Lancaster University Management School
Working Paper
2005/066

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The Abortion-Crime Link: Evidence from England and Wales

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October 2005

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Acknowledgements: We are grateful to Rob Witt and to participants at seminars at Nottingham University Business School, Lancaster University Management School and at University of Surrey Department of Economics for many useful comments and suggestions.

Abstract

We use panel data from 1983 to 1997 for the 42 police force areas in England and Wales to test the hypothesis that legalizing abortion contributes to lower crime rates. We provide an advance on previous work by focusing on the impact of possible endogeneity of effective abortion rates with respect to crime. Our use of U.K. data allows us to exploit regional differences in the provision of free abortions to identify abortion rates. When we use a similar model and estimation methodology, we are able to replicate the negative association between abortion rates and reported crime found by Donohue and Levitt for the U.S. However, when we allow for the potential endogeneity of effective abortion rates with respect to crime, we find no clear connection between the two.

JEL Classifications: K42, I38, J13

Key words: abortion, crime, fertility.

I. Introduction.

During the 1990s the United States witnessed a large, abrupt drop in crime rates across virtually all categories and in all regions. Between 1991 and 1999 murder rates fell by approximately 40 percent with violent and property crime rates falling by about 30 percent.[1] This dramatic and unexpected fall in crime led to a scramble by researchers for an explanation, and while several factors may have played a role in the reduction of crime (e.g. increased police presence, strong economic growth, reduction in crack cocaine) none of them were capable of explaining the magnitude and timing of the decline (Levitt, 2004).

Donohue and Levitt (2001) – henceforth D & L – offer an explanation. The authors argue that the legalization of abortion some 15 to 20 years earlier may be a large part of the answer. Their hypothesis (discussed in greater detail below) is that legalized abortion ultimately reduced the birth of children who, had they have been born, would have been at greater risk of committing crimes when they reached their teenage years. The D & L paper prompted several attempts by U.S. academics to disprove their claims (also discussed below) and was debated in the editorial sections of several prominent newspapers including the *Wall Street Journal,* the *New York Times* and the *Washington Post*. Even New York's Cardinal John O'Connor weighed in on the topic.[2]

The goal of this study is to test the D & L hypothesis with data from the United Kingdom. Aggregate data suggests that trends in total and property crime followed a very similar pattern in the U.K. to those in the U.S., despite the fact that abortion in the U.K. was legalized about five years prior to the U.S. Using panel data from 1983 to 1997

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[1] Donohue and Levitt (2001), p.392.

[2] "That Research on Abortion and Crime" found at: http://cny.org/archive/cv/cv082699.htm

for the forty two police force areas in England and Wales and using a model and estimation methodology that is similar to theirs, we are able to replicate their finding of a negative association between abortion rates and reported crime. However, when we allow for the potential endogeneity of effective abortion rates with respect to crime, we find no clear connection between the two.

The remainder of the paper is organized as follows: Section II provides greater detail of the D & L hypothesis and discusses some of the relevant research. Section III gives a brief history of abortion policy in the U.K. Section IV follows with our model of crime and discusses the covariates included and their expected effects on crime rates. Section V discusses the estimation approach, describes the data set and presents our empirical findings. Concluding thoughts are found in section VI.

II. The Linkage between Abortion and Crime Rates.

The D & L hypothesis that changes in abortion rates may lead to changes in crime rates some years later rests on two propositions: that changes in the abortion rate will change the *size* of birth cohorts, as well as the *composition* of the cohort. The first is a rather straightforward proposition that if the abortion rate increases, *ceteris paribus*, the birth cohort is smaller thus leaving fewer individuals later to commit crimes. It is the second proposition that D & L stress in their paper, and is clearly more controversial. They write:

> "Far more interesting from our perspective is the possibility that abortion has a disproportionate effect on the births of those who are most at risk of engaging in criminal behavior. To the extent that abortion is more frequent among those parents who are least willing or able to provide a nurturing home environment, as a large body of evidence suggests, the

> impact of legalized abortion on crime might be far greater than its effects on fertility rates." (p. 386).

In other words, D & L suggest that abortion may significantly alter the composition of birth cohorts in a way that leaves relatively fewer potential criminals than if abortion were not legally available. The reasoning behind this is twofold. First, legalized abortion allows women to better manage their fertility. That is, if a woman becomes pregnant at an inopportune time (e.g. during temporary financial difficulties, or while a student) she can terminate the pregnancy and perhaps later bear children when conditions are more favorable. The second (and somewhat related) reason abortion may reduce crime, has to do with the kind of environment that children would be born into if abortion is not available. Gruber, Levine and Staiger (1999) consider what kind of life the 'marginal child' might have experienced if abortion had not been the chosen course of action by the pregnant mother. Based on research using state-level data from the 1980 U.S. census and U.S. Vital Statistics, they note that the marginal child would likely have faced multiple hardships. They write:

> "Our results suggest that the marginal children who were not born as a result of abortion legalization would have systematically been born into less favorable circumstances if the pregnancies had not been terminated: they would have been 60 percent more likely to live in a single parent home, 50 percent more likely to live in poverty, 45 percent more likely to be in a household collecting welfare, and 40 percent more likely to die during the first year of life." (p. 265).

D & L argue that legalized abortion may have reduced exposure to such hardships and ultimately caused a reduction in crime 15 to 20 years later. Or, as Levitt and Dubner summarize it in their best-selling book *Freakonomics*, "Legalized abortion leads to less unwantedness; unwantedness leads to high crime; legalized abortion, therefore, led to less crime." (p. 139).

Subsequent Research on the Abortion – Crime Link

Several papers have emerged following Donohue and Levitt (2001) testing the causal linkage between abortion and crime. Sen (2002) uses provincial crime data for Canada during the period 1983 to 1998 to consider the effects of legalized abortion on both fertility rates and crime. Employing a model and methodology quite similar to that of D & L, (with the exception of his computation of the abortion measure used in the regressions),[3] he finds support for their theory that legalized abortion reduces violent crime. The results do not hold, however, for general property crime. He further notes that the major impact of legalized abortion was the reduction of teenage fertility rates which in turn strongly reduced crime in Canada. This result, he argues, lends support to the theory that legalized abortion affects crime rates mostly because it allows women to optimally time their pregnancies.

Little else in terms of international research on the abortion – crime link has surfaced.[4] There has, however, been a lively debate about the Donohue and Levitt's results for the U.S. Joyce (2004a) strongly criticizes the D & L paper claiming that their estimation approach fails to carefully identify the effect of the abortion rate on crime. He argues that because the period D & L analyze, 1985 to 1997, coincides with the rise and fall of the crack-cocaine epidemic in the U.S. their results likely suffer from an omitted variable bias. That is, the rise and fall of crime during this period might falsely be attributed to the legalization of abortion when in fact it was due to the fluctuations in the

[3] Weighted abortion values are computed using population of age groups of males rather than arrests as D & L use.

[4] In a non-technical piece, Leigh and Wolfers (2000) note that certain aspects of the murder rate in Australia during the 1990s are consistent with the D & L theory. Other papers that do not directly test the abortion – crime link, but touch on related issues include Charles and Stephens (2002) which investigates the effects of abortion legalization on adolescent substance abuse in the U.S., and Hunt (2003) which considers teenage birth rates and crime in U.S.

crack-cocaine market. In an effort to better identify the effects, if any, of abortion on crime, Joyce uses a difference-in-difference approach and examines crime rates of cohorts born just before and after abortion legalization. He results show no crime reducing effects from abortion legalization.

Donohue and Levitt (2004) respond to Joyce's criticism of their earlier work. They note that Joyce's decision to focus on the period of 1985 to 1990 has led to an omitted variables bias in his estimates. They support this claim with two facts: first, this period coincides with the peak in the U.S. crack-cocaine epidemic. Second, they provide evidence showing that states that legalized abortion previous to the 1973 *Roe v. Wade* decision,[5] as well as states with generally high abortion rates suffered more than other states from crack and the crime associated with the surge in drug use. Thus, without adequate controls for crack-cocaine usage, they argue Joyce's results are biased. The authors then show that, using the same technique as Joyce (2004a) but extending the data set on either side to include earlier and later years, the crime-reducing effects of abortion re-emerge.

Joyce (2004b) then offered a response to the critique of his earlier paper. Joyce argues that some predictions of the abortion-crime relationship proposed by D & L do not survive further scrutiny. First, Joyce argues that U.S crime should have fallen sharply as cohorts born soon after legalization reached peak ages of criminal activity i.e. 15 to 24. Crime did not fall in the manner expected. Second, the impact of abortion legalization on fertility rates was higher for blacks than for whites. Yet this does not translate into any racial differences in reported crime rates.

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[5] There were five states, (Alaska, California, Hawaii, New York and Washington) that legalized abortion previous to 1973.

Essentially, the debate over impact of abortion on crime centers on the extent to which of the hardships described by Gruber, Levine and Staiger (1999) translate into higher crime rates and how the legalization of abortion may reduce the occurrence of those hardships among birth cohorts. This study addresses this subject by investigating the relationship between abortion and crime rates for England and Wales. The difference-in-differences methodology, as applied to before- and after- legislation changes has recently been generally criticized by Bertrand, Duflo and Mullainathan (2004) as estimates of regime changes tend to understate standard errors on the legislation coefficient.[6] Given this critique, and since we wish to replicate D & L's study as closely as possible for England and Wales, we develop our econometric analysis using data on access to abortion rather than changes in legislation.

