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Is it Really Safe Sex? Analyzing the Causal Link between Contraceptive Usage and Crime Rates*

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ABSTRACT

This research investigates the possibility of a causal link between contraceptive use in the 1970s and the decline of crime rates observed during the 1990s. A theoretical framework is adopted in which individual contraceptive use reflects a decision to delay parenthood until a family network can be established. This decision, in turn, increases the costs associated with criminal behavior, decreasing the possibility of such behavior. In this context, contraceptive use can affect the crime rate by reducing the number of individuals with low costs and high potential for engaging in criminal activity. With data on contraceptive use from the Centers for Disease Control Family Growth Survey, this research estimates the relationship between the crime rate in the 1990s and contraceptive use in the 1970s. This research extends the existing literature on crime and abortion by considering the effects of a wide array of reproductive choice technologies on the crime rate. Results provide evidence that the use of contraceptive methods does have statistically significant effects on the crime rates.

JEL: J12, K42
Key Words: crime rate, birth control, poverty, choice

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INTRODUCTION

Given the findings of Donohue and Levitt (2001), the causal effect of abortion on crime has been debated. Advances in discovering this relevant link begins with the research of Donohue and Levitt (2001) who explained the decrease in the crime rates observed in the 90's to the number of abortion after Roe v. Wade 1973. A Further test in Romania shows how outcomes of children born after an abortion ban had worse labor and educational market achievements similar to adults (Pop-Eleches, 2006). Challenges to the presumably causal link between abortion and crime were made most notably by Joyce 2001, 2004; Foote and Goetz 2005; Cook and Laub 2003; Dinardo, forthcoming. They argue that the findings by Donohue and Levitt (2001) were not compelling once the key statistical measurement errors were considered. However, Donohue and Levitt (2004, 2006) replied to their concerns by correcting and finding evidence of a significant link between abortion rates and crime rates.

If there is a significant link between abortion and crime rates, then there may be also a link between contraceptive usage and the crime rates. The central goal of this research is to investigate the possible causal link between crime and individual contraceptive use. Presumably, contraceptive use leads to better family planning and a decrease in the number of children who may later become juvenile delinquents and participants in criminal activities. The cumulative effect of social/economic, cultural, and sociopsychological factors heavily influences the likelihood of a child becoming a juvenile delinquent (Shulman, 1949). In general, children are more likely to become juvenile delinquents and participate in criminal activities when they are born into family structures that are not intact (Painter and Levine, 2000).

The basic idea pursued in this research is that contraceptives use may lower the crime rate by reducing the size of the birth cohort most likely to enter a future criminal cohort.

Donohue and Levitt (2001) report that the drop in the U.S crime rate in the early 1990s can be explained by the increase in abortion rates in the 1970s shortly after the Supreme Court ruling in Roe v. Wade. This research extends the work of Donohue and Levitt (2001) by considering the full menu of reproductive technology choices beyond abortion, and their effect on the crime rate in the early 1990s.

The remainder of this paper is as follows introducing a brief literature review of contributing factors to criminal activity. Section III formulates a theory and methodology that establishes the link between contraceptive use and crime rates, using A.D. Roy's Model of self selection (Roy, 1951). Section IV will empirically test the link between contraceptive use and crime rates using a fixed effect model estimator. Lastly, Section V will provide any conclusion and policy implication from the results.

UNDERSTANDING THE DECREASE IN CRIME

The United States experienced a sharp decline in the crime rate during the 1990s. The Federal Bureau of Investigation (FBI) reported that crime in every category across the United States showed signs of a decrease during this time period. In the FBI Uniform Crime Report, the categories of Violent Crime, Property, Murder, Forcible Rape, Robbery, Aggravated Assault, Burglary, Larceny Theft, and Vehicle Theft show a decrease during the 1990s. Most notable were the 33% decrease in violent crimes and 30% decrease in property crime during this time period. The number of violent and property crimes committed for the United States both rose and peaked in the late 1980s, but during the time between 1990 and 2000, the rates for these categories begin to decrease.

It was first suggested by Becker (1968) that improvements in legitimate labor market opportunities or a strong economy makes crime less attractive. However, the research of Freeman (1995), Machin and Meghir (2000), Gould, Weinberg and Mustard (1997), Donohue and Levitt (2001) and Raphael and Winter-Ebmer (2001) suggest that there is a statistically significant but weak relationship between unemployment rates and property crime.

Heineke (1978) categorized the economic models of crime as either a portfolio or a labor supply problem. Under the portfolio approach, an individual must decide how much wealth to put at risk through involvement in crime. Under the labor supply approach an individual must determine the amount of time to be allocated to illegal activity (Davis, 1988). The portfolio approach is supported by Allingham and Sandmo (1972), Kolm (1973), and Singh (1973). The labor supply approach was supported by Becker (1968), Ehrlich (1970, 1975) and Stigler (1970).

Much of the economic modeling of crime begins with the works of Becker (1968), Stigler (1970), and Ehrlich (1973). Becker (1968) puts forth a very useful rationale for crime. He attempts to find the optimal level of public and private policies to decrease the crime rate. Becker (1968) looks at the social value of a crime, but Stigler (1970) investigates various ways to decrease or limit the supply of criminals. Additionally, he examines the best policies to deter criminals from committing various offenses. Stigler analyzes factors that affect the supply of criminals. He conjectures that the laws designed to prevent crimes are highly influenced by public policy and that public opinion are not adequate for the prevention of crime.

In addition to establishing the economic rationale for the crime rate, it is necessary to understand what cost will deter people from committing crimes. Ehrlich (1973) tries to explain the crime level by measuring the value of the time allocated between illegitimate activities versus legitimate activities. Within this analysis, the focus is directed on the environmental factors contributing to criminal activities. He advocates more spending on law enforcement where expenditures depend on the effectiveness of the cost in deterring crime compared with alternative methods of combating crime. This research sets the framework as to how increase cost in certain factors can deter an individual from participation in illegal activity.

The environment and social interactions are also factors contributing to crime. Glaeser, Sacerdote, and Scheinkman (1996) argue that there are strong peer-effects that contribute to an individual being a participant or a catalyst in criminal activity. Some of the deterrents that influence negative social interaction according to this study are: strong parents, formal schooling, and information that counters peer influences. This research adopts a theoretical framework in which family planning decisions condition the number of unwanted children who may later join a criminal cohort, as an approach to exploring the possible causal nexus between crime rate and contraceptive use.

In this research we investigate the possible causal link between the reductions in the crime rate during the 1990s and the use of a wide array of reproductive choice technologies. While there are many arguments why crime rate fell during the 90s, Donohue and Levitt's (2001) findings have attracted attention to the role of reproductive choice technologies and their effects on future cohorts of criminals. In addition, reproductive choice technologies permit individuals some control over the timing of conception and provide an opportunity to bear children under more favorable conditions. This too could influence whether their children would participate in criminal activities later in life. This line of reasoning provides a possible key to understanding the causal link between contraceptive use and future crime rates. This study will discuss how family planning may affect the number of participants in criminal activity. By delaying child birth until the necessary resources are available, a parent can increase the cost associated with a child's individual involvement in criminal activity.

