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# THE IMPACT OF LEGALIZED ABORTION ON CRIME OVER THE LAST TWO DECADES

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## ABSTRACT

Donohue and Levitt (2001) presented evidence that the legalization of abortion in the early 1970s played an important role in the crime drop of the 1990s. That paper concluded with a strong out-of-sample prediction regarding the next two decades: "When a steady state is reached roughly twenty years from now, the impact of abortion will be roughly twice as great as the impact felt so far. Our results suggest that all else equal, legalized abortion will account for persistent declines of 1 percent a year in crime over the next two decades." Estimating parallel specifications to the original paper, but using the seventeen years of data generated after that paper was written, we find strong support for the prediction. The estimated coefficient on legalized abortion is actually larger in the latter period than it was in the initial dataset in almost all specifications. We estimate that crime fell roughly 20% between 1997 and 2014 due to legalized abortion. The cumulative impact of legalized abortion on crime is roughly 45%, accounting for a very substantial portion of the roughly 50-55% overall decline from the peak of crime in the early 1990s.

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## I. Introduction

Donohue and Levitt (2001) proposed a link between the legalization of abortion and future crime. The theory motivating that analysis is simple: decades of social scientific research have demonstrated that unwanted children are at an elevated risk for less favorable life outcomes on multiple dimensions including criminal involvement,[1] and the legalization of abortion appears to have dramatically reduced the number of unwanted births.[2] As a consequence, cohorts exposed to legalized abortion would be expected to exhibit less criminal behavior than would have been the case absent the legalization of abortion. Using a range of empirical identification strategies, Donohue and Levitt (2001) argued that legalized abortion might well be the single most important factor in reducing crime in the 1990s – perhaps accounting for as much as half of the drop in crime observed in the United States between 1991 and 1997, the endpoint of their data. The claims in Donohue and Levitt (2001) proved to be highly controversial. The research triggered at numerous critical academic comments[3] and subsequent replies (Joyce 2006, Foote and Goetz 2008, Dills and Miron 2006, Lott and Whitley 2007, Chamlin et al. 2008), as well as numerous extensions consistent with the original findings (François et al. 2014, Sen 2007, Shoesmith 2015, Hay and Evans 2006).[4] To this day, there remains a great diversity of views on the merits of the hypothesis among academics.

There are a number of reasons why Donohue and Levitt (2001) provoked such a strong academic response.[5] First, the magnitude of the results was both large and surprising. At the time, a voluminous academic literature had developed to address the question of understanding fluctuations in crime, including the reasons for the dramatic crime reduction observed during the 1990s. Prior to Donohue and Levitt (2001), there was no mention in this literature of a link between abortion and crime. For a previously unrecognized mechanism to account for possibly half of the largest crime reduction in American history posed a fundamental challenge to the existing scholarship on crime. Second, the evidence presented in Donohue and Levitt (2001) was suggestive, but not definitive. The identification of the estimates was derived neither from a randomized experiment nor even from a credibly exogenous natural experiment (with the possible exception of the 1973 Supreme Court decision in *Roe v. Wade*). Instead, Donohue and

[1] See citations provided on pages 387-389 in Donohue and Levitt (2001).

[2] There is also a more direct and mechanical link between abortion and crime. If legalized abortion causes birth rates to decline, then the affected cohorts will be smaller upon reaching peak crime ages. Levine (2007)( "In the United States, the process of abortion legalization in the early 1970s represented the biggest change in policy; studies of the impact of this policy-change suggest that birth rates fell considerably in response."); Levine et al. (1999); Bitler and Zodovny (2003). It does appear, though, that most of the initial abortion-driven declines in birth rates reflects delaying of fertility (presumably to a more propitious time) rather than a reduction in overall lifetime fertility. Thus, any crime-reducing impact that operates through this mechanical channel will be relatively modest and short-lived. The specifications of Donohue and Levitt (2001) will capture both the unwantedness and cohort-size effects.

[3] For critical academic comments, see Cook and Laub (2002), Zimring (2007), Kahane, Paton, and Simmons (2008), Dills, Miron, and Summers (2008), Anderson and Wells (2008), Joyce (2009a), and Joyce (2009b). For supportive academic comments, see Berk et al. (2003), Listokin (2003), Pop-Eleches (2006), Charles and Stephens, Jr. (2006), Ananat et al. (2009), and Hunt (2006).

[4] We have received more than 200 requests for our original data and code for the purposes of replication.

[5] There was also a strong response to the hypothesis in the popular press, including front-page headlines (Brandon 1999), network news coverage, and op-ed reactions in many major newspapers (Goode 1999, Samuelson 1999, Stille 2001, Stossel and Varney 2006, Lott 2008). Much of that coverage was negative, or at the least, laced with skepticism.

Levitt (2001) presented evidence from a collage of different sources of variation, each of which had its weaknesses.[6] Third, the timing of the crack epidemic – which coincided with the peak-crime ages of the first cohort exposed to legalized abortion – increased the difficulty of teasing out the causal impact of legalized abortion. Fourth, at the time, it was rare for economists to posit theories with such long lags between a stimulus (in this case, abortion) and an outcome (in this case, crime roughly two or more decades later).[7] All of the existing explanations for fluctuations in crime focused on more proximate causes, e.g. the number of police, expected punishment, or the state of the labor market. Finally, the results of Donohue and Levitt (2001) were based on a short time window of abortion exposure. The original paper used data only through 1997. At that time, the first nationwide cohort of individuals exposed to legalized abortion was only in their early twenties.

In the face of these inherent challenges, reasonable people might disagree as to the persuasiveness of the evidence presented in Donohue and Levitt (2001). But the Donohue-Levitt theory makes a strong out-of-sample prediction, which was advanced almost two decades before the full of impact of abortion on crime would be felt. In the conclusion to their paper, Donohue and Levitt wrote:

> "Roughly half of the crimes committed in the United States are done by individuals born prior to the legalization of abortion. As these older cohorts age out of criminality and are replaced by younger offenders born after abortion became legal, we would predict that crime rates will continue to fall. When a steady state is reached roughly twenty years from now, the impact of abortion will be roughly twice as great as the impact felt so far. Our results suggest that all else equal, legalized abortion will account for persistent declines of 1 percent a year in crime over the next two decades."

In this paper, we analyze the extent to which the nearly twenty years of crime data generated after our analysis was completed support or refute the hypothesized link between abortion and crime. Our methodology is straightforward: we reproduce the primary tables presented in Donohue and Levitt (2001), but extending the data set to cover the period from 1998-2014. The choice of specification in the original paper provides a strong degree of discipline on the exercise we carry out. In contrast to the typical empirical economics paper, where the researchers run many specifications and only report a few of those, we constrain ourselves by the choices made in the original paper.[8] In addition, we report updated results specifications suggested by the subsequent exchange between Foote and Goetz (2008) and Donohue and Levitt (2008).
The results obtained provide strong support for the hypothesized link between abortion and crime. For most of the specifications reported in the original paper, the point estimates are larger in the out-of-sample 1998-2014 period than in the original publication. This finding is particularly striking because the tables use very different sources of identification (e.g. the natural experiment associated with early legalization, cross-state differences in abortion rates

[6] We discuss these different sources of variation at length below.
[7] Over the last two decades, such theories have become much more common in economics. See, for example, a number of papers on fetal origins. Almond (2006); Almond (2011); Acemoglu, Johnson, and Robinson (2001).
[8] The only exceptions we make are (1) to use a better measure of abortion which tracks abortion by state of residence as opposed to state of occurrence – these better data were also used in Donohue and Levitt (2004) and Donohue and Levitt (2008), and (2) to drop/replace a few control variables used in the original paper that are not available for the later years.

after legalization, within-state differences in crime rates for those born just before or after legalized abortion, etc.) Consequently, it appears that the predictions made in Donohue and Levitt (2001) for the next two decades were borne out.

The remainder of the paper is as follows. Section II provides background on the key legal and institutional factors relating to abortion in the United States and also describes the data used in this analysis. Section III replicates and extends the results in Donohue and Levitt (2001) to cover the additional years of data from 1998-2014. Section IV illustrates the different paths in crime and abortion over our data period for the high and low abortion rate states. Section V concludes, placing these findings into the broader context of abortion-related research that has been conducted over the last 15 years.

## II. Background and Data

Beginning in the early 1990s, crime unexpectedly began to fall – even as some of the most prominent criminologists of the day were predicting crime was about to explode.[9] By 1997, the last year of data used in Donohue and Levitt (2001), violent crime and property crime had fallen 30 percent, and homicide was down 40 percent. The declines in crime have continued to the present. Between 1997 and 2014 (the last year of data included in our analysis), Uniform Crime Reports data show that violent crime per capita fell by 36.8 percent, property crime fell by 40.4 percent, and homicide declined by 35.3 percent.