A key issue not addressed in the existing literature is the possibility that abortion rates may be endogenous to crime. In particular, socio-economic conditions at the time of conception are known to have a strong influence both on the likelihood of conception and on the likelihood of a pregnancy being ended by abortion. However, these same socio-economic conditions are also likely to influence social and economic capital invested in these children and, as a consequence, will affect the likelihood of these children committing crimes in subsequent years. Consider, for example, a social change that (given constant access to abortion) leads to more births and fewer abortions amongst women in poor socio-economic circumstances in a particular region. In this case, we

[6] Bertrand *et al.* find that difference-in-difference estimations based on changes in laws are systematically biased in favor of uncovering an intervention effect, particularly when the outcome variable is positively serially correlated over time (almost certainly the case with crime). Their critique of identification of treatment effects by differences-in-differences would tend to reinforce Joyce (2004a)'s result of no correlation between abortion and crime and would cast doubt on the significant intervention effect found by D & L (2004) when using a longer time period. D & L (2001) did not use a difference-in-difference method, preferring instead to model differences in access to abortion across states.

would be likely to observe a spurious relationship between decreases in abortion rates in that area and increases in crime rates in subsequent years. Thus, an important goal of this paper is to identify the causal effect of changes in abortions rates using variables that reflect access to abortion.

III. Abortion in the U.K.

The 1831 Offences Against the Person Act (re-enacted in 1867) made it an offence punishable by life imprisonment to 'procure a miscarriage' or provide the means for a woman to 'procure a miscarriage'. The Infant Life Preservation Act (1929) confirmed that it was an offence to destroy a child capable of being born alive, unless done in good faith to preserve the life of the mother.

Following a court case in 1938, in which a doctor who had performed an abortion on a girl who had been raped was acquitted, abortions were permitted on serious medical grounds. The major change in the law occurred with the passing of the 1967 Abortion Act. This provided a defense to the Offences Against the Persons Act under certain conditions, the most important being that two doctors state in good faith that continuation of the pregnancy would involve risk, greater than if the pregnancy were terminated, of injury to the physical or mental health of the pregnant woman or to any existing children of the pregnant woman. Many doctors have interpreted this clause as permitting abortion in any case. However, as we will see below, the requirement for the involvement of two doctors is an important element of our identification strategy.

The Abortion Act came into force in April 1968 and applied to England, Scotland and Wales, but not Northern Ireland. The Act was still limited by the Infant Life

Preservation Act and this meant that the effective time limit for abortion was 28 weeks – the earliest date at which a fetus would be viable at that time. The 1967 Act was amended by the 1991 Human Fertilisation and Embryology Act. This decoupled abortion law from the Infant Life Preservation Act and imposed a formal time limit on abortions in most cases of 24 weeks. In certain cases, most particularly when the fetus was thought to be at risk of being born with physical or mental abnormalities, abortion was permitted at any stage. There have been no further amendments to the Abortion law in the U.K. since 1991.

During 1969, the first full year in which the Abortion Act was in place, 49,829 abortions were carried out on residents in England and Wales. This increased rapidly to over 100,000 by 1972 and then more gradually to about 170,000 in 1989. From this point onwards, the annual number of abortions on residents has remained relatively stable.

A natural question is whether the 1967 Act actually led to a significant increase in the total number of abortions. For obvious reasons, illegal abortions are not reported in official statistics. However, based on maternal deaths and morbidity statistics, Goodhart (1969; 1972) concludes that between 10,000 and 20,000 illegal abortions were taking place in the U.K. each year, although a proportion of these would have been on overseas residents.[7] Further, Cavadino (1976) presents strong evidence that significant numbers of illegal abortions continued to take place even after legalization in 1968. Taken together the evidence suggests that the 1967 Abortion Act led to an increase in the order of

[7] Other authors suggest that as many as 250,000 illegal abortions took place in the U.K. each year. However, higher estimates such as this were usually proposed by organizations campaigning for abortion legalization (see, for example, the Birth Control Trust, 1988) and their basis is difficult to establish. As Greenwood and Young (1976) argue, "Experience shows that wherever legislation has become more permissive there has been an initial & sustained rise in the number of legal abortions. Easier access and acceptance of abortion enables many women who would not have risked the back street market to terminate their pregnancies," (p.31).

magnitude of abortions being carried out on residents in England Wales. Certainly, the likelihood of measurement error from illegal abortion needs to be borne in mind when interpreting our empirical estimates below. On the other hand, the most relevant feature of the 1967 Act for this paper is the dramatic increase in abortions provided free of charge on the National Health Service (NHS). Prior to the Abortion Act, in the region of 3,000 abortions were performed in NHS hospitals in the U.K. per year (Royal College of Obstetricians and Gynaecologists, 1966) whilst by 1972 this figure had risen to around 57,000. Hence, there was a major shift in the availability and monetary cost of abortions for women in socio-economics groups in which crime is most prevalent.

Identifying Abortion Access

There are several features which distinguish the practice of abortion law in the U.K. from other countries such as the U.S. and which assist us in identifying the impact of the level of access to abortion from the number of abortions that are carried out. Most importantly, abortions can be obtained either from the National Health Service (NHS) or from private operators. Although private abortions are provided on a commercial basis, in principal, NHS abortions are available free of charge to any woman irrespective of income or wealth. In order to obtain an NHS abortion, a woman has to be referred by her general practitioner to an appropriate surgeon at an NHS hospital.

In practice, the level of availability of NHS abortion services has differed widely across regions and over time and this has been a constant source of concern for campaigners in favor of abortion.[8] There are several reasons for this. As most NHS care

[8] The discussions of the 1974 Lane Committee of enquiry into the workings of the Abortion Act provides an extensive discussion of this. More recently, see the First Report of the Independent Advisory Group on

is provided free at the point of use, health authorities have to take strategic decisions about where they will allocate scarce resources. The priority that is given to abortion services has historically varied quite considerably both across authorities and over time. These variations have been enhanced by two factors, firstly the fact that medical personnel have a statutory right to opt out of involvement in abortion if they have a conscientious objection to the procedure and, secondly, differences in the strictness with which doctors operating on the NHS have applied the conditions for abortion in the 1967 Act. In some cases, this means that some women are refused an NHS abortion. In other cases, women are referred to an NHS provider outside their area of residence. More generally, an implication of the pressure on resources is that patients requesting an NHS abortion will have to wait longer than if they were to go to a private provider.

In general, a private provider will very rarely refuse to offer a woman an abortion under the terms of the 1967 Act. The geographical distribution of private providers, however, is not uniform, with high numbers of providers in certain densely populated areas such London and Birmingham and low numbers elsewhere.

This variation in abortion availability across regions and over time serves a very useful purpose of helping us to identify abortion access from the numbers of abortions carried out. In particular, our discussion suggests two identifying variables that will be suitable instruments for the availability of abortion in any area. The first is the number of NHS abortions that are obtained by women resident in each area as a proportion of the total number of abortions (*RATIONHS*). The second is the number of abortions that are performed in the health authority of residence as a proportion of the total number of

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Teenage Pregnancy (2001) in which it is argued that there continue to be extensive regional disparities in abortion provision.

abortions obtained by resident women (*RATIOHOME)*. Fixed effects regressions confirm the strong explanatory power that both of these variables have for the total rate of abortions.

Abortion Data

In contrast to many parts of the U.S., health authorities in the U.K. have a statutory requirement to report every legal abortion, whether carried out on the NHS or by privately. As a consequence, a complete set of data is available from the Department of Health on the number of abortions performed in each region, broken down by the age, marital status, place of residence of the mother and type of provider – NHS or private.

We follow Donohue and Levitt in constructing measures of effective abortion rates, weighted by the age profile of the criminal population. Abortions can be expected to have an impact on crime rates only when the children who have been aborted would have been old enough to commit crimes. Hence, we firstly calculate the annual abortion rate as a proportion of live births in each police force area. By using lagged values, this provides us with the abortion rate ($AR_{i,j,t}$) in area *i* for any age, *j*, in the current year, *t*:

$$AR_{i,j,t} = AR_{i,t-j} \qquad (1)$$

The potential impact of a high abortion rate for any particular cohort will depend on how prevalent crime is amongst that cohort. For this reason, we calculate the effective abortion rate ($EAR_{j,t}$) as the weighted sum of the abortion rate of each age group:

$$EAR_{i,t} = \sum_j AR_{i,j,t}.W_j \qquad (2)$$

where W_j is the percentage of crime that is committed by cohort *j* in area *i*. The weights are derived from data published by the Home Office on numbers cautioned or found guilty for different crime categories for each area in each year. The weights we use vary for different crime categories and for each police fore area but are constant across years.[9] If abortion really does have an impact on crime, then the age distribution of crime may be endogenous to abortion. This would suggest that we construct the weights using data from a period before abortion could have had an impact and this is the procedure followed by Donohue and Levitt. However, the age distribution of crime may also vary over time for other reasons. In this case, relying on pre-abortion weights may bias the results. We experiment with three different sets of crime weights. The first set is based on data from 1979 to 1980, before abortion could possibly have an impact. The second is based on data from 1998 to 2001, the years immediately after our sample. The third is the weighted mean of the first two. In practice we find that our results are not at all sensitive to the choice of weights and all the results reported here are based on the third set. Figure 1 plots the abortion ratio (abortions to 1000 live births) from 1976 to 1990, and the effective abortion rate from 1976 to 1997.