THEORY/METHODOLOGY

The economic theory of choice can be extended in making the decision to use contraceptives during sexual activity (Donohue and Levitt, 1999). Assume that contraceptive cost associated with sexual activity is classified as either low or high. Low cost activity carries with it the highest probability of unintended pregnancy because no birth control is purchased. Call this the high risk strategy (H). High cost activities carry with it the lowest probability of unintended pregnancy and has a positive birth control cost. Call this the low risk strategy (L). Choosing the low risk strategy has a cost of "*C*", due to lost in purchasing power. The probability of conception (CN) is equal to P_H (the probability associated with using high risk strategy) and P_L (the probability associated with low risk strategy). Let the probability of CN given H and CN given L respectively be: $P_H = P(CN \mid H)$ and $P_L = P(CN \mid L)$. Conception has a high probability of occurring when $P(CN \mid H) > P(CN \mid L)$.

Let the utility of a newborn child be *B*, if the net utility of *B* is positive then an individual's utility increases with a newborn child. $B<0$ corresponds to a case where an individual is better off without the baby at that given time. A child born to parents when $B < 0$ can be said to be unwanted, to the extent that an unwanted child is unlikely to be the beneficiary of parental investments such as human capital that increase the opportunity cost of crime. Children born under the condition $B < 0$, unwanted newborns are more likely to engage in criminal activity in later years.

The expected utility from engaging in sexual activity can be modeled as follow:

$$EU_L = P(CN \mid L)B - C = P_L B - C \quad (1)$$

$$EU_H = P(CN \mid H)B = P_H B \quad (2)$$

The expected utility specifications in (1) and (2) are based on the risk level taken at the time of the sexual act. It is assumed that the utility of sexual activity is the same regardless of the associated risk, therefore our interest is in what determines the equilibrium sexual activity strategy, to the extent that the low-risk strategy corresponds to sexual activity where the individual uses contraceptive methods—the likely effect of the equilibrium strategy on unwanted newborns.

Setting equation (1) and (2) equal and solving for B yields the equilibrium condition:

$$P_H B = P_L B - C \Rightarrow B = \frac{C}{(P_L - P_H)} \quad (3)$$

It is plausible that the low risk strategy is taken if and only if (Donohue and Levitt, 1999):

$$B \leq \frac{C}{(P_L - P_H)} \quad (4)$$

Since $P_H > P_L$, then $P_L - P_H < 0$, and the low risk strategy may be exercised if $B<0$. This establishes the theory that for all individuals engaging in sexual activity for which children are unwanted, the low-risk strategy is the equilibrium choice. *As such, in a population where unwanted newborns are more likely to engage in criminal activity, there will be a causal and inverse relationship between contraceptive use and crime rates.* Some women do adopt a high risk strategy, even though $B < 0$. In this case, the pregnancy may be unwanted and may opt to have an abortion.[1]

[1] According to Donohue and Levitt (1999), if a woman chooses to abort a pregnancy, it may cost her the amount of "*A*" which includes both emotional and monetary cost as well as the possibility of complication with future child bearing. A woman will choose to abort if and only if $B<-A$, or the utility of having the baby is more

CHILDREN AND SELF SELECTION INTO CRIMINAL ACTIVITY

Why might "unwanted" children select to engage in criminal activity later on in life? If choice of activities is governed by self-selection processes conditioned on differential costs and productivity (Roy, 1951), then relative to wanted children, unwanted children may have lower costs of engaging in criminal activity. For example, the absence of a nuclear and extended family networks at the time of birth could result in low stocks of human and social capital. Human and social capital is important for success later in life. Therefore, unwanted children may face unfavorable schooling/labor market opportunities that reduce the opportunity cost of crime.

A Roy-type selection model (Roy, 1951) is well-suited when considering how unwanted children select into criminal activity. Selection model allows us to determine the probability of participating in either a legal or an illegal occupation. Let the log of earnings from legal and illegal activities respectively be indexed by 0 and 1. The log earnings from each profession are denoted by the following:

$$w_0 = \mu_0 + \varepsilon_0 \text{ and } w_1 = \mu_1 + \varepsilon_1 \quad (5)$$

In equation (5) μ_0 and μ_1 are interpreted as one's mean earnings in a particular activity. $\varepsilon_0 \sim N(0, \sigma_0^2)$ and $\varepsilon_1 \sim N(0, \sigma_1^2)$ or consider ε_0 and ε_1 as the mean value of an

negative than the cost of an abortion. The negative value of "A" is expressed because it could be misleading with respect to cost being a positive number and the utility of a baby being less than zero. Because abortion as an option is costly, "no wanted baby will ever be aborted, and some unwanted babies will be born." (Donohue and Levitt, 1999). $-A < \frac{C}{(P_L - P_H)}$ Then choosing the low level of pregnancy risk is more efficient means of preventing birth than abortion. In the above mentioned equation, the usage of contraceptives will be preferred as a precautionary choice. For all women the level of risk is identical to the level chosen when the abortion is illegal. If $-A \geq \frac{C}{(P_L - P_H)}$ then the abortion becomes a more efficient method of birth control than precaution.

individual's skills in a particular profession.[2] However, with the choice of activity there is an associated cost (C). The cost of choosing a particular type of activity also has an associated time related cost. The choice to participate in illegal activity depends on the sign of the index function.

$$I = \ln(w_1 /(w_0 + C)) \approx (\mu_1 - \mu_0 - \pi) + (\varepsilon_1 - \varepsilon_0) \qquad (6)$$

Borjas (1987) accounts for time by the term $\pi = C/w_0$. The variable π is a constant; which establishes that, C is directly proportional to w_0.

Assume that a person knows their own C, μ_0, and μ_1 and their own ε_0 and ε_1. The researcher can only observe an individual's choice to participate in legal or illegal activity. Assume further that the cost of a particular choice is highly sensitive to the nuclear and/or extended family network that is present, this network then serves to condition behavior, creates a system of rewards and punishments, and provides a source of social capital that expand the set of legitimate opportunities for a child. The use of contraceptives allow one to time pregnancy affording an opportunity to put into place the nuclear and/or extended family networks that make possible for the future success of a child.

Established nuclear and/or extended family networks can also increase the costs associated with illegal activities by imposing upon a child higher moral costs---the costs associated with the "shaming" members of one's family network. These costs can be viewed as a stigma-cost. This stigma-cost associated with a family network is increased when resources, such as maturity, time, income, etc., are available. The use of contraceptives gives an individual

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2 This model will continue the assumption of Roy's Model that assumes jointly lognormal distribution with means of μ_0 and μ_1. These mean values are considered socioeconomic variables that are observable. Also, the value of ε_0 and ε_1 socioeconomic variables that are unobservable which are the same as discussed in Borjas (1987)

control over the timing of their pregnancy. This control over timing can potentially allow an individual an opportunity to give birth where a more supportive family network is present. Arguably this would impact crime through the increase stigma cost associated with the presence of a more intact family network.