Prior to 1970, abortion was illegal in the United States. Five states (California, New York, Alaska, Hawaii, and Washington) legalized abortion around 1970. In 1973, the Supreme Court decision in *Roe v. Wade* made abortion legal nationwide.[10] Despite *de jure* legalization, it took almost a decade for the number of abortions performed to reach a steady state, due to a lack of available providers as well as evolving norms. One striking feature of the data is the enormous heterogeneity in abortion usage across states. Dividing states into thirds according to the number of abortions per live birth, the lowest tertile has a steady-state abortion rate that is roughly one-half that of the middle tertile and one-fourth that of the top tertile.

The path to legalization did not create particularly compelling quasi-randomized variation in abortion exposure. Although the early legalization of abortion in five states might appear to serve as a natural experiment, these five states are clear outliers. Even after steady state abortion rates are reached in the 1980s, the abortion rates in the early legalizing states are more than double those in the rest of the nation. As a consequence, Donohue and Levitt (2001) relied on a collage of individually imperfect sources of variation in an effort to discern the causal impact of abortion on crime. These consisted of a comparison of early-legalizing states to the rest of the country, a comparison of states with high and low abortion rates after abortion became legal everywhere, differences in crime patterns within states for cohorts born before and after legalization, and differences in arrest rates within states by single year of age.

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[9] DiIulio (1996) and Fox (1996). For example, the Council on Crime in America (co-chaired by Bush "Drug Czar" William Bennett and Carter Attorney General Griffin Bell) released a report in November 1995, which stated: "America is a ticking violent crime bomb, and there is little time remaining to prepare for the blast." The imagery came from Council member John DiIulio, then a Professor at Princeton, who later was appointed by President George W. Bush as the first director of the White House Office of Faith-Based and Community Initiatives.

[10] For more institutional details regarding the legalization of abortion, see Donohue and Levitt (2001).

An additional complexity of the analysis is that the impact of abortion on crime is not expected to be immediate, but rather is only felt when cohorts exposed to abortion *in utero* reach an age at which crimes are committed.[11] At least initially, the expected impact of abortion on crime increases gradually as more and more of the crime-age cohorts have been exposed to legalized abortion and as these cohorts transition from the relatively low crime ages of the early teenage years to the peak-crime ages in the late teens and early twenties. Thus, the hypothesized impact of abortion on crime emerges only incrementally; the full impact is not felt for many decades.

To capture the extent to which legalized abortion would be expected to influence crime in a given state and year, Donohue and Levitt (2001) developed a metric they named the "effective abortion rate" per 1,000 live births. The "effective abortion rate" is the weighted average of the abortion rates of the birth cohorts in a state, with the weights determined by the share of total arrests nationally for a particular crime category of individuals of that age. More formally,

$$EffectiveAbortion_t = \sum_a Abortion_{t-a} \cdot \left(\frac{Arrests_a}{Arrests_{total}}\right)$$

where *t* indexes years and *a* indexes the age of a cohort. Abortion is the number of abortions per 1,000 live births, and the ratio of arrests inside the parentheses is the fraction of arrests for a given crime involving individuals with age *a*.[12]

In a steady state with all cohorts subjected to the same abortion rate, the effective abortion rate is equal to the actual abortion rate. For many years following the introduction of legalized abortion, the effective abortion rate will be below the actual abortion rate since many active criminal cohorts are too old to have been affected by legalized abortion. For instance, following Roe v. Wade, the actual abortion rate (per 1000 live births) rose to a steady state of about 400. Yet we estimate that the effective abortion rate in 1991 was only about 33 for homicide, 63 for violent crime, and 126 for property crime. Because property crime is disproportionately done by the young, the effect of abortion legalization is felt earlier for that crime category. The effective rates grew steadily, rising to 142, 180, and 253, respectively, by 1997. In 2014, the effective abortion rates for these three crime categories had risen to 329, 342, and 337, respectively. If legalized abortion reduces crime, then crime should continue to fall (all else equal) as long as the effective abortion rate is rising.

Throughout this paper, we attempt to mirror the specifications of Donohue and Levitt (2001) as closely as possible, in order to tie our hands with respect to *ex post facto* model selection. We make only one exception to this rule. In our original paper, we used abortion data that reflected the state in which an abortion was performed. This was less than ideal for our purposes because a substantial number of women travel across state lines to have an abortion. A much more

[11] A benefit of this time lag is that it helps to distinguish the abortion-crime hypothesis from other competing stories. Most other factors explaining crime (e.g., policing strategies, prisons, crack cocaine) have a contemporaneous impact. In contrast, the abortion-crime hypothesis makes a strong prediction: abortion rates should have no impact on crime until fifteen to twenty years later.

[12] This effective abortion rate includes legal abortion exposure prior to 1973 in the five states that legalized in 1970.

natural metric for constructing an abortion rate would use the mother's state of residence.[13] This latter measure only became available from the Alan Guttmacher Institute after our initial research was published. We have consistently used this abortion by state of residence measure since it became available (see Donohue and Levitt (2004, 2008) and Donohue, Grogger, and Levitt (2009)) and continue to do in this paper.[14]

## III. Results

### A. Crime Fell Earlier and Further for the Five Early-Legalizing States

We begin by looking at the patterns of crime in the five states (Alaska, California, Hawaii, New York, and Washington) that legalized or quasi-legalized abortion around 1970 relative to crime patterns in the rest of the nation where abortion did not become legal until the Supreme Court decision in *Roe v. Wade* of January 1973. Table 1 provides an updated version of Table 1 in Donohue and Levitt (2001). For each of three crime categories (violent, property, murder), we present percent changes in crime between 1976 and 1982, between 1982 and 1997, and between 1997 and 2014 for early legalizers and the rest of the country. We also report the difference in these percent changes in crime between early legalizing states and the rest of the nation. The first two columns correspond to data available in Donohue and Levitt (2001). The third and fourth columns, which reports how crime changed in the early legalizers versus the rest of the country in the period 1997-2014 and cumulatively between 1982 and 2014, are new.

As noted above, these five early legalizing states not only legalized abortion early, but continued to have higher abortion rates throughout the period. The bottom panel of the table presents the effective abortion rate for violent crime for the two sets of states at the end of each time period, calculated using equation (1). The gap in the effective abortion rate between the early legalizers and the rest of the country has continued to grow over the entire time period, albeit more slowly in the later period. In 1997, the difference in the effective abortion rate between these two sets of states was 149; by 2014 the difference had increased to 219.7. Our theory predicts no difference in crime patterns across early legalizers and the rest of the country prior to 1982 (when the first abortion-exposed cohort is beginning to reach a crime-committing age), but greater decreases in crime for all periods since then.

The results in Table I confirm that prediction. Prior to 1982, there are no statistically different crime trends across early-legalizing and all other states. Property and violent crime were increasing at a slower rate in early legalizing states between 1976 and 1982, whereas murder was rising faster in early-legalizing states, whether measured by UCR or Vital Statistics data.[15]

[13] For example, after New York legalized its previously very strict abortion laws in 1970, hundreds of thousands of women came from other states for abortions until the 1973 Roe decision legalized abortion nationally (Jacobs, 2018).

[14] The different abortion data between this paper and our 2001 paper explains the discrepancy in our references to particular effective abortion rates.

[15] We were strongly advised by Phil Cook to rely on the Vital Statistics (VS) homicide counts as a more reliable measure than the Uniform Crime Reports (UCR) figures. Indeed, when we explored this difference we found that the voluntarily reported UCR murder figures showed some troubling under counts of murder, particularly in low abortion rate states. We present results using UCR murder to maintain consistency with our initial paper and for VS homicide in light of their apparent greater accuracy. Note that in the last two columns of Table 1, the magnitude of the greater murder drop in the early legalizing states grew and the standard error of this difference fell when the VS

Between 1982 and 1997, violent crime fell by 30.4 percent (se=8.1 percent) in early legalizing states relative to the rest of the country. The parallel numbers for property crime and homicide are -35.3 percent (se=5.8) and –16.2 percent (se=10.7) with UCR data and -14.2 percent (se=9.9) using Vital statistics data. Of greatest interest, however, are the new results presented in column 3. Violent crime fell by an additional 20.9 percent (se=8.3 percent) in early legalizing states relative to the rest of the nation between 1997 and 2014. The difference in property crime was not statistically significant over the recent time period (-3.0 percent; se= 4.6 percent); the gap in homicide, however, was large (roughly -30 percent) and significant. The cumulative differences across the entire time period are enormous and highly statistically significant for all three crime categories, -51.2 percent (se=10.9), -38.3 percent (se=8.4), and -45.0 percent (se=11.2) respectively for violent crime, property crime, and homicide respectively.

### B. Crime Fell More in High-Abortion States Than in Low-Abortion States

A second source of variation for identifying a link between abortion and crime is a comparison of crime patterns across states with differing level of abortion usage post-legalization. Following Donohue and Levitt (2001) we rank order states by abortion usage in the years immediately following *Roe v. Wade* and partition the states into three categories with equal numbers of states in each category: low, medium, and high.[16] The three top panels of Table II report the percent changes in high, medium, and low abortion states for violent crime, property crime, and homicide respectively, for the periods 1973–1985, 1985–1997, and 1997-2014. The bottom panel of the table reports the mean effective abortion rate at the beginning and ending of the relevant period for the three groups of states.

