The Road to Crime: An Unintended Consequence of the Interstate Highway System

The Road to Crime

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Abstract: The necessity to overhaul national infrastructure has become one of the key issues of US domestic policy in recent years. While the benefits of infrastructure spending are often straightforward, its unintended consequences are less well understood. This paper studies the impact of transportation infrastructure on local crime, focusing on the construction of the Interstate Highway System (IHS), the largest public works project in US history. Using a staggered difference-in-differences design and a county-by-year panel dataset spanning all US counties between 1960 and 1993, we find that a highway opening in a county led to an 8% rise in total index crime. This effect is driven by property crime (burglary, larceny, and motor vehicle theft), although some evidence suggests an increase in violent crime as well. Exploring potential mechanisms, we show that the positive effect of highways on crime is concentrated in counties with low pre-existing stock of police resources where increased connectivity may have raised the returns to crime. Moreover, we find that highway construction induced higher local employment, average firm size, and the local population size, thus increasing the returns to criminal activity, and ultimately the risk of victimisation in the newly-connected counties.

Keywords: Interstate Highway System, local crime, economic development, local law enforcement

Classification: H54, K42, O18

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1 Introduction

The need for a significant overhaul of national infrastructure has become one of the core issues of US domestic policy in recent years, culminating in the signing of the $1.2 trillion bipartisan infrastructure bill by President Biden on November 15, 2021 (Tankersley, 2021).[1] While the public debate on infrastructure spending usually centres on its benefits, the unintended consequences are often overlooked. This paper considers the unintended consequences of transportation infrastructure investment, focusing on one aspect in particular—the increase in crime. To that end, we analyse the effects of the construction of the Interstate Highway System (IHS), the largest public works project in US history and the second largest highway network in the world (Nall, 2015).[2]

The IHS—with its 46,876 miles of highways built primarily between 1956 and 1992 (Federal Highway Administration, 2021)—may have increased criminals' mobility and the returns to criminal activity by connecting faraway locations through high speed limits and a lack of traffic barriers (Agnew, 2020). Highways also facilitate predatory crime by bringing together persons unknown to one another (Strand, 2012). Due to population movements induced by the IHS, the newly-connected communities may also have witnessed an influx of individuals with a higher propensity to commit crime, such as young men (O'Flaherty and Sethi, 2015). Finally, by boosting local economic development (Michaels, 2008), the construction of the highway likely opened up new areas to crime as criminal opportunities increased (Freedman and Owens, 2016), and individuals—and their property—became exposed to a higher risk of victimisation (Cantor and Land, 1985).

We evaluate the impact of the IHS construction on local crime by exploiting its staggered rollout, as the highways were successively introduced into new counties across the country. In particular, using the FBI's Uniform Crime Reporting (UCR) data and an unbalanced, county-by-year panel dataset spanning all 3,131 US counties between 1960 and 1993,[3] we employ a difference-in-differences estimation strategy with staggered treatment adoption, comparing counties where an interstate highway opened with those where one did not, before and after the introduction of the highway infrastructure. We find a positive overall effect on crime, driven mainly by an increase in property crime, although some evidence suggests a rise in violent crime

[1] Named the American Jobs Plan (source: The White House).
[2] In 2010, the IHS was surpassed in total length by China's National Trunk Highway System (He, Xie and Zhang, 2020).
[3] 1960 is the first year for which crime data is available, while 1993 is the last year for which we have the highway construction data. The county-level UCR data were compiled by Kaplan (2021b) from the original agency-level data provided by the FBI.

as well. More specifically, according to the estimates from a two-way fixed effects (TWFE) specification, the opening of an interstate highway in a county led to an 8.1% increase in total index crime, with property crime increasing by 8.4% and violent crime by 5%. Considering the individual index crimes, we observe a positive effect across a range of categories, namely burglary (+7.7%), motor vehicle theft (+10.7%), theft (+9.6%), assault (+8.6%), and robbery (+5.6%). At the same time, there is no increase in the incidence of rape or homicide. The event study estimates support the validity of the static estimates except those for motor vehicle theft and robbery, which need to be interpreted with caution, given a lack of clean parallel pre-trends. Next, we narrow down the study period to the years 1960 to 1980, during which the majority of the highway system was built (Michaels, 2008) and the US experienced an unprecedented rise in aggregate crime (O'Flaherty and Sethi, 2015). We, nevertheless, find similar estimates across the board.

Our main results are robust to a battery of robustness checks, such as the elimination of urban cores from the estimation sample, the inclusion of trends of the baseline characteristics, and the clustering of standard errors at a higher level of geography. The estimates for assault and robbery are, however, sensitive to some of the alternative specifications. Furthermore, we estimate both the static and the dynamic version of the newly-developed interaction-weighted (IW) estimator by Sun and Abraham (2020), which is robust to any treatment effect heterogeneity. As a result, most estimates increase in magnitude, with the effect for theft and assault reaching nearly 20%. However, as with the TWFE event study, one must exercise caution when interpreting the effect on motor vehicle theft and robbery. Finally, given the known imputation concerns with the UCR data, we estimate a series of sensitivity analyses which confirm that the measurement error—inherent in the UCR data—is not driving our findings.

Exploring some of the mechanisms through which the IHS could have affected crime, we first show that the positive effect of highways on crime is observed only in counties with a below-median initial police size, suggesting that increased connectivity in underpoliced counties might have raised the local returns to crime. We also consider the responses of local law enforcement which may have mitigated the crime surge induced by the highway's construction. We find that introducing a highway increased local police numbers by 3.4%, although directly controlling for police employment does not alter the main crime estimates. Furthermore, highway's opening led to a heightened police presence in the affected communities, as proxied by the number of patrols per officer (+2.9%). This increase was driven by extra vehicular patrols (+3.5%), whereas foot patrols remained unaffected.

Next, we estimate the effect of highways on a range of local economic indicators and demographic outcomes. While we do not find a positive effect on earnings—contrary to the previous findings of Michaels (2008) and Chandra and Thompson (2000)—we show that the introduction of a new highway led to a 3% increase in the share of the working population, driven by higher employment in the manufacturing (+6.6%) and wholesale (+2.2%) sectors. Moreover, the average firm size increased by about 2.2%. Highway construction also led to a 4% increase in the county population size, though the population growth was not accompanied by a disproportionate influx of individuals with a higher propensity to commit crime. Nevertheless, larger population – alongside higher employment and average firm size – translate into a higher concentration of potential targets of criminal activity, thus increasing the returns to crime, and ultimately the risk of victimisation (Cantor and Land, 1985).

Finally, we test for the local displacement of criminal and economic activity. We do not find evidence of any substantial displacement of crime from the highway-adjacent counties, indicating that higher local criminal mobility was not a main driving force behind the observed rise in crime. Similarly, we do not observe a significant displacement of economic activity from the neighbouring counties, suggesting that the effect of highways on local economic outcomes was due to the creation of new economic activity.

Our paper contributes to the existing literature in three key areas. First, we extend the literature studying the effects of the IHS on local communities by focusing primarily on its unintended consequences, namely a rise in crime. This paper is the first to estimate the causal effect of interstate highways on the incidence of crime. Previous studies have shown a positive effect of highways on local economic activity in general (Chandra and Thompson, 2000), and trade-related activities in particular (Michaels, 2008; Keeler and Ying, 1988). Jaworski, Kitchens and Nigai (2020) argue that removing the IHS would reduce real US GDP by $619.1 billion (3.9%), with one quarter of this fall due to reduced access to international markets. Other papers have explored the population dynamics brought on by the IHS construction. Baum-Snow (2007) shows that highways fuelled the suburbanisation of American cities, with one third of this effect attributed to the reduced quality of life in central city areas (Brinkman and Lin, 2022).

Second, we add to the emerging literature on the impact of infrastructure in general on local crime and delinquent behaviour. Highway networks have been found to increase burglary rates in Ireland (Agnew, 2020), while also facilitating the spread of national gangs into new territories in El Salvador (Baires, Dinarte and Schmidt-Padilla, 2020). On the other hand, Montolio (2018), studying the case of Spain, shows that a nationwide infrastructure investment policy may actually reduce crime and reoffending rates by lowering the unemployment rate. Focusing on the construction of a highway system whose scale dwarfs that in Ireland or El Salvador, we find that a highway opening in a community increases various types of property crime, with some evidence of an increase in violent crime as well. Consistent with the findings of Agnew (2020), our results suggest a modest effect, with estimates not exceeding 11% in the main specification.

Lastly, we build on existing studies analysing the determinants of the so-called big swings in aggregate US crime throughout the second half of the twentieth century and into the twenty-first century. While most papers have focused on the great American crime decline of the 1990s (Zimring, 2007; Levitt, 2004) and the subsequent modest crime decline of the twenty-first century (Marcotte and Markowitz, 2011), relatively little is known about the causes of the great American crime rise of the 1960s and 1970s (O'Flaherty and Sethi, 2015). The IHS—the majority of which was built in the 1960s (Michaels, 2008)—could have contributed to this nationwide crime surge. However, given the magnitude of our estimated coefficients, we postulate that the role of the IHS was probably minor.

The remainder of the paper is organised as follows: Section 2 discusses background information and some related literature. Section 3 presents the conceptual framework. In Section 4, we describe the data, the empirical specification, and the identification strategy. Results are presented in Section 5. Section 6 discusses further threats to identification, while Section 7 discusses potential mechanisms through which the IHS may affect crime levels. Section 8 then concludes the paper.

2 Background and previous work

2.1 History of the Interstate Highway System

The IHS—with 46,876 miles of highways built as of 2021 (Federal Highway Administration, 2021)—is arguably the largest public works project in US history (Nall, 2015; Federal Highway Administration, 1999). The final cost estimate in 1991 put the overall price tag at around $128.9 billion (or 2.1% of total US GDP in 1991), with federal funds accounting for $114.3 billion of this sum (Federal Highway Administration, 2021).[4] The IHS was the largest highway network in the world until it was surpassed in 2010 by China's National Trunk Highway System (He, Xie and Zhang, 2020). The history of IHS planning goes back to the late 1930s, when President Roosevelt instructed the US Bureau of Public Roads to look into the feasibility of building toll superhighways across the continental United States (Federal Highway Administration, 2021).

In 1941, Roosevelt appointed the National Interregional Highway Committee which in its 1944 report to the US Congress laid out concrete plans for the National System of Interstate and Defense Highways. This was authorised as a provision of the Federal-Aid Highway Act of 1944, thus establishing plans for the future IHS (Gifford, 1984). However, it was not until the passage of the Federal-Aid Highway Act of 1956 and the Federal-Aid Revenue Act of 1956 during Eisenhower's presidency that the funding and logistics for the project were secured and construction could finally begin. Hence the official name of the project—the Dwight D. Eisenhower National System of Interstate and Defense Highways (Federal Highway Administration, 2021).

