Public Sector Pay Inequality Dynamics in Baltimore, Boston, and New York City

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Executive Summary

In recent years, major cities have published high quality data on their payroll's annual salaries and overtime earnings. Paying employees is a major expenditure for cities. In 2018, the city of Baltimore spent $804 million on 11,658 employees, Boston spent $909 million on 8,854 employees, and New York City spent $16 billion on 195,194 employees (excluding teachers and part-time workers). These large sums of expenditure raise questions of who is earning this income and whether the earnings inequality documented in the private sector is readily apparent in the urban public sector.

We study trends in public sector pay inequality in Baltimore City, Boston, and New York City. We observe large differentials in pay at a point in time and over time. Pay inequality has increased from 2011 to 2018 in Boston and Baltimore. The ratio of total earnings in 2011 between the 90th percentile and the 50th percentile in Boston was 1.71 while in 2018 this disparity grew to 1.85. In Baltimore, this ratio increased from 1.6 to 1.79. In New York City, the ratio grew only slightly from 2.61 to 2.63. In Baltimore and Boston, police and fire department employees experienced larger gains in total pay at the top of the total pay distribution than at the bottom, resulting in rising pay inequality. Overtime earnings contributed to pay inequality in all three cities. In Baltimore, the mean overtime earnings of those at the top of the total pay distribution were more than the total pay of those near the median in 2018. A gender gap in earnings is observed in all three cities with the female to male median total pay ratio at 79.62% in Baltimore, 71.17% in New York City, and 59.37% in Boston. These gender gaps have slightly narrowed in recent years.

Introduction

Big city newspapers such as the Baltimore Sun, the Boston Globe, and the New York Post report each year on the superstar pay, often driven by overtime pay, earned by a few local public employees. News articles name police officers who earn over $680,000 and plumbers earning over $300,000.[1,2] In 2018, 40 of the 50 highest paid Baltimore City employees worked for the police department.[3] Cities spend large sums of taxpayer dollars on public employee salaries, with top earners taking home impressive salaries. In 2018, the city of Boston spent over $900 million on the salaries of 8,854 full-time public employees (not including teachers), which accounted for nearly a third of the adopted budget for the year.[4] These facts raise questions about fairness and the potential alternative uses of scarce government funds.

Rising public sector pay inequality is an underexplored topic that has social and economic consequences. City governments have key responsibilities for providing basic services that form the backbone of urban quality of life. Cities face budget constraints. Broadly given a tax base, city governments can allocate funds to either operating or capital budgets, investing in labor or infrastructure maintenance and improvements. This raises questions of opportunity cost. In cities such as Baltimore, many public schools are unable to afford air conditioning and proper heating, leading to school cancellations and lost days of learning.[5,6]

The rise of the open source urban big data movement creates an opportunity to benchmark cities both at a point in time and over time with respect to how public sector workers are paid. We focus on Baltimore City, Boston, and New York City because they are three major cities that readily supply high quality micro data about their public sector pay. In this report, we do not investigate whether this payment is fair or efficient. Instead, we seek to establish a set of facts documenting inequality in total pay (salary plus overtime) both within major cities at a point in time and across cities as time passes.

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[1] Officer Shawn Harris, Boston Police Department, $684,000 (due to back pay). McDonald, D. "5 police officers top Boston's payroll for 2018." *The Boston Globe*. February 22, 2019/ https://www.bostonglobe.com/metro/2019/02/22/five-boston-police-officers-top-city-payroll-for/aG7IEGiZK9pUkeSyOwkppN/story.html Accessed 10/13/19.

[2] Plumber Vincenzo Giurbino, Housing Authority, $315,158. Post Staff Report. "Reports show NYC plumbers are making a fortune in overtime." *New York Post*. December 23, 2018. https://nypost.com/2018/12/23/reports-show-plumbers-are-among-the-citys-top-earners/ Accessed 10/13/19.

[3] Broadwater, L. "Once again, most highly paid Baltimore employees are police officers." *The Baltimore Sun*. September 26, 2018. https://www.baltimoresun.com/politics/bs-md-ci-police-ot-pay-20180926-story.html Accessed 10/17/19.

[4] Table 2

[5] Richman, T. "Baltimore schools without air-conditioning dismissing early for third time this year." *The Baltimore Sun*. September 23, 2019. https://www.baltimoresun.com/education/bs-md-schools-air-conditioning-early-dismissal-20190923-5yjf72jaqzehtfpkcglwcrgm6a-story.html Accessed 10/13/19.

[6] Joshua, G., Hurwitz, M., Park, J., and Smith, J. "Heat and Learning." *NBER*. Working Paper No. 24639. May 2018. https://www.nber.org/papers/w24639

Research Questions

The rise in income inequality has been a topic of growing importance and concern with an emerging body of literature investigating the trends and causes (Piketty and Saez (2006) and Saez and Zucman (2016)).[7,8] This research has mainly focused on trends in private sector pay inequality. Yet, over 15% of the workforce is employed by the public sector.[9]

Previous research on public sector employment and income has mostly focused on pension liabilities, collective bargaining, and union contracts (Rauh (2015), Freeman and Han (2016), DiSalvo and Kucik (2017), and Frandsen (2015)).[10,11,12,13] Other research has looked at how public sector unions have affected pay inequality and the role that gender and skill play (Card, Lemieux, Riddell, 2018).[14] Previous studies have also investigated the question of whether collective bargaining and unions have led to high public sector pay relative to private sector pay (Keefe, 2015).[15]

Research on wage dispersion in the private and public sector from 1970 to 2000 found an increasing gap between public sector pay relative to the private sector. This raises concerns about public sector worker attraction and retention, especially in an increasingly competitive economy (Borjas 2002).[16]

[7] Piketty, T. and Saez, E. "The Evolution of Top Incomes: A Historical and International Perspective." *American Economic Review*. 96(2). May 2006. https://www.aeaweb.org/articles?id=10.1257/000282806777212116

[8] Saez, E. and Zucman, G. "Wealth Inequality in the United States since 1913: Evidence from Capitalized Income Tax Data." *The Quarterly Journal of Economics*. 131(2). May 2016. https://academic.oup.com/qje/article/131/2/519/2607097

[9] Bureau of Labor Statistics. Employment by major industry sector, 2018. https://www.bls.gov/emp/tables/employment-by-major-industry-sector.htm Accessed 10/23/19.

[10] Rauh, J. "Why City Pension Problems Have Not Improved, and a Roadmap Forward." *Hoover Institution Economics Working Papers*. January 19, 2015. https://www.hoover.org/sites/default/files/15101_-_rauh_-_why_city_pension_problems_have_not_improved_and_a_roadmap_forward.pdf

[11] Freeman, R. and Han, E. "The War Against Public Sector Collective Bargaining in the US." *Journal of Industrial Relations*. 54(3), 386-408. May 28, 2012. https://journals.sagepub.com/doi/pdf/10.1177/0022185612442279

[12] DiSalvo, D. and Kucik, J. "Unions, Parties, and the Politics of State Government Legacy Cost." *Policy Studies Journal*. 46(3). 2018. https://onlinelibrary.wiley.com/doi/pdf/10.1111/psj.12232

[13] Frandsen, B. "The Effects of Collective Bargaining Rights on Public Employee Compensation: Evidence from Teachers, Firefighters, and Police." *ILR Review*. 69(1), 84-112. https://journals.sagepub.com/doi/full/10.1177/0019793915603068

[14] Card, D., Lemieux, T. and Riddell, W.C. "Unions and Wage Inequality: The Roles of Gender, Skill, and Public Sector Employment." *NBER*. Working Paper No. 25313. November 2018. https://www.nber.org/papers/w25313.pdf

[15] Keefe, J. "Laws enabling public-sector collective bargaining have not led to excessive public-sector pay." *Economic Policy Institute*. Briefing Paper #409. October 16, 2015. https://www.epi.org/publication/laws-enabling-public-sector-collective-bargaining-have-not-led-to-excessive-public-sector-pay/

[16] Borjas, G. "The Wage Structure and the Sorting of Workers into the Public Sector." *NBER*. Working Paper No. 9313. October 2002. https://www.nber.org/papers/w9313.pdf

Little research has focused on pay inequality within the public sector and observed trends over time. We address this research gap by focusing on several key questions. Has pay inequality increased? Is overtime driving increases in total pay and pay inequality? Has pay increased more in certain city departments such as the police and fire department? Is there a gender pay gap? Are gender pay disparities improving or worsening? Are cities hiring more workers per capita over time?

Data

A city's total labor expenditure can rise either because more workers are employed or because average earnings are rising. By observing employees for the same cities over multiple years we explore both of these margins. Since we observe the total pay for each worker, we can measure each city's overall annual empirical earnings distribution.

We access publicly available data on public sector employee pay made accessible through open government data portals.[17] The data cover 2011 to 2018 for Baltimore City and Boston and 2014 to 2019 for New York City. These include all available years of data as of September 2019. We work with nominal dollar values and do not deflate the data as we are studying a time of low inflation.

We are not able to include teacher pay in our datasets as Baltimore City does not include teachers in their dataset. Data on teacher pay in Baltimore City is only publicly available for the most recent year. For an even comparison, we remove teachers from the Boston and New York City datasets. Schools are also funded by school districts, not simply by local urban governments. For these reasons, we avoid them in this analysis.

To focus our analysis on full-time employees, we remove the following from our datasets. We drop observations if an employee received gross pay under $5,000 in a year, worked fewer than 600 hours in a year (which assumes 40 work weeks at 15 hours a week and less is a part-time employee), and remove interns, students, and temporary workers who are listed as non-salaried employees or as temporary employees.