IV. The Model of Crime

In order to investigate the possible linkage between crime and abortion we consider the following model (which bears close resemblance to D & L):

$$\text{Ln}(Crime_{it}) = \beta_o + \beta_1 EAR_{it} + X_{it}\Gamma + \gamma_i + v_t + \varepsilon_{it} \qquad (3)$$

where $Crime_{it}$ is the crime rate (total and by sub-category) for police force area i in year t. The measure EAR_{it} is the effective abortion rate as described above. The vector X_{it} contains a number of covariates designed to control for various factors that may affect

[9] Appendix A provides an example of how the effective abortion rate is calculated.

crime rates (discussed in detail below). The variables γ_i and v_t are included to control for police force area and year fixed effects, respectively.

Covariates

The variables included in vector X_{it} are motivated by work on the economic analysis of crime pioneered by Becker (1968) and Ehrlich (1973) (see Freeman (1999) for a survey). This analysis views crime as either a risky gamble or a time allocation problem analogous to the work-leisure decision in theory of labor supply. The latter direction has become popular in theoretical and empirical work and this is the approach we follow here.[10] Essentially, an individual faces a choice between legal market work and crime. Crime is chosen when the difference between expected return from crime and the expected return from market work exceeds an exogenous threshold. As the difference in expected returns increases then more individuals choose crime over market work and the aggregate supply of crime is then decreasing in labor market opportunities. However, the aggregate demand for crime is determined by the supply of resources that can be acquired through crime and transformed into monetary gains i.e. the supply of loot. As both income and wealth in a region increase, so the demand for crime increases. This theory has been viewed as primarily applicable to property crime, and empirical evidence is more plentiful for this type of crime, but some authors argue that the theory can be extended to embrace violent crime (Fajnzylber *et al*. 2002).

In our data set we have region-level statistics on two variables which capture labor market opportunities (log average weekly earnings and male unemployment rate)

[10] The time-allocation model of crime is summarized by Deadman and Pyle (2000).

and a proxy for regional wealth given by the number of cars per capita.[11] The net effect of regional income on crime is ambiguous since increased earnings will raise the demand for crime (more income translates into more consumption goods to steal) and will reduce the supply of crime as expected returns from market work rise relative to expected returns to crime. Using U.S county-level data Gould *et al.* (2002) find strong evidence that higher wages are associated with lower crime rates.[12] Similarly, an increase in unemployment rate is predicted to increase the supply of crime (expected returns from legal market work decline) and lower the demand for crime (rising unemployment is associated with reduced consumption) giving an ambiguous net effect. Empirical evidence from regional panel data tends to support a positive influence of unemployment on property crime. Examples are Levitt (1996), Raphael and Winter-Ebmer, (2001) and Gould *et al.* (2002) for the U.S, Witt *et al*., (1999) and Carmichael and Ward (2001) for the U.K and Edmark (2005) for Sweden. An exception which finds a negative correlation between unemployment and crime for some theft categories is Entorf and Spengler (2000) for former West German states. The use of both average earnings and unemployment rate as covariates should in principle allow us to obtain an estimated effect of unemployment on crime through the supply of crime rather than the indirect negative effect via demand for crime (Edmark, 2005). Hence, we predict that male unemployment has a positive influence on crime rates.[13]

[11] See Appendix B for detailed variable descriptions and sources.

[12] For England and Wales, Machin and Meghir (2004) find that hourly wages at the first quartile are negatively associated with crime rates for each of burglary, theft and vehicle crime categories.

[13] The use of male unemployment rates is partly due to greater consistency of definition and coverage over time for men and the fact that the overwhelming majority of crimes are committed by (young) men; crime rates are then likely to respond more to male unemployment rates than total unemployment rates. The unemployment rate is not logged in our estimations.

Increased wealth raises the demand for crime as more 'loot' is available. We lack a precise measure of regional wealth but we do have a useful proxy for wealth in the form of number of registered motor vehicles by private individuals per capita. Car ownership appears in the Witt *et al.* (1999) study of regional crime rates in England and Wales. They find a significant positive effect of car ownership on property crime rates and interpreted this to reflect higher demand for crime as car ownership increased over the period 1983 to 1996. For vehicle crime, defined in England and Wales as 'theft of or from a motor vehicle' and an important part of our theft category, the proposition that increased car ownership is associated with greater crime rates has strong intuitive appeal.

The supply of crime is predicted to fall as the expected costs of punishment rise. The latter is a combination of expected probability of being caught and expected severity of punishment, through fines or jail sentence and the adverse impacts on labor market opportunities that go with a criminal conviction. We lack suitable sentencing and prison population data that would match our crime data. In England and Wales, offenders are often tried and incarcerated in courts and prisons in regions different to the police force areas where the crimes were committed. D & L used a measure of prison population in their empirical analysis. We have just one measure of cost of punishment, which is the number of police in a police force area. We expect that a greater number of police will be associated with an increased probability of catching criminals and hence an increased expected cost of committing crime. Therefore, increased police strength is predicted to lower crime rates. However, we must be wary of the concern of Levitt (1997) that police strength may respond positively to increased crime rates as citizens demand greater police protection and express this through voting behavior. Here, we endeavor to reduce this endogeneity bias by using the log of number of police per capita, lagged one period. For England and Wales, Witt *et al*. (1999) found, using a similar measure to ours, that increased police strength was associated with reduced property crime rates.

The final covariate that we use, not present in D & L, is a measure of social deprivation, the rate, per 1,000 people under 18 years, of children in local authority care. In England and Wales, children whose parents are deemed unfit to provide for care (e.g. because of violence or drug abuse) can be placed under the care of local authorities, either in care homes or with foster parents. The proportion of children in such care is a proxy for poor social conditions which might be conducive to increased crime since the stocks of human and social capital will be relatively low in areas with greater social deprivation.

To summarize, D & L had as their list of control covariates: prisoners and police per capita, state unemployment rate, state income per capita, percentage of population below poverty line, a measure of welfare generosity, beer consumption per capita and a dummy variable for presence of concealed handgun laws. Our list has some measures in common notably police per capita, regional unemployment rate and regional earnings.

Our children in care variable is intended to proxy social deprivation and we have a proxy for wealth as a control alongside a measure of income. It is worth noting that in D & L's estimates for property crime only prisoners, unemployment and gun law dummy delivered significant coefficients while for violent crime all control variables had insignificant coefficients. Thus, not all of their chosen control variables performed well as predictors of crime activity.[14, 15]

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[14] Prisoners and police variables had significant coefficients in an equation for murder. Income, beer consumption and welfare generosity delivered insignificant coefficients in all crime categories.

V. The Data Set, Estimation Approach and Empirical Findings

Data Description

The panel data employed covers the 42 police force areas over the years 1983 through 1997, a period for which data on all variables were available. We work with two data sets: recorded crime and cautions plus guilty data.[16] Table 1a shows a breakdown of recorded crime by type and period, Table 1b provides summary statistics for recorded crime rates, cautions plus guilty rates, and the covariates:

<<table 1a>>

<<table 1b>>

Figure 2 shows the time plot of total, violent and property crime for the period covered in this study. As in evident in Figure 2, total and property crime follow almost exactly the same pattern as that reported for the U.S. by D & L (see D & L, Figure II, p. 392). Both decreased slightly between 1986 and 1988, increased rapidly up to 1992 followed by a significant decline thereafter. Violent crime, on the other hand, increased more or less consistently over the whole period, a pattern which contrasts strongly with that reported for the U.S. Figure 3 reports a similar time series plot for total number of cautions plus the total number of people found guilty in the courts in the following year. The introduction of a one year lead on the guilty data is intended to capture the lags in the judicial process as cases are brought to the courts. The cautions plus guilty figures do not

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[15] Two covariates were experimented with but dropped due to lack of significant coefficients. These were ratio of 75th to 25th percentile weekly earnings (highly correlated with average earnings) and proportion of school-leavers with no formal qualifications to proxy low levels of human capital.

[16] Some data on victim reports of crime are available from the British Crime Victim Survey but these are not available either as a panel or on a consistent annual basis. Although there are concerns about the rigor and accuracy with which reported crime offences are compiled (Macdonald, 2002) we have no other source of data appropriate to panel data modeling and close enough to the approach taken by D & L. We assume therefore that any errors in crime reporting do not produce biases in our estimated coefficients and standard errors. Any deviations in crime reporting across police forces will then be picked up in area fixed effects.

show the same pattern as for recorded crimes. A downward trend in total cautions and guilty is not apparent for the 1990s, when recorded crime fell, and the series diverge sharply as between under 21s (downward trend) and over 21s (upward trend). A tendency by both police and judiciary to steer offending under 21s away from official cautions and not to take them to court is one reason for the divergence. In contrast police and judiciary may have taken a more severe approach when apprehending over 21s, especially repeat offenders.

<<figure 2>>

<<figure 3>>

The significant decreases in murder, violent and property crime in the U.S. starting from 1991 – eighteen years after the end of the 1973 Supreme Court ruling abolishing restrictions on abortion – are a key part of the D & L case that abortion legalization reduced crime. As abortion in the U.K. was legalized five years earlier than in the US, if legalization has the causal effect of reducing crime, we would expect the downward trend in crime to occur five years earlier in the U.K. than in the U.S. The fact that, at least for total and property crime, we observe almost exactly the same timing in crime trends in the U.K. is somewhat problematic for an abortion-crime link.