Initial planning of the IHS—depicted in Figure 1—took into consideration a number of factors, namely the location of military and naval establishments, the nationwide population distribution, agricultural production and manufacturing activity, the location of post-World War II employment, and interregional traffic demand (US House of Representatives, 1944). By 1956, national defence became one of the main drivers of the IHS construction. Highways were seen as key strategic infrastructure necessary to facilitate any emergency military deployment across the country (US Congress, 1949). At the same time, the US government saw the need to connect principal metropolitan areas, cities, and industrial centres across the country, while

[4]This estimate covers only the 42,795 miles built under the Interstate Construction Program. Turnpikes incorporated into the IHS as well as other logical additions and connections financed without Interstate Construction funds are excluded (Federal Highway Administration, 2021).

also connecting with routes of continental importance in Canada and Mexico (US House of Representatives, 1944; Michaels, 2008). The initial authorisation of 37,324 miles was later extended to 41,000. The roads were to be built according to federal interstate standards.[5] The bulk of the highways were built between 1956 and 1975 (Michaels, 2008). In 1992, the IHS was declared complete although some construction continued into the 1990s and 2000s (McNichol, 2006). Today, the 46,876 miles of interstate highways remain an essential component of the US transportation network. In 2019, the IHS carried 26% of annual vehicle-miles of travel despite comprising only 1.2% of national road mileage (Federal Highway Administration, 2019).

2.2 Interstate Highway System and local communities

A number of studies have explored the effects of the IHS on local communities. Baum-Snow (2007) argues that the IHS fuelled the suburbanisation of American cities. He observes that between 1950 and 1990, the central city population declined by 17% despite 72% population growth in metropolitan areas as a whole. Brinkman and Lin (2022) suggest that one third of this effect can be attributed to reduced quality of life, especially through barrier effects.[6] In a case study of the city of Detroit, Carter (2019) similarly finds that highway construction led to a decline in population density, the share of black residents, and property values in the affected neighbourhoods. A handful of papers have also considered the impact of the IHS on trade and economic outcomes. Jaworski, Kitchens and Nigai (2020) show that removing the IHS would reduce real GDP by $619.1 billion (3.9%), with one quarter of this fall due to reduced access to international markets. Consistent with this, Michaels (2008) finds that counties connected by the highway network experienced an increase in trade-related activities, such as trucking and retail sales, which raised the relative demand for skilled manufacturing workers in skill-abundant counties and reduced it elsewhere.[7] Chandra and Thompson (2000) further argue that highway construction had a differential local impact across industries, with some growing due to reduced transportation costs, while others shrank as economic activity relocated.

[5]Such as the minimum design speed of 70 mph (113 km/h) except in urban and mountainous areas, all access onto and off the highway controlled with interchanges and grade separations, minimum of two lanes in each direction (each 12 feet wide), a 10-foot right paved shoulder, a 4-foot left paved shoulder, and 16 feet of vertical clearance to accommodate military vehicles transporting intercontinental ballistic missiles, or ICBMs (AASHTO, 2001, 2005).
[6]Increases in the cost of travel between neighbourhoods severed by a highway.
[7]Higher productivity growth in trucking is also found in Keeler and Ying (1988).

2.3 Trends in aggregate US crime

Since the late 1950s, the US has witnessed periods in which all major index crimes moved up and down together (Figs. 2 and 3). Most of the literature has focused on studying the causes of the great American crime decline of the 1990s, and the subsequent modest decline of the twenty-first century (Zimring, 2007; Levitt, 2004; Marcotte and Markowitz, 2011). During the 1990s, the aggregate violent crime rate in the US dropped by 33% while the property crime rate decreased by 30%.[8] Four traditional factors have been proposed to explain this crime drop: the size of the police force (Chalfin and McCrary, 2018), the size of the prison population (Levitt, 1996), the changing age composition of the population (Zimring, 2007), and macroeconomic performance (Gould, Weinberg and Mustard, 2002). However, since these variables together fail to explain most of the decline, other "non-traditional" factors have been proposed, such as the end of the crack epidemic (Levitt, 2004) and the rise of private protection (Cook and MacDonald, 2011).

In contrast to the great American crime decline of the 1990s, relatively little is known about the determinants of the great American crime rise of the 1960s and 1970s. Between 1960 and 1980, the property crime rate increased by 210%, before levelling off during the 1980s. Violent crime continued to climb even throughout the 1980s, eventually reaching its all-time peak in 1991. Overall, the violent crime rate increased by 371% between 1960 and 1991.[9] While some of the crime surge could have been due to improved crime reporting and more reliable data collection, these factors cannot explain such a substantial and indiscriminate crime rise—affecting all communities and all regions of the country (O'Flaherty and Sethi, 2015). The four traditional variables also fail to explain any meaningful portion of the crime wave. Non-traditional explanations proposed by scholars, such as President Nixon's War on Drugs (declared in 1971), the Vietnam War draft lottery, the race riots of the 1960s, the expansion of air travel, and the increased lead content in gasoline coupled with uptake in driving,[10] have not been rigorously examined (O'Flaherty and Sethi, 2015). Another potential explanation—the construction of the IHS—is the subject of this paper.

[8] The most pronounced decline was observed for robbery (-47%), murder (-44%), and burglary (-42%). Source: authors' calculations based on UCR data from the Sourcebook of Criminal Justice Statistics Online.

[9] Authors' calculations based on the UCR data from the Sourcebook of Criminal Justice Statistics Online.

[10] After World War II, the lead concentration in gasoline steadily increased until the EPA-imposed restrictions in 1973, which eventually led to the complete phaseout of leaded gasoline in 1995 (Reuben, Elliott and Caspi, 2020).

3 Conceptual framework

The effect of the IHS on local crime is *ex ante* ambiguous. On the one hand, as Agnew (2020) argues, highways can increase criminals' mobility and returns to criminal activity by providing them with the least-cost path that connects faraway locations through high speed limits and a lack of traffic barriers. This decreases the time an offender is in transit and provides them with a quick escape option and the possibility of committing several offences in a short time Agnew (2020). The IHS also facilitates predatory crime by bringing together persons who are unknown to one another (Strand, 2012). Furthermore, population movements induced by the highway's construction can bring in individuals who are disproportionately more likely to commit crime, such as those aged between 15 and 34 (O'Flaherty and Sethi, 2015). The opening of a new highway can also spur local economic development (Michaels, 2008; Chandra and Thompson, 2000) which increases the amount of "thievable" property available, thus leading to more criminal opportunities in the affected communities (Freedman and Owens, 2016). Similarly, better labour market opportunities can mean that individuals spend less time within their primary-group locations (homes and neighbourhoods), thus exposing themselves and their property to a higher risk of victimisation (Cantor and Land, 1985).

On the other hand, improved wages and employment prospects increase an individual's opportunity cost of committing crime, thus reducing their propensity to participate in the criminal markets (Gould, Weinberg and Mustard, 2002). Another reason for a negative relationship could be a change in police behaviour. In other words, a local law enforcement agency (LEA) could respond to a highway opening, for example, by increasing its officer numbers and boosting its presence in the affected communities. Studies have shown that a larger police force reduces the level of local crime (Evans and Owens, 2007), with the effect more pronounced for violent crime than property crime (Chalfin and McCrary, 2018).[11] Similarly, heightened police presence has been found to decrease crime (Di Tella and Schargrodsky, 2004).

[11]Due to the larger police elasticity with respect to violent crime (-0.12) than property crime (-0.07) (Chalfin and McCrary, 2018).

4 Data and empirical strategy

4.1 Data

The analysis employs an unbalanced county-by-year panel which spans all 3,131 US counties from 1960 until 1993.[12] 1960 is the first year for which agency-level data[13] from the FBI's UCR Program is available. 1993 is the last year available in Baum-Snow (2007)'s IHS dataset. Our panel dataset thus combines several data sources.

First, we use data from Baum-Snow (2007) to identify each opening of an interstate highway in a US county during the period between 1960 and 1993. The evolution of the construction of the IHS in each decade during this period is depicted in Figure 4. We combine Baum-Snow (2007)'s data with the county-by-year panel dataset compiled by Kaplan (2021b) and based on the FBI's UCR Program: Offenses Known and Clearances by Arrest, 1960-2019, dataset. This database contains a detailed breakdown of the UCR Part I index crimes: (1) burglary (breaking or entering); (2) larceny-theft; (3) motor vehicle theft; (4) murder; (5) aggravated assault; (6) robbery; and (7) forcible rape. The first three are classified as property crimes while the other four are violent crimes.[14] We make a couple of minor adjustments with respect to the official definitions of the Part I index crimes. In particular, we consider homicide instead of murder since it occurs more frequently and also captures vehicular manslaughter, which is relevant in our context.[15] We also consider total assault, which is a broader definition than aggravated assault.

For the study of potential mechanisms, we first merge in county-level data from the FBI's UCR Program: Law Enforcement Officers Killed and Assaulted (LEOKA), 1960-2019. This database—compiled by Kaplan (2021a)—contains information about the size of local LEAs as well as the number of patrols per officer, capturing the intensity of the police presence in local communities. Second, we add data from the US Census Bureau's County Business Patterns (CBP), for the period between 1964 and 1993, which contains various measures of local economic performance. These data were primarily obtained from Manson et al. (2022),

[12]The panel uses the 1990 US county classification.
[13]Which are then aggregated to the county level.
[14]Source: FBI, UCR: Crime in the United States, 2011. Since 1979, Part I index crimes also include arson, but its occurrence is rare and detection uncertain (O'Flaherty and Sethi, 2015), thus we exclude it from the analysis.
[15]Homicide is the act of killing of one human being by another human being, which may or may not be legal. Murder is the act of one human being unlawfully killing another human being. Vehicular manslaughter is a homicide caused by one's unlawful or negligent operation of a motor vehicle (source: Cornell Law School, Legal Information Institute, Wex).

with further supplements taken from Eckert et al. (2022a) and Eckert et al. (2022b). Finally, we employ the 1969 to 1993 population estimates from the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) Program, and based on the US Census Bureau's Population Estimates Program (PEP). Table 1 reports descriptive statistics for the main variables used in the empirical analysis.

4.2 Difference-in-differences with staggered treatment adoption

To empirically investigate the impact of the IHS's construction on local crime in the US, we take advantage of the data's panel structure and estimate the following difference-in-differences two-way fixed effects (TWFE) specification with staggered treatment adoption:

$$Ln\ (crime)_{i,t} = \alpha_i + \beta_1 Any\ highway_{i,t} + \beta_2 Pop_{i,t} + \beta_3 Pop^2_{i,t} + \gamma_t + \theta_{s,t} + \Phi_c t + \varepsilon_{i,t} \quad (1)$$

where $Ln\ (crime)_{i,t}$ is the natural logarithm of the total number of UCR Part I index crimes in county i and year t. $Any\ highway_{i,t}$ is the indicator variable equal to 1 when $t \geq E_i$, where E_i is the year when county i registered the opening of at least 1 mile of interstate highway. Eq. (1) further controls for the quadratic in the county population ($Pop_{i,t}$, $Pop^2_{i,t}$), county fixed effects (α_i), year fixed effects (γ_t), state-by-year fixed effects ($\theta_{s,t}$), and commuting zone-specific linear time trends ($\Phi_c t$).[16] State-by-year fixed effects control for any state-level policy changes and other year-shocks that affect all counties within the same state equally. Commuting zone time trends capture any linear changes to the local labour markets. $\varepsilon_{i,t}$ is the error term, clustered at the county level. Observations are weighted by the 1960 county population. The overall index crime is then broken down into property crime (burglary, motor vehicle theft, and theft) and violent crime (assault, robbery, homicide, and rape). We further split these two categories into seven individual crimes to understand which ones drive the main result.

