Investigating the Effects of Furloughing Public School Teachers on Juvenile Crime in Hawaii*

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Abstract

Policymakers have long been concerned about the large social costs of juvenile crime. Detecting the causes of juvenile crime is an important educational policy concern as many of these crimes happen during the school day. In the 2009-10 school year, the State of Hawaii responded to fiscal strains by furloughing all school teachers employed by the Department of Education and cancelling classes for seventeen instructional days. We examine the effects of these non-holiday school closure days to draw conclusions about the relationship between time in school and juvenile arrests in the State of Hawaii on the island of Oahu. We calculate marginal effects from a negative binomial model and find that time off from school is associated with significantly fewer juvenile assault and drug-related arrests, although there are no changes in other types of crimes, such as burglaries. The declines in arrests for assaults are the most pronounced in poorer regions of the island while the decline in drug-related arrests is larger in the relatively more prosperous regions.

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1. Introduction

Examinations of crime rates in the U.S. show that arrests for both violent crimes and property crimes rise sharply in adolescence before dropping to lower levels in later life. By at least one measure, 20 to 30 percent of all crimes in the U.S. are committed by adolescents (Levitt, 1998). The measured costs of these crimes are enormous: to the juveniles themselves; to their victims; and to the larger society. Furthermore, the external costs to society are estimated to comprise, by far, the largest share of total costs (Levitt and Lochner, 2001).

Due to the large social costs, policy makers have long been concerned about the causes of juvenile crime. Levitt and Lochner (2001) review previous research and identify several determinants of juvenile crime including biological (Wilson and Herrnstein, 1985), social (Glaeser, Sacerdote, and Scheinkman, 1996), and economic factors (Grogger 1998). In particular, a rich literature documents the importance of educational attainment in determining criminal behavior (Lochner, 2010). According to theory, increased educational attainment and accompanying higher wages should deter crime by raising the opportunity cost of crime. Researchers find some empirical evidence for this effect. For example, Lochner and Moretti (2004) find that high school completion causally reduces crime rates and Anderson (2012) finds an effect of minimum dropout age policies on crime.

In related work, researchers also find tentative evidence of an effect of length of school day and school year on teenage pregnancy and crime rates. Berthelon & Kruger (2011) find that a program that lengthens the school day in Chile results in an overall lower teenage pregnancy rate for girls between the ages of 15-19 years old. They attribute this result to more hours of supervision and not to the longer-run effect of higher educational levels. In related work, Pires and Urzua (2011) find similar results on reduction in motherhood in Chile and arrests. Additionally, they find that academic outcomes and cognitive scores increase as well. Anderson and Walker (2012) find evidence for a positive relationship between four-day school weeks in Colorado and student achievement. Other research finds that shorter school years lead to an increase in property crimes, but a decrease in violent crimes (Jacob and Lefgren, 2003; Luallen, 2006). This work is of particular policy relevance, as state and local governments continue to search for ways to trim budgets.

We confirm and build on this earlier work by studying the effect of a shorter school year —, due to school closures on some non-holiday workdays — on juvenile crime in the State of Hawaii. In the 2009-10 school year, the State of Hawaii responded to fiscal strains by furloughing all school teachers employed by the Department of Education (DOE)[1] and cancelling class for seventeen instructional days. The budget cuts did not affect the Honolulu Police Department (HPD) which serves the entire island of Oahu, therefore any changes in crime rates would not be attributable to the level of law enforcement on those days. Our measure of school closures overlaps to some extent with State of Hawaii Employee (not Department of Education) furlough days as well. Part of our observed effects may be due to this combined effect of the two State of Hawaii furloughs (both the Department of Education and other State of Hawaii employees). The actual DOE furlough days themselves -- which were all Fridays -- were chosen arbitrarily and not related to any observed levels of juvenile crime. There is no evidence, either in newspaper reports or anecdotally, that these decisions were made with considerations about crime levels in mind. Therefore, by comparing a "furlough Friday" with an otherwise similar, non-furlough Friday, we are able to estimate a treatment effect that is not biased by omitted variables that might be correlated with both the choice of the furlough day and crime rates.

The Hawaii DOE announced furlough days toward the beginning of the school year, allowing parents some time to plan for their children's day off from school. Since an advance announcement to parents would be a natural component of any policy to cut school years, our estimates approximate the effect of children being out of school during a non-holiday weekday on crime rates. Anecdotally, there is variation in parental responses to the cuts in instructional days. For example, some parents were able to enroll their children in quickly established "after school" programs, while others did not. The lack of data prevents a more precise investigation of these responses. However, we find heterogeneity of effects on crime rates across regions and posit that some of these differences may be attributable to differences in parental responses to cuts.

Our results show that furlough days are associated with fewer juvenile assault arrests, confirming previously estimated effects in the literature. As is consistent with a causal effect of furloughs on crime, these effects occur predominantly in the daytime with no significant change in evening arrests for juveniles except in Metropolitan Oahu. We look at the effects in four

[1] All public schools in the State of Hawaii are part of a single school district.

separate regions: the Leeward coast or the southwestern shore; the Windward coast or the northeastern shore; Metropolitan Oahu which is along the southeastern shore and includes Honolulu; and Central Oahu which is in the center of the island and includes parts of the North Shore which is along the northwestern shore. While there are reductions in the four regions that we consider, the results are most prominent in the Leeward region of Oahu. The magnitude of the coefficient is almost twice the size of that for the other three regions of the island. This area is, in general, slightly more rural and populated by households with lower education and incomes than other areas on the island as shown in Figure 1.

We also show that arrests for drug-related crimes declined on the furlough Fridays. This result is new to the literature, and as with assaults, these effects, too, were concentrated during the daytime. However, unlike the effect on assault arrests, the reduction in drug-related arrests occurs primarily in Metropolitan Oahu. Figure 1 indicates that this area is generally more affluent than the rest of the island. The decline of drug violations but not assaults in higher income neighborhoods and the decline of assaults but not drug violations in lower income neighborhoods indicate the presence of significant distributional effects of policies that reduce time in school.