There are (at least) three alternative explanations for the observed patterns in crime trends across the two countries: 1. Abortion legalization reduced crime in the U.S. but not the U.K. 2. Abortion did reduce crime in the U.K., but other factors have swamped the time series relationship. 3. Abortion did not reduce crime either in the U.K. or the U.S. and any negative correlation between abortion and crime is spurious. In the empirical part of this paper, we test the first hypothesis by attempting to correlate changes in abortion rates within regions of the U.K. with changes in subsequent crime rates. A significant negative correlation between abortion and crime rates (as found by D & L for the U.S.) would be evidence against a differential effect between the two countries. We also attempt to test for a spurious relationship between abortion and crime by modelling abortion rates as endogenous and using suitable instruments to identify their effect on crime.

Estimation Approach

We begin our estimation of equation (3) by adopting the same method employed in D & L, namely we estimate a fixed-effects model with year dummies. The data are weighted by area population and we assume an AR(1) error structure – we refer to these as simply the 'fixed-effects' results.

One concern is that the disturbances in equation (3) are possibly correlated across time *and* space. For example, crime in one police force area may be committed by residents of a neighboring area. Consequently, our next approach is to estimate regressions controlling for such spatial correlation using the panel-corrected standard errors method as described by Beck and Katz (1995). Once again we allow for area fixed-effects, year dummies and an AR(1) error structure. We refer to these as the 'PCSE' regression results.

Our third estimation method is to consider the possibility that our variable of primary interest—effective abortion rates (or EAR_{it} in equation (3))—may be endogenous to crime. In order to do this, we need to use variables that reflect changes in the supply of rather than demand for abortion. As discussed above, suitable data exist for the U.K.

on free provision of abortion on the NHS and provision in the patient's area of residence. Thus, our third approach is to estimate equation (3) using an instrumental variables (two-stage least-squares) method with Newey-West standard errors and using *RATIONHS* and *RATIOHOME* as our instruments. Once more, we model the error structure as an AR(1) and including area fixed-effects and year effects. We refer to these as IV regressions.

In each case, regressions are performed for total recorded crime rates and separately for seven subcategories (violence, sex, burglary, robbery, theft, fraud and damage).[17]

Empirical Results

Tables 2 through 4 contain the estimation results for these three models using data on recorded crime (by total and sub-categories). The fixed effects model, which is closest to that reported by D & L is reported in Table 2. Effective abortion rates are associated with significantly lower recorded rates of total crime and of burglaries, robberies and theft. Abortion is positively and significantly associated with rates of violent and sex crimes. No significant association (using a 5% significance level) is found for rates of fraud and damage. In these models, unemployment and children-in-care are associated with significantly higher crime both in total and for least some sub-categories.

The sign and significance of results for the PCSE models (reported in Table 3) is fairly similar to that for fixed effects. In general, the abortion coefficients are smaller in

[17] We also estimated a dynamic version of equation (3) with a lagged-dependent variable using the method set out in Arellano and Bond (1991). The results, however, produced few significant regressors other than the lagged dependent variable.

magnitude than for the fixed effects model, whilst the positive effect of abortion on violent crime rates is no longer statistically significant.

The IV results (reported in Table 4) differ considerably from the fixed effects and PCSE results, particularly in relation to abortion. The Wu-Hausman test statistic is strongly significant for total crime and for all sub-categories except sex crimes, robbery and damage. Thus, there is evidence against abortion rates being exogenous to crime. For total crime and for most sub-categories, the coefficient on abortion is now statistically insignificant. The exceptions are violent crime for which the coefficient is significantly negative and fraud for which the coefficient is significantly positive. The final point to note with the IV results is that the log of police per capita is now estimated to have a negative and significant impact on recorded crime.

Robustness Checks

The results in Tables 5 through 7 are robustness checks using the same three models on total recorded crime but on different sub-sections of the population. The first check (reported in Table 5) is to exclude London. The rationale for this is that London is characterized by an extremely mobile population and experiences very high rates of migration to and from other areas of the U.K. as well as from other countries. As a result, any correlation between abortion and subsequent crime is likely to be very diluted and difficult to pick up. The next checks (reported in Tables 6 and 7) are to estimate the models using abortions to single women and to teenagers. To the extent that crime is relatively more prevalent amongst offspring of these groups, one would expect any correlation between abortion and crime to be strongest in these regressions. Examining abortions to teenagers is particularly important in the light of Sen's (2002) finding that the main route by which abortion legalization reduced crime in Canada was through reductions in teenage fertility. For reasons of space, the discussion of these results is restricted to the abortion coefficients.

These robustness checks lead to mixed results. For single women, the abortion coefficients in the fixed effects and PCSE models continue to be negative and strongly significant. However, when London is excluded the coefficient on effective abortion rates is no longer statistically significant for either fixed effects or PCSE. For teenage abortions, the coefficient is significant in the fixed effects model but not in the PCSE model. In all three cases, the Wu-Hausman test strongly rejects the null hypothesis of exogeneity and the coefficients on abortion for the IV models are never statistically significant.

Wooldridge (2002) notes that the first difference estimator will be more efficient than the fixed effects estimator in the context of serial correlation. Consequently, Table 8 reports estimates of the three models using first differences.[18] We report the results both for total crime and for violent crime. The coefficients on abortion are of similar order of magnitude and sign to those using the fixed effects estimator, but are never statistically significant.

The final experiment (reported in Table 9) uses the cautions plus guilty data set as an alternative measure of crime. The data are pooled over age groups 10 to 13, 14 to 16, 17 to 20 and 21 years & over, with effective abortion measures being computed by age-group specific weights. In addition, the other covariates are interacted with age group dummy variables to allow for variation in effects by age. This specification enables differences in effective abortion rates between age groups to help identify any abortion-crime effect. Once again, results are reported for the three models: fixed effects, PCSE and IV. For the first two models, the abortion coefficient is negative but insignificant at all conventional levels. For the IV model, the coefficient is negative and significant at the 10% level. However, as with the first difference models, the Wu-Hausman test does not reject the null hypothesis of exogeneity at the 5% level of significance.

VI. Discussion and Conclusions

The claims in Donohue and Levitt (2001) that the legalization of abortion in the U.S. in the 1970s led to a subsequent reduction in crime in the 1990s caused a significant stir among economists, criminologists and others. The goal of this paper was to put the D & L hypothesis to test in a different environment, namely the U.K.

Of the many results presented in this paper, there are two things we can say with confidence. First, increased unemployment rates are associated with increased crime. Second, the greater the proportion of children in care (our proxy for 'social deprivation'), the greater the crime rate. These results are remarkably consistent and robust to various estimation methods.

We are unable to say with confidence, however, that abortion legalization in the U.K. significantly reduced crime in England and Wales some twenty years hence. We come to this conclusion by first noting, as we did earlier, that total recorded crime in the U.K. began to decrease at about the same time as in the U.S., despite the fact that

[18] In addition, results from a Levin, Lin and Chu (2002) panel unit root test indicated possible non-stationarity for the recorded violence and sex crime variables. Thus, first-difference estimation may

abortion legalization occurred about five years earlier. Thus we have a discrepancy in the timing of the potential effect of abortion on crime between the U.S. and the U.K.

Furthermore, regression models linking effective abortion rates in the U.K. and subsequent recorded crime suggests the same negative and significant correlation between the two variables (at least for total crime and some sub-categories) as that reported for the U.S. by D & L. The fact that we are able to replicate the D & L result in the U.K. is suggestive that the first hypothesis we noted earlier, that abortion legalization reduced crime in the U.S. but not in the U.K., is not a satisfactory explanation of the different patterns of crime in the two countries.

Recalling our third hypothesis, that abortion did not reduce crime in either the U.K. or the U.S. and the negative correlation is a spurious one, we test this hypothesis by modeling abortion rates as endogenous to crime. In this approach, we identify abortion rates using on the proportion of abortions provided in the patient's area of residence and the proportion provided free of charge. When abortion is treated as being endogenous, the negative correlation between abortion rates and crime disappears. Although these results are consistent with the correlation between abortion and crime being spurious, the validity of the IV results depends on the validity and strength of the instruments. Although we have confidence in the strength of the instrumental variables used here, it is possible that the instruments themselves are endogenous. Future research might usefully explore this issue further by attempting to identify explicitly unobservable variables that may explain both variation in abortion rates and variation in subsequent crime.

In any case, puzzles remain that need explanation. In particular, to be able to discount the abortion-crime link satisfactorily, researchers would need to identify more

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alleviate this problem.

fully the social phenomenon that led to reductions in at least some crime categories in the early 1990s both in the U.K. and the U.S. In general, however, we believe that an examination of alternative regulatory environments is a fruitful direction for researchers who want to improve our understanding of the link between abortion and crime.

Lastly, it must be noted that few of our results are robust to different specifications and samples. For example, although we continue to find a significant negative correlation between abortion and crime rates in the exogenous models when we control for cross-sectional correlation and when we use abortions to single women, the correlation does not hold for some sub-categories (e.g. violent and sex crimes) and is not robust to other specifications (excluding London, teenage abortions, difference-in-difference estimation and using cautions-plus-guilty as an alternative measure of crime). Similarly, although the finding of no significant correlation between abortion and crime in the endogenous models is somewhat more robust to our various experiments, we do find evidence of a negative correlation between abortion and violent crime and, when using the cautions plus guilty data, we find weak evidence of a negative correlation between abortion and total crime.