The coefficient of interest (β_1) captures the (plausibly) causal effect of the IHS opening on county crime, conditional on the set of covariates ($\alpha_i,\ Pop_{i,t},\ Pop^2_{i,t},\ \gamma_t,\ \theta_{s,t},\ \Phi_c t$). The identifying assumption relies on the absence of contemporaneous shocks that would affect crime in the control counties. Given that the IHS is a federal project primarily funded by the federal government, and whose plans date back to the late

[16] Commuting zones are county groupings which approximate the local US labour markets (Autor and Dorn, 2013).

1930s, the existence of such shocks is arguably very unlikely.[17] Differential pre-trends between the treated and control counties are also a threat to the identification. To address this concern, we estimate a traditional event study design which takes the same form as eq. (1), except *Any highway*$_{i,t}$ is replaced by a set of lags and leads for each year before and after the IHS opening. The year before the IHS opening is the reference year. The event study specification also allows for investigation of the dynamic evolution of the highway treatment effect. Lastly, recent econometrics literature highlights a concern that the TWFE estimator will be biased if there are heterogeneous treatment effects over time (de Chaisemartin and D'Haultfoeuille, 2020). Therefore, as a key robustness check, we estimate both the static and the dynamic version of the newly-developed interaction-weighted (IW) estimator by Sun and Abraham (2020).

5 Results

We begin the presentation of our results by first showing the event study estimates. Figures 5, 6, and 7 display the dynamic specification of eq. (1) with confidence intervals at the 95% level. The pre-highway opening estimates support the parallel trends assumption in all cases, except for robbery (Fig. 7) and, to some extent, motor vehicle theft (Fig. 6). Therefore, given the lack of clean parallel pre-trends, these two outcomes need to be interpreted with caution. The post-opening estimates show an immediate rise in total index crime, with the effect increasing in magnitude around three years after the opening of the highway (Fig. 5). This positive effect is driven by property crime (Fig. 5), mainly theft and burglary, with motor vehicle theft increasing as well (Fig. 6). However, the dynamic design also reveals increases in the violent crimes of assault and rape, with a delayed effect on the latter (Fig. 7). Short-run event study estimates—shown in Figures A.1 to A.3—paint a similar picture, while also identifying a somewhat cleaner increase in robbery offences (Fig. A.3). Turning to the difference-in-differences estimates (eq. 1), we find that the opening of an interstate highway in a county led to an 8.1% increase in the number of index crimes (Table 2, col. 4). Consistent with the event study figures, this result is driven by an 8.4% rise in property crime (Table 3, Panel A, col. 4), although the difference-in-differences estimates suggest some increase in violent crime as well (+5%; Table 3, Panel B, col. 4). Breaking down property crime into individual index crimes, we find

[17] The federal government paid 90% of the cost of the project with states contributing the remaining 10%. In the western states with large amounts of untaxed public land, the federal share could be increased to 95% (Federal Highway Administration, 2021).

that the IHS opening induced a 7.7% increase in burglaries, a 10.7% increase in motor vehicle theft, and a 9.6% increase in larcenies (Table 4, cols. 1-3). In respect of violent crimes, we observe increases in assaults (+8.6%) and robberies (+5.6%), while rapes and homicides remain unaffected (Table 4, cols. 4-7).

Given that the county population in the intercensal years is imputed by the US Census Bureau,[18] we address the risk of measurement error in this variable by re-estimating eq. (1) with population figures taken from the census years only. The estimates are similar when using population either from the nearest previous census (Table A.1) or the nearest subsequent census (Table A.2). Conversely, eliminating population controls altogether does not substantially alter the results (Table A.3). The main coefficients are also not sensitive to the use of the inverse hyperbolic sine transformation of the dependent variable (Table A.4) and the clustering of standard errors at the level of commuting zones (Table A.5). All individual estimates—except for that of assault—are further robust to the elimination of potential outliers (Table A.6), as well as the inclusion of more restrictive county-specific linear time trends instead of commuting zone trends (Table A.7). Another concern is the large number of zeros in variables such as homicide, whose incidence is rare at the county level. We therefore estimate a Poisson pseudo-likelihood regression which is well suited for count outcomes. Our results, presented in Table A.8, show an adjusted incidence rate ratio (IRR) greater than one for all outcomes except homicide, indicating a higher incidence rate for the treated counties following the opening of a highway. The estimates are statistically significant at the 5% level for total crime, property crime, violent crime, larceny, and assault (Table A.8, cols. 1-3, 6, and 7).

We further explore the effects of the IHS construction on crime during the sub-period from 1960 to 1980. These years were characterised by the sharpest rise in aggregate index crime (Fig. 2), coupled with the construction of the bulk of the interstate highways (Fig. 4). Table 5 presents the results. Consistent with the main analysis, we observe a 7.2% increase in total index crime, driven mainly by a 7.6% rise in property crime (Table 5, cols. 1 and 2). As before, the five individual crimes responsible for this local surge are burglary (+8.8%), motor vehicle theft (+11.1%), larceny (+7.3%), assault (+6.8%) and robbery (+6.8%).

[18] The imputation is carried out using current data on births, deaths, and migration (US Census Bureau, 2023).

6 Threats to identification and further robustness checks

6.1 Alternative estimator

Difference-in-differences estimation with staggered treatment timing can suffer from a bias if there are heterogeneous treatment effects over time. More specifically, since the main estimate is the weighted sum of the average treatment effects (ATEs) in each group and time period, some ATEs may be given negative weights, which can then cause the difference-in-differences estimate to have a different sign than all the ATEs (de Chaisemartin and D'Haultfoeuille, 2020). A number of new estimators have been developed to overcome this issue.[19] Given the complexity of our setup—namely the large number of fixed effects—we implement the interaction-weighted (IW) estimator developed by Sun and Abraham (2020). This estimator is based on three steps: first, it estimates the lags and leads in the event study design, but with a separate coefficient for each "cohort."[20] Second, it estimates the weights by sample shares of each cohort in the relative period(s). Finally, the IW estimator is calculated as the weighted average of the estimates across cohorts (from the first step), using the weight estimates derived in the second step. In our setting, we use the never-treated group as the control group.[21] Figures A.4, A.5, and A.6 depict the event study estimates while Table A.9 shows the static average effects. Overall, all estimates—except for the coefficients on robbery and (to some extent) motor vehicle theft—are robust to using this alternative estimator. Furthermore, the majority of the coefficients increase in magnitude, while some nearly double. In particular, we observe that the incidence of theft/larceny increases by 18.2% while assaults increase by 16.2% following the opening of a highway in a county.

6.2 Imputation concerns with the UCR data

Since the UCR is a voluntary program, the participating LEAs do not always provide 12 months of crime data to the FBI.[22] The FBI uses an imputation method, described in detail in Maltz and Targonski (2002), to bridge these gaps in the data. Similarly, in constructing county-level crime counts, the data reported by

[19] See, for example, Sun and Abraham (2020), de Chaisemartin and D'Haultfoeuille (2020), or Callaway and Sant'Anna (2021).
[20] A cohort is comprised of units (counties) with the same treatment timing.
[21] Due to computational limits, we do not include commuting zone linear time trends in the estimation, as that would make the variance matrix highly singular.
[22] There are various reasons behind this underreporting, including natural disasters, budgetary restrictions, and personnel changes (Maltz and Targonski, 2002).

statewide agencies has to be allocated into individual counties in proportion to each county's share of the state's population. Finally, large urban LEAs which span more than one county likewise have to have their crimes distributed into the relevant counties in proportion to each county's share of the agency's population (Maltz and Targonski, 2002). These are all potential sources of measurement error which could pose a challenge to our analysis. However, as noted by Bianchi, Buonanno and Pinotti (2012), the use of natural logarithms combined with the inclusion of county and year fixed effects should substantially mitigate these concerns. Furthermore, restricting the estimation sample to observations with the coverage indicator equal to 100% increases the magnitude of the main coefficient across all outcomes (Table A.10).[23]

Lastly, we have re-estimated the main analysis using the original FBI's UCR agency-level data (compiled by Jacob Kaplan), while keeping the highway treatment at the county level. The standard errors also remain clustered at the county level. Given that LEA non-reporting creates the most serious of the imputation concerns, we focus solely on observations for which a full calendar year of data were reported to the FBI. Table A.11 shows estimates using only the LEAs which are confined to a single county, while Table A.12 further adds agencies that span more than one county. We do this by splitting the large agencies into multiple observations, one for each relevant county. Reassuringly, we observe that both exercises deliver results that are consistent with our main estimates. The only major difference is the estimate on robbery which essentially drops to zero.[24]

6.3 Inclusion of different sets of linear trends

Given the commuting zone linear time trends are estimated using both pre- and post-treatment data, they could potentially capture a part of the treatment effect. Thus, we re-estimate each trend using only the period before the first county in the commuting zone receives a highway. For most outcomes, eq. (1) yields a larger main coefficient (Table A.14). Next, we consider the factors behind the initial IHS planning as potential confounders. More specifically, we include the linear trends of the following baseline characteristics which influenced the initial highway placement (US House of Representatives, 1944): (1) the share of the population

[23] These are essentially observations in which all relevant law enforcement agencies reported crime data for the full 12 months. This sample restriction leaves us with 52,873 observations (50% of the original sample).

[24] In a final exercise, we add crime counts reported by the state and federal agencies. These are distributed among the local LEAs according to their relative population sizes. However, in the end, these add little to each LEA's crime counts since state and federal agencies ordinarily do not report a great deal of crime (Maltz and Targonski, 2002). Hence, it is unsurprising that the estimates—shown in Table A.13—are virtually identical to those presented in Table A.12.

in agricultural occupations in 1940; (2) the number of manufacturing establishments in 1940; (3) the total population in 1940; (4) the distance to the nearest post-World War II military or naval establishment; and (5) the unemployment rate in 1950.[25] We do this using two different approaches. In the first approach, we split the counties according to the median value of each baseline variable, interacting the resulting binary variables with the linear time trend. The resulting crime estimates are very close to the main coefficients (Table A.15). In the second approach, we interact each of the five baseline factors with year-specific binary variables, thus generating separate linear trends for each year of the panel. As shown in Table A.16, the results are consistent with the main analysis, although there is some decrease in magnitude of the estimated coefficients.

6.4 Eliminating urban cores

Many cities witnessed social changes in the 1960s—such as the race riots and the white flight—which likely spurred a rise in crime independently of the IHS construction. Therefore, the inclusion of urban cores in the analysis risks the possibility of a multi-barrelled treatment. To address this concern, we refine the estimation sample by first dropping all counties in the top 25% of the 1960 population distribution.[26] Results are shown in Table A.17. Estimates of property crime are somewhat attenuated (Table A.17, cols. 2, 4-6), although not statistically different from the main coefficients. In terms of violent crimes, the coefficient on assault remains the same, while that on robbery increases in magnitude (Table A.17, cols. 7 and 8). We also observe a positive effect on rape (Table A.17, col. 9), which was previously undetected. Then, in order to eliminate the set of urban cores more precisely, we drop all counties in the top 25% of both the 1960 population and population density distributions.[27] Reassuringly, the estimates—presented in Table A.18—are in line with those shown in Table A.17.

