes in decades. Perhaps the nature of this relationship has flipped since the 1970's, meaning that increased expenditures have been more effective in deterring crimes than they have been in decades past.

Worrall and Kovandzic (2010) attempted to identify the relationship between police and crime rates in 5100 U.S. cities using annual data from 1990 to 2001, with crime rates as their dependent variable. Recognizing the issue of endogeneity between crime rates and police levels, they opted for an instrumental variable approach in their analysis and instrumented police levels with both federal law enforcement grants and a measure of police hiring. A series of fixed-effects instrumental variable models were generated using GMM (generalized method of moments), which, they argue, has become increasingly popular in recent years among

researchers trying to address the issue of endogeneity and instrument validity (Worrall and Kovandzic, 2010).

The results of Worrall and Kovandzic (2010) indicated that there was a modest inverse relationship between crime and police levels (as police levels increase, crime decreases). Furthermore, they claim that the effects were more concentrated in cities with larger populations. Also among their explanatory variables; percent non-white, was found to be negatively associated with 6 of 7 crime categories, a result inconsistent with other recent studies (Krivo, 2009). This effect was argued to be a symptom of panel data, and that "racial composition, particularly at the city level, is both invariant and slow-moving, leading to possible collinearity with unit dummy variables", which could be a potential reason for the sign changes on the coefficients (Worrall and Kovandzic, 2010).

Using local level data from 1960-70, Beaton (1974) tested whether different size cities produce different results with regards to police expenditures, stating a few reasons for his motivation: 1) Using broad population ranges in the analysis may produce heteroskedastic residuals 2.) The level of political activity of local citizens changes with city size, and 3.) Cities declining in population have different policing requirements than those growing in population. Cities were separated into different strata based on population size, and analyzed separately, including explanatory factors such as population density, growth rate, age demographics, and some industry-specific employment variables. In general, the results showed that for cities growing in population, population was the most significant variable in affecting per-capita police expenditures. For cities declining in population, population density was shown to be most significant (Beaton, 1974).

Using a sample of 79 cities and 1973 data, Bahl et al. (1978) employed a structural equation approach to their analysis, and sought to answer the question of "how do variations in community characteristics and local government fiscal capacity act to affect expenditures through their effects on employment and compensations" (Bahl et al., 1978). Three equations were estimated: compensation, employment, and crime. Two-stage least squares is used in estimating each equation. Traditional cross-section expenditure models, they argue, are limited in their ability to explain public sector behavior, and their results suggest that important variables have been excluded from previous analyses (Bahl et al., 1978). Among the three equations, they opted to include the manufacturing wage, degree of unionization, price of private goods, and the average length of prison sentence served. In conclusion, the results of the analysis, with respect to police employment, show that police employment responds positively with crime, population, income, and the nonwhite population, and negatively with education. They concluded that police employment varies among cities "not only because of variations in the need for services but because of variations in the cost of providing any given level of services" (Bahl et al., 1978).

Chamlin (1990) examined macro social determinants of police expenditures in Chicago, using 1904-1958 data. Included in the set of explanatory variables are city revenues, percent black, unemployment rates, and arrest rates. "The Thompson Administration" – referring to Chicago Mayor William Hale, or "Big Bill" Thompson, who, during his mayoral term, reportedly maintained strong ties to organized crime, and even appointed one of Al Capone's lieutenants to Inspector of Weights and Measure – is also included in the model to account for the potential influence that Thompson's criminal ties could have on the amount of policing resources employed to combat crime (Chamlin, 1990).

The results of Chamlin (1990) suggest that city revenues and percent black have a dominant influence in affecting police expenditures, with a 1% increase in percent black corresponding to a $16,500 increase in police expenditures. Also, police funding was found to decline substantially during the years of Mayor William Thompson. A more surprising result, according to Chamlin (1990), is that the previous year's police expenditure didn't seem to have any significant influence on the next period's expenditures. The findings indicate that "budgetary decision-makers respond more to the local environment than previous research implies" (Chamlin, 1990).

Jackson and Carroll (1981) emphasized the role of racial composition, civil rights mobilization activity, and number of riots in the 1960's to help explain variations in municipal police expenditures in 90 non-southern U.S. cities. They suggest that previous studies typically ignore these factors in their analyses. In addition to these factors, their model specification hypothesizes that police service expenditures respond to population size and density, the percentage of the population below the poverty level, the ratio of black to white median income as a measure of racial inequality, total city revenue, and the local crime rate. Among the statistically significant variables in the linear expenditure model are total city revenues, percent black, population, population density, civil rights mobilization activity, and percent below the poverty line. Population, percent black, population density, city revenue, and civil rights mobilization activity were shown to be positively related to police expenditures, while poverty and police expenditure were shown to be negative in relation. Neither the number of riots nor the crime rate was not found to be a significant factor affecting policing expenditures. The results (2SLS), as they suggest, "lead us to argue that police expenditures are a resource that is

mobilized or expanded when a minority group appears threatening to the dominant group"
(Jackson and Carroll, 1981).