We use *genderize.io*, an Application Programming Interface (API), to generate a "likely gender" variable from the first names in the datasets. This method uses names from the *genderize.io*

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[17] Analyze Boston. https://data.boston.gov/dataset/employee-earnings-report Open Baltimore. https://data.baltimorecity.gov/City-Government/Baltimore-City-Employee-Salaries-FY2018/biyh-j8tc NYC Open Data. https://data.cityofnewyork.us/City-Government/Citywide-Payroll-Data-Fiscal-Year-/k397-673e Accessed September 2019.

database created by Casper Strømgren in August 2013.[18] In Appendix I, we report more details about our methodology.

We assume that the administrative databases report accurate data on total pay for employees. We also assume that a worker in a given city and in a given year is equally productive as another public sector worker in another city in the same year. If New York City workers are twice as productive as Boston workers, then comparing pay per worker across cities does not offer a valid benchmark.

Findings

The Level of Pay Between Cities

To examine the level of pay between Baltimore, Boston, and New York City public sector employees, we observe the distribution of total pay. Tables 1-3 (see Appendix II for tables) and Charts 1 and 2 show the change in total pay for each city from the earliest year of available data to the most recent year at nine points in the distribution. As Chart 1 shows, the level of pay was highest at most of the points across the distribution in Boston, followed closely by New York City, with Baltimore employees at the top of the distribution far lower in the start year.

Chart 1: Total Pay Distribution for Public Sector Employees in Start Year

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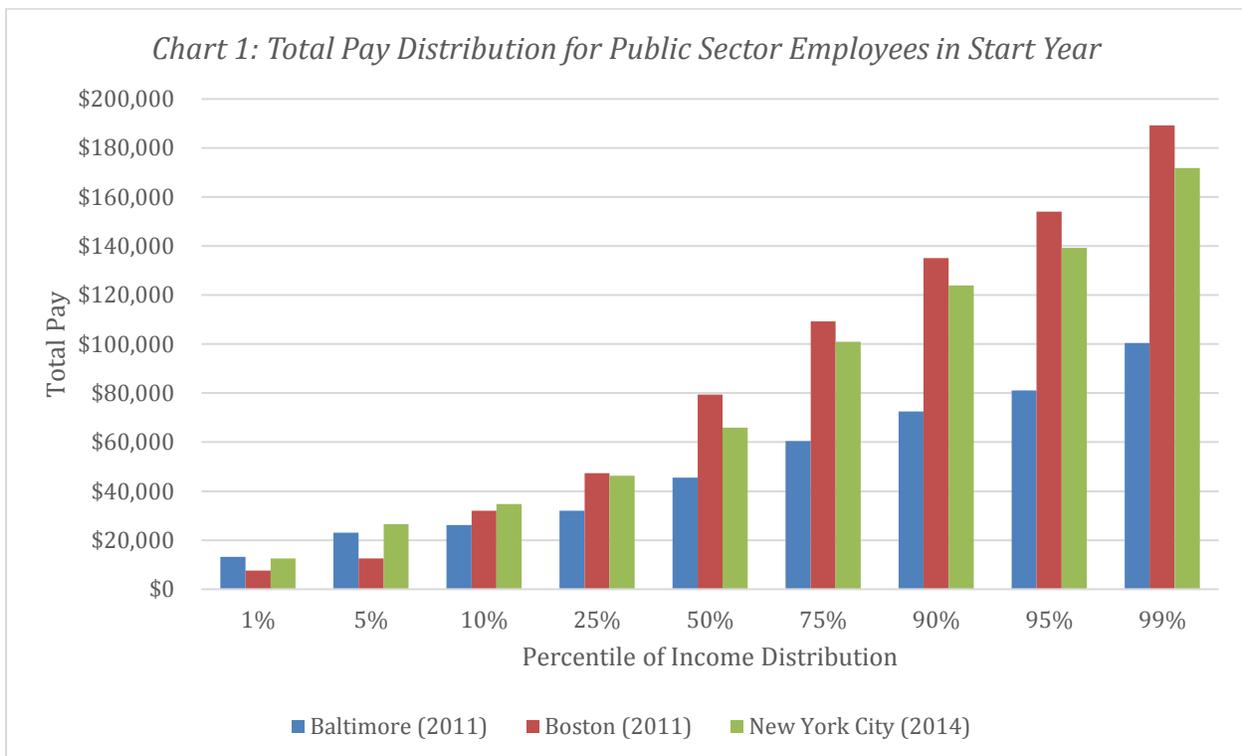
[18] Wais, K. "Gender Prediction Methods Based on First Names with genderizeR." *The R Journal*. 8(1). August 2016. https://journal.r-project.org/archive/2016-1/wais.pdf

Chart 2 shows that growth in total pay in Baltimore City resulted in earnings closer to those of New York City by the end year, but did not reach the total pay of employees in Boston, who also experienced significant growth.

Chart 2: Total Pay Distribution for Public Sector Employees in End Year
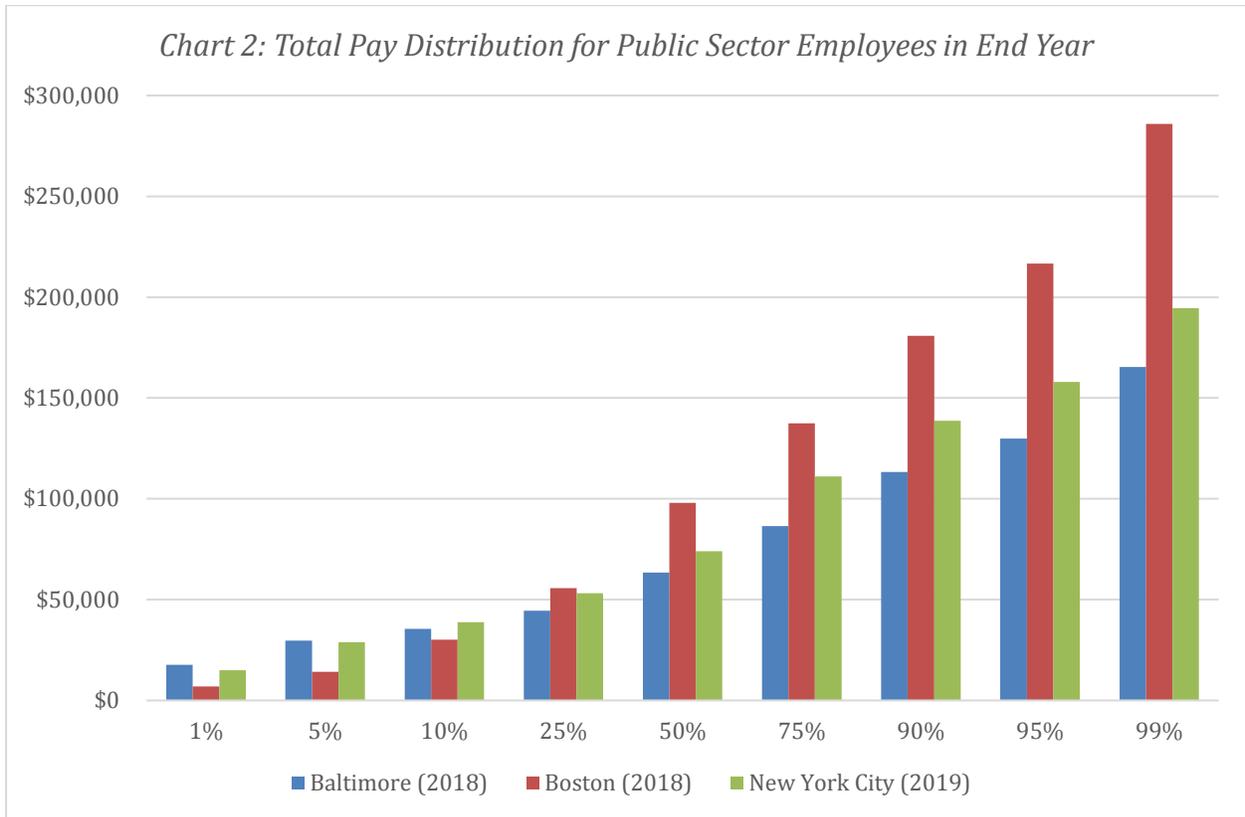
All cities experienced growth in median public employee total pay over the sample period. In Baltimore (Table 1), median total pay grew by nearly 40%, the highest level of growth, but the lowest starting total pay. It grew from $45,500 in 2011 to $63,400 in 2018. Boston (Table 2) experienced similar growth in median total pay of nearly $20,000, but the median in 2011 was over $30,000 higher than in Baltimore at $79,300. In New York City (Table 3), median total pay grew by the least (12%) from $65,900 to $74,000, but growth occurred over the shortest time period in the data, 2014 to 2019.

In the most recent year of data, both New York City and Baltimore had smaller median total pay, $74,000 and $63,400 respectively, than Boston in its earliest year, $79,300. The median total pay in Boston increased to roughly $98,000 in 2018, which was more than the 75th percentile in Baltimore in 2018 ($86,500).

While gaps in the levels of pay between the three cities decreased over time, substantial increases in Boston's level of pay offset some of Baltimore's increases. Baltimore's increases in total pay

brought it more in line with the pay distribution in New York City. Total pay in Boston remained the highest across the majority of points in the distribution, and especially those at the top.

Growth in Pay Inequality in Urban Public Sector Earnings

The level of pay increased at almost all points in the distribution in all three cities, but how did increases differ between different points in the distribution? Are those earning the most experiencing the greatest increases in pay? Is pay inequality getting worse over time? We examined trends in total pay inequality by comparing increases in total pay across the distribution in each city.

Chart 3 shows that Baltimore and Boston experienced the greater increases in total pay toward the top of the pay distribution with a growth of over 50% at the 99th percentile in Boston and a growth of almost 65% at the 99th percentile in Baltimore. However, in the start year in 2011, Boston's public sector pay was much higher than in Baltimore.[19] In New York City, the increases were much less and more evenly distributed across the percentiles, with a 13% growth at the 99th percentile and a 19% growth at the 1st percentile. But again, in the start year, New York City had a higher median and 99th percentile compared to Baltimore.