There should be little or no impact of abortion on crime prior to 1985, because effective abortion rates are extremely low in 1985, even in high abortion states. The results in column 1 are consistent with that conjecture. Violent crime rate patterns are very similar across low, medium, and high abortion states. Property crime rises less in high abortion states than low abortion states, but the opposite pattern is true for homicide, where crime declines are smallest in the high abortion states, .

The crime changes between 1985 and 1997 reveal a very different pattern. For each crime category, high abortion states experience more favorable crime trends than medium abortion states, with low abortion states faring the worst. For all three crime categories, the difference between and high-abortion states and low-abortion states is greater than 30 percentage points.

data was used instead of the UCR data. The same is true in Table IV: using the VS data uniformly strengthens the estimated effect of legalized abortion on murder.

[16] The District of Columbia is included here and elsewhere in the paper, giving us 51 states, which allows 17 states per category.

TABLE I

Crime Trends for States Legalizing Abortion Early vs. the Rest of the US
Natural Log of Differences in Crime Rates over Various Periods

| *Crime Category* | *1976-1982* | *1982-1997* | *New Period, 1997-2014* | *Cumulative, 1982-2014* |
|---|---|---|---|---|
| *Violent Crime* | | | | |
| Early Legalizers | 16.6 | -12.8 | -61.9 | -74.6 |
| Rest of U.S. | 20.9 | 17.6 | -41.0 | -23.4 |
| Difference | -4.3 | -30.4 | -20.9 | -51.2 |
| | (5.5) | (8.1)** | (8.3)* | (10.9)** |
| *Property Crime* | | | | |
| Early Legalizers | 1.7 | -44.1 | -54.5 | -98.6 |
| Rest of U.S. | 6.0 | -8.8 | -51.5 | -60.3 |
| Difference | -4.3 | -35.3 | -3.0 | -38.3 |
| | (2.9) | (5.8)** | (4.6) | (8.4)** |
| *Murder (UCR)* | | | | |
| Early Legalizers | 6.3 | -40.8 | -61.9 | -102.7 |
| Rest of U.S. | 1.7 | -24.6 | -33.0 | -57.6 |
| Difference | 4.6 | -16.2 | -28.9 | -45.0 |
| | (7.4) | (10.7) | (7.0)** | (11.2)** |
| *Murder (VS)*[17] | | | | |
| Early Legalizers | 8.3 | -36.8 | -62.6 | -99.4 |
| Rest of U.S. | 4.2 | -22.7 | -30.7 | -53.4 |
| Difference | 4.1 | -14.2 | -31.9 | -46.1 |
| | (6.1) | (9.9) | (6.2)** | (10.4)** |
| *Effective abortion rate at end of period* | | | | |
| Early Legalizers | 0.0 | 297.9 | 515.0 | 515.0 |
| Rest of U.S. | 0.0 | 148.8 | 295.3 | 295.3 |
| Difference | 0.0 | 149.0 | 219.7 | 219.7 |

*Notes. * $p < 0.05$, ** $p < 0.01$*

*Early legalizing states are Alaska, California, Hawaii, New York and Washington. These five states legalized abortion in late 1969 or 1970. In the remaining states, abortion became legal in 1973 after Roe v. Wade. Percent change in crime rate is calculated by subtracting the fixed 1985 population-weighted average of the natural log of crime rate at the beginning of the period from the fixed 1985 population-weighted average of the natural log of crime rate at the end of the period. The rows labeled "Difference" are the difference between early legalizers and the rest of the United States (standard errors are reported in parentheses). The bottom panel of the table presents the effective abortion rate for violent crime, as calculated using equation (1), based on the observed age distribution of national arrests for violent crime in*

[17] Legal interventions are excluded from these Vital Statistics homicide counts.

*1985. Entries in the table are fixed 1985 population-weighted averages of the states. Abortion data are from the Alan Guttmacher Institute (by mother's state of residence); crime data are from the Uniform Crime Reports or the National Vital Statistics System. Because of missing crime data for 1976, the 1976-1982 calculations omit the District of Columbia. There is no overlap of time periods.*

Column 3 of Table II presents results for the time period that post-dates the publication of the original paper. Across all three crime categories, the decline in crime is greatest for the high abortion states and smallest for the low abortion states, as theory would predict. The magnitude of the differences are substantial: violent crime has fallen an additional 30+ percentage points since 1997 in high-abortion states relative to low-abortion states. For property crime that difference is over 18 percentage points, and for homicide it is 12 or 18 percentage points, depending on the data source. Aggregating over the entire time period 1985 to 2014 (Column 4), high abortion states have experienced a reduction in crime relative to low abortion states of -64.0, -50.2, and -45.3 percentage points for violent crime, property crime, and homicide respectively. With Vital Statistics data, the homicide impact is -55.3 percentage points.

TABLE II

Crime Changes 1985-2014 as a Function of Abortion Rates 1973-2014

| Abortion Frequency | % Change in Crime Rate | | | |
|---|---|---|---|---|
| | *1973-1985* | *1985-1997* | *New Period, 1997-2014* | *Cumulative Period, 1985-2014* |
| *Violent Crime* | | | | |
| Lowest | + 31.7 | + 28.6 | -25.1 | 3.4 |
| Medium | + 31.5 | + 17.9 | -36.4 | -18.5 |
| Highest | + 30.2 | -1.5 | -59.2 | -60.6 |
| *Property Crime* | | | | |
| Lowest | + 32.2 | + 9.3 | -41.5 | -32.2 |
| Medium | + 30.7 | + 2.1 | -46.3 | -44.3 |
| Highest | + 15.1 | -22.3 | -60.1 | -82.4 |
| *Murder (UCR)* | | | | |
| Lowest | -22.0 | + 7.9 | -33.1 | -25.2 |
| Medium | -19.0 | -14.7 | -33.7 | -48.4 |
| Highest | -10.1 | -25.4 | -45.1 | -70.5 |
| *Murder (VS)* | | | | |
| Lowest | -17.3 | +15.4 | -28.2 | -12.8 |
| Medium | -22.6 | -11.5 | -29.4 | -40.9 |
| Highest | -7.3 | -21.6 | -46.5 | -68.1 |
| *Effective Abortions Per 1000 at End of Period* | | | | |
| Lowest | 1.1 | 81.7 | 183.9 | 183.9 |
| Medium | 2.0 | 133.8 | 266.7 | 266.7 |
| Highest | 7.4 | 249.1 | 452.2 | 452.2 |

*Notes.*

*States are ranked by effective abortion rates for violent crime in 1997, with the seventeen states with lowest abortion rates classified as "lowest", the next 17 states classified as "medium" and the highest seventeen states (including District of Columbia) classified as "highest." The effective abortion rate is the estimated average abortion rate per 1000 live births for criminals in the state (number of abortions per state according to mother's state of residence), as calculated using equation (1), based on the observed age distribution of national arrests for violent crime in 1985. All values in the table are weighted averages using 1985 state populations as weights. Percent change in crime rate is calculated by subtracting the fixed 1985 population-weighted average of the natural log of crime rate at the beginning of the period from the fixed 1985 population-weighted average of the natural log of crime rate at the end of the period. Because crime rates are extremely low until the mid-teenage years, legalized abortion is not predicted to have had a substantial impact on crime in the period 1973-1985, but would be predicted to affect crime in the period 1985-2014. Abortion data are from the Alan Guttmacher Institute; crime data are from Uniform Crime Reports or the National Vital Statistics System. There is no overlap of time periods.*

### C. Abortion is Highly Significant in Explaining Crime Reductions in Panel Data

A third source of variation comes from panel data analysis that allows us to control for other factors, in addition to abortion rates, that influence crime. The specification estimated takes the form:

$$\ln(CRIME_{st}) = \beta_1 ABORT_{st} + X_{st}\Theta + \gamma_s + \lambda_t + \epsilon_{st}$$

The dependent variable is the respective logged per capita crime rate in state *s* at time *t.* Our main independent variable of interest is the effective abortion rate for a given state, year and crime category. *X* is a vector of state-level controls, including prisoners and police per capita, a set of variables capturing state economic conditions, lagged state welfare generosity, an indicator for the presence of concealed handgun laws, and per capita beer consumption. Both state and year fixed effects are included, represented by $\gamma_s$ and $\lambda_t$ respectively. All regressions are weighted by state population and adjusted for serial correlation using the method outlined by Bhargava, Franzini, and Narendranathan (1982).

Summary statistics for the full estimating sample are provided in Table III. We present both overall standard deviations and within-state standard deviations, which is the more relevant measure since state-fixed effects are included in all specifications. The effective abortion rates are slightly different across crime categories because the age distribution of arrests differs across crimes.