III.   Data

Police protection expenditure data as well measures of local revenue are drawn from the
Census Bureau's Annual Survey of State and Local Governments. The Census survey defines
police protection expenditures as expenditures relating to the "preservation of law and order and
traffic safety. Includes police patrols and communications, crime prevention activities, detention
and custody of persons awaiting trial, traffic safety, vehicular inspection, and the like." All
revenue and expenditure data are measured in thousands of 2012 dollars, excluding per-capita
expenditures, which is measured in dollars.

Violent crime data for local police departments are drawn from the FBI's Uniform Crime
Reports (UCR) and are measured as "rate per 100K inhabitants". The aggregate rate of violent
crime includes four sub-categories of violent crime; forcible rape, aggravated assault, robbery,
and murder and non-negligent manslaughter.

Employment data from the U.S. Bureau of Labor Statistics' Local Area Unemployment
page include level-variables like total labor force, employment, and unemployment.
Unemployment rates are measured as percentage of the labor force unemployed. The Bureau of
Labor Statistics defines unemployed as "persons aged 16 years and older who had no
employment during the reference week, were available for work, except for temporary illness,
and had made specific efforts to find employment sometime during the 4-week period ending

with the reference week. Persons who were waiting to be recalled to a job from which they had

been laid off need not have been looking for work to be classified as unemployed."

Measures of income, poverty, age, gender and race are drawn from the American

Community Survey (ACS). Specific measures of income mean and median household income,

as well as the mean-to-median household income ratio, which is included as a measure of income

inequality. Percent living in poverty is measured as percent of the local population living below

the poverty threshold, which varies by different household criteria. Age, gender, and race

variables include levels as well as percentages of the local population. All data are annual, or

single-year estimates. Income measures have also been inflation-adjusted to 2012 dollars.

Table 3.1 - Summary Statistics, all years

Variable	N	Mean	Std. Dev	Minimum	Maximum
Population	1119	455,984.76	781,808.81	139,158	8,391,881
Poverty Rate	1120	18.6	6.7	3.1	42.6
Unemployment Rate	1118	7.4	3.2	1.8	25.1
Violent Crime Rate	1110	759.69	421.36	50.6	2,480.70
Percent Non-white	1119	35.14	16.76	3.86	88.69
Percent Male	1120	48.96	1.43	45.3	53.9
Percent Age 15-24	1120	15.44	3.10	8.7	37.5
Mean/Median Household Income Ratio	1120	1.372	0.123	1	1.853
Median Income	1120	$ 50,302.37	$ 13,844.15	$ 23,600.00	$ 109,538.60
General Revenue	1120	$1,611,602.34	$7,080,394.26	$ 138,732.08	$86,142,824.29
Police Protection Expenditure	1120	$ 166,682.88	$ 429,551.15	$ 14,123.88	$ 5,065,889.00
Police Protection Expenditure Per Capita	1119	$ 314.66	$ 123.19	$ 85.90	$ 1,064.67

Note: Table includes pooled data from all years (2005-2012). All revenue, tax, and expenditure data are inflation adjusted and measured in thousands of dollars, excluding per-capita police expenditures, which are measured in dollars. Sample includes 140 U.S. cities.

Table 3.2 - Summary Statistics, 2005

Variable	N	Mean	Std Dev	Minimum	Maximum
Population	140	430,902.95	755,182.67	139,158	7,956,113
Poverty Rate	140	17.4	6.6	4.1	42.6
Unemployment Rate	139	5.3	1.5	2.3	13.5
Violent Crime Rate	138	825.02	449.69	84.1	2,405.50
Percent Non-white	140	36.16	16.98	4.69	87.38
Percent Male	140	48.82	1.48	45.3	52.2
Percent Age 15-24	140	14.43	2.29	9	26.5
Mean/Median Household Income Ratio	140	1.355	0.122	1	1.741
Median Income	140	$ 50,776.62	$ 13,729.60	$ 28,337.30	$ 97,369.40
General Revenue	140	$1,543,176.18	$6,753,422.61	$ 138,732.08	$79,127,298.89
Police Protection Expenditure	140	$ 160,436.30	$ 427,133.28	$ 14,349.08	$ 4,654,326.54
Police Protection Expenditure Per Capita	140	$ 309.88	$ 125.63	$ 85.90	$ 995.06

Table 3.3 - Summary Statistics, 2012

Variable	N	Mean	Std Dev	Minimum	Maximum
Population	140	471,008.12	794,442.25	151,019	8,336,697
Poverty Rate	140	20.7	6.8	4.4	42.3
Unemployment Rate	140	8.5	2.5	3.5	19.2
Violent Crime Rate	139	685.44	399.60	50.6	2,122.90
Percent Non-white	140	34.95	16.70	5.25	85.41
Percent Male	140	48.88	1.18	45.7	52.1
Percent Age 15-24	140	15.68	3.20	10.5	33.4
Mean/Median Household Income Ratio	140	1.388	0.125	1	1.776
Median Income	140	$ 47,670.94	$ 13,407.18	$ 23,600.00	$ 100,574.00
General Revenue	140	$1,621,144.41	$7,259,536.69	$ 143,326.00	$85,077,983.00
Police Protection Expenditure	140	$ 168,115.71	$ 451,640.60	$ 18,878.00	$ 5,065,889.00
Police Protection Expenditure Per Capita	140	$ 305.08	$ 118.50	$ 105.46	$ 891.57