Chart 3: Change in Total Pay for Public Sector Employees by Percentile of Income Distribution From Start Year to End Year


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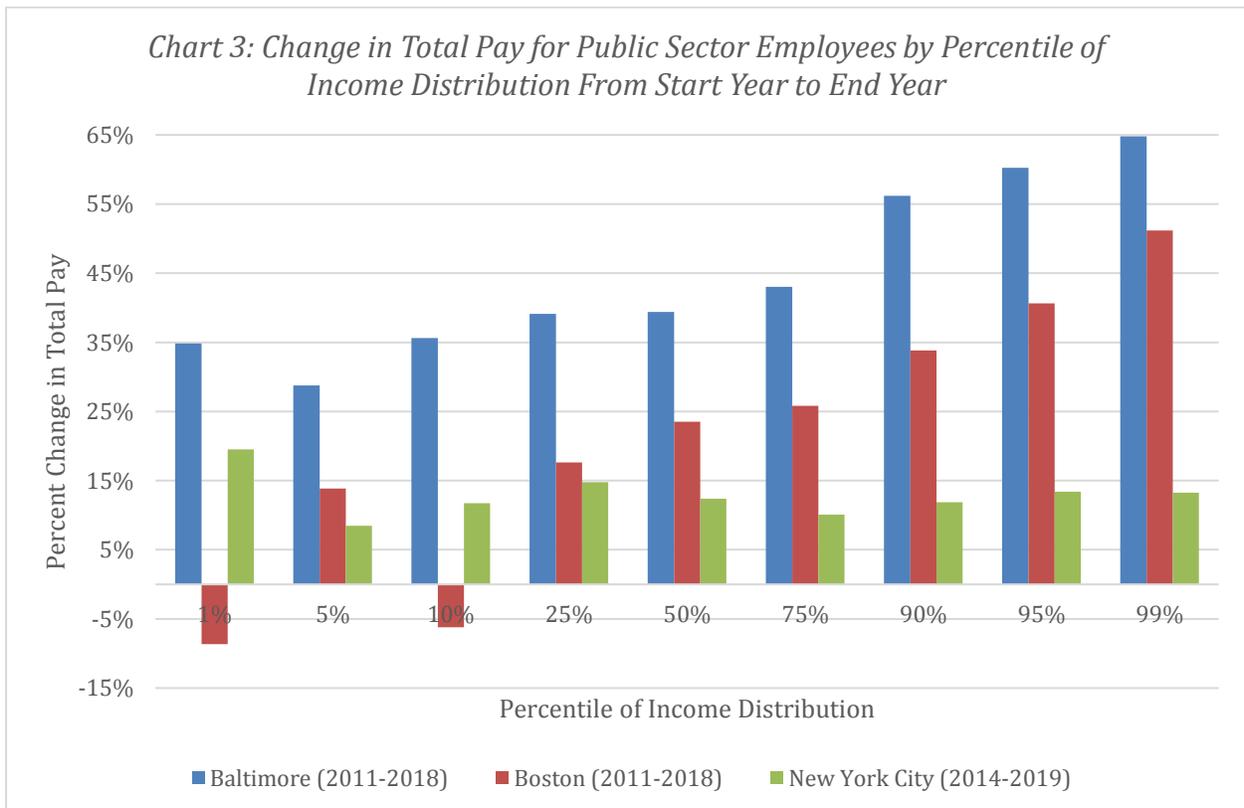
[19] See Tables 1 and 2

In 2018, the employee at the 99th percentile earned nearly three times the total pay of the employee at the median in Boston. This same figure was 2.6 times in Baltimore (2018) and New York City (2019).

Over the time period examined, total pay of public sector employees in Baltimore and Boston became more unequal. In New York City, growth in total pay was more evenly distributed.

Overtime and Over Budget?

Cities are increasingly concerned with persistent overtime spending surpassing adopted budgets. In Baltimore, the police department spent more than double its overtime budget in the fiscal year ending June 30, 2018.[20] This raises concerns about a growing gap between budgeted and actual payroll expenditures and an increasing reliance on overtime.

We examine the share of overtime pay at different points in the pay distribution in each city. Table 4 and Chart 4 show overtime pay as a share of mean total pay for employees in different cross sections of the total pay distribution in each city in 2018.[21]

Chart 4: Base Pay and Overtime Pay for Public Sector Employees in 2018

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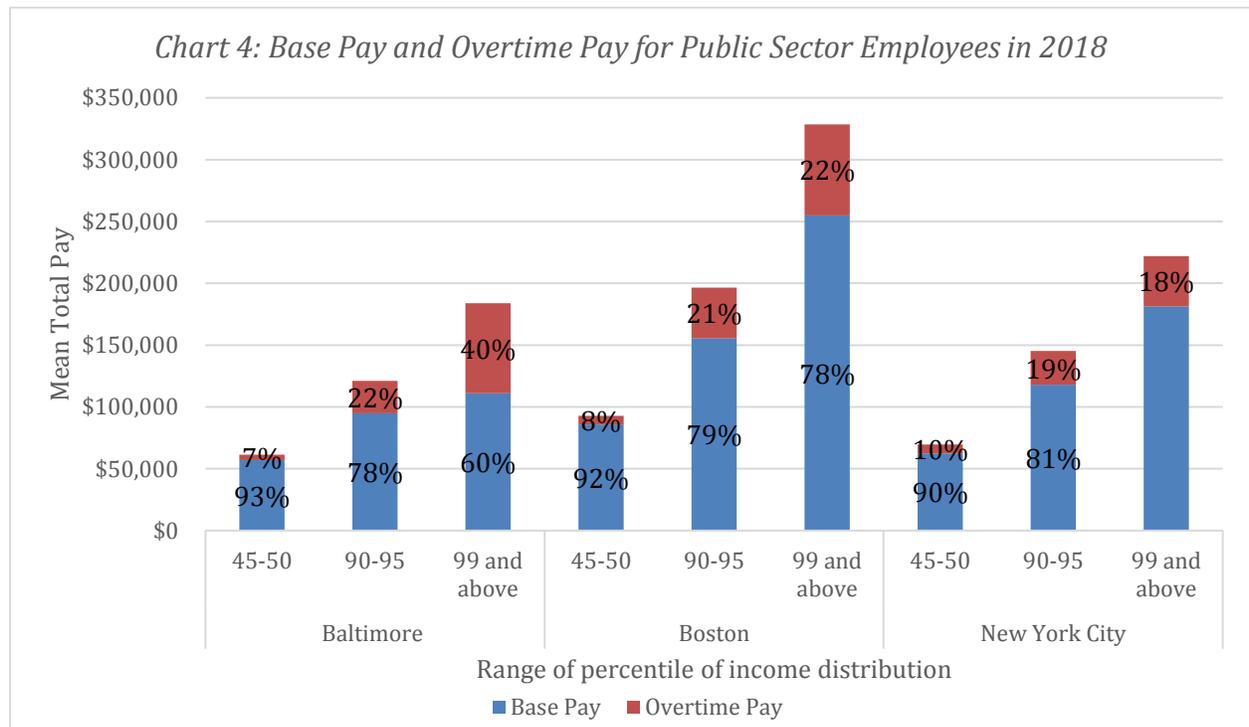
[20] Broadwater, L. and Duncan, I. "Baltimore to use $21 million in excess tax revenue to pay for police OT that ran over budget." *The Baltimore Sun*. June 6, 2018. https://www.baltimoresun.com/maryland/baltimore-city/bs-md-ci-police-overtime-20180605-story.html

[21] The mean pay was calculated across the percentile range. The percent overtime number was calculated as the mean overtime pay across the percentile range divided by the mean total pay. Base pay is defined as total pay minus overtime pay.

The chart shows that those at the higher end of the total pay distribution had a higher share of their pay, on average, coming from overtime. In Baltimore, employees at the 99th percentile and above had 39.6% of their total pay coming from overtime hours, which was almost double the share of those at the 90th to 95th percentile and 32 percentage points more than those at the 45th to 50th percentile in 2018. In Baltimore, the mean overtime earnings of those at the top of the distribution were more than the total pay of those near the median.[22]

In Boston and New York City, the share of total pay that was attributable to overtime pay was significantly less at the top of the income distribution compared to Baltimore, but similar to Baltimore for the 90th to 95th percentile and 45th to 50th percentile.

It is clear that those earning higher total pay earn a greater percentage of their pay from overtime. Overtime pay distribution is most unequal in Baltimore and there is a clear trend that those at the top of the pay distribution earn a larger percentage of their total pay from overtime compared to those near the median.

Rising Pay Inequality for the Police and Fire Departments

Particular attention is given to police department budgets in large cities in the US and the amount of money spent on overtime. The Baltimore Sun and the Boston Globe publish stories of exorbitant overtime spending and over 90% of police budgets going to personnel costs.[23,24] A recent story in the Baltimore Sun highlighted that the Baltimore Fire Department was "using overtime to fill nearly one-third of shifts amid daily staffing shortages."[25]

Tables 5-7 show the total pay distribution for police and fire departments in each city from the earliest available year to the most recent year of data. Chart 5 shows the percent increase in pay across the distribution from start year to end year. Police and fire department employees experienced total pay growth at all levels in all observed cities. Overall, Baltimore experienced the highest pay increases at the most points in the income distribution, followed by Boston and New York City. Similar to all employees, with the exception of the 5th percentile, Boston and

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[22] Note: In Baltimore, the overtime pay variable captures all other pay, including time off, not just overtime pay. This results in some employees in the data having negative "overtime" hours. However, this is consistent across the distribution.