The fragility of the results in this paper serve to emphasize the difficulty researchers have in identifying causal effects of social change such as abortion legalization on crime rates some years hence, particularly given the myriad of other social changes occurring over the same time and which may dilute any effect.

Figure 1: Abortion Ratio and Effective Abortion Rates Across Time

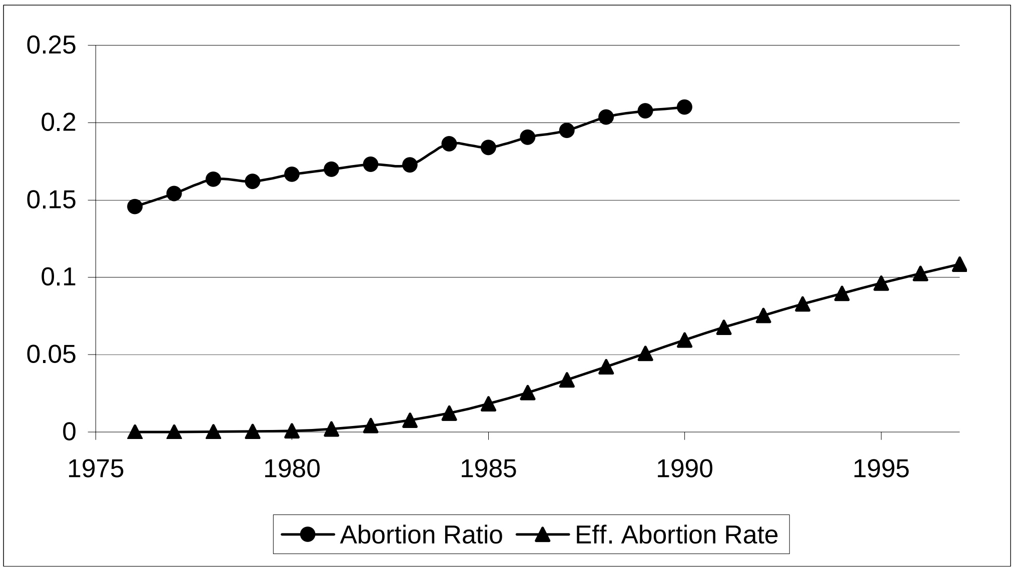
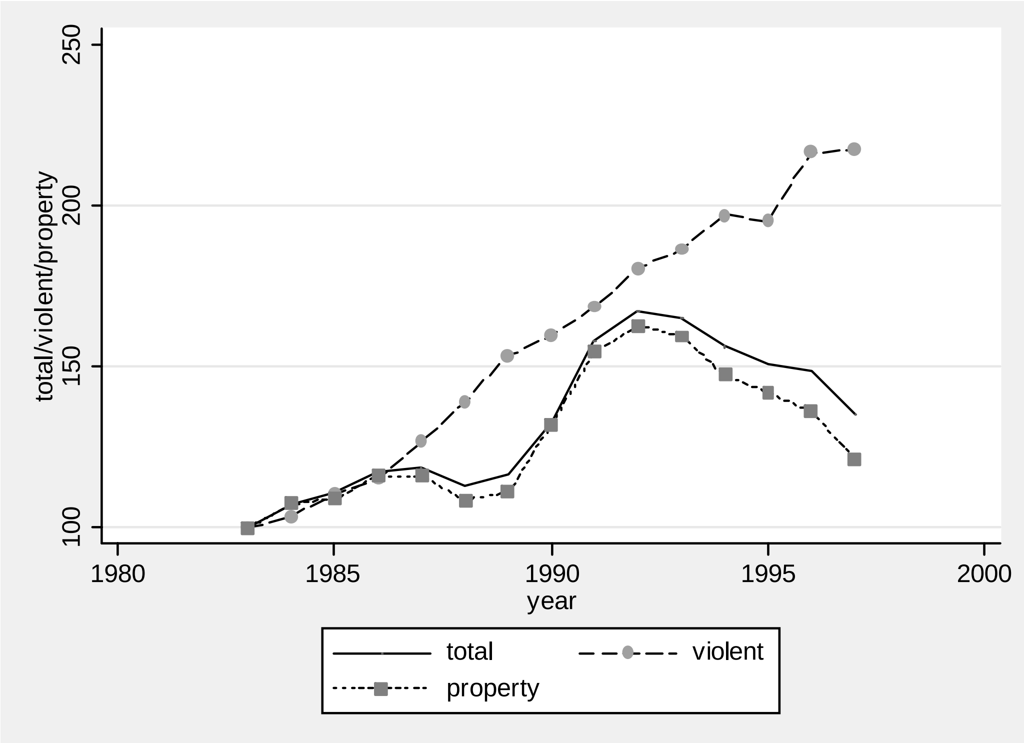


Figure 2: Recorded Total, Violent and Property Crime Rates in England and Wales – 1983 to 1997



Note: Violent is the sum of violent crime and robbery. Property is the sum of burglary and theft.

Figure 3: Total cautions and guilty in England and Wales

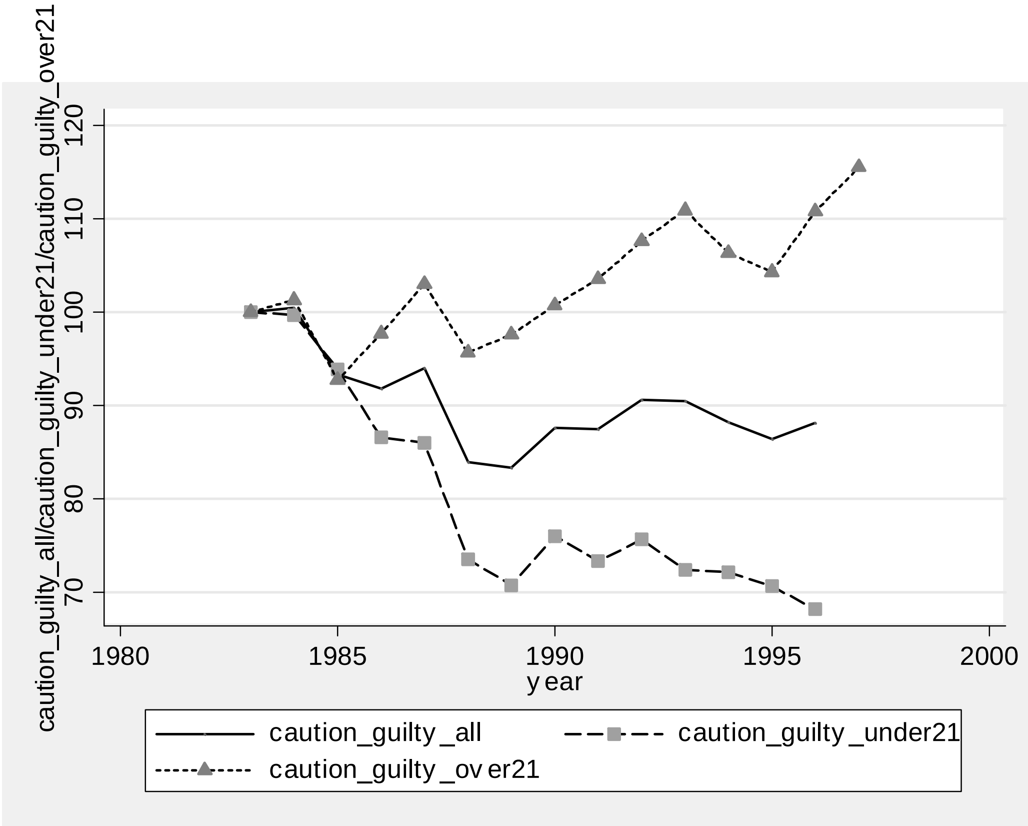


Table 1a: **Recorded Crime trends for England and Wales 1983-97 by Category and Percentage Changes over Sub-Periods**

	1983-85	1986-89	1990-93	1994-97	1983-97
Violent	9.5	41.0	11.1	14.2	125.6
Sex	5.1	28.9	1.3	3.7	62.5
Burglary	7.4	-11.8	36.0	-19.5	25.1
Robbery	24.2	10.2	59.8	5.1	185.4
Theft	10.4	4.5	15.9	-15.5	26.9
Fraud	10.7	0.8	10.1	-8.0	10.4
Damage	21.6	10.0	50.3	-5.7	97.8

Table 1b: **Descriptive Statistics**

	Mean	**Standard Deviation**	**Minimum**	**Maximum**
Recorded offence rates				
Total	78.58	28.81	28.49	160.87
Violent	3.33	1.37	1.18	10.00
Sex	0.51	0.16	0.22	1.30
Burglary	18.66	8.99	5.02	54.69
Robbery	0.47	0.61	0.03	4.72
Theft	4.04	13.64	14.92	86.36
Fraud	2.44	1.01	0.88	6.63
Damages	12.74	5.86	2.15	36.75
Cautions plus guilty rates				
Age 14-17	1.92	0.67	0.44	5.50
Age 17-21	2.28	0.66	0.85	4.14
Age 21 and over	5.10	1.24	2.27	9.43
Covariates				
Real average wage (£ 1987)	220.5	27.18	167.0	343.7
Male unemployment (%)	9.00	3.77	1.46	22.50
Cars	360.78	62.75	206	599
Police	2.16	0.45	1.56	4.64
Children in care	5.21	1.53	1.50	12.70

All reported values refer to annual observations at police force area level for 1983-97 with the exception of cautions plus guilty. The numbers found guilty are given a lead of one year to reflect delays in judicial processes in bringing cases to court. All variables are weighted by 1000 population in police force areas except for real average wage, male unemployment rate, children in care and no qualifications. All values refer to 630 observations over the period 1983-97.