Figure 3.1

Figure 3.2

AVERAGE VIOLENT CRIME
PER 100K POPULATION

832.8   848.5   838.9

799.2

740.2

704.1
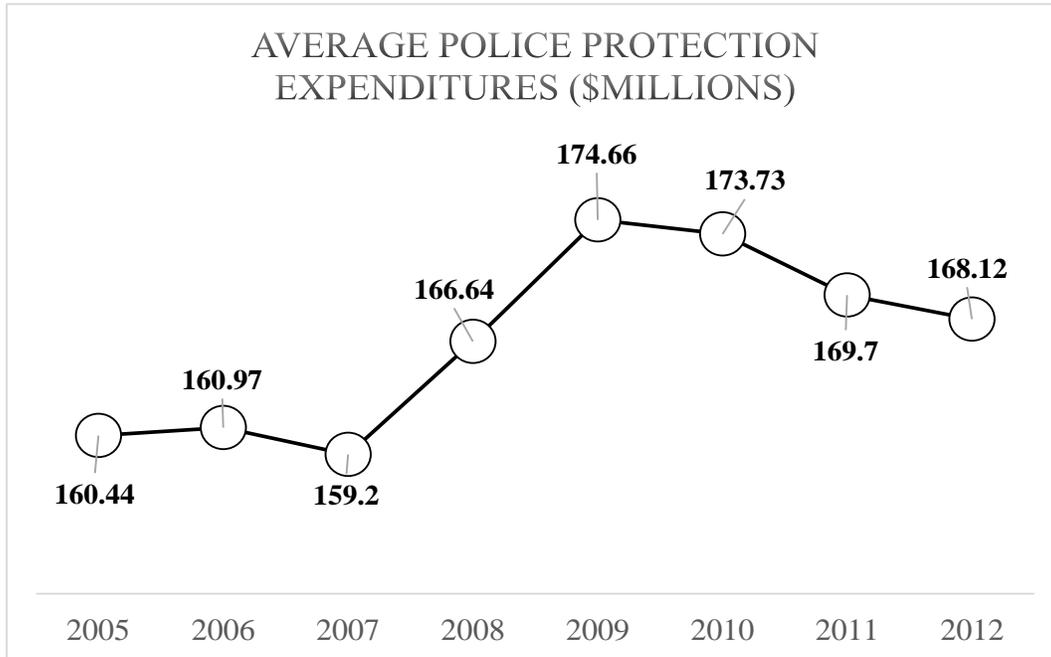
679.1

688.6
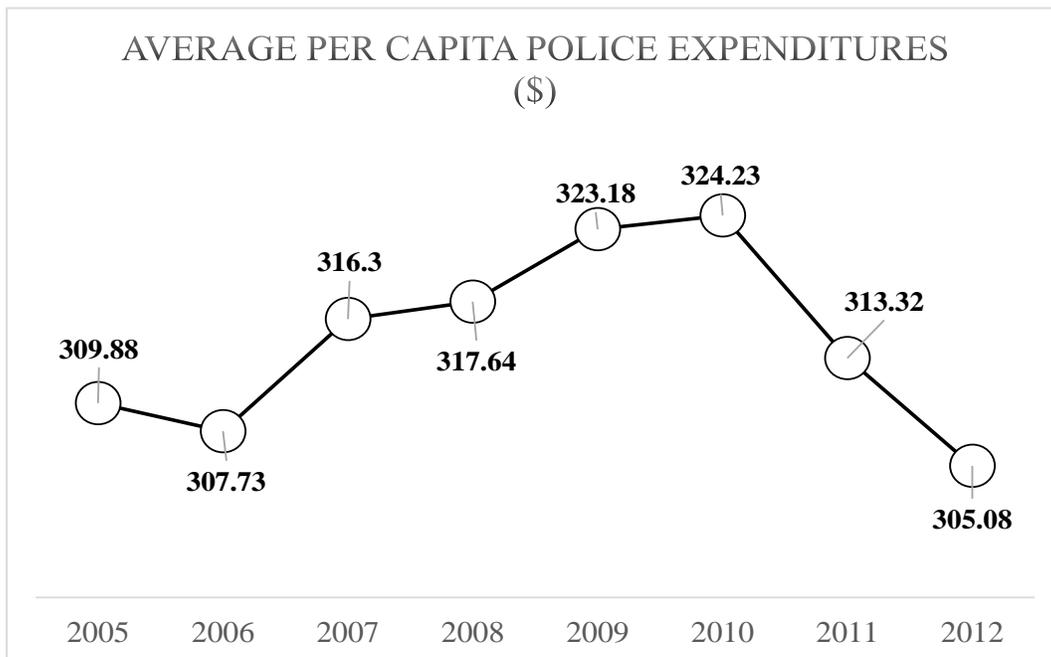
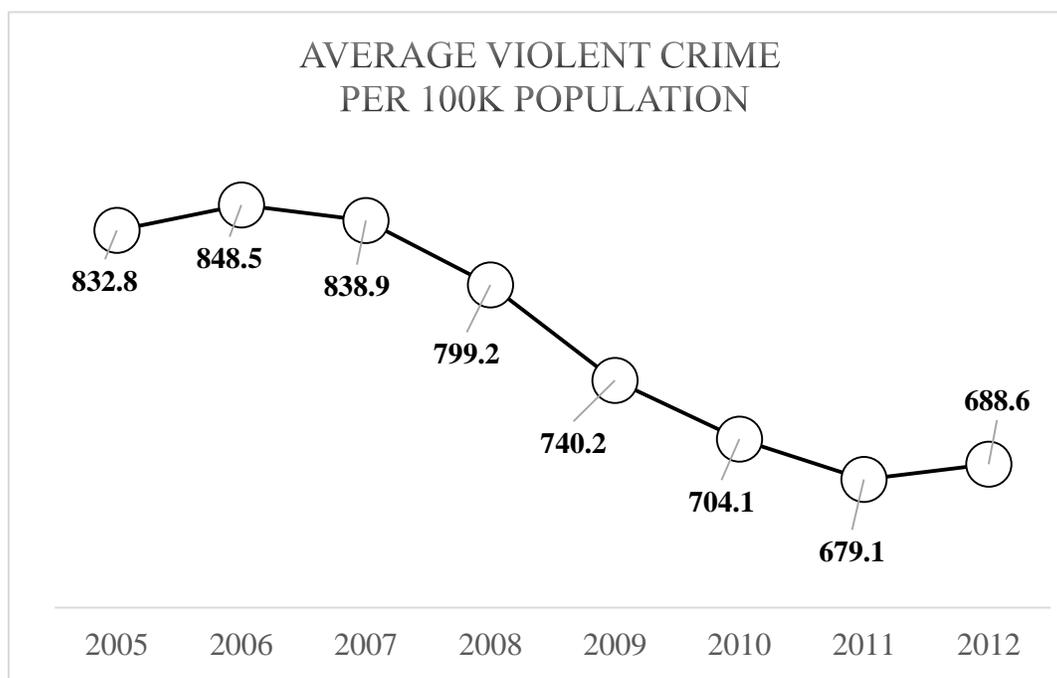| 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |

Figure 3.3

The summary statistics found in Tables 3.1 - 3.3 provide insight into the data used in the

analysis. The average population in the sample from Table 3.3 is roughly 450K. It should be

noted that many of these variables have standard deviations higher than their means. This is due

to the "mega-cities" like New York and L.A. in the sample that inflate many of the average

values, as well as their standard deviations. Due to this, many of these variables are logged in

the analysis in attempt to normalize their distributions. Tables 3.2 and 3.3 serve to show how the

means of the variables have changed, from 2005 to 2012. Though we can't discern the path the

data followed between 2005 and 2012, we can gain a general look at the beginning and ending

years of the sample. For instance, since 2005, unemployment rates, poverty rates, general

revenue, and total police expenditures have increased. However, median income, violent crime, and police expenditures per-capita have all decreased since 2005.

In Figures 3.1 and 3.2, we can see a surprising decline in both per-capita and total police expenditures starting in 2010. This could be due to a number of reasons, but a likely possibility is that these declines were brought about as a result of the 2007-09 financial crisis. Many cities were hit with substantial revenue losses during this time, and cuts to different areas of public services wouldn't be unexpected. We can also see from Figure 3.3 a fairly steady decline in rates of violent crime throughout the sample period. A comparison of Figures 3.1 and 3.3 show a "mirrored" relationship, in which rates of violent crime fall as total police expenditures rise. Whether or not the decrease in crime was brought about by the rise in police spending isn't a central question to this analysis, but previous research has shown the existence of minor to moderate deterrent effects (McPheters and Stronge, 1974, Worrall and Kovandzic, 2010).

IV.   Methodology

The empirical model for this analysis will largely follow the work of McPheters and Stronge (1974), Worrall and Kovandzic (2010), and Beaton (1974). This work employs a two-stage least-squares panel model approach (fixed effects), using the predicted violent crime-rate values from the first-stage as the instrumental variable in the second stage (police expenditures). This methodology will address the endogeneity problem of the model by attempting to remove the correlation between the endogenous variable (crime) and the error term in the police expenditure equation. Such estimation will result in consistent estimators.