[25] Data was obtained from IPUMS NHGIS and OpenDataSoft.
[26] The 75^{th} percentile of the 1960 population distribution is 39,399 inhabitants.
[27] The 75^{th} percentile of the 1960 population density distribution is 67.23 inhabitants per square mile.

7 Potential mechanisms

7.1 Police size and presence in local communities

Exploring potential mechanisms, we first consider the effect heterogeneity with respect to the initial police size. As shown in Table 6, the positive effect on crime is entirely concentrated among counties that were below the median police size in 1960, with crimes such as motor vehicle theft increasing by as much as 21% (Table 6, col. 5). This suggests that counties with a large pre-existing stock of police resources saw little increase in crime once the highways were introduced, whereas increased connectivity and new targets of criminal activity in underpoliced counties may have significantly raised the local returns to crime.

Next, we study the responses of local law enforcement which might have mitigated the crime rise induced by the highway's construction. More specifically, LEAs might respond to an anticipated or actual crime surge induced by highway construction by boosting their ranks and increasing their presence in the affected communities. Studies have shown a causal inverse relationship between the size of the police force and index crime (Evans and Owens, 2007), with the effect being larger for violent crime than property crime (Chalfin and McCrary, 2018). A similar relationship has been estimated between crime and the intensity of police presence in the community (Di Tella and Schargrodsky, 2004). We explore this link using data for the period between 1960 and 1993, taken from the FBI's UCR Program: Law Enforcement Officers Killed and Assaulted (LEOKA) database, which was compiled by Kaplan (2021b). We find a 3.4% increase in the number of police officers per 10,000 population following a highway opening (Table 7, col. 1), although directly controlling for police employment does not alter the main crime estimates (Table A.19).[28] We also observe a 2.9% increase in the number of patrols per officer (Table 7, col. 2), driven by additional vehicular patrols (+3.5%), while foot patrols remained unaffected (Table 7, cols. 3 and 4).[29] Sun and Abraham (2020)'s estimates paint the same picture, while the effect on police size almost triples in magnitude (Fig. A.7, Table A.21).

[28]This finding helps to ameliorate another concern with the analysis—that the crime rise could be largely an artefact of better crime reporting induced by a larger police size. Reassuringly, this so-called reporting bias is generally small in magnitude (Levitt, 1998). Nevertheless, we also show that highway construction actually led to a small decrease in the overall clearance rate, defined as the share of all index crimes cleared by an arrest within the same year. This result—depicted in Table A.20—suggests that despite increases in police employment, LEAs were unable to fully keep up with the rise in crime.

[29]The police data is aggregated to the county level from the following types of agencies listed in the LEOKA database: (1) constables/marshals; (2) local police departments; (3) sheriff's offices; and (4) special jurisdictions.

7.2 Local economic development

Another potential mechanism through which the IHS could have affected crime is via its effect on local economic development, as improved economic conditions increase criminal opportunities (Freedman and Owens, 2016) and expose individuals—and their property—to a higher risk of victimisation (Cantor and Land, 1985). Previous research has identified a positive effect of the IHS on incomes in rural counties. More specifically, Chandra and Thompson (2000) find 5-8% earnings growth in the services and retail industries, while Michaels (2008) estimates a 7-10% per capita increase in trucking income and retail sales. To extend these analyses further, we employ CBP data compiled by Manson et al. (2022), Eckert et al. (2022a), and Eckert et al. (2022b) for the period from 1964 to 1993, and re-estimate eq. (1) using all US counties and a broad set of economic outcomes.

Results are depicted in Tables 8 and A.22. Contrary to the previous studies, we do not observe a positive effect on annual earnings per employee (Table 8, col. 1).[30] On the other hand, we find a 3% rise in the share of the working population (Table 8, col. 2), driven by employment boosts in the manufacturing (+6.6%) and wholesale (+2.2%) sectors (Table A.22, cols. 4 and 6). In addition, the opening of an interstate highway increased the average firm size, as measured by the number of employees per business establishment (+2.2%; Table 8, col. 5).[31] These findings are robust to implementing the alternative estimator of Sun and Abraham (2020) (Figs. A.8-A.9; Table A.23). Lastly, while the TWFE estimates suggest some increase in firm density as well (Table 8, col. 4), this result is not confirmed by Sun and Abraham (2020)'s estimator. Overall, the combined increase in the local employment rate and the average firm size could help explain the observed positive impact of the IHS on crime, especially given that property crimes are driving this result.

7.3 IHS and demographic changes

Given its role in fuelling the suburbanisation of American cities (Baum-Snow, 2007; Brinkman and Lin, 2022), we theorise that a highway opening in a county could have brought in a disproportionate number of individuals—such as young men—who have a higher propensity to commit crime.[32] Thus, we evaluate

[30] Although income data is only available in the CBP after 1973 and there is no sectoral breakdown.
[31] We use the term *firm* interchangeably with the term *business establishment*, which is used by the US Census Bureau in the CBP data.
[32] According to O'Flaherty and Sethi (2015), 93% of state and federal prisoners in 2010 were male, while 64.2% of all arrestees in 2011 were between the ages 15 and 34 (the group comprises only 27.4% the total population).

the effects of the IHS on the size and the composition of the local population. We find that the highway construction increased the size of a county's population by 4% (Table 9, col. 1).[33] However, dropping population controls from the main specification does not substantially increase the magnitude of the crime estimates (Table A.3). Moreover, utilising the 1969 to 1993 data from the National Cancer Institute's SEER Program, we find that a highway's introduction slightly decreased the share of young men in the population (-1.2%; Table 9, col. 4), while also increasing the share of the white population (+1.3%; Table 9, col. 5). We also observe an increase in the share of the older working age population, namely those aged 35-44 (+1.3%) and 45-54 (+1.6%; Table A.24, cols. 4 and 5). Importantly, while Sun and Abraham (2020)'s estimator confirms the positive effect on population size (Fig. A.10; Table A.25, col. 1), the rest of the coefficients decline in magnitude and become insignificant (Figs. A.10 and A.11; Table A.25, cols. 2-7). Taken together, these findings do not suggest a disproportionate influx of crime-prone individuals into the affected communities. At the same time, population growth brought on by the highway construction increased the density of potential victims, thus raising the risk of victimisation in the affected counties (Cantor and Land, 1985).

7.4 Local criminal mobility and returns to criminal activity

Lastly, highways might increase the mobility of criminals, as offenders either commit crime while travelling or they travel to commit crime (Morselli and Royer, 2008). While we are unable to observe criminals' long-distance mobility, the immediate increases in the incidence of theft and, to some extent, burglary (Figs. 6 and A.5) appear to be broadly consistent with this mechanism. On the other hand, we can directly test for the local displacement of crime, which would indicate changes to local criminal mobility. Using only the never-treated counties, we assign a placebo treatment to all counties bordering at least one county which at some point adopted a highway. The timing of this placebo treatment mirrors that of the actual treatment, so that a bordering county receives a value of 1 whenever a highway is opened in any of its adjacent counties. The results are presented in Table A.26. While most of the estimated coefficients are negative—indicative of some shift in criminal activity from the highway-adjacent counties to the highway counties—their magnitudes are

[33] Note that given the inclusion of county fixed effects, an increase in the population directly translates into an increase in the population density.

small and none are statistically significant. However, since the coefficient magnitudes are non-trivial relative to the main effect, and given that crime displacement may extend beyond the adjacent counties, we cannot be completely certain of how much crime was displaced by the highway construction. Nevertheless, the small and imprecise point estimates in Table A.26 suggest the role of local criminal mobility in explaining the observed rise in crime is likely to be minor.

Similarly, we do not find substantial evidence for the local displacement of economic activity (Table A.27), suggesting that the observed positive effect on local economic outcomes is due to the creation of new economic activity. This is important when considering the returns to criminal activity. While actual returns are unobserved, Ehrlich (1973) posits that the rewards associated with crimes, such as robbery, burglary, and theft, are contingent upon the presence of transferable assets, which can be approximated by the level of income or the number of potential victims in the community. Although we do not find an increase in the wage income per worker, we do observe a positive effect on the local population size, employment rate, and the average firm size, which together increased the concentration of potential victims and targets of criminal activity. This evidence indicates that increased returns to criminal activity might have played an important role in driving the observed rise in crime in the newly-connected counties.

8 Conclusion

This paper studies the unintended consequences of investment in transportation infrastructure, focusing on the case of the IHS and its impact on local US crime. Using a staggered difference-in-differences design and a panel dataset spanning all 3,131 counties between 1960 and 1993, we find that the opening of an interstate highway in a county led to an 8.1% rise in total index crime. This increase was primarily driven by a higher incidence of property crime, specifically burglary (+7.7%) and theft/larceny (+9.6%). Motor vehicle theft also increased (+10.7%), though given a lack of clean parallel pre-trends, the effect needs to be interpreted with caution. Furthermore, we observe an increase in violent crime, although the individual estimates are sensitive to some of the alternative specifications. Regarding potential mechanisms, we first show that the positive effect on crime is only found in counties with a low pre-existing stock of police resources, indicating that increased connectivity in underpoliced counties may have substantially raised the local returns to crime.

This highlights the importance of state and federal policies promoting long-term investments in local law enforcement. Second, we argue that the rise in crime might also be explained by the combined positive effect of highways on the local employment rate, average firm size, and the local population size, which translated into a higher concentration of victims, thus increasing the returns to criminal activity, and ultimately the risk of victimisation. Finally, we do not find strong evidence of local displacement of criminal activity, suggesting that increased local criminal mobility did not play a major role in the observed crime rise.

Our work is particularly relevant for developing countries, many of which have either recently undertaken or are yet to undertake large-scale highway construction projects. Our findings emphasise the importance of understanding the unintended consequences for local communities. Future research should therefore explore the nexus between highway infrastructure and crime in countries such as China, whose National Trunk Highway System has recently become the largest highway network in the world (He, Xie and Zhang, 2020).