Notably, our estimates of the reduction in juvenile arrests on these furlough days are substantially larger than previous estimates in Jacob and Lefgren (2003) and Luallen (2006). Given the limitations of our data, it is hard to know exactly why this is the case, but one explanation could be that, because the DOE furloughs often coincided with furloughs of state employees, parents who were furloughed along with their children were better able to monitor their children. Another important factor to consider is that approximately one in five students in Hawaii attends private schools.[3] This implies the average socioeconomic status of the families that do send their children to public schools is lower than would otherwise be expected. In addition, we anticipate that the ability of schools to facilitate certain criminal activities increases as their populations become poorer.

The remainder of the paper is organized as follows: section 2 describes the data and summarizes sample statistics; section 3 lays out the empirical strategy and research design;

[3] See, for example, http://www.civilbeat.com/articles/2010/10/04/4031-the-impact-of-private-schools-on-public-education/

section 4 presents the results; section 5 provides additional robustness checks and results while section 6 concludes.

2. **Data**

This paper uses data from the Honolulu Police Department which maintains jurisdiction over the entire island of Oahu, including the cities of Honolulu, Kapolei, Kailua, Pearl City, Mililani Town, and others, as well as the outlying rural areas of the island. These data are a census of all arrests on Oahu between January 2007 and August 2010. Included in this census is information on arrests for the following: assault (both simple and aggravated), burglary and drug offense (sales/manufacturing, and possession). The data include information on the age and gender of the person arrested, the time and date that the crime took place, and the police beat in which the arrest occurred.

Detailed tabulations of these data are reported in Table 1 for our population of interest, people 18 and under. We also report these tabulations by gender and by region for the interested reader where each region is constituted by police beats. For males and females, between January 2007 and August 2010, there were 4,956 juvenile arrests on Oahu. Of these, assaults constitute 52 percent of all crimes; drug possession constitutes 22 percent; burglary constitutes 8 percent; the rest consists of DUIs, violation of liquor laws and domestic violence.

We display temporal patterns of arrests in Figure 2 which shows two salient patterns. First, juvenile arrests tend to be higher during the day than the evening. Second, arrests for assault and drug-related offenses are higher during the week than the weekend. Taken together, this is suggestive evidence that schools may be facilitators of these crimes. There is no evidence, however, that the numbers of juvenile arrests are higher or lower on Fridays than on other days of the week during the daytime. Formal tests of the null that there are no differences across weekdays in arrests during the daytime fail to reject at the 5% level ($p = 0.0769$ for assault; $p = 0.9214$ for burglary; $p = 0.1682$ for drug-related crimes); there are, however, significant differences across days during the nighttime which is not surprising since Friday night is followed by the weekend ($p = 0.0038$ for assault; $p = 0.0277$ for burglary; $p = 0.0078$ for drug-related crimes). To facilitate regression analysis and to allow for temporal patterns in crime, we use the raw data from HPD to create a new data set in which the unit of observation is a half-day

(either "day" or "night"). Day is defined as 6 AM to 6 PM and night is 6 PM to 6 AM.[4] For each observation, we tabulate the number of occurrences of three types of crimes: any assault, a category which includes both simple and aggravated assault; burglary; and drug offenses, including sales, manufacturing and possession. We do not consider violations of liquor laws, domestic violence or DUI arrests because these do not occur frequently enough to allow for precise estimates.

Next, we construct additional dummy variables that enable us to control for seasonal patterns in the data. First, we construct dummy variables for day of the week and month/year/region interactions. Second, we construct a dummy variable for school being out of session based on the DOE calendars for academic years (AY) 2006/2007, 2007/2008, 2008/2009, 2009/2010 and 2010/2011. This dummy variable is set to one if school is out of session for teaching in-service days, summer vacation, and parts of winter break other than Christmas and New Year's Day; we call this variable "Out-of-School." Hawaii's school calendar typically includes 180 instructional days, although the school year for 2009/2010 was shortened to 163 days due to the furlough days. We create another dummy variable that indicates whether the date is a state or federal holiday which we call "Holiday." Next, we create dummy variables for the seventeen furlough Fridays (which apply only to the Department of Education and its employees alone) that occur in the school year 2009-2010 which we call "DOE Furlough."

Finally, we create a dummy variable for nine State of Hawaii employee furlough days which we call "State Furlough." These furlough dates applied to State of Hawaii employees other than the Department of Education. There was overlap of the Department of Education furlough days and furlough days for the other State of Hawaii employees on 13 different dates in 2009-2010. In other words, only four Department of Education furlough Fridays are independent of the State of Hawaii furlough days. Therefore, we are not able to separately estimate the effects for the general state furlough days. We include these State of Hawaii employee furlough days to potentially control for the effect of additional parental supervision. We expect these variables to have a similar effect on juvenile crimes as the DOE furlough days; controlling for

[4] Note that our definition of night spans two calendar days as we collect all crimes that took place between 6PM and 6AM of the following morning; however, these crimes are coded as occurring on the first calendar day. We also provide robustness checks using alternative definitions of "day" (redefined as 6am to 2pm and 2pm to 6pm) and "night" (redefined as 6pm to 6am). These estimates are discussed in Section 5 of the paper which follows.

these State of Hawaii furlough days allows us to remove some of this additional effect from our DOE furlough days.

3. **Empirical Strategy**

We let y_{dmtr} denote the number of arrests that took place on day of the week *d* in month *m* during year *t* in region *r*. With some abuse of notation, we estimate the following regression model

$$y_{dmt} = H_{dmt}\eta + N_{dmt}\nu + K_{dmt}\theta + F_{dmt}\phi + S_{dmtr}\Sigma + u_{dmt}$$

where H_{dmt} is Holiday, N_{dmt} is Out-of-School, K_{dmt} is State Furlough and F_{dmt} is DOE Furlough. Each of these variables is defined in the previous section. The parameter ϕ estimates the effect of a furlough Friday on juvenile arrests. The vector S_{dmtr} is a comprehensive set of controls for seasonality which includes dummies for each day of the week; dummies for month, year and region; dummies for the double interactions of month/year, month/region and year/region; and dummies for the triple interaction of month, year, and region. We also include controls for Federal, State, and local holidays and for other Department of Education days off. Our estimates compare a furlough Friday with other days of the week in which school is in session; therefore, we include controls to avoid potential seasonal and day of the week variation in criminal activities. In total, we have four regions and 1338 days in our data; so the regressions that pool across regions have 5352 observations.