Under fixed-effects estimation, unique intercepts for each cross-section and time-series are estimated, which allows for the examination of city/time-specific unobserved effects in each model. This method was chosen due to the nature of the models being estimated. Participating in a crime is a behavior, and such behaviors are inherently difficult to predict within the context of linear regression models, and the decision to participate in such crimes is likely one that is subject to factors beyond what is controlled for in the models presented. We would expect human psychology, attitudes, and risk perceptions to come into play when explaining criminal behavior (Ehrlich, 1973), but these variables are difficult to measure, and are more often than not, unavailable for use in studies such as this.

The same can be assumed in the police expenditure equation. There are likely characteristics of cities that are unobserved, either due to their difficulty of measurement or unavailability of the data itself. Fixed-effects estimation attempts to control for such omitted factors. The unique intercept allows for city specific "fixed-effects", in which the unobserved factors are theoretically represented. The same equations are also applied to both population strata sub-groups – those with populations less than 400K in year 2005, and those with greater than 400K in year 2005. The equations of violent crime and per-capita police expenditures are as follows:

Stage 1.

- $\ln(\text{CRIME(IV)}) = \{\ln(\text{POLICE EXPENDITURE}_{t-1}),\ \text{INEQUALITY},$

  UNEMPLOYMENT RATE , PERCENT NONWHITE, PERCENT AGE 15-24,

  PERCENT MALE, PERCENT POVERTY, $\ln(\text{POPULATION})\}$

Stage 2.

- $\ln(\text{POLICE EXPENDITURE}) = \{\ln(\text{POLICE EXPENDITURE}_{t-1}),\ \ln(\text{CRIME(IV)}),$

  $\ln(\text{REVENUE})$, PERCENT NONWHITE, $\ln(\text{POPULATION})\}$

In Stage1, the dependent variable is the log of the violent crime rate, and is a function of

the log of the previous year's per-capita police expenditures, the mean-to-median household

income ratio (inequality), the unemployment rate, percent nonwhite, percent ages 15-24, percent

male, percent in poverty, and the log of the population. The predicted values from the crime

equation (Stage 1) are then substituted into the police expenditure equation (Stage 2).

In Stage 2, the dependent variable is the log of local police expenditures per-capita, and is

a function of the logged value of the previous year's police spending per-capita, the predicted

crime-rate values from Stage 1, the log of city's general revenue, percent non-white, and the log

of the local population. Lagged measures of expenditure are included in each equation since

current police spending and crime rates assumptively follow a slower process in responding to

changes from previous periods.

V.   Hypotheses

Violent Crime

Theory suggests that increases in violent criminal activity within a locality leads to increased outlays for police protection, and research regarding crime rates and police expenditures generally finds this to be true (McPheters and Stronge, 1974, and Worrall and Kovandzic, 2010), albeit with a few exceptions (Pressman and Carol, 1971). Thus, a positive relationship is to be expected between per-capita police protection expenditures and violent crime-rates (as crime goes up, police expenditures increase). For example, Baltimore – a city with exceedingly high rates of violent crime (roughly twice the average in the sample) - spent 371 million dollars on police protection in 2012, with the sample average being roughly 160 million (Annual Survey of State and Local Governments, 2012).

Conversely, we would expect increased police expenditure to have a deterrent effect on crime rates. That is, increases in police expenditures reduce crime. This effect could be argued in both directions, however, as increased police presence may result in increased reported crime by local police departments. It is difficult to capture the true crime rate in this sense, as many crimes go undetected by police, or unreported by civilians. Thus, increases in violent crime are expected to exert positive influence on police expenditures, while increases in police expenditures are expected to exert negative influence on rates of violent crime.

Previous year's police expenditures

Adjusting for inflation, the dollar amount of revenue sources devoted to policing expenses in the previous period is expected to have a positive relationship with the current level of police protection spending. Assuming the previous period's budget was put to use in its full extent, this might imply to budgetary decision makers that the need for at least that level of funds is "justified" in the next period, even though there may not be an actual need for such funds within the police department. The assumption that police departments will use all or most of the funds available to them seems fairly reasonable, as there may be a moral hazard for police departments to hurry and use their available funds before the end of the fiscal year, regardless of whether or not those funds would provide some kind of benefit to the community. Using data on procurement spending of the U.S. Federal Government, Liebman and Mahoney (2010) found that end of the year spending is 4.9 times higher than the year average, and that large majority of these funds went towards lower quality projects. Many times, last minute spending may reflect an organization's fear of receiving lesser revenue allocations in successive periods. In either case, they would likely lobby for at least the previous period's level of funding to accomplish necessary policing activities, hence the expectation of a positive relationship with current expenditures.

Revenue

Increases in the amount of available funding for local public functions is expected to have a positive impact on the amount of funding allocated towards police protection. As a city's budgetary constraint is lessened, more funds are available to be allocated where they are needed.