[23] Fenton, J. "Baltimore police overtime spending soars as department grapples with understaffing, shift changes." *The Baltimore Sun*. April 22, 2017. https://www.baltimoresun.com/news/investigations/bs-md-ci-police-overtime-budget-woes-20170408-story.html Accessed 10/13/19.

[24] Ransom, J. "For some Boston officers, extra money comes easy." *The Boston Globe*. June 20, 2017. https://www.bostonglobe.com/metro/2017/06/20/for-some-boston-police-officers-extra-money-comes-easy/oS47lc7OuYyVZbTPBv1zQL/story.html Accessed 10/13/19.

[25] Rector, K. "Baltimore Fire Department using overtime to fill nearly one-third of shifts amid daily staffing shortages." *The Baltimore Sun*. March 19, 2019. https://www.baltimoresun.com/maryland/baltimore-city/bs-md-fire-department-overtime-20190315-story.html Accessed 10/13/19.

Baltimore police and fire department employees experienced higher growth at the upper levels of the income distribution, while in New York City, gains were distributed more evenly.

Chart 5: Change in Total Pay for Police and Fire Department Employees by Percentile of Income Distribution From Start Year to End Year
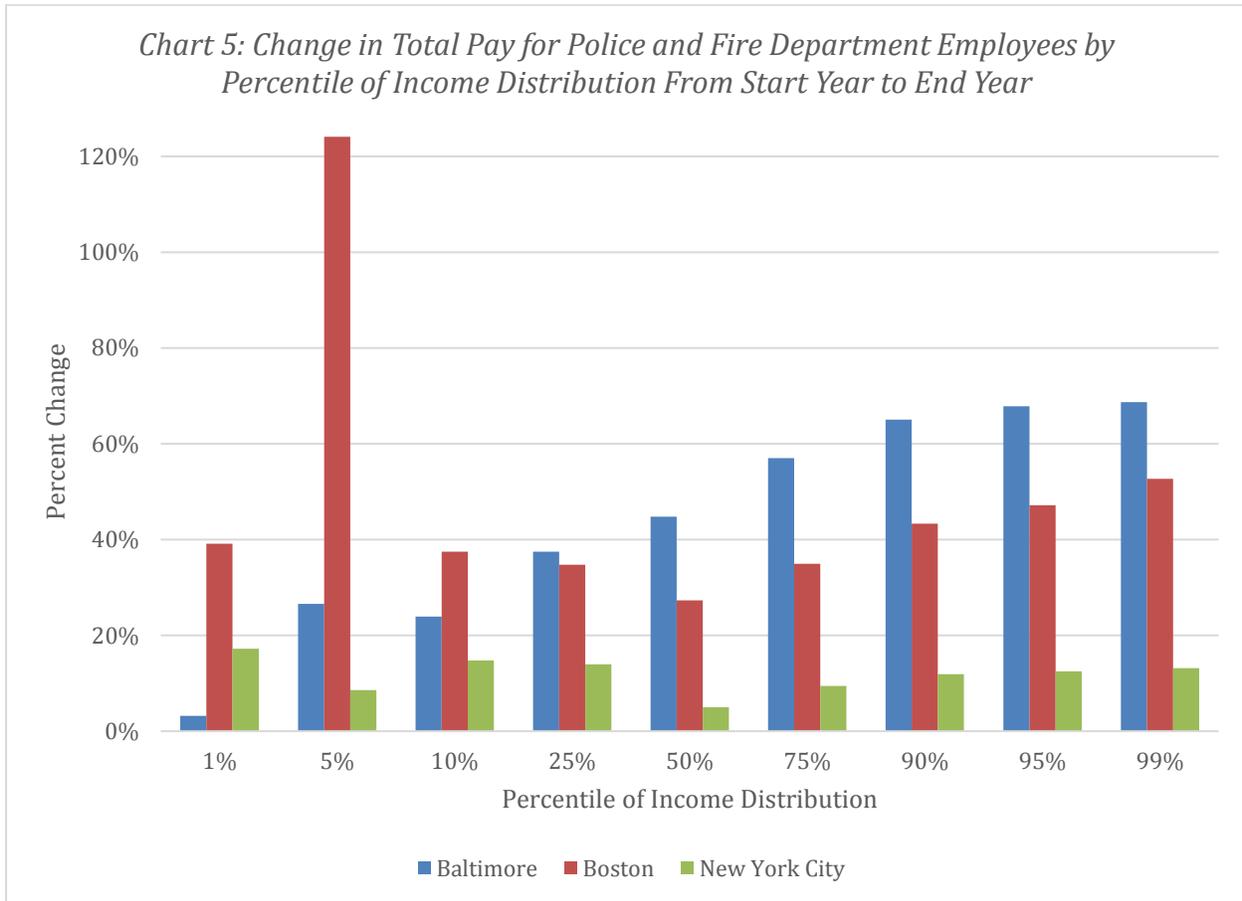
Chart 6 shows the total pay distribution for police and fire department employees in the end year of the data. Median total pay in Boston (Table 5) was highest in both the start and end year, growing by 27% from $104,200 in 2011 to $132,700 in 2018. The median total pay was higher in Boston in the first observed year than it was in the final observed year in Baltimore ($17,000 lower) and New York City ($5,000 lower). Median total pay in Baltimore (Table 6) grew at the fastest rate of any observed city by 45% from $60,200 in 2011 to $87,200 in 2018, but still remained the lowest of any city in the final year. New York City (Table 7) had the least growth of median total pay, growing just 5% from $94,700 in 2014 to $99,500 in 2019.

In 2018, the police and fire department employee at the 99th percentile in Boston earned $305,000 compared to $199,600 in New York City and $177,200 in Baltimore City. One

explanation for the high pay rates in Boston is that back pay has led to significant increases in total pay as a result of legislation in Boston in recent years.[26]

Chart 6: Total Pay Distribution for Police and Fire Department Employees in End Year
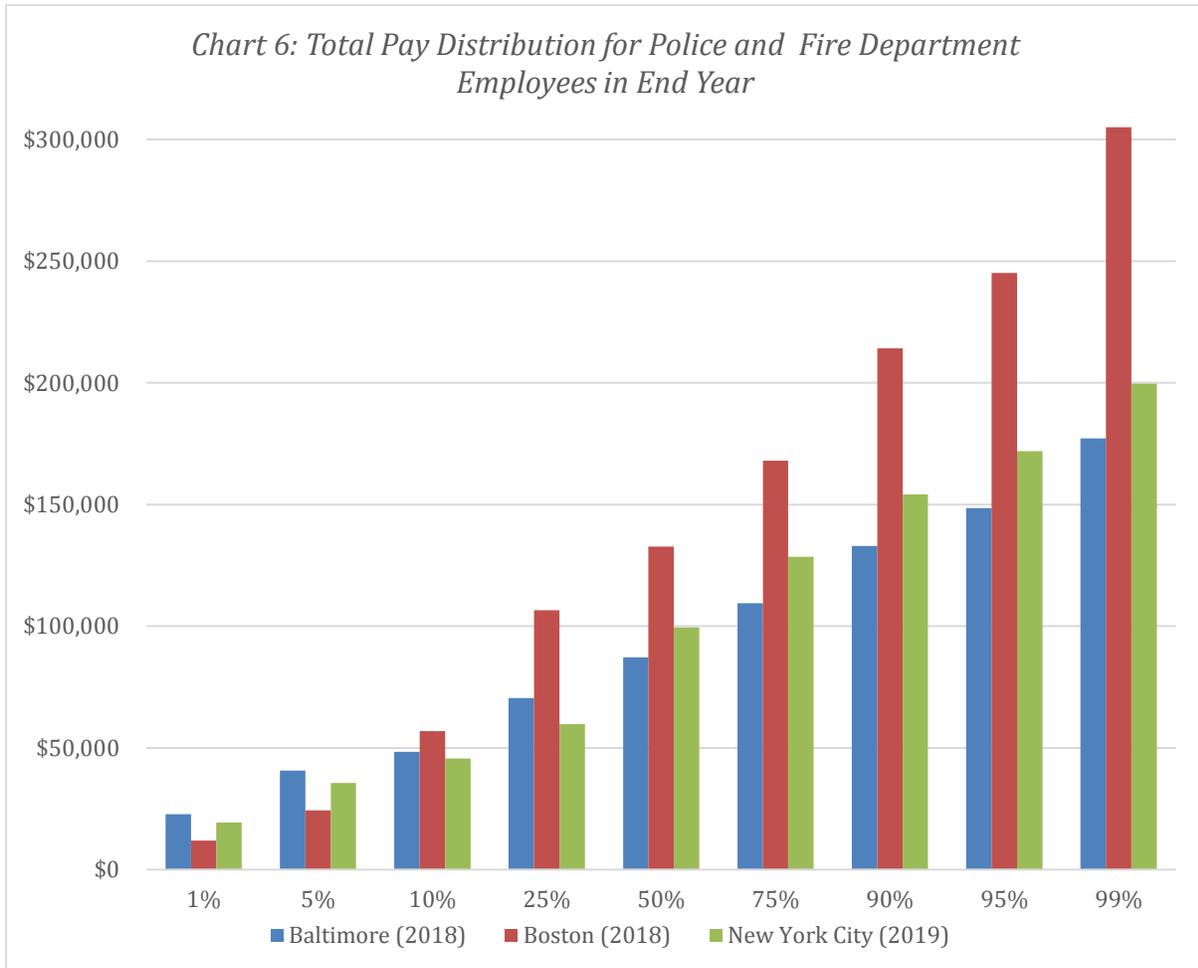
We separate police and fire department employee median total pay in Tables 8 and 9 on the following page to observe differences between the departments. Table 8 shows the total pay of the median police department employee in each city and the change from the start to end year. Baltimore City Police Department (BPD) employees experienced the greatest increase in median total pay over the time period of any observed police department, but started with the lowest median total pay, $59,600 compared to a high of $97,500 in the Boston Police Department (BoPD). New York City Police Department (NYPD) employees experienced the least growth in median total pay and in the final year had comparable median total pay to the BPD. BoPD's median total pay growth of 43.95% over the time period resulted in a median total pay of $140,300 by 2018, almost $45,000 more than either the BPD or NYPD.