If we assume that stigma-cost are higher when a family network is available, then a child whose birth was planned would have a higher stigma-cost associated with participating in criminal activity. Conversely, a child born at an inopportune time may not have the necessary family network in place, thereby creating a lower stigma-cost associated with participating in criminal activity.

Building on equation (6), the correlation between illegal and legal earning can be defined as follows:

$$\rho = \frac{\sigma_{01}}{\sigma_0 \sigma_1}, \text{ where } \sigma_{01} \text{ is the cov } (\sigma_0, \sigma_1) \qquad (7)$$

According to Bojars (1987) implementing this model requires knowledge about ρ, however we do not need to know ε_0 and ε_1. It follows that an individual will participate in criminal activity when the index function, I > 0 or:

$$(\mu_1 - \mu_0 - \pi) + (\varepsilon_1 - \varepsilon_0) > 0 \qquad (8)$$

The terms in the first parentheses suggest that the difference between the mean earnings of illegal activity minus the mean earnings from legal activity and the cost associated with the activity must be positive. Also, in the second set of parentheses, the difference between the values of the skills to participate in legal and illegal activity has to be positive in order for this condition to be true.

If follows from equation (7) that the probability of choosing an individual at random who will participate in illegal activities instead of legal activities can be derived.

Let $\nu = \varepsilon_1 - \varepsilon_0$, then the probability of a child choosing to participate in criminal activity can be notated as follows:

$$P = \Pr[\nu > (\mu_0 - \mu_1 + \pi)] = \Pr\left[\frac{\nu}{\sigma_\nu} > \frac{(\mu_0 - \mu_1 + \pi)}{\sigma_\nu}\right] \qquad (9)$$

$$= 1 - \Phi\left(\frac{(\mu_0 - \mu_1 + \pi)}{\sigma_\nu}\right) = 1 - \Phi(z) \text{ where z = } \left(\frac{(\mu_0 - \mu_1 + \pi)}{\sigma_\nu}\right).$$

In equation (9) Φ is equal to the standard normal distribution (Borjas, 1987). It is shown that as "z" increases, the probability of participating in criminal activity decreases. If we analyze "z," the greater the cost of π, the greater z becomes. It is maintained that the stigma-cost associated with criminal behavior is greater when a family network is present. This suggests that the probability of an individual participating in a criminal activity would be lower when pregnancies are timed through the use of birth control. Conversely, an untimely pregnancy attributed to high risk sexual behavior increases the probability of a child involvement in criminal activity.

This approach allows us to set forth a theoretical framework which explains why children born in a particular cohort are more likely to participate in crime. Furthermore, this affords an opportunity to incorporate contraceptive use as a variable that empowers individuals to better influence the environment (i.e. family network) around which children are reared. The theory of optimal contraceptive use and selection into criminal activity suggests that empirically, the crime rate will be a function of contraceptive usage sufficiently lagged to account for the timing of the entry of a birth cohort into the criminal cohort.

To formalize this idea, a utilization rate is constructed from the sample to understand the total amount of contraceptives used in a state. Because the use of contraceptives does not immediately affect the crime rate, utilization rate is gathered from an earlier period than the crime rate. In this research a 17 year difference is selected between the use of contraceptives and the crime rate. For clarification, if a person uses birth control in 1973, its effect on crime will not be felt until 17 years later in 1990. Juvenile delinquency can occur earlier than age 17 however; this age group represents the high crime cohort if the group is deemed unwanted. Therefore, in this research that convention is followed. A specification of the process generating crime is as follows:

$$\begin{gathered}\ln(Crime_{st}) = \beta_1(Contraceptive_{st}) + \beta_i X_s + \gamma_s + \lambda_t + \varepsilon_{st} \\ for\ i = (2, \cdots, n)\end{gathered} \quad (10)$$

where "*s*" indexes states in the region, and "*t*" reflects time. γ_s and λ_t are used to represent state and time fixed effects. Even though this is a semi-log model, a double log model will be used to examine the effect of a utilization rate on the decreasing crime rate. This model estimated can be expressed as follows[3]:

$$\begin{gathered}\ln(Crime_{st}) = \beta_1 \ln(Contraceptive_{st}) + \beta_i \ln X_s + \gamma_s + \lambda_t + \varepsilon_{st} \\ for\ i = (2, \cdots, n)\end{gathered} \quad (11)$$

The dependent variable in equations (10) and (11) is the natural log of the crime rate.[4] The contraceptive variable is the utilization rate calculated from a sample of the National Family Growth Survey. The utilization rate is calculated as follows:

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[3] This equation is similar to the model expressed by Donohue and Levitt 2001.

[4] This crime rate represents the Property and Violent crime rate per the population. Each crime rate will be estimated separately.

$$Utilization\ Rate = \frac{Total\ number\ of\ female\ population\ using\ contraceptive}{Total\ number\ of\ female\ population} \qquad (12)$$

This utilization rate shows what proportion of the female population reported using contraceptives, during the selected period.[5]This variable denoted as "X", is a vector that includes the number of prisons and police per capita, the unemployment rate, per capita income, incarceration rate, the poverty rate, presence of concealed handgun laws, and per capital beer consumption. These variables are the same ones supported by prior research (Donohue and Levitt 2001)[6]. This resulting model is adjusted for population differences.

Data on individual contraceptive usage are from the National Survey of Family Growth (NSFG).[7] The NSFG, sponsored by the Center for Disease Control (CDC), covers cycles for the years 1973 -1995, which provides an opportunity to verify if variation in the use of contraceptives technologies by individuals in the 1970s across geographic regions, for example states, had an effect on crime rates in the 1990s. The NSFG conducts the national samples of women 15-44 years of age, interviewed in person in their households. Sample sizes were 9,797 in 1973, 8,611 in 1976, 7,969 in 1982, 8,450 in 1988, and 10,847 in 1995. In this sample abortion was an option but was not reported as a method of contraception during the years of 1973-1976. This resulted in a panel of 204 observations covering the 50 states and the District of

[5] The period of interest is 1973 to 1976. Furthermore, women are used because only this group was surveyed in the CDC family growth data.

[6] Further description/definition of variables is located in the appendix under definition of terms.

[7] The data was provided to the Mississippi Urban Research Center, by the Centers for Disease Control. The NSFG conducts the national samples of women 15-44 years of age, interviewed in person in their own households. Sample sizes were 9,797 in 1973, 8,611 in 1976, 7,969 in 1982, 8,450 in 1988, and 10,847 in 1995. The National Survey of Family Growth includes U.S. women 15-44 years of age. In Cycles 1, 2, and 3, only the conterminous United States was included. In Cycles 4 and 5, Alaska and Hawaii were included. Analysis can be done for the four major census regions (Northeast, Midwest, South, and West) and for metropolitan and non-metropolitan areas. Estimates cannot be made for individual States or for smaller areas. Therefore the selected dates of 1973-1976 provide state observations that increase the sample size.