It would make sense in this case to expect a positive relationship. That is, a city's spending on police should not be reduced if more funds are available. Rather, there is increased potential for more funds to be allocated towards policing measures should there be an immediate need for such services, if the level of available funding grows. Thus, since the amount of police protection expenditures is a direct function of the amount of revenue available to the city, it is a relevant factor in explaining variations in police spending.

Income, Poverty & Unemployment

Economic well-being, or lack thereof, is thought to be a primary contributor of social unrest and/or crime in large municipalities. With lower incomes, and fewer opportunities in the job market, individuals are more likely to substitute away from legal activities toward illegal ones (Ehrlich, 1973). This reality is illustrated by low-income, inner-city neighborhoods with high levels of unemployment. Measures of income, poverty and unemployment are expected to affect levels of police expenditures indirectly, as they are likely to affect rates of crime first and foremost, hence why these variables appear in the crime equation but are exempt from the police expenditure equation. It is expected that poverty (% below poverty line), and unemployment rates (% unemployed) are positively related to rates of violent crime. As for the mean-to-median income ratio, the measure of income inequality in the first stage equation, it is expected that increases in this ratio will lead to increases in the estimated crime rate. Increases in this ratio would suggest that the top earners' average wages have increased, or that median household income has decreased. In either case, income inequality is greater, and likely effects crime rates positively.

Though one may argue that increasing income inequality is likely to have more of an effect on property crimes as opposed to violent crimes, a positive relationship may still exist between inequality and violent crime, as increased desperation among a city's poorest residents could lead to higher frequencies of certain types of violent offenses like aggravated assaults or robberies. Indeed, throughout the sample, cities with the greatest degree of income inequality (Atlanta, Miami, New Orleans) tend to see higher rates of violent crime (1,675 per 100K, Atlanta 2006), relative to the average crime rate in the sample (760 per 100K inhabitants). Whether this is a causal relationship or a mere correlation is unknown, but increased inequality is expected to exert a positive influence on crime rates in the model.

Race, Age, Gender Demographics

Demographic factors such as age and race distributions also play an important role in the police expenditure literature (Beaton, 1974, Worrall and Kovandzic, 2010, McPheters and Stronge, 1974). Cities with higher concentrations of young, minority groups tend to see higher rates of crime. While this theory is confirmed in much of the related crime and police literature, McPheters and Stronge (1974) found insignificant effects of minority presence on crime, after other factors like urban decay are accounted for. It is expected, however, that the measure of minority presence (percent black or percent non-white) would exert a positive influence on the crime-rate and level of police expenditures.

Typically, minority groups are faced with lower incomes as well as higher rates of unemployment, especially in large cities. A recent 2016 report presented by the Chicago Urban League reported that almost half of Chicago's young black men between the ages of 20-24 are

neither employed nor in school. Nationally, 32% of young black males are unemployed, according to the report. Such high rates of unemployment, accompanied by low household incomes among these groups is seen as a driving force for crime (Ehrlich, 1973), and it is expected that the results will show a positive influence in both the crime, and police expenditure equation. That is, it is hypothesized that police expenditures increase with minority presence directly, regardless of whether or not these groups are committing crimes at disproportionate rates. Thus, a measure of minority presence is included in both equations. Regarding gender, having larger populations of males is expected to exert a positive influence on crime, since males commit violent crimes at a far higher rate than females. 83% of total crime in year 2000 was committed by males (Krienart, 2003).

VI.   Results

It should be noted that a number of the variables discussed above appear only in the first-stage crime equation. For example, income and gender/age demographics were only included in the crime model as it is the assumption that these variables affect crime to a greater degree than police expenditures. Also, while we won't draw any conclusions from the first-stage results, since the sole purpose of the first stage is to create the instrument for crime, the results of Stage 1 are listed in Table 6.1.

The results of the Stage 2 fixed-effects models are shown in Table 6.2. All three population categories are present in the table. The table includes the panel model details,

including number of cross-sections and time-series lengths. In the lower portion of the table,

coefficient estimates are displayed as well as the estimate's standard error in parentheses.

Table 6.1 – Stage 1. Results, Coefficient Estimates

Stage 1. Coefficient Estimates: Two way Fixed Effects			
	Full Sample	**Pop < 400K**	**Pop > 400K**
Cross Sections	140	100	40
Time Series Length	8	8	8
R-Squared	0.9705	0.9694	0.9711
Variable	Coefficient Estimates & (SE's)		
Intercept	9.747***	7.575***	14.75***
	(1.257)	(1.6207)	(2.377)
Police Expend. Per Cap (t-1)	-0.0514	-0.073	-0.0946
	(0.0401)	(0.0514)	(0.068)
Mean/Median Income Ratio	-0.0361	-0.00126	-0.0654
	(0.0864)	(0.1024)	(0.18)
Poverty Rate	0.005**	0.00855***	-0.0067
	(0.0022)	(0.00264)	(0.00454)
Unemployment Rate	-0.0042	-0.00121	-0.0076
	(0.0035)	(0.00456)	(0.0056)
Log (Population)	-0.3058***	-0.1344	-0.5285***
	(0.0958)	(0.126)	(0.1604)
Percent Nonwhite	0.00261**	0.00349***	0.00014
	(0.0011)	(0.0013)	(0.0022)
Percent Male	0.0054	0.0065	0.00915
	(0.0049)	(0.0055)	(0.0122)
Percent Age 15-24	0.00027	-0.00141	-0.0078
	(0.0035)	(0.00425)	(0.1604)
Year Dummies	Yes	Yes	Yes
City Dummies	Yes	Yes	Yes

Significant coefficient estimates are denoted with asterisks, with significance at the 1%, 5%, and 10% levels denoted "***", "**", and "*", respectively.

