Descriptive Finding

A formal decomposition of declining youth crime in Denmark

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Abstract

BACKGROUND
Over the recent decades and across most developed democracies, youth crime has been in steady decline, and declining youth crime now constitutes an important contemporary demographic change. Yet underneath this change lingers the question of how we should best grasp declining youth crime.

OBJECTIVE
To decompose declining youth crime in Denmark into its extensive and intensive margins, and show results from birth cohort analyses.

METHODS
We apply Das Gupta's (1993) method for rate decomposition to Danish registry data that holds information on all criminal justice contacts of full birth cohorts. We show results among 15–17-year-old youth by year as well as follow birth cohorts by age.

RESULTS
The main driver of declining youth crime in Denmark is that fewer young people are experiencing contact with the criminal justice (extensive margin), and not lower rates of criminal recidivism among youth with criminal justice contact (intensive margin); a result which is found using both year and birth cohort analyses.

CONTRIBUTION
The knowledge provided in our descriptive findings – that change at the extensive margin is the main driver of declining youth crime in Denmark – represents a first step towards understanding the important demographic change that youth crime has been in decline across developed democracies over the past decades.

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1. Introduction

The recent decline in youth crime is an important social and demographic change. In the US the arrest rate among 15–17-year-olds has dropped by 60% since its peak in the mid-1990s (own calculations from Snyder and Mulako-Wangota 2016). Other developed democracies, e.g., the UK, Denmark, and the Netherlands, have witnessed similar declines, although the timing varies across countries (Danish Ministry of Justice 2016; Statistics Netherlands 2014; Youth Justice Board 2015). This decline is important because it shows that society is becoming safer and that youth today devote themselves less to anti-social activities.

Yet, despite declining youth crime, little is known about the mechanisms driving the change. At the broadest level, change could come from two margins, the extensive or the intensive. The extensive margin measures the number of young people who offend. If fewer youth today are charged with a crime, it affects the extensive margin. The intensive margin measures the number of offenses among those who experience criminal justice contact. If offenders today recidivate less, it affects the intensive margin.

Therefore an important first step in understanding declining youth crime is to analyze whether changes at one or the other margin – or both – are the prime drivers of this trend. This is the aim of this descriptive finding, and we report both year-by-year and birth cohort estimates. Not only will such estimates improve our insight into today's youth crime but they will also help policymakers and criminal justice stakeholders in their efforts to maintain or even further the current decline.

Only one existing study has pursued this research agenda. Berg, Baumer, Rosenfeld, and Loeber (2016) compare the extensive and intensive margins of crime among 17–18-year-olds in the US in the early and late 1990s. They find that the property crime rate changed at both margins during that period. The rate of serious violent crimes changed only at the extensive margin among white youth but at both margins among black youth. However, declining youth crime outside the US is a more recent phenomenon, and it is unclear whether results from the US in the 1990s are applicable to other contexts today.

2. Data and method

We use administrative data from Statistics Denmark. Statistics Denmark collects data on transactions between residents and public and private agents and makes this data available to researchers as individual-level data. The registers are linkable and constitute a longitudinal full population panel. We rely on criminal justice and population registers from 1996 to 2013 and focus on 15–17-year-olds. Fifteen years

of age is our lower bound, as this is the age of criminal responsibility in Denmark – with a small exception between July 1st 2010 and March 1st 2012, when the limit was 14 years. We use 17 years of age as our upper bound: 17-year-olds are minors in many aspects, including how they are treated in the criminal justice system (e.g., they are primarily sent to youth facilities).

Our crime rate measure derives from the register of charges, and covers all Penal Code violations. Of these, property and violent offenses constitute 80% and 15% of charges against 15–17-year-olds respectively, theft, vandalism, and simple assault being the most common charges. Our focus on Penal Code violations means that we exclude, for example, charges for traffic offenses and minor drug offenses, but our results are robust to the inclusion of these charges. We use charges rather than convictions, as changes in convictions over time are more likely to reflect both changes in youth's behavior and changes in system behavior (such as judges' workload). Although also sensitive to system behavior such as policing efforts, charges are more likely to express the illegal action for which a person is apprehended.

