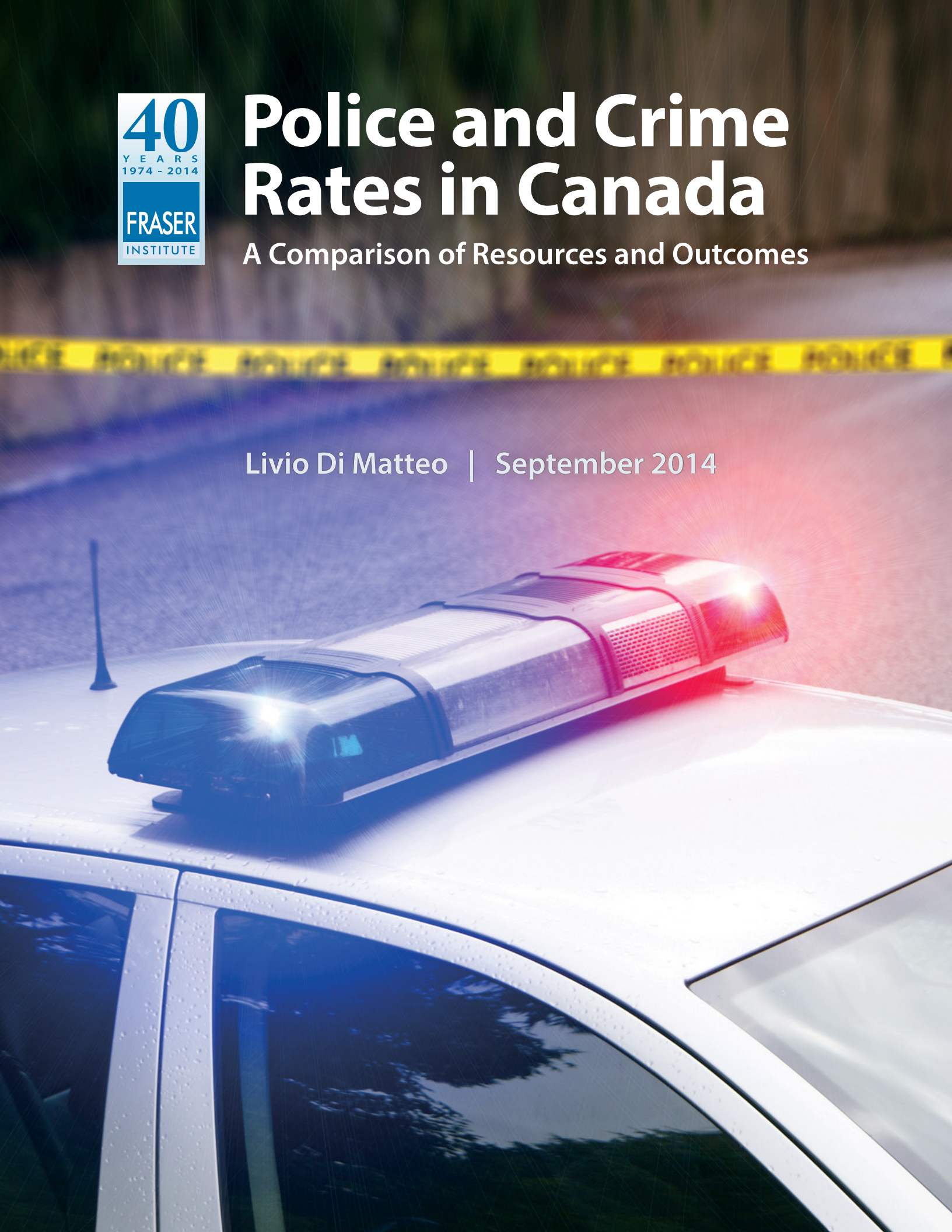




Police and Crime Rates in Canada

A Comparison of Resources and Outcomes

Livio Di Matteo | September 2014



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Summary

There is rising policy concern in Canada over growing policing costs given that crime rates have fallen dramatically in recent years. Between 2001 and 2012, police officers per 100,000 of population in Canada rose 8.7% while the crime rate declined by 26.3%.

This was accompanied by growing expenditures and a decline in workload as measured by criminal code incidents per officer. Real per capita police expenditures in Canada between 1986 and 2012 rose 45.5% while criminal code incidents per officer declined by 36.8%.

Public debate on rising police costs must be considered in the context of increasing overall public spending in Canada and a more complex society. Policing has evolved beyond just dealing with crime and includes a wider range of problem social behaviours, which are factors in police resource and expenditure growth.

As well, there are changes in the technology of both crime and policing as well as other factors affecting staffing such as operational load due to service demand and response time, socio-economic factors such as demographics and crime trends, and strategic directions of police forces in terms of governance and policing methods.

There is substantial variation in the number of police officers per 100,000 of population across the provinces and territories as well as Canadian census metropolitan areas (CMAs). The highest number of police officers per 100,000 of population and the highest real per capita police expenditures are generally found in the sparsely populated territories.

Across the provinces, in 2013 the number of police officers per 100,000 of population was the highest in Manitoba at 213 and the lowest in Prince Edward Island at 160. Real per capita police expenditures in 2012 were the highest in Ontario at \$272.50 (2002 dollars) and lowest in Prince Edward Island at \$148.20.

A regression equation was estimated for the determinants of police officers per 100,000 of population across Canadian CMAs for the census years 2001, 2006, and 2011 that controlled for crime rates and other socio-economic differences. The actual and predicted numbers of police officers per

100,000 were compared and a min-max methodology was employed to rank the differences between predicted and actual to obtain an efficiency ranking.

Using this methodology, Kelowna, British Columbia, Moncton, New Brunswick, and Ottawa-Gatineau, Ontario-Quebec were found to have the most efficient staffing levels with their actual numbers of police officers per 100,000 of population substantially below what the regression model predicted they could have. Closely following them and also in the top 10 most efficient services are Saguenay, Quebec, Quebec City, Quebec, Kitchener-Waterloo-Cambridge, Ontario, Trois-Rivières, Quebec, Kingston, Ontario, Greater Sudbury, Ontario, and Sherbrooke, Quebec.

Saint John, New Brunswick, Winnipeg, Manitoba, and Windsor, Ontario have the least efficient staffing levels with their actual numbers well above what the regression model predicted. Also in the bottom 10 are St. Catharines-Niagara, Ontario, Abbotsford-Mission, British Columbia, Thunder Bay, Ontario, St. John's, Newfoundland, Peterborough, Ontario, Regina, Saskatchewan, and Victoria, British Columbia.

After controlling for crime rates and other explicit socio-economic confounding factors, substantial differences in staffing remain that can be attributed to local circumstances and conditions that are not easily identified. Some of these differences may reflect inefficient use of police resources while others may reflect other more difficult to quantify local socio-economic differences that raise unique challenges to policing.

There is substantial scope for police forces across Canada's CMAs to discover what best practices are when it comes to more efficient operation of policing given the range and examples of staffing.

Introduction

There is growing public concern¹ over the rising cost and sustainability of police services given that crime rates continue to decline, police salaries rise, and arbitrators often settle police contracts without taking a municipality's ability to pay into account (Leuprecht, 2014; Wentz, 2014, Apr. 17). Since 1999, police compensation has grown faster than inflation with the costs of pensions, benefits, and overtime being particularly important contributors (Standing Committee on Public Safety and National Security, 2014: 10).

For example, in Toronto as in many other cities in Ontario, a large proportion of the police officers now make the provincial Sunshine List.² It was recently revealed that 2,983 out of 8,000 workers in the Toronto police force—about 37.2% of the force's workers—earned more than \$100,000 in 2013 (Peat, 2014, March 28). Canadian police costs have been increasing at rates above both inflation and other public spending (CBC News, 2013a, Jan 15).

In the case of Toronto, Canada's largest city, it was reported that the per capita cost of policing has increased 14%—to \$387 per resident—in the past four years, which is twice the inflation rate (Kari, 2014, Aug. 8). This concern has even sparked a recent federal summit on policing costs given that police budgets have doubled over the last 15 years (Public Safety Canada, 2013; CBC News, 2013b, Jan. 15).

Yet, public debate on rising police costs should not be considered in isolation as overall public spending in Canada has also grown. Moreover, society is now more complex and the nature of policing has evolved beyond just dealing with crime but also a wider range of social problems and behaviours, which can be a factor in police resource and expenditure growth. Police provide the valuable service of public safety and a focus on total police budgetary costs alone without taking other factors into account does a disservice to an

1. For a recent example from a meeting of Ontario municipalities, see Brennan (2014, Aug. 8).

2. The Sunshine List in Ontario refers to the provincial Public Sector Salary Disclosure Act, which since 1996 annually discloses the names, positions, salaries, and taxable benefits of public sector employees earning more than \$100,000 annually.

important public policy issue.³ As a result, the more appropriate question is perhaps not how much is being spent and how quickly it is rising but whether the resources spent are being used as efficiently as possible given the outcomes.

More to the point, can police services be more efficient in their use of increasingly scarce public resources? The evidence suggests that the number of police officers relative to population varies substantially across major Canadian census metropolitan areas (CMAs) even after adjusting for differences in crime rates and other socio-economic variables. Even considering the changing nature of police work over time, this means there is room for improvement when it comes to the more efficient provision of police services in Canada.

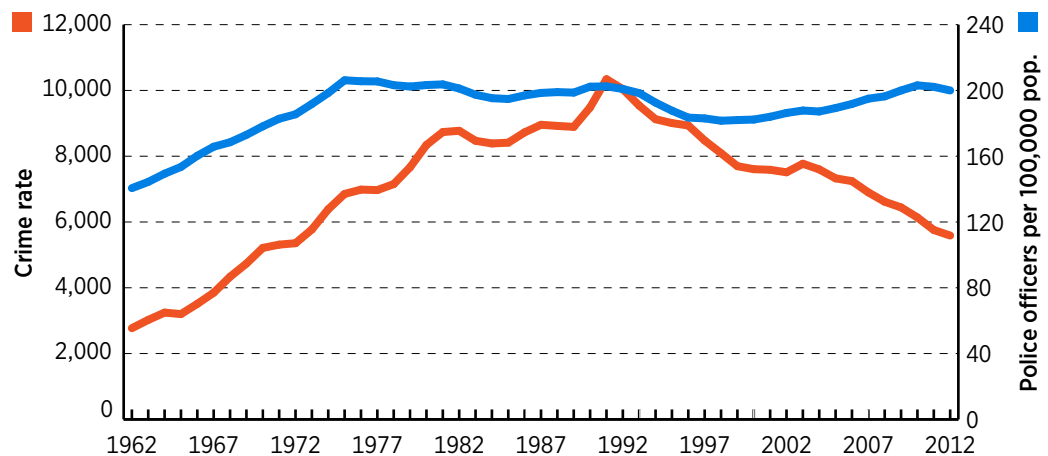
This study reviews the literature on the relationship between police resources and crime rates and then examines trends in crime rates and police resources in Canada. This study then estimates the “efficiency” of police staffing across Canadian CMAs using a determinants approach that first estimates the relationship between police officers per 100,000 population and the crime rate controlling for other factors, and then uses that relationship to estimate the predicted number of officers. This predicted number is then compared to the actual number to see if Canadian CMAs have more or fewer officers than predicted.

3. According to the Report of the Standing Committee on Public Safety and National Security: “The evidence heard clearly demonstrates that while police strength in Canada is significantly lower than in other western countries and police-reported crime rates are declining, police expectations continue to increase and Canadian police forces remain very busy” (2014: 9).

Overview

Police staffing and expenditures have grown dramatically over the last decade across Canadian CMAs. In 2012, there were 69,505 police officers in Canada representing the culmination of a decade of growth in police strength (Statistics Canada, 2014: Table 1). At the same time, the crime rate as measured by major police reported criminal code incidents has declined steadily. **Figure 1a** plots the number of total police officers⁴ per 100,000 of population from 1962 to 2012 in Canada as well as the crime rate defined as the number of criminal code incidents per 100,000 of population over the period 1962 to 2012. After rising for several decades, the crime rate peaked in 1991 and has since steadily declined.

Figure 1a: Police resources and crime rate, 1962-2012



Note: Crime rate = Criminal Code incidents per 100,000 population (excluding criminal code traffic and drug offences).

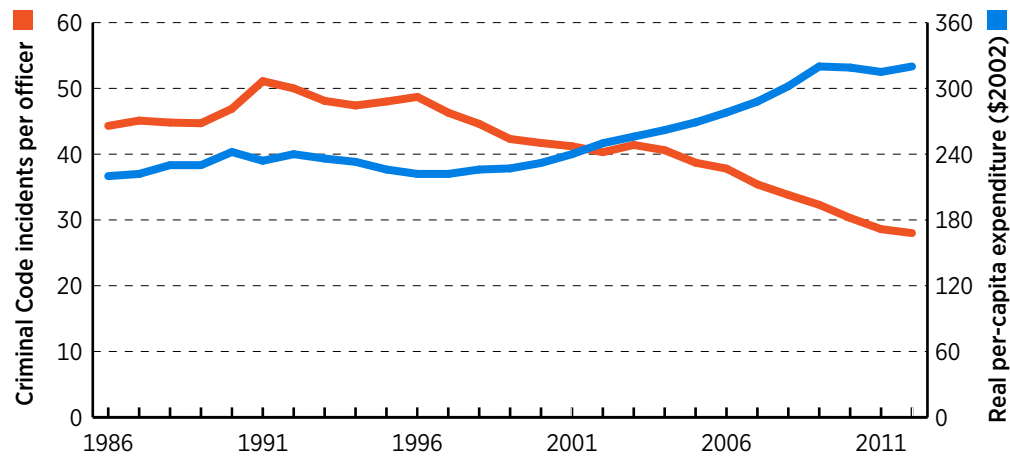
Sources: Statistics Canada, 2014: table 1; Statistics Canada, CANSIM tables 510001, 510026.

Meanwhile, police staffing resources rose from 1962 to 1975 and then entered a period of gradual decline from 1975 to 1998 before resuming an upward trend. Between 2001 and 2012, police officers per 100,000 of population in Canada rose 8.7% while the crime rate declined by 26.3%.

4. This total includes provincial and municipal police services as well as RCMP operating at the municipal, provincial, and federal levels.

This was accompanied by an increase in expenditures and a decline in workload as measured by criminal code incidents per officer. Total expenditures on policing in Canada in 2012 were \$13.5 billion or 0.7% of GDP.⁵ As **figure 1b** illustrates, real per capita police expenditures in Canada rose between 1986 and 2012, growing 45.5%, while criminal code incidents per officer declined by 36.8%.⁶

Figure 1b: Police expenditures and crime incidents per police officer, Canada, 1986–2012



Sources: Statistics Canada, 2014: table 1; Statistics Canada, CANSIM tables 510001, 510026.