Table 6.2 – Stage 2. Results, Coefficient Estimates

Stage 2. Coefficient Estimates: Two way Fixed Effects			
	Full Sample	**Pop < 400K**	**Pop > 400K**
Cross Sections	140	100	40
Time Series Length	8	8	8
R-Squared	0.94	0.927	0.953
Variable	Coefficient Estimates & (SE's)		
Intercept	11.282***	10.437***	0.366
	(3.398)	(2.409)	(4.339)
Violent Crime (IV)	-0.1157	0.141	0.4695
	(0.32)	(0.2361)	(0.304)
Police Expend. Per Cap (t-1)	0.242***	0.2158***	0.3909***
	(0.0372)	(0.045)	(0.0675)
Log (General Revenue)	0.2111***	0.1744***	0.2449***
	(0.0372)	(0.0462)	(0.0689)
Log (Population)	-0.728***	-0.7277***	-0.261
	(0.1248)	(0.104)	(0.1982)
Percent Nonwhite	0.0002	-0.0008	0.0000061
	(0.00124)	(0.0013)	(0.002)
Year Dummies	Yes	Yes	Yes
City Dummies	Yes	Yes	Yes

Significant coefficient estimates are denoted with asterisks, with significance at the 1%, 5%, and 10% levels denoted "***", "**", and "*", respectively.

General revenue, population, and the previous year's police spending are all significantly related to the current year's expenditures, across all three models, excluding population in the "mega-city" sample. A more surprising result is that the effect of violent crime on police spending is entirely insignificant across all three models, and shows no major contribution to explaining variations in police expenditures. This result is in contrast to McPheters and Stronge

(1974), in which total crime was shown to have a positive impact on police expenditures. The measure of total crime used in their analysis included property crimes as well, which this study has ignored. This could be a potential reason for violent crime's insignificance in this model, as property crimes occur at much higher frequencies than do violent crimes (UCR). The inclusion of property crimes in addition to violent crimes in this model may produce different results.

Lastly, the lack of a substantial relationship regarding the effect of crime on police expenditures does tell us something, however. We can reasonably infer from these findings that there may be a large deterrent effect occurring, where crime responds dramatically to police expenditures, but not vice versa. However, a separate analysis would need to be conducted to assess the validity of such statements.

The coefficient regarding the previous year's level of police spending is positive in relation to the current year's spending, across all three models. Since both the response and independent variables are logged in this case, we can interpret these coefficients as elasticities. The coefficient value of .242 indicates that a 10% increase in the previous year's police spending per-capita results in an increase of 2.42%, according to the model. This would mean that a 10% increase in past police spending results in an increase of about $8 per person, on average. Thus, the typical city - i.e. Atlanta, or Sacramento - would experience an increase of over $3.5 million in total police expenditure. A similar result is found in the sample including cities with less than 400K populations, and a much larger effect in the "mega-city" sample. These results are in contrast to the results of Chamlin (1990), in which no significant relationship was found between past spending and current spending. The larger effect in the mega-city sample may tell us something about the nature of large city governments and how budgetary decisions are made

regarding police expenditures. There may exist considerably higher levels of influence on the part of police departments in lobbying for higher levels of revenue allocations, given that the previous year's allocation was put to use in its full extent.

General revenue was also found to have a statistically significant and positive impact on police expenditures. Since this term is also logged in the model, the interpretation of this coefficient is also an elasticity. According to the model, a 10% increase in local general revenue results in a 2.11% increase in police expenditures. This translates to an average increase of about $7 per-person, or $3.2 million in total police expenditures, which is fairly substantial when considering a modest 10% increase in yearly revenues. If such a trend were to continue over the years, the growth in police expenditures becomes even more apparent. This result was expected, since the expansion of a local government's ability to provide increased allocations of revenue to various entities providing public services would likely result in more revenue allocations given to them, assuming that the performance of such entities has been sufficient, and there is no reason to cut funding, or allocate the additional funds elsewhere instead. This result is in accordance with the results of McPheters and Stronge (1974), in which city revenues were one of the primary factors in explaining variations in police expenditures.