9 Supplementary data

The data and codes for this paper are available on the Journal repository. They were checked for their ability to reproduce the results presented in the paper. The replication package for this paper is available at the following address: https://doi.org/10.5281/zenodo.12571788

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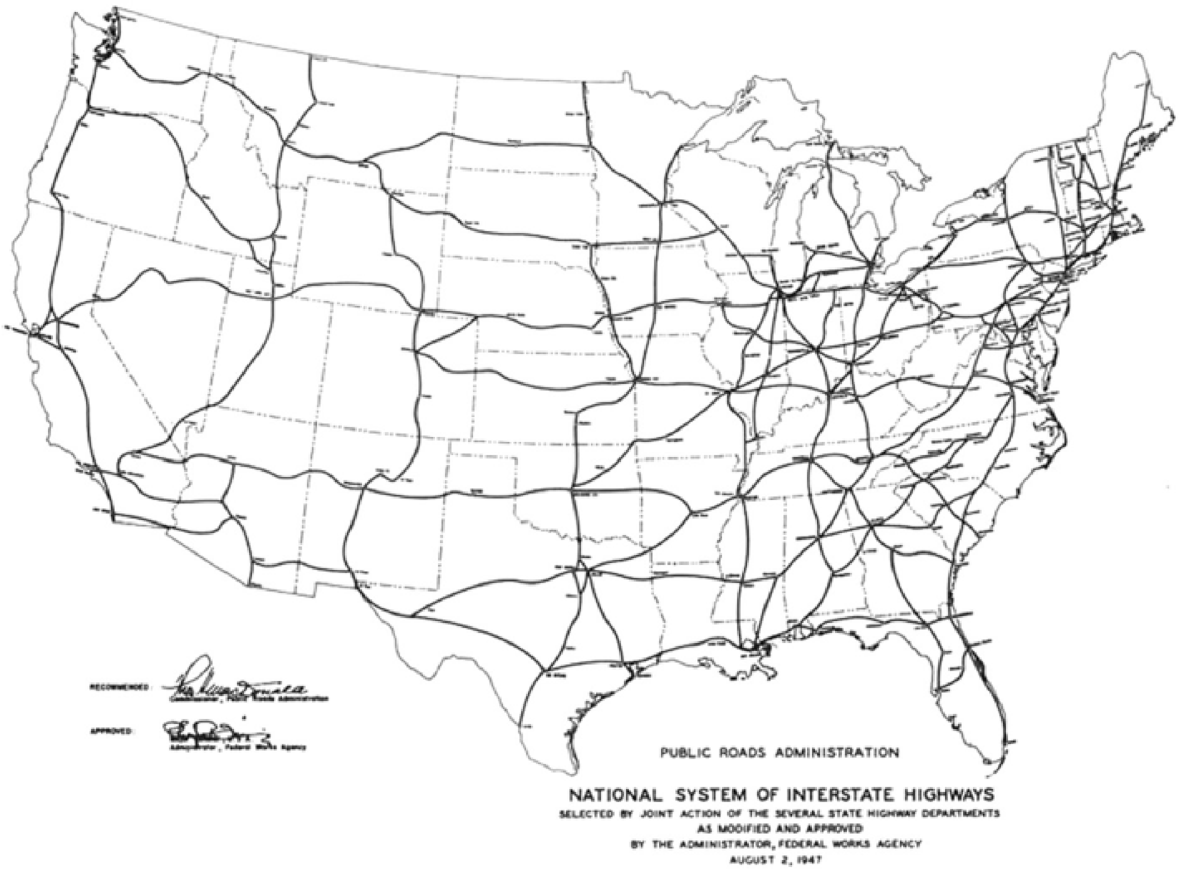
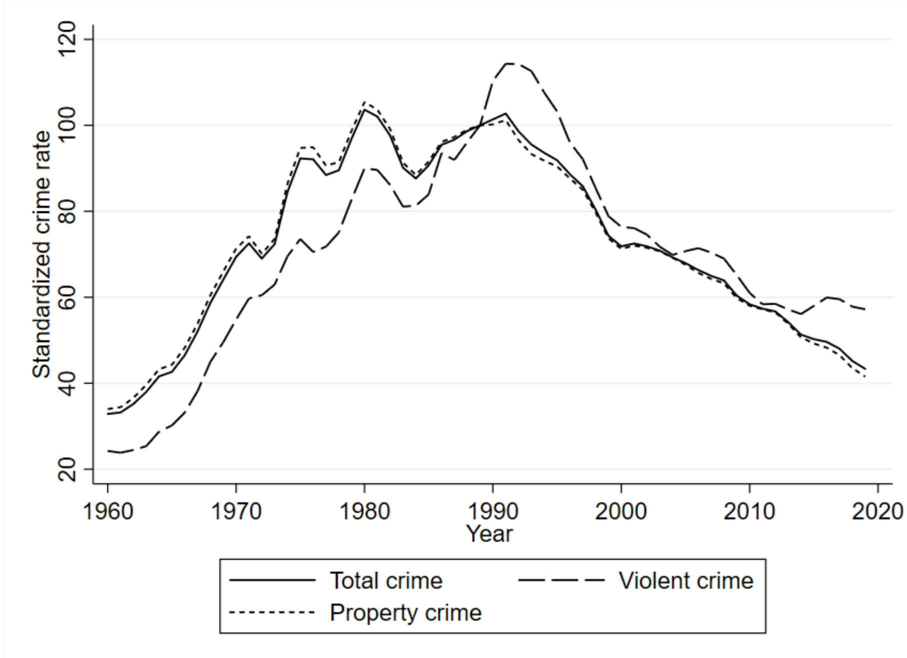
Figure 1: Planned US Interstate Highway System (as of 1947)



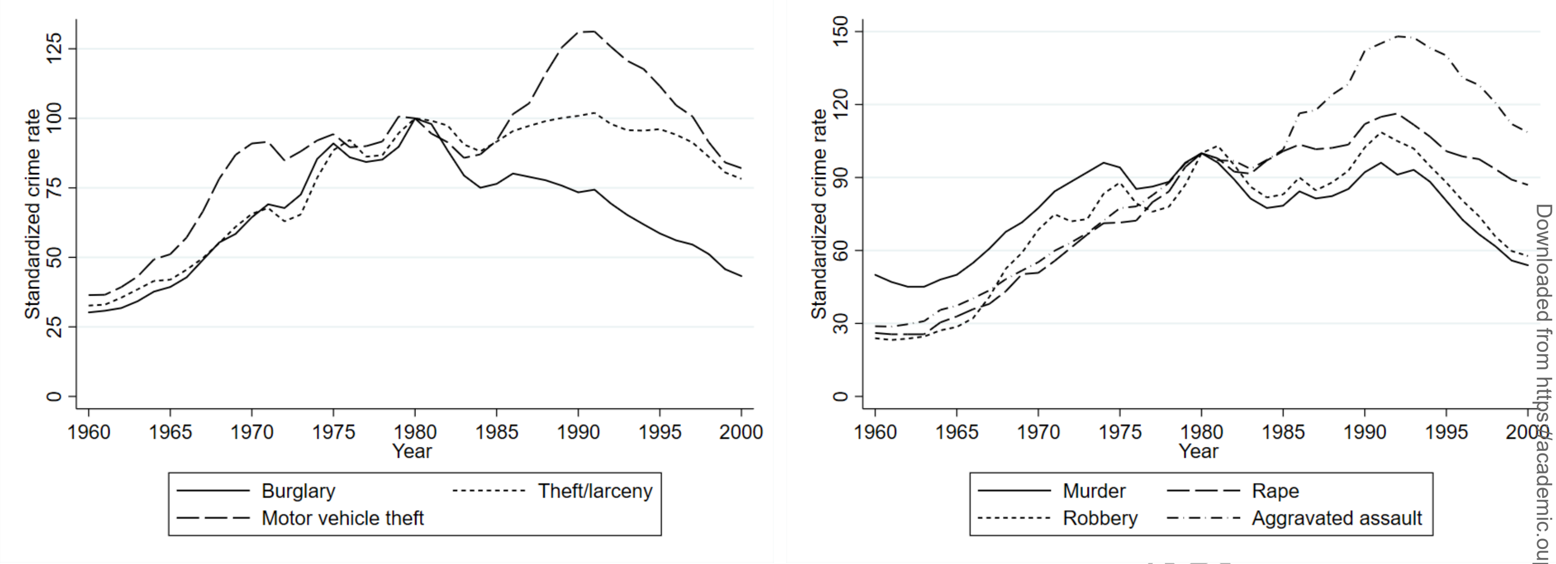
Notes - Source: Bureau of Public Roads (1955)

Figure 2: Crime in the United States, 1960-2019



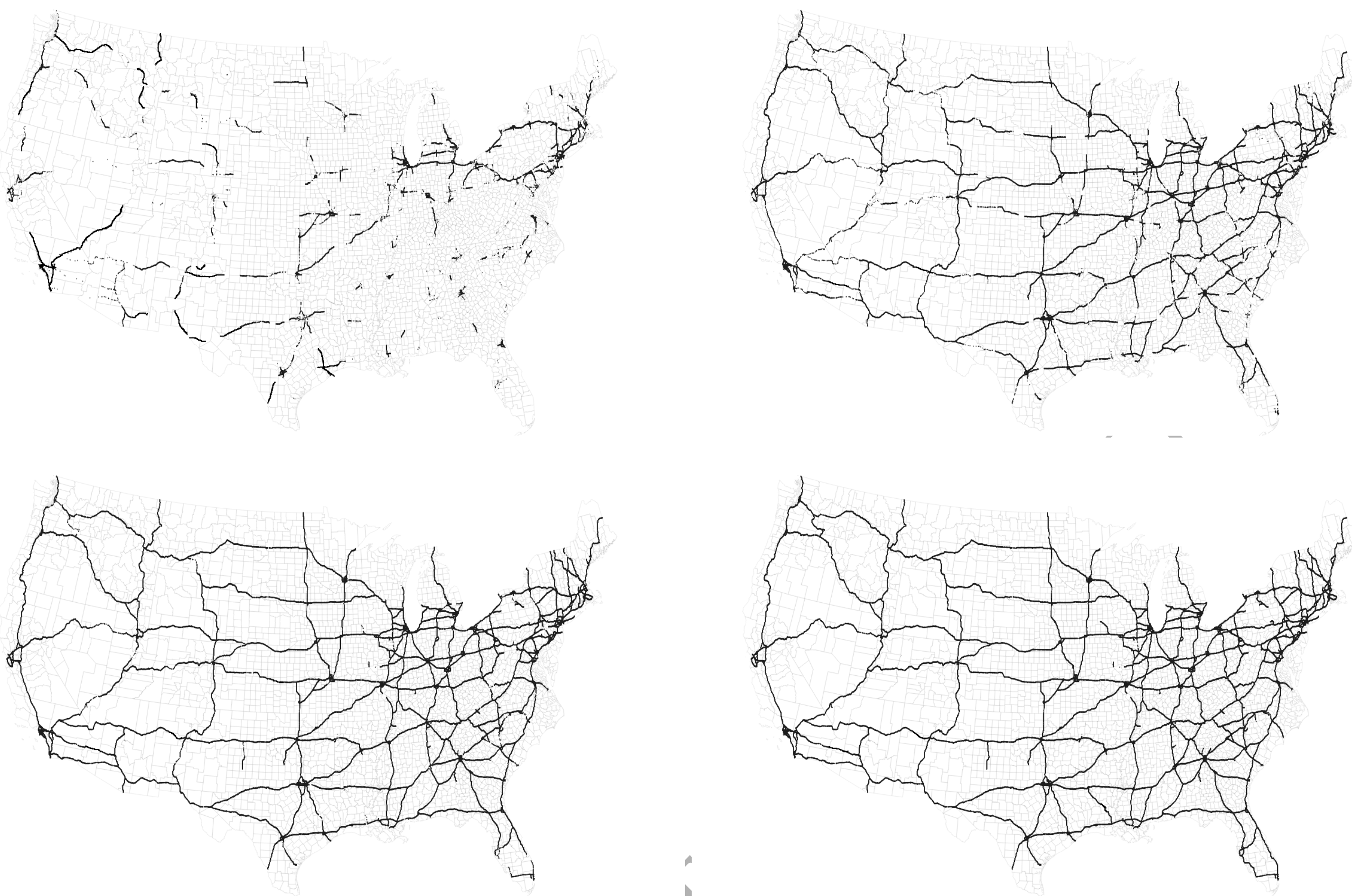
Notes - Crime rates are calculated per 100,000 inhabitants. All variables are standardised so that 1989=100. Data comes from the FBI's Uniform Crime Reporting (UCR) Program (Sourcebook of criminal justice statistics Online).