To analyze whether declining youth crime occurs on the extensive or the intensive margin – and thus to analyze how changes on each margin contribute to the overall development of youth crime – we use Das Gupta's (1993) method of rate decomposition. Equation 1 shows how the age- and year-specific charge rates, R_{ta}, reflect changes at the intensive and extensive margins. Here, R_{ta} is measured as the sum of charges during year t within each age group (a) per 1,000, and the rate is the product of the extensive (E, proportion of the population charged with a crime in year t) and intensive (I, average number of crimes that each charged individual is charged with in year t) margins:

$$R_{ta} = \left(\frac{\# \, charged_{ta}}{\# \, pop_{ta}} * \frac{\# \, charges_{ta}}{\# \, charged_{ta}} \right) * 1000 = (E_{ta} * I_{ta}) * 1000 \qquad (1)$$

Das Gupta's decomposition method standardizes one margin to its mean value across the observed years and then allows only for changes on the other margin. Conducting this procedure for both margins provides the total decomposition. Specifically, changes at the extensive margin contribute to the overall change in charge rates from one year to the next by $\omega_E = \frac{I_{t+1}+I_t}{2}(E_{t+1} - E_t)$. Similarly, changes at the intensive margin contribute by $\omega_I = \frac{E_{t+1}+E_t}{2}(I_{t+1} - I_t)$. We may then express each of these contributions as percentages of the overall change in the charge rate. The 'multi' option in the 'rdecompose' command in Stata 13 ensures internal consistency between standardizations when comparing across more than two years (Li and Kinfu 2015).

2.1 Cohort analyses

The panel structure of our data also allows for cohort analyses. Such analyses will show the persistence of low or high levels of criminality within cohorts across age (here we use cohorts 1986–1996), and will demonstrate whether lifetime charge rates have decreased across birth cohorts or whether more recent cohorts simply postpone their criminality into young adulthood. For this part of the analysis we measure the extensive margin of crime as the cumulative proportion of each cohort ever charged with a crime, by age. We measure the intensive margin as the cumulative mean number of charges, up to a specific age, among those who were charged with a crime.

3. Results

Figure 1 shows calendar-year-specific and age-group-specific charge rates from 1996 to 2013 in Denmark. For all age groups the charge rate declined, but we see the sharpest decline among the youngest age groups. In 2013, charge rates among 15–17 and 18–20-year-olds were at almost half the 1996 level, with 36 and 45 charges per 1,000 in 2013 respectively, and 62 and 74 charges per 1,000 in 1996 respectively. Among the youngest age group, those aged 15–17 years, we observe a particularly steep 46% drop between 2004 and 2013.

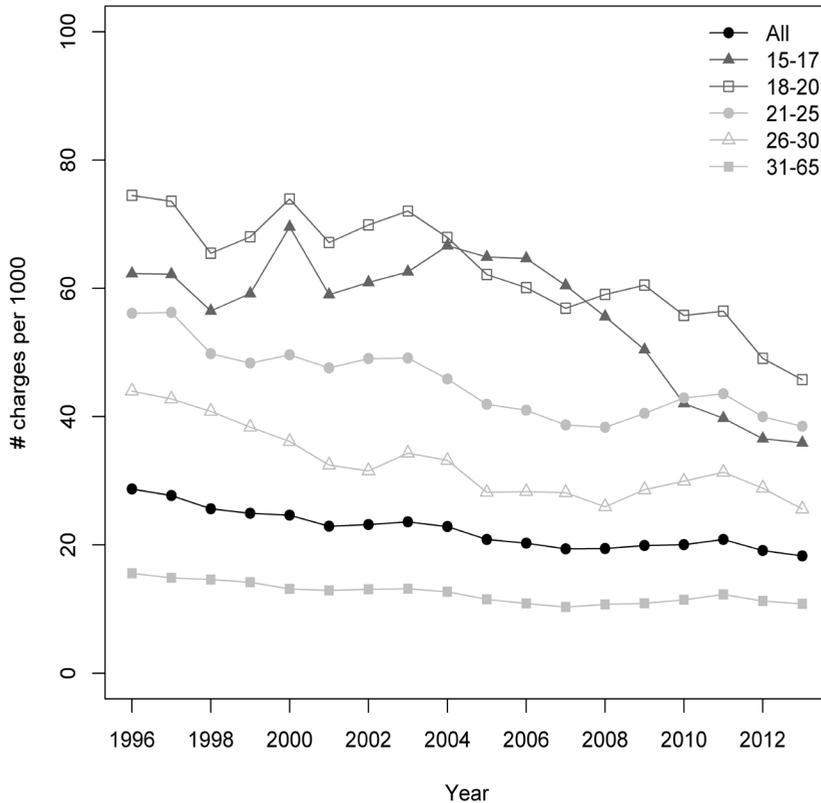**Figure 1:   Criminal charges per 1,000 Danes, by age, 1996–2013**