It should also be noted that policing is also but one portion of what is an entire criminal justice system that includes policing, the courts, and corrections and parole. According to estimates by the Parliamentary Budget Officer, between 2002 and 2012 total expenditures for the Canadian criminal justice system increased by 66%, reaching \$20.3 billion in 2012 or 1.1% of GDP (2013: 14).⁷ In real terms (2002 dollars) the increase was 37%, growing from \$12.2 billion in 2002 to \$16.7 billion by 2012 (2013: 14). Real per capita spending during this period increased by 23%—from \$389 to \$478.

The pronounced increase in police staffing resources and expenditures since 2000 being accompanied by a decrease in the crime rate is of course a welcome result. Part of the decrease can be attributed to changes in policing

5. Author's calculations.

6. Government expenditures in Canada have also grown during this period and the rise in police expenditures can be compared to increases in total government expenditure or health spending. For example, over the period 2000–2012, real per capita police expenditures rose 34%. Real per capita total government spending in Canada grew by 16%, and real per capita public health spending grew by 44%. Source: author's calculations from Canada, Department of Finance, 2013; Canadian Institute for Health Information, 2013; Statistics Canada, CANSIM tables 510001, 510026.

7. Based on an estimate of \$13.5 billion for policing expenditures in 2012 and total criminal justice expenditures of \$20.3 billion, this would suggest that policing expenditures account for two-thirds of criminal justice system spending in Canada.

methods that have been more proactive⁸ with respect to crime prevention and also more resource intensive given the broader range of community and police interactions required. For example, the Toronto Police Service has made proactive policing a priority, investing 27% of its resources to problem solving and targeting of crime (2013: 19).⁹ The Calgary Police Service has shifted its policing strategy through two-dozen community policing programs, which involve addressing neighborhood issues through decentralized and collaborative interaction with citizens.¹⁰

However, it remains that staffing and total spending on policing has continued to grow even while crime rates decline and indeed police salary costs have become more of a preoccupation in popular discussion.¹¹ Rising police resource intensity in terms of both staffing and expenditures is partly the result of the changing nature and complexity of police work. Factors affecting staffing include the operational load due to service demand and response time, socio-economic factors such as demographics and crime trends, and strategic directions of police forces in terms of governance and policing styles (Toronto Police Services, 2013: 72).¹²

New technology is also playing a role on both the crime and policing sides with investigations in financial, commercial, or cyber crime generating large volumes of e-mail, phone, and text messages that need to be examined (Standing Committee on Public Safety and National Security, 2014: 15). As well, the growth of DNA analysis requiring the collection and analysis of samples is an additional demand on police time and resources. There are demands for increased levels of transparency and accountability with ensuing bureaucratic requirements from the criminal justice system as well as the growth in demand for other police services and activities that are not directly related

8. Proactive policing in response to gang and drug-related violence involves police resources being targeted to suspected individuals prior to crimes being committed.

9. The Toronto Police Service outlines that 59% of its resources go to investigation, 16% to problem solving, 11% to proactive targeting, 4% to intelligence, 8% to support services, and the remainder to other functions such as forensics.

10. An example of such a program is the Domestic Conflict Response Team or DCRT. See Guigon (2012).

11. Leuprecht notes:

Between 2005 and 2010 for instance the total annual cost including benefits, payroll taxes, and so on for a sworn member with Peel Region Police Services increased from \$96,300 to \$113,761. In Durham, the equivalent cost increased from \$159,865 in 2008 to \$182,108 in 2011 (Durham Regional Police Service 2013). Total cost per sworn member for municipalities that contract with the Ontario Provincial Police (OPP) for policing services (including cost-recovery for dispatch and equipment) rose by 18% from \$122,200 in 2007 to \$144,000 in 2011 (Auditor General 2012, 248). (2014: 7–8)

12. The growth of financial and Internet/computer based crime is an example of changing crime trends that also can affect policing style.

to crime and law enforcement.¹³ For example, the public expects police to deal with public drunkenness, social disorder, mental illness, and other social behaviour issues, even though they are not always a direct police responsibility (Public Safety Canada, 2013: 5; Standing Committee on Public Safety and National Security, 2014: 15–17).

Yet, despite changes in the nature of police work, public expectations still associate police with crime fighting as the prime activity. In the absence of new standardized measures of police activity that include these new and diverse workload requirements, crime rates remain the most consistent and broadly available benchmark outcome measure. As well, declining crime rates are a tangible outcome measure of policing activity whereas call volumes or the fulfillment of other bureaucratic requirements are measures of the demand for police resources but are not direct productivity outcomes.

One can argue that the decline in crime rates is the result of more resources being devoted to fighting crime. However, taking a longer view shows that police resources per 100,000 of population are now where they were in the early 1990s whereas crime rates have declined 46% since 1991. This suggests that the long-term relationship between police resources and crime rates is not necessarily an inverse one. Moreover, if one examines the relationship between crime rates and police officers per 100,000 of population across provinces and CMAs, the relationship between greater police resources and crime rates is also not an inverse one—indeed, police resource measures and crime rates can often be positively correlated.

While one can argue that higher crime rates require more police resources to fight crime, it nevertheless remains that some CMAs have substantially smaller police forces than their crime rates alone would predict while others are substantially larger. Given that the changing nature of police work with its associated new resource demands seems to be a trend affecting all major urban police forces in the country, the question that remains is as follows: After controlling for crime rates and other factors that may affect police staffing, what should the number of police officers per capita be in Canadian CMAs? Which CMAs are the most efficient in their police officer staffing?

13. For an overview of the changing nature of police work and the associated cost factors and potential for efficiencies, see Leuprecht (2014). Leuprecht notes that much of a uniformed officer's time is spent waiting to give testimony in court, transcribing interviews, teaching CPR, conducting background checks, or transporting prisoners and there may be efficiencies in pursuing alternate service delivery for some of these activities. According to Leuprecht, the main areas that need to be addressed in reining in police costs include the changing nature of policing and public expectations, the harnessing of economies of scale from overhead, and alternate service delivery for items that do not require uniformed police officers making upwards of \$100,000 per year. There is also mounting bureaucracy and additional public expectations to provide policing for schools.

The Determinants of Crime and Police Resources

The dramatic decline in Canadian crime rates since 1991 (see figure 1a) is paralleled in the United States where homicide rates fell 43% between 1991 and 2001 and violent and property crime fell 34 and 29% respectively (Levitt, 2004: 163). Over the period 1990 to 2000, with the exception of automobile theft, which increased in Canada, the general drop in the Canadian crime rate was comparable to that of the United States (Paternoster, 2010: 799). The explanations in the media for this drop in the United States included the implementation of new innovative policing strategies, changes in the market for crack cocaine, an aging population, a stronger economy,¹⁴ tougher gun control laws, and increases in the number of police (Levitt, 2004: 164).

However, according to Levitt (2004) the key factors were the rising prison population, the waning crack epidemic, the legalization of abortion¹⁵ in the 1970s, and increases in the number of police. The aging of the population and the reduction of a youthful population generally more likely

14. Many studies of the relationship between the economy and crime have generally found statistically significant but small relationships between unemployment and property crime and no systematic relationship between violent crime and unemployment. See, for example, Freeman, 1995. A study for Greece finds that rising unemployment rates raise the rate of property crime but have no significant impact on violent crime; see Saridakis and Spengler, 2009.

15. There is substantial debate over the factors that sparked the crime decline, with the legalization of abortion being quite controversial. The impact of legalized abortion in the wake of the *Roe v. Wade* case in 1973, which set guidelines for the availability of abortions in the United States, occurred after the legalization of abortion in Canada in 1969. Levitt (2004) explains that legalizing abortion resulted in a reduction in unwanted births and unwanted children are at a greater risk of crime. Levitt's original results on the impact of abortion on crime rates were published with Donohue (Donohue and Levitt, 2001) and challenged by Foot and Goetz (2001) and there was a follow up by Donohue and Levitt in 2008. Drum (2013) explores the research suggesting that it was actually the reduction in lead levels in the environment through the reduction of leaded gasoline starting in the 1970s that may have reduced crime rates, given the link between childhood lead exposure and juvenile delinquency.

to commit crimes was not an important factor (Levitt, 1999). As for the impact of the economy on lower crime, Levitt argued the impact is likely more indirect via the impact on government budgets and by extension on police and prison spending (Levitt, 2004: 171). Indeed, it has been argued that economic downturns actually decrease criminal opportunities as when unemployment is high more people are at home serving as “guardians” of their property and when out and about they carry less cash and possessions (Scheider, Spence, and Mansourian, 2012: 2).

The general premise behind greater numbers of police officers is not only that they will apprehend more criminals but also that there is a deterrence effect. It is posited that having more police officers on duty raises the probability of being caught when engaging in criminal acts, which serves to deter criminals. However, the empirical evidence supporting a deterrence effect has not always been definitive.¹⁶

Some of the decline in crime rates in the United States is attributed to the role of the police in deterrence. However, while many studies found that police levels did not have a significant impact on crime rates, other studies have criticized them on both theoretical and methodological grounds and recent studies have found a significant impact. A key methodological problem of the earlier studies was not taking the simultaneous or bi-directional nature of the relationship between police and crime—that is, more police reduce crime but more crime also leads to the demand for more police.¹⁷ There is also the possibility that when there are fewer police officers there is less reported crime, which means that in cities where there have been dramatic reductions in police staffing, people simply stopped even bothering to report many crimes (Scheider, Spence, and Mansourian, 2012: 10).

16. Paternoster writes:

Particular criminal justice policies such as police “crackdowns,” enhanced enforcement in and surveillance of high crime areas or “hot spots,” mandatory minimum sentences, sentencing enhancements for firearm possession, “three-strike” laws, and others are all enacted with the expectation that they will successfully engineer the crime rate down through deterring offenders and would-be offenders. (2010: 766)

He concludes that while criminal offenders are rational actors and respond to deterrence, the criminal justice system, because of the delayed imposition of punishment, is not well constructed to take advantage of this rationality.

17. As Di Tella and Schargrodsy note: “It is likely that the government of a city in which the crime rate increases will hire more police officers. Areas beset by high crime will thus end up with more police officers than areas with low crime rates, introducing a positive bias in the police coefficient in a crime regression” (2004: 115). This is an extremely large literature. For overviews, see Di Tella and Schargrodsy (2004), Kovandzic and Sloan (2002), Marvell and Moody (1996), and Cameron (1988).

Marvell and Moody (1996) find a significant inverse relationship between the number of police officers and state-level homicide, robbery, and burglary rates over the period 1973 to 1992. For the period 1970 to 1992, Levitt (1997) finds that an increase in the number of police reduced crimes, with the effect stronger for violent as opposed to property crimes. Kovandzic and Sloan (2002) use county-level data from Florida over the period 1980 to 1998 and a time-series statistical technique and find that increased police levels did reduce crime rates.¹⁸ Lin (2009) explores the role of police on crime using US state data and argues that while economic theory suggests police and crime are negatively correlated, it is surprisingly difficult to demonstrate this relationship empirically, as areas with greater numbers of crimes also tend to hire more police. Lin resolves this issue by employing another statistical technique¹⁹ that adjusts for this bi-directional relationship and finds that a 1% increase in police presence with respect to crime results in a reduction of about 1.1% for violent crime, and 0.9 for property crime.

Di Tella and Schargrodsy (2004), using data on car theft location before and after a terrorist attack that saw a redeployment of police into a specific geographic area, find a large deterrent effect of observable police on crime. Another study by Klick and Tabarrok (2005) uses terror alert levels set by the Department of Homeland Security in the United States, which provided a change in police presence levels in Washington, DC. They find that the level of crime decreased significantly in Washington, DC during high alert periods.²⁰ Worrall and Kovandzic (2010) use data for 5,000 cities over the period 1990 to 2001 and find an inverse relationship between police levels and crime, but mainly in the larger cities. Guffey, Larson, and Kelso (2010) compare crime rates in 24 US metropolitan areas over a 12 year period and find some, but not overwhelming, support for a negative correlation between police officer staffing and crime rates.

There are also studies that do not support the assessment that increased police numbers reduced crime rates. Klick and Tabarrok (2005) note that many studies they surveyed either found no relationship or that increases in the number of police are associated with increases in the level of crime. Paternoster (2010: 789, 799) notes that while Canada and the United States experienced comparable declines in their crime rates between 1990 and 2000, Canada actually experienced a 10% decline in the number of police officers per 100,000 during this period while the United States saw an expansion of about 14%.

18. They use a technique known as Granger causality.

19. The regression technique used is known as two stage least squares.

20. Again, one might wonder whether it was the increased police staffing that scared off the criminals or the terror alerts, which made even criminals fear for their safety.

Eck and Maguire (2000) review the literature on crime rates and police officers and conclude that only a few of these studies dealt rigorously with the methodological problems inherent in the analysis and of those they conclude that the police has no real effect on the drop in the crime rate. As well, some studies have found evidence of crime displacement, that is, when crime areas are targeted with additional police resources, the crime migrates to nearby geographic areas with no overall decrease (Weisbrud et al., 2006).

The Data

The data in this study is from assorted Statistics Canada sources and are used to compile data at the provincial and CMA levels for police resources, police expenditures, and crime rates along with other demographic, economic, and socio-economic variables. Data on police resources and staffing is from the annual publication *Police Resources in Canada* published by Statistics Canada and the Canadian Centre for Justice Statistics from 2001 through 2013. The information on police personnel and expenditures is collected each year from each police service in Canada by Statistics Canada using the annual *Police Administration Survey*. A key concept here is “police strength,”²¹ which is defined as the number of police officers per 100,000 people in a given area (Canada, a province or territory, a CMA, or a police jurisdiction) and provides a standardized measure that allows for comparisons both over time and across the country (Statistics Canada, 2012b: 6).²²

The traditional crime measure used in this analysis is the number of criminal code offences excluding traffic incidents (and which also excludes drug offences). The data on crime is collected by the *Uniform Crime Reporting (UCR) Survey* that was established in 1962 and operates with the cooperation and assistance of the Canadian Association of Chiefs of Police. This data is published by Statistics Canada, and the Canadian Centre for Justice Statistics (CCJS), originally as *Crime Statistics in Canada*, and more recently as *Police-Reported Crime Statistics in Canada*. This paper looks at the reports from the years 2000 through 2012.

The traditional police-reported crime rate is calculated by dividing the number of these criminal code incidents reported to police by the population and is usually expressed either as a rate per 100,000 of population or as incidents per police officer. Recent years have seen this measure accompanied by a new measure that began in 2009 known as the *Crime Severity Index*

21. Police strength is the actual number of officers on staff as opposed to the term “authorized strength,” which is used by police services to refer to the number of positions available whether or not they are filled. See Statistics Canada (2012b): 8.