Table 2: Fixed-Effects Regressions: Recorded Crime, England and Wales, 1983-1997 for 42 Police Force Areas

	Crime Category							
Variable	***Total***	***Violent***	***Sex***	***Burglary***	***Robbery***	***Theft***	***Fraud***	***Damage***
Effective abortion rate	-2.544***	2.038*	3.079***	-3.266***	-5.367***	-2.555***	2.777*	-0.289
	[0.677]	[1.124]	[0.962]	[1.145]	[1.081]	[0.673]	[1.583]	[1.052]
ln(average real wage)	-0.02	-0.105	0.171	0.18	0.759*	0.015	0.12	-2.338***
	[0.140]	[0.223]	[0.376]	[0.211]	[0.412]	[0.140]	[0.370]	[0.534]
Unemployment rate	0.019***	-0.001	0.017**	0.017**	-0.012	0.013***	-0.002	0.043***
	[0.004]	[0.007]	[0.008]	[0.007]	[0.010]	[0.004]	[0.011]	[0.010]
ln(cars per 1000 people)	-0.132	0.085	-0.055	-0.053	0.309	-0.231***	-0.117	0.329
	[0.086]	[0.137]	[0.222]	[0.131]	[0.237]	[0.086]	[0.227]	[0.320]
ln(police per capita (t-1))	-0.105	-0.429*	-1.131***	-0.028	-0.780**	0.036	-0.119	-0.829*
	[0.140]	[0.223]	[0.346]	[0.212]	[0.384]	[0.140]	[0.368]	[0.464]
Children in Care (4 yr. mov. avg.)	0.028***	0.006	-0.004	0.009	-0.031	0.041***	0.016	0.045**
	[0.010]	[0.017]	[0.018]	[0.016]	[0.024]	[0.010]	[0.027]	[0.022]
Constant	-2.0793***	-8.2649***	-15.2912***	-4.5599***	-17.0382***	-1.5295***	-6.7337***	1.4171
	[0.2955]	[0.4611]	[2.0589]	[0.3737]	[1.7219]	[0.2892]	[0.8223]	[4.8518]
Observations	588	588	588	588	588	588	588	588
Number of areas	42	42	42	42	42	42	42	42
Test for first-order autocorr (pvalue)	135.2 (0.000)	171.5 (0.000)	9.5 (0.004)	119.6 (0.000)	44.4 (0.000)	95.5 (0.000)	100.7 (0.000)	2.2 (0.142)
Within group R-squared	0.687	0.406	0.341	0.656	0.707	0.712	0.221	0.575
Between group R-Squared	0.186	0.571	0.417	0.273	0.769	0.449	0.422	0.027
Overall R-Squared	0.073	0.033	0.035	0.17	0.189	0.166	0.198	0.029

Standard errors in brackets. Dependent variables are measured as the natural logs of the per capita rate. All regressions include year dummies and are estimated using population weights for 1990. * significant at 10%; ** significant at 5%; *** significant at 1%. First-order autocorrelation test is based on Wooldridge (2002, pp.282-283) with the null hypothesis of no first-order autocorrelation.

Table 3: Panel-Corrected Standard Errors Regressions: Recorded Crime, England and Wales, 1983-1997 for 42 Police Force Areas

	Crime Category							
Variable	***Total***	***Violent***	***Sex***	***Burglary***	***Robbery***	***Theft***	***Fraud***	***Damage***
Effective abortion rate	-1.969***	1.093	2.708***	-3.752***	-1.795**	-1.649***	0.11	-0.458
	[0.713]	[0.909]	[0.941]	[0.874]	[0.876]	[0.638]	[1.322]	[4.162]
ln(average real wage)	-0.106	0.08	-0.016	-0.046	0.514	-0.13	0.457	-0.682**
	[0.135]	[0.193]	[0.328]	[0.214]	[0.391]	[0.149]	[0.401]	[0.309]
Unemployment rate	0.015***	0.008	0.017**	0.030***	-0.009	0.011**	0.018*	0.015*
	[0.004]	[0.006]	[0.008]	[0.007]	[0.010]	[0.005]	[0.010]	[0.008]
ln(cars per 1000 people)	-0.073	-0.072	-0.06	-0.093	0.22	-0.105	-0.038	0.06
	[0.076]	[0.146]	[0.201]	[0.152]	[0.217]	[0.070]	[0.249]	[0.160]
ln(police per capita (t-1))	-0.174	-0.717***	-0.930***	-0.177	-0.781**	-0.148	-0.139	-0.206
	[0.123]	[0.207]	[0.284]	[0.209]	[0.321]	[0.136]	[0.317]	[0.356]
Children in Care (4 yr. mov. avg.)	0.025***	0.030***	-0.001	0.021	-0.045**	0.032***	0.008	0.021
	[0.008]	[0.011]	[0.015]	[0.015]	[0.018]	[0.009]	[0.017]	[0.014]
Constant	-3.2023***	-10.7885***	-13.3174***	-5.0422**	-16.4286***	-3.2979**	-9.1395***	-3.2899
	[1.2117]	[2.0150]	[2.6606]	[2.0640]	[3.3677]	[1.3341]	[3.1981]	[2.5377]
Observations	630	630	630	630	630	630	630	630
Number of areas	42	42	42	42	42	42	42	42
R-Squared	0.982	0.988	0.954	0.977	0.976	0.984	0.962	0.951

Panel-corrected standard errors in brackets. Dependent variables are measured as the natural logs of the per capita rate. All regressions include year and area dummies and are estimated assuming a within-panel AR(1) error structure. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4: Instrumental Variables (Two-Stage Least-Squares) Regressions: Recorded Crime, England and Wales, 1983-1997 for 42 Police Force Areas

	Crime Category							
Variable	***Total***	***Violent***	***Sex***	***Burglary***	***Robbery***	***Theft***	***Fraud***	***Damage***
Effective abortion rate	2.164	-7.619**	1.399	4.955	0.957	3.31	35.377**	-1.115
	[1.941]	[3.135]	[5.092]	[3.409]	[3.094]	[2.557]	[15.661]	[2.189]
ln(average real wage)	-0.509*	0.652	0.182	-0.701	0.361	-0.46	-1.655	-1.169***
	[0.265]	[0.433]	[0.479]	[0.438]	[0.561]	[0.293]	[1.349]	[0.331]
Unemployment rate	0.016***	0.021***	0.016*	0.032***	-0.006	0.010*	-0.008	0.015*
	[0.006]	[0.008]	[0.010]	[0.010]	[0.010]	[0.005]	[0.025]	[0.008]
ln(cars per 1000 people)	0.095	-0.833***	-0.219	0.199	0.533*	0.153	1.905**	0.043
	[0.171]	[0.286]	[0.262]	[0.271]	[0.293]	[0.181]	[0.838]	[0.194]
ln(police per capita (t-1))	-0.722***	-0.729**	-0.928**	-1.194***	-1.612***	-0.705***	-0.866	-0.292
	[0.208]	[0.371]	[0.371]	[0.343]	[0.454]	[0.221]	[0.814]	[0.338]
Children in Care (4 yr. mov. avg.)	0.042***	0.011	-0.002	0.060***	-0.036	0.050***	0.087*	0.02
	[0.013]	[0.020]	[0.016]	[0.021]	[0.026]	[0.015]	[0.050]	[0.015]
Constant	-5.5602***	-9.4295***	-13.3992***	-9.8431***	-22.6220***	-6.5941***	-14.0095**	-1.14
	[2.0348]	[3.1862]	[3.2458]	[3.3469]	[4.2185]	[2.0190]	[7.0334]	[2.6483]
Observations	630	630	630	630	630	630	630	630
Number of areas	42	42	42	42	42	42	42	42
Wu-Hausman exog, test (pvalue)	9.14 (0.003)	15.22 (0.000)	0.046 (0.830)	11.33 (0.000)	1.09 (0.297)	8.69 (0.003)	14.89 (0.000)	0.395 (0.530)

Newey-West standard errors in brackets. Dependent variables are measured as the natural logs of the per capita rate. All regressions include year and area dummies and are estimated assuming an AR(1) error structure. * significant at 10%; ** significant at 5%; *** significant at 1%.
Instruments for Effective abortion rate include the proportion of abortions carried out a carried out in region of domicile and the proportion of abortions that are carried are carried out on the National Health Service

Table 5: Regressions for Total Recorded Crimes, excluding London: England and Wales, 1983-1997 for 41 Police Force Areas