Figure 3: Trends in US crime, individual index crimes (1960-2000)



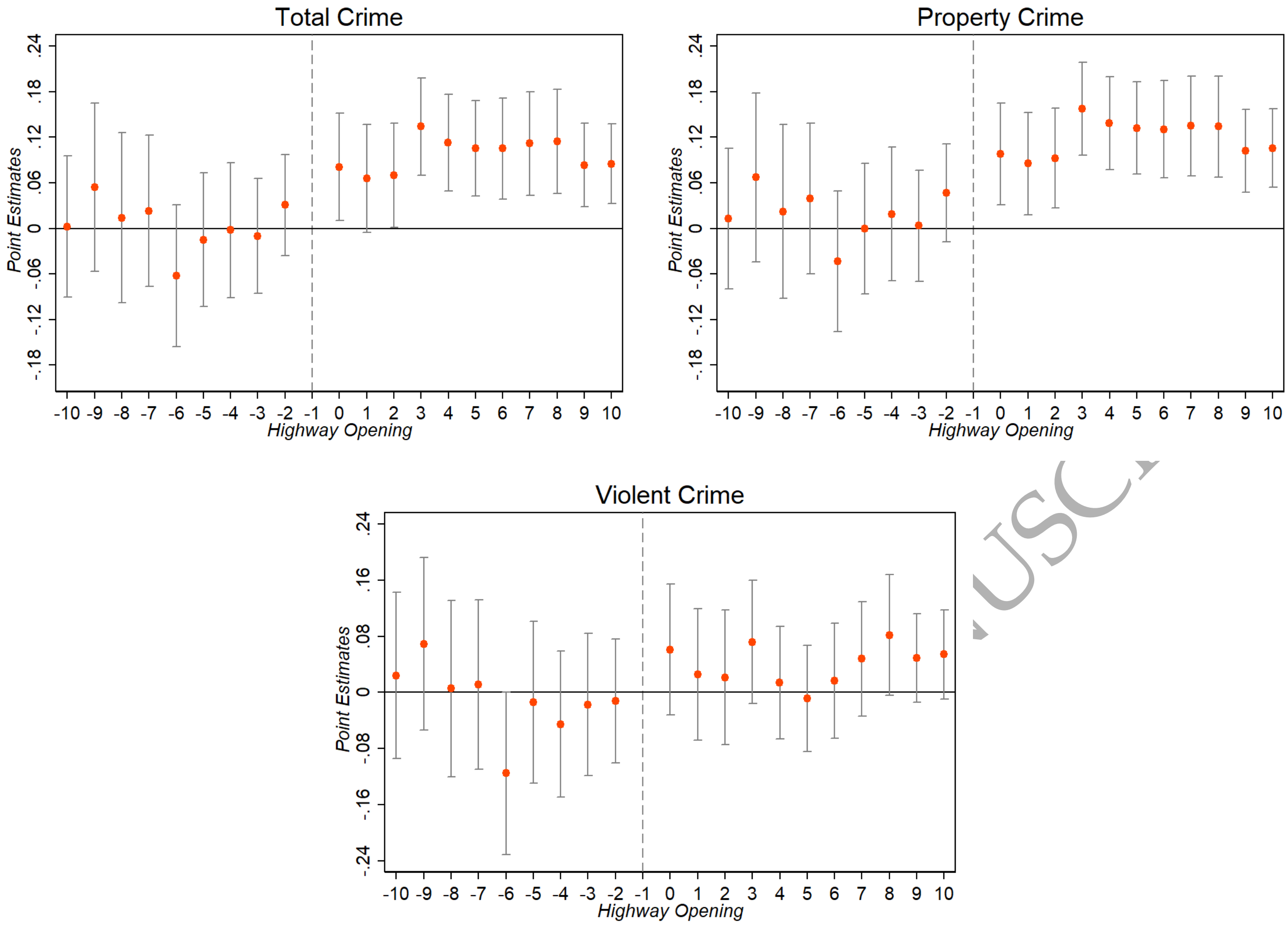
Notes - Crime rate is calculated per 100,000 inhabitants. All variables are standardised so that 1980=100. Data comes from the FBI's Uniform Crime Reporting (UCR) Program (Sourcebook of criminal justice statistics Online).

Figure 4: Evolution of the US Interstate Highway System (1960-1990)



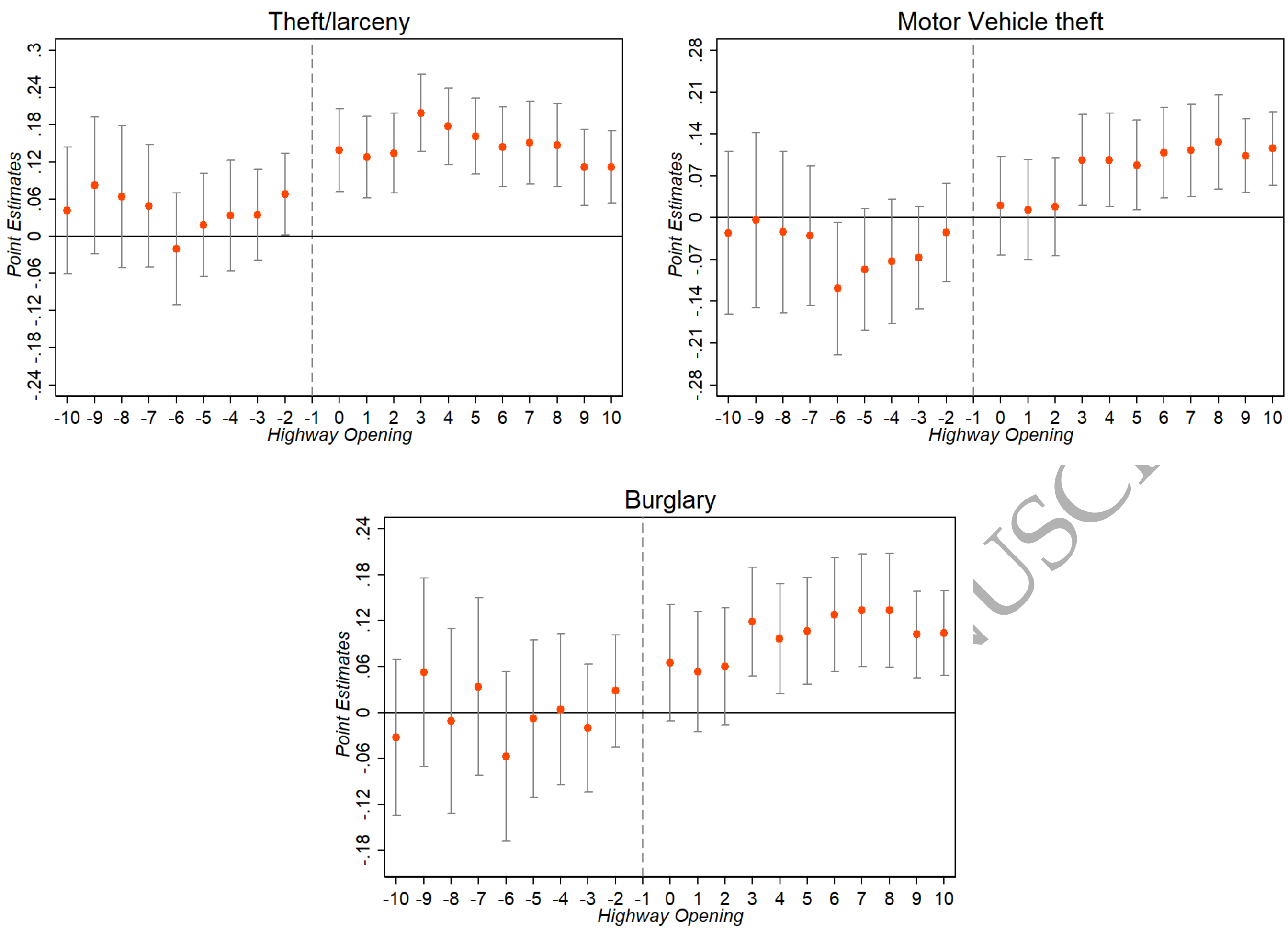
Notes - Km of IHS open as of 1960 (top-left); km of IHS open as of 1970 (top-right); km of IHS open as of 1980 (bottom-left); km of IHS open as of 1990 (bottom-right). Data comes from the Baum-Snow (2007). Duranton, Morrow and Turner (2014), and the US Census Bureau's Cartographic Boundary Files.