Columbia. The state level control variable will be lagged to ensure the effects of the selected variables on criminal activities are observable. From the NSFG, the following contraceptive methods were reported:

1. birth control pill
2. douche
3. foam
4. jelly, cream, suppository
5. IUD, coil, loop
6. condom, rubber
7. diaphragm
8. rhythm calendar
9. rhythm temperature
10. abstinence
11. withdrawal, coitus interruptus
12. sterilization, wife
13. no method
14. sterilization, husband
15. other method

For the purpose of this research, the examination of the major contraceptive technologies will be determined both as a collective use of each technology and individual use of technology. Even though specified, combination of technologies will not be examined in this study, only single used technologies.[8] Second, crime statistics will be gathered from the FBI Uniform Crime Report. This report has data on the various violent and property crimes from 1960 to 2004 for every state in the US. Since this study is looking at the crime rate after the 1990s, the only years that will be examined will be the 1990 to 1993. Any crime data used prior to this time period is used to show trends in the crime rate. Third, information on the number of prisons, police, and incarceration rate is collected from the Correctional Population in the United States published by the Bureau of Justice Statistics (BJS). Lastly, population characteristics such as the poverty rate,

[8] For example, in this data set, condom/foam and diaphragm/sponge, was specified both as used together and separate. This study will not examine combinations such as this for individual birth control technology usage. However, as specified earlier, total use of all birth control technologies will be analyzed.

unemployment rate, and the per capita state personal income will be gathered from the Census Bureau United States Statistical Abstract.[9]

RESULTS

Table 1 reports the mean and standard deviation of the relevant variables for the entire sample. For the 50 states and Washington, DC in the sample, the following variables were constructed: the number of violent crimes per population (VIOLENT), the number of property crimes per population (PROPERTY), the number unemployed per population (UNEMPLOY), the number of people below the poverty line per population (POVERTY), a binary variable indicating whether or not the state has the presence of a concealed gun law (GUNLAW), the income per population for a state (INCOME), the amount of beer consumption per population (BEER), the number of police per population (POLICE), the number of people incarcerated per population (INCARCERATE), the number of prisons per population (PRISON), and the number of females using any specified form of contraceptive technology per female population (CONTRACEPTIVE).[10]

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9 Any information that the census does not have, such as beer consumption and the presence of a concealed handgun law, will be gathered from Donohue and Levitt's data set that they have made readily available

10 The variable CONTRACEPTIVE will consist of each of the 16 methods specified in Chapter III, gathered from the NSFG provided by CDC. For example, PILL is the number of females using the pill as a technology per female population. Each contraceptive use measure was multiplied by the inverse of the probability weight reported for each household. This insured that each contraceptive use measures reflected the number relevant for a given states population.

Table 1. Sample Mean, Standard Deviations, Minimums, and Maximums

Variable	Mean	Std. Dev.	Min	Max
VIOLENT	0.0059687	0.0041191	0.0006556	0.029218
PROPERTY	0.0464819	0.0116684	0.0232418	0.0883928
PRISON	0.0027112	0.0016304	0.0006254	0.0128684
POLICE	0.002807	0.0009889	0.0017017	0.0090795
INCARCARATE	0.0028172	0.0018091	0.00067	0.01549
BEER	23.65784	3.808325	12.7	40.2
INCOME	22058.69	3514.342	15438.31	33165.66
GUNLAW	0.3480392	0.4775204	0	1
UNEMPLOY	0.0622044	0.0152709	0.02142	0.113
POVERTY	0.1383627	0.0416704	0.06	0.264
CONTRACEPTIVE	0.7924152	0.1038189	0.2823926	1
N	204	---	---	---

Table 1 reveals that approximately 80% of the sample female population during the periods of 1973-1976 in a state used some form of contraceptives technologies. This sample also reveals that the average income in the United States is around 22,000 for the period of 1990-1993 and 4% of the population commits all of the property crime. The percentage of unemployment in the United States is 6%, therefore the numbers are near the national average during the 1990s. The variable of interest for this study, examines the utilization rate of contraceptive technology by the population. Utilization can also be specified by each individual contraceptive technology.

Table 2 reports on the mean and standard deviation of the various contraceptive technologies for the sample of females in the population. For the 50 states and Washington, DC in the sample, the following variables were constructed: the number of females per female population using the Pill (PILL), the number of females per female population using Foam (FOAM), the number of females per female population using the Diaphragm (DIAPHRAGM), the number of females per female population using Jelly (JELLY), the number of females per female population using the Diaphragm/Jelly (D_and_J), the number of females per female population using the Douche (DOUCHE), the number of females per female population using IUD (IUD), the number of females per female population using female sterilization (F_STERILIZATION), the number of females per female population using male Sterilization (M_STERILIZATION), the number of females per female population using the Condom (CONDOMS), the number of females per female population using the Pill (PILL), the number of females per female population using rhythm temperature (RHYTHM_TEMP), the number of females per female population using rhythm calendar (RHYTHM_CAL), the number of females per female population using the withdraw method (WITHDRAWL), the number of females per female population using abstinence (ABSTINENCE), and the number of females per female population using all other methods (ALL_OTHER).

Table 2. Contraceptive Methods' Means, Standard Deviation, Minimum, and Maximum

Variable	Mean	Std. Dev.	Min	Max
PILL	0.3211919	0.0997025	0	0.5962672
FOAM	0.3211919	0.0997025	0	0.5962672
DIAPHRAM	0.0068822	0.0151805	0	0.1725997
JELLY	0.0069722	0.0201816	0	0.1524305
D and J	0.0301333	0.0729917	0	0.758118
DOUCHE	0.0061021	0.0098909	0	0.0821751
IUD	0.0954336	0.0844195	0	0.5396144
ABORTION	0	0	0	0
F_STERILIZATION	0.0836949	0.0633907	0	0.3649648
M_STERILIZATION	0.0936815	0.0793295	0	0.4436441
CONDOMS	0.0606053	0.0746707	0	0.7200888
RHYTHM_TEMP	0.0025843	0.00813	0	0.0782185
RHYTHM_CAL	0.0244761	0.0354112	0	0.2551622
WITHDRAWL	0.0160093	0.0348805	0	0.3438732
ABSTINENCE	0.0052525	0.0158019	0	0.1541676
ALL_OTHER	0.0066102	0.0316395	0	0.382412
N	204	---	---	---

Table 2 reveals that the majority female population preferred the pill and foam as the contraceptive technology of choice as appose to all other technology. According to this sample, approximately 32 % of the female population use both Pill and Foam as a contraceptive choice. It is also revealed in the sample, that the females' contraceptive choice of abortion was not selected. This is manly due to the large number of underreporting specified in this sample. Furthermore, the least preferred method of contraceptive practice over the period was rhythm temperature and abstinence, with the maximum utilization rate by a state at 7 percent and 15 percent of the population.