We estimate the model using two methods. First, we use the negative binomial model (NBM). Employing the NBM maintains consistency with the previous literature (*e.g.* Jacob and Lefgren 2003 and Luallen 2006) and conveniently allows us to make direct comparisons of the magnitude of our estimates with those in previous work. The NBM is more flexible than the Poisson model for count data as it does not restrict the conditional variance to be equal to the conditional mean (Greene 2008). We tested this restriction and found that our data were indeed over-dispersed indicating that the NBM is preferred to the Poisson.[5] We also estimate a linear model using ordinary least squares (OLS) as a secondary method to estimate the differential effects of furlough Fridays on arrests in different regions of the island and by gender; we did this since for many of these estimations neither the NBM nor the Poisson Model converged.

[5] We do not report the results of these tests to save space.

The interpretation of ϕ in the various models is slightly different. In the NBM, the transformation $1 - \exp(\phi)$ delivers the percentage decrease in crime on a furlough Friday relative to a typical Friday in which school was in session. In the linear model, the estimated coefficient represents the change in the number of arrests on a furlough Friday relative to a typical Friday.

4. Main Empirical Results

In Table 2, we report results from the NBM in which we pool the data across regions. The estimate of ϕ for daytime assault arrests in column one is negative, significant and larger than one in magnitude; it indicates about a 1-exp(-1.19), or 69% decline in assault arrests on any given furlough Friday. This result is robust to the inclusion of a dummy variable for other state of Hawaii furloughs in column 2.

We also estimate the model using nighttime arrests as a check on our results. Furlough days should only affect school children during the day and we do not expect there to be any systematic effects on nighttime arrests.[6] The coefficient is smaller both in magnitude and statistical significance suggesting that the school day may be fomenting these conflicts. The patterns for drug offenses in the next set of three columns are similar to those for assaults. Once again the estimated coefficient is negative and large in magnitude indicating a decline of 77% in column 4. As with the assault arrests, we do not find a statistically significant effect of furlough days on drug offenses in the evening. There are no statistically significant effects of furlough Fridays on burglaries in the final two columns; we do not report regression results for nighttime burglaries because there were too few observations and the NBM regression did not converge.[7]

The regression coefficients for the out-of-school and holiday variables are statistically significant and often larger in magnitude than our furlough Friday coefficients. These variables indicate the effect of either being out of school due to the officially designated school year or for state or federal holidays respectively. The size and statistical significance of these coefficients

[6] Our reasoning is as follows: parental supervision at night should be unaffected by the occurrence of a furlough day during the work day hours. Furloughs for state employees and the Department of Education occurred during standard work day hours and would not be expected to have had a separate effect on parental time and supervision at night.

[7] We also examine other crimes such as domestic violence, DUI and violation of liquor laws but do not find any noteworthy results. To save space, we do not report them here.

may provide additional evidence for the role of parental supervision, which is assumed to be greater during these particular out of school days, in juvenile crime.

In Table 3, we conduct an analysis similar to the one reported in Table 2 except we use OLS regressions where observations are pooled across regions and then subsequently separated by the four regions on the island of Oahu. In the first panel, we examine the results for the pooled analysis and find that the results are qualitatively very similar to those from the NBM regressions above. The estimated coefficients on the DOE Furlough are negative and statistically significant on assaults and drug offenses during the day but not at night. There are no results for burglary during the day. We find some evidence that there is a negative effect on burglaries at night on DOE Furlough days in column 6; it should be noted that these results are driven by an unusually small number of actual arrests by adolescents.

The subsequent four panels separate out the analysis by the Leeward, Central, Metropolitan and Windward regions of the island of Oahu. In the first column, we see that the furlough Fridays reduce the incidence of juvenile assaults in all four regions: Leeward, Central Oahu, Metropolitan and Windward Oahu; although the coefficient for Windward Oahu is only statistically significant at the 10% level. The observed reduction in juvenile assault arrests is largest for the Leeward part of the island which, on average, is poorer and less educated than the rest of Oahu.[8] It is also noteworthy that we do see a sizable and significant reduction in assault arrests in Metropolitan Oahu during the evening. A possible explanation for this result may stem from the relatively high population density in this region which may have some concentration effects even outside of school. As a result, there may be spillover of effects into the early evening hours for assault arrests.

The coefficients on drug offenses are large and statistically significant for Metropolitan and Windward Oahu. We note that there is a small reduction in the incidence of burglaries in Leeward Oahu, but no statistically significant effects for other regions of the island.

Once again, we find that the coefficient on holiday is negative and statistically significant. The effects are often as large or larger than the coefficient on furlough Fridays. The coefficients on out-of-school variables are nearly as large as the furlough Friday coefficients and are often statistically significant as well. As noted earlier, this may be additional evidence on the importance of parental supervision on juvenile arrests.

[8] We refer the reader, once again, to Figure 1.

Overall, we find a statistically significant difference in the incidence of juvenile arrests for assaults and drug offenses due to school furlough days. Our analysis controls for very general seasonal variation in youth crime and arguably isolates the effect of furlough days on these variables. Additionally, there is some evidence that there are heterogeneous effects by region of the island. We discuss a potential interpretation of these results in the conclusion.

5. Other Empirical Results

In Table 4, we conduct a robustness check by separating the data by Fridays alone and by dropping extreme arrest days. In columns one and four, we restrict our analysis of assault and drug arrests on Fridays alone. The effect of the furlough Fridays continued to be negative and statistically significant for assaults and drug offenses with this more restricted analysis; the coefficients are only slightly smaller than the results obtained in Table 2. In columns two and five, we further restrict the analysis to Fridays during AY2009/2010, the results are not significantly different than previous findings as well. Finally, in columns three and six, we exclude observations for which there are more than four arrests in a single day and region. Omitting these extreme outliers does not diminish our initial findings from Table 2 as the estimated coefficients in columns 3 and 6 are very close in magnitude and statistical significance to our main results. The coefficients on out-of-school and holiday variables are qualitatively very similar to results found in Tables 2 and 3. The effects are often quite large and statistically significant in the regression results.