Figure 5: Event study – Interstate Highway System and local crime



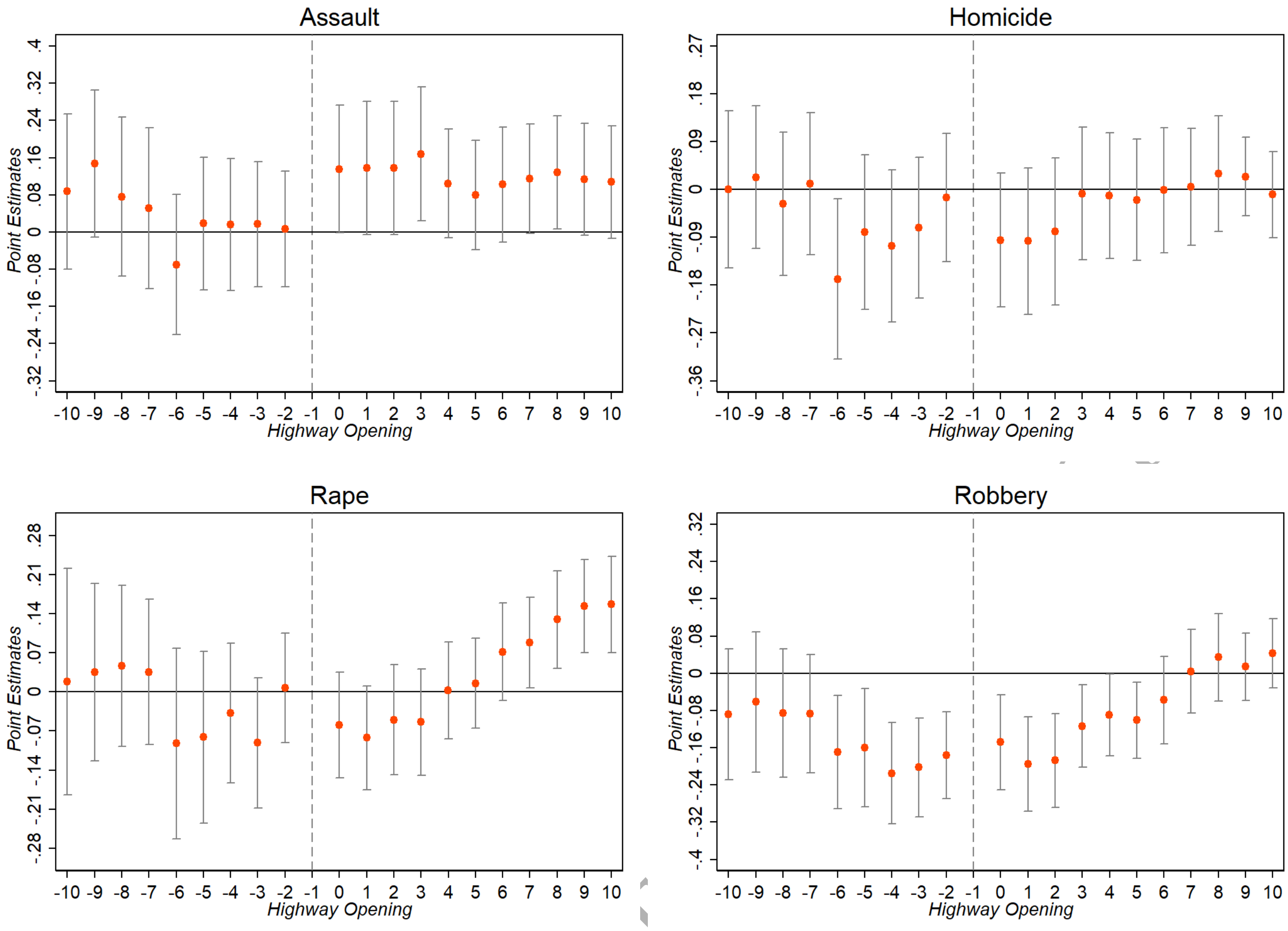
Notes - The graphs depict the event study results implemented with TWFE OLS estimator. Dependent variables: *Total Crime* – natural log of total # of index crimes; *Property Crime* – natural log of total # of property crimes; *Violent Crime* – natural log of total # of violent crimes. Coefficient estimates are provided together with the 95% confidence intervals. Data comes from the FBI's Uniform Crime Reporting Program: Offenses Known and Clearances by Arrest, 1960-2019, compiled by Kaplan (2021b). Interstate Highway System county-by-year panel data was compiled by Baum-Snow (2007).

Figure 6: Event study – Interstate Highway System and property crime



Notes - The graphs depict the event study results implemented with TWFE OLS estimator. Dependent variables: *Theft/larceny* – natural log of # of thefts (larcenies); *Motor vehicle theft* – natural log of # of motor vehicle thefts; *Burglary* – natural log of # of burglaries. Coefficient estimates are provided together with the 95% confidence intervals. Data comes from the FBI's Uniform Crime Reporting Program: Offenses Known and Clearances by Arrest, 1960-2019, compiled by Kaplan (2021b). Interstate Highway System county-by-year panel data was compiled by Baum-Snow (2007).

Figure 7: Event study – Interstate Highway System and violent crime



Notes - The graphs depict the event study results implemented with TWFE OLS estimator. Dependent variables: *Assault* – natural log of # of assaults; *Homicide* – natural log of # of homicides; *Rape* – natural log of # of rapes *Robbery* – natural log of # of robberies. Coefficient estimates are provided together with the 95% confidence intervals. Data comes from the FBI's Uniform Crime Reporting Program: Offenses Known and Clearances by Arrest, 1960-2019, compiled by Kaplan (2021b). Interstate Highway System county-by-year panel data was compiled by Baum-Snow (2007).

Table 1: Descriptive statistics – main variables

Variable	No. of observations	Mean	Standard deviation
Any highway	105,651	0.33	0.47
Total index crimes	105,651	3,346.0	20,950.7
Property crimes	105,651	2,986.8	17,348.4
Violent crimes	105,651	359.8	3,817.1
Burglaries	105,651	854.3	5,231.6
Motor vehicle thefts	105,651	336.5	3,163.5
Thefts/larcenies	105,651	1,795.9	9,273.1
Assaults	105,651	490.7	3,016.9
Robberies	105,651	146.1	2,137.7
Rapes	105,651	20.02	129.4
Homicides	105,651	7.77	54.55
Annual earnings per employee	62,088	13,780.3	8,597.9
Working share	93,037	20.11	11.06
No. of firms per 1,000 pop.	93,180	19.61	8.36
No. of firms per 100 km^2	93,180	506.8	8,002.2
No. of employees per firm	93,180	10.46	4.75
Police officers per 10,000 pop.	105,615	4.07	6.61
No. of patrols per officer	92,526	0.78	2.23
No. of car patrols per officer	92,526	0.71	2.05
No. of foot patrols per officer	92,526	0.05	0.26
County population	105,651	71,176.7	270,333.0
% male	77,170	49.14	1.64
% aged 15-34	77,170	30.28	4.93
% male aged 15-34	77,170	15.35	2.94
% white	77,170	89.70	14.97

Notes: Any highway – binary var. equal to 1 if county has at least 1 mile of interstate highway open; *Total index crimes* – total # of index crimes; *Property crimes* – total # of property crimes; *Violent crimes* – total # of violent crimes; *Burglaries* – # of burglaries; *Motor vehicle thefts* – # of motor vehicle thefts; *Thefts/larcenies* – # of thefts (larcenies); *Assaults* – # of assaults; *Robberies* – # of robberies; *Rapes* – # of rapes; *Homicides* – # of homicides; *Annual earnings per employee* – total annual earnings (payroll) per employee; *Working share* – # of employees in the county (mid-March) as % of the total county population; *No. of firms per 1,000 pop.* – # of business establishments per 1,000 county population; *No. of firms per 100 km^2* – # of business establishments per 100 km^2 of county geographical area; *No. of employees per firm* – # of employees per business establishment; *Police officers per 10,000 pop.* – # of local law enforcement officers per 10,000 pop.; *No. of patrols per officer* – total # of patrols (per officer) conducted by local law enforcement; *No. of car patrols per officer* – total # of vehicular patrols (per officer) conducted by local law enforcement; *No. of foot patrols per officer* – total # of foot patrols (per officer) conducted by local law enforcement; *County population* – total county population; *% male* – share of male population (as % of total population); *% aged 15-34* – share of population aged 15-34; *% male aged 15-34* – share of population aged 15-34 & male; *% white* – share of white population (as % of total population). Data comes from the FBI's Uniform Crime Reporting Program: Offenses Known and Clearances by Arrest, 1960-2019 (Kaplan, 2021b); Uniform Crime Reporting Program: Law Enforcement Officers Killed and Assaulted (LEOKA), 1960-2019 (Kaplan, 2021a);U.S. Census Bureau's County Business Patterns, 1964-1993 (Manson et al., 2022; Eckert et al., 2022a,b); National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) Program (based on data from U.S. Census Bureau's Population Estimates Program – PEP); and Interstate Highway System county-by-year panel data by Baum-Snow (2007).

Table 2: Interstate Highway System and total index crime

	Ln (total crime)			
	(1)	(2)	(3)	(4)
Any highway	0.114***	0.129***	0.090***	0.081***
	(0.042)	(0.037)	(0.028)	(0.023)
Year FE	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes
Population & population^2	No	Yes	Yes	Yes
State-by-year FE	No	No	Yes	Yes
Commuting zone linear time trends	No	No	No	Yes
Observations	105,651	105,651	105,617	105,617
No. of counties	3,131	3,131	3,130	3,130
Adjusted R-squared	0.953	0.953	0.982	0.984

Notes: Standard errors in parentheses, clustered at the county level. All regressions are weighted by the 1960 county population. *Ln (total crime)* – natural log of total # of index crimes; *Any highway* – binary var. equal to 1 if county has at least 1 mile of interstate highway open. Data comes from the FBI's Uniform Crime Reporting Program: Offenses Known and Clearances by Arrest, 1960-2019, compiled by Kaplan (2021b). Interstate Highway System county-by-year panel data was compiled by Baum-Snow (2007). *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

Table 3: Interstate Highway System and property vs. violent crime

	Ln (property crime)			
Panel A	(1)	(2)	(3)	(4)
Any highway	0.139***	0.153***	0.095***	0.084***
	(0.044)	(0.039)	(0.028)	(0.024)
Year FE	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes
Population & population^2	No	Yes	Yes	Yes
State-by-year FE	No	No	Yes	Yes
Commuting zone linear time trends	No	No	No	Yes
Observations	105,651	105,651	105,617	105,617
No. of counties	3,131	3,131	3,130	3,130
Adjusted R-squared	0.951	0.952	0.981	0.983
	Ln (violent crime)			
Panel B	(1)	(2)	(3)	(4)
Any highway	-0.059	-0.034	0.072**	0.050*
	(0.055)	(0.050)	(0.032)	(0.029)
Year FE	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes
Population & population^2	No	Yes	Yes	Yes
State-by-year FE	No	No	Yes	Yes
Commuting zone linear time trends	No	No	No	Yes
Observations	105,651	105,651	105,617	105,617
No. of counties	3,131	3,131	3,130	3,130
Adjusted R-squared	0.959	0.961	0.977	0.979

Notes: Standard errors in parentheses, clustered at the county level. All regressions are weighted by the 1960 county population. *Ln (property crime)* – natural log of total # of property crimes; *Ln (violent crime)* – natural log of total # of violent crimes; *Any highway* – binary var. equal to 1 if county has at least 1 mile of interstate highway open. Data comes from the FBI's Uniform Crime Reporting Program: Offenses Known and Clearances by Arrest, 1960-2019, compiled by Kaplan (2021b). Interstate Highway System county-by-year panel data was compiled by Baum-Snow (2007). *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

Table 4: Interstate Highway System and individual index crimes

	(1) Ln (burglary)	(2) Ln (motor vehicle theft)	(3) Ln (theft/larceny)	(4) Ln (assault)	(5) Ln (robbery)	(6) Ln (rape)	(7) Ln (homicide)
Any highway	0.076***	0.107***	0.096***	0.086**	0.056**	-0.022	0.010
	(0.025)	(0.028)	(0.026)	(0.038)	(0.028)	(0.037)	(0.034)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population & population^2	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-by-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Czone linear time trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	105,617	105,617	105,617	105,617	105,617	105,617	105,617
No. of counties	3,130	3,130	3,130	3,130	3,130	3,130	3,130
Adjusted R-squared	0.981	0.982	0.979	0.970	0.982	0.960	0.960

Notes: Standard errors in parentheses, clustered at the county level. All regressions are weighted by the 1960 county population. *Ln (burglary rate)* – natural log of # of burglaries; *Ln (motor vehicle theft)* – natural log of # of motor vehicle thefts; *Ln (theft/larceny)* – natural log of # of thefts (larcenies); *Ln (assault)* – natural log of # of assaults; *Ln (robbery)* – natural log of # of robberies.; *Ln (rape)* – natural log of # of rapes; *Ln (homicide)* – natural log of # of homicides; *Any highway* – binary var. equal to 1 if county has at least 1 mile of interstate highway open. Data comes from the FBI's Uniform Crime Reporting Program: Offenses Known and Clearances by Arrest, 1960-2019, compiled by Kaplan (2021b). Interstate Highway System county-by-year panel data was compiled by Baum-Snow (2007). *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