Regression results are shown in Table IV. The dependent variable in columns 1 and 2 is (logged) violent crime. Columns 3 and 4 present results for (logged) property crime, and columns 5 and 6 reflect (logged) homicide. For each of the three crime categories, two different specifications are reported. The odd-numbered columns present results without control variables (other than the state- and year-fixed effects); the even columns add the full set of controls. The top two rows present the two effective abortion rate measures, one corresponding to the time period included in our earlier study and the other capturing the period since that time.

All of the coefficients on abortion are negative, implying that higher abortion rates are associated with lower crime. These estimated effects of abortion are in almost all cases highly statistically significant—more so than any other variable included in the analysis. Notably, the coefficient on abortion in the time period that post-dates are initial study are larger in magnitude in all six specifications, implying that the out of sample results are even stronger than those in the original paper. The real-world magnitude implied by the coefficients on abortion is substantial. An increase in the effective abortion rate of 100 per 1000 live births (the mean effective abortion rate in 2014 for violent crime is 341.56 with a standard deviation of 128.72 across states) is associated with a reduction of roughly 10-20 percent in crime.

TABLE III
Summary Statistics, 1985-2014

| Variable | Mean | Standard Deviation (Overall) | Standard Deviation (Within State) |
|---|---|---|---|
| Violent crime per 1000 residents | 5.40 | 2.38 | 1.57 |
| Property crime per 1000 residents | 38.81 | 12.17 | 9.72 |
| Murder per 1000 residents (UCR) | 0.07 | 0.04 | 0.02 |
| Murder per 1000 residents (VS) | 0.07 | 0.04 | 0.02 |
| Effective abortion rate per 1000 live births by crime: | | | |
| Violent crime | 210.1 | 152.9 | 127.0 |
| Property crime | 246.3 | 150.0 | 113.3 |
| Murder | 184.5 | 148.2 | 127.6 |
| Prisoners per 1000 residents | 3.83 | 1.61 | 1.05 |
| Police per 1000 residents | 3.09 | 0.70 | 0.33 |
| State personal income per capita (current $ unadj) | 30571 | 10553 | 9844 |
| AFDC generosity per recipient family (t-15) | 5560 | 2788 | 1923 |
| State unemployment rate (percent unemployed) | 6.19 | 1.91 | 1.72 |
| Beer shipments per capita | 0.71 | 0.11 | 0.05 |
| Poverty rate (percent below poverty level) | 13.46 | 3.23 | 1.77 |

*Notes.*
*All values reported are means of annual, state level observations for the period 1985-2014 with the following exceptions. In 1996, there was a transition from AFDC to TANF. From 1998 onwards, the AFDC variable reflects TANF assistance. It is lagged by 15 years. The police and prisoners data are both logged and once-lagged, so correspond to the years 1984-2013. The values reported in the table are population weighted averages. The effective abortion rate is a weighted average of the abortion rate for each cohort born in a state, with weights determined by the percentage of arrests by age for a given crime category in the United States in 1985 as shown by equation (1).*

# TABLE IV

Panel-data Estimates of the Relationship between Abortion Rates and Crime, 1985-2014

| Variable | ln(Violent Crime Per Capita) | | ln(Property Crime Per Capita) | | ln(Murder Per Capita) [UCR] | | ln(Murder Per Capita) [VS] | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| EAR | -0.174 | -0.160 | -0.124 | -0.134 | -0.076 | -0.104 | -0.102 | -0.121 |
| '85-'97 | (0.021)** | (0.022)** | (0.018)** | (0.017)** | (0.036)* | (0.039)** | (0.032)** | (0.035)** |
| EAR | -0.182 | -0.169 | -0.137 | -0.151 | -0.120 | -0.154 | -0.143 | -0.166 |
| '98-'14 | (0.018)** | (0.020)** | (0.017)** | (0.016)** | (0.017)** | (0.022)** | (0.017)** | (0.021)** |
| ln (Incarc. | | 0.012 | | -0.103 | | -0.126 | | -0.117 |
| Rate)t-1 | | (0.037) | | (0.035)** | | (0.054)* | | (0.052)* |
| ln (Police | | -0.012 | | -0.024 | | -0.229 | | -0.247 |
| Emp.)t-1 | | (0.025) | | (0.021) | | (0.069)** | | (0.062)** |
| State Unemp. | | 0.048 | | 0.651 | | 1.346 | | 1.128 |
| | | (0.359) | | (0.321)* | | (0.722) | | (0.655) |
| ln (Income | | -0.032 | | -0.120 | | 0.320 | | 0.168 |
| Per Capita) | | (0.129) | | (0.118) | | (0.234) | | (0.210) |
| Poverty Rate | | -0.001 | | -0.000 | | -0.003 | | -0.001 |
| | | (0.001) | | (0.001) | | (0.003) | | (0.002) |
| AFDC | | 0.000 | | -0.000 | | -0.000 | | -0.000 |
| generosity | | (0.000) | | (0.000) | | (0.000) | | (0.000) |
| Shall-issue law | | 0.024 | | 0.022 | | -0.040 | | -0.013 |
| | | (0.014) | | (0.011) | | (0.022) | | (0.022) |
| Beer | | 0.293 | | 0.153 | | 0.263 | | 0.410 |
| | | (0.119)* | | (0.105) | | (0.218) | | (0.205)* |
| *N* | 1,530 | 1,517 | 1,530 | 1,517 | 1,530 | 1,517 | 1,501 | 1,488 |
| $R^2$ | 0.82 | 0.84 | 0.97 | 0.98 | 0.86 | 0.87 | 0.88 | 0.88 |

*Notes.* * $p < 0.05$, ** $p < 0.01$.

The dependent variable is the log in the per capita crime rate named at the top of each pair of columns. The first column in each pair presents results from the specifications in which the only additional covariates are state- and year-fixed effects. The second column presents results using the full specification. The data set is comprised of annual state level observations (including the District of Columbia) for the period 1985-2014. State- and year-fixed effects are included in all specifications. The prison and police variables are once-lagged to minimize endogeneity. Estimation is performed using a two-step procedure. In the first step, weighted least squares estimates are obtained, with weights determined by state population. In the second step, a panel data generalization of the Prais-Winsten correction for serial correlation developed by Bhargava et al. [1982] is implemented. Standard errors are in parentheses.

### D. Linking Abortion Rates to Arrests By Age

The analysis up to this point has used crime rates as outcome variables. Crime rates are the obvious outcome to focus on, but suffer from the shortcoming that the perpetrator is frequently unknown. Consequently, any analysis using crime rates is restricted to having state-year as the unit of analysis. This level of analysis does not allow us to take advantage of the unusual richness in the predictions of the abortion-crime hypothesis, which argues that crime patterns should differ by cohort, even in a given state and year, depending on the abortion rate when that cohort was *in utero*.

Arrest data provide an opportunity to test the hypothesis with a level of specificity not possible with crime data. For the subset of crimes in which an arrest is made, the age of the individuals arrested is reported. Thus, we can analyze arrest data at the level of state x year x single year of age. This allows us to include dummy variables for state x age, age x year, and state x year. The precise specification estimated is:

$$\ln(ARRESTS_{sta}) = \beta_1 ABORT_{sta} + \gamma_{sa} + \lambda_{at} + \theta_{st} + \epsilon_{sta}$$

where *s*, *t*, and *a* index state, year, and age, respectively. The variable *ARRESTS* is the raw number of arrests for a given crime. As our measure of the abortion rate for a particular cohort, we use the abortion rate in the state where the arrest was made in the calendar year most likely to have preceded the arrestee's birth. State x age, age x year, and state x year dummies absorb variation along those different dimensions. All of the variation in the covariates used in the panel regressions estimated above is at the state x year level, so no variation remains in those covariates in these specifications. Data by single year of age are available only for ages 15 to 24 (for older and younger ages the data are grouped, typically into five year age windows) so we limit our sample to that age range.

Table V presents the results. The dependent variable is the logged number of arrests for the crime category listed at the top of the column. Following the original paper, we present results for violent crime (columns 1-3) and property crime (columns 4-6), but not for homicide, because homicide is rare enough (with arrest often rarer) that many state-year-age cells are empty. The set of covariates included grows moving from left to right for a given crime category, as noted in the bottom portion of the table. The top two rows present the coefficient on the abortion rate in the period covered by the original data (top row) and in later years (second row). Only the coefficient on the abortion rate is shown in the table.[18]

Across both crime categories and all specifications, Table V reports abortion coefficients that are negative and highly statistically significant. The inclusion of additional covariates does not have an obvious impact on the magnitude of the abortion coefficients. Consistent with regression results presented above, the point estimates on the abortion coefficient are larger in magnitude in

[18] Donohue and Levitt (2001) also presented specifications by single year of age. To economize on the number of columns, we present this full set of results in Appendix A.

the later period than in the initial sample period in five of the six columns. In some, but not all, of the specifications, those differences are statistically significant.