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[26] Irons, M. "Police detective tops Boston's payroll with a total of over $403,000." *The Boston Globe*. February 14, 2017. https://www.bostonglobe.com/metro/2017/02/14/police-detective-tops-boston-payroll-with-total-over/6PaXwTAHZGEW5djgwCJuTI/story.html Accessed 10/16/19.

Table 8: Median Total Pay for Police Department Employees			
City	Start Year	End Year	Difference
Baltimore (2011- 2018)	$59,660.00	$95,166.00	59.51%
Boston (2011-2018)	$97,514.66	$140,367.00	43.95%
NYC (2014-2019)	$85,157.55	$95,473.28	12.11%

Table 9 shows the median total pay for fire department employees in each city and the change from the state to end year. Median total pay for fire department employees was higher than for police department employees in the start year in all three cities. However, the significant increases in median total pay in the Baltimore and Boston police departments resulted in higher pay in those cities by the end year. New York City Fire Department employees had almost no increase in the median total pay from 2014 to 2019, but still remained higher than police department employees in the end year.

Table 9: Median Total Pay for Fire Department Employees			
City	Start Year	End Year	Difference
Baltimore (2010-2018)	$61,635.10	$81,841.45	32.78%
Boston (2011-2018)	$105,976.90	$130,659.80	23.29%
NYC (2014-2019)	$100,253.7	$101,658.50	1.41%

Union contracts and collective bargaining agreements in Baltimore, Boston, and New York City offer some insight into these differences in pay increase.[27] New York City police and fire department collective bargaining agreements had relatively low levels of base wage increases. In 56% of the observed individual unit contract years, base wage increases were 1%, varying between 1.5% and 3% in the remainder of the years across 11 public safety bargaining units.

In Boston, pay increases were generally higher, with annual increases in the 2-3% range in 81% of the observed contract years, and 1% in all other years except two (which had 0% increases) across nine bargaining units. This may explain the larger total pay increases in Boston than in New York City.

In Baltimore, negotiated wage increase were erratic, ranging from 0% in some years to 6% in others, with an average annual percentage increase of 2.7% from 2009 to 2020 and 3% for the years that cover our public sector employee data. These higher percent annual wage increases in Boston and Baltimore explain some of the higher increases in total pay observed in comparison to New York City, but, as discussed earlier in this paper, changes in overtime use have also contributed to total pay increases.

Gender Inequality in Total Pay

All Employees

Using our "likely gender" variable created using the first name of each employee, we examine gender differences in total pay across the three cities over time. We find that New York City employed the highest share of female employees in 2018, with female employees constituting 62% of the workforce, while making up 52% of the workforce in Baltimore and 45% in Boston.

Table 10 on the following page shows the median total pay by gender in the final year of data in each city. The female to male ratio shows what percent of total pay female employees receive relative to males. Baltimore City had the least gender pay inequality at the median in the final year, with the female employee earning nearly 80% of the male median total pay, compared to 71% in New York City, and 59% in Boston. This means that the male employee at the median in Boston received almost twice the total pay that the female employee earned.

Over the sample period, median total pay inequality improved the most in New York City, improving by nine percentage points from 2014 to 2019 (note that this was also the shortest time period), compared to less than one percentage point improvement in Baltimore from 2011 to

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[27] Boston Collective Bargaining Agreements https://www.boston.gov/departments/labor-relations; NYC Collective Bargaining Agreements https://www1.nyc.gov/site/olr/labor/labor-recent-agreements.page; Baltimore Public Employee Contracts https://labor-commissioner.baltimorecity.gov/contract-agreements with prior years obtained through a public information act request.

2018, and four percentage points improvement in Boston from 2011 to 2018, where improvement is getting closer to gender pay equality in the median total pay.

Table 10: Median Total Pay by Gender in End Year			
Year	Male	Female	Female/Male Ratio
Baltimore (2018)	$69,305.79	$55,178.10	79.62%
Boston (2018)	$115,656.73	$68,663.69	59.37%
New York City (2019)	$88,334.47	$62,869.41	71.17%

Table 11 shows the median total pay by gender in police and fire departments. There was less gender inequality in median total pay in Baltimore police and fire departments, but more inequality in New York City, and almost the same level of inequality in Boston.

Table 11: Median Total Pay by Gender in Police and Fire Departments in End Year			
Year	Male	Female	Ratio
Baltimore (2018)	$89,799.63	$75,200.01	83.74%
Boston (2018)	$140,699.89	$84,358.95	59.96%
New York City (2019)	$110,510.03	$63,345.52	57.32%

In Baltimore City, the median total pay ratio fell almost four percentage points over the period, with the female median falling from 87.2% to 83.7% but reaching a high of nearly 93% in 2015.

In Boston, this same ratio improved by nearly five percentage points, and in New York City it improved by almost six percentage points.

Table 12 shows the total pay distribution by gender in 2018 across all cities. In Baltimore, the median female employee earned $55,178 in 2018 while the median male earned $69,305. The differential between male and female earnings is much larger in Boston and New York City.

Chart 7 shows the female to male total pay ratio across the income distribution in each city. In Baltimore and New York City, the ratio exhibited a U shaped distribution with the female share highest at the bottom and the top of the distribution and lowest at the median. In Boston, the distribution was more uneven, but still higher at the 99th percentile than for most of the distribution, with the female to male share being nearly 70% compared to being below 70% at each part of the distribution except the 1st percentile.

Chart 7: Female to Male Total Pay Ratio by Percentile of Income Distribution
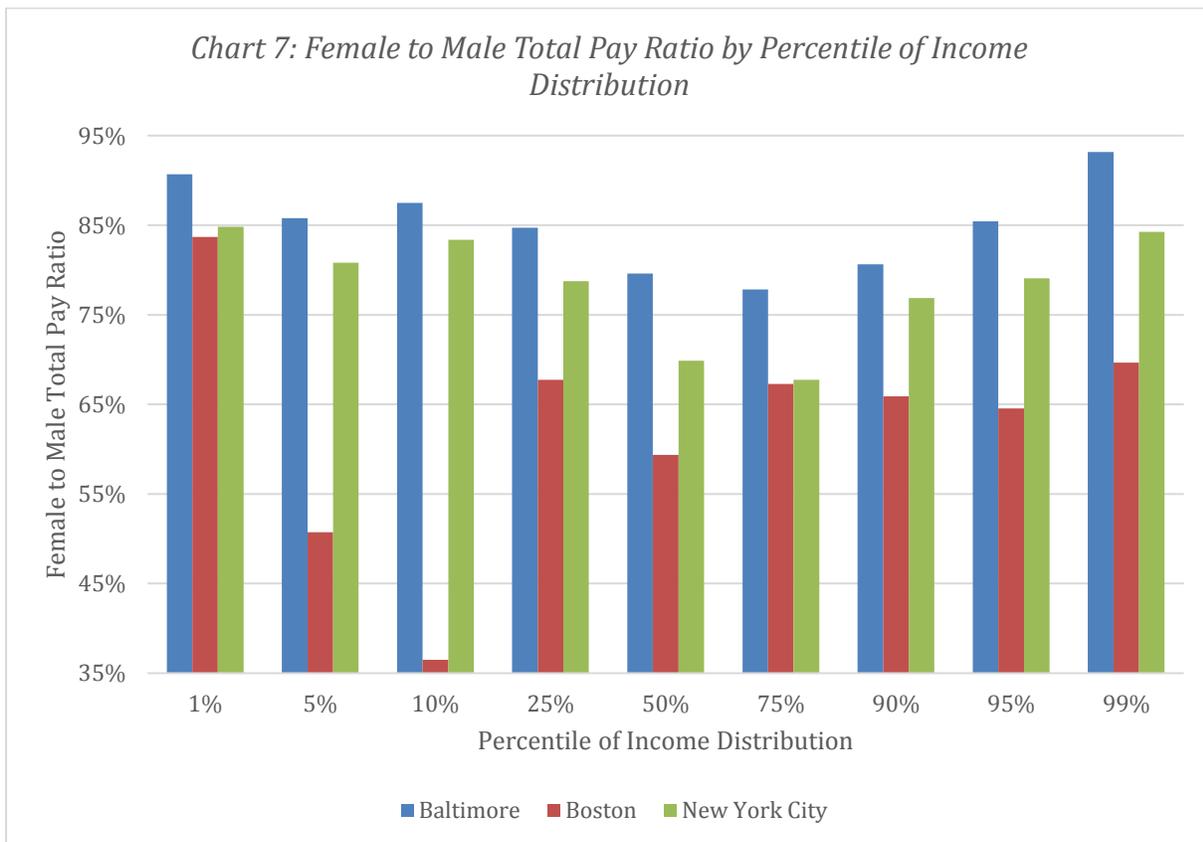
To observe gender total pay inequality at the top of the distribution, we look at the percent share by gender and total number of employees earning more than $200,000.[28] Chart 8 shows the gender share of employees earning total pay over $200,000 in the most recent year of data. The number of male employees receiving total pay over $200,000 in Baltimore was nearly three

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[28] Employees earning $200,000 are either near or above the 99th percentile of the income distribution in each city

times higher than the number of female employees. This same measure was five times higher in New York City and 18 times higher in Boston.