Table 3 reports the estimates for the full sample using Ordinary Least Square (OLS) regression. Column 1 and 2 are specified by the following model:

$$\begin{aligned} CRIME = B_0 + B_1 UNEMPLOY + B_2 POVERTY + B_3 GUNLAW + B_4 INCOME + B_5 BEER + \\ B_6 POLICE + B_7 INCARCERATE + B_8 CONTRACEPTIVE \end{aligned} \quad (4.1)$$

This is estimated in both semi-log form denoted as (4.2)

$$\begin{aligned} \ln(CRIME) = B_0 + B_1 UNEMPLOY + B_2 POVERTY + B_3 GUNLAW + B_4 INCOME + B_5 BEER + \\ B_6 POLICE + B_7 INCARCERATE + B_8 CONTRACEPTIVE \end{aligned} \quad (4.2)$$

and double log form denoted as (4.3).

$$\begin{aligned} \ln(CRIME) = B_0 + B_1 \ln(UNEMPLOY) + B_2 \ln(POVERTY) + B_3 GUNLAW + B_4 \ln(INCOME) + \\ B_5 \ln(BEER) + B_6 \ln(POLICE) + B_7 \ln(INCARCERATE) + B_8 \ln(CONTRACEPTIVE) \end{aligned} \quad (4.3)$$

Of the eight variables under consideration, the main variable of interest is CONTRACEPTIVE. Table 3 reports OLS parameter estimates for (4.1) The parameter estimates reveals a statistically significant relationship to violent crimes for POVERTY, GUNLAW, INCOME, BEER, POLICE, INCARCERATE, and CONSTANT. The variables UNEMPLOY and CONTACEPTIVE are not significant for violent crimes. Column (2) reveals a statistically significant relationship to property crime for POVERTY, GUNLAW, POLICE, INCARCERATE and CONSTANT. For both violent and property crime, CONTRACEPTIVE was not statistically significant and did not contain the correct sign. The coefficients for the selected variables and standard errors are small suggesting the model may be specified incorrectly.

Understanding the selected variables effect on the change in the crime rates reveals the results of semi-log form denoted as (4.2). For the ln (VIOLENT), the variables UNEMPLOY, POVERY, GUNLAW, INCOME, BEER, POLICE, INCARCERATE, and CONSTANT are statistically significant. The variable CONTACEPTIVE is not statistically significant nor contains the expected sign, however, for ln(PROPERTY), GUNLAW, POLICE, INCARCERATE, and CONTRACEPTIVE is statistically significant. Although statistically significant, CONTRACEPTIVE does not have the expected sign. Some interesting expected results shown are the strong effect that the coefficients for POLICE and INCARCERATE has on violent crime. For the double-log form denoted as (4.3), all variable for consideration are statistically significant for ln (VIOLENT), however, CONTRACEPTIVE does not contain the expected sign. For ln (PROPERTY) only GUNLAW, POLICE, and INCARCERATE are statistically significant. The coefficients in (4.3) are Elasticities. Most of the selected variables specified suggest little effect on crime. This effect could be attributed to the model being mis-specified. The OLS estimates for this sample are mis-specified, because this is a panel data set and OLS is an inappropriate measure for this data. All the coefficients in these models are not accurate predictors of the effects in violent and property crime. Table 3 reveals CONTRACEPTIVE does not have the expected sign and is not statically significant through out each of the models specified. This can be attributed to OLS being a biased estimation model for the effect on crime over time.

OLS parameter estimates are unbiased if there are no omitted variables in the specification that are correlated with the error term. The panel nature of the data however introduces the possibility of unobserved year and state effects. In addition, because the NSFG underreports abortions increases the probability of the parameter estimated being undermined by unobserved heterogeneity.[11]

Given the possibility of unobserved heterogeneity, which introduces a bias in the OLS parameter estimates, Tables 4 and Table 5 report a Random and Fixed Effects parameter estimates respectively for equations 4.1, 4.2, and 4.3. Random Effect parameter estimates assume individual specific constant terms as randomly distributed across cross –sectional units (Green, 2005).[12] Fixed Effects parameter estimates assume that differences across units can be captured in the differences in the constant term.

Table 4 reports the parameter estimates for equations 4.1, 4.2, and 4.3 using the Random Effect Model. Table 4 reports the Random Effect Model estimation results. For equation (4.1), UNEMPLOY, GUNLAW, INCOME, INCARCERATE, and CONTRACEPTIVE are statistically significant to violent crime. CONTRACEPTIVE does have the expected sign. For property crime the variables that are statistically significant are GUNLAW, BEER, POLICE,

[11] Abortion is underreported across the sample population and introduces a source of omitted variable bias. For example, the interviewer-administered National Survey of Family growth (NSFG) had overall abortion ranges of 35%-50% or what is believed to be the actual level of abortion on the 1976 -1988 rounds (Forrest, 1987, and Jones and Forrest, 1992). This underreporting may be caused by the perception of it being a threatening question (Udry et. al., 1996). This is very evident in the sample selected from the NSFG which had no reported abortion for the selected years.

[12] It is also possible to allow the slopes to vary across i, but this method introduces some new methodological issues, as well as considerable complexity in the calculations. A study on the topic is Cornwell and Schmidt (1984). Also the assumption of a Fixed T is only for convenience. The more general case in which T_i varies across units (Green, 1995a)

CONTRACEPTIVE and CONSTANTS. Equation (4.2) in Table 4 reveals statistically significant results for GUNLAW, BEER, INCARCERATE, CONTRACEPTIVE, and CONSTANT to ln (VIOLENT) as the dependent variable. For ln(PROPERTY) POVERTY, GUNLAW, BEER, CONTRACEPTIVE, and CONSTANT are statistically significant. The equation (4.3) estimates statistically significant results for ln (GUNLAW), ln (INCOME), ln (INCARCERATE), ln (CONTRACEPTIVE), and CONSTANT to ln (VIOLENT). For ln (PROPERTY) the variables that are statistically significant are ln (POVERTY), ln (GUNLAW), POLICE, and CONTRACEPTIVE. The CONTRACEPTIVE variable has the expected sign and is statistically significant throughout all models specified. It is suggested to use a Fixed Effects Model as an appropriate estimation model (Green, 2001 and Gujarati 1998).

Table 5 reports Fixed Effects parameter estimates for equations 4.1, 4.2, and 4.3. The Fixed Effects parameters for equation (4.1) reveals statistically significant results for UNEMPLOY, BEER, INCARCERATE, CONTRACEPTIVE and CONSTANT to violent crime. For property crime, statistically significant relationships are reported for CONTRACEPTIVE and CONSTANT. The Fixed Effects parameters for (4.2) reveal statistically significant results to violent crimes for UNEMPLOY, INCOME, CONTRACEPTIVE, and CONSTANT. For property crime, CONTRACEPTIVE and CONSTANT are statistically significant. The parameters for (4.3) reveal statistically significant results for violent crime for UNEMPLOY, INCOME and CONTRACEPTIVE. For property crime, statistically significant results are estimated for POVERTY, and INCARCERATE. The CONTRACEPTIVE variable in the Fixed Effects Model has the expected sign and is statistically significant throughout all models specified, except for property crime in (4.3) which is not statistically significant.