In Table 5, we provide an alternate division of the day. We partition the day into three time periods: 6AM-2PM, 2PM-6PM and 6PM-6AM (of the following calendar day). We find that the time period 6AM-2PM continues to experience large reductions in assault and drug offense arrests due to furlough days. Effects are even larger during the 2PM-6PM time period for assaults than earlier in the day. This may indicate that conflicts that may begin during the school day spill over to afterschool hours. This spillover effect may explain the negative and significant effects on assaults during the evening that we saw in Table 3 in Metropolitan Oahu. To further explore this, we report results by region for the alternative partitions of the day using OLS in Table 6. We see that in Metropolitan Oahu, it is indeed the case that the effects of the furloughs on assault arrests are the least common between 6AM and 2PM as indicated by an estimate of -0.12, which is insignificant, and the most common in the evening hours as indicated by an

estimate of -0.32; the effect between the hours of 2PM and 6PM is in between at -0.21. In contrast to Leeward and Central Oahu where assault arrest are more likely during school hours, it appears as if assaults in Metropolitan Oahu, while more likely on school days, are occurring outside of school hours.

On the other hand in Table 5, we do not see any effects for drug offenses outside of school hours suggesting that monitoring during school hours may be playing a role in the observed decline in drug offenses. The coefficients on out-of school and holiday are often quite large and statistically significant in these regressions as well. Looking at the effects by region in Table 6, we see similar patterns.

Finally, in Table 7, we decompose the effects of the furlough days on arrests by gender. The NBM is not useful for this analysis as it does not converge. As a result we estimate a linear model here. Results for out-of-school and holiday are qualitatively similar to earlier findings. The effects of furlough days are largest for male arrests, in general. There are no effects for assaults committed by females. However, there is a significant, but small reduction in drug offense arrests for women. In unreported results, we do show that there was a significant and sizable reduction in assault arrests in Leeward Oahu of -0.23 for females, but there were null effects for females in the rest of the island; presumably, the large effects for both men and women is what underlies the large effects of the furloughs on assaults in Leeward Oahu.

6. Discussion and Conclusion

The estimated effects of furlough Fridays in Tables 2 and 3 identify two main results: first, there are statistically significant effects of DOE furloughs and resulting time off from school in reducing youth assault arrests and youth drug arrests, but there are no concomitant effects on arrests for burglaries; second, the effects on youth assault arrests are especially pronounced in the Leeward region of the island, which has lower average income and education levels than the other three regions. We also find that the effects on youth drug arrests are significant in the Metropolitan and Windward regions of the island.

We estimate the models using information on youth nighttime arrests as well. If DOE furloughs causally impact the decline in daytime arrests, then we should not observe any similar reduction in the incidence of arrests on furlough days at night. Because the DOE furloughs affect students' time in school during the day but not necessarily any variables at night, we would not

expect any effect of the furloughs on nighttime arrests. The observed results for nighttime arrests in Tables 2, 3 and 5 generally support our claim; we find an occasionally statistically significant result, however, the results are not consistent across arrest-type or region of the island.

As an added element of variation in our research design, 13 of the 17 DOE furlough days coincided with State employee furloughs which affect parental time at work. In fact, during these 13 days when students did not attend school, a number of their parents would also not have been at work if they were employed by the state of Hawaii. As a result, the effects on youth arrests may have occurred in two ways. Because students were not associating with one another at school, they may have had less opportunity to engage in fights and drug offenses. This "concentration" effect would therefore imply a decrease in certain types of infractions. Second, we may observe fewer arrests if students are appropriately monitored by adults. Without teacher and school supervision, the level of monitoring would have been low on DOE furlough days. However, because State employee furloughs often coincided with these DOE furloughs, parental monitoring may increase as teacher monitoring falls for some students. To the extent that State employment and parental monitoring practices differ across families and neighborhoods, the overlap of the adult State furloughs with student time off from school introduces heterogeneity into our estimates.

Our estimates of the effect of furlough days on assault and drug arrests are substantially larger than those found in Jacob and Lefgren (2003). In Table 4 of their paper, the coefficient estimates for simple assault and drug violations are -0.37 and -0.09, whereas the corresponding estimates in Table 2 of this paper are -1.11 and -1.35. We get statistically significant results for both the juvenile assault and drug offense outcomes; previous research has not found a statistically significant relationship for drug violations.

An examination of the different treatments between the two papers leads to one fairly obvious interpretation of these differences. Jacob and Lefgren (2003) analyze student time off from school without parental furlough days, however, our estimates include both the time off from school and the possibility that there is increased monitoring by parents. Previous estimates therefore identify the impact of concentration and school monitoring effects on juvenile crime; our estimates confirm these results and provide evidence on the efficacy of a third type of monitoring, that of parents and other non-teachers. Unfortunately, we are unable to perfectly

disentangle the concentration effect, the teacher monitoring effect, and the non-teacher monitoring effect from one another.

It is also important to bear in mind that our larger effects may simply be a consequence of Oahu's public schools serving a relatively poorer population than the schools in Jacob and Lefgren (2003) which uses a more nationally representative sample from the United States. The relatively high rates of private school attendance in Hawaii imply that the public schools on Oahu serve a disproportionately poorer population. To the extent that crime is more prevalent in poorer schools, then reductions in the length of the number of days in school should deliver larger reductions in crime in poorer areas.

Next, we observe differences in effects by region of the island. Our analysis of these differences, while far from conclusive, nevertheless suggests a possible interpretation of the results. We find effects of the furloughs on crime rates in four regions of Oahu, two of which are relatively wealthy (Metropolitan and Windward) and two of which are less wealthy (Leeward and Central). We see very clearly that juvenile assault arrests (but not drug arrests) decreased most dramatically in the Leeward region of the island, and juvenile drug arrests fell in the Metropolitan and Windward regions. Because the DOE furloughs equally affected schools in all four of these regions, the observed disparities in crime rates cannot be attributed to differential treatment across schools in different regions of the island. One possible reason for the disparate effects on crime by region may be the variation in monitoring response of parents across these areas.