Figure 2 shows the calendar-year-specific charge rate among 15–17-year-old youth by its extensive and intensive margins. According to these results, which correspond to findings published by the Danish Ministry of Justice (2016), changes at the extensive margin are the primary drivers of the decline in youth charges from 2004 onwards. Between 1996 and 2004 the share of youth who were charged at least once within a given year rose from 3.1% to 3.8%, but by 2013 this share had declined to 2.1%.

Figure 2 also shows a general decrease at the intensive margin over the entire period. However, this decrease fluctuates and does not show the same steady decline since 2004 that we observed at the extensive margin.

Figure 2:   Criminal charges at the extensive and intensive margins, ages 15–17, 1996–2013
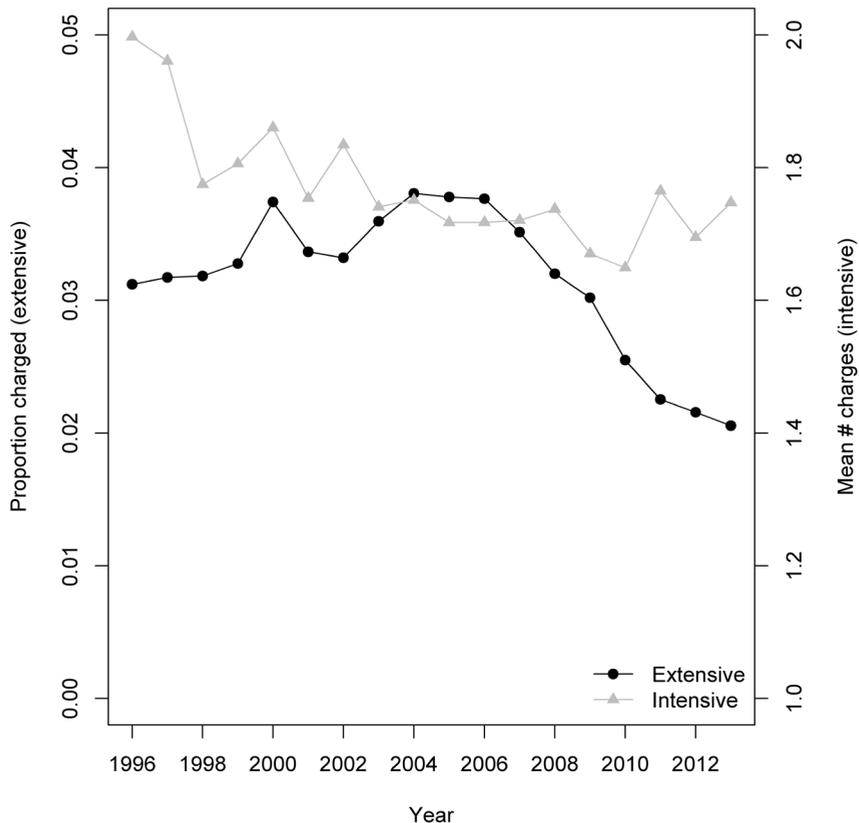
Table 1 shows that changes at the intensive margin drove changes in charge rates from 2004 to 2006 (the baseline year is 2004). However, this changed in 2007–2010, when up to 96% of the decrease occurred at the extensive margin. In 2013 practically all (99.6%) of the decrease (from 67 charges per 1,000 in 2004 to 36 in 2013) reflected changes at the extensive margin. In conclusion, the decline in charge rates from 2004 to 2013 among young people in Denmark reflects the fact that a lower proportion of youth received a criminal charge in 2013 than in 2004. Changes in recidivism played only a minor role in this development.