TABLE V

The Relationship between Abortion Rates and Arrests, by Single Year of Age, 1985-2014

| | ln (Violent Arrests) | | | ln (Property Arrests) | | |
|---|---|---|---|---|---|---|
| Abortion Rate (x100) | -0.029 | -0.050 | -0.033 | -0.034 | -0.018 | -0.028 |
| '85-'96 | (0.006)** | (0.007)** | (0.005)** | (0.006)** | (0.006)** | (0.004)** |
| Abortion Rate (x100) | -0.038 | -0.043 | -0.048 | -0.071 | -0.065 | -0.039 |
| '97-'14 | (0.006)** | (0.006)** | (0.007)** | (0.005)** | (0.005)** | (0.007)** |
| Controls include: | | | | | | |
| Fixed effects for state and age*year interactions | Yes | Yes | Yes | Yes | Yes | Yes |
| state*age interactions | No | Yes | Yes | No | Yes | Yes |
| state*year interactions | No | No | Yes | No | No | Yes |
| *N* | 13,546 | 13,546 | 13,546 | 13,554 | 13,554 | 13,554 |
| $R^2$ | 0.964 | 0.973 | 0.994 | 0.959 | 0.971 | 0.994 |

*Notes.* * $p < 0.05$, ** $p < 0.01$ Standard errors are clustered by year of birth x state.
Results in the table are coefficients from estimation of equation (3). The unit of observation in the regression is annual arrests by state by single year of age. The sample covers the period of 1985-2014 for ages 15-24. There are two abortion rate variables, one for our initial period (1985-1995) and one for the remainder of our full data period (1997-2014). The abortion rate for a cohort of age *a* in state *s* in year *y* is the number of abortions per 1000 live births in state *s* in year $y - a - 1$. Note that this is the actual abortion rate, rather than the "effective" abortion rate used in preceding tables. Therefore, the coefficients in this table are not directly comparable to those of earlier tables. If data were available for all states, years, and ages, the total number of observations would be 15,300. Due to missing arrest data and occasional zero values for arrests, the actual number of observations is somewhat smaller. A complete set of year-birth cohort interactions are included in all specifications to capture national changes in the shape of the age-crime profile over time. State-year interactions are also included. Estimation is weighted least squares, with weights determined by total state population. Standard errors have been corrected to account for correlation over time within a given birth cohort in a particular state. Such a correction is necessary because the abortion rate for any given cohort is fixed over time, but multiple observations corresponding to different years of age are included in the regression. Results for murder are not included in the table because murder is infrequent, leading to many zeros when analyzed at the level of state and single year of age.

### E. Improving the Precision of Our Abortion Measures

The results presented thus far have directly mimicked the specifications and data definitions of Donohue and Levitt (2001), with the exception of using the improved abortion by state of residence data introduced in Donohue and Levitt (2008). Our purpose in doing so was to make the comparison of the new results to the original results as clear as possible.

In the years since that first paper was published, however, we have made three other improvements to our variable construction to more closely link these variables to what the theory suggests are the appropriate proxies. First, we constructed an abortion measure that better corresponds to the actual month and year of birth of the individual. Second, we have adjusted our abortion measure to take into account cross-state mobility between birth and adolescence. Third, recognizing the noise in our abortion proxy (based on Alan Guttmacher Institute data), we

have used another independently generated estimate of the abortion rate (from the Centers for Disease Control) as an instrumental variable.[19]

Table VI illustrates the impact of using the improved abortion measure and instrumenting to undo the impact of measurement error in our abortion proxy. The structure of Table VI is identical to that of Table V presented above. The only difference is the improvement to the methodology. The better approach leads to an increase in magnitude for eleven out of the twelve reported abortion coefficients. The mean of the coefficients reported in Table V is -.041; in Table VI the mean is nearly twice as large: -.073. Note that with the improved approach, the abortion coefficients in the latter period no longer appear systematically larger than those from the original time period. For violent crime, the point estimates are smaller in the latter period in two specifications and essentially the same in the most complex model shown in column 3. For property crime, the results are more erratic, much larger in the latter period in the first two specifications, but essentially zero for the 1997-2014 period in the column 3 specification.

This last finding for property crime may seem anomalous, but closer inspection of the data reveals a possible explanation. In earlier work, Donohue, Grogger, and Levitt (2009) noted that the drop in the number of children raised in adverse circumstances because of the legalization of abortion not only reduced the crime rate years later but it also led to a reduction in teen and out-of-wedlock births. This effect also shows up in an organic decline in the teen abortion rate for this second generation who were born after legalization. As a result, the effective abortion rates for property crime actually started to turn down in 31 states and the District of Columbia late in our data period.[20] But this drop in abortions was not signaling an increase in unwanted births (leading to adverse outcomes later in the lives of the new birth cohort) but rather a decrease in unwanted pregnancies. This is part of the larger story that reductions in abortion rates that are engineered from a reduction in unwanted pregnancies will have benign effects on the resulting birth cohort while coercive efforts by the state to reduce abortions without reducing unwanted pregnancies will have adverse effects on the resulting birth cohort.

Returning to our anomalous abortion coefficient for the latter period for property crime, by controlling for state*year effects, the abortion coefficient may be muddied by the new younger cohort which has both fewer unwanted births and fewer abortions, because there are fewer unwanted pregnancies and older cohorts within the state in the same year with higher abortion rates and a similarly low crime rate (but one achieved by higher abortions reducing unwanted births). For the earlier period, however, the third column property crime effect remains strong because the echo effect of early legalization was not yet dampening the demand for abortions.[21]

[19] For additional details, see Donohue and Levitt (2008).

[20] In contrast, the effective abortion rates continued to rise through 2014 for violent crime and murder, but the effective abortion rates for those crimes will follow the downward turn of the property effective abortion rates when more of the second generation born after abortion legalization enter the later ages at which violent crime and murder are committed.

[21] No state had experienced a drop in the effective abortion rate for property crime by 1996, the end of the data period captured in our early period estimate of the impact of abortion on property crime in Table VI, column 3.

# TABLE VI

Estimated Effects of Abortion on Crime with Measurement Error Correction, 1985-2014

| | ln (Violent Arrests) | | |
|---|---|---|---|
| Abortion Effect '85-'96 | -0.057 | -0.091 | -0.084 |
| | (0.012)** | (0.014)** | (0.013)** |
| Abortion Effect '97-'14 | -0.062 | -0.057 | -0.062 |
| | (0.010)** | (0.011)** | (0.019)** |
| Abortion measure used | IV Using CDC | IV Using CDC | IV Using CDC |
| Controls include: | | | |
| Fixed effects for state and age*year interactions | Yes | Yes | Yes |
| state*age interactions | No | Yes | Yes |
| state*year interactions | No | No | Yes |
| *N* | 13,546 | 13,546 | 13,546 |
| $R^2$ | 0.964 | 0.973 | 0.994 |

| | ln (Property Arrests) | | |
|---|---|---|---|
| Abortion Effect '85-'96 | -0.077 | -0.051 | -0.055 |
| | (0.010)** | (0.010)** | (0.009)** |
| Abortion Effect '97-'14 | -0.137 | -0.125 | 0.008 |
| | (0.013)** | (0.015)** | (0.020) |
| Abortion measure used | IV Using CDC | IV Using CDC | IV Using CDC |
| Controls include: | | | |
| Fixed effects for state and age*year interactions | Yes | Yes | Yes |
| state*age interactions | No | Yes | Yes |
| state*year interactions | No | No | Yes |
| *N* | 13,554 | 13,554 | 13,554 |
| $R^2$ | 0.959 | 0.971 | 0.994 |

*Notes.* * $p < 0.05$, ** $p < 0.01$. Standard errors are clustered by year of birth x state.

## IV. Illustrating the Greater Drops in Crime in High Abortion States

To illustrate how tightly the relative increases in abortions in high abortions states correspond to the relative drops in crime in these states relative to low abortion rate states, we divided the states into two groups of roughly equal population in 1985 according to the number of abortions per 1,000 live births based on state of residence.[22] The relative changes in population in the two groups from 1977-2014 is shown below:

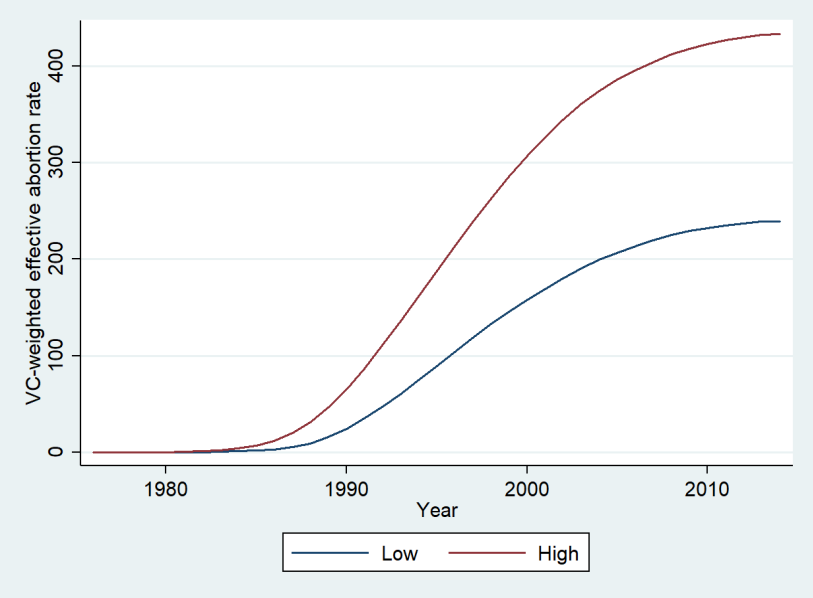
| | 1977 | 1985 | 2014 |
|---|---|---|---|
| Group Low | 112.1473 | 118.888 | 150.4659 |
| Group High | 107.6126 | 119.0358 | 168.4415 |

*Notes:* Population in millions

Figure I shows the difference in effective abortion rates between our high and low abortion states, weighted to reflect when legalized abortion would be expected to influence violent crime. The impact of legalized abortion starts slowly but rises substantially in both sets of states after 1990, although obviously much more rapidly in the high abortion states. Our thesis predicts that while both sets of states would experience downward pressure on crime by virtue of the growing effective abortion rates, the impact would be substantially greater on crime in the high abortion states.