Chart 8: Gender Share of Employees Earning Total Pay Greater than $200,000 in End Year

Numbers on columns represent the number of actual employees
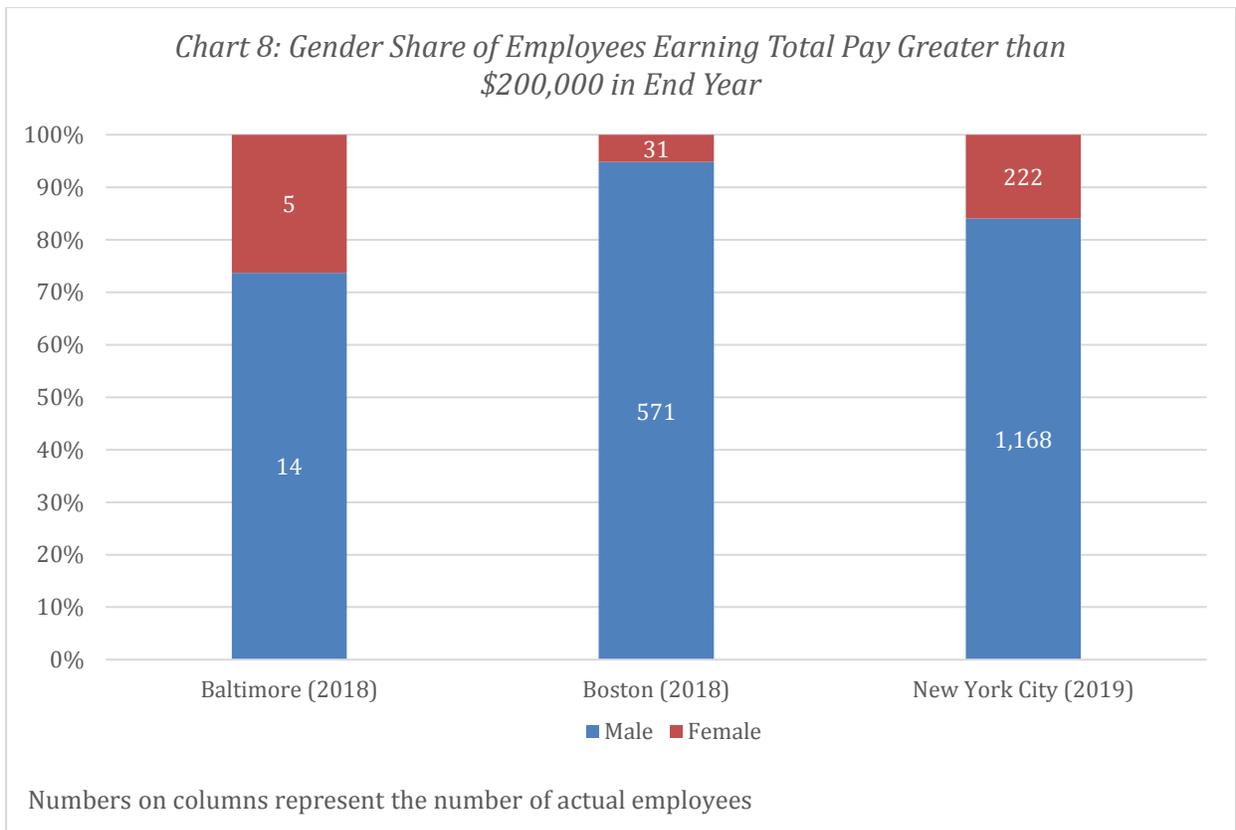
How much of the observed gender total pay inequality is due to differences in overtime worked? To answer this, we looked at differences in the gender pay gap in both base salary and overtime in Boston and New York City, controlling for differences in pay between departments.[29] The gender pay gap for base salary was $20,205 higher for male employees in Boston and $12,649 higher in New York City, but with overtime added, the pay gap climbs to $26,979 in Boston and $17,152 in New York City. This means that in both Boston and New York City, male employees are earning more in overtime than female coworkers. The use and allocation of overtime hours contributes to the gender total pay gap in both cities.

The data show that gender pay inequality is high in Boston and New York City, especially in the police and fire departments. However, the gender pay gap is marginally improving in both cities. Baltimore has the least gender pay inequality of any observed city, and this is even more so for the police and fire department median employee. Overtime is a significant contributing factor to the gender pay gap and the male to female ratio of top earners in all cities is high, and worst in Boston.

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[29] We were not able to do this in Baltimore City due to the significant variation in naming of departments.

The Growth of Local Government

All Employees

How has the size and composition of local governments changed over time? We examine the change in total number of employees in each city. Table 13 shows the number of public sector employees by year and city.[30] Over the time period examined for each city, Baltimore was the only city to experience a decline in the total number of public sector employees, with the loss of 856 employees for a 7% decrease. During the same time period as Baltimore, Boston increased their number of public sector employees, gaining 886 employees for an 11% increase. Similarly, New York City increased their number of public sector employees, gaining 17,736 employees for a 10% increase.

Year	Baltimore		Boston		New York City	
	Table 13: Number of Public Sector Employees by Year and City					
	Number	Employees per 1,000 residents	Number	Employees per 1,000 residents	Number	Employees per 1,000 residents
2011	12,514	21	7,968	11	-	-
2012	12,563	21	7,994	12	-	-
2013	12,331	20	8,082	12	-	-
2014	12,148	20	8,658	12	179,231	21
2015	11,938	20	8,720	13	181,761	21
2016	11,825	20	8,704	13	186,284	22
2017	11,251	19	8,879	13	191,886	22
2018	11,658	19	8,854	13	195,194	23
2019	-	-	-	-	196,967	23

The number of employees per 1,000 residents, as shown in Table 13, ranges from 13 in Boston in the final year of data to 23 in New York City, with Baltimore at 19. While Baltimore and Boston have similar population sizes, 600,000 compared to 700,000, Boston has 25% fewer employees than Baltimore, while having the same number of police and fire department employees. It is unclear if this is a result of fewer agencies in Boston or fewer employees per agency. This could partly be explained by the fact that Baltimore City is one of the few cities in the US that is a

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[30] Please see the Data section of the paper for more information on which public sector employees are included in these figures.

county, resulting in fewer overlapping jurisdictions and so more government functions could be placed on the city government.

New York City's staff has increased during the economic boom and is the largest it has ever been, prompting concerns that an economic downturn could result in large layoffs of public sector employees.[31] It is important to note that Baltimore City lost nearly 3% of its population during this period while both New York City (1.5% growth) and Boston (9% growth) grew in terms of population.

Police and Fire Departments

We also examine changes in the number of police and fire department employees over time. Table 14 shows the number of police and fire department employees by year and city and Table 15 shows the same for just police department sworn officers.

Baltimore had 449 fewer employees in its police and fire departments in 2018 than in 2011, accounting for 52% of the reduction in the number of employees in the city, while constituting only 40% of the total number of employees. The majority of this loss has occurred because of a low replacement rate. For example, in 2016, the department lost 308 officers, but only hired 79. Baltimore City administrators cited the decline in officers and the subsequent increase in the use of overtime as unsustainable and leading to employee burnout.[32] The Baltimore police union, Fraternal Order of Police Lodge no. 3, has regularly highlighted the lack of 500 officers as a major reason why they are unable to lower the violent crime rate in the city.[33] This holds true in the data: there were 452 fewer officers in 2018 (2,866) than in 2011 (2,414). The department has increasingly relied on overtime to fill this need for police. The city has focused on the need to recruit a new cohort of officers in recent years with the BPD hiring slogan "Be a part of the greatest comeback story in America".[34]

Chart 9 shows the cumulative change in the number of police and fire department employees over the time period examined. New York City increased their number of police and fire department employees by 4,594 to a total of 70,646 for a 7% increase. New York City police and fire department employees constituted 35% of all public employees in the city in 2019, but only

[31] Goodman, D. "With Largest Staff Ever, New York City Reimagines How It Works." *New York Times*. June 15, 2017. https://www.nytimes.com/2017/06/15/nyregion/high-number-city-employees-bill-deblasio.html Accessed 10/13/19.

[32] Rector, K. "Amid Baltimore's persistent violence, police department failing to fill 500 patrol officer positions." *The Baltimore Sun*. February 6, 2019. https://www.baltimoresun.com/news/crime/bs-md-ci-officers-decline-20190205-story.html Accessed 10/13/19.

[33] Gessler, P. "Baltimore Police FOP: There's Not Enough Officers To Respond To 911 Calls In 'Dangerous City'." *CBS Baltimore*. July 30, 2019. https://baltimore.cbslocal.com/2019/07/30/baltimore-police-fop-not-enough-officers-to-respond-to-911-calls-in-dangerous-city/ Accessed 10/13/19.

[34] https://bpdrecruit.org/ Accessed 10/13/19.

accounted for 26% of the increase in the number of employees, meaning the increase in employees mainly came from other departments.