**Table 1:** **Decomposition of charge rates among 15–17-year-olds, baseline year *t*=2004**

t	R	Diff	E	I	ω_E	ω_I	$\%\omega_E$	$\%\omega_I$	# charges	# charged	# pop
1996	62.30	-4.35	0.03	2.00	-12.86	8.51	295.85	-195.85	11,220	5,619	180,102
1997	62.19	-4.45	0.03	1.96	-11.77	7.31	264.17	-164.17	10,795	5,506	173,582
1998	56.48	-10.16	0.03	1.77	-10.99	0.83	108.17	-8.17	9,440	5,319	167,130
1999	59.18	-7.46	0.03	1.81	-9.42	1.95	126.15	-26.15	9,762	5,405	164,953
2000	69.59	2.94	0.04	1.86	-1.18	4.12	-39.99	139.99	11,470	6,166	164,828
2001	59.02	-7.62	0.03	1.75	-7.72	0.10	101.33	-1.33	9,974	5,687	168,989
2002	60.92	-5.72	0.03	1.83	-8.70	2.98	152.03	-52.03	10,598	5,777	173,955
2003	62.58	-4.07	0.04	1.74	-3.69	-0.38	90.77	9.23	11,178	6,421	178,631
2004	66.64	0.00	0.04	1.75	-	-	-	-	12,271	7,008	184,127
2005	64.88	-1.76	0.04	1.72	-0.48	-1.28	27.47	72.53	12,359	7,197	190,492
2006	64.67	-1.98	0.04	1.72	-0.70	-1.27	35.58	64.42	12,772	7,437	197,503
2007	60.45	-6.20	0.04	1.72	-5.08	-1.12	81.96	18.04	12,248	7,119	202,618
2008	55.59	-11.05	0.03	1.74	-10.58	-0.48	95.67	4.33	11,548	6,647	207,738
2009	50.43	-16.21	0.03	1.67	-13.46	-2.75	83.03	16.97	10,642	6,371	211,012
2010	42.05	-24.60	0.03	1.65	-21.36	-3.24	86.84	13.16	9,044	5,484	215,087
2011	39.76	-26.89	0.02	1.76	-27.31	0.42	101.57	-1.57	8,558	4,849	215,262
2012	36.55	-30.09	0.02	1.69	-28.42	-1.67	94.45	5.55	7,858	4,636	214,983
2013	35.92	-30.73	0.02	1.75	-30.62	-0.11	99.64	0.36	7,548	4,320	210,150

Note: *t* = year. *R* = charge rate (charges per 1,000 15-17-year-olds). *Diff* = difference in charge rate compared to 2004. *E* = extensive margin (proportion charged in year t). *I* = intensive margin (mean number of charges per charged person in year t). *ω* = margin's absolute contribution to the overall change in crime compared to 2004. *%ω* = margin's percentage contribution to the overall change in crime compared to 2004. The table also shows the number of charges, the number of charged and the population size (for 15-17-year-olds) used to calculate charge rates and the intensive and extensive margins for each year.

Figure 3 shows the shares of offenders charged with 1, 2, 3, 4, and 5+ crimes within each year from 1996 to 2013. The distribution of these shares is stable from 2004 onwards, reflecting the stable composition of the group of offenders, even though our decomposition shows that fewer youth initiate a criminal career. Thus, the young people driving the decline at the extensive margin are drawn from the entire distribution of young people (with all levels of crime proneness), a finding that validates Tonry's (2014) rejection of the gateway hypotheses.