22. Again, it should be noted that this does not include civilians employed by police services, which therefore underestimates total staffing resources used by police services.

(CSI).²³ This measure differs from the traditional crime rate in that it takes into account not only the volume of crime in terms of incidents but it also weights the crimes in terms of their seriousness (Statistics Canada, 2009a).

While drug and traffic offences are excluded from the traditional crime rate, they are included in the CSI. As well, the CSI uses seriousness “weights” based on sentencing data that makes offences subject to incarceration as more serious. It should be noted that a comparison of the two measures for Canada as a whole over the period 1999 to 2007 found that the crime rate decreased by 15%, while the CSI dropped even further (21%) and the two measures generally move together quite closely (Statistics Canada, 2009a). However, the CSI is an index standardized to the value of “100” for Canada using 2006 as a base year. As a result, one can only compare trends in police reported crimes using this measure and not levels, still making the traditional crime rate a useful measure as it allows for jurisdictional comparisons of both trends as well as specific levels of crime.²⁴

Criminal code offences used in calculating the traditional crime rate generally include violent crime (e.g., homicide, sexual assault, assault, robbery, abduction, etc.), property crime (e.g., break and enter, motor vehicle theft, arson, identity fraud, etc.), and other criminal code offences (counterfeiting, weapons violations, child pornography, terrorism, etc.) Criminal code traffic offences and drug offences are excluded from the traditional crime rate.²⁵

For example, in 2012, there were 1,949,160 total criminal code incidents (excluding traffic and drug offences). Added to these would be 140,869

23. According to Statistics Canada,

The Crime Severity Index (CSI) takes into account both the volume and the seriousness of crime. In the calculation of the CSI, each offence is assigned a weight, derived from average sentences handed down by criminal courts. The more serious the average sentence, the higher the weight for that offence. As a result, more serious offences have a greater impact on changes in the index. All *Criminal Code* offences, including traffic offences and other federal statute offences, are included in the CSI. (2014: 19)

However, it should be noted that any differences in sentencing across jurisdictions could affect the weighting for offences and potentially affect the comparisons across jurisdictions.

24. As well, the Crime Severity Index is available nationally from 1998 to the present but only begins for provinces, territories, and CMAs in 2007.

25. Excluded criminal code traffic violations include impaired driving and other criminal code traffic violations. Drug offences include possession or trafficking of cannabis, cocaine, or other drugs. It should also be noted that recent media reports suggest that police may have become less keen on enforcing Canada’s drug laws particularly in the case of cannabis and by extension are devoting fewer resources to the activity. Whereas the per capita incidence of cannabis possession actually rose between 2002 and 2013, the per capita incidence rates for trafficking, importation, and production have declined. See Galloway (2014, July 25).

criminal code traffic violations (e.g., impaired driving and other traffic violations) and 109,455 drug offences (e.g., possession, trafficking). Thus, the total criminal code incidents used to calculate the traditional police reported crime rate account for approximately 87% of total reported crimes and can be considered to account for most crime.²⁶ Moreover, the omission of these other categories would be a serious concern if their trends were increasing, given the decline in the traditional crime rate but their combined rate over the last decade has remained quite flat.²⁷

One can debate whether the crime data presented by Statistics Canada provides a full measure of the workload facing police officers in Canada. The Uniform Crime Reports reflect only part of the work that the public expects police officers to handle while the calls for police service have not fallen at the rate that criminal code offences and rates have dropped (Standing Committee on Public Safety and National Security, 2014). As well, Statistics Canada and the Canadian Centre for Justice Statistics note that there can be up to four offences per criminal incident but only the most serious is used which results in “some offences being slightly underrepresented” (Statistics Canada, 2013a: 6). This criticism has been recently applied to the reporting of crime over the methodology employed in the construction of the CSI.²⁸

26. For more detail, see Statistics Canada (2013a).

27. Between 2001 and 2012, the rate per 100,000 of criminal code traffic violations declined slightly from 406.3 to 404. That rate for drug offences rose from 295.7 to 314 but as already noted, much of the increase in the rate for drug offences was for possession rather than trafficking or production. See Statistics Canada (2002a, 2013a).

28. For example, the CSI has been criticized as being imprecise and subjective because incidents with multiple crimes only are reported as a single offence thereby minimizing the information reported. See Newark (2014, Aug. 11).

Analysis

In 2001, there were a total of 57,076 police officers in Canada and by 2012 this number grew to 69,505—an increase of 21.8%. Over the same period, Canada’s population grew from 31.1 to 34.9 million people—an increase of 12.2%. The number of police officers has grown faster than the population.²⁹ Indeed, the number of police officers per 100,000 in Canada grew from 184 in 2001 to 200 by 2012.³⁰

Total expenditures on policing in nominal dollars rose from \$7.3 billion in 2001 to \$13.5 billion by 2012 while the total number of criminal code incidents fell from 2.4 million to 2.0 million incidents and the number of incidents per police officer fell from 41.3 to 28.6.³¹

Figure 2 presents the total number of police officers per 100,000 of population by province and territory in Canada for the years 2001 and 2013.

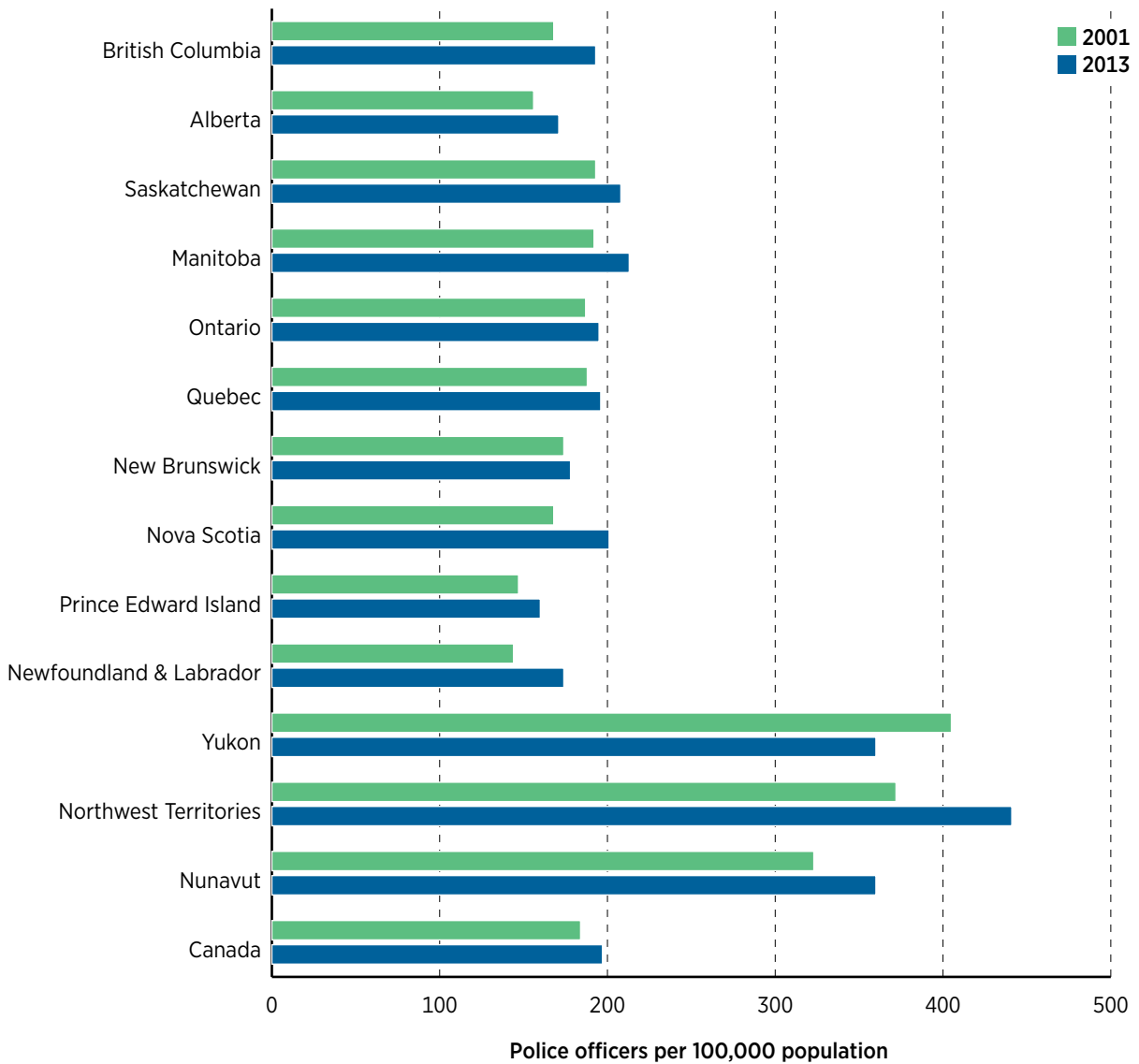
Police officers per 100,000 of population in 2001 ranged from a high of 405 in the Yukon to a low of 144 in Newfoundland and Labrador. By 2013, they ranged from a high of 441 in the Northwest Territories to a low of 160 in Prince Edward Island. Across the provinces, police numbers per capita were highest in Manitoba and Saskatchewan and lowest in Alberta and Prince Edward Island. Between 2001 and 2013, all the provinces and territories have seen an increase in the numbers of police officers per 100,000 of population with the exception of Yukon, which saw a decline. More recently, a small

29. It should be noted that the trend is similar in the United States. Between 1992 and 2008 the number of state and local law enforcement officers in the United States increased from 564,000 to 705,000 full-time sworn personnel—an increase of 25%. The average annual growth rate for officers during this period was 1.6% whereas the average annual growth rate of population in the United States was 1.2%. See Reaves (2012: 1).

30. See Statistics Canada (2002b): table 7; Statistics Canada (2014): table 1.

31. For expenditures and criminal code incidents, see Statistics Canada (2013b): table 1. Expenditures amounts are in current dollars, which are not adjusted for inflation or deflation. Total operating expenditures include salaries, wages, benefits, and other operating expenses that are paid from the police service budget, as well as benefits paid from other government sources. Revenues, recoveries, and those costs that fall under a police service’s capital expenditures are excluded.

Figure 2: Total police officers per 100,000 population, 2001 and 2013



Note: The estimate of total police officers is for provincial and municipal police services as well as RCMP operating at the municipal, provincial, and federal level.

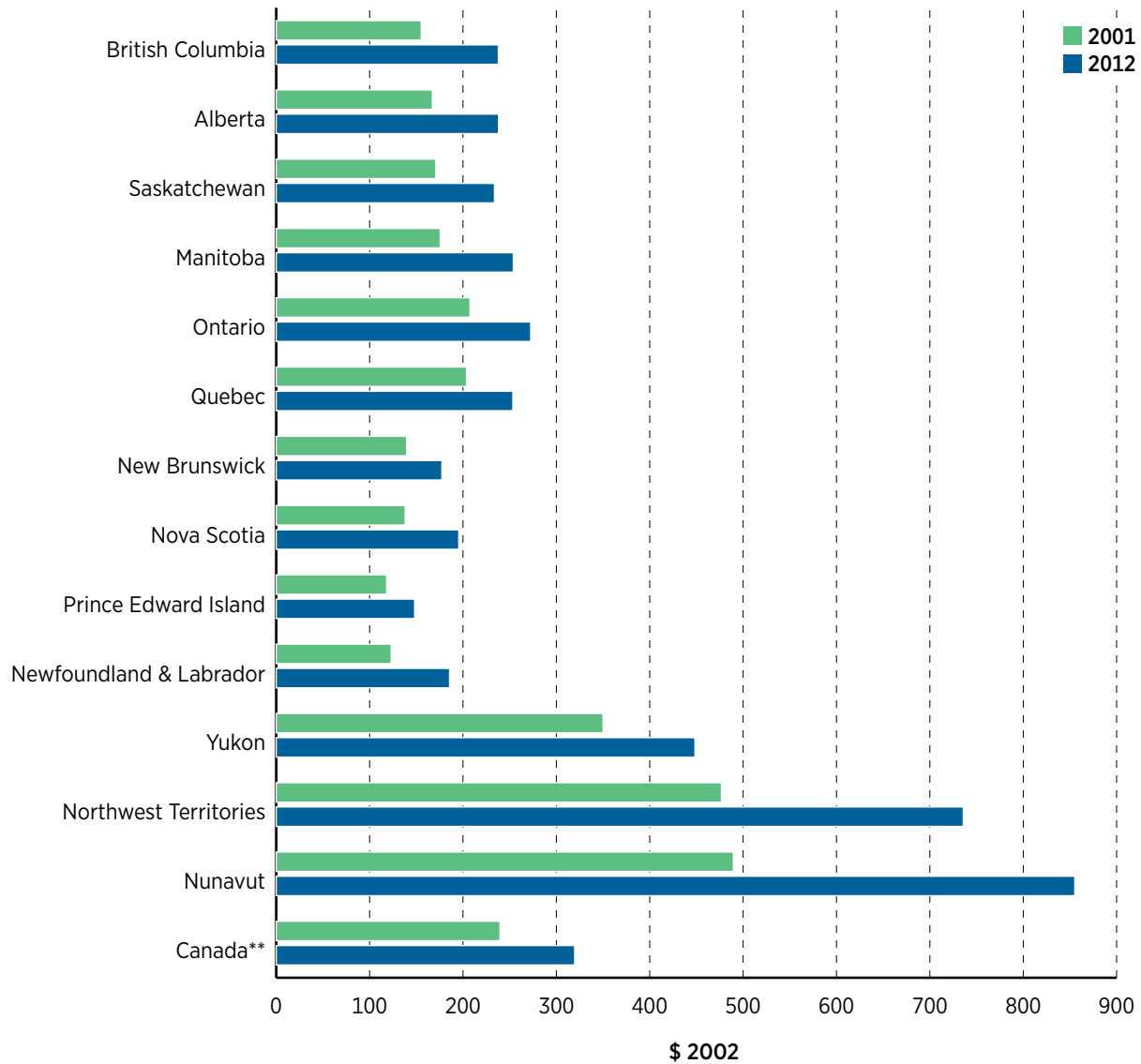
Sources: Statistics Canada, 2002b, 2014.

decline in per capita police strength appears to have started. Between 2012 and 2013, police officers per 100,000 of population fell in all provinces and territories except Ontario, British Columbia, and the Yukon.

Figure 3 provides real per capita police spending by province and territory (in 2002 dollars) for the years 2001 and 2012.³²

32. Expenditures deflated using the Consumer Price Index, 2009 basket, 2002=100. Statistics Canada (2011a). Author's calculations.

Figure 3: Real per-capita provincial/territorial and municipal police expenditures* (\$ 2002), 2001 and 2012



Notes: *Expenditures deflated using the Consumer Price Index, 2002 = 100. Expenditures are gross operating expenditures and include costs paid for from police department budgets and benefits paid from other sources. Revenues, recoveries, and capital expenditures are excluded. **Provincial/territorial expenditures include the amount billed to the province, territory, or municipality for RCMP contract policing but not the total cost of the contract. Remaining costs are included in federal police expenditures included under Canada.