	Models		
Variable	Fixed-Effects	PCSE	IV
Effective abortion rate	0.604	-1.217	2.589
	[1.641]	[0.918]	[2.503]
ln(average real wage)	0.011	-0.103	-0.256
	[0.126]	[0.136]	[0.216]
Unemployment rate	0.022***	0.016***	0.018***
	[0.004]	[0.004]	[0.005]
ln(cars per 1000 people)	-0.073	-0.07	-0.071
	[0.076]	[0.075]	[0.144]
ln(police per capita (t-1))	-0.09	-0.18	-0.705***
	[0.131]	[0.123]	[0.205]
Children in Care (4 yr. mov. avg.)	0.028***	0.024***	0.029**
	[0.010]	[0.009]	[0.012]
Constant	-2.9702***	-3.2759***	-5.7686***
	[0.2185]	[1.2124]	[2.0074]
Observations	574	615	615
Number of areas	41	41	41
Test for first-order autocorr (pvalue)	202.9 (0.000)	--	--
Wu-Hausman exog, test (pvalue)	--	--	5.10 (0.024)
Within group R-squared	0.734	--	--
Between group R-Squared	0.674	--	--
Overall R-Squared	0.552	0.982	--

Standard errors (appropriate for each model) are reported in brackets.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6: Regressions for Recorded Total Crimes using Effective Abortion computed for Single Women: England and Wales, 1983-1997 for 42 Police Force Areas

	Models		
Variable	Fixed-Effects	PCSE	IV
Effective abortion rate	-4.533***	-3.609***	3.928
	[1.050]	[1.244]	[3.511]
ln(average real wage)	-0.009	-0.093	-0.556*
	[0.140]	[0.136]	[0.293]
Unemployment rate	0.019***	0.015***	0.016***
	[0.004]	[0.004]	[0.006]
ln(cars per 1000 people)	-0.142*	-0.078	0.105
	[0.085]	[0.076]	[0.177]
ln(police per capita (t-1))	-0.123	-0.176	-0.720***
	[0.139]	[0.124]	[0.210]
Children in Care (4 yr. mov. avg.)	0.026**	0.023***	0.045***
	[0.010]	[0.008]	[0.014]
Constant	-2.2160***	-3.2372***	-5.3830***
	[0.3028]	[1.2170]	[2.0509]
Observations	588	630	630
Number of areas	42	42	42
Test for first-order autocorr (pvalue)	133.7 (0.000)	--	--
Wu-Hausman exog, test (pvalue)	--	--	9.22 (0.002)
Within group R-squared	0.69	--	--
Between group R-Squared	0.095	--	--
Overall R-Squared	0.056	0.982	--

Standard errors (appropriate for each model) are reported in brackets.
 * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7: Regressions for Recorded Total Crimes using Effective Abortion computed for Teenagers: England and Wales, 1983-1997 for 42 Police Force Areas

	Models		
Variable	Fixed-Effects	PCSE	IV
Effective abortion rate	-11.383**	-3.017	7.68
	[4.499]	[3.289]	[6.692]
ln(average real wage)	-0.056	-0.155	-0.419**
	[0.140]	[0.134]	[0.213]
Unemployment rate	0.018***	0.014***	0.017***
	[0.004]	[0.004]	[0.005]
ln(cars per 1000 people)	-0.093	-0.049	0.028
	[0.085]	[0.076]	[0.141]
ln(police per capita (t-1))	-0.045	-0.19	-0.705***
	[0.139]	[0.126]	[0.199]
Children in Care (4 yr. mov. avg.)	0.029***	0.028***	0.040***
	[0.011]	[0.008]	[0.012]
Constant	-1.6839***	-3.2003***	-5.5319***
	[0.2773]	[1.2144]	[1.9752]
Observations	588	630	630
Number of areas	42	42	42
Test for first-order autocorr (pvalue)	145.8 (0.000)	--	--
Wu-Hausman exog, test (pvalue)	--	--	3.94 (0.047)
Within group R-squared	0.68	--	--
Between group R-Squared	0.433	--	--
Overall R-Squared	0.097	0.982	--

Standard errors (appropriate for each model) are reported in brackets.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 8: First-Difference Regressions for Total Recorded Crimes, England and Wales, 1983-1997 for 42 Police Force Areas

	Models (Total Crime)			***Models (Violent Crime)***		
Variable	Fixed-Effects	PCSE	IV	Fixed-Effects	PCSE	IV
D. Effective abortion rate	-1.502	-1.387	-7.26	1.287	1.246	-6.999
	[1.801]	[1.704]	[8.427]	[2.074]	[2.118]	[8.155]
D. ln(average real wage)	-0.101	-0.105	-0.051	0.1	0.106	0.184
	[0.127]	[0.121]	[0.152]	[0.202]	[0.177]	[0.230]
D. Unemployment rate	0.014***	0.014***	0.016***	-0.002	-0.002	0.001
	[0.004]	[0.005]	[0.005]	[0.007]	[0.007]	[0.008]
D. ln(cars per 1000 people)	-0.024	-0.006	-0.046	0.144	0.156	0.11
	[0.090]	[0.076]	[0.105]	[0.138]	[0.121]	[0.141]
D. ln(police per capita (t-1))	-0.082	-0.082	-0.069	-0.568***	-0.579***	-0.555**
	[0.133]	[0.130]	[0.132]	[0.214]	[0.218]	[0.223]
D. Children in Care (4 yr. mov. avg.)	0.020**	0.022**	0.015	0.009	0.01	0.001
	[0.009]	[0.011]	[0.012]	[0.018]	[0.017]	[0.020]
Constant	0.0094	0.1350***	0.0619	0.0767***	0.0768***	0.1551*
	[0.0212]	[0.0193]	[0.0787]	[0.0278]	[0.0259]	[0.0802]
Observations	588	588	588	588	588	588
Number of areas	42	42	42	42	42	42
Wu-Hausman exog, test (pvalue)	--	--	0.501 (0.479)	--	--	0.579 (0.447)
R-Squared	0.705	0.682	--	0.203	0.203	--

Standard errors (appropriate for each model) are reported in brackets.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 9: Total Cautions + Guilty: England and Wales, 1983-1997 for 42 Police Force Areas[a]

	Models		
Variable	Fixed-Effects	PCSE	IV
Effective abortion rate	-0.09	-0.679	-2.230*
	[0.233]	[0.719]	[1.238]
ln(average real wage)	-1.076***	-1.433***	-1.793***
	[0.412]	[0.495]	[0.512]
(age group 14 to 16)	1.943***	2.084***	2.524***
	[0.630]	[0.374]	[0.593]
(age group 17 to 20)	1.735***	2.010***	3.123***
	[0.559]	[0.596]	[0.687]
(age group 21 and over)	1.186***	1.205**	0.028
	[0.410]	[0.578]	[0.886]
Unemployment rate	0.036***	0.024*	0.022**
	[0.007]	[0.012]	[0.010]
(age group 14 to 16)	0.005	0.003	0.006
	[0.010]	[0.010]	[0.009]
(age group 17 to 20)	-0.022**	-0.029*	-0.036***
	[0.009]	[0.016]	[0.008]
(age group 21 and over)	-0.034***	-0.038**	-0.025**
	[0.007]	[0.018]	[0.010]
ln(cars per 1000 people)	-0.006	-0.186	-0.312
	[0.302]	[0.290]	[0.379]
(age group 14 to 16)	0.69	0.670***	0.822**
	[0.519]	[0.253]	[0.408]
(age group 17 to 20)	0.466	0.332	0.351
	[0.446]	[0.344]	[0.399]
(age group 21 and over)	-0.163	-0.269	-0.106
	[0.312]	[0.365]	[0.473]
ln(police per capita (t-1))	0.62	0.449	1.030*
	[0.558]	[0.500]	[0.573]
(age group 14 to 16)	0.461	-0.189	-0.95
	[0.906]	[0.482]	[0.639]
(age group 17 to 20)	-0.454	-0.599	-0.955
	[0.792]	[0.627]	[0.674]
(age group 21 and over)	-0.917	-0.921	-2.334***
	[0.578]	[0.712]	[0.732]

Table 9: Total Cautions + Guilty: England and Wales, 1983-1997 for 42 Police Force Areas (cont.)

	Models		
Variable	Fixed-Effects	PCSE	IV
Children in Care (4 yr. mov. avg.)	0.012	0.021	0.025
	[0.029]	[0.025]	[0.023]
(age group 14 to 16)	-0.096**	-0.056***	-0.056*
	[0.045]	[0.020]	[0.029]
(age group 17 to 20)	-0.025	-0.001	0.021
	[0.040]	[0.030]	[0.030]
(age group 21 and over)	0.029	0.043	0.057*
	[0.030]	[0.033]	[0.034]
Constant	-14.170***	6.915	13.263***
	[2.129]	[4.316]	[5.069]
Observations	2224	2392	2056
Number of area-age groups	168	168	168
Test for first-order autocorr (pvalue)	12.44 (0.001)	--	--
Wu-Hausman exog, test (pvalue)	--	--	2.979 (0.085)
Within group R-squared	0.607	--	--
Between group R-Squared	0.012	--	--
Overall R-Squared	0.016	0.943	--

Standard errors (appropriate for each model) are reported in brackets.
The coefficients associated with (age group 14 to 16), age group 17 to 20) and (age group 21 and over) are the interaction effects by age group for each covariate.
* significant at 10%; ** significant at 5%; *** significant at 1%.
a: Excludes data for Northumbria, age group 10-13, for 1993 and 1997 as the reported values were not credible.

References

Arellano, Manuel. and Stephen Bond, (1991), "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations." *The Review of Economic Studies*, 58: 277-297.