Table 3: OLS Regression, Semi Log, and Double log Estimates for Violent and Property Crimes

Specification	OLS		OLS (Semi Log Model)		OLS (Semi Log Model)	
	(4.1)		(4.2)		(4.3)	
	Violent Crime	Property Crime	Ln (Violent) Crime	Ln (Property) Crime	Ln (Violent) Crime	Ln (Property) Crime
UNEMPLOY	0.0143162	-0.0106552	5.015068[b]	-0.2675362	0.2307902[b]	-0.0215241
	(0.0091863)	(0.047392)	(2.291905)	(1.085475)	(0.1051341)	(0.0568458)
POVERTY	0.0249361[a]	-0.0119799[b]	3.390109[a]	-0.5449654	0.4975319[a]	-0.075402
	(0.0049628)	(0.0256028)	(1.238168)	(0.5864121)	(0.1292709)	(0.0698965)
GUNLAW	-0.0011514[a]	-0.0039163[a]	-0.4951254[a]	-0.1247624[a]	-0.3653862[a]	-0.0802407[a]
	(0.0002571)	(0.0013262)	(0.0641345)	(0.0303749)	(0.0542598)	(0.0293382)
INCOME	0.000000295[a]	-0.000000112	0.0000565[a]	-0.0000012	1.130208[a]	-0.0983996
	(0.0000000613)	(0.000000316)	(0.0000153)	(0.00000725)	(0.2695095)	(0.1457233)
BEER	-0.0000617[b]	0.0002457	-0.0259527[a]	0.0030007	-0.5529757[a]	0.0568976
	(0.0000317)	(0.0001633)	(0.0078967)	(0.00374)	(0.153795)	(0.0831567)
POLICE	0.8493104[a]	3.767683[a]	-113.5853[b]	55.2208[b]	0.0991676	0.3820053[a]
(t-1)	(0.2436738)	(1.257109)	(60.79453)	(28.79307)	(0.1583092)	(0.0855975)
INCARCERATE	1.091648[a]	2.328977[a]	207.0793[a]	52.39796[a]	0.7316372[a]	0.1814637[a]
	(0.1231533)	(0.6353457)	(30.72569)	(14.55208)	(0.0632321)	(0.0341895)
CONTRACEPTIVE	0.0001577	0.0089734	0.2642435	0.1590381[a]	0.2827498[c]	0.110485
(t-17)	(0.0011726)	(0.0060493)	(0.2925454)	(0.1385532)	(0.1635395)	(0.0884255)
CONSTANT	-0.0086064[a]	0.0225856[b]	-7.047895[a]	-3.437386	-8.04493[b]	0.8957135
	(0.0017518)	(0.0090373)	(0.4370514)	(0.2069931)	(3.319333)	(1.794758)
N	204	204	204	204	204	204
R_squared	0.8451	0.4863	0.6505	0.4213	0.7692	0.502

[a]Significant at the .01 level, [b]Significant at the .05 level, [c] Significant at the .10 level,
Standard errors in parentheses
N = Number of observation

Table 4: Random Effect Models, Semi Log, and Double log Estimates for Violent and Property Crimes

Specification	Random Effect Model (4.1)		Random Effect Model (4.2)		Random Effect Model (4.3)	
	Violent Crime	Property Crime	Ln (Violent) Crime	Ln (Property) Crime	Ln (Violent) Crime	Ln (Property) Crime
UNEMPLOY	0.0103015[a]	-0.0095029	1.220172	-0.1264446	0.0734045	0.0125763
	(0.0049885)	(0.0268294)	(0.7762248)	(0.5728758)	(0.0504685)	(0.0363784)
POVERTY	-0.0000367	-0.0164184	-0.2417271	-0.4962285[b]	-0.0273598	-0.0865474[b]
	(0.0026204)	(0.0141256)	(0.4045107)	(0.301081)	(0.0535121)	(0.0389081)
GUNLAW	-0.0009158[b]	-0.0042717[b]	-0.167888[b]	-0.1112563[b]	-0.1986018[a]	-0.1225909[b]
	(0.0003881)	(0.0020099)	(0.0703641)	(0.0441792)	(0.0683955)	(0.0441939)
INCOME	2.31E-07[a]	-8.82E-08	0.000047[a]	-3.24E-06	0.959908[a]	-0.0449676
	(0.0000000696)	(0.000000356)	(0.0000138)	(0.00000789)	(0.2724014)	(0.1677756)
BEER	0.0000471	0.0003687[c]	-0.0038399	0.0072462[c]	0.1108614	0.1395747
	(0.0000358)	(0.0001893)	(0.0059114)	(0.0040952)	(0.128132)	(0.0890786)
POLICE	0.2146034	1.433252[c]	6.49328	39.87956[b]	0.0629834	0.1282916[b]
(t-1)	(0.1590606)	(0.8512542)	(25.31109)	(18.24535)	(0.0767994)	(0.0551954)
INCARCERATE	1.039547[a]	0.7586782	63.88513[a]	6.115395	0.3983632[a]	-0.0151975
	(0.1122172)	(0.5903978)	(19.30791)	(12.82049)	(0.0674387)	(0.0437238)
CONTRACEPTIVE	-0.0015786[a]	-0.006807[b]	-0.1864879[b]	-0.1482507[a]	-0.1725547[a]	-0.0903365[b]
(t-17)	(0.0005009)	(0.0027037)	(0.0770259)	(0.0575661)	(0.0531754)	(0.0387687)
CONSTANT	-0.0028417	0.0432892[a]	-6.311652[a]	-3.096188[a]	-12.32491[a]	-2.541902
	(0.0017211)	(0.0089336)	(0.319566)	(0.1959891)	(2.957321)	(1.839482)
N	204	204	204	204	204	204
R_squared	0.7732	0.3788	0.4401	0.3031	0.6177	0.2184

[a]Significant at the .01 level, [b]Significant at the .05 level, [c] Significant at the .10 level
Standard errors in parentheses
N = Number of observation

Table 5: Fixed Effects Models, Semi Log, and Double log Estimates for Violent and Property Crimes

Specification	Fixed Effects Model (4.1)		Fixed Effects Model (4.2)		Fixed Effects Model (4.3)	
	Violent Crime	Property Crime	Ln (Violent) Crime	Ln (Property) Crime	Ln (Violent) Crime	Ln (Property) Crime
UNEMPLOY	0.0128591[a]	-0.0041	1.382689[a]	-0.0055024	0.0986382[b]	0.0328194
	(0.0045512)	(0.0264424)	(0.7133382)	(0.5743573)	(0.0438097)	(0.0335638)
POVERTY	-0.0019534	-0.0107	-0.3083752	-0.3622873	-0.0507645	-0.0773936[b]
	(0.002364)	(0.0137348)	(0.3705238)	(0.298334)	(0.0460672)	(0.0352933)
GUNLAW	-0.000328	-0.00048	-0.0423883	-0.0241465	-0.0576848	-0.0385948
	(0.0004749)	(0.002759)	(0.0744295)	(0.0599283)	(0.0724699)	(0.0555212)
INCOME	3.94E-07	-6.85E-07	0.0000653[c]	-0.0000167	1.566093[a]	-0.072663
	(0.000000107)	(0.000000622)	(0.0000168)	(0.0000135)	(0.3367631)	(0.2580035)
BEER	0.0000609[c]	0.000315	-0.0030897	0.0071157	0.0667846	0.0368059
	(0.0000361)	(0.0002098)	(0.005659)	(0.0045564)	(0.1174452)	(0.089978)
POLICE	-0.1849734	-0.35873	-19.6725	11.26632	-0.0437714	0.0162155
(t-1)	(0.1518831)	(0.8824408)	(23.80561)	(19.16752)	(0.0674497)	(0.0516751)
INCARCERATE	0.6216422[a]	-0.72988	20.74784	-19.4275	0.098851	-0.2648382[a]
	(0.1268416)	(0.7369496)	(19.8807)	(16.00731)	(0.0722066)	(0.0553195)
CONTRACEPTIVE	-0.0011555[b]	-0.00482[c]	-0.1622512[a]	-0.1163204[b]	-0.1387119[a]	-0.0487035
(t-17)	(0.0004486)	(0.0026066)	(0.0703173)	(0.0566172)[a]	(0.0456496)	(0.0349734)
CONSTANT	-0.004891[b]	0.062935[a]	-6.602546[a]	-2.725124	-20.69051	-4.048663
	(0.0022726)	(0.0132037)	(0.356197)	(0.2867986)	(3.600201)	(2.758213)
N	204	204	204	204	204	204
R_squared	0.5606	0.2201	0.1844	0.127	0.2237	0.3092