Figure I

Effective Abortions Rates in High and Low Abortion States (Weighted by violent crime)

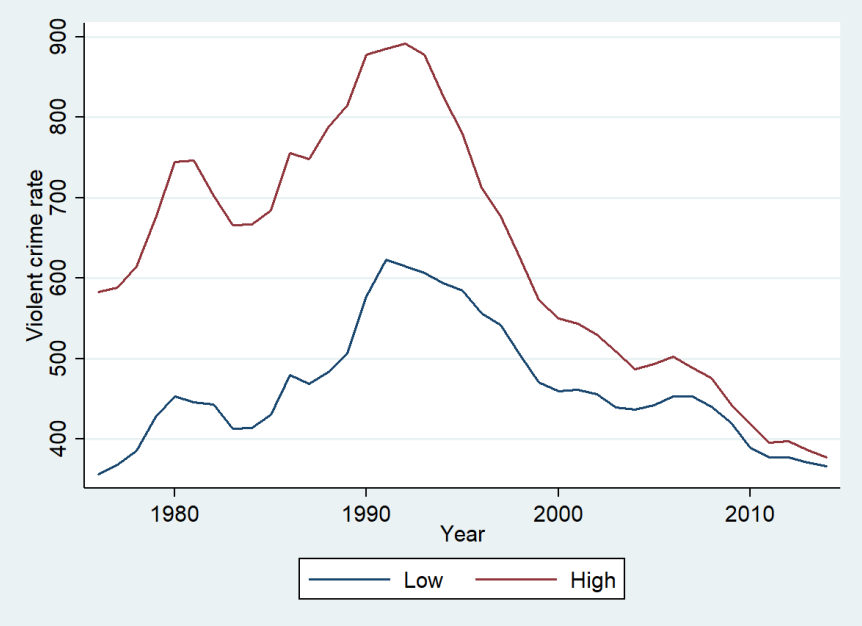



[22] The 32 states in the Low abortion rate group are: Alabama, Alaska, Arkansas, Delaware, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Mexico, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, West Virginia, Wisconsin, and Wyoming. The 19 High abortion rate states are: Arizona, California, Colorado, Connecticut, District of Columbia, Florida, Georgia, Hawaii, Maryland, Massachusetts, Michigan, Nevada, New Hampshire, New Jersey, New York, North Carolina, Rhode Island, Virginia, and Washington.

Figure II illustrates the pattern of violent crime over the period from 1977-2014 in these two sets of states. While both sets were being battered by sharply rising violent crime until the early 1990s, the pattern reversed and the high abortion states showed much more dramatic drops in crime for the remainder of our data period. While in the late 1970s and up to the early 1990s, violent crime was substantially higher in high abortion states, the persistent faster decline over the next quarter-century largely eliminated that gap.

Figure II

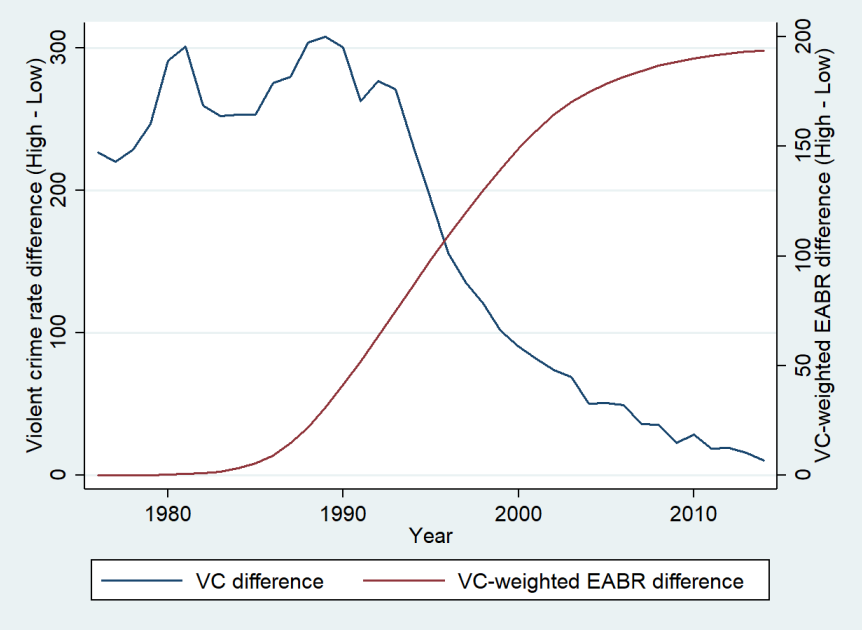
Violent crime rate in High and Low Abortion States, 1977-2014




The interesting connection between the greater increase in abortion and the greater drops in violent crime experienced in the high abortion states can be seen by plotting the difference in violent crime rates on the same graph as the difference in the abortion rates in these two sets of states, as shown in Figure III. The violent crime rate vacillated between 250 and 300 more crimes per 100,000 population in the high abortion states in the decade prior to 1990. But just as the greater increases in abortion in the high abortion states took hold, continuing for the remainder of our data period, the higher violent crime rate in the high abortion states began shrinking almost to nothing by 2014.

Figure III

The Growing Abortion Disparity Corresponds to a Relative Decline in the Violent Crime Rate, 1977-2014




The same patterns shown in Figures I – III also can be seen for murder and property crimes. Figures IV and V replicate the Figure III juxtaposition showing the pronounced opposing movements of the rising gap in effective abortion rate which corresponds to the declining gap in murder and property crime, respectively. Indeed, as Figure IV reveals, the relatively greater drop in murder in the high abortion states was so substantial that by the end of our data period the higher murder rates of the high abortion states had not only been eliminated but had actually been reversed. By 2014, the high abortion states had a murder rate that was 0.342 per 100,000 lower than the murder rate in low abortion states.

Visually, the same pattern of a higher initial crime rate in the high abortion states that declines and was ultimately reversed at the same time that the abortion differential grew is seen in Figure V for property crime. Note that the murder rate gap was eliminated in roughly 2008 and turned in favor of high abortion states thereafter, while in the case of property crime this contemporaneous decline in the higher initial crime was eliminated almost a decade earlier. Interestingly, the higher property crime and murder rate differentials of the high abortion rate states were both eliminated at about the time that their respective effective abortion differentials (over the low abortion rate states) reached 175 per 1000 births. Since property crime tends to be committed by younger criminals, the property crime effective abortion rate differential reached 175 roughly 10 years earlier than the murder effective abortion rate.

Figure IV

The Growing Abortion Disparity Corresponds to a Relative Decline in the Murder Rate, 1977-2014