Chart 9: Cumulative Change in Number of Police and Fire Department Employees
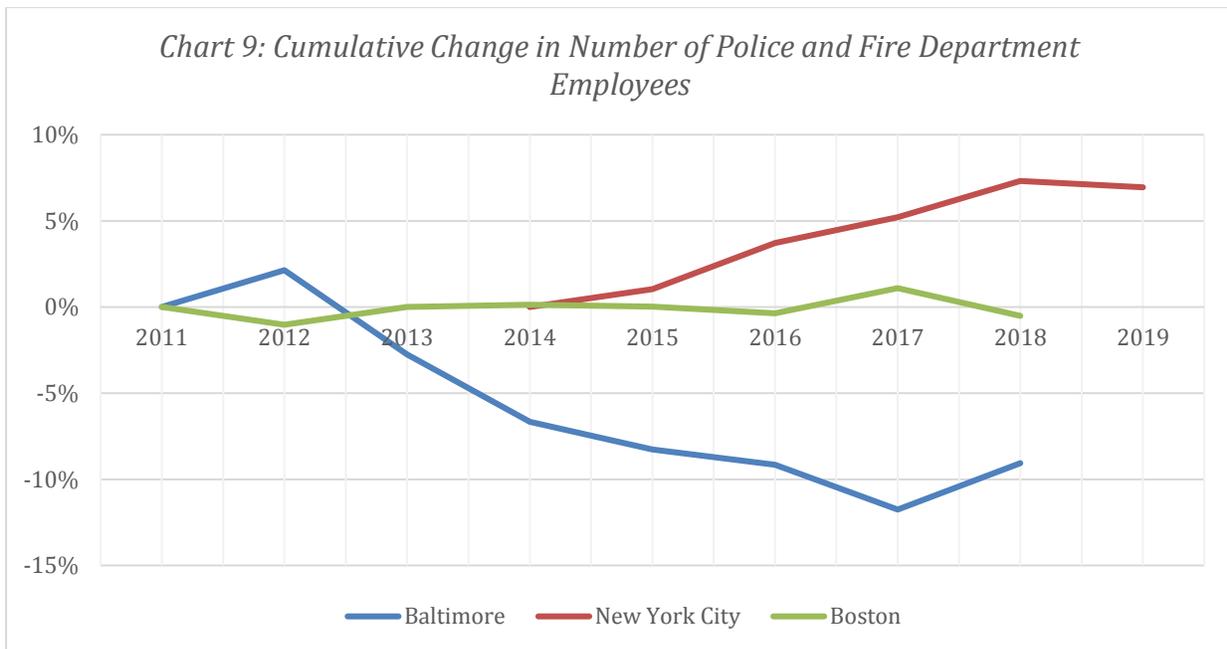
The number of police and fire department employees in Boston remained relatively constant over the entire period. Almost all of the increase in the number of employees came from other departments. Police and fire department employees in Boston constituted 57% of the workforce in 2011, falling to 52% in 2018, with the loss of 23 employees as the city had a net gain of 886 total employees. In recent years, the Boston Police Department has faced the issue of an increasing number of officers reaching the number of years eligible for retirement, leading to staff shortages.[35]

The number of police and fire department employees per 1,000 residents was 6.5 in Boston, 7.5 in Baltimore, and 8.2 in New York City. This means that New York City had more police and fire department employees per capita than Boston and Baltimore. This holds true when observing only police department officers.

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[35] Handy, D. "As More Officers Reach Retirement, Boston's Police Force Is Becoming Less Diverse." *WBUR News*. June 21, 2017. https://www.wbur.org/news/2017/06/21/boston-police-department-staffing-problems Accessed 10/13/19.

Conclusion

In this report, we used micro data for the cities of Baltimore, Boston, and New York City to study public sector salaries and overtime earnings. We have not studied pension contributions. We observe large differentials in pay at a point in time and over time. The ratio of total earnings in 2011 between the 90th and the 50th percentile in Baltimore was 1.6 while in 2018 this ratio was 1.79. In Boston, this same ratio grew from 1.71 to 1.85.[36] A gender gap in earnings is observed in all three cities with the female to male median total pay ratio at 79.62% in Baltimore, 71.17% in New York City, and 59.37% in Boston. These gender gaps have slightly narrowed over time.[37]

We document high overtime pay for a select set of city employees. While this allocation of overtime contributes to overall pay inequality, it may help an agency to reduce its total costs of supplying a given level of quality adjusted employee service hours. City government incurs a fixed cost in recruiting and training new employees. City government also incurs fixed costs in terms of health insurance and retirement plans. These total fixed costs provide city government with a possible incentive to reduce the total staffing of workers and instead to employ each trained employee more total hours per year, if overtime costs are less than the cost of training and benefits for worked hours.

However, there is also a concern that the quality of work declines when employees become overworked and consequently burn out. We also do not know if overtime is being efficiently allocated, if supervisors in charge of allocating overtime are engaging in favoritism, or if fraud in overtime reporting is occurring, as cited in a whistleblower lawsuit and audits in Baltimore City.[38,39] Boston police officers were recently suspended due to alleged payroll abuse.[40] This raises the question of whether public employees who earn the most are working the hardest or benefitting from a lack of oversight and fraud.

Is a shortage of workers driving increases in pay inequality as a smaller number of employees are taking on more overtime hours and need to be compensated to remain? While both Boston and

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[36] Tables 1-3
[37] Table 12

[38] Ericson, E. "Baltimore Police Marine Unit rife with fraud, bogus overtime and abuse, suit says." Baltimore Brew. January 3, 2019. https://www.baltimorebrew.com/2019/01/03/baltimore-police-marine-unit-rife-with-fraud-bogus-overtime-and-abuse-suit-says/
Shen, F. "Veteran Baltimore police officer suspended for overtime abuse." *Baltimore Brew*. June 20, 2019. https://baltimorebrew.com/2019/06/20/veteran-baltimore-police-officer-suspended-for-overtime-abuse/ Accessed 10/20/19.
[39] Eichensehr, M. "Overtime audit of Baltimore police shows lack of oversight, controls." *Baltimore Business Journal*. October 24, 2018. https://www.bizjournals.com/baltimore/news/2018/10/24/overtime-audit-of-baltimore-police-shows-lack-of.html Accessed 10/17/19.
[40] Ellement, J. and Mulvihill, M. "Boston officers are suspended in payroll investigation." *The Boston Globe*. February 11, 2019. https://www.bostonglobe.com/metro/2019/02/11/three-boston-police-officers-suspended-amid-payroll-investigation/kU4brsedjUaetW467svw8M/story.html Accessed 10/24/19.

New York City hired around 10% more workers over the time period observed for each city, inequality and total pay increases were much higher in Boston than in New York City. Baltimore lost employees and had large increases in total pay and pay inequality. While this coincided with the death of Freddie Gray while in police custody in 2015, we do not attribute cause.

While we observe a gender pay gap that is partially attributable to differences in overtime pay, the reasons for this gap require further examination. Are female employees more likely to be in lower paying and lower skill jobs? What role does gender discrimination play? Are male supervisors and administrators biased in hiring and overtime allocation practices? We were also unable to observe racial pay gaps and inequality as race is not a variable in the open data.

Baltimore features a shrinking police department and relatively low pay, but with large increases in total pay in recent years. Our descriptive study cannot answer how many more people would apply to be Baltimore police officers if wages continued to grow and became as high as they are in Boston. However, stories in the Boston Globe also cite hiring difficulties in that city.[41]

Are local governments in close proximity to each other competing for public sector employees, driving up payroll costs? There is anecdotal evidence of this in Baltimore City, with officers making lateral moves to the surrounding county police departments.[42] This means that Baltimore City is bearing the fixed cost of training police officers who then leave to use their increased human capital in other jurisdictions that consequently don't have to bear these fixed costs.

While we were able to observe differences in wage increases negotiated through union and collective bargaining unit contract agreements in police and fire departments across the cities, we did not observe these differences across all public sector employee bargaining units and unions. Therefore, we are unable to determine to what extent they might be driving growing total pay inequality and differences in compensation within and across cities. We are now researching these issues in more depth.

There are other factors that could explain pay inequality in New York City. Engineers and top management in the Department of Environmental Protection have the largest share of employees earning over $350,000 and that is attributed to large amounts of overtime pay. For instance, Bhavesh Patel, a stationary engineer, clocked 1,992 overtime hours on top of his 2,086 regular hours and earned nearly $540,000 in 2018.[43] Engineers clocking top pay is unique to New York

[41] Lotan, G. "As public skepticism of police increases, departments are changing their approach to recruitment." *The Boston Globe.* August 14, 2019. https://www.bostonglobe.com/metro/2019/08/14/public-skepticism-police-increases-departments-are-changing-their-approach-recruitment/NNZ0O3CPv5tmHPX20wKUjL/story.html Accessed 10/28/19.

[42] Rector, K. "Counties are hiring away Baltimore police officers — undercutting city efforts to boost force." *The Baltimore Sun*. March 8, 2019. https://www.baltimoresun.com/news/crime/bs-md-sun-investigates-regional-police-recruiting-20190207-story.html Accessed 10/17/19.

[43] Hicks, N. and Campanile, C. "This NYC sewer worker made over $530K last year." *New York Post*. October 5, 2018. https://nypost.com/2018/10/05/this-nyc-sewer-worker-made-over-530k-last-year/ Accessed 10/17/19.

City in our research in these three cities, and it would be intriguing to investigate the culture and necessity of overtime amongst maintenance workers. It may speak to a problem of insufficiently scaling up the public workforce in critical areas related to infrastructure.

The scale of a city's total public employment and the overall payroll expenditure depends on the health of a city's economy. A booming economy will yield the tax base to support a larger, well-funded government. High skilled public sector workers will have potentially lucrative private sector options. During a boom, these workers will be offered private sector jobs and this will drive up their public sector pay. Since we do not observe these private sector offers, we cannot disentangle how much of the rise in public sector pay is due to public sector bargaining success versus the competition for high end talent between the public and the private sector.

Since we only have eight years of data, we are not able to observe the full employment life cycle. If we were, we could more fully observe how employees enter and leave the workforce. This results in an incomplete story and truncated sample. As more data become available, we will be able to study public sector worker career dynamics as some choose to leave a city's workforce to either enter the private sector or to work for another local government.

We are also unable to identify if public sector workers are increasingly required to have specialized skills, licenses, and training at the highest positions, which would justify higher salaries. More work is required to identify the driving cause behind the observed total pay increases and growth in inequality.

Appendix I: Methodology

Police Officers

We define "police officers" in the dataset by selecting those employees working in the police department whose title includes "police", "det", "detective", "lieutenant", "sergeant", or "captain". This selection allowed us to remove the majority of civilian positions in the police department and select the majority of sworn officers.