Lastly, population is significant and negative in relation to per-capita police expenditures in two of the three models. This result is quite interesting, as one might expect to see a positive relationship between the two. However, this finding suggests that as the local population increases, the amount of policing expenditures per person declines, all else constant. The coefficient value of -.728 in the full sample model suggests that a 10% increase in the local population results in a 7.28% decrease in per-capita police expenditures. This result may point

to the difficulty of scaling such expenditures with population growth at a constant rate, as the amount of revenue collected each year likely grows at a slower pace than the rate of population growth. It is important to note once more that the primary source of revenues for local governments are property taxes, and a higher population doesn't necessarily mean higher property tax revenues, since certain occupancies may have a larger number of individuals residing there. If a measure of the number of tax-paying residencies in the city were included as an explanatory factor in the model, we may then see a positive relationship with police expenditures. However, the effect of such a variable is likely already captured by the measure of general revenue in the model, and may cause issues with collinearity. For these reasons, no such variable is included in the analysis.

VII.   Conclusion

This paper has focused on identifying the socio-economic determinants that affect levels of per-capita police spending in large U.S. cities. While there is a considerable body of literature regarding city-level expenditures in general, the analyses of specific government functions are more limited with regard to police expenditures. This paper serves to expand on previous works by incorporating more recent data within a panel structure, and aims to provide insight as to why certain public functions are funded to the degree that we see. The findings of this study point to existence of inertia in the funding for police expenditures. That is, even with rates of violent and property crimes at some of their lowest levels in decades – which may have been accomplished by the increased levels of expenditures since the 1980's – local governments have failed to scale back revenue allocations to police departments, and a general shift in focus among police

departments seems to have taken place. Instead of employing more resources in response to violent crimes, a possible interpretation of these results seems to be that policing may respond to local budgetary constraints to a greater degree than crime itself.

It is also important to note that the use of "budgetary capacities" may not be an accurate reflection of a city's ability to provide funding for certain public services. Pressures from local constituents and other outside influences may prompt police departments and budgeters to find funds for certain uses, whether that be from local, federal, or private sources. Local pressure to fund body cameras for police officers is a noteworthy example of this, in addition to other technologies that are costly to provide for a police department. In response to this pressure, police departments are needing to "find" the money even when their budgets don't allow for these purchases. For example, in 2014 the L.A. Police Department announced that it would be purchasing 7,000 body cameras for its officers. At the time, local budget constraints wouldn't allow for this amount of increased spending, and the money for the cameras needed to be funded privately through donations (L.A. Times, 2014). Thus, even without growth in revenues, a city may be pressured into funding police to a higher degree because of community concerns, as is happening recently related to police brutality and lack of transparency. If budgeters are forced to "find" these funds, this may come at the cost of scaling back allocations to other areas of public services like education or health spending. Thus, a city's ability to provide police services certainly does depend on the amount of available funding, but there are likely other factors that have been generalized within the definition of "budgetary capacities" that are deserving of this caveat.

Also, with more police and less violent/property crime, police have turned to making drug arrests, which are up close to 50% since the early 90's (JPI, 2012). It may be difficult to assess whether drug use in large cities has increased at the same rate as drug arrests, as arrests for drug use may not be an appropriate measure of actual drug use, since police may be arresting drug offenders that have essentially "slipped through the cracks" when more focus was placed on combatting violent crimes in the 80's and 90's.

Future extensions of research regarding police spending in the next decade would complement this study well. It would be worthwhile to explore how police expenditures are responding to other types of crime, like cyber-crimes. With technology playing such an integral role in today's society, the potential for these crimes has only increased, and the potential for police to change their focus towards combatting such crimes is a likely possibility. Furthermore, future studies would benefit by incorporating different measures of influence that local constituents may have on the budget process, in addition to local perceptions regarding fear of crime, and other social or community pressures that may influence levels of police spending. Measures of such variables likely have some effect on how revenues are allocated, but are inherently difficult to measure with accuracy, hence their lack of availability. These potential omitted factors are, in theory, controlled for in the model, as a result of fixed-effects estimation, but the model suffers from a lack of ability to separate out each of these omitted effects, and the effects are assumed to be time-invariant. With shorter time-series lengths, as is the case in this analysis, this assumption is likely more valid, as it may take longer for social perceptions and/or expectations to change drastically within a community. While substantial changes in these

unobserved characteristics may have taken place over the course of eight years, on the whole it is likely that many have stayed the same.

If police spending in large city governments were to be scaled back in the future, there is potential to see positive impact on other areas of public discourse like health and education spending, and improvements in such areas may provide greater benefits to the community than an increased police presence, the benefits of which may even come in the form of further reductions in local crime. In a time where local police forces - especially in large cities - have become more militarized, growing distrust between citizens and their police forces has caused increased tensions, especially in communities of color where social justice movements and other forms of activism are more prevalent.

The jury is still out on what specifically causes changes in police spending, as multiple studies, including this one, have produced conflicting results. Much more research regarding determinants of crime and police expenditures needs to be done before we can conclusively define their relationship, and only then can strategies and local policies be implemented to efficiently and effectively serve the needs of local communities to the greatest effect.

VIII.   References

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