For example, some parents may have been better able to afford supplementary programs to replace the school days lost during the DOE furloughs. Anecdotally, such programs were often provided by community organizations and were organized in significant numbers following the announcement of the DOE furloughs. However, they were often not offered free of charge and as a result, wealthier families may have been more likely to take advantage of them. In addition, more affluent households may have been better poised to rearrange their schedules to accommodate the furloughs since they are substantially less likely to have multiple jobs and long commutes. As a result, we suspect that a relatively higher level of after-school non-teacher monitoring in the Metropolitan and Windward areas and a steeper decline in youth drug arrests, relative to other areas of the island, together imply that monitoring effects are especially important to the incidence of drug activity among youths.

Furthermore, the Metropolitan and Windward areas are quite densely populated relative to the Leeward and Central regions. This may suggest that for students in the Metropolitan and Windward areas, time out of school does not necessarily result in decreased concentration effects for juvenile criminal activity. In other words, students may be more likely to congregate and associate with one another even outside of school when their neighborhoods are more densely populated. The relatively lower population densities in the Leeward and Central neighborhoods, together with the relatively steep decrease in assault arrests due to the DOE furloughs in these areas as compared to the Metropolitan and Windward areas, suggests an important role of concentration effects in the incidence of juvenile assaults.

Finally, we investigated whether the effect of school closures on some non-holiday workdays due to State of Hawaii DOE furloughs had differential effects by gender. Our analysis indicates that males tended to see the largest reduction in criminal arrests on these furlough days for assaults and drug arrests. However, we did find a smaller and statistically significant result for females with regard to drug arrests. These results provide a strong indication of a gendered effect of furlough days on juvenile crime in this scenario.

We therefore confirm, as previous work has found, that time out of school results in declines in certain types of juvenile crime. In addition, our estimates suggest the relative importance of concentration effects in juvenile assault arrests and the relative importance of monitoring effects in juvenile drug arrests. As concentration and monitoring effects may vary by neighborhood and household socioeconomic status, the impact of policies to reduce time in school may have disparate impacts on youth crime rates in relatively wealthy and less wealthy neighborhoods.

To conclude, it would be flippant to say that our results suggest that school should be canceled as a means of preventing crime. However, our results do suggest that additional steps could be taken to deter crime when children are in school. While proposing exact policies is beyond the scope of this work, we do believe that policy makers should be more cognizant of school's ability to facilitate rather than prevent certain crimes, particularly in poorer schools.

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Table 1: Juvenile Crime Numbers in the City and County of Honolulu, Jan 2007- Aug 2010

	All Regions	Leeward	Central	Metropolitan	Windward
			Males and Females		
Assault	2564	656	528	960	408
	(51.74%)	(64.06%)	(48.75%)	(48.12%)	(49.16%)
Drug Offenses	1080	127	285	445	216
	(21.79%)	(12.40%)	(26.32%)	(22.31%)	(26.02%)
Burglary	375	133	97	90	55
	(7.57%)	(12.99%)	(8.96%)	(4.51%)	(6.63%)
Other Crimes	937	108	173	500	151
	(18.91%)	(10.55%)	(15.97%)	(25.06%)	(18.19%)
Total	4956	1024	1083	1995	830
			Males		
Assault	1666	419	344	650	246
	(46.20%)	(57.87%)	(42.73%)	(43.92%)	(42.56%)
Drug Offenses	864	102	225	360	170
	(23.96%)	(14.09%)	(27.95%)	(24.32%)	(29.41%)
Burglary	336	119	89	84	44
	(9.32%)	(16.44%)	(11.06%)	(5.68%)	(7.61%)
Other Crimes	740	84	147	386	118
	(20.52%)	(11.60%)	(18.26%)	(26.08%)	(20.42%)
Total	3606	724	805	1480	578
			Females		
Assault	898	237	184	310	162
	(66.52%)	(79.00%)	(66.19%)	(60.19%)	(64.29%)
Drug Offenses	216	25	60	85	46
	(16.00%)	(8.33%)	(21.58%)	(16.50%)	(18.25%)
Burglary	39	14	8	6	11
	(2.89%)	(4.67%)	(2.88%)	(1.17%)	(4.37%)
Other Crimes	197	24	26	114	33
	(14.59%)	(8.00%)	(9.35%)	(22.14%)	(13.10%)
Total	1350	300	278	515	252

Note: Other Crimes includes DUI, violation of liquor laws and domestic violence. Columns in each section total to 100%.

Table 2: NBM Regression Results, Pooling Regions

	Assault[1]			Drug Offenses[2]			Burglary	
	Day Arrests		Night Arrests	Day Arrests		Night Arrests	Day Arrests[3]	
DOE Furlough	-1.19***	-1.20***	-0.54	-1.48***	-1.50***	-0.46	-0.70	-0.70
	(0.35)	(0.35)	(0.48)	(0.45)	(0.45)	(0.69)	(1.32)	(1.32)
Out-of-School[4]	-1.17***	-1.16***	0.14	-1.85***	-1.83***	-0.05	-0.13	-0.12
	(0.12)	(0.12)	(0.15)	(0.20)	(0.20)	(0.28)	(0.36)	(0.36)
Holiday[5]	-1.66***	-1.66***	-0.02	-1.94***	-1.95***	-0.62	0.56	0.56
	(0.25)	(0.25)	(0.24)	(0.37)	(0.37)	(0.49)	(0.52)	(0.52)
State Furlough[6]	-	-0.50	-	-	-1.21	-	-	-0.06
		(0.55)			(1.05)			(1.20)
R2	0.1031	0.1032	0.0916	0.1641	0.1645	0.1992	0.1576	0.1576
N	5352	5352	5352	5352	5352	5352	5352	5352

[1]Includes both simple and aggravated assaults.
[2]Includes sales, manufacturing and possession.
[3]The negative binomial model did not converge presumably due to too few burglaries during the evenings.
[4]This is a dummy variable for school being out-of-session for a reason other than a state or federal holiday.
[5]Includes both state and federal holidays.
[6]This is a dummy variable for the nine state employee furlough days that were not DOE furloughs.
All models control for the day of the week as well as dummies for the interaction of month, year and region.
* Significant at the 90% level. ** Significant at the 95% level. *** Significant at the 99% level.