Figure 3: **Proportion of charged by number of charges in a given year, ages 15–17, 1996–2013**
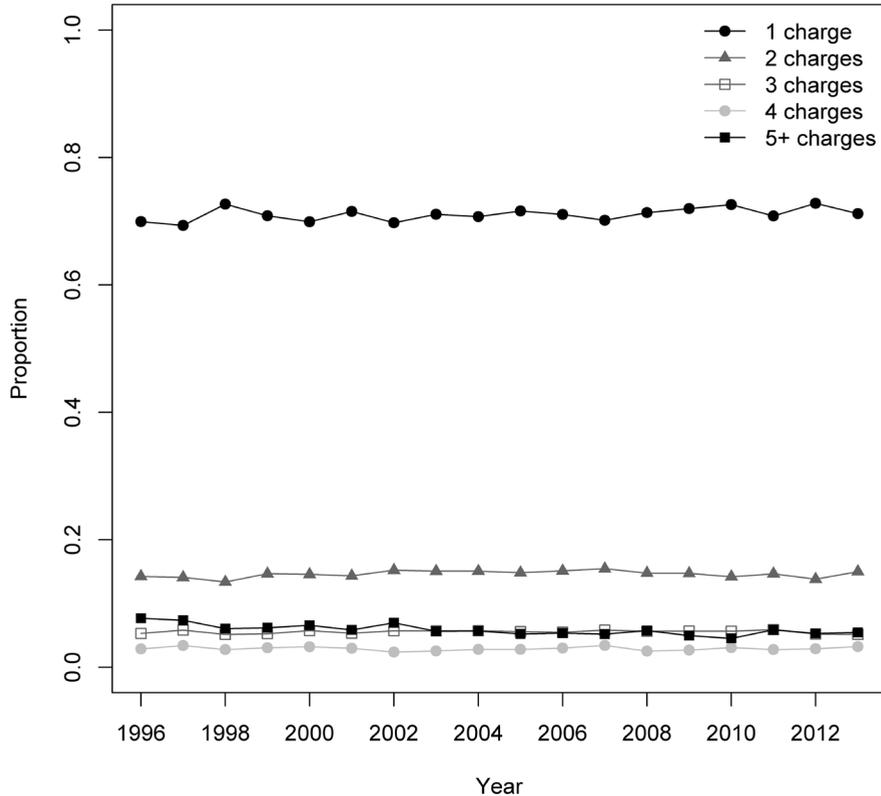

3.1 Results from cohort analyses

Figure 4 shows results from the cohort analyses, and plots the extensive (panel a) and intensive (panel b) margins of charges by age for select birth cohorts. These results demonstrate how more recent birth cohorts contribute most to the observed changes at the extensive margin, both in adolescence and early adulthood. While 13% of the 1988 cohort had faced charges at age 21 (in 2009), this only applied to 10.6% of the 1992 cohort (in 2013). As we observe parallel trajectories between recent birth cohorts and the 1992 cohort and even lower proportions charged at age

17 (4.8% in the 1996 cohort compared to 6.9% in the 1992 cohort), we may expect to see even lower charge rates in the coming years, when these cohorts move into young adulthood (a prediction that is also proposed in von Hofer 2014).

Panel b in Figure 4, however, shows that across the birth cohorts there is little evidence of changes at the intensive margin. While fewer youth experience criminal justice contact, recidivism among those who do mirrors recidivism among earlier cohorts. At age 17 the mean number of charges is between 2.2 and 2.3 for all birth cohorts, and even at age 21 the cohorts have similar recidivism rates.

Figure 4: **Cumulative proportion charged and number of charges, by age and birth cohort**

(a) Extensive margin   **(b) Intensive margin**
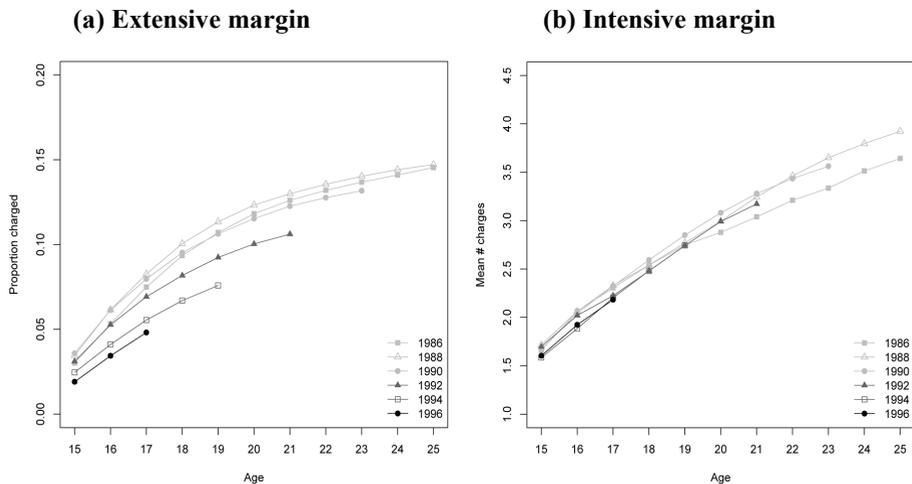
4. Discussion

Why is youth crime dropping throughout the developed democracies? According to our findings, the main driver of declining youth crime in Denmark is that in recent years fewer young people have experienced criminal justice contact, and not lower rates of criminal recidivism. Using Danish register data on criminal charges, we decomposed the declining youth charge rate into its extensive and intensive margins and found that most of the decline occurs at the extensive margin. Exploiting the panel structure of Danish register data, we also showed that more recent birth cohorts have substantially lower charge rates, by age, compared to earlier cohorts, despite the fact that all cohorts have identical rates of recidivism. As a result we

may also expect these cohorts to have lower overall levels of crime in early adulthood.