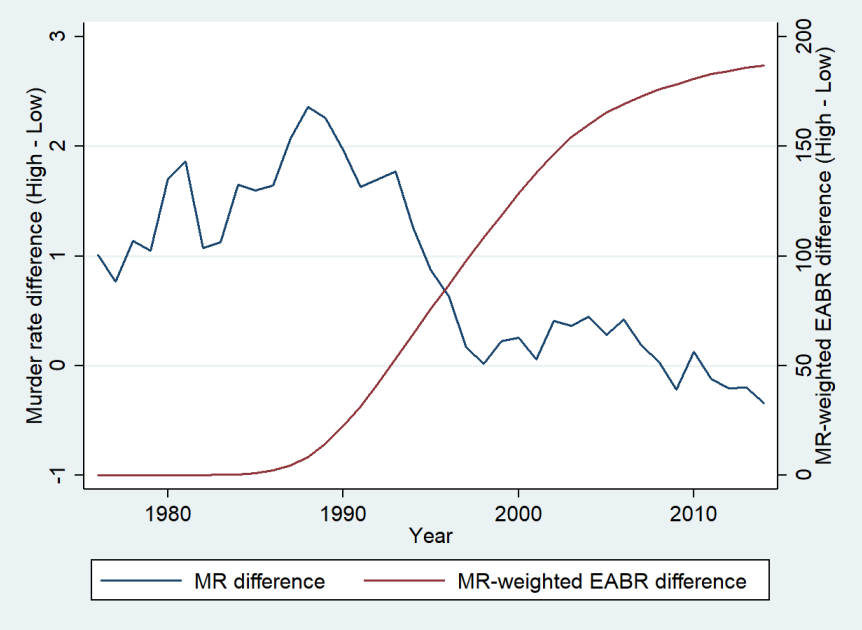
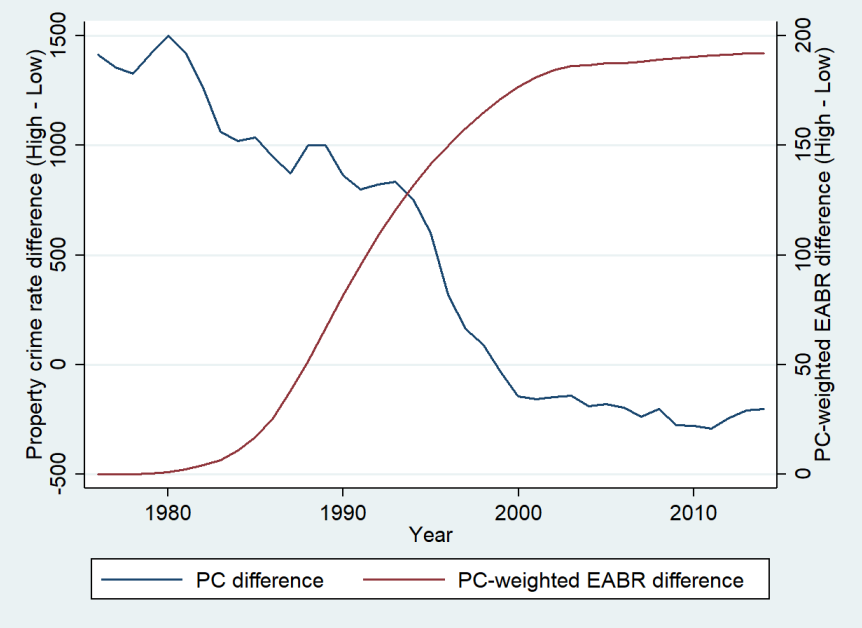



Figure V

The Growing Abortion Disparity Corresponds to a Relative Decline in the Property Crime Rate, 1977-2014




Of course, these graphs are only juxtaposing the contemporaneous growth in abortion rates with the greater crime drops of the high abortion rate states, but we know that the rates of police staffing and incarceration were growing very substantially over this period. One could imagine that the high abortion rate states simply grew their police forces and incarceration rates faster

than low abortion rate states starting around 1990. In this event, these other policies might explain all or most of the relative crime drop that we have paired with the rising relative abortion rates.

To explore this possibility, we plot the relative changes in our two sets of states for rates of incarceration and police staffing Figures VI and VII, respectively. The figures clearly document the very substantial expansions in these two crime-fighting technologies but two points underscore why these factors do not undermine the hypothesized link between legalized abortion and crime. First, the steady increases in both incarceration and police cannot explain the sudden and unanticipated decline in the crime rate starting in roughly 1990. Second, we have just seen that the crime drops were substantially greater in high abortion states, so if the abortion-crime thesis is to be undermined by increasing incarceration or growing police forces we would need to see greater increases in these factors in the high abortion states. But the figures refute this proposition. Figure VI shows that incarceration rates rose more sharply and are now substantially higher in the low abortion states. Thus, the greater crime-reducing increases in incarceration in the low abortion states would suggest that the relative crime improvements in the high abortion states depicted in Figures III-V that we attribute to increased abortion are, if anything, understated.

Figure VI

Incarceration rate trends in High and Low Abortion States

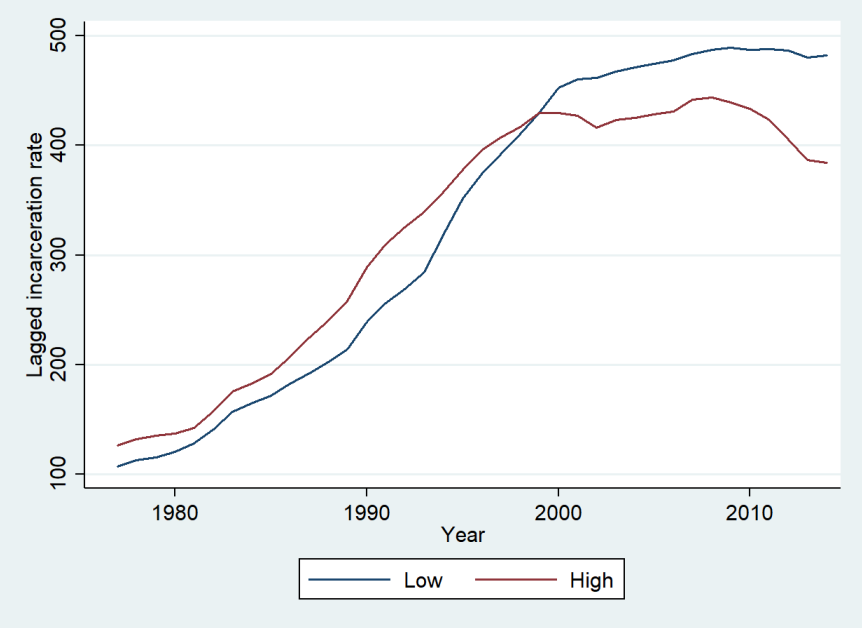
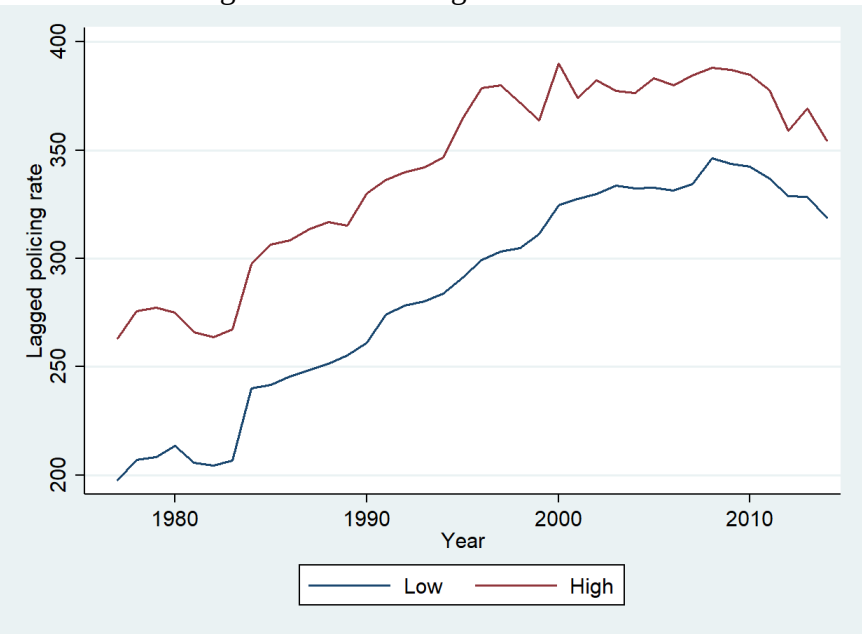



Figure VII reaffirms that both sets of states have substantially increased police staffing over our data period, at least until the financial crisis led to budget cutbacks and both groups experienced dips in the ensuing years. While the high abortion states have always had higher police staffing rates, at least over the last 15 years the police staffing gap between high and low abortion states has narrowed. Again the relatively greater crime-reducing expenditures on police employment in low abortion states would be the opposite of the pattern needed to explain away the link between higher abortion and lower crime.

Figure VII

Police staffing rate trends in High and Low Abortion States




## V. Conclusion

It is rare for an economic theory to make predictions for twenty years into the future that are both bold and precise. The abortion-crime hypothesis of Donohue and Levitt (2001), however, did just that. Based on an extrapolation that assumed the same point estimates in the ensuing two decades as were estimated in the original sample, Donohue and Levitt (2001) predicted that crime would fall an additional 20 percent in the United States. The results in this paper provide strong support for that prediction. Using the same specifications as Donohue and Levitt (2001), but extended to a sample that includes an additional seventeen years of data, in almost all cases the point estimates are at least as large as in the original analysis, and in many cases the point estimates are bigger. The effective abortion rate rose from roughly 190 in 1997 to 330 in 2014.[23] Using the preferred specifications in Table IV – the same specifications upon which the original predictions were based -- the implied crime decline due to legalized abortion over the ensuing 17 years was slightly greater than 20 percent, with a cumulative impact of legalized abortion on crime of roughly 45 percent.