Table 3: OLS Regression Results, Pooling and By Region

	Assault[1]	Drug[2] Offenses	Burglary	Assault[1]	Drug[2] Offenses	Burglary
	Day Arrests			**Night Arrests**		
			All Regions			
DOE Furlough	-0.35***	-0.24***	-0.03	-0.09*	-0.03	-0.03**
	(0.06)	(0.05)	(0.02)	(0.05)	(0.04)	(0.01)
Out-of-School[3]	-0.36***	-0.23***	-0.00	0.02	-0.00	-0.01
	(0.03)	(0.02)	(0.02)	(0.03)	(0.01)	(0.01)
Holiday[4]	-0.42***	-0.23***	0.03	0.01	-0.02	0.00
	(0.03)	(0.02)	(0.03)	(0.04)	(0.02)	(0.03)
R2	0.1218	0.1125	0.0454	0.0711	0.0658	0.0388
N	5352	5352	5352	5352	5352	5352
			Leeward Oahu			
DOE Furlough	-0.53***	-0.12	-0.11**	-0.05	0.03	-0.04
	(0.10)	(0.07)	(0.05)	(0.13)	(0.06)	(0.04)
Out-of-School[3]	-0.47***	-0.14***	-0.08***	0.01	-0.03***	-0.04*
	(0.06)	(0.02)	(0.03)	(0.04)	(0.01)	(0.02)
Holiday[4]	-0.53***	-0.14***	0.15	-0.01	-0.01	-0.02
	(0.07)	(0.07)	(0.11)	(0.06)	(0.02)	(0.03)
R2	0.1411	0.0903	0.0536	0.0399	0.0445	0.0421
N	1338	1338	1338	1338	1338	1338
			Central Oahu			
DOE Furlough	-0.29***	-0.17	-0.01	0.03	-0.01	-0.03
	(0.09)	(0.15)	(0.03)	(0.09)	(0.02)	(0.02)
Out-of-School[3]	-0.30***	-0.29***	0.05	0.02	0.02	0.02
	(0.06)	(0.04)	(0.05)	(0.03)	(0.02)	(0.01)
Holiday[4]	-0.33***	-0.31***	-0.07**	-0.04	-0.01*	-0.01
	(0.06)	(0.05)	(0.03)	(0.03)	(0.01)	(0.01)
R2	0.1051	0.1252	0.0554	0.0449	0.0293	0.0405
N	1338	1338	1338	1338	1338	1338
			Metropolitan Oahu			
DOE Furlough	-0.33**	-0.40***	0.01	-0.32***	-0.10	-0.04
	(0.17)	(0.07)	(0.06)	(0.09)	(0.14)	(0.03)
Out-of-School[3]	-0.45***	-0.26***	-0.03	-0.06	-0.03	-0.01
	(0.08)	(0.04)	(0.02)	(0.07)	(0.05)	(0.02)
Holiday[4]	-0.52***	-0.23***	-0.02	0.08	-0.02	0.06
	(0.07)	(0.06)	(0.02)	(0.15)	(0.05)	(0.10)
R2	0.1225	0.1063	0.0314	0.0623	0.0577	0.0409
N	1338	1338	1338	1338	1338	1338
			Windward Oahu			
DOE Furlough	-0.24*	-0.28***	-0.00	-0.03	-0.04	-0.02
	(0.12)	(0.06)	(0.02)	(0.10)	(0.03)	(0.02)
Out-of-School[3]	-0.22***	-0.22***	0.04	0.10	0.03	-0.01
	(0.04)	(0.03)	(0.03)	(0.06)	(0.02)	(0.01)
Holiday[4]	-0.29***	-0.24***	0.06	0.02	-0.03	-0.01
	(0.05)	(0.04)	(0.06)	(0.05)	(0.02)	(0.01)
R2	0.1022	0.1159	0.0422	0.0440	0.0430	0.0472
N	1338	1338	1338	1338	1338	1338

[1]Includes both simple and aggravated assaults.

[2]Includes sales, manufacturing and possession.
[3]This is a dummy variable for school being out-of-session for a reason other than a state or federal holiday.
[4]Includes both state and federal holidays.
All models control for the day of the week as well as dummies for the interaction of month, year and region.
* Significant at the 90% level. ** Significant at the 95% level. *** Significant at the 99% level.
Robust standard errors are reported.

Table 4: Robustness Checks, NBM Regressions, Day Arrests

	Assault			Drug Offenses		
	Only Fridays	Only Fridays AY2009-2010	No Outliers[1]	Only Fridays	Only Fridays AY2009-2010	No Outliers[1]
DOE Furlough	-1.08**	-1.11**	-1.24***	-1.58***	-1.53***	-1.43***
	(0.48)	(0.51)	(0.34)	(0.52)	(0.57)	(0.45)
Out-of-School	-1.52***	-1.87**	-1.18***	-1.43***	-1.19	-1.83***
	(0.28)	(0.78)	(0.12)	(0.41)	(0.82)	(0.20)
Holiday	-2.35***	-2.18**	-1.60***	-1.87***	-1.37*	-1.91***
	(0.62)	(0.86)	(0.25)	(0.62)	(0.73)	(0.37)
R2	0.2860	0.3123	0.1045	0.3231	0.3414	0.1637
N	764	208	5336	764	208	5348

Notes: Per Table 1.
[1]We drop days with more than 4 arrests during the day.

Table 5: NBM Regressions for Alternative Partitions of the Day

	Assault			Drug Offenses		
	6AM-2PM	2PM-6PM	6PM-6AM	6AM-2PM	2PM-6PM	6PM-6AM
DOE Furlough	-1.05**	-1.43**	-0.54	-1.70***	-0.44	-0.46
	(0.42)	(0.64)	(0.48)	(0.54)	(0.90)	(0.69)
Out-of-School	-1.57***	-0.69***	0.14	-2.22***	-0.69*	-0.05
	(0.16)	(0.18)	(0.15)	(0.25)	(0.38)	(0.28)
Holiday	-2.28***	-1.10***	-0.02	-3.14	-0.23	-0.62
	(0.42)	(0.32)	(0.24)	(0.72)	(0.52)	(0.49)
R2	0.1150	0.0968	0.0916	0.1900	0.2005	0.1992
N	5352	5352	5352	5352	5352	5352

Notes: Per Table 2.