But while our findings provide one answer to the puzzle of declining crime rates, we are still far from fully understanding this trend. In the literature there are multiple untested hypotheses putting forward possible explanations. Farrell, Tilley, and Tseloni (2014) consider 17 hypotheses mentioned in the literature. The authors assess the relevance of each hypothesis using four criteria: cross-national applicability, applicability to previous increases in crime, applicability to increases in 'e-crimes' and phone theft, and applicability to the timing of the crime decline across contexts. Only one hypothesis meets all criteria. This is the security hypothesis describing how changes in the quantity and quality of security impact crime rates. By increasing perceived apprehension risks (e.g., because of increased surveillance) and refining security measures to increase the effort it takes to surpass security measures (e.g., bypassing active anti-theft mechanisms in cars requires skill and time), committing certain types of offenses has simply become more cumbersome (Farrell, Tilley, and Tseloni 2014). However, increased security is insufficient to explain our findings, as it would affect both first time offenses and recidivism, and thus both margins.

In fact, broad explanations of general changes in the crime rate might not sufficiently address the nature of the current trends in youth crime, where we observe a simultaneous de-normalization of crime and stable recidivism. Instead we should turn to separate explanations.

Here, the question of stable recidivism rates seems the most straightforward. Our results indicate that the consequence of committing a first crime are unaltered and start the offender on a negative spiral with the same slope today as it had years ago. Similarly, current efforts aimed at reintegrating offenders and avoiding criminal recidivism are fruitless, either because these efforts are insufficient or because the barriers to reintegration are too high. To test this possible explanation, future studies should compare criminal pathways today with criminal pathways a decade or more ago.

The question of the lowered share of first-time offenders is less straightforward. For example, Kim, Bushway, and Tsao (2016) find that neither penal policies nor policing strategies explain changes in US arrest rates between 1990 and 2010. Rather, the changes are best explained by differences across birth cohorts. However, the same conclusion is rejected in a Swedish study (Bäckman et al. 2014), where cohort differences in the composition of offenses have more explanatory power. To further complicate matters, another Swedish study analyzes 34 birth cohorts and finds that only males experience changes in conviction rates (von Hofer 2014) and that female rates are stable.

But despite country-level differences, which are particularly pronounced in comparisons of Scandinavian and Anglo-Saxon countries, we cannot ignore the

parallel trends observed in crime rates across developed democracies. In fact, the rates of some types of crime, such as homicide, have shown parallel trends since the late Middle Ages (Tonry 2014), at least in English-speaking countries. The parallel trends across developed democracies may be the key to answering the question of declining youth crime.

Common cultural changes, such as increased accessibility to and use of electronic devices such as smartphones and tablets, may have prevented young people from committing their first crime, by simple incapacitation (Cunningham, Engelstätter, and Ward 2011). Changes in how certain types of behavior are diagnosed and treated may also affect the extensive margin of youth crime. For example, Lichtenstein et al. (2012) found lower conviction rates among people with ADHD symptoms during medication periods than during periods without medication. The increasing use of medication to reduce symptoms of ADHD has also impacted Danish children's risk of foster care placement (Fallesen and Wildeman 2015). Future studies should further examine these explanations and, if possible, provide causal evidence of how they affect the likelihood of first-time offending.

However, despite the lack of bulletproof explanation, the decline in youth crime gives room for optimism. The optimism increases, knowing that the decline in youth crime extends into young adulthood; a result that has also been found using trajectory models on data from both the UK and the US (D'Unger et al. 1998; Nagin and Land 1993). Society becomes safer, and young people's prospects for the future become brighter, as fewer of them are challenged by having a criminal record. However, many unanswered questions still remain regarding the current trend of declining youth crime. The results of this paper, that change at the extensive margin is the main driver of declining youth crime, represent a crucial step towards gaining a deeper understanding of this important social and demographic change.

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