[a]Significant at the .01 level, [b]Significant at the .05 level, [c] Significant at the .10 level
Standard errors in parentheses
N = Number of observation

Although the results in Table 4 and 5 are sensible, and conform generally to expectations, a Hausman test to discriminate between the Random and Fixed Effects parameter specification indicates that the Fixed Effects specification is consistent with the data.[13] This conclusion can be gleamed from the significant value of the chi^2 statistic for both violent and property crimes. Although not reported, the Hausman test is performed for all estimated models in equation 4.1, 4.2, and 4.3, and the Fixed Effects parameters are consistent for this data set, as apposed to the Random Effect parameters.

[13] Hausman Test (1978) is based on the idea that under the hypothesis of no correlation, both OLS the Least Squared Dummy Variable (LSDV) model and GLS are consistent, but OLS is inefficient, whereas under the alternative, OLS is consistent but GLS is not. Therefore, under the null hypothesis, two estimates should not differ systematically and a test can be based on the difference. Hausman result the covariance of an efficient estimator with its difference from an inefficient estimator is zero, which implies that the $Cov[b, \hat{\beta}] = Var[\hat{\beta}]$. Hausman test is based on the fixed and random effects regressions is based on the parts of the coefficient vectors and the asymptotic covariance matrices that correspond to the slope in the models, that is ignoring the constant terms (s) (Green, 2000)

Table 6. Hausman Test: Property and Violent Crime

Property Crimes	(b) fixed	(B) .	(b-B) Difference	S.E.
UNEMPLOY	-0.0055024	-0.1264446	0.1209422	0.0412263
POVERTY	-0.3622873	-0.4962285	0.1339412	
GUNLAW	-0.0241465	-0.1112563	0.0871099	0.0404919
INCOME	-0.0000167	-3.24E-06	-0.0000135	0.000011
BEER	0.0071157	0.0072462	-0.0001306	0.0019977
POLICE	11.26632	39.87956	-28.61325	5.873784
INCARCERATE	-19.4275	6.115395	-25.5429	9.584824
CONTRACEPTIVE	-0.1163204	-0.1482507	0.0319303	
	chi2 = 71.85			
	Prob>chi2 =.000			
Violent Crime				
UNEMPLOY	1.382689	1.220172	0.1625172	
POVERTY	-0.3083752	-0.2417271	-0.0666481	
GUNLAW	-0.0423883	-0.167888	0.1254998	0.024262
INCOME	0.0000653	0.000047	0.0000183	9.60E-06
BEER	-0.0030897	-0.0038399	0.0007502	
POLICE	-19.6725	6.49328	-26.16578	
INCARCERATE	20.74784	63.88513	-43.13729	4.737789
CONTRACEPTIVE	-0.1622512	-0.1864879	0.0242367	
	chi2 = 21.04			
	Prob>chi2 =.0037			

Since the Fixed Effects parameters are consistent, further examination of Table 5 is necessary. Table 5 reveals the coefficients for the selected variables for equation (4.1), (4.2), and (4.3) similar to the expectation of this research. For equation (4.1), one of the most striking features is that the standard errors in parenthesis are smaller than expected. An explanation suggests that the size of the variables and the relationship to each other may need to be adjusted using equation (4.2) or (4.3) as an estimator. Further examination of equation (4.1), reveals a number of noteworthy aspects. UNEMPLOY having a positive coefficient of 0.021859 for violent crime and a negative coefficient of -0.0041 for property crime. An explanation of this occurrence lies in the mixed literature reviews of the effects that unemployment has on crime. Another attribute of equation (4.1) in Table 5, suggest the relationship between income and violent crime is positive while the relationship between income and property crime is negative. The explanation for this relationship can be attributed to role that income has on violent crime and property crime. Property crimes are usually committed to increase ones potential earnings, for example robbery or stealing merchandise to pawn. However, income does not have the same relationship to violent crimes.

Table 5, (4.2), reveals an alternate measure of the effects of these selected variables on crime. Most notable correction from equation (4.1) to (4.2) is the smaller values of the standard errors. Examining the coefficient of CONTRACEPTIVE for violent and property crimes reveals the significant coefficients of -0.1622512 and -0.1163204 respectively. Further interpretation of these results suggests that the semi-log model provides evidence that an increase contraceptive usage decreases the violent and property crime approximately 16% and 11% respectively.[14] Equation (4.2) leaves room to examine the sensitivity of this variable to the crime rates.

Using the double log model in (4.3) an estimation of the elasticity of contraceptive use to crime can be determined. However Equation (4.3) reveals the elasticity of contraceptive use to violent crimes and property crimes. The coefficient for CONTRACEPTIVE is significant and suggests that for every 1% increase in

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[14] Gujarati (2003) suggests that in a semi-log model, the slope coefficient measures the constant proportional or relative change in Y for a given absolute change in the value of X. If multiply the relative change in Y by 100, will give the percentage change or the growth rate, in Y for an absolute change in X.

contraceptive use leads a 0.13 percent decrease in violent crimes. While significant for violent crimes, contraceptive use is not significant for property crimes. This is contrary to what is expected. Because a large number of property crimes are committed by juvenile delinquents, the use of contraceptive is expected to be highly significant with the decrease of property crime. Even though it is not significant, it does have the appropriate sign and can be interpreted as having -0.04 elasticity to property crime.

These results raise the questions concerning the effect on crime using various individual contraceptive methods. Using equation (4.2), Table 7 reveals the result from individual contraceptive technology on both violent and property crime. Table 7 utilizes all individual methods specified by the CDC in a fixed effects model. Due to the large number of variables in the model, few of the selected variables are statistically significant to violent crimes, most notably male sterilization. For property crimes, the pill, male and female sterilization, and the douche are statistically significant. Furthermore, these variables contain the expected sign. A fascinating feature can be revealed through the large number of significant individual technology with property crime rather than when using the total utilization in Table 5. An explanation of this phenomenon is established with the group of individuals who may use these particular methods. Individuals that use these methods may have a higher probability of juvenile delinquents that will participate in criminal activity, similar to our expectation.