Table 6: OLS Regression Results, Pooling and By Region, Alternative Partitions of the Day

	6AM – 2PM	2PM –6PM	6PM – 6AM	6AM – 2PM	2PM –6PM	6PM – 6AM
	Assault[1]			**Drug Offenses[2]**		
			All Regions			
DOE Furlough	-0.20***	-0.14***	-0.09*	-0.22***	-0.02	-0.03
	(0.05)	(0.04)	(0.05)	(0.05)	(0.02)	(0.04)
Out-of-School[3]	-0.26***	-0.10***	0.02	-0.23***	-0.01	-0.00
	(0.02)	(0.02)	(0.03)	(0.02)	(0.00)	(0.01)
Holiday[4]	-0.28***	-0.13***	0.01	-0.21***	-0.01	-0.02
	(0.02)	(0.02)	(0.04)	(0.01)	(0.01)	(0.02)
R2	0.0945	0.0646	0.0711	0.1086	0.0421	0.0658
N	5352	5352	5352	5352	5352	5352
			Leeward Oahu			
DOE Furlough	-0.39***	-0.14***	-0.05	-010	-0.02	0.03
	(0.10)	(0.05)	(0.13)	(0.07)	(0.01)	(0.06)
Out-of-School[3]	-0.36***	-0.11***	0.01	-0.13***	-0.02*	-0.03***
	(0.05)	(0.03)	(0.04)	(0.02)	(0.01)	(0.01)
Holiday[4]	-0.40***	-0.13***	-0.01	-0.13***	-0.02	-0.01
	(0.05)	(0.04)	(0.06)	(0.02)	(0.01)	(0.02)
R2	0.1092	0.0780	0.0399	0.0891	0.0361	0.0445
N	1338	1338	1338	1338	1338	1338
			Central Oahu			
DOE Furlough	-0.19***	-0.10	0.03	-0.26*	0.09	-0.01
	(0.05)	(0.08)	(0.09)	(0.14)	(0.08)	(0.02)
Out-of-School[3]	-0.23***	-0.07**	0.02	-0.27***	-0.02	0.02
	(0.05)	(0.03)	(0.03)	(0.03)	(0.01)	(0.02)
Holiday[4]	-0.24***	-0.09	-0.04	-0.30***	-0.01	-0.01*
	(0.04)	(0.06)	(0.03)	(0.04)	(0.02)	(0.01)
R2	0.0947	0.0464	0.0449	0.1183	0.0458	0.0293
N	1338	1338	1338	1338	1338	1338
			Metropolitan Oahu			
DOE Furlough	-0.12	-0.21**	-0.32***	-0.30***	-0.10***	-0.10
	(0.14)	(0.10)	(0.09)	(0.06)	(0.04)	(0.14)
Out-of-School[3]	-0.32***	-0.15***	-0.06	-0.23***	-0.02	-0.03
	(0.05)	(0.04)	(0.07)	(0.03)	(0.02)	(0.05)
Holiday[4]	-0.30***	-0.20***	0.08	-0.25***	0.02	0.02
	(0.06)	(0.05)	(0.15)	(0.04)	(0.05)	(0.05)
R2	0.0885	0.0783	0.0623	0.1119	0.0369	0.0577
N	1338	1338	1338	1338	1338	1338
			Windward Oahu			
DOE Furlough	-0.11	-0.12***	-0.03	-0.23***	-0.05**	-0.04
	(0.12)	(0.05)	(0.10)	(0.06)	(0.03)	(0.03)
Out-of-School[3]	-0.17***	-0.05	0.10	-0.22***	-0.01	0.03
	(0.03)	(0.03)	(0.06)	(0.02)	(0.02)	(0.02)
Holiday[4]	-0.18***	-0.11***	0.02	-0.22***	-0.02	-0.03*
	(0.03)	(0.03)	(0.05)	(0.03)	(0.03)	(0.02)
R2	0.0780	0.0611	0.0440	0.1062	0.0503	0.0430
N	1338	1338	1338	1338	1338	1338

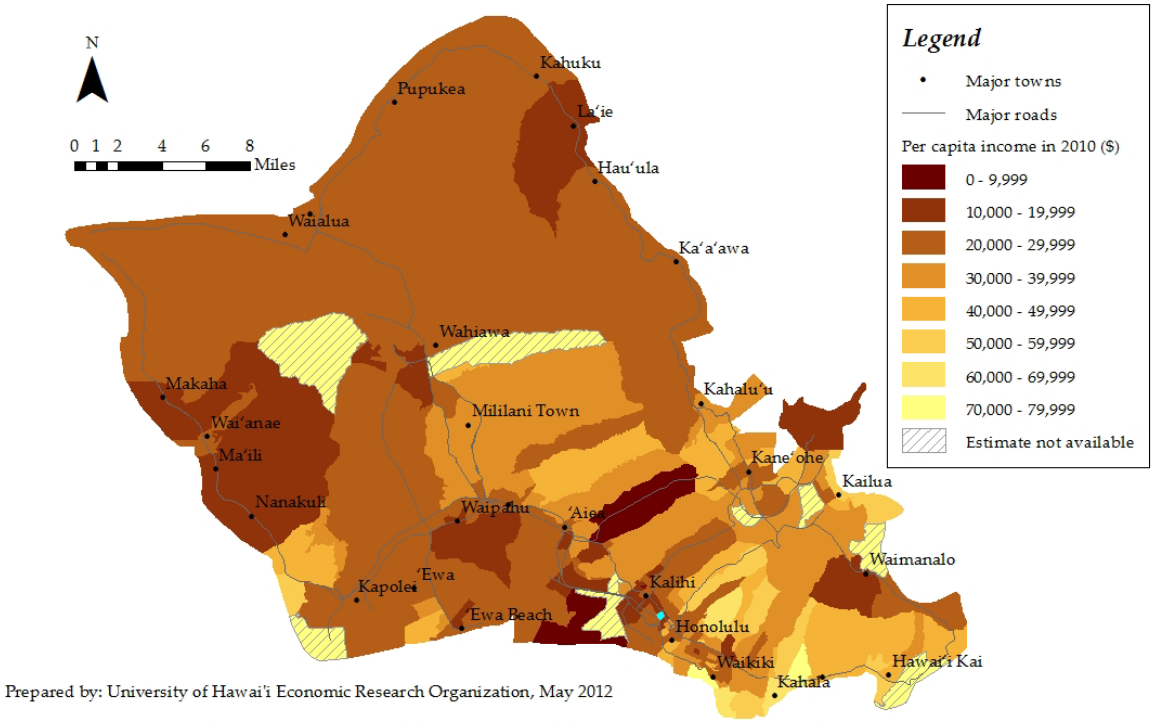
[1]Includes both simple and aggravated assaults.
[2]Includes sales, manufacturing and possession.
[3]This is a dummy variable for school being out-of-session for a reason other than a state or federal holiday.
[4]Includes both state and federal holidays.
All models control for the day of the week as well as dummies for the interaction of month, year and region.
* Significant at the 90% level. ** Significant at the 95% level. *** Significant at the 99% level.
Robust standard errors are reported.