Sources: Statistics Canada, 2002b, 2013b, 2014, 2011a.

In 2001, real per capita expenditures³³ on police ranged from a low of \$118 in Prince Edward Island to a high of \$490 in Nunavut. In 2012, real per capita expenditures were again the lowest in Prince Edward Island at \$148 and highest in Nunavut at \$855. Amongst the provinces, Ontario and Quebec have the highest per capita spending on police.

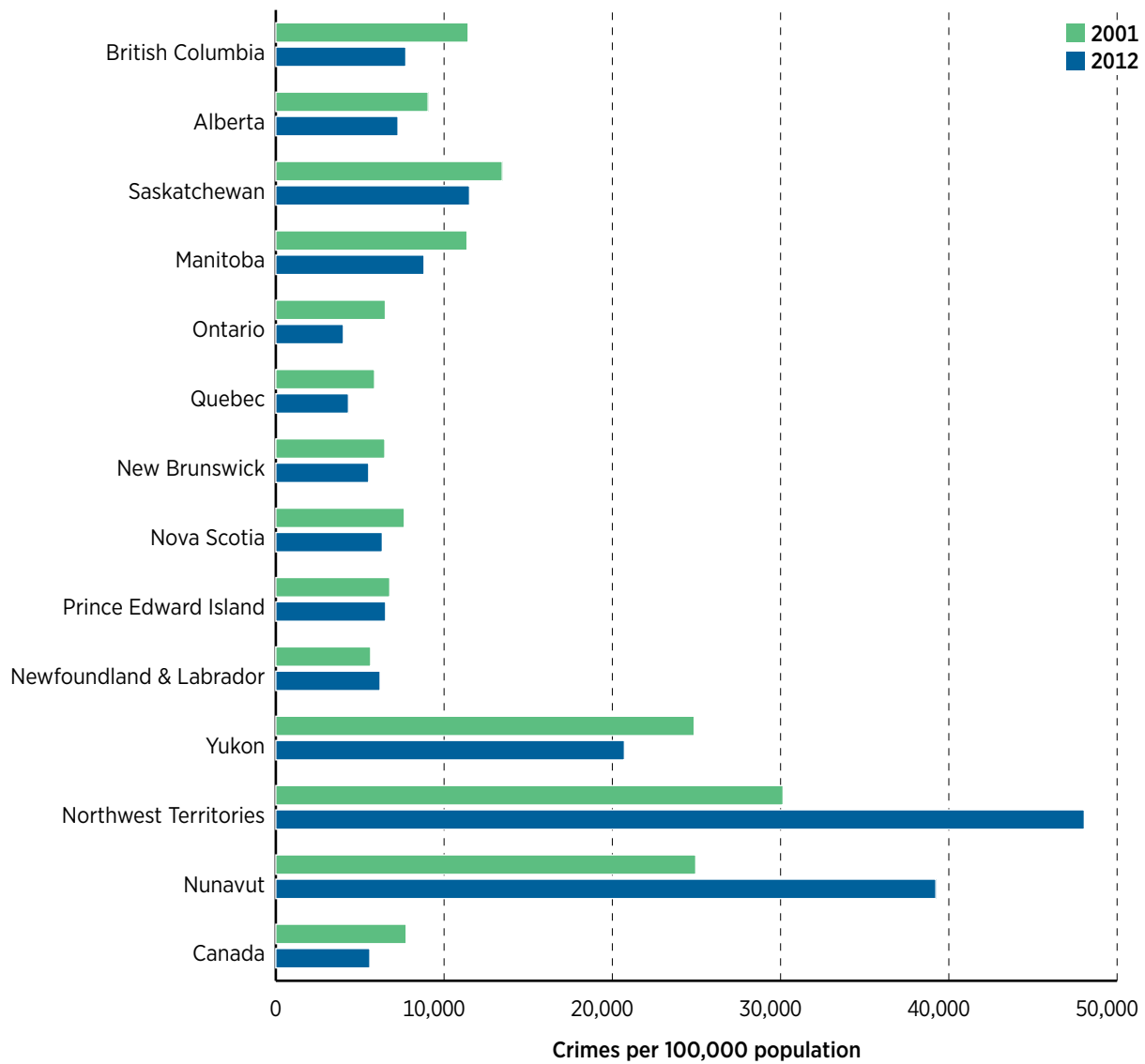
All provinces and territories saw an increase in real per capita police expenditures between 2001 and 2012. The biggest percentage increases were in Nunavut, the Northwest Territories, and British Columbia and the lowest were in New Brunswick, Prince Edward Island, and Quebec. While per capita police numbers recently declined in many provinces and territories, real per capita spending numbers continue to rise. For the most recent available numbers for 2012, real per capita police expenditures again rose in all the provinces and territories from the previous year.

Figure 4 presents the crime rates for the provinces and territories between 2001 and 2012. The highest crime rates are in the territories. Amongst the provinces, the highest crime rates are in Saskatchewan and Manitoba while the lowest rates are in Ontario and Quebec. In general, crime rates in Canada appear to rise as one moves from east to west and from south to north. The higher crime rates in western and northern Canada could be a function of the larger Aboriginal population shares and the greater tendency for Aboriginal people to be victims of crime.³⁴ With the exception of Newfoundland and Labrador, the Northwest Territories, and Nunavut, the remaining provinces and territories all saw a decline in their crime rates defined as criminal code incidents per 100,000 of population (excluding traffic violations). The biggest percentage decreases in the crime rate occurred in Quebec, British Columbia, and Ontario.

³³. Expenditures are gross operating expenditures and include costs paid for from police department budgets and benefits paid from other sources. Revenues, recoveries, and capital expenditures are excluded. Provincial/territorial expenditures also include the amount billed to the province, territory, or municipality for RCMP contract policing but not the total cost of the contract. Remaining costs are included in federal police expenditures included under Canada. See Statistics Canada (2002b), (2013b), (2014).

³⁴. According to self-reported information from the 2009 General Social survey (GSS), Aboriginal people were two times more likely than non-Aboriginal people to experience violent victimization such as an assault, sexual assault, or robbery (232 versus 114 incidents per 1,000 population). As well, the Aboriginal population is relatively younger than the non-Aboriginal population and violent incidents were more likely to be committed against younger Aboriginal people. See Government of Canada (2013a), "Aboriginal People as Victims of Crime" and (2013b), "Aboriginal Victimization in Canada: A Summary of the Literature". Western and northern Canada have larger Aboriginal population shares than other regions of the country. According to data from the 2006 Census of Canada (see Data Key), Canada's Aboriginal population share was 3.6% while in the territories it ranged from a high of 81% in Nunavut to a low of 23% in the Yukon. Amongst the provinces, the highest shares were in Manitoba at 15% and Saskatchewan at 14%.

Figure 4: Police reported crime rates in Canada: Criminal Code incidents (without traffic and drug offences) per 100,000 population, 2001 and 2012

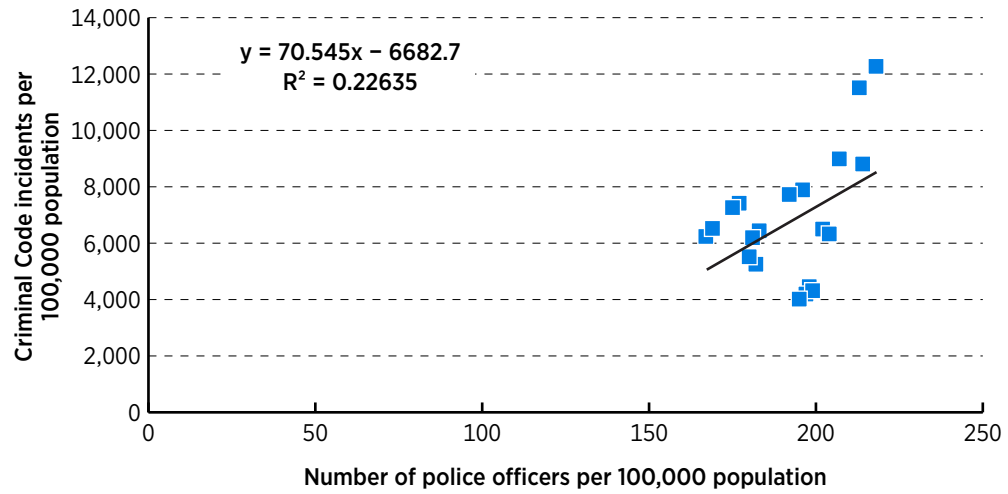


Sources: Statistics Canada, 2002a, 2013a.

Figures 5a and 5b look at the recent relationship between police staffing resources and the crime rate at the provincial-territorial level.

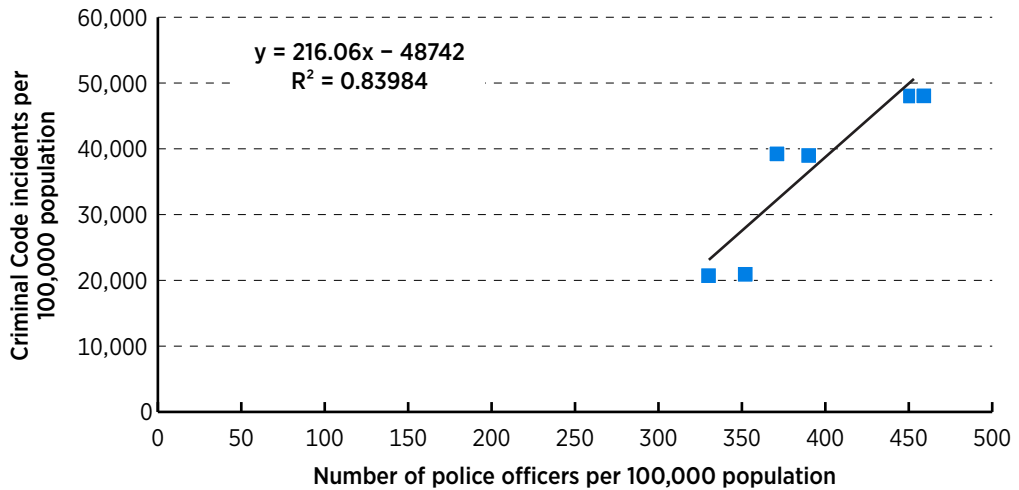
Given the much higher crime rates and staffing levels per capita at the territorial level relative to the provinces, the two types of regional jurisdiction are plotted separately with figure 5a presenting the provincial relationship and figure 5b the territorial one. While there has been a drop in crime rates over time, a positive correlation between crime rates and the number of police per 100,000 of population remains across the provinces and territories.

Figure 5a: Crime rate compared to number of police officers, provinces only, 2011 and 2012



Sources: Statistics Canada, 2012b, 2013b, 2014 (*Police Resources in Canada, 2011–2013*); Statistics Canada, 2011b, 2012a, 2013a (*Police-Reported Crime Statistics in Canada, 2010–2012*).

Figure 5b: Crime rate compared to number of police officers, territories only, 2011 and 2012

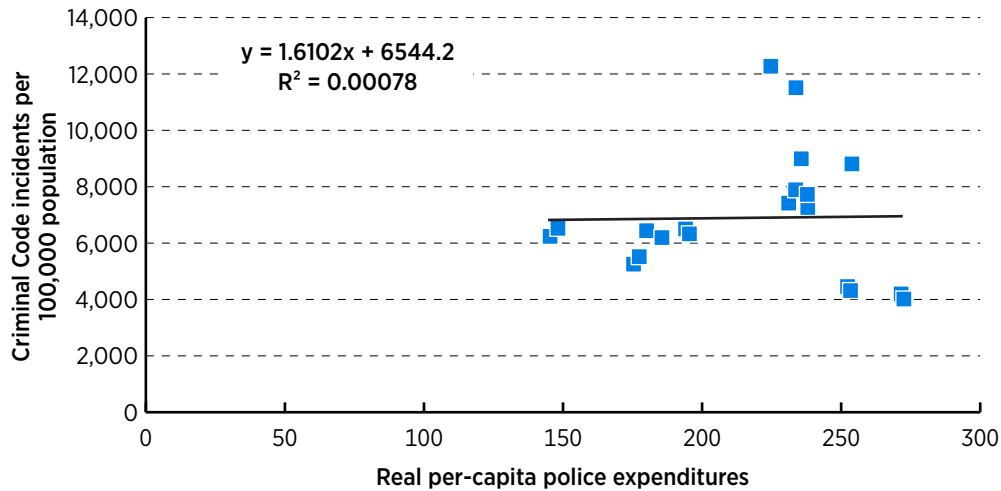


Sources: Statistics Canada, 2012b, 2013b, 2014 (*Police Resources in Canada, 2011–2013*); Statistics Canada, 2011b, 2012a, 2013a (*Police-Reported Crime Statistics in Canada, 2010–2012*).

This is in keeping with the earlier discussion that while one would expect an inverse relationship between more police resources and crime rates, at the same time, across jurisdictions, higher crime rates could be associated with a demand for more police resources. There is however, considerable variation around the trend line. The relationship between police resources and crime rates across the provinces is essentially flat when real per capita

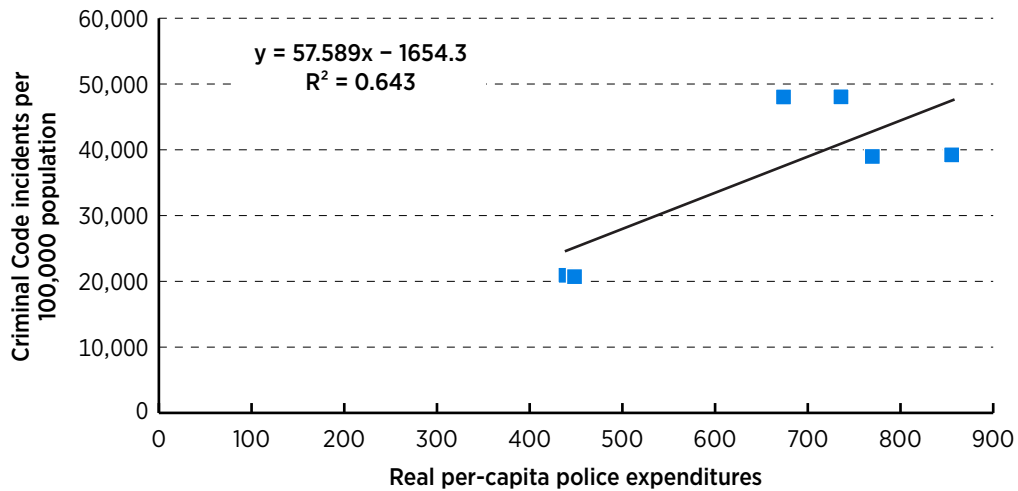
expenditures are plotted against crime rates in **figure 6a** with very little of the variation in crime explained by spending. However, there is a positive correlation between spending and crime rates when the territorial data is examined in **figure 6b**.³⁵

Figure 6a: Crime rate compared to real per capita police expenditures (\$2002), provinces only, 2011 and 2012



Sources: Statistics Canada, 2012b, 2013b, 2014 (*Police Resources in Canada, 2011–2013*); Statistics Canada, 2011b, 2012a, 2013a (*Police-Reported Crime Statistics in Canada, 2010–2012*).