Table 5: Interstate Highway System and local crime: 1960-1980 period

	(1) Ln (total crime)	(2) Ln (property crime)	(3) Ln (violent crime)	(4) Ln (burglary)	(5) Ln (motor vehicle theft)
Any highway	0.072***	0.076***	0.035	0.088***	0.111***
	(0.022)	(0.022)	(0.026)	(0.023)	(0.025)
Year FE	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes
Population & population^2	Yes	Yes	Yes	Yes	Yes
State-by-year FE	Yes	Yes	Yes	Yes	Yes
Czone linear time trends	Yes	Yes	Yes	Yes	Yes
Observations	64,994	64,994	64,994	64,994	64,994
No. of counties	3,122	3,122	3,122	3,122	3,122
Adjusted R-squared	0.984	0.984	0.979	0.981	0.982
	(6) Ln (theft/larceny)	(7) Ln (assault)	(8) Ln (robbery)	(9) Ln (rape)	(10) Ln (homicide)
Any highway	0.073***	0.068*	0.068***	0.025	0.045
	(0.025)	(0.039)	(0.023)	(0.031)	(0.031)
Year FE	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes
Population & population^2	Yes	Yes	Yes	Yes	Yes
State-by-year FE	Yes	Yes	Yes	Yes	Yes
Czone linear time trends	Yes	Yes	Yes	Yes	Yes
Observations	64,994	64,994	64,994	64,994	64,994
No. of counties	3,122	3,122	3,122	3,122	3,122
Adjusted R-squared	0.980	0.969	0.982	0.966	0.958

Notes: Standard errors in parentheses, clustered at the county level. All regressions are weighted by the 1960 county population. *Ln (total crime)* – natural log of total # of index crimes; *Ln (property crime)* – natural log of total # of property crimes; *Ln (violent crime)* – natural log of total # of violent crimes; *Ln (burglary)* – natural log of # of burglaries; *Ln (motor vehicle theft)* – natural log of # of motor vehicle thefts; *Ln (theft/larceny)* – natural log of # of thefts (larcenies); *Ln (assault)* – natural log of # of assaults; *Ln (robbery)* – natural log of # of robberies; *Ln (rape)* – natural log of # of rapes; *Ln (homicide)* – natural log of # of homicides; *Any highway* – binary var. equal to 1 if county has at least 1 mile of interstate highway open. Data comes from the FBI's Uniform Crime Reporting Program: Offenses Known and Clearances by Arrest, 1960-2019, compiled by Kaplan (2021b). Interstate Highway System county-by-year panel data was compiled by Baum-Snow (2007). *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

Table 6: Heterogeneity by initial police force size

	(1) Ln (total crime)	(2) Ln (property crime)	(3) Ln (violent crime)	(4) Ln (burglary)	(5) Ln (motor vehicle theft)
Any highway: above 50p	0.017	0.022	-0.042	0.021	0.024
	(0.024)	(0.025)	(0.034)	(0.028)	(0.030)
Observation	42,328	42,328	42,328	42,328	42,328
No. of counties	1,250	1,250	1,250	1,250	1,250
Adjusted R-squared	0.990	0.989	0.984	0.987	0.986
Any highway: below 50p	0.130***	0.133***	0.081	0.111**	0.205***
	(0.047)	(0.048)	(0.052)	(0.052)	(0.059)
Observation	42,234	42,234	42,234	42,234	42,234
No. of counties	1,247	1,247	1,247	1,247	1,247
Adjusted R-squared	0.969	0.968	0.954	0.962	0.961
Year FE	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes
Population & population^2	Yes	Yes	Yes	Yes	Yes
State-by-year FE	Yes	Yes	Yes	Yes	Yes
Czone linear time trends	Yes	Yes	Yes	Yes	Yes

	(6) Ln (theft/larceny)	(7) Ln (assault)	(8) Ln (robbery)	(9) Ln (rape)	(10) Ln (homicide)
Any highway: above 50p	0.031	0.003	-0.009	-0.089**	-0.015
	(0.027)	(0.049)	(0.035)	(0.042)	(0.052)
Observation	42,328	42,328	42,328	42,328	42,328
No. of counties	1,250	1,250	1,250	1,250	1,250
Adjusted R-squared	0.987	0.975	0.986	0.969	0.964
Any highway: below 50p	0.144***	0.119*	0.082	0.059	0.010
	(0.049)	(0.061)	(0.053)	(0.067)	(0.049)
Observation	42,234	42,234	42,234	42,234	42,234
No. of counties	1,247	1,247	1,247	1,247	1,247
Adjusted R-squared	0.963	0.949	0.961	0.922	0.897
Year FE	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes
Population & population^2	Yes	Yes	Yes	Yes	Yes
State-by-year FE	Yes	Yes	Yes	Yes	Yes
Czone linear time trends	Yes	Yes	Yes	Yes	Yes

Notes: Standard errors in parentheses, clustered at the county level. Counties split into two groups based on the median 1960 size of the local police force (no. of officers per 10,000 population). All regressions are weighted by the 1960 county population. *Ln (total crime)* – natural log of total # of index crimes; *Ln (property crime)* – natural log of total # of property crimes; *Ln (violent crime)* – natural log of total # of violent crimes; *Ln (burglary)* – natural log of # of burglaries; *Ln (motor vehicle theft)* – natural log of # of motor vehicle thefts; *Ln (theft/larceny)* – natural log of # of thefts (larcenies); *Ln (assault)* – natural log of # of assaults; *Ln (robbery)* – natural log of # of robberies; *Ln (rape)* – natural log of # of rapes; *Ln (homicide)* – natural log of # of homicides; *Any highway* – binary var. equal to 1 if county has at least 1 mile of interstate highway open. Data comes from the FBI's Uniform Crime Reporting Program: Offenses Known and Clearances by Arrest, 1960-2019, compiled by Kaplan (2021b). Interstate Highway System county-by-year panel data was compiled by Baum-Snow (2007). *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

Table 7: Interstate Highway System and law enforcement size and community presence

	(1) Ln (officers per 10,000 pop.)	(2) Ln (patrols per officer)	(3) Ln (car patrols per officer)	(4) Ln (foot patrols per officer)
Any highway	0.034*	0.029***	0.035***	-0.003
	(0.019)	(0.011)	(0.011)	(0.005)
Year FE	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes
Population & population^2	Yes	Yes	Yes	Yes
State-by-year FE	Yes	Yes	Yes	Yes
Czone linear time trends	Yes	Yes	Yes	Yes
Observations	105,615	92,526	92,526	92,526
No. of counties	3,130	3,127	3,127	3,127
Adjusted R-squared	0.872	0.873	0.857	0.637

Notes: Standard errors in parentheses, clustered at the county level. All regressions are weighted by the 1960 county population. *Ln (officers per 10,000 pop.)* – natural log of total # of local law enforcement officers per 10,000 pop.; *Ln (patrols per officer)* – natural log of total # of patrols (per officer) conducted by local law enforcement; *Ln (car patrols per officer)* – natural log of total # of car patrols (per officer) conducted by local law enforcement; *Ln (foot patrols per officer)* – natural log of total # of foot patrols (per officer) conducted by local law enforcement; *Any highway* – binary var. equal to 1 if county has at least 1 mile of interstate highway open. Data comes from the FBI's Uniform Crime Reporting Program: Law Enforcement Officers Killed and Assaulted (LEOKA), 1960-2019, compiled by Kaplan (2021a). Interstate Highway System county-by-year panel data was compiled by Baum-Snow (2007). *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

Table 8: Interstate Highway System and local economic development (1964-1993)

	(1) Ln (earnings per employee)	(2) Ln (working share)	(3) Ln (# firms per 1,000 pop.)	(4) Ln (# firms per 100 km^2)	(5) Ln (# employees per firm)
Any highway	-0.006	0.030**	0.009	0.039***	0.022**
	(0.012)	(0.013)	(0.010)	(0.015)	(0.009)
Year FE	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes
Population & population^2	Yes	Yes	Yes	Yes	Yes
State-by-year FE	Yes	Yes	Yes	Yes	Yes
Czone linear time trends	Yes	Yes	Yes	Yes	Yes
Observations	62,088	93,037	93,180	93,180	93,180
No. of counties	3,124	3,126	3,128	3,128	3,128
Adjusted R-squared	0.992	0.935	0.899	0.998	0.935

Notes: Data for regression in column (1) restricted to 1974-1993. Standard errors in parentheses, clustered at the county level. All regressions are weighted by the 1960 county population. *Ln (earnings per employee)* – natural log of total annual earnings (payroll) per employee. *Ln (working share)* – natural log of # of employees in the county (mid-March) as % of the total county population; *Ln (# of firms per 1,000 pop.)* – natural log of # of business establishments per 1,000 county population; *Ln (# of firms per 100 km^2)* – natural log of # of business establishments per 100 km^2 of county geographical area; *Ln (# employees per firm)* – natural log of # of employees per business establishment. *Any highway* – binary var. equal to 1 if county has at least 1 mile of interstate highway open. Data comes from the U.S. Census Bureau's County Business Patterns (1964-1993), compiled by Manson et al. (2022), Eckert et al. (2022a), and Eckert et al. (2022b). Interstate Highway System county-by-year panel data was compiled by Baum-Snow (2007). *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

Table 9: The effect of Interstate Highway System on population size & composition

	(1) Ln (population)	(2) Ln (% male)	(3) Ln (% aged 15-34)	(4) Ln (% male aged 15-34)	(5) Ln (% white)
Any highway	0.040***	-0.003*	-0.004	-0.013**	0.013***
	(0.011)	(0.002)	(0.004)	(0.006)	(0.004)
Year FE	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes
State-by-year FE	Yes	Yes	Yes	Yes	Yes
Commuting zone linear time trends	Yes	Yes	Yes	Yes	Yes
Observations	105,617	77,170	77,170	77,170	77,170
No. of counties	3,130	3,114	3,114	3,114	3,114
Adjusted R-squared	0.997	0.951	0.975	0.963	0.989

Notes: Standard errors in parentheses, clustered at the county level. Estimation sample in cols. (2)-(5) is restricted due to data availability to 1969-1993. All regressions are weighted by the 1960 county population. *Ln (population)* – natural log of total county population; *Ln (% male)* – natural log of share of male population (as % of total population); *Ln (% aged 15-34)* – natural log of share of population aged 15-34; *Ln (% male aged 15-34)* – natural log of share of population aged 15-34 & male; *Ln (% white)* – natural log of share of white population (as % of total population); *Any highway* – binary var. equal to 1 if county has at least 1 mile of interstate highway open. Data comes from the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) Program (based on data from U.S. Census Bureau's Population Estimates Program – PEP); FBI's Uniform Crime Reporting Program: Offenses Known and Clearances by Arrest, 1960-2019, compiled by Kaplan (2021b); and Baum-Snow (2007). *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.