Table 7. Fixed Effects Model using Individual Contraceptive technology.

	Ln (Violent)	Ln (Property)
UNEMPLOY	1.162166	0.2141729
	(0.7184713)	(0.5538367)
POVERTY	-0.2378953	-0.4466654
	(0.3864177)	(0.2978718)
GUNLAW	-0.0364402	-0.0553905
	(0.0737894)	(0.0568809)
INCOME	0.0000724[a]	2.24E-06
	(0.0000175)	(0.0000135)
BEER	-0.0022793	0.0011568
	(0.0058035)	(0.0044737)
POLICE	-5.728337	12.70968
(t-1)	(24.53813)	(18.91532)
INCARCERATE	4.38425	-7.446915
	(21.50778)	(16.57936)
PILL	-0.1704341	-0.1901041[b]
	(0.1227095)	(0.0945912)
DIAPHRAGM	-0.4939834	-0.5374178
	(0.4458876)	(0.3437144)
JELLY	-0.0233014	0.2156651
	(0.4489992)	(0.346113)
DOUCHE/JELLY	-0.4741141	-0.1166517
	(0.1250643)	(0.0964063)
DOUCHE	0.3543574	0.9885251[c]
	(0.7603367)	(0.5861089)
IUD	-0.0591033	-0.1319137
	(0.1725004)	(0.1329727)
FEMALE_STER	0.1431188	-0.3674262[a]
	(0.1605882)	(0.1237901)
MALE_STER	-0.6906702[b]	-0.8142537[a]
	(0.2726038)	(0.2101378)
CONDOMS	-0.0588017	-0.1497519
	(0.1452681)	(0.1119805)
RHYTHM_TEMP	-0.4169824	-0.0550774
	(0.7104615)	(0.5476624)
RHYTHM_CALEND	0.2677544	0.2651027
	(0.2486374)	(0.1916632)
WITHDRAWL	-0.2887931	-0.1993831
	(0.2374849)	(0.1830663)
ABSTINENCE	-0.0787279	0.0395993
	(0.3557875)	(0.2742604)
ALL_OTHER	-0.1263963	0.0545754
	(0.1770833)	(0.1365054)
CONSTANT	-6.765694[a]	-2.937844[a]
	(0.3737951)	(0.2881416)

Examining the effect that each individual technology separately may have on criminal activity, leads to the estimation and the coefficients in Table 8. Although each specific technology was estimated separately using equation (4.2), only the coefficients and the standard errors are reported for each of the contraceptive technologies. Table 8 reveals significant values for the PILL, FOAM, JELLY, DOUCHE/JELLY and MALE_STER to violent crimes. For property crimes, the PILL FOAM, DOUCHE, FEMALE_STER, MALE_STER, CONDOMS, and WITHDRAWL are statistically significant. Once again, it is shown that many of the individual technologies have stronger relationship to property crime than the utilization rate.

Table 8. Fixed Effects Model Separate Contraceptive Technology Coefficients

	Violent Crimes		Property Crimes	
Variable	Coefficients	Standard Errors	Coefficients	Standard Errors
PILL	-0.1645138[c]	0.0882512	-0.1370815[c]	0.0707289
FOAM	-0.1645138[c]	0.0882512	-0.1370815[c]	0.0707289
DIAPHRAM	-0.3307751	0.4067013	-0.2466278	0.3263605
JELLY	0.0282423[c]	0.4610123	0.398611	0.3683483
D and J	-0.4775124[a]	0.1204882	-0.1265674	0.1012128
DOUCHE	0.2450537	0.7739056	1.041052[c]	0.6150012
IUD	-0.0955056	0.115673	-0.0962309	0.0926677
F_STERILIZATION	0.1040831	0.1631153	-0.3813419[a]	0.1271517
M_STERILIZATION	-0.3128163[c]	0.188406	-0.544984[a]	0.1457035
CONDOMS	0.1025755	0.0736182	0.101809[c]	0.0588469
RHYTHM_TEMP	0.2212802	0.6591876	0.8396286	0.5243958
RHYTHM_CAL	0.1969394	0.203567	0.2086736	0.1629102
WITHDRAWL	0.0412803	0.1747971	0.2674633[c]	0.1384807
ABSTINENCE	0.2108562	0.3563859	0.2729362	0.2853418
ALL_OTHER	-0.1396346	0.1806038	0.0191846	0.1451715

CONCLUSION/POLICY IMPLICATION

Our results show there is a statistically significant inverse relationship between the use of contraceptive in the 1970s relative to both property and violent crimes in the 1990s. Furthermore, the utilization rate of all contraceptive technologies provides stronger relationship to violent crimes rather than property crimes. Because a majority of criminal activity pertaining to property crime consists of juvenile delinquents, this research expected a stronger link than the statistically significant one established in this research.

We also find additional evidence that contraceptive use has a causal effect on criminal activity. Surprisingly, when examining the utilization rate of each technology on the crime rate it is established that the pill, foam, male sterilization and female sterilization were more consistent contributors to the decrease in crime. It is at this point that the results have a stronger relationship between each of the individual technologies and property crime versus violent crime. An explanation of this observation can be linked to the type of individuals that utilize these particular methods. For example, individuals that are poor may choose less expensive forms of contraceptive use, or they may select highly successful methods of contraceptive use. This is the case with selection of the pill and foam, being a more effective per dollar method of contraception versus, the withdrawal technique. Also, male and female sterilization are highly successful low cost ways to prevent conception. These technologies provide evidence of their inverse relationship to property crime.

To the extent that the availability of contraceptives affects birth cohorts, policy makers find strength when arguing for an increased in spending on family planning incentives. While on the forefront of this debate is the constitutional right to abortion, Roe v. Wade, various amounts of choices may provide an avenue to increase the general public use of noninvasive contraceptives, thereby decreasing long run societal cost. Certain state level controls are very expensive and requires a large portion of the state budget to finance. Utilizing a cost effective funding of contraceptive usage could lead to decrease state expenditures later. The cost associated with the process of incarcerating an individual is expensive, (e.g. court cost, processing fees, housing). Expenditures on readily available low cost contraceptive technology could be instituted, which would decrease the cost that envelops incarceration.

Human and social capital investment plays an important role in determining the outcomes of individuals. More importantly, this capital investment helps develop children to become more functional in society. This research suggests that better family planning could lead to a decrease in various amounts of social problems by increasing the stigma cost associated with criminal behavior. Society has often stated that it "takes a village to raise a child." This is very evident from this research. The stigma cost associated with behavior is increased when individuals have enough time to establish a family network. This network helps to mold an individual into a more productive citizen. In many instances, the family network will deter a child from participating in criminal activities. For society, being involved in community and neighborhood programs could increase the cost associated with children participating in crime. Children, as shown in the literature, which possess low social capital investment, have a higher probability of participating in criminal activity. Adopting specific technology may allow an individual more time to set up a family network that will deter their child from participating in criminal activity.

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