The strong evidence of the impact of legalized abortion on crime in the United States would of course be strengthened by similar evidence from a different continent where the timing of abortion legalization and frequency of abortions varies greatly from ours. In fact, François et al. (2014) provide such evidence with a panel data analysis with country and year fixed effects from 1990-2007 for 16 Countries in Western Europe. The paper "confirm[s] the negative impact of abortion on crime for both homicides and thefts…." While the authors do not compute the

[23] In peak years of abortion, almost 1 of every 3 conceptions in the United States ended in abortion.

impact of their regression coefficients and even speculate that their estimates are smaller than ours, their model showing the impact on crime 15 years after abortion legalization implies that the declines resulting from abortion legalization 25 years after legalization are 12-40% for homicide and 23-43% for theft. These estimates are roughly comparable to and therefore provide significant support for our own estimates on data from the United States.

## Appendix A

The Relationship between Abortion Rates and Arrests, by Single Year of Age, 1985-2014

| | ln (Violent Arrests) | | | ln (Property Arrests) | | |
|---|---|---|---|---|---|---|
| Ab Rate x | 0.013 | -0.049 | -0.038 | -0.029 | 0.006 | -0.025 |
| Age = 15 ('85-'96) | (0.011) | (0.013)** | (0.011)** | (0.010)** | (0.011) | (0.008)** |
| Ab Rate x | 0.009 | -0.030 | -0.032 | -0.061 | -0.026 | -0.013 |
| Age = 15 ('97-'14) | (0.009) | (0.015)* | (0.012)** | (0.010)** | (0.012)* | (0.010) |
| Ab Rate x | -0.002 | -0.033 | -0.022 | -0.039 | 0.004 | -0.019 |
| Age = 16 ('85-'96) | (0.010) | (0.011)** | (0.008)** | (0.008)** | (0.010) | (0.006)** |
| Ab Rate x | -0.007 | -0.021 | -0.025 | -0.078 | -0.030 | -0.014 |
| Age = 16 ('97-'14) | (0.008) | (0.013) | (0.009)** | (0.009)** | (0.010)** | (0.010) |
| Ab Rate x | -0.019 | -0.030 | -0.014 | -0.033 | 0.013 | -0.000 |
| Age = 17 ('85-'96) | (0.009)* | (0.010)** | (0.007)* | (0.008)** | (0.009) | (0.006) |
| Ab Rate x | -0.023 | -0.028 | -0.032 | -0.074 | -0.026 | -0.002 |
| Age = 17 ('97-'14) | (0.008)** | (0.012)* | (0.009)** | (0.008)** | (0.009)** | (0.009) |
| Ab Rate x | -0.055 | -0.049 | -0.029 | -0.053 | -0.001 | -0.006 |
| Age = 18 ('85-'96) | (0.007)** | (0.009)** | (0.006)** | (0.006)** | (0.008) | (0.004) |
| Ab Rate x | -0.051 | -0.047 | -0.050 | -0.104 | -0.044 | -0.016 |
| Age = 18 ('97-'14) | (0.007)** | (0.010)** | (0.008)** | (0.007)** | (0.008)** | (0.007)* |
| Ab Rate x | -0.058 | -0.049 | -0.022 | -0.045 | -0.013 | -0.009 |
| Age = 19 ('85-'96) | (0.008)** | (0.009)** | (0.006)** | (0.007)** | (0.009) | (0.004)* |
| Ab Rate x | -0.050 | -0.046 | -0.045 | -0.088 | -0.052 | -0.017 |
| Age = 19 ('97-'14) | (0.007)** | (0.010)** | (0.007)** | (0.007)** | (0.008)** | (0.007)* |
| Ab Rate x | -0.067 | -0.059 | -0.028 | -0.032 | -0.019 | -0.010 |
| Age = 20 ('85-'96) | (0.009)** | (0.010)** | (0.006)** | (0.009)** | (0.011) | (0.005)* |
| Ab Rate x | -0.048 | -0.045 | -0.044 | -0.074 | -0.060 | -0.022 |
| Age = 20 ('97-'14) | (0.007)** | (0.010)** | (0.008)** | (0.007)** | (0.008)** | (0.007)** |
| Ab Rate x | -0.061 | -0.057 | -0.027 | -0.019 | -0.026 | -0.013 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Age = 21 (’85-’96) | (0.014)** | (0.011)** | (0.008)** | (0.010) | (0.011)* | (0.006)* |
| Ab Rate x | -0.051 | -0.051 | -0.052 | -0.065 | -0.071 | -0.034 |
| Age = 21 (’97-’14) | (0.008)** | (0.009)** | (0.007)** | (0.007)** | (0.008)** | (0.007)** |
| Ab Rate x | -0.053 | -0.052 | -0.020 | -0.012 | -0.034 | -0.014 |
| Age = 22 (’85-’96) | (0.020)** | (0.013)** | (0.009)* | (0.011) | (0.011)** | (0.007)* |
| Ab Rate x | -0.047 | -0.049 | -0.051 | -0.061 | -0.082 | -0.041 |
| Age = 22 (’97-’14) | (0.008)** | (0.009)** | (0.007)** | (0.007)** | (0.008)** | (0.007)** |
| Ab Rate x | -0.055 | -0.064 | -0.034 | -0.006 | -0.041 | -0.023 |
| Age = 23 (’85-’96) | (0.032) | (0.019)** | (0.010)** | (0.012) | (0.012)** | (0.006)** |
| Ab Rate x | -0.046 | -0.050 | -0.053 | -0.059 | -0.092 | -0.050 |
| Age = 23 (’97-’14) | (0.009)** | (0.009)** | (0.008)** | (0.008)** | (0.008)** | (0.008)** |
| Ab Rate x | -0.057 | -0.063 | -0.026 | -0.015 | -0.068 | -0.042 |
| Age = 24 (’85-’96) | (0.054) | (0.027)* | (0.013)* | (0.021) | (0.015)** | (0.009)** |
| Ab Rate x | -0.044 | -0.043 | -0.047 | -0.059 | -0.095 | -0.056 |
| Age = 24 (’97-’14) | (0.009)** | (0.009)** | (0.007)** | (0.008)** | (0.008)** | (0.007)** |
| Controls include: | | | | | | |
| Fixed effects for state and | | | | | | |
| age*year interactions | Yes | Yes | Yes | Yes | Yes | Yes |
| state*age interactions | No | Yes | Yes | No | Yes | Yes |
| state*year interactions | No | No | Yes | No | No | Yes |
| $N$ | 13,546 | 13,546 | 13,546 | 13,554 | 13,554 | 13,554 |
| $R^2$ | 0.965 | 0.973 | 0.994 | 0.959 | 0.971 | 0.995 |

*Notes.* * $p < 0.05$, ** $p < 0.01$ Standard errors are clustered by year of birth x state.

# Appendix B

Distinguishing Between the Channels through Which Abortion Affects Crime, 1985-2014

| | ln (Violent Arrests) | | ln (Viol Arrests Per Capita) |
|---|---|---|---|
| | (1) | (2) | (3) |
| Abortion measures | -0.076 | -0.039 | -0.026 |
| with corrections ’85-’98 | (0.009)** | (0.008)** | (0.007)** |
| Abortion measures | -0.061 | -0.054 | -0.051 |
| with corrections ’99-’14 | (0.011)** | (0.010)** | (0.011)** |
| IV using CDC ’85-’98 | -0.081 | -0.048 | -0.034 |
| | (0.014)** | (0.013)** | (0.011)** |
| IV using CDC ’99-’14 | -0.078 | -0.088 | -0.092 |
| | (0.020)** | (0.019)** | (0.020)** |
| Controls include: | | | |
| Fixed effects for state and | | | |
| age*year interactions | Yes | Yes | Yes |
| state*age interactions | Yes | Yes | Yes |
| state*year interactions | Yes | Yes | Yes |
| ln (population) | No | Yes | No |
| *N* | 13,546 | 13,546 | 13,546 |
| $R^2$ | 0.994 | 0.994 | 0.970 |

| | ln (Violent Arrests) | | ln (Prop Arrests Per Capita) |
|---|---|---|---|
| | (1) | (2) | (3) |
| Abortion measures | -0.045 | -0.018 | 0.004 |
| with corrections ’85-’98 | (0.005)** | (0.005)** | (0.005) |
| Abortion measures | -0.006 | -0.001 | 0.004 |
| with corrections ’99-’14 | (0.013) | (0.013) | (0.013) |
| IV using CDC ’85-’98 | -0.053 | -0.029 | -0.007 |
| | (0.009)** | (0.009)** | (0.008) |
| IV using CDC ’99-’14 | -0.005 | -0.002 | -0.009 |
| | (0.023) | (0.022) | (0.022) |
| Controls include: | | | |
| Fixed effects for state and | | | |
| age*year interactions | Yes | Yes | Yes |
| state*age interactions | Yes | Yes | Yes |
| state*year interactions | Yes | Yes | Yes |
| ln (population) | No | Yes | No |

| | | | |
|---|---|---|---|
| $N$ | 13,554 | 13,554 | 13,554 |
| $R^2$ | 0.994 | 0.994 | 0.975 |

*Notes.* * $p < 0.05$, ** $p < 0.01$ Standard errors are clustered by year of birth x state.

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