Beck, Nathaniel and Jonathan N. Katz (1995) "What To Do (and Not To Do) With Time-Series – Cross-Section Data in Comparative Politics." *American Political Science Review*, 89: 634-647.

Becker, Gary (1968), "Crime and Punishment: An Economics Approach." *Journal of Political Economy*, 76: 175-209.

Bertrand, Marianne, Esther Duflo and Sendhil Mullainathan (2004), "How Much Should We Trust Difference-In-Difference Estimates?" *Quarterly Journal of Economics*, vol. 119, no. 1: 249-275.

Carmichael, Fiona and Robert Ward (2001), "Male Unemployment and Crime in England and Wales, *Economics Letters*," 73: 111-115.

Cavadino, Paul (1976), "Illegal Abortions and the Abortion Act 1967." *British Journal of Criminology*, 16 (1), 63-67.

Deadman, Derek. and David Pyle. (2000), "An Economic Model of Criminal Activity in Z. MacDonald and D. Pyle (eds.) *Illicit Activity: The Economics of Crime, Drugs and Tax Fraud*, 15-37, Aldershot: Ashgate Publishers.

Donohue, John J., III and Steven D. Levitt (2004), "Further Evidence That Legalized Abortion Lowered Crime: A Reply to Joyce." *Journal of Human Resources*, vol. 39, no. 1: 29-49.

___________________________________ (2001), "The Impact of Legalized Abortion on

Crime." *Quarterly Journal of Economics*, vol. 116, no. 2: 379-420.

Edmark, Karin. (2005), "Unemployment and Crime: Is There a Connection?" *Scandinavian Journal of Economics*, 107: 353-373.

Ehrlich, Isaac (1973), "Participation in Illegal Activities: A Theoretical and Empirical Investigation." *Journal of Political Economy*, 81: 551-565.

Entorf, Horst and Hans Spengler (2000), "Socioeconomic and Economic Factors of Crime in Germany: Evidence from Panel Data of the German States," *International Review of Law and Economics*, 20: 75-106.

Fajnzylber, Pablo, Daniel Lederman and Norman Loayza (2002), "What Causes Violent Crime?" *European Economic Review* 46: 1323-1357.

Freeman, Richard (1999), "The Economics of Crime," in O. Ashenfelter and D. Card (eds.) *Handbook of Labor Economics* Vol. 3, Amsterdam: North Holland.

Goodhart, Charles B (1969), "Estimation of Illegal Abortions." *Journal of Biosocial Science*, 1: 235-238

_________________ (1972), "On the Incidence of Illegal Abortion." *Population Studies*, 26: 207-233.

Gould, Eric, Bruce Weinberg and David Mustard (2002), "Crime Rates and Local Labor Market Opportunities in the United States: 1979-1997." *Review of Economics and Statistics*, Vol. 84, No. 1: 45-61.

Greenwood, V & J Young, (1976), *Abortion in Demand*, London: Plato Press.

Gruber, Jonathan Phillip Levine and Douglas Staiger, (1999), "Abortion Legalization and Child Living Circumstances: Who Is the 'Marginal Child'?" *Quarterly Journal of Economics*, vol. 114, no. 1: 263-91.

House of Commons Committee on the Working of the Abortion Act [Lane Committee] (1974), *The Report of the Committee on the Working of the Abortion Act*, London: HMSO.

Independent Advisory Group on Teenage Pregnancy (2001), *First Annual Report*, November, London: Department of Health.

Joyce, Theodore (2004a), "Did Legalized Abortion Lower Crime?" *Journal of Human Resources,* 39, no. 1: 1-38.

_______________(2004b), "Further Tests of Abortion and Crime", *National Bureau of Economic Research Working Paper* No. 10564.

Levin, Andrew, Chien-Fu Lin and Chia-Shang James Chu (2002), "Unit Root Tests in Panel Data: Asymptotic and Finite Sample Properties." *Journal of Econometrics*. 108: 1-24.

Levitt, Steven D. and Stephen J. Dubner, (2005) *Freakonomics: A Rogue Economist Explores the Hidden Side of Everything*, New York: William Morrow.

Levitt, Steven D. (1996), "The Effect of Prison Population Size on Crime Rates: Evidence from Prison Overcrowding Litigation," *Quarterly Journal of Economics*, 111: 319-352.

_______________ (1997), "Using Electoral Cycles in Police Hiring to Estimate the Effect of Police on Crime," *American Economic Review*, 87: 270-290.

_______________ (2004), "Understanding Why Crime Fell in the 1990s: Four Factors That Explain the Decline and Six That Do Not." *Journal of Economic Perspectives*, Winter, 18, no. 1: 163-90.

Machin, Stephen and Costas Meghir (2004), "Crime and Economic Incentives", *Journal* *of Human Resources*, vol. 39, no. 4: 958-979.

Macdonald, Ziggy (2002), "Official Crime Statistics: Their Use and Interpretation", *Economic Journal*. Vol. 112, No. 2: F85-F106.

Raphael, Stephen. and Rudolf Winter-Ebmer (2001), "Identifying the Effect of Unemployment on Crime," *Journal, of Law and Economics*, 44: 259-283.

Reilly, Barry and Robert Witt (1996), "Crime, Deterrence and Unemployment in England and Wales: An Empirical Analysis", *Bulletin of Economic Research*: vol. 48, no. 2: 137-153.

Royal College of Obstetricians and Gynaecologists (1966), 'Legalised Abortion: Report by the Council of the Royal College of Obstetricians and Gynaecologists', *British Medical Journal*, 297 (2nd April): 850-854.

Sen, Anindya (2002), "Does Increased Abortion Lead to Lower Crime? Evaluating the Relationship between Crime, Abortion and Fertility," Unpublished manuscript, University of Waterloo Department of Economics.

Simms, Madeleine (1988), *Abortion in Britain before the Abortion Act: a survey of the historical evidence*, London: Birth Control Trust.

Witt, Robert, Alan Clarke and Nigel Fielding (1999), "Crime and Economic Activity: A Panel Data Approach", *British Journal of Criminology* vol 39, No. 3: 391-400.

Wooldridge, Jeffrey M (2002), *Econometric Analysis of Cross Section and Panel Data*, Cambridge, Mass.: MIT Press.

Appendix A: Calculating the Effective Abortion Rate

The following example illustrates how the effective abortion rates are calculated for burglaries crime in 1985 and 1986 in a fictional police force area, X.

Firstly assume that abortion rates (abortions as a proportion of births) in area X are as follows

Year	Abortion Rate
1967 and before	0
1968	0.1
1969	0.2
1970	0.25
1971	0.3
1972	0.35
1973	0.4
1974	0.5
…	…

The cohort-related abortion rates in 1985 and 1986 are as follows:

Age (j)	AR_{X1985}	AR_{X1986}
12	0.4	0.5
13	0.35	0.4
14	0.3	0.35
15	0.25	0.3
16	0.2	0.25
17	0.1	0.2
18	0	0.1
19+	0	0

Now assume that 20% of people cautioned or sentenced for burglary in X are 19 or over, 30% are aged 18, 20% are 17, 10% are 16, 6% are 15, 2% are 14, 1% are 13 and none are under 12. We uses these figures the as the, W_{Xj}. Next we calculate W_{Xj} x AR_{Xt} for each year as follows:

Age (j)	W_{Xi}	AR_{X1985}	AR_{X1986}	W_{Xj} x AR_{X1985}	W_{Xj} x AR_{X1986}
12	0	0.4	0.5	0	0
13	0.01	0.35	0.4	0.0035	0.004
14	0.02	0.3	0.35	0.006	0.007
15	0.06	0.25	0.3	0.015	0.018
16	0.1	0.2	0.25	0.02	0.025
17	0.2	0.1	0.2	0.02	0.04
18	0.3	0	0.1	0	0.03
19+	0.2	0	0	0	0

The effective abortion rate in 1985 and 1986 is then calculated as the sums of each of the final columns:

$EAR_{X1985} = 0.0645$

$EAR_{X1986} = 0.124$

Appendix B: Data sources and definitions

Crime variables

All crime data used were obtained from the Home Office as summarized annually in *Criminal Statistics Supplementary Tables Volume 3* and refer to 42 police force areas in England and Wales. Figures for the two London police force areas, City of London and Metropolitan Police were combined.

Abortion data

All data on abortion are taken from the *Abortion Statistics* annual reference volumes published by the Office for National Statistics.

Police strength

Numbers of police officers in each police force area were obtained from *Police Officer Strength England and Wales*, House of Commons Library Research Paper 01/28, 2001.

Population

Population numbers for police force areas were derived by adding county data taken from *Census of Population 2001*.

Real average earnings

Average earnings are weekly earnings for all full-time adult male workers as given in *New Earnings Survey*, published annually. The reported employment weights from the survey were used to combine county data into police force areas. The price deflator used in all items retail price index, base year 1987, from Office of National Statistics.

Male unemployment rate

This series was obtained from NOMIS, the National On-line Manpower Information Service based at the University of Durham. The denominator is the male labor force actively seeking work. Labor force weights are used to aggregate counties into police force areas.

Cars

Numbers of car registrations as collected by the U.K. Driver and Vehicle Licensing Agency and reported in annual editions of *Regional Trends*. Figures are weighted by 1000 population.

Children in care

Number of children, under 18, in local authority care per 1000 resident population under 18. Figures were obtained from *Regional Trends*. Population weights were used to combine counties into police force areas.