Figure 6b: Crime rate compared to real per capita police expenditures (\$2002), territories only, 2011 and 2012



Sources: Statistics Canada, 2012b, 2013b, 2014 (*Police Resources in Canada, 2011–2013*); Statistics Canada, 2011b, 2012a, 2013a (*Police-Reported Crime Statistics in Canada, 2010–2012*).

³⁵. It should be noted that these are both simple correlations and do not control for other variables that may affect the relationship between crime rates and police resource measures.

Figure 7 presents the total number of police officers in municipal and provincial policing for the years 2001 and 2013 for selected Canadian CMAs.³⁶ When ranked according to their officers per 100,000 population in 2013, the smallest numbers are for Saguenay, Quebec and Trois-Rivières, QC, each at 122 police officers per 100,000 of population. The largest numbers are for Winnipeg, Manitoba and Thunder Bay, Ontario, each at 189 officers per 100,000 of population.

Over the period 2001 to 2013, the only declines in police officers per 100,000 in these 24 selected CMAs occurred in Saguenay, QC, Trois-Rivières, QC, Saint John, New Brunswick, Hamilton, ON, Toronto, ON, Saskatoon, Saskatchewan, Windsor, ON, Regina, SK, and Thunder Bay, ON. The remaining 15 CMAs all saw increases.

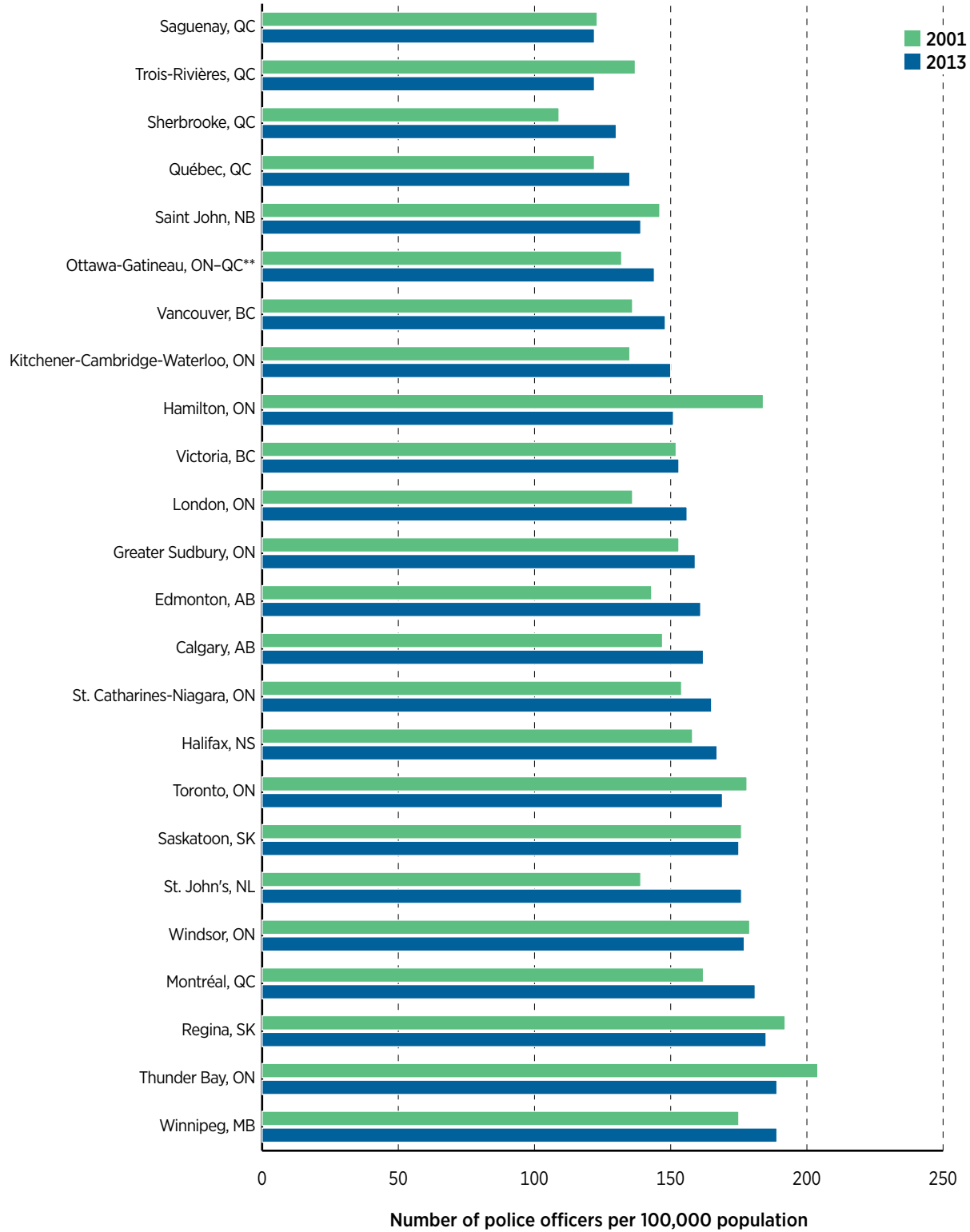
In 2001, the median number of police officers per 100,000 for these 24 CMAs was 149.5. By 2013, this grew to 160. The range in these numbers across CMAs is quite substantial especially when considered relative to the median. In 2001, for example, the smallest number is for Sherbrooke, QC at 109 police officers per 100,000 while the largest is for Thunder Bay, ON at 204. In 2013, the median was 160 and ranged from a low of 122 for both Saguenay, QC and Trois-Rivières, QC and a high of 189 for both Winnipeg, MB and Thunder Bay, ON.

Trying to account for the large differences across CMAs is an important exercise. For example, in 2001 Thunder Bay, ON had 95 officers more per 100,000 of population than Sherbrooke, QC. Some of this difference can be explained by differences in crime rates. For example, crime rates in 2001 were higher in Thunder Bay at 8,602 criminal code incidents per 100,000 of population compared to 6,541 for Sherbrooke. However, while Thunder Bay's police officers per 100,000 population was 87% greater than Sherbrooke's, its crime rate was only 32% greater, suggesting factors other than crime rate may account for the difference.

Figure 8 presents the crime rates in 2001 and 2012 for these same CMAs ranked by the rate in 2012. The lowest crime rate in 2012 was in Toronto, ON at 3,131 criminal code incidents per 100,000 of population and the highest in Regina, SK at 8,755. All CMAs saw a decline in crime rates between 2001 and 2012 with the exception of St. John's, Newfoundland, which saw an increase of 10.1%. The largest percentage declines in crime rates over this period were in Toronto, ON, Winnipeg, MB, and Regina, SK while the smallest declines were in St. John's, NL, Saint John, NB, and Trois-Rivières, QC.

³⁶. CMAs included in this figure are those for which data was available in both 2001 and 2013. In 2001, data was not available for Moncton, NB, Barrie, ON, Kingston, ON, Peterborough, ON, Brantford, ON, Guelph, ON, Kelowna, BC, and Abbotsford-Mission, BC. These cities are however included in the regression analysis and efficiency ranking later in the analysis.

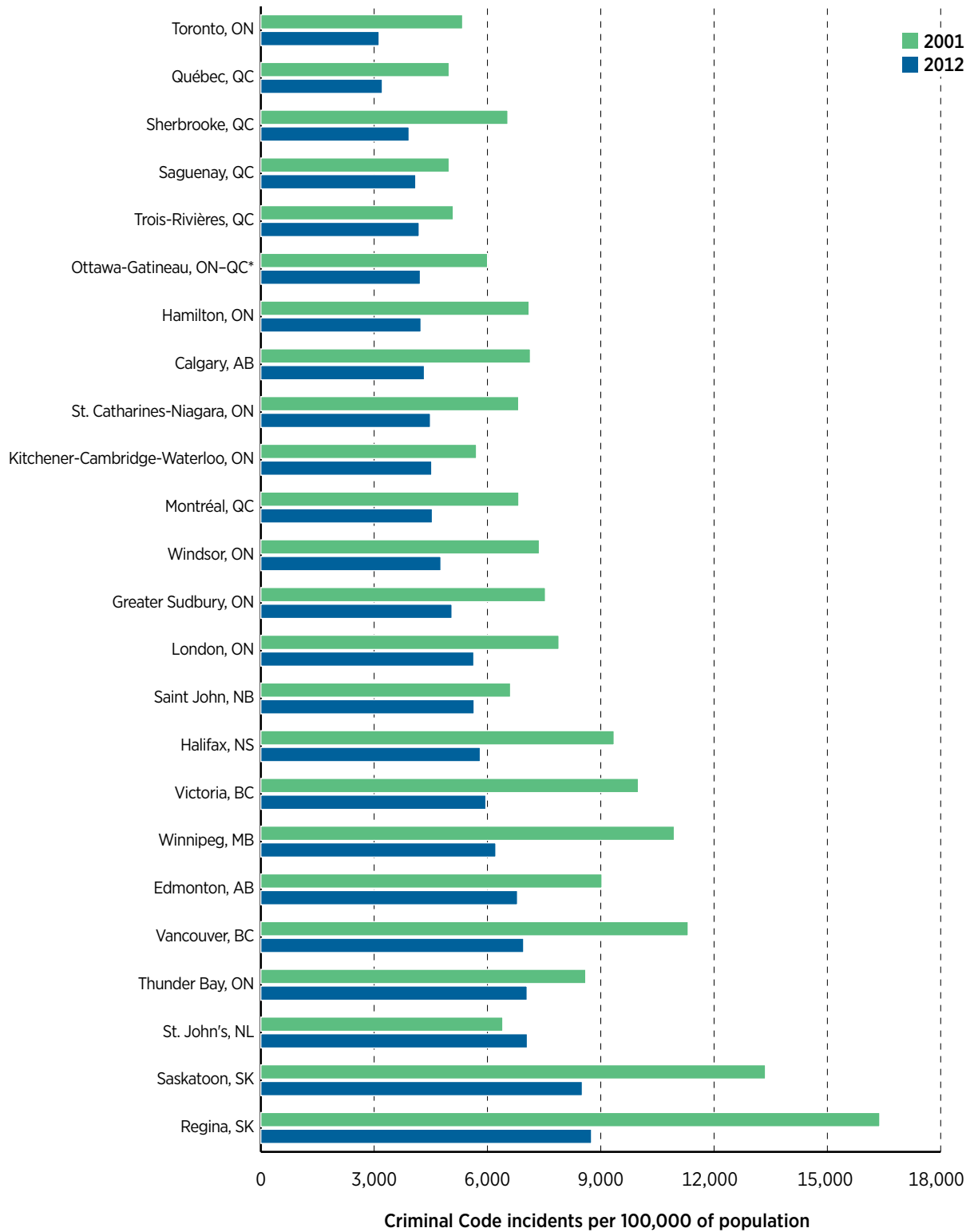
Figure 7: Total police officers per 100,000 population,* selected Canadian CMAs, 2001 and 2013



Notes: *Only those officers involved in municipal and provincial policing.**Weighted population share average of 0.236 for Gatineau and 0.764 for Ottawa.

Sources: Statistics Canada, 2002b, 2013b, 2014.

Figure 8: Police-reported crime rates: Criminal Code incidents (without traffic or drug offences) per 100,000 population, selected Canadian CMAs, 2001 and 2012



Note: *Weighted population share average of 0.236 for Gatineau and 0.764 for Ottawa.

Sources: Statistics Canada, 2002b, 2013a.

Finally, **figure 9a** plots crime rates and police officers per 100,000 for these CMAs using the years 2001 and 2012.³⁷

Again, the relationship is a positive one with but with considerable dispersion around the trend line. Based on the trend number of police officers per 100,000 of population alone, some CMAs have substantially smaller crime rates than their police force size would suggest while others are substantially larger. For example, in 2012, both Quebec City and Saguenay had 131 police officers per 100,000 of population but Quebec City's crime rate was 3,216 criminal code incidents per 100,000 of population while Saguenay's was 4,101.

Figure 9b plots the percent change in crime rates from 2001 to 2012 against the percent change in police officers per 100,000 of population with a linear trend.³⁸

The result here is also interesting in that the positive slope of the linear trend implies that CMAs with larger percent increases in police officers per 100,000 of population actually experienced smaller percent declines in crime rates.

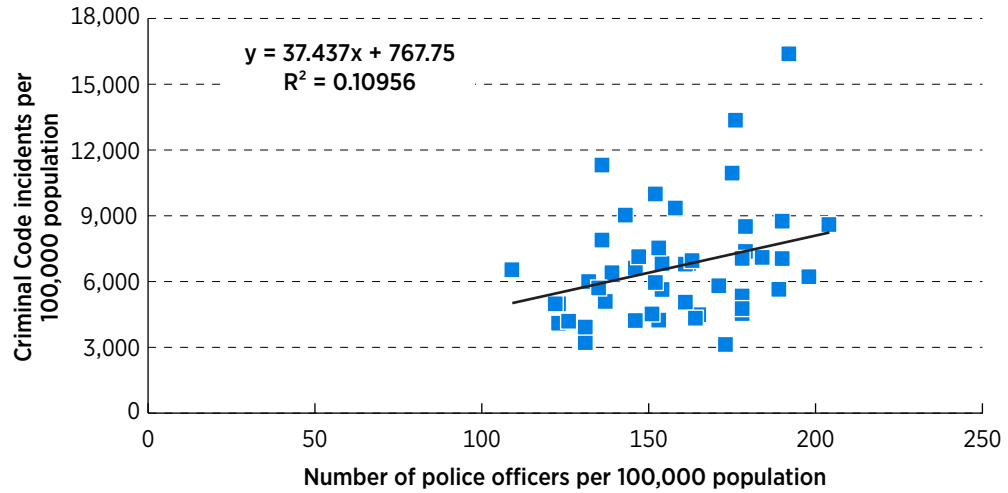
No doubt, other factors can affect the number of officers per capita aside from just the crime rate but one would expect crime to be a major factor. However, the fitted relationship in figures 9a and 9b do not take confounding factors into account. For example, is the geographic size of municipalities and subsequent population density a factor? Do more spread out CMAs need more police? There may also be economies of scale in policing, with larger and more densely populated jurisdictions facing lower policing costs and therefore being able to have fewer police officers per 100,000 of population than smaller jurisdictions.