Gender

The information on public sector employee pay contained name information without gender. Therefore, we used *genderize.io*, an Application Programming Interface (API) to obtain information about gender from the first names in the datasets. This method used names from the *genderize.io* database created by Casper Strømgren in August 2013 and regularly updated since. Regular incremental updates are possible due to continuous scanning of public profiles and their gender data in major online social networks such as Facebook. The database is continuously growing by processing from approximately 15,000 to 20,000 social network profiles per day (Wais, 2016). When a name is input into the database as a query term, we get several values as the output - *gender, count and probability. Count* shows how many social network profiles in the database have been recorded with this particular term as a first name and *probability* shows the proportion of profiles with the first name and the predicted gender (Strømgren, 2015). Therefore, we not only know the gender prediction for a given term but also how confident we can be with this particular prediction.

Kamil Wais is a data scientist who developed the *genderizeR* package for programming language R for predicting gender, and he compared the accuracy of gender prediction from *genderize.io,* US Census Data and US Social Security Administration (SSA) first name data. genderizeR used *genderize.io*, and he showed that his proposed method based on *genderize.io* API outperforms methods based on the US SSA and US Census data with the parameters set by the authors of the studies that evaluated the SSA and Census data. From comparison of the three methods in the Wais study, we can now assume that using genderize.io API as a gender data source is likely the best currently available approach.

Appendix II: Tables

Table 1: Total Pay Distribution for Baltimore City Public Sector Employees			
Percentiles	2011	2018	Change
1%	$13,148.91	$17,729.45	34.84%
5%	$23,096.71	$29,740.10	28.76%
10%	$26,173.76	$35,503.23	35.64%
25%	$32,023.33	$44,555.09	39.13%
50%	$45,503.28	$63,426.15	39.39%
75%	$60,509.30	$86,538.25	43.02%
90%	$72,556.12	$113,317.40	56.18%
95%	$81,082.79	$129,938.40	60.25%
99%	$100,395.90	$165,446.00	64.79%
Mean	$47,802.09	$68,987.97	44.32%
N	12,514	11,658	

Percentiles	2011	2018	Change
Table 2: Total Pay Distribution for Boston Public Sector Employees			
1%	$7,661.37	$7,000.00	-8.63%
5%	$12,515.97	$14,248.97	13.85%
10%	$32,065.36	$30,079.25	-6.19%
25%	$47,354.97	$55,700.95	17.62%
50%	$79,351.41	$98,028.14	23.54%
75%	$109,275.30	$137,500.50	25.83%
90%	$135,108.00	$180,808.80	33.83%
95%	$154,103.10	$216,693.60	40.62%
99%	$189,172.50	$285,966.90	51.17%
Mean	$81,335.99	$102,703.30	26.27%
N	7,968	8,854	

Table 3: Total Pay Distribution for New York City Public Sector Employees

Percentiles	2014	2019	Change
1%	$12,530.86	$14,974.51	19.50%
5%	$26,577.70	$28,826.61	8.46%
10%	$34,780.03	$38,858.51	11.73%
25%	$46,303.89	$53,144.54	14.77%
50%	$65,902.51	$74,055.14	12.37%
75%	$100,891.50	$111,068.30	10.09%
90%	$123,948.10	$138,646.90	11.86%
95%	$139,297.70	$157,940.00	13.38%
99%	$171,793.80	$194,615.20	13.28%
Mean	$74,546.33	$83,350.30	11.81%
N	179,231	196,967	

Table 4: Overtime Pay as a Percentage of Total Pay in 2018						
	Baltimore		Boston		NYC	
Percentile Range	Mean Total Pay	% Overtime	Mean Total Pay	% Overtime	Mean Total Pay	% Overtime
45-50	$61,479.83	7.04%	$92,731.00	7.51%	$69,709.33	10.31%
90-95	$121,151.10	21.59%	$196,607.40	20.83%	$145,260.50	18.75%
99 and above	$183,787.00	39.60%	$328,424.60	22.40%	$221,966.90	18.34%

Table 5: Total Pay Distribution for Boston Police and Fire Department Employees			
Percentiles	2011	2018	Change
1%	$8,558.10	$11,909.48	39.16%
5%	$10,871.46	$24,361.90	124.09%
10%	$41,407.52	$56,934.13	37.50%
25%	$79,034.67	$106,513.90	34.77%
50%	$104,243.50	$132,736.60	27.33%
75%	$124,471.00	$167,956.40	34.94%
90%	$149,413.30	$214,116.40	43.30%
95%	$166,566.90	$245,181.70	47.20%
99%	$199,775.90	$305,041.30	52.69%
Mean	$100,485.60	$136,858.30	36.20%
N	4,563	4,540	-0.50%

Percentiles	2011	2018	Change
	Table 6: Total Pay Distribution for Baltimore City Police and Fire Department Employees		
1%	$22,120.87	$22,830.71	3.21%
5%	$32,134.54	$40,671.05	26.56%
10%	$39,020.76	$48,360.67	23.94%
25%	$51,287.31	$70,520.51	37.50%
50%	$60,265.67	$87,273.18	44.81%
75%	$69,669.89	$109,388.50	57.01%
90%	$80,540.75	$132,924.50	65.04%
95%	$88,477.53	$148,511.30	67.85%
99%	$105,041.80	$177,218.10	68.71%
Mean	$60,310.48	$90,263.49	49.66%
N	4,958	4,509	-9.06%

Table 7: Total Pay Distribution for New York City Police and Fire Department Employees

Percentiles	2014	2019	Change
1%	$16,486.52	$19,325.39	17.22%
5%	$32,765.60	$35,590.58	8.62%
10%	$39,738.49	$45,606.27	14.77%
25%	$52,471.85	$59,801.08	13.97%
50%	$94,757.77	$99,507.84	5.01%
75%	$117,449.40	$128,563.20	9.46%
90%	$137,783.30	$154,151.70	11.88%
95%	$152,849.60	$171,919.80	12.48%
99%	$176,432.50	$199,608.00	13.14%
Mean	$88,749.22	$96,971.47	9.26%
N	66,052	70,646	6.96%

Table 8: Median Total Pay for Police Department Employees

City	Start Year	End Year	Difference
Baltimore (2011- 2018)	$59,660.00	$95,166.00	59.51%
Boston (2011-2018)	$97,514.66	$140,367.00	43.95%
NYC (2014-2019)	$85,157.55	$95,473.28	12.11%

Table 9: Median Total Pay for Fire Department Employees

City	Start Year	End Year	Difference
Baltimore (2010-2018)	$61,635.10	$81,841.45	32.78%
Boston (2011-2018)	$105,976.90	$130,659.80	23.29%
NYC (2014-2019)	$100,253.7	$101,658.50	1.41%

Table 10: Median Total Pay by Gender in the Sample End Year			
Year	Male	Female	Female/Male Ratio
Baltimore (2018)	$69,305.79	$55,178.10	79.62%
Boston (2018)	$115,656.73	$68,663.69	59.37%
New York City (2019)	$88,334.47	$62,869.41	71.17%

Table 11: Median Total Pay by Gender in Police and Fire Departments in End Year			
Year	Male	Female	Ratio
Baltimore (2018)	$89,799.63	$75,200.01	83.74%
Boston (2018)	$140,699.89	$84,358.95	59.96%
New York City (2019)	$110,510.03	$63,345.52	57.32%

Table 12: Total Pay Distribution by Gender in 2018

	Baltimore		Boston		New York City	
Percentiles	Female	Male	Female	Male	Female	Male
1%	$16,753.23	$18,473.41	$6,313.19	$7,542.21	$14,426.58	$17,010.90
5%	$28,025.48	$32,676.98	$10,852.27	$21,385.63	$25,433.00	$31,472.23
10%	$32,592.73	$37,248.20	$15,173.52	$41,566.38	$34,627.04	$41,535.44
25%	$40,629.40	$47,952.75	$44,549.04	$65,745.89	$45,817.39	$58,171.01
50%	$55,178.10	$69,305.79	$68,663.69	$115,656.70	$60,425.44	$86,461.74
75%	$72,166.02	$92,740.24	$101,957.70	$151,506.00	$82,718.63	$122,116.10
90%	$96,236.48	$119,376.00	$130,239.30	$197,652.60	$112,693.30	$146,579.60
95%	$115,389.00	$135,048.30	$149,124.60	$231,044.80	$131,081.80	$165,764.80
99%	$155,594.40	$167,011.20	$207,653.70	$298,138.50	$168,767.10	$200,285.50
N	3,866	7,414	2,703	5,990	71,230	115,668
Mean	$60,427.67	$73,767.58	$73,708.36	$116,302.30	$67,781.06	$91,875.67
Above $200k	5	14	31	571	222	1168

Year	Baltimore		Boston		New York City	
	Number	Employees per 1,000 residents	Number	Employees per 1,000 residents	Number	Employees per 1,000 residents
2011	12,514	21	7,968	11	-	-
2012	12,563	21	7,994	12	-	-
2013	12,331	20	8,082	12	-	-
2014	12,148	20	8,658	12	179,231	21
2015	11,938	20	8,720	13	181,761	21
2016	11,825	20	8,704	13	186,284	22
2017	11,251	19	8,879	13	191,886	22
2018	11,658	19	8,854	13	195,194	23
2019	-	-	-	-	196,967	23

Table 13: Number of Public Sector Employees by Year and City

Table 14: Number of Police and Fire Department Employees by Year and City			
Year	Baltimore	NYC	Boston
2011	4,958	-	4,563
2012	5,064	-	4,516
2013	4,822	-	4,563
2014	4,628	66,052	4,569
2015	4,548	66,734	4,564
2016	4,504	68,502	4,546
2017	4,375	69,495	4,613
2018	4,509	70,885	4,540
2019	-	70,646	-

Table 15: Number of Police Department Officers by Year and City			
Year	Baltimore	NYC	Boston
2011	2,866	-	2,276
2012	2,887	-	2,259
2013	2,846	-	2,267
2014	2,743	35,375	2,261
2015	2,682	35,277	2,257
2016	2,531	36,583	2,238
2017	2,372	36,583	2,324
2018	2,414	37,139	2,239
2019	-	37,344	-