Table 7: OLS Regressions Broken Down by Gender, Day Arrests

	Assault		Drug Offenses	
	Males	Females	Males	Females
DOE Furlough	-0.27***	-0.07	-0.18***	-0.07***
	(0.04)	(0.05)	(0.04)	(0.02)
Out-of-School	-0.23***	-0.13***	-0.18***	-0.05***
	(0.02)	(0.02)	(0.01)	(0.01)
Holiday	-0.25***	-0.17***	-0.17***	-0.06***
	(0.03)	(0.02)	(0.02)	(0.01)
R2	0.0873	0.0806	0.0981	0.0560
N	5352	5352	5352	5352

Notes: Per Table 2.
Robust standard errors are reported.

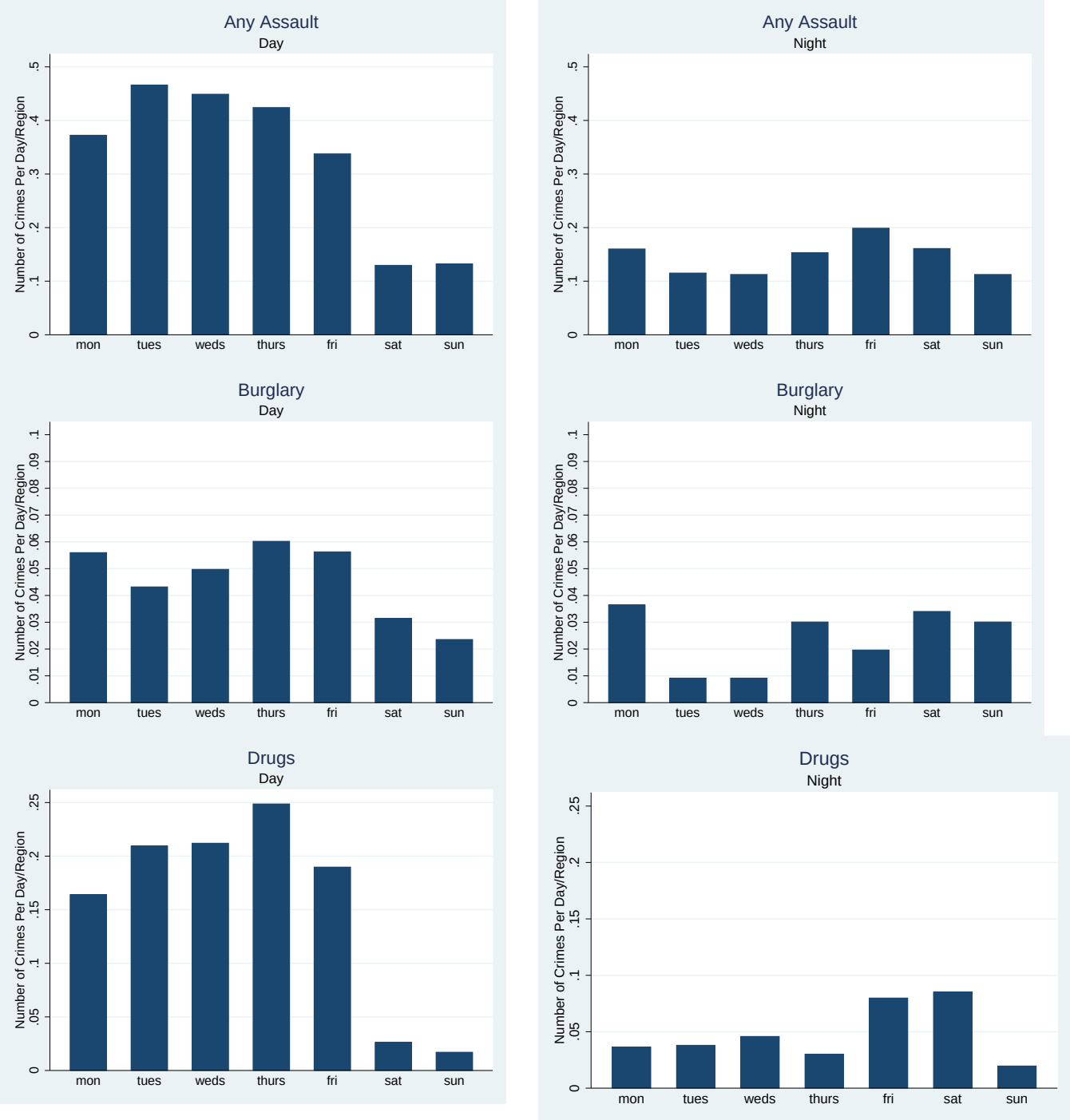
Figure 1: Per Capita Income by Census Tract on Oahu



Prepared by: University of Hawai'i Economic Research Organization, May 2012

NOTE: "Per capita income for past 12 months" data comes from 2006-2010 American Community Survey 5-Year Estimates
http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_10_5YR_B19301&prodType=table

Figure 2: Average Temporal Patterns by Day of the Week for Juvenile Arrests Across Regions



Note: We denote crimes that occur in the day as occurring between 6 AM and 6 PM. Crimes which occur at night occur between 6PM and 6AM. While our definition of night spans two calendar days as we collect all crimes that took place between 6PM and 6AM of the following morning; however, these crimes are coded as occurring on the first calendar day.