Is age distribution of the population a factor? Are "older" cities quieter and easier to police? What is the effect of economic variables such as income or unemployment on both crime and subsequent police staffing? An attempt needs to be made to take other determinants into account when examining the relationship between police staffing resources and crime rates before attempting to conclude if one CMA is more efficient in its deployment of police resources than another.

37. The F-statistic (1,46) for this regression was 5.66 and the police officer coefficient was statistically significant at the 5% level with a t-value of 2.38. The constant was not significant.

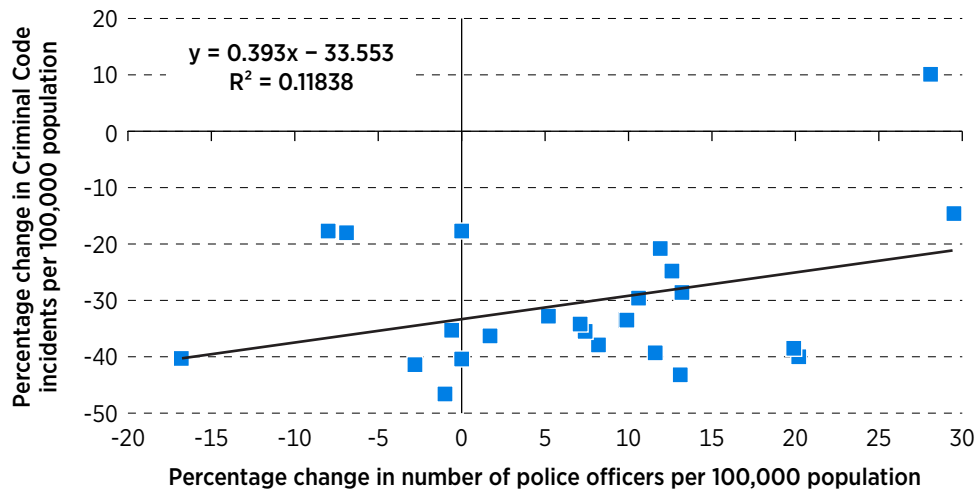
38. The F-statistic (1,22) for this regression was 2.95 and the percent change in police officer strength coefficient was statistically significant only at the 10% level with a t-value of 1.72. The constant was statistically significant at the 5% level with a value of -11.29.

Figure 9a: Crime rate compared to number of police officers, selected Canadian CMAs, 2011 and 2012



Sources: figures 7 and 8.

Figure 9b: Percentage change in crime rate compared to percentage change in number of police officers, selected Canadian CMAs, 2011 and 2012



Sources: figures 7 and 8.

Estimating the Efficiency of Police Resources in Major Canadian CMAs

The previous analysis has illustrated the relationship between police officers per 100,000 population and crime rates but without controlling for other factors. Controlling for other factors is necessary in order to estimate the efficiency of police resource use.³⁹ This section presents estimates of the “efficiency” of police staffing across Canadian CMAs using a determinants approach that first estimates the relationship between police officers per 100,000 and the crime rate controlling for other factors and then using that relationship to estimate the predicted number of officers. This predicted number is then compared to the actual number to see if Canadian CMAs have more or fewer officers than predicted. This difference is then ranked using the min-max methodology.

The socioeconomic determinants of police staffing are complex and any determinants regression will have both demand and cost side factors in the equation. The crime rate is an obvious determinant of the level of police staffing required in terms of officers per 100,000. As well, there are other factors such as the age distribution of a police force, the role of retirement and attrition, and economic factors such as recessions and unemployment that can affect both the levels of crime as well as the fiscal resources available for policing, as well as other local factors affecting crime such as age distribution of local populations and family structure.⁴⁰ In any study, the

³⁹. It should be noted that another approach would be to examine per capita police expenditures in each of the CMAs. Per capita police expenditure data is publically available at the national and provincial level from Statistics Canada but has not been provided in a similar available format at the CMA level.

⁴⁰. Wilson and Weiss summarize many of the factors as follows: the efficiency and productivity of staff, crime rates and their anticipated growth or decline, types and volume of calls, official population/officer ratio requirements, collective bargaining requirements and negotiated workloads, technology, organizational capability, geographic issues, response times, public pressure, and policing styles (2012: 11–13). For example, population density should be considered an important variable when it comes to the cost of police services as per household municipal costs are affected by the economies of scale

variables selected are ultimately a function of the level of aggregation of the analysis and the data available at that level.⁴¹

The data for the regressions is from the Census of Canada and Statistics Canada at the CMA level for major communities for which data on both crime rates and police staffing levels was available in the 2001, 2006, and 2011 census years.⁴² This allowed for additional socio-economic variables for those years to be obtained from the Census of Canada. The number of available CMAs varies by year with 24 communities in 2001, 26 communities in 2006, and 32 communities in 2011.⁴³ The variables that are used in the regressions are summarized in a table in appendix I with sources in the Data Key section. The regression variables are socio-economic variables that other studies discussed earlier have often included in regressions that seek to analyse the determinants of crime rates and police resources.

The model used to estimate the determinants of police officers per 100,000 of population is a simultaneous equations approach with both a crime rate and a police officer regression to address the potential for bi-directional causality.⁴⁴ A simultaneous equation approach is utilized because of the potential for bi-directional causality between the crime rate and police officers per

present in a municipality's size. Found (2012) finds that the costs per household of police services are minimized with a population of about 50,000 residents. However, none of the CMAs in this study have a population below 50,000.

41. Many of the studies have been done for the United States and reflect the variables available there. For example, the determinants of crime used by Worrall and Kovandzic (2010) include police levels, per capita income, percent non-white population, percent of population aged 18 to 24, and the percent employed. Kovandzic and Sloan (2002) use the following as determinants of police levels: crime rates, population shares of males, the unemployment rate, per capita personal income, and prison population, along with geographical dummy variables. Levitt (1997), along with electoral variables as a determinant of police officer staffing and crime rates, also includes public welfare spending per capita, education spending per capita, unemployment rates, percentage of the population that is black, the percentage of female headed households, and the percentage of population aged 15 to 24. The studies done for the United States generally have also made use of much larger data sets.

42. The CMA was selected as the unit of analysis given that the effects of policing are generally local and a large number of CMAs over time provides a relatively larger sample size. It should be noted that CMAs are sometimes composed of multiple municipalities with separate policing jurisdictions with different rules regarding crime reporting procedures, staffing, and response times.

43. Abbotsford-Mission, BC and Kingston, ON appear in 2006 and 2011 while Barrie, ON, Brantford, ON, Guelph, ON, Kelowna, BC, Moncton, NB, and Peterborough, ON only appear in 2011.

44. The estimation technique is two stage least squares and the estimation package is STATA 13.0. Essentially, in this approach the crime rate is regressed on a set of determinants and used to construct a "fitted crime" variable, which is then used in the police officer regression. As well, the crime rate equation uses a "Fitted police resources" variables as part of the estimation process.

100,000 of population, as well as the fact that similar variables can be the determinants of both crime and policing. The same basic set of variables is used in both the crime rate equation and the number of police resources equation, but there are some variables in the crime equation that are correlated with crime but not police resources and vice versa, which serve as instruments—variables that allow for the separate equations to be identified and estimated.⁴⁵

The regression results for both the police resources and crime regressions are presented in appendix II. First, with respect to the determinants of crime rate, the regression results show that the number of police officers per 100,000 of population does have a statistically significant negative effect on the crime rate. Each police officer per 100,000 is associated with a decline of 159 crimes per 100,000 of population.⁴⁶ Relative to Ontario, crime rates in all other regions are significantly higher. As well, the relationship between crime rates and population density is positive as crime rates rise as population density rises, but the result is not very statistically significant.⁴⁷

45. The unemployment rate, the proportion of population aged 15 to 24 years, the proportion of single parent families, the Aboriginal proportion of population, and being a city over 1 million people (big city) are included as independent variables only in the crime rate equation while the full time employment to population ratio and population under 250,000 (small city) are only in the police resources regression while median family income, population density, and regional dummies are in both. The big city variable is in the determinants of crime regression to control for the possibility that there is more crime in big cities while the possible effects of fixed costs and economies of scale is in the police resource regression with the number of the small city variable. A year variable was included in initial specifications to control for potential time trend effects but was highly correlated with other explanatory variables and omitted from subsequent specifications. Moreover, it was conceptually difficult to argue what those time trend effects should be in terms of influencing police staffing and the effects of time were therefore better placed in the residual. As well, weighted regression was used with population of the CMA as the weighting variable using the analytic weight option in STATA. This was done because even after controlling for population density and large versus smaller urban centers, there remains the fact that very large CMAs represent a greater share of Canada's population and therefore should have a greater weight in the regression.

46. The coefficients in this regression can be used to estimate the elasticity or sensitivity of the crime rate to police staffing. At a mean in the CMA data set of 6,990 crimes and 156.2 officers per 100,000 population, a 1% increase in the number of police officers per 100,000 results in a 3.5% decrease in the crime rate, controlling for all other factors (Source: Author's calculations). Determinants of crime rate studies in the United States have found similar results and an elasticity in this study of -3.5% is comparable. Lin (2009) finds estimates of the elasticity of the crime rate to policing ranging from -0.56% for assault to -4.14% for auto theft. Levitt (1997) finds elasticities ranging from 0 for property crime (meaning more police have no effect) to -3.03% for murder. There are however, also lower estimates of the elasticity of crime to police levels for the United States. See for example, Kovandzic and Sloan (2002) or Marvell and Moody (1996).

47. The classic argument is that higher population density affords more opportunities for crime. On the other hand, more densely populated areas offer the potential for greater surveillance and lower crime. See Harries (2006).

The effect of economic variables shows that higher incomes are associated with more crime but the effect is not statistically significant, while higher unemployment rates are associated with less crime. The proportion of single parent families and the proportion of Aboriginal population are both significantly associated with a higher crime rate. As well, bigger cities—defined as CMAs with over 1 million people—are associated with higher crime rates but again the result is not statistically significant. The variables in the regression explain 36% of the variation in the crime rates across these Canadian CMAs, suggesting there are other unexplained local differences that account for variations in crime rates.⁴⁸

As for the determinants of police officers per 100,000, it would appear that there is indeed a positive relationship between the crime rate and police officers per 100,000 of population.⁴⁹ In terms of regional effects, the number of police officers per 100,000 of population is significantly lower in Western Canada relative to Ontario after controlling for other factors. There is a U-shaped and statistically significant relationship between police officers and population density. As well, the effect of the economic variables on police staffing is positive—a reflection of greater full-time employment and higher family incomes eventually translating into greater local resources for police services—but the effect is only statistically significant for median family incomes.

The variables in the regression explain about 39% of the variation in police officers per 100,000 across these Canadian CMAs. This suggests that about two-thirds of the variation is unexplained and could be the result of other micro-level differences such as local variation in crime composition, workloads, collective agreements, community preferences, and other geographic or police technology issues.⁵⁰ These additional micro-level differences unfortunately could not be incorporated into the analysis due to data limitations.

The police resources regression coefficients allows for a comparison of actual staffing with what would be predicted by the variables in the regression. The coefficients were used to predict what the number of police officers per

48. An r-square of 36% is relatively low compared to studies that have been done in the United States but relative to these US studies, this data set is also relatively small (82 observations), does not have as many explanatory variables, and spans a shorter time horizon (three years). For example, Lin (2009) uses a panel of 50 US states covering the period 1970 to 2000 (1,409 observations) with a larger number of socio-economic variables. The r-squares in the various specifications used by Lin range from 62 to 97%.

49. Again the coefficient for this relationship can be used to estimate the elasticity or sensitivity of police staffing to the crime rate. Here, the result is not as sensitive with a 1% increase in the crime rate being associated with only a 0.21% increase in police staffing (Source: Author's calculations).

50. For example, some police services may simply have opted for neighborhood policing methods that are more labour-intensive than others. As well, there is the possibility that traffic and drug offences—which are omitted from the traditional crime rate—may be more taxing of police resources in some CMAs relative to others.

100,000 of population would be for the CMAs in 2011. Of the 32 CMAs for which police staffing was available for 2011, 12 of them had actual staffing levels below what the regression equation would have predicted for them while 20 of them had larger police forces than what were predicted. An interpretation of this result is that police services with the number of police officers per 100,000 below predicted strength are more parsimonious and therefore efficient in their employment of resources.

Table 1 lists the CMAs in alphabetical order and provides their actual numbers of police officers per 100,000 of population and the number predicted by the regression equation.

Table 1: Comparison of actual and predicted number of police officers per 100,000 population for Canadian CMAs, 2011

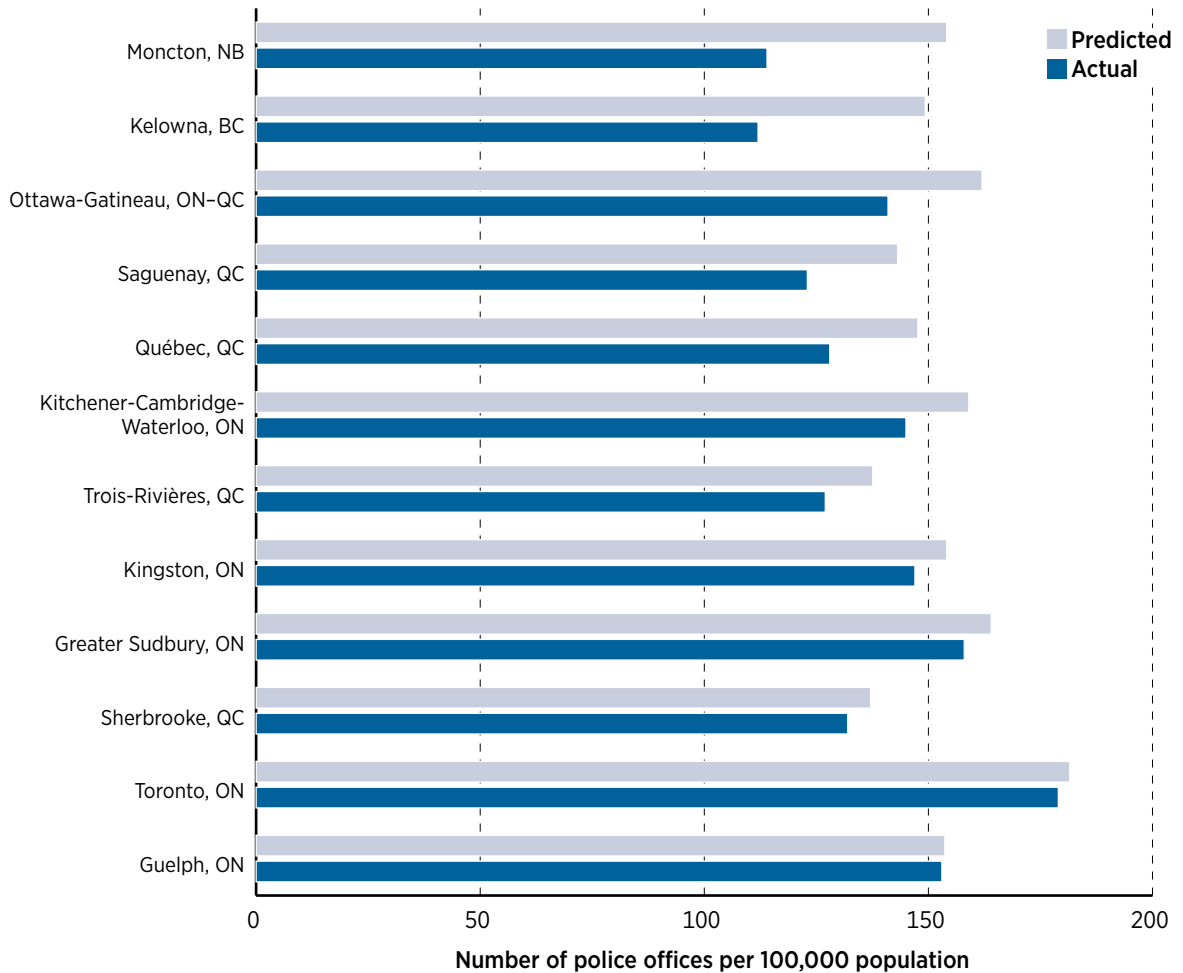
CMA	Actual	Predicted	CMA	Actual	Predicted
Abbotsford-Mission, BC	159	130	Peterborough, ON	163	146
Barrie, ON	155	154	Québec, QC	128	148
Brantford, ON	168	156	Regina, SK	194	177
Calgary, AB	159	146	Saguenay, QC	123	143
Edmonton, AB	164	161	Saint John, NB	200	160
Greater Sudbury, ON	158	164	Saskatoon, SK	182	171
Guelph, ON	153	154	Sherbrooke, QC	132	137
Halifax, NS	171	164	St. Catharines-Niagara, ON	171	138
Hamilton, ON	154	152	St. John's, NL	180	163
Kelowna, BC	112	149	Thunder Bay, ON	193	170
Kingston, ON	147	154	Toronto, ON	179	182
Kitchener-Cambridge-Waterloo, ON	145	159	Trois-Rivières, QC	127	138
London, ON	155	151	Vancouver, BC	165	162
Moncton, NB	114	154	Victoria, BC	155	140
Montréal, QC	182	177	Windsor, ON	181	138
Ottawa-Gatineau, ON-QC	141	162	Winnipeg, MB	187	145

Sources: Statistics Canada, 2012b; author's calculations.

Figures 10 and 11 plot the predicted versus the actual number of police officers per 100,000 of population for Canadian CMAs in 2011.

As **figure 10** shows, the cities with the actual number of officers per 100,000 of population below what would be predicted range from Moncton, NB—with 40 officers per 100,000 less than what would be predicted—to Guelph, ON—with about one officer per 100,000 less than predicted.

Figure 10: Canadian CMAs with actual police strength below predicted, 2011



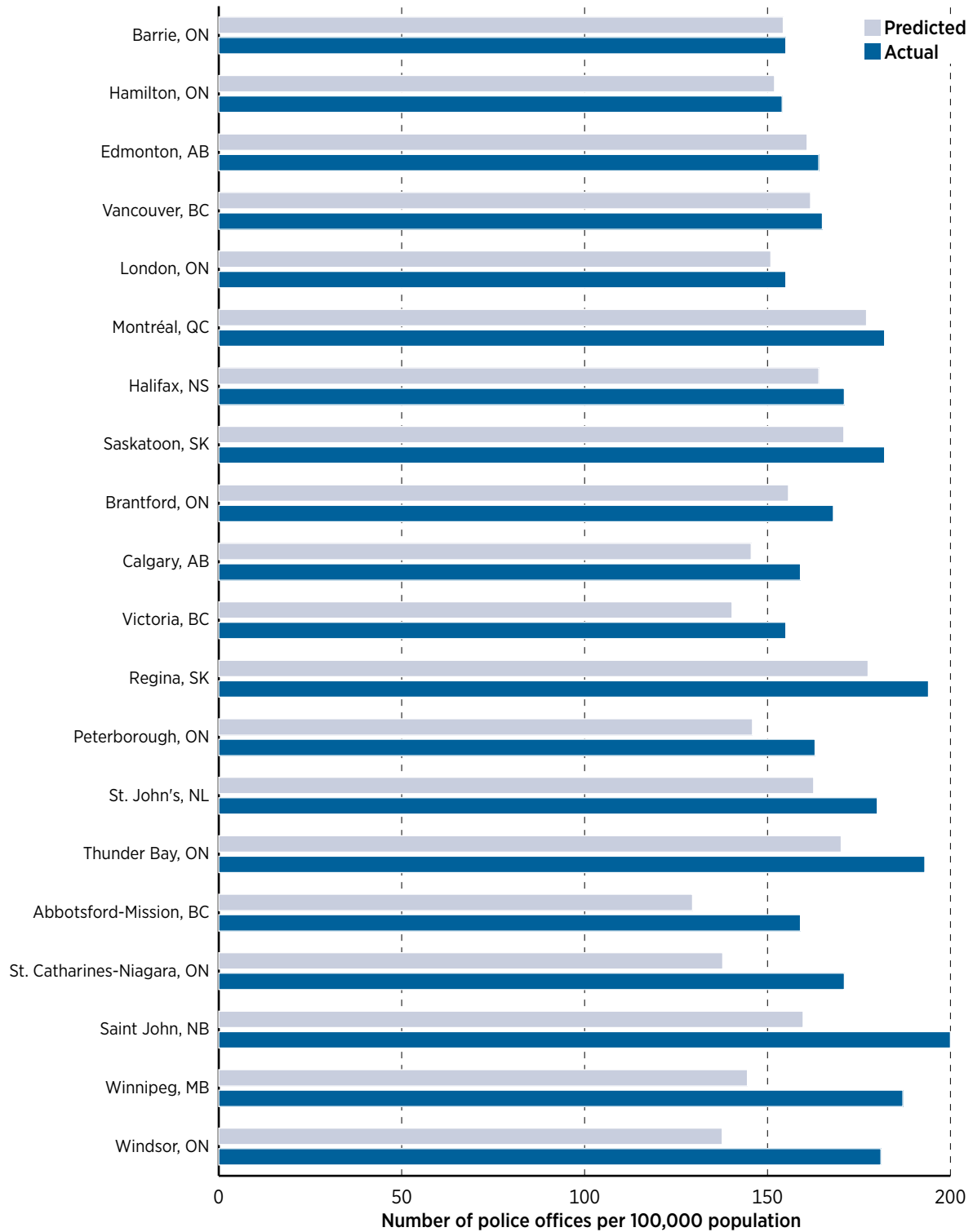
Sources: Author's calculations based on regression results in Appendix 2.

Meanwhile, [figure 11](#) shows differences that range from Barrie, ON with about one officer per 100,000 of population more than predicted to Windsor, ON with 43 police officers per 100,000 of population more than predicted.

The final comparison in [figure 12](#) is an efficiency comparison based on the predicted and actual results from the regression analysis presented in figures 10 and 11. The differences between actual and predicted number of police officers per 100,000 across CMAs were used to calculate an efficiency ranking using the min-max methodology.⁵¹

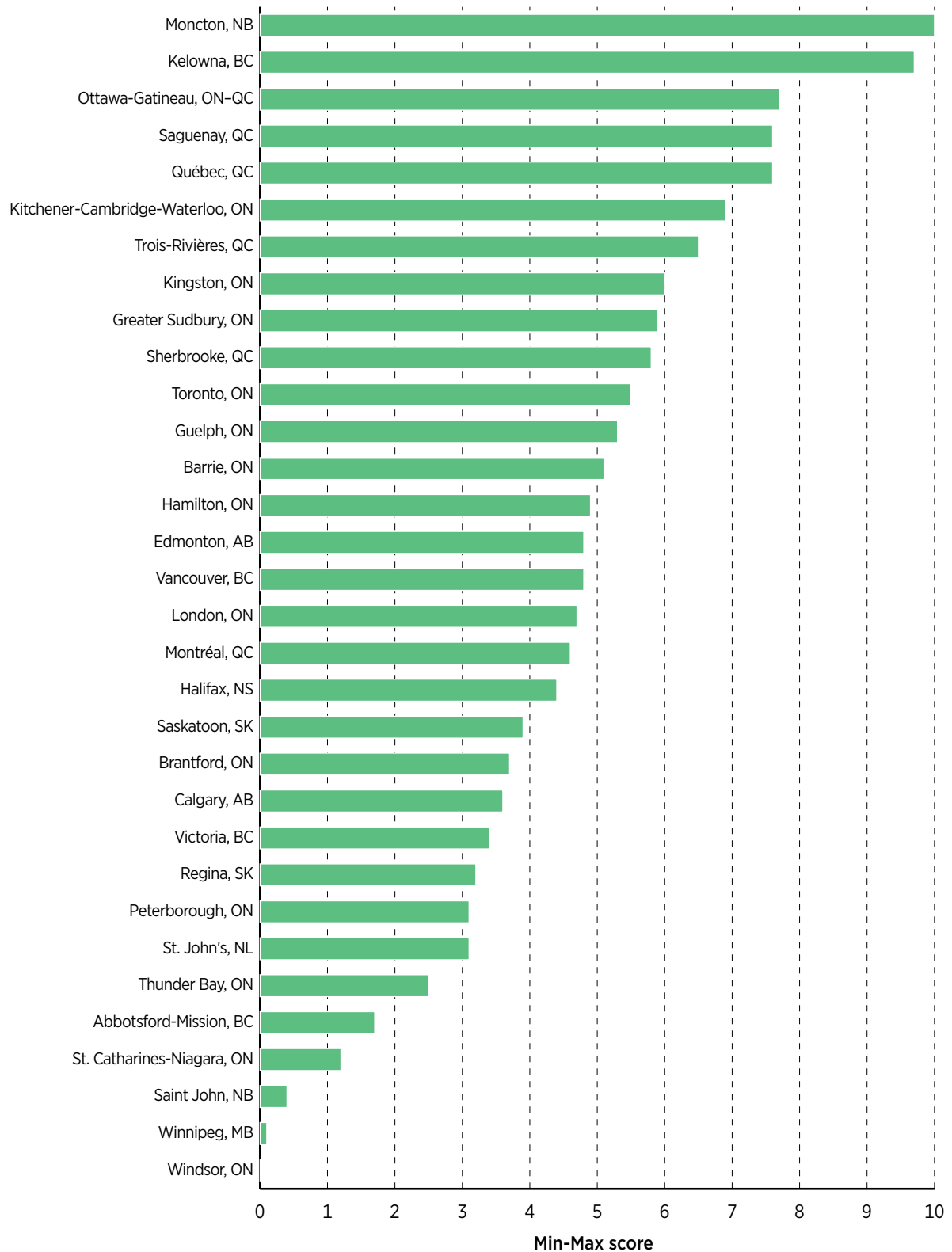
⁵¹ The min-max methodology was applied to the raw data for each of the indicators to generate a score between 0 and 10, and these scores were used to construct a ranking of the outcomes. The min-max methodology is commonly used in Fraser Institute publications to generate standardized scores for comparison purposes. See for example Barua (2012) and Di Matteo (2013). The methodology has also been employed by the United Nations in its Human Development Index Reports.

Figure 11: Canadian CMAs with actual police strength above predicted, 2011



Sources: Author's calculations based on regression results in Appendix 2.

Figure 12: Efficiency comparison of Canadian CMAs based on min-max ranking of regression result differences (predicted versus actual) in police officers per 100,000 of population, 2011



In the case of the difference between actual and predicted number of police officers, the lower score is the more favourable outcome and therefore the formula takes the following form:

$$\left[\frac{(\text{Maximum}(\text{Range of CMA Values}) - \text{CMA Value})}{(\text{Maximum}(\text{Range of CMA Values}) - \text{Minimum}(\text{Range of CMA Values}))} \right] \times 10$$

As figure 12 shows, as measured by the min-max ranking of regression result differences between actual and predicted police officers per 100,000 of population and after controlling for differences in crime rates, regional variation, population density, and other confounding factors, the three most efficient CMAs in terms of police resources are Moncton, NB, Kelowna, BC, and Ottawa-Gatineau, ON–QC. Closely following them and in the top 10 most efficient services are Saguenay, QC, Quebec, QC, Kitchener-Waterloo-Cambridge, ON, Trois-Rivières, QC, Kingston, ON, Greater Sudbury, ON, and Sherebrooke, QC.⁵²

The three least efficient police services in terms of the deployment of police staffing using the criteria in this study are Saint John, NB, Winnipeg, MB, and Windsor, ON. Also in the bottom 10 are St. Catharines–Niagara, ON, Abbotsford-Mission, BC, Thunder Bay, ON, St. John’s, NL, Peterborough, ON, Regina, SK, and Victoria, British Columbia.⁵³

What is interesting about these results is that no region of the country has a monopoly on either the most or least efficient staffing levels when it comes to police officers per 100,000 of population—both types of forces are scattered across the country. Moreover, small and large cities can be found amongst both in the most and least efficient forces. However, Canada’s three largest cities—Toronto, Montreal, and Vancouver—are in neither the top or bottom 10.

This suggests that after controlling for crime rates and other explicit socio-economic confounding factors, substantial differences in staffing remain that are the result of local circumstances and conditions that are not easily identified for quantitative analysis. Amongst these factors may be the types

52. With respect to Canada’s biggest cities, Canada’s largest city, Toronto is in the 11th spot. Vancouver is 16th and Montreal, 18th.

53. It should be noted that this ranking in general displayed some sensitivity to the regression specification and estimation used. An earlier specification and estimation that included time trend but not the Aboriginal proportion of population as variables found the five most efficient cities were Kelowna, BC, Moncton, NB, Kingston, ON, Hamilton, ON, and Saguenay, QC. The specification retained for this study but estimated using un-weighted 2SLS found the top five most efficient cities to be Kelowna, BC, Moncton, NB, Ottawa-Gatineau, ON–QC, Saguenay, QC, and Kitchener-Waterloo-Cambridge, ON with Kingston in sixth place, Quebec City seventh, and Hamilton tenth.

and volume of calls and crimes, any locally mandated official population/officer ratio requirements, collective bargaining requirements and negotiated workloads, technology, organizational capability, geographic issues, response times, public pressure, and policing styles (Wilson and Weiss, 2012: 11–13). Indeed, future research should be directed towards quantifying these other aspects and factors that likely help determine and affect staffing levels in order to improve estimates of efficiency in staffing.

Conclusion

Staffing levels and public expenditures for police forces across the country grew substantially over the last decade even while crime rates dropped dramatically. Between 2001 and 2012, police officers per 100,000 of population in Canada rose 8.7% while the crime rate declined by 26.3%. This was accompanied by an increase in expenditures and a decline in workload as measured by criminal code incidents per officer.

While the nature of policing workloads has been shifting in recent years with the growing complexity and diversity of police work, the need for greater accountability requirements and the expansion of their activities into areas like social and domestic disturbances and mental health, it is their role with respect to public safety and fighting crime that remains at the forefront of public expectations and perceptions. Growing numbers of police officers and declining crime rates raise the question of whether the most efficient use is being made of policing resources across the country.

There is substantial variation in the number of police officers per 100,000 of population across the provinces and territories as well as Canadian CMAs. The highest number of police officers per 100,000 of population and the highest real per capita police expenditures are generally found in the sparsely populated territories. Across the provinces, in 2013 the number of police officers per 100,000 of population was the highest in Manitoba at 213 and the lowest in Prince Edward Island at 160. Real per capita police expenditures in 2012 were the highest in Ontario at \$272.50 (2002 dollars) and lowest in Prince Edward Island at \$148.20.

A regression equation was estimated for the determinants of police officers per 100,000 of population across Canadian CMAs for the census years 2001, 2006, and 2011 that controlled for crime rates and other socio-economic differences. The actual and predicted numbers of police officers per 100,000 were compared and a min-max methodology was employed to rank the differences between predicted and actual numbers to obtain an efficiency ranking. Using this methodology, Kelowna, BC, Moncton, NB, and Ottawa-Gatineau, ON–QC were found to have the most efficient staffing levels with their actual numbers of police officers per 100,000 of population substantially

below what the regression model predicted they could have. Saint John, NB, Winnipeg, MB, and Windsor, ON had the least efficient staffing levels with their actual numbers above what the regression model predicted.

When the efficiency ranking is expanded to the bottom and top 10 CMAs, no region of the country had a monopoly on either most or least efficient staffing levels when it comes to police officers per 100,000 of population—both types of forces are scattered across the country. Moreover, small and large cities can be found amongst both the most and least efficient forces. This suggests that after controlling for crime rates and other explicit socio-economic confounding factors, substantial differences in staffing remain that are the result of local circumstances and conditions that are not easily identified. Some of these differences undoubtedly reflect inefficient use of police resources while others may reflect other more difficult to quantify local socio-economic differences that raise unique challenges to policing. There is substantial scope for police forces across Canada's CMAs to discover what best practices are when it comes to more efficient operation of policing given the range and examples of staffing.

Appendix 1: Regression variables

Dependent Variables

Crimes per 100,000	Criminal code incidents per 100,000 population for Canadian CMAs
Police Officers per 100,000	Policer officers per 100,000 of population for Canadian CMAs

Independent Variables

Atlantic	1 if CMA is in Atlantic Canada (NL, PE, NS, NB), 0 otherwise.
Quebec	1 if CMA is in Quebec, 0 otherwise.
Ontario	1 if CMA is in Ontario, 0 otherwise.
West	1 is CMA is in the West (MB, SK, AB, BC).
Population Density	Population of CMA divided by land area in square kilometres.
Population Density Squared	Population density multiplied by population density.
Median Family Income	Median family income in dollars in CMA.
Unemployment Rate	Rate of unemployment in CMA.
Proportion of Population Aged 15 to 24	Proportion of CMA population aged 15 to 24 years.
Proportion of Population Aboriginal	Proportion of CMA population that is Aboriginal.
Proportion of Single Parent Families	Proportion of total families in CMA headed by a single parent.
Big City	CMA has population bigger than 1 million people.
Small City	CMA has population below 250,000 people.
Ratio of Full Time Employment to Adult Population	Ratio of those employed full time to population aged 25-64 years.

Data source for Variables: Census of Canada and Statistics Canada. See Data Key.

Appendix 2: Population weighted regression results*

(two stage least squares, STATA 13.0 estimation package)

	Crimes per 100,000		Police Officers per 100,000	
	Coefficient	z-statistic ^{**} , ^{***}	Coefficient	z-statistic
Crimes per 100,000			0.0047563	2.52
Police Officers per 100,000	-158.948	-2.09		
Atlantic	3443.269	2.38	-3.1334	-0.32
Quebec	1383.611	2.09	-0.2450083	-0.06
West	3174.034	2.61	-16.46974	-2.13
Population Density	8.67807	1.77	-0.079314	-2.5
Population Density Squared	-0.0001772	-0.03	0.0001124	3.89
Median Family Income	0.0252242	0.37	0.0006464	2.35
Unemployment Rate	-389.414	-1.76		
Full-Time Employment Ratio			57629.71	1.37
Proportion of Population Aged 15 to 24	6199.876	0.12		
Proportion Single Parent Families	129868	2.17		
Proportion Aboriginal	88085.77	2.44		
Big City	309.3324	0.37		
Small City			-1.207266	-0.18
Constant	4492.836	0.55	46.74949	1.17
Wald chi2(12)	109.57		58.89	
Wald chi2(9)				
R-squared	0.3642		0.3937	
N	82		82	

Notes: * Analytic weight option used with population of CMA as weighting variable. ** **Bold** denotes statistically significant at 5% level. *** **Bold italic** denotes statistically significant at 10% level.

Data Key

 [Click to view whole table](#)

Variable	Unit	Source	Year
CMA DATA			
Population	Number	Statistics Canada	2001, 2006, 2011
Land area	Square Km.	Statistics Canada	2001, 2006, 2011
Population density	Population per square Km.	Statistics Canada	2001, 2006, 2011
Median age	Years	Statistics Canada	2006, 2011
			2001
Total families	Number	Statistics Canada	2001, 2006, 2011
Couple families	Number	Statistics Canada	2001, 2006, 2011
Single parent families	Number	Statistics Canada	2001, 2006, 2011
Unattached individuals	Number	Statistics Canada	2001, 2006, 2011
Total employment	Thousands	Statistics Canada	2001, 2006, 2011
FT employment	Thousands	Statistics Canada	2001, 2006, 2011
PT employment	Thousands	Statistics Canada	2001, 2006, 2011
Unemployment rate	Percent	Statistics Canada	2001, 2006, 2011
Population aged 0-14	Number	Statistics Canada	2001, 2006, 2011
Population aged 15-24	Number	Statistics Canada	2001, 2006, 2011

Description	Link
CANSIM Table 051-0046. <i>Estimates of population by census metropolitan area, sex and age group for July 1, based on the Standard Geographical Classification (SGC) 2006</i>	
Population and dwelling counts, for census metropolitan areas, 2011 and 2006 censuses	http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/hltfst/pd-pl/Table-Tableau.cfm?T=205&S=3&RPP=50
Calculations by authors based on Statistics Canada	
2011 Census of Canada: topic-based tabulations - Age and Sex; Catalogue No. 98-311-X2011019	">http://www12.statcan.ca/census-recensement/2011/dp-pd/tbt-tt/Lp-eng.cfm?LANG=E&APATH=3&DETAIL=0&DIM=0&FL=A&FREE=0&GC=0&GID=0&GK=0&GRP=1&PID=0&PRID=0&PTYPE=101955&S=0&SHOWALL=0&SUB=0&Temporal=2011&THEME=88&VID=0&VNAMEE=&VNAMEF=>
2006 Census: Data products - Topic-based tabulations (age and sex)	">http://www12.statcan.ca/census-recensement/2006/dp-pd/tbt/Lp-eng.cfm?LANG=E&APATH=3&DETAIL=0&DIM=0&FL=A&FREE=0&GC=0&GID=0&GK=0&GRP=1&PID=0&PRID=0&PTYPE=88971,97154&S=0&SHOWALL=0&SUB=0&Temporal=2006&THEME=66&VID=0&VNAMEE=&VNAMEF=>
CANSIM Table 111-0011. <i>Family characteristics, by family type, family composition and characteristics of parents, annual</i>	
CANSIM Table 111-0011. <i>Family characteristics, by family type, family composition and characteristics of parents, annual</i>	
CANSIM Table 111-0011. <i>Family characteristics, by family type, family composition and characteristics of parents, annual</i>	
CANSIM Table 111-0012. <i>Family characteristics, by family type, age of older adult, and family income, annual</i>	
CANSIM Table 282-0110. <i>Labour force survey estimates (LFS), by census metropolitan area based on 2006 census boundaries, sex and age group, annual</i>	
CANSIM Table 282-0110. <i>Labour force survey estimates (LFS), by census metropolitan area based on 2006 census boundaries, sex and age group, annual</i>	
CANSIM Table 282-0110. <i>Labour force survey estimates (LFS), by census metropolitan area based on 2006 census boundaries, sex and age group, annual</i>	
CANSIM Table 282-0110.	
CANSIM Table 051-0046. <i>Estimates of population by census metropolitan area, sex and age group for July 1, based on the Standard Geographical Classification (SGC) 2006</i>	
CANSIM Table 051-0046. <i>Estimates of population by census metropolitan area, sex and age group for July 1, based on the Standard Geographical Classification (SGC) 2006</i>	

Variable	Unit	Source	Year
Population aged 25-44	Number	Statistics Canada	2001, 2006, 2011
Population aged 45-64	Number	Statistics Canada	2001, 2006, 2011
Population aged 65+	Number	Statistics Canada	2001, 2006, 2011
Median family income	Dollars	Statistics Canada	
Crime rate and police officers	Per 100,000 Pop	Statistics Canada	2001, 2006, 2011
Aboriginal population	Number	Statistics Canada	2006
		Statistics Canada	2001
		Statistics Canada	2011
PROVINCIAL DATA			
CPI	2002=100	Statistics Canada	All
Population	Number	Statistics Canada	All
Crime rates, police expenditures, and police officers	Per 100,000 Pop	Statistics Canada	2001-2012
Aboriginal population	Number	Statistics Canada	2006
	Number	Statistics Canada	2001

Description	Link
CANSIM Table 051-0046. <i>Estimates of population by census metropolitan area, sex and age group for July 1, based on the Standard Geographical Classification (SGC) 2006</i>	
CANSIM Table 051-0046. <i>Estimates of population by census metropolitan area, sex and age group for July 1, based on the Standard Geographical Classification (SGC) 2006</i>	
CANSIM Table 051-0046. <i>Estimates of population by census metropolitan area, sex and age group for July 1, based on the Standard Geographical Classification (SGC) 2006</i>	
CANSIM Table 111-0011. <i>Family characteristics, by family type, family composition and characteristics of parents, annual</i>	
Statistics Canada, <i>Police Resources in Canada</i> , Statistics Canada, 2001-2007, Catalogue No. 85-225-XIE; 2008-2013, Catalogue No. 85-225-X.; Statistics Canada, 2000-2007, <i>Crime Statistics in Canada</i> , Catalogue Number 85-002-XIE; Statistics Canada, 2008-2012, <i>Police Reported Crime Statistics in Canada</i> , Catalogue No. 85-002-X.	http://www5.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=85-225-X&lang=eng&chprog=1 ; http://www.statcan.gc.ca/pub/85-002-x/2012001/article/11692-eng.htm ; http://www.statcan.gc.ca/pub/85-002-x/85-002-x2012001-eng.htm
Aboriginal identity population by age groups, median age and sex, 2006 counts for both sexes, for Canada and census metropolitan areas and census agglomerations	http://www12.statcan.gc.ca/census-recensement/2006/dp-pd/hlt/97-558/pages/page.cfm?Lang=E&Geo=CMA&Code=01&Table=1&Data=Count&Sex=1&Age=1&StartRec=1&Sort=2&Display=Page
<i>Aboriginal Peoples of Canada: Highlight Tables, 2001 Census</i>	http://www12.statcan.ca/english/census01/Products/standard/themes/DataProducts.cfm?S=1
<i>National Household Survey, Aboriginal population Profile 2011</i>	http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/aprof/index.cfm?Lang=E
CANSIM Table 326-0021. <i>Consumer Price Index (CPI), 2009 basket, annual (2002=100)</i>	
CANSIM Table 051-0001. <i>Estimates of population, by age group and sex for July 1, Canada, provinces and territories, annual</i>	
Statistics Canada, <i>Police Resources in Canada</i> , Statistics Canada, 2001-2007, Catalogue No. 85-225-XIE; 2008-2013, Catalogue No. 85-225-X.; Statistics Canada, 2000-2007, <i>Crime Statistics in Canada</i> , Catalogue Number 85-002-XIE; Statistics Canada, 2008-2012, <i>Police Reported Crime Statistics in Canada</i> , Catalogue No. 85-002-X	http://www5.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=85-225-X&lang=eng&chprog=1 ; http://www.statcan.gc.ca/pub/85-002-x/2012001/article/11692-eng.htm ; http://www.statcan.gc.ca/pub/85-002-x/85-002-x2012001-eng.htm
CANSIM Table 109-0300. <i>Census indicator profile, Canada, provinces, territories, health regions (2011 boundaries) and peer groups, every 5 years</i>	Based on Statistics Canada, 2006 Census (20% sample)
CANSIM Table 109-0200. <i>Census indicator profile, Canada, provinces, territories, health regions and peer groups, 2001, every 5 years</i>	Based on Statistics Canada, 2001 Census (20% sample)

Variable	Unit	Source	Year
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NOTES

Total families: Only includes number of families; unattached individuals are excluded. Families are comprised of: 1) couples (married or common-law, including same-sex couples) living in the same dwelling with or without children, and 2) single parents (male or female) living with one or more children. Persons who are not matched to a family become persons not in census families. They may be living alone, with a family to whom they are related, with a family to whom they are unrelated or with other persons not in census families. Beginning in 2001, same-sex couples reporting as couples are counted as couple families.

Couple families: A couple family consists of a couple living together (married or common-law, including same-sex couples) living at the same address with or without children. Beginning in 2001, same-sex couples reporting as couples are counted as couple families.

Single parent families: A lone-parent family is a family with only one parent, male or female, and with at least one child.

Description	Link
<p>Unattached individuals: A person not in census families is an individual who is not part of a census family, couple family, or lone-parent family. Persons not in census families may live with their married children or with their children who have children of their own. They may be living with a family to whom they are related or unrelated. They may also be living alone or with other non-family persons.</p>	
<p>Median family Income: This data only takes into account the income of families (with or without children, couples, and single parents). Unattached individuals are excluded. Total income is income from all sources. A detailed definition of what is included in total income is available from the User's Guide to this series, available at http://www.statcan.gc.ca/imdb-bmdi/4105-eng.htm.</p>	
<p>Crime rate: Crime rate represents the number of criminal code incidents (excluding traffic offences) per 100,000 